19th Academic Sessions

"Overcoming Challenges in The Next Decade"

ABSTRACTS

02nd March 2022
University of Ruhuna
Sri Lanka

ISSN 2362 - 0412

 ISSN 2362-0412

Abstracts

19th Academic Sessions

and

18th Vice Chancellor's Awards

02nd March 2022

University of Ruhuna

Matara, Sri Lanka

Abstracts

19th Academic Sessions and 18th Vice Chancellor's Awards

ISSN 2362-0412

Editor-in-Chief

Professor E.P.S. Chandana, Department of Biosystems Technology,
Faculty of Technology, University of Ruhuna.

Organizing Committee

Chairperson
Dr. K.G.S.H. Gunawardana, Dean, Faculty of Technology

Secretary
Dr. (Mrs.) V.H.P. Vitharana, Faculty of Technology

Treasurer
Dr. T. Karunarathna, Faculty of Technology

Conference Management Systems and Website Editor

Mr. H.A.C. Priyankara

How to cite: Author(s). (2022). Title of the paper. In E. P. Saman Chandana (Eds.), *Abstracts of the 19th Academic Sessions of University of Ruhuna* (pp. page number). University of Ruhuna.

 ISSN 2362-0412

Faculty Representatives

Dr. (Mrs.) D.M. Gamage, Faculty of Agriculture

Dr. (Mrs.) Sewwandi Subasinghe, Faculty of Allied Health Sciences

Dr. S.M.T.D. Sundarapperuma, Faculty of Allied Health Sciences

Dr. B.I.A. Mendis, Faculty of Engineering

Mrs. R.G.A. Iroshanie, Faculty of Fisheries and Marine Sciences & Technology

Dr. P.K.M. Dissanayake, Faculty of Humanities and Social Sciences

Dr. Tharaka Wijesundara, Faculty of Management and Finance

Dr. (Mrs.) Pushpika Jayawardena, Faculty of Medicine

Prof. Jinasena W. Hewage, Faculty of Science

Dr. A.M. Ajward, Faculty of Technology

Mr. J.A. Ajith, Assistant Librarian, Library, Faculty of Technology

Organizing Committee Members

Dr. P.K. Subash Jayasinghe
Dr. B.L. Sanjaya Thilakarathne
Dr. (Mrs.) K.M.W Rajawatta
Dr. A.M. Ajward
Dr. (Mrs.) H.C.C. De Silva
Dr. Niranjan Kannangara
Mr. H.L. Subasinghe
Mr. M.P. Uditha Isuranga
Mr. N. D. Walimuni
Ms. W.M.C.S. Jayaweera
Ms. Hasini Ganege
Ms. Ishanka K. Dias
Ms. D.N. Liyanage
Ms. Hiranya Amarasinghe
Ms. J.K.D. Buddhika Gayashani Jayaneththi
Ms. K.H. Jayani Imalka
Ms. M.S. Jayathilaka
Ms. R.S. Wickrama Arachchi
Ms. Rathnaikage Shakya
Ms. W.G. Ayomi Pabasara
Ms. W.H.N.Y. Hewage
Ms. Yashodha G. Kondarage
Ms. Akila Brahmana
Ms. Chanduni Yasadhara Gamage
Ms. E.H.M.P.M. Wijerathna
Ms. Malsha Prabuddhi
Ms. Rasika Hettiarachchi
Ms. H.P. Hewarathna
Mr. Buddika Premarathne
Ms. U.E. Kumanayake

 ISSN 2362-0412

Foreword

It is with utmost pleasure that I am writing this message to the 19th Academic Sessions and 20th Vice Chancellor`s Awards of University of Ruhuna. Indeed, it is a great achievement of the University of Ruhuna for having conducted this Academic Sessions for the 18th consecutive year. Prestigious academic sessions of University of Ruhuna give a wonderful opportunity to academic staff of University of Ruhuna to showcase their research findings. Indeed, the sessions will also help to develop mutual understanding and collaborations among academic staff.

This year we have received 128 papers and after a thorough review process, 108 papers are published as abstracts and accepted papers are orally presented. There are poster presentations as well.

Reviewers do their best to maintain the quality of publications published in the proceedings of the Academic Sessions as it reflects the quality of our academic community. I take this opportunity to congratulate all the authors whose papers were accepted to present in the Academic Sessions and I am very grateful to all reviewers who extended their fullest contribution in reviewing the submissions. I also wish to thank all the researchers who submitted papers for the Academic Sessions of University of Ruhuna.

Prof.E.P.S. Chandana
Dept. of Biosystems Technology
Editor-in-Chief
19th Academic Sessions
University of Ruhuna

 ISSN 2362-0412

Message from the Chairperson

It is a great honor having the opportunity to host the 19th Academic Sessions and the 18th Vice Chancellor's Awards ceremony of University of Ruhuna. I am very proud of the strength of the young staff of the Faculty of Technology (FOT) which is vividly demonstrated by organizing an event at this scale. There are only 33 academic staff members present in the faculty with only nine senior lectures having doctoral degrees in relevant fields.

The Faculty of Technology, University of Ruhuna was established in 2016 to fulfil the requirement of providing university education to students following technology subject streams in the advanced level examination. Currently there are about 850 students following the degree program under three different disciplines, namely: Engineering Technology, Information and Communication Technology and Biosystems Technology. Over the past years, we have faced many challenges building the Faculty of technology to bring it up to the present status by improving the human resources, infrastructure, and laboratory facilities. The faculty has gone through a rapid development of infrastructure over the past few years. The lecture hall complex including the auditorium where the inaugural ceremony of the academic session is held, was declared opened on the 24th of February 2022. The 19th Academic Sessions is the first event conducted in this brand-new auditorium and it is also the first Academic Sessions conducted by the Faculty of Technology.

I humbly present this collection of abstracts of 19th academic sessions under the theme of "Overcoming Challenges in the Next Decade". In the 19th Academic Sessions, we have automated the abstract calling and reviewing process for the first time in academic sessions of University of Ruhuna. This has enabled secure submissions of abstracts and double-blind reviewing process to enhance the quality of the overall process. Moreover, it has made the overall process much convenient, while ensuring a higher quality and saving the time of the limited number of staff of the faculty. Further, we have taken many steps in this direction to move forward with the Digital Technologies in FOT. I believe that the development of infrastructure of Digital Technologies will contribute immensely to thrive research in the next decade.

Moreover, this time we have opened a poster session for the undergraduates to present their research findings to a broader audience in the university. I believe this will be continued in future academic sessions of University of Ruhuna.

I take this opportunity to express my sincere gratitude to Senior Professor Sujeewa Amarasena, the Vice Chancellor of University of Ruhuna. Finally, I thank the Deputy Vice Chancellor and all the staff of the university for providing the assistance to make this event a success.

Dr. K.G.S.H. Gunawardana
Chairperson,
19th Academic Sessions and 18th Vice Chancellors Awards Ceremony.
Dean, Faculty of Technology
University of Ruhuna.
02nd March 2022.

 ISSN 2362-0412

Contents

 ISSN 2362-0412

Message from the Vice Chancellor

"Overcoming challenges in the next decade"

Let me first congratulate the Faculty of Technology of University of Ruhuna for organizing the 19th Academic sessions and 18th VC awards in a scale acceptable to the current situation of the Country under very strict health guidelines. This has been meticulously planned and implemented with the opening of the new building complex comprising of 500 seat Auditorium, Lecture theatre complex, Board room, ICT laboratory, Drawing office, departmental space in the second phase of the construction. The new infrastructure would undoubtedly expand the opportunities for higher education. This would be another gift for expansion of free education system in our country.

The entire world has changed with the pandemic of Covid-19. Sri Lanka is still in the recovery path of the impact of this deadly disease. The impact on all countries has been multifaceted. The impact on the economies especially in small countries had been devastating. People have been struggling to manage day to day affairs and this will remain so at least for few years. Most of these countries even cannot think of the possibility of long term planning. Therefore, Countries need to look for short term and medium term challenges and find low cost simple ways to improve productivity, bridging the gap between state income and expenditure, simplifying procedures to improve efficiency, reducing wastage and corruption at every level. These will help Sri Lanka have short term gains as a country.

In Post Covid-19 situation country will still grapple with issues of governance, democracy, structure of the state, ethnoreligious dialogues, chronic lethargy of state machinery, poor work ethics and attitudes of workers etc. All these will retard our country's progress than Covid-19 impact and economic downfall if we do not resolve these issues now itself. The example for this in our own past. When we became independent after WW II as a country Sri Lanka started to develop internal political conflicts resulting in 500000 mostly young people dyeing in North and South with no foreign invasion. This retarded our own development with several billion rupees spent on destruction rather than development. Therefore, our first challenge is to see through these issues at low cost with no conflicts. Those public policy changes will have huge positive development and economic impacts.

 ISSN 2362-0412

Then we need to review the state subsidy scheme and review and restructure it for absolutely needy while others are made to bear the cost of services in a graded scale based on equity. Financial cost of that approach would be low.

The Universities and the academia have not adequately focused on applied research on resolving the country's problems in science, agriculture, politics, governance, economic etc and therefore the theme "Overcoming Challenges of Sri Lanka in the next decade" is very timely and important. If we focus on next ten years of research on these areas with both short term and long term targets in our mind and get research outcomes on accurate modelling based on countries that have gone through worst disasters, the country would be on the right track in no time.

Let me wish the Dean and the organizing committee all the success in the first ever academic sessions organized by the Faculty of Technology in a brand new building complex.

Senior Professor Sujeewa Amarasena

Vice chancellor

University of Ruhuna

 ISSN 2362-0412

Award of Emeritus Professorships

Sernior Prof. Rev. M. Soratha Thero

Faculty of Humanities and Social Sciences

Senior Prof. (Ms.) H.M.K.K. Pathirana

Faculty of Science

Prof. Oscar Amarasinghe

Faculty of Agriculture

Senior Prof. (Mrs.) N.J.De.S. Amarasinghe

Faculty of Science

Senior Prof. P. Hewage

Faculty of Humanities and Social Sciences

 ISSN 2362-0412

Recipients of the 18th Vice Chancellor's Awards- 2022

The Most Outstanding Scholar

Prof. (Mrs) G.H.M.J. Subashi De Silva
Faculty of Engineering

The Most Outstanding Promoter of International Relations

Senior Prof. Champa M. Navaratne
Faculty of Agriculture

The Most Outstanding Staff Inventor/Innovator

Dr. H.C.P. Karunasena
Faculty of Engineering

The Most Outstanding Student Inventor/Innovator

Mr. H.M.W.A.I. Herath
Faculty of Agriculture

The Most Outstanding Young Researcher

Dr. R.H.M.P.N. Rathnayake
Faculty of Allied Health Sciences

The Highest Recipient of Grants

Senior Prof. Champa M. Navaratne
Faculty of Agriculture

 ISSN 2362-0412

Recipients of the Best Presenter Awards

18th Academic Sessions 2021

Best Presenter (Oral) of Technical Session: Together Towards Excellence in Humanities

Ven. Aparekke Sirisudhamma, Faculty of Humanities and Social Sciences

Best Presenter (Oral) of Technical Session: Together Towards Excellence in Engineering

Dr. C. Seneviratne, Faculty of Engineering

Best Presenter (Oral) of Technical Session: Together Towards Excellence in ICT & Mathematics

Ms. K.G.P. Hansani, Faculty of Science

Best Presenter (Oral) of Technical Session: Together Towards Excellence in Livestock, Food & Biotechnology

Dr. M. K. Shirani, Faculty of Science

Best Presenter (Oral) of Technical Session: Together Towards Excellence in Management

Dr. B.L. Galhena, Faculty of Management and Finance

Best Presenter (Oral) of Technical Session: Together Towards Excellence in Medical & Health Sciences

Ms. W.N.D. De Silva, Faculty of Medicine

 ISSN 2362-0412

Best Presenter (Oral) of Technical Session: Together Towards Excellence in Social Sciences
Dr. N. Keembiyahetti, Faculty of Humanities and Social Sciences

Best Presenter (Oral) of Technical Session: Together Towards Excellence in Soil, Water & Environmental Science
Dr. K.A.S. Kodikara, Faculty of Science

Best Presenter (Oral) of Technical Session: Together Towards Excellence in Technology
Mr. P.H.P.N. Laksiri, Faculty of Technology

Best Presenter (Poster) of Technical Sessions: Together Towards Excellence in Agriculture
Dr. S.R. Amarasinghe, Faculty of Agriculture
Dr. D.M. Gamage, Faculty of Agriculture
Prof. P.L.N. Lakshman, Faculty of Agriculture

Best Presenter (Poster) of Technical Sessions: Together Towards Excellence in Humanities and Social Sciences
Ms. I.G.S. Kumari, Faculty of Humanities and Social Sciences

Best Presenter (Poster) of Technical Sessions: Together Towards Excellence in Medical & Health Sciences
Ms. P. Wijesiriwardhana, Faculty of Allied Health Sciences

Best Presenter (Poster) of Technical Sessions: Together Towards Excellence in Science & Engineering
Mrs. K.A.M. Sudarshani, Faculty of Science

 ISSN 2362-0412

Keynote Speech

KNOWLEDGE, TECHNOLOGY AND COMPLEXITY IN ECONOMIC GROWTH

Prof. R.M.G. Rajapakse

Department of Chemistry, University of Peradeniya, Peradeniya 20400

ABSTRACT

Overcoming challenges in the next decade is a highly appropriate theme that should be addressed in relation to the Island's current economic situation. Ricardo Hausmann, The director, Center for International Development and Professor of the Practice of Economic Development, Harvard Kennedy School of Government and José Domínguez, Professor of Structural Engineering, School of Engineering, University of Seville, recognize that the application of complexity science tools allows for the better understanding in the fields of economics that will gear a nation towards both social and technological development[1]. The application of scientific knowledge for technological developments enables forecast future trends in the global economics and to take necessary steps towards catering for future demands. Overcoming challenges in the next decade is a timely and highly relevant theme that should be addressed in relation to the Island's current economic situation. The wealth of a country depends mainly on the correct and visionary political decisions taken to progressively improve economy in a reasonable timeframe such as a decade or more. The *ad hoc* and abrupt decisions taken without proper studies over a three quarter of a century have completely ruined the economy of our country pushing it towards poorest countries of the world despite its wealth of experts with diverse knowledge, talents and capabilities, and genuine desire to contribute it towards national development. Sri Lanka can be a knowledge hub earning through knowledge-based economy. Additionally, the scientific knowledge can be converted to innovative products with advanced technological developments that can be patented. The number of patents produced in Sri Lanka needs to be drastically increased and either the patents can be sold or be converted to commercial products. Sri Lanka is blessed with diverse natural resources such as high-quality minerals and varieties of endemic flora and fauna. In our research, carried out over the last three and half decades, we have been working on adding enormous value to mundane local minerals yet the minerals are still exported in their raw form without any value addition. Time is ripe to ban the exportation of minerals in their raw forms and either to export

 ISSN 2362-0412

value-added products or to develop devices or products using value-added minerals. Sri Lanka should not be a country that depend on imported petroleum oil for electricity production or even for transportation. Instead, the use of renewable energies such as solar energy should be adapted in real terms not just as attractive political stories. The enormous money wasted for the exportation of oil should be stopped and the money should be used to supply solar panels free-of-charge particularly to the low-income citizens while at a subsidized cost to others. For example, 4 kWh solar panels fixed on our rooftop generates more than sufficient electricity for us and to add the rest to the national grid. We have high-quality graphite for making large scale electrodes for hydrogen gas production from water electrolysis where the required electrical energy can be easily generated from solar cells. Reducing the consumption of natural gas and petroleum oil will not only benefit the economy of the Island but also protect us from various diseases caused by environmental pollution associated with toxins produced by their combustion. All what is needed is a visionary leadership!

References

1. https://rcc.harvard.edu/knowledge-technology-and-complexity-economic-growth

 ISSN 2362-0412

Oration

Engineers mimicking Reinforcement Learning in the Brain

by
Dr. N.W.J.A.L. Prins

Department of Electrical and Information Engineering, Faculty of Engineering, University of Ruhuna.

Introduction

Reward based learning, 'reinforcement learning' (RL) is found in many day to day activities. Similar models can be found in the brain. The basal ganglia and the cerebellum in the brain were thought to be dedicated to motor control in the early days. However, now it is believed that the cerebellum, the basal ganglia, and the cerebral cortex are specialized for different types of learning; supervised learning, reinforcement learning and unsupervised learning, respectively (Doya, 2000). Engineers for centuries have mimicked nature and in this case, the three types of learning are types that have been used extensively in artificial intelligence (AI). AI relies on the machine being able to learn certain patterns and structures of the data in order to predict output or the action the machine should do. Self-driven cars, thought controlled robots, prosthetics, photo tagging in social media, google targeted advertisements are a few examples.

In early days, engineers modelled the neural networks in the brain; artificial neural networks (ANN). The biological neural network has many redundancies in its connections, is able to map the input to the output and has the ability to adjust itself based on the feedback received through sensory inputs like touch and visual feedback. Similarly, ANN had many interconnections and had a mechanism to receive feedback by comparing the output to a desired signal. This comparison to a desired signal brings about an 'error' which can be used to change the parameters in the ANN. Such error based learning is what is called supervised learning. In unsupervised learning, no such external signal exists and the system purely relies on the input data structure to make decisions. There are many real world examples that cannot rely on such extremes but rather rely on something in-between. In other words we do not have anything to use as an error signal (as in the case of amputees for controlling robotic limbs), neither can we rely solely on the input data structure in real world cases where the data is contaminated with noise. The reward

based learning in the brain motivated engineers to find a way to introduce this reward based learning in to machine learning. This revolutionized the field of machine learning as it was possible now to teach the machine based on reward and punishment.

Brain-machine interfaces (BMI) is one of the applications where medicine and engineering fuse together. This is widely used in paralyzed patients to help them to think of movements and be able to control computer cursors, artificial limbs, robots or their own paralyzed limbs. Many of the BMIs designed through the ages have used supervised learning techniques creating the necessity of a desired signal in order to perfect the algorithm. However, in the case of amputees or paralyzed individuals, there is no physical movement in order to acquire a desired signal. This is where RL can be helpful as it does not need a supervised error signal. If we are able to acquire a reward signal from the brain itself, the system can be truly autonomous. The initial work was done in 2007 as proof of concept and applied to rodents that were able to control a robotic arm (DiGiovanna et al., 2007). In 2010 the research progressed to value (reward and punishment) based decision making (Mahmoudi and Sanchez, 2011).

This paper reviews the research carried out from 2011 to establish a new RL architecture that can use BMIs for paralyzed individuals to be able to control in a truly autonomous manner. In our research we developed an architecture that was able to take the feedback from the brain itself (Pohlmeyer et al., 2012). Next, we were able to show that the this architecture was able to receive signals from two different sources from the brain to be truly an autonomous agent (Mahmoudi et al., 2013). Extracting features from these neural data is also an important step in the BMI process (Prins et al., 2013). In the next paper, we showed how even amidst neural perturbations, this model was able to self-adjust and maintain its performance with animal data (Pohlmeyer et al., 2014). The next challenge we had was to be able to change the architecture in a way to receive a less than perfect feedback. Our research showed the theoretical simulations of being able to include a confidence metric (Prins et al., 2014). We have shown with simulated data that indeed this is possible (Prins et al., 2017b). One of the research published was behavioural training for non-human primates (NHP) to carry out experiments in order to test such models (Prins et al., 2017a). We had already shown proof of concept that the striatum was a good candidate to extract such a reward signal (Geng et al., 2013). All of this gave us the confidence that a system can be implemented where a paralyzed person will someday be able to go home with a system without having a caregiver supervising this system. We performed some BMI clinical trials with electroencephalographic (EEG) data for spinal cord injured (SCI) subjects (Gant et al., 2018). Final research shows how a SCI subject was implanted with two electrocorticography (ECoG) strips and was sent home

with ability to open and close his hand with his own volition (Cajigas et al., 2021). These 10 research publications span across a decade and capture work done by the author for a longer period (and is continuing). This paper discusses the process from the initial phase where we started mimicking RL in the brain and finally sending a paralyzed person home to be able to open and close his hands with his own volition.

Methods

BMI has several components as shown in Figure 1: data acquisition, signal processing, external device/actuator and feedback. Data acquisition block collects the neural data from the subject and pre-amplifies it before sending it to the signal processing block. The signal processing block is the hub of the BMI. It does all the filtering and feature extraction needed for the algorithm to be able to classify the signals or to be able to interpret the subject's intention. Next is the external device or the actuator (robotic arm, computer cursor). The final component is the feedback provided; this can be audio-visual feedback, feedback to the brain or to the algorithm itself. One of the challenges in BMI is to be able to give the feedback to the classification algorithm. In able bodied persons, this signal is taken from their limbs and given as a feedback. Unlike in an able bodied person, a paralyzed person is unable to move their limbs and hence the necessity for a BMI system.

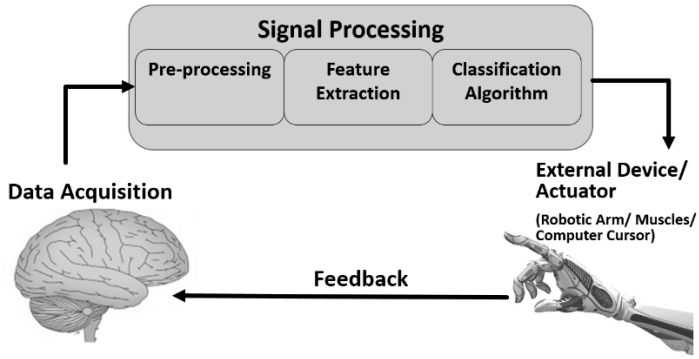

Figure 1: Brain-Machine Interface (BMI) system: Data acquisition, signal processing, external device/actuator and feedback.

Therefore we developed a reward based architecture that would not require such error signals and the preliminary work was done using NHP. Animal behavioural training rely on repetitive movements, encouraged by rewards (usually food pellets or juice rewards) (Prins et al., 2017a). The different types of learning in the brain are shown in Figure 2. Out of these, the supervised learning relies on the external error signal which is difficult to

 ISSN 2362-0412

acquire from paralyzed subjects and the unsupervised learning techniques which rely on the input data structures are not 100% reliable due to noise in biological data. Therefore we proposed the RL based system.

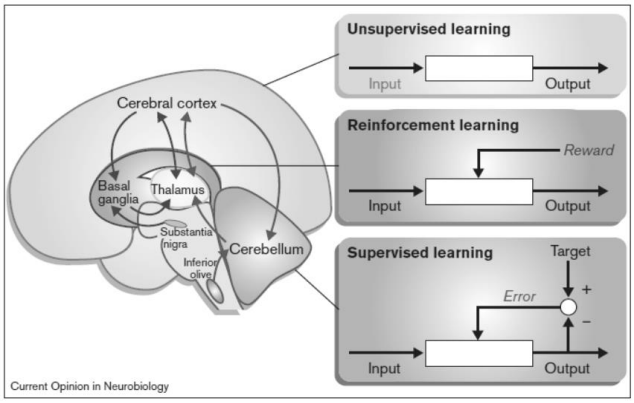

Figure 2: Different types of learning in the brain (Doya, 2000).

RL techniques are vast and can be quite exhaustive; any method one can think of to include a reward in to the algorithm, such method can be used for RL. Therefore the first step was to select a RL architecture which would be a realistic model to test our theory on. We selected the actor-critic RL paradigm where the actor takes an action and the critic criticizes this action (Mahmoudi et al., 2013). Figure 3 shows the basic model for an autonomous system. We were able to show proof of concept using Hebbian RL; neurons that fire together, wire together. Unlike traditional ANN, using the Hebbian rule makes it possible to give the feedback faster to earlier stages of the network (Mahmoudi et al., 2013).

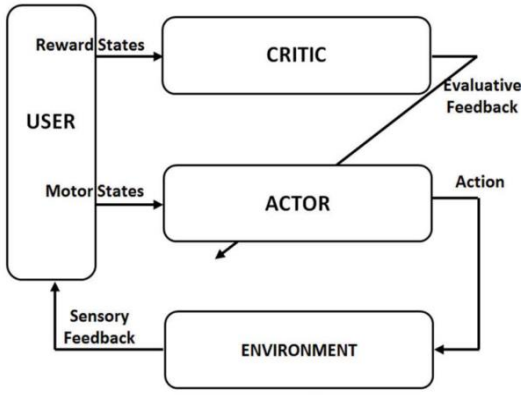

Figure 3: The actor–critic model for autonomous BMI (Prins et al., 2014).

In order to test the stability of this system, we introduced neural perturbations and tested on NHP (Pohlmeyer et al., 2014). Even with a 50% of the neural data missing or 50% neural data addition, the system was able to quickly readjust and maintain its accuracy levels. The critic is the key to making the BMI autonomous; therefore we proposed to take the critic signal from the reward centres of the brain itself. We have shown that this is possible with NHP neural data (Prins et al., 2013). However, one of the discoveries from this research was that the critic accuracy limited the overall performance. Since biological data have less than perfect accuracy, it was important to be able to not rely on the critic completely but only use the critic when it was able to provide good feedback. We overcame this challenge by introducing a confidence metric for the critic (Prins et al., 2014); when the critic was confident, the critic feedback would be used, but otherwise it would be ignored. This system was tested with NHP for a two choice task where the animal was controlling the robotic arm. The experimental paradigm steps are given in Figure 4.

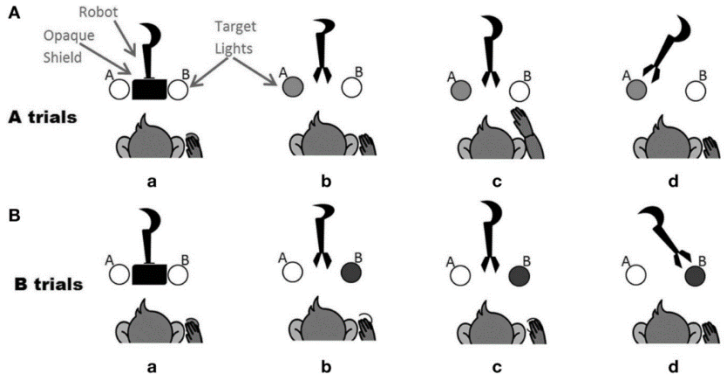

Figure 4: Experimental paradigm for the NHP controlling the robotic arm for two types of trials (Prins et al., 2014).

The next experiments were on simulated data from the reward centres of the brain and testing if the BMI was able to maintain the accuracy with a less than perfect critic (Prins et al., 2017b). Through simulations we were able to find out the sweet spot for the thresholding of the critic confidence (Prins et al., 2017b).

Results

The results presented here are in two sections:(1)foundations of perfect critic and critic with confidence metric for RL based BMI (2)applications of BMI for human clinical trials. Figure 5 shows an example of neural data from NHP. Here the primary motor cortex (MI)

 ISSN 2362-0412

was targeted for the input to the actor and the nucleus accumbens (NAcc) was targeted for the input to the critic. The colour shades show neural data from different neurons.

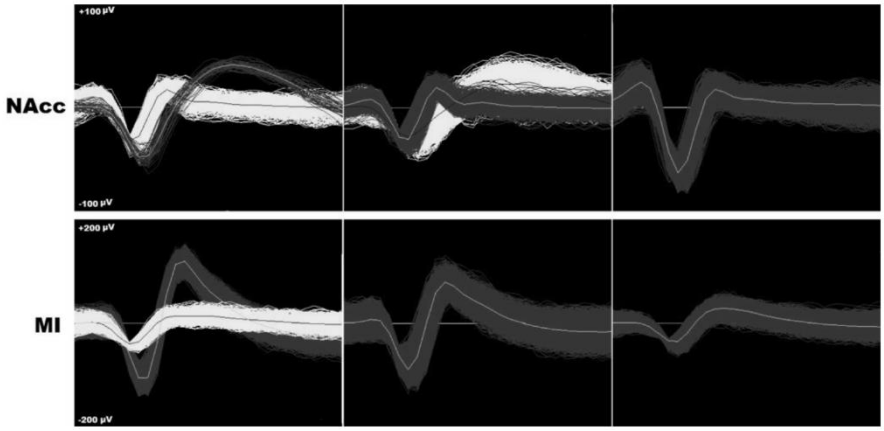

Figure 5: Neural data from reward centre of the brain (NAcc) and motor cortex (MI) (Prins et al., 2017a)

In order for the algorithm to learn the task, there are several parameters that need to adjust. Some of these are called the weights which map the input to the output. Figure 6 shows how the weights were stabilized and when there were perturbations, adjusted itself again to stabilize and give an accurate output. This showed proof of concept that the Hebbian actor-critic model was theoretically suitable for our application. NHP tests with this showed that even with 50% add or drop, the BMI was able to quickly adjust its weights and maintain the performance (Pohlmeyer et al., 2014). Thus proving that for a perfect critic, the actor is able to maintain its performance.

 ISSN 2362-0412

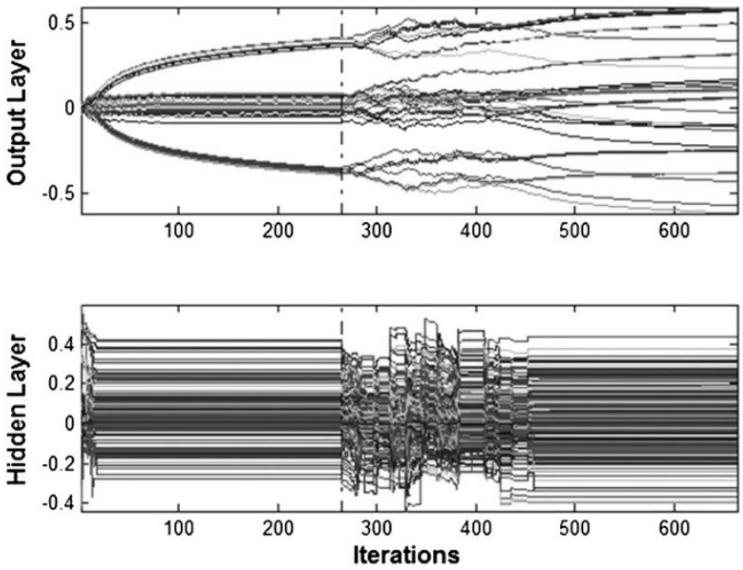

Figure 6: Hidden layer and output layer weights of the ANN for the actor (Mahmoudi et al., 2013)

Next, the critic was tested. Figure 7 shows how having the confidence measure inbuilt to the critic increases the overall performance in (A)simulated data (B)simulated data with noise (C)real NHP data (Prins et al., 2014). This research showed that if we have the ability to include this confidence metric into the critic, the overall performance can be improved.

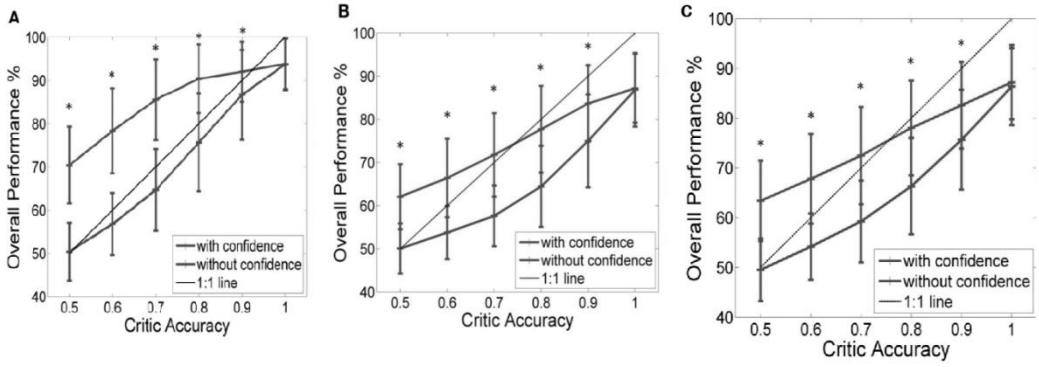

Figure 7: Comparison of overall performance with and without the confidence measure (A) simulated data (B) simulated data with noise (C) real NHP data (Prins et al., 2014)

The solution to this was to introduce a threshold to the critic. Figure 8 shows how the hidden and output weights changed with no threshold, 0.12 and 0.24 threshold. Through this research we were able to conclude that having a threshold is important but a too high threshold affects the overall system negatively. While the threshold is heavily data

 ISSN 2362-0412

dependant, the research findings concluded 0.1-0.15 threshold was best for the data tested (Prins et al., 2017b).

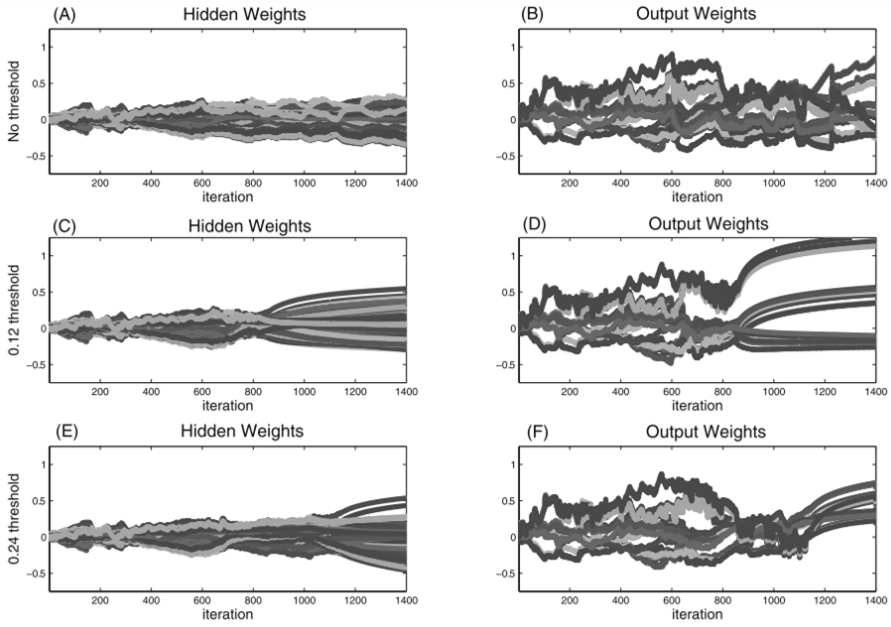

Figure 8: How weights change with the threshold value (Prins et al., 2017b)

After NHP results were confident, we started with non-invasive clinical trials as shown in Figure 9A. Rather than controlling robotic arms (like the NHP did), we were able to give the subjects regain of their own paralyzed hands using functional electrical stimulation (FES) with EEG signals above the motor cortex of C5-C6 SCI subjects. These subjects were able to move their shoulders but had no function in their hands. They were able to control their hand opening and closing with 75% accuracy (Figure 9B) (Gant et al., 2018). While this was impressive, it was not conducive to send subject home with wires connected everywhere.

 ISSN 2362-0412

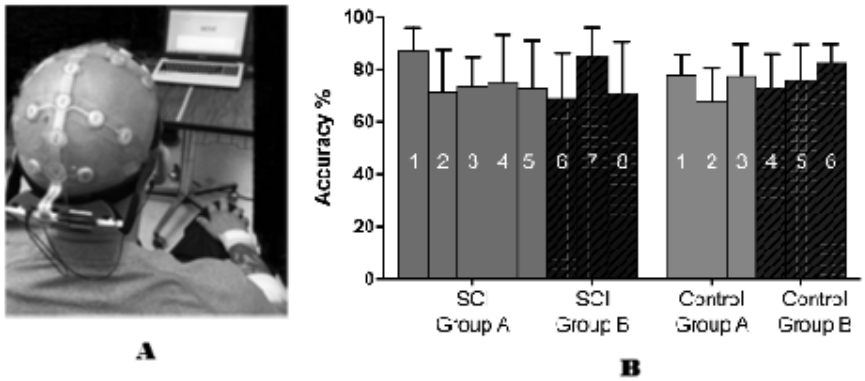

Figure 9: (A) EEG experimental setup showing EEG cap (Data acquisition), signal processing (computer) and actuator (electrode pads on arm) (B) average accuracies of SCI and control groups (Gant et al., 2018).

Final piece of the puzzle was to completely internalize the system and have a person use the system at home (Cajigas et al., 2021). Two ECoG electrode strips were implanted above the motor cortex as decided by fMRI imaging (Figure 10A,B). The signals were transmitted wirelessly from the transmitter. These signals were decoded by the algorithm and fed back to the subject's paralyzed hand by a FES orthosis. Figure 10C shows the experimental setup and Figure 10D shows the spectrograms of the two raw ECoG channels.

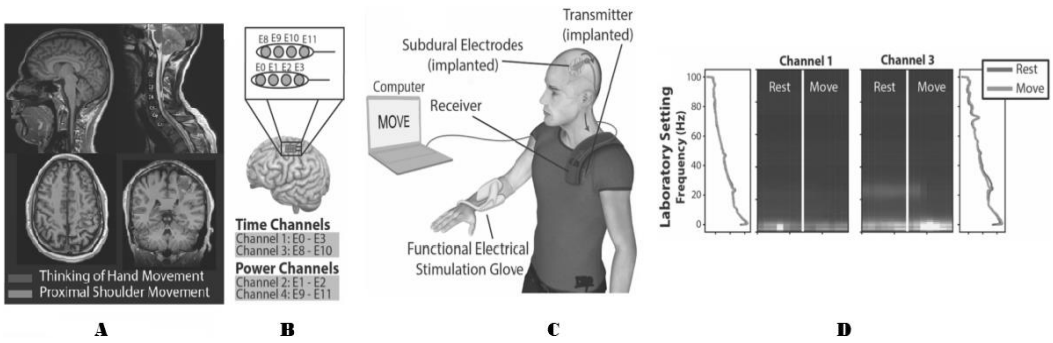

Figure 10: (A) fMRI image showing the active areas during shoulder movement and thinking of hand movement (B) placement of ECoG channels (C) Laboratory set up (D) ECoG spectrograms (Cajigas et al., 2021).

We started at 55% accuracy on a naïve classifier and in the same day achieved 90% accuracy. Over a period of 10 weeks, the BMI maintained an 89% accuracy (Figure 11A). He was able to increase performance and speed of the Jebsen Hand Function Test (JHFT) during the 20 weeks of the study (Figure 11B). His handwriting samples in the figure shows how the fluidity improved also (Figure 11C). Finally, the subject was able to go home with

 ISSN 2362-0412

the system and control it solely with his own volition without an external cue guiding him (Figure 11D).

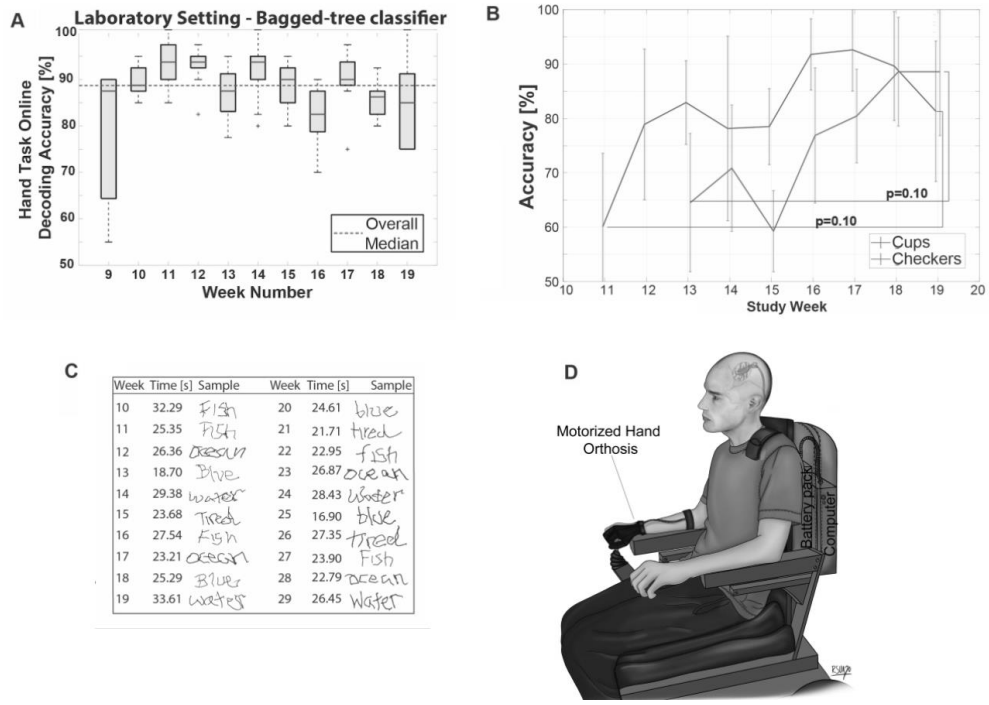

Figure 11: (A) classifier accuracy (B) task accuracy of moving a cup and piece of checkers (C) hand writing (D) Home system (Cajigas et al., 2021).

Conclusion

The research presented here is from theoretical foundations to practical implementation of BMI to be used without an external training signal. Starting with the RL based BMI architecture, it was shown how an actor-critic model is able to handle a reward signal rather than an error from a desired output. This architecture was proven to be effective with input perturbations but sensitive to the critic accuracy. The results showed how a critic confidence measure is able to increase the overall performance. Our results demonstrated that a fully implanted BCI can be safely and reliably used to decode movement intent from motor cortex allowing for volitional control of hand grasp by a patient with SCI in laboratory and home environment. The system was completely internalized in our case where as in many other cases there is a pedestal protruding from the patient's skull.

 ISSN 2362-0412

References

CAJIGAS, I., DAVIS, K. C., MESCHEDE-KRASA, B., PRINS, N. W., GALLO, S., NAEEM, J. A., PALERMO, A., WILSON, A., GUERRA, S. & PARKS, B. A. 2021. Implantable brain-computer interface for neuroprosthetic-enabled volitional hand grasp restoration in spinal cord injury. *Brain Communications*.

DIGIOVANNA, J., MAHMOUDI, B., MITZELFELT, J., SANCHEZ, J. & PRINCIPE, J. Brain-machine interface control via reinforcement learning. Neural Engineering, 2007. CNE'07. 3rd International IEEE/EMBS Conference on, 2007. IEEE, 530-533.

DOYA, K. 2000. Complementary roles of basal ganglia and cerebellum in learning and motor control. *Current opinion in neurobiology,* 10**,** 732-739.

GANT, K., GUERRA, S., ZIMMERMAN, L., PARKS, B. A., PRINS, N. W. & PRASAD, A. 2018. EEG-controlled functional electrical stimulation for hand opening and closing in chronic complete cervical spinal cord injury. *Biomedical Physics & Engineering Express,* 4**,** 065005.

GENG, S., PRINS, N. W., POHLMEYER, E. A., PRASAD, A. & SANCHEZ, J. C. Extraction of error related local field potentials from the striatum during environmental perturbations of a robotic arm. 2013 6th International IEEE/EMBS Conference on Neural Engineering (NER), 2013. IEEE, 993-996.

MAHMOUDI, B., POHLMEYER, E. A., PRINS, N. W., GENG, S. & SANCHEZ, J. C. 2013. Towards autonomous neuroprosthetic control using Hebbian reinforcement learning. *Journal of neural engineering,* 10**,** 066005.

MAHMOUDI, B. & SANCHEZ, J. C. 2011. A symbiotic brain-machine interface through value-based decision making. *PloS one,* 6**,** e14760.

POHLMEYER, E., MAHMOUDI, B., GENG, S., PRINS, N. & SANCHEZ, J. 2014. Using Reinforcement Learning to Provide Stable Brain-Machine Interface Control. *PLOS One*.

POHLMEYER, E. A., MAHMOUDI, B., GENG, S., PRINS, N. & SANCHEZ, J. C. Brain-machine interface control of a robot arm using actor-critic rainforcement learning. 2012 Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 2012. IEEE, 4108-4111.

PRINS, N. W., GENG, S., POHLMEYER, E. A., MAHMOUDI, B. & SANCHEZ, J. C. Feature extraction and unsupervised classification of neural population reward signals for reinforcement based BMI. 2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), 2013. IEEE, 5250-5253.

PRINS, N. W., POHLMEYER, E. A., DEBNATH, S., MYLAVARAPU, R., GENG, S., SANCHEZ, J. C., ROTHEN, D. & PRASAD, A. 2017a. Common marmoset (Callithrix jacchus) as a primate model for behavioral neuroscience studies. *Journal of neuroscience methods,* 284**,** 35-46.

PRINS, N. W., SANCHEZ, J. C. & PRASAD, A. 2014. A confidence metric for using neurobiological feedback in actor-critic reinforcement learning based brain-machine interfaces. *Frontiers in neuroscience,* 8**,** 111.

PRINS, N. W., SANCHEZ, J. C. & PRASAD, A. 2017b. Feedback for reinforcement learning based brain–machine interfaces using confidence metrics. *Journal of neural engineering,* 14**,** 036016.

 ISSN 2362-0412

Abstract Index

Agriculture, Environment, and Biological Sciences

Computer Science and Information Technology

Covid 19 Issues and Solutions

Economics, Finance, and Management

Education, Humanities, and Social Sciences

Engineering, Technology, and Applied Sciences

Human Health, Pharmaceuticals, and Medicine

 ISSN 2362-0412

Agriculture, Environment, and Biological Sciences

 ISSN 2362-0412

Comparative Assessment on the Prevalence and Antibiotic Resistance of Bacteria Associated with Larvae, Post- Larvae and, Adult of *Macrobrachium rosenbergii*

E.G.K.Y.C. Bandara[a]*, H.H.S. Pramodhi[a], L.N.L.P. Jayasinghe[a], W.W.L. Sachintha[a], S.U. Pathiranage[b], D.N.N. Madushanka[b], K.V.D.M. Hasintha[b], H.C. Nadishani[b], H.A.D. Ruwandeepika[a] and K.H.M.A. Deepananda[a]

[a] *Department of Fisheries and Aquaculture, Faculty of Fisheries and Marine sciences & Technology, University of Ruhuna, Matara, Sri Lanka*
[b] *Department of Livestock Production, Faculty of Agricultural Sciences, Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka*

*Corresponding author: *yogya@fish.ruh.ac.lk*

ABSTRACT

Culture-based fisheries of Giant Freshwater Prawn (GFP), *Macrobrachium rosenbergii* have been introduced in Sri Lankan reservoirs, making economically important component in the inland fishery. Hitherto, microbial studies associated with GFP in reservoirs have not been reported. Present study is of utmost importance since it is a novel study conducted in the Sri Lankan context to ascertain the total bacteria and total *Vibrio* associated with larvae, post larvae and adults of *M. rosenbergii* and investigate the antibiotic sensitivity of these associated bacteria. Five larvae and post larvae samples containing 30 individuals in each were collected from 10 different tanks in freshwater prawn breeding centre, Kahandamodara whilst the sample of adult *M. rosenbergii* were collected from five reservoirs; Ridiyagama, Bandagiriya, Urusita wewa, Handapanagala wewa and, Muthukandiya wewa. All the samples were homogenized separately. To determine the total bacteria count (TBC) and total vibrio count (TVC), samples were inoculated on Standard plate count agar plates and Thiosulfate Citrate Bile Sugar (TCBS) plates, respectively by spread plate method. TBC and TVC were expressed as Colony Forming Unit/mL (CFU/mL). Kirby-Bauer disk diffusion method was used to examine the antibiotic sensitivity of the bacteria associated with different life stages of *M. rosenbergii* against Ampicillin (10µg), Ciprofloxacin (30µg) and Tetracycline (30µg). Mean no of total bacteria count associated with larvae, post larvae and adult were $2.96\pm2.4x10^{8}$ CFU/mL, $2.64\pm5.90x10^{11}$ CFU/mL and, $1.05\pm2.30x10^{11}$ CFU/mL, respectively. The mean no of total bacteria associated with post larvae and adult of *M. rosenbergii* were significantly higher ($p<0.05$) than that of in the larvae. Mean no of total *Vibrio* count of post larvae ($3.62\pm2.00x10^{4}$ CFU/mL) were significantly lower ($p<0.05$) than that of larvae ($4.13\pm3.54x10^{6}$ CFU/mL) and adult ($4.31\pm3.11x10^{6}$ CFU/mL). Bacteria associated with all the stages of *M. rosenbergii* showed resistance to Ampicillin whilst they were sensitive to Ciprofloxacin and Tetracycline. Present study warrants comprehensive studies on antibiotic sensitivity of all larval stages (12) of *M. rosenbergii*.

Keywords: Antibiotics sensitivity, Giant Freshwater Prawn, Life Stages, Spread Plate method

 ISSN 2362-0412

Evaluation of Phytotoxic Effect of Compost Mixtures Derived from Water Hyacinth (*Eichhornia crassipes L.*) Using Relative Seed Germination Percentage

W.M.C.S. Jayaweera [a*], S.R. Amarasinghe [b], A.L. Ranawake [c]

[a]*Department of Biosystems Technology, Faculty of Technology, University of Ruhuna, Sri Lanka*
[b]*Department of Soil Science, Faculty of Agriculture, University of Ruhuna, Sri Lanka*
[c]*Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Sri Lanka*

*Corresponding author: *champikajayaweera@btec.ruh.ac.lk*

ABSTRACT

The presence of toxic metals or salts in the compost prepared by water hyacinth (WH) and their possible toxic effect on the plants must be tested before the soil amendment. In the present study, a seed germination test was carried out to evaluate the possible phytotoxic effect of four compost mixtures generated by mixing different ratios of water hyacinth collected from *Gamachchiwewa*, Weeraketiya. The compost mixtures were, WH only (T0), WH with cattle manure-Albesia sawdust mixture in 1:1 ratio (T1), 2:1 ratio (T2), and 3:1 ratio (T3). The control experiment was conducted using deionized water. Four aqueous compost extracts (ACE) were prepared as 25%, 50%, 75%, and 100% using each mature compost mixture by adding deionized water, and ACE was used for the germination test. The radish seeds were used to evaluate the effect of WH compost on the relative seed germination percentage (RSG%). The formula used to calculate RSG% was: (number of germinated seeds in the treatment/number of germinated seeds in the control) ×100%. Thirty seeds of radish in three replicates were germinated in each ACE for 72 h. According to the results, the germination of radish was not inhibited at any ACE. The value of RSG% of T0 was significantly higher than the control (α=0.05). All ACE recorded pH values in the range of 6–9. There was a positive correlation between WH compost and pH (α=0.05, p=0.000). The EC varied in a range of 1190.25-2233 μScm^{-1} while the water-extractable NH_4^+ concentration was significantly higher (α=0.05) in the ACE of T2 (15.64 ± 6.34 mg/L) and T3 (12.24 ± 5.92 mg/L). The values of RSG% were significantly correlated with pH (r=0.487, p=0.05) and EC (r=0.531, p=0.05). The values of pH were significantly correlated with EC (r=0.694, p=0.01), RSG% (r=0.487, p=0.05) and NH_4^+ (r=0.479, p=0.05). Moreover, the EC was significantly correlated with NH_4^+ (r=0.833, p=0.01) and Fe^{3+} (r=0.535, p=0.05) while NH_4^+ was significantly and positively correlated with the Fe^{3+} (r=0.845, p=0.01). It was revealed that WH collected from the particular location can be integrated into compost without a toxic effect on the seed germination.

Keywords: *Compost, physicochemical properties, relative seed germination, water hyacinth*

 ISSN 2362-0412

First Record of the Freshwater Red Algal Genus *Batrachospermum* from Southern Sri Lanka

K.S.S. Atapaththu [a*], K. Sanjaya [a], H.P.L. Guruge [a], M.H.M.A.S.V. Gunawardana[b], W.G.S.M. Kumarii [b], E.D. Jayalath [c], S. Prasad [d], Y.M.A.L.W. Yapa [e], and R.A. Maithreepala [a]

[a] *Department of Limnology and Water Technology, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Matara*
[b] *Department of Botany, Faculty of Science, University of Ruhuna, Matara*
[c] *National Sun Yat-sen University, Taiwan*
[d] *Laboratory of Water Pollution Control Technology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085, China*
[e] *Department of Chemistry, Faculty of Science, University of Ruhuna, Matara*

*Corresponding author: *keerthi@fish.ruh.ac.lk*

ABSTRACT

Batrachospermum is a freshwater red alga, recorded in Hortain-Plains, while its existence in other regions in Sri Lanka remains unknown. During the field studies in the headwater region of Waturawa-Ela, a tributary of Gin Ganga in Deniyaya, a morphologically similar alga to *Batrachospermum* was observed in two locations. One location was at the stream origin while the other one was downstream (~1km). The present study aimed to investigate the abundance and the taxonomic position of the observed red alga. Field observations were conducted from November-2019 to December-2020. Algal coverage was estimated using a quadrate, while water quality was determined by measuring pH, temperature, salinity, TDS, dissolved concentrations of oxygen and nutrients. The chlorophyll content of algae was also measured. Red algae covered a wider area of the substrate in the upstream site (4-22%) compared to the downstream site (6-13%). Water quality was in pristine environmental condition with oligotrophic nutrient levels that might have provided an ideal condition for this species. Morphological identification was done microscopically using identification keys. Two morphologically distinct types were identified as olive green and purple, while it was identified as *Batrachospermum* sp. The olive-green type was rich in Chlorophyll-a (89.89±2.76 mg/gFW) while purple type contained approximately similar amounts of Chlorophyll-a (60.09±5.2 mg/gFW) and Chlorophyll-b (50.88±7.33 mg/gFW). A region of the plastid-encoded ribulose-1,5-biphosphate (*rbc*L, 1,282 bp) gene was amplified with universal primers, F150 forward and *rcb*L reverse. Amplified DNA fragments showed low nucleotide identity (35-37%) to other red algae species used in the alignment. As this is the first record of freshwater red algae in Southern Sri Lanka, further studies with other marker genes such as 18S rRNA and 5′ region of the cytochrome *c* oxidase subunit I (COI-5P) genes with better query coverage are required to confirm the identity of this species in the genus *Batrachospermum.*

Keywords: *Headwaters, Batrachospermum, Chlorophyll, morphology, 16S rRNA*

 ISSN 2362-0412

Identification of Field-Level Implementation Issues of Dairy Cattle Breeding Policy in Sri Lanka

G.G.D.C. Gamage [a], Chandima Gajaweera [a*], Prabudda Manjula [b], M.D.N. Gunaratne [c], Indunil Pathirana [a]

[a]*Department of Animal Science, Faculty of Agriculture, University of Ruhuna.*
[b]*Department of Animal Science, Faculty of Animal Science and Export Agriculture, Uva Wellassa University.*
[c]*Faculty of Management and Finance, University of Colombo.*

*Corresponding author: *gajaweera@agri.ruh.ac.lk*

ABSTRACT

Dairy cattle breeding is a long-term process of selection and mating of cattle. Sri Lanka has a well-defined comprehensive and legalized Dairy Cattle Breeding Policy (CBP). Artificial Insemination (AI) is the primary tool that use to implement the dairy cattle breeding programme. However, typically cattle breeding is just a mating focusing only on the immediate progeny and there is a distinct gap between the scientific recommendations of CBP and the implementation at the farmers' level. Hence this study was conducted to identify the implementation gap of the policy recommendations. The data were collected via pre-tested questionnaires from cluster-based purposively selected 103 Livestock Development Instructors(LDIs) representing all the agro-climatic zones. The degree of following of CBP was analyzed with a Mean score index and Kruskal-Wallis test, which was applied to test whether there is any significant difference in the level of the above score by provinces. Chi-squared test was used to find out whether there is significant associations between the degree of following up the policy and the profile factors of LDIs. The majority of the LDIs (97%) were aware of the CBP. 57% and 34% of LDIs have recommended the CBP(2010) without any change and with minor amendments respectively. The majority of the LDIs (96%) conduct dairy cattle breeding following a specific breeding plan. The Central Province has shown a significantly higher level of following the CBP ($P < 0.05$) while it was least in Eastern Province. Moreover, gender and age of LDIs are associated with the degree of following the CBP ($P < 0.05$). Semen of some of the recommended breeds such as Ayrshire and Sahiwal were not available at the field level and 75% of LDIs intensively use Girolando semen without official recommendations due to its popularity and unavailability of some recommended semen types. In conclusion, the existing CBP(2010) has been recommended by the LDIs as a comprehensive guideline for local dairy development. but there is a distinct implementation gap in the policy recommendations and it must be addressed by the relevant authorities for a successful CBP at the farmers' level.

Keywords: *Dairy cattle breeding policy, Field implementation, Issues, Sri Lanka*

 ISSN 2362-0412

Impact of Marketing Mix Antecedents on Consumer Re-purchase Intention of Milk Powder

M.G.T. Lakmali [a], G.C. Samaraweera [a*], N.M.N.K. Narayana [b], W.M.R. Laksiri [c]

[a] *Department of Agricultural Economics, Faculty of Agriculture, University of Ruhuna, Sri Lanka*
[b] *Department of Animal Science, Faculty of Agriculture, University of Ruhuna, Sri Lanka*
[c] *Department of Marketing, Faculty of Management and Finance, University of Ruhuna, Sri Lanka*

*Corresponding author: *gangani@agecon.ruh.ac.lk*

ABSTRACT

How marketing mix antecedents decide consumer re-purchase intention is questionable in the global marketing literature in the present context. Moreover, the selection of effective marketing mix antecedents that guarantee the financial sustainability of a particular organization is a challenging task today, particularly in a dynamic global marketing environment with the sudden changes in marketing mix components. In the Sri Lankan context, the literature seems completely lacking in this connection. Therefore, the present study aims to bridge this knowledge gap by examining the impact of marketing mix antecedents on consumers' re-purchase intention with special reference to milk powder marketed in Sri Lanka. Brand personality, price perception, perceived quality of the brand, country of origin, and exposure to advertisement were mainly selected as the marketing mix antecedents. A Google form-based pre-tested structured questionnaire was developed to collect data and information to test the hypotheses of the research. Data were collected from a convenient sample of Sri Lankan milk powder consumers (n=100). Structural Equation Modelling using the Partial Least Squares method was used to examine the relationship among main constructs considered in the study. The results revealed that exposure to the advertisements (t= 2.656; p=0.008) and the perceived quality of the brand (t= 3.456; p=0.001) were proven to have a significant influence on consumers' re-purchase intention of milk powder. Price perception (t= 0.094; p=0.657), brand personality (t= 1.770; p=0.077) and country of origin (t= 0.974; p=0.331) were insignificant. The study concluded that marketers should pay more attention on the significant factors while paying less attention on the insignificant factors in order to assure financial sustainability of an organization. This study drives future researchers to engage in more explorations in this regard.

Keywords: *Marketing mix antecedents, milk powder, re-purchase intention, Sri Lanka*

 ISSN 2362-0412

Investigation on the Issues of Protected House Farmers' Sub Agricultural Sector in Sri Lanka. A Case Study of Farmers in Matara District, Southern Province Sri Lanka.

M.S. Jayathilaka [a*], H.A.C. Priyankara [a], B.C.S. Ranasinghe [b]

[a] *Department of Biosystems Technology, Faculty of Technology, University of Ruhuna*
[b] *Group Sustainability, Dialog Axiata PLC, Colombo 02*

*Corresponding author: *mevuni@fot.ruh.ac.lk*

ABSTRACT

Sri Lankan agriculture sector has shown a technological transformation with addressing traditional challengers and barriers to improve production, productivity, and quality of the products in the last decades. Protected houses, green-houses, or in terms of growing crops under a controlled environment can be identified as one of the newly emerged sub sectors in the Sri Lankan agriculture sector. The protected house farming community in Sri Lanka is still unable to achieve the desired perspectives of adapting to those technologies. This study was conducted to analyse the current context of the small and medium-scale protected framers in Southern province, Sri Lanka. The investigation was done by interviewing 30 small and medium-scale protected house farmers using a semi-structured type questionnaire. Management practices including irrigation, fertilizers and raw materials, transportation, financial status and market availability and technological adaptations were considered as thematic areas for the analysis. When considering labour used for crop management practices ,93% of the protected house farmers only used family labour for the daily crop management practices. Only 7% of the target group used both hired labour and family labour for the crop management in the protected house. Each farmer utilized an average of 4.5 labour hours per day for 1000ft^2 for management practices including training, fertigation and harvesting. Ninety five percentage of respondents stated that they cannot leave their protected house without any supervision because of the daily management practices including irrigation and fertilization. Every farmer was aware of the importance of controlling microclimate conditions to increase crop productivity and the role of automation for it. They reported that the bell pepper and salad cucumber did not meet the market quality during prolonged high temperatures. Results revealed and highlighted those major issues on lack of technological system implementations for microclimate control, inability to leave the crop at least a day, scarcity of labour and unavailability of a proper consultation channel. The highlighted major issues have hindered the development of protected agriculture in Sri Lanka. Strengthening of the consultancy services on management practices and new technologies that potential to adapt local existing conditions are recommended to increase the productivity and promote adaptation to protected house cultivations.

Keywords: *Protected Agriculture, Technology Adoption, Survey, Cultivations*

 ISSN 2362-0412

In-vitro Study of Cytotoxic Effect of *Cinnamomum zeylanicum* Leaves and Bark Extracts Against Breast Cancer Cell Line; MCF-7

K.T.S. Madhushika [a], Vajira P. Bulugahapitiya [a]*, E.P.S. Chandana [b], K.H.T. Karunarathna [b], W.A.H.M. Karunarathna [b], P.B. Galhena [c], Y.S. Wijayasinghe [c]

[a] *Department of Chemistry, Faculty of Science, University of Ruhuna, Wellamadama, Matara, Sri Lanka.*
[b] *Department of Biosystems Technology, Faculty of Technology, University of Ruhuna, Kamburupitiya, Matara, Sri Lanka.*
[c] *Department of Biochemistry and Clinical Chemistry, University of Kelaniya, Ragama, Sri Lanka.*

*Corresponding author: *vajira@chem.ruh.ac.lk*

ABSTRACT

Cinnamomum zeylanicum Blume (Ceylon cinnamon; belongs to the family Lauraceae) is a popular spice used worldwide and claimed for various pharmacological applications including anti-oxidant, anti-microbial and anti-cancer activities. Several studies have shown strong cytotoxic potential of cinnamon bark extracts against different cancer cells**.** Further, it is reported that anti-carcenogic potential of cinnamon varies with the types of cancers and the nature of the extracts. Though leaves of Cinnamon contain numerous bioactive compounds, its anti-cancer activities against different cancers have been less studied. Therefore, this study was carried out on comparatively investigation of cytotoxic effects of leaves and bark of Ceylon cinnamon against human breast cancer cells. The extracts were prepared using leaves and bark of cinnamon in five -year maturity stage via macerating with water and methanol. The cytotoxic effect of methanolic and aqueous extracts against human triple positive adenocarcinoma (MCF-7) cell line were evaluated at a post-incubation of 48 hrs using MTT colorimetric assay. Cell viability of MCF-7 was evaluated by mitochondrial dehydrogenases activity at concentrations of 25, 50, 100, 200 µgmL^{-1} of leaves and bark extracts compared to the negative and positive control, 0.5% methanol and Tamoxifen respectively. A moderate cytotoxic effect was observed in both (leaves and bark) methanolic extracts while no cytotoxic activity was evident by aqueous extracts against MCF-7. Out of the two methanolic extracts, bark showed higher cytotoxic effect (IC_{50}; 59.43 µgmL $^{-1}$) compared to leaves (IC_{50}; 127.65 µgmL $^{-1}$). However, the cytotoxic effects of leaves and bark are not as stronger as that of tamoxifen (IC50; 9.86 gmL $^{-1}$). The findings of this study confirmed that the leaves have less cytotoxic potential towards MCF-7 compared to the bark. As an outcome, it is suggested of developing nutraceutical supplements using leaves and bark of Ceylon cinnamon to be used in reducing the risk of cancer.

Acknowledgement: NSF grant SP/CIN/04/2016 and University of Ruhuna

Keywords: *Cancer, Ceylon cinnamon, methanolic extracts, aqueous extracts, MTT assay*

 ISSN 2362-0412

Land-Use/Cover Alterations in Coconut Plantations in Western and Southern Coasts of Sri Lanka from 1996 to 2017

S.K. Madarasinghe [a], K.K.A.S. Yapa [a*], L.P. Jayatissa [b]

[a] *Department of Physics, Faculty of Science, University of Ruhuna, Matara.*
[b] *Department of Botany, Faculty of Science, University of Ruhuna, Matara.*

*Corresponding author: *kanthi@phy.ruh.ac.lk*

ABSTRACT

Bearing a large economic importance, coconut is mainly cultivated in the coastal zone of Sri Lanka due to the availability of optimum conditions for coconut growth. However, conversion of coconut plantations into other land-uses could be observed all along the coast during the past few decades. Therefore, this study aims at investigating the land-use changes that occurred in coconut plantations in the western and southern coasts of Sri Lanka over two decades (1996-2017). Two digital land-use/cover (LULC) maps of a 2km belt of the western and southern coastal belts were obtained for the two years, 1996 and 2017, and area statistics were calculated followed by an overlay analysis using ArcMap software. Two sample proportion test was applied using R statistical software to test the significance of the area changes that occurred from 1996 to 2017. The study area had 29,798 ha of coconut plantations in 1996 which has significantly reduced down to 14,183 ha by 2017 (-52.4%, $p<0.05$). Moreover, overlay analysis revealed that coconut plantations that existed in 1996 had been replaced with many other LULC types by 2017, in particular, aquaculture, bare lands, grassland and marsh, homesteads, settlements, rubber plantations, minor crops (e.g. oil-palm), sandy areas, scrubland and chena. Replacement of 14,446 ha, 1,434 ha and 82 ha of coconut plantations with homesteads, settlements and bare lands, respectively provides evidence of the reduction of economically important crop plantations, mainly for coastal urbanization. Although several government authorities and institutions are responsible for the production, quality improvement, support development, and conduct research on coconut, continuous decrease of coconut plantations shows their poor monitoring and non-interference towards protecting these areas. Therefore, this paper emphasizes the urgent need of preserving the coconut plantations on the coastal belt of Sri Lanka, which significantly contributes to the country's economy. In that respect, proper enforcement of policies to prevent unnecessary conversion of economically important land-uses must be done by authorities to minimize such drastic changes.

Keywords: *coastal coconut plantations, economic importance, proper monitoring*

 ISSN 2362-0412

Mapping Spatial Variability of Irrigation Water Quality in Kamburupitiya Divisional Secretariat Area, Matara, Sri Lanka

K.M.C. Fernando [a]*, H.I.G.K. Anuruddi [b]

[a] *Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Mapalana, Kamburupitiya 81100, Sri Lanka*
[b] *University of Colombo Institute for Agro-Technology and Rural Sciences, Hambantota, Sri Lanka*

*Corresponding author: *menaka@crop.ruh.ac.lk*

ABSTRACT

Irrigation is a procedure of controlled run in multiple water sources in a judicious manner for maximizing crop production. Quality irrigation water is one of the essential inputs of agriculture for sustaining productivity, farmers' income and rural development. The present study was carried out to assess and map spatial variability of irrigation water quality in the Kamburupitiya divisional secretariat area for paddy by selecting seventy nine paddy fields located in 46 Grama Niladhari divisions (GN). The pH, EC (ds/m), salinity (ppt) and TDS (mg/l) were measured six times in all samples from September 2020 to February 2021 using EXTECH pH meter and WalkLAB Professoional Conductivity-TDS-Salinity meter. About 20% of selected water samples (17 paddy fields) which reported the highest EC, pH, salinity and TDS were further analyzed for total hardness (TH), total alkalinity (TA), Calcium (Ca^{+2}), Magnesium (Mg^{+2}), nitrate-nitrogen (N) and total iron (TI). Sampling sites were tracked using Global Positioning System (GPS) while sampling. Spatial variation of pH, EC, salinity and TDS were mapped using ArcGIS software for the selected GPS points. As the maximum permissible levels of measured parameters for Sri Lankan irrigation water is not available, the mentioned parameters were compared with Sri Lankan drinking water standards except for EC. The mean EC of the study area was 123.81 ± 49.97 ds/m while the maximum EC value recorded in the study area (Bibulewela GN division) was slightly higher than that of the WHO standards for drinking water. The mean values of pH was 7.84 (± 0.32). The maximum pH value of the irrigation water was equal to the upper limit of the SLS standard for drinking water. The salinity was in between 0-0.03 ppt while the TDS was in the range of 25.31 - 201.33 mg/l. Maximum values of the salinity and TDS were less than that of the SLS standard for drinking water. Furthermore, TH, TA, concentrations of Ca^{+2}, Mg^{+2}, N and TI in irrigation water were significantly different (p <0.01) from the recommended maximum permissible levels of drinking water. All measured values were lower than that of the SLS drinking water standards. Therefore, it can be concluded that the quality of the water supplied to the paddy fields in the Kamburupitiya DS division was at a satisfactory level except for the Bibulewela GN division, indicating its suitability as irrigation water for paddy production. This study suggests the importance of developing quality standards for irrigation water in Sri Lanka.

Keywords: *Irrigation water, maximum permissible levels, quality, salinity, SLS standards*

 ISSN 2362-0412

Preliminary Study of Guinea Grass (*Megathyrsus maximus*) Biochar as a Phosphorus Source

T.U.H. Liyanage, D.M.C.S. Dissanayaka, W.M.C.S. Jayaweera, K.M.W. Rajawatta, E.P.S. Chandana, K.H.T. Karunarathna*

Department of Biosystems Technology, Faculty of Technology, University of Ruhuna, Sri Lanka

*Corresponding author: *thissa@btec.ruh.ac.lk*

ABSTRACT

The *Megathyrsus maximus* commonly known as guinea grass is an invasive species in Sri Lanka that can be found throughout the island. Biochar has a wide range of potential applications as a soil amendment and as a fuel source. Biochar can adsorb different chemical components due to its porous structures, thus biochar can function as a fertilizer. Biochar is inherently having the ability to adsorb and release plant nutrients to ensure optimum availability of micronutrients to plants. The objective of this study was to develop a guinea grass biochar as a potential slow releasing phosphorus source to be used as a soil amendment. Guinea grass biochar was synthesised at different pyrolysis temperatures range from 200^{o}C to 500^{o}C under low oxygen environment. Phosphate releasing capacity of the biochar and air-dried guinea grass were studied spectrophotometrically. The phosphate relasing ability was studied by mixing 0.5g of biochar and 200 ml of dislited water for 24h at ambient conditions. The biochar yield was calculated as 92%, 48% 36% and 23.0% for 200^{o}C, 300^{o}C, 400^{o}C and 500^{o}C respectively. The highest phosphate release (66 ppm) was given by the biochar synthesised at 400^{o}C and air-dried guinea grass, 200^{o}C, 300^{o}C, and 500^{o}C samples were 17, 20, 41 and 34 ppm, respectively. The calculated standard P_2O_5 % of 400^{o}C biochar was 1.97 %, parallel to vermicompost. The pH of biochar at 400^{o}C was about 10. Finding of the present study demonstrated the potential use of guinea grass biochar as a phosphate source which can be use as soil amendment to enrich phosphorous level of soil and neutralize the acidity of soil. Further studies are recommended to fortify biochar with nitrogen, potassium, phosphorous *etc*. and analyse kinetics of nutrient adsorption/releasing.

Keywords: *Biochar, Fertilizer, Gguinea grass, P_2O_5 , Pyrolysis*

 ISSN 2362-0412

Use of Soil Salinity and Redox Potential in Assessing Restoration Success of Mangrove Juveniles of *Rhizophora mucronata* Lam.

K.A.S. Kodikara [a]. S.K. Madarasinghe [b], J. Andrieu [c], L.P. Jayatissa [a*]

[a] *Department of Botany, Faculty of Science, University of Ruhuna, Matara, Sri Lanka*
[b] *Department of Physics, Faculty of Science, University of Ruhuna, Matara, Sri Lanka*
[C] *GEOSpatial Monitoring & amp; Information Technology (GeoSMIT) department, French Institute of Pondicherry (IFP), Pondicherry, India*

*Corresponding author: *sunandaruh@gmail.com*

ABSTRACT

Mangrove restoration has become a priority for the Sri Lankan government in its quest to provide safeguard against ocean surges though restoration success is not retrospectively monitored. The primer introduced by the Society of Ecological Restoration International (SER) is barely used in success evaluation as it is time consuming and expensive at some point. Therefore, this study aimed at testing the likelihood of using soil salinity and redox potential at 10 cm depth, as a simple proxy to measure success of *Rhizophora mucronata* mangrove juveniles. Three mangrove restoration sites namely; Panama, Panakala and Halawa (belong to dry zone) on the eastern coast of Sri Lanka were subjected to the study. Per each site, six *R. mucronata* mangrove patches i.e. same aged, three successful (>25%) and three unsuccessful patches (<10%), were selected. From each patch, 12 (twelve) soil samples were randomly collected and soil salinity and redox potential of soils were measured with a multimeter. Soil bulk density (SBD). Soil pH, soil porosity were studied additionally. Level of survival of *R. mucronata* juveniles and cumulative height were recorded for each patch and considered as response variables. Generalized Linear Model (GLM) was performed taking soil salinity and redox potential as explanatory variables. According to the results, soil parameters showed remarkable variations among the successful and unsuccessful patches. Mean soil salinity in the successful sites (8.4±2.1 psu) was significantly lower than ($p<0.05$) the unsuccessful sites (14.2±1.6 psu). On the contrary, the successful sites showed significantly higher ($p<0.05$) mean redox potential (-38±14 mV) as compared to the unsuccessful sites (-192±47 mV). GLM results indicated a significant interactive effect of soil salinity (low) and redox potential (high) on level of survival and growth performances of planted *R. mucronata* juveniles. These conditions collectively reflect soil maturity of mangrove restored sites. Therefore, we propose that interactive effect; soil salinity × redox potential, can be used as a simple, worthy proxy in evaluating success of *R. mucronata* mangrove juveniles.

Acknowledgment: FSPI-SEDRIC project provided financial assistance for the research.

Keywords: *Soil properties, dry zone, restoration success, proxy, GLM*

 ISSN 2362-0412

Water Stability of Aggregates as Affected by Heating Temperature and Duration of Exposure in a Water Repellent *Eucalyptus* Surface Soil

H.T.M. Perera, D.A.L. Leelamanie *

Department of Soil Science, Faculty of Agriculture, University of Ruhuna

*Corresponding author: *leelamanie@soil.ruh.ac.lk*

ABSTRACT

Water repellency (WR) in soils is a phenomenon caused by organic compounds that prevents the spontaneous penetration of water into soils. It is common under plant species such as Eucalyptus, Casuarina, and Pine that are containing high amounts of waxes and resins in their litter materials. These species are also known to be highly prone to wildfires. Depending on heating dynamics, fire-generated heat may alter soil properties. WR and aggregate stability (AS) are two of the properties that are reported as affected by heat. Furthermore, WR in soils and AS are reported mostly as positively related. This study aimed to examine the effects of different heating temperatures (T_H) and exposure durations (D_E) on WR, AS, and their interrelation, using a water-repellent *Eucalyptus grandis* forest soil. Water-repellent aggregates (diameter: 3-5 mm) collected from the surface (0-5 cm) soil were exposed to four temperatures (150, 200, 250, 300°C) separately for three durations (30, 60, and 120 min). The WR was determined using the molarity of an ethanol droplet test up to its minimum measurement of 90° contact angle, and water drop penetration time test for samples with contact angles <90°. The percentage of water-stable aggregates (%WSA) was determined using wet sieving apparatus. The WR decreased with increasing T_H and D_E up to 200°C. Samples became non-repellent at temperatures ≥250°C under all D_E levels. The %WSA increased up to T_H of 250°C, while decreased at 300°C under all D_E levels. The change in %WSA under shortest D_E (30 min) was lower than that at longer D_E (60, 120 min). With increasing T_H, the relation between SWR and the % change in WSA increased up to 200°C, then slightly decreased up to 250°C, and became negative beyond that for all D_E levels. Results revealed that although WR of aggregates decreased with heating, AS did not always decreased, where the relation was not essentially positive as claimed in previous reports. The D_E did not show significant impact on WR, AS, or their interrelation. Further studies are necessary with more D_E and T_H levels to verify these impacts and exact interrelations.

Keywords: Aggergate stability, Exposure duration, Heating temperature, Water repellency

Computer Science and Information Technology

 ISSN 2362-0412

Application of Vision Transformers in Online Advertisement Identification

C.R. Liyanage [a*], M.K.S. Madushika [b], R.D. Nawarathna [c]

[a]*Department of Information and Communication Technology, Faculty of Technology, University of Ruhuna*
[b]*Department of Computer Science, Faculty of Science, University of Ruhuna*
[c]*Department of Statistics and Computer Science, Faculty of Science, University of Peradeniya*

*Corresponding author: *ravihari@ictec.ruh.ac.lk*

ABSTRACT

Advertisements(ads) play an important role in many sectors, such as business, education and government as they can influence cultural and religious aspects of a society by disseminating important messages to people. Generally, image-based advertisements are more creative and different from other images as these contain slogans explaining the message of the ad, symbolic and atypical objects and different placements of objects within an image. Identification of advertisements from other images is important on digital media in getting customer attention or blocking them from websites. This study proposes a method to use a supervised learning approach to classify images into ads or not-ads. Another objective of this study is to verify the application of Vision Transformers (ViT) in the domain of image-based ad analysis. ViT is a novel image classification architecture derived similar to the Convolutional Neural Network (CNN), where images are divided into patches and trained using the technique called "Multi-Headed Self Attention". The experiment was conducted using 19,700 images that were labelled as ad and not-ad. Two ViT models with different patch sizes, which were pre-trained on ImageNet-21K dataset were used for image classification. These two models were trained as batches of size 10 for a maximum of 20 epochs. The dataset was split into two main parts as training and testing and set the validation split as 0.2. The highest accuracy of 82% was gained from the 32x32 patch sized model during validation. Moreover, an accuracy of 84%, precision of 85%, and recall of 84% resulted during its testing phase. The results of this study were compared with the state of the art research using CNN. The study has proved that the ViT architecture can achieve comparative results with the limited available computational resources.

Keywords: *Advertisements, Classification, Vision Transformers*

 ISSN 2362-0412

Developer Centric Framework for End User Involvement in Application Design

Kokila Harshan Ramanayaka*, P.G. Waruna Lasantha

Information Technology Unit, Faculty of Humanities and Social Sciences, University of Ruhuna, Sri Lanka

*Corresponding author: *kokila@hss.ruh.ac.lk*

ABSTRACT

With the advancement of information and communication technology, computer software has been designed to make it easy for end-users to build and customize the software to suit their needs. As a result, end-users have become software developers and have the opportunity to contribute directly to technological development activities. The main intent of this paper is to propose the new integrated technology stack for API based application development used for developed, Developer Centric Framework for Enduser Involvement in Application Design. The technology stack with CentOS 8 operating system has been applied for application development. On top of that, Containerized environment with Docker and Portainer has been used to manage the containers. The backend API architecture was developed using the existing PHP Laraval 8.0 framework, and the backend was serving with Nginx as a reverse proxy with Apache. Herein, JWT (JSON Web Token) has been used to secure communication between the frontend and backend. The frontend has been developed with Angular 11 together with component-based architecture. In contrast, Jenkins has been used for Continuous Integration and Continuous Delivery (CICD). Jenkins has done the frontend app building process and deployment to production servers. Content Delivery Network (CDN) has been used to fast deliver the content as an intermediate service. This framework will allow institutional information management to be effective, efficient, and used for other related purposes with minor customization. The faculty website developed using the above framework with the proposed technology stack is actively running with regular updates of events, news notices etc., by department users. The results of the activity logs generated by the framework ensure that the staff profiles are updated with up-to-date information by themselves without facing any barriers. The proposed technology stack will reduce the time it takes to rebuild similar systems, thus reducing the cost and improving the quality and productivity of the software.

Keywords: *developer centric framework, reusability, software engineering, web technology*

 ISSN 2362-0412

Improving the Sinhala Handwritten Word Recognition Using a Dictionary with Consonant and Vowel Information Extraction

Chamari Silva [a*], Nisaba Jayasundere [b]

[a]*Information Technology Unit, Faculty of Humanities and Social Sciences, University of Ruhuna.*
[b]*Deapartment of Electrical and Information Engineering, Faculty of Engineering, University of Ruhuna.*

*Corresponding author: *chamari@hss.ruh.ac.lk*

ABSTRACT

Sinhala language is used by Sinhalese, the major ethnic group native to Sri Lanka, that comprise the majority of the population (75%) in the country. Most of the textual data gathered in Sri Lanka is in the Sinhala language. The written paper documents in Sinhala is converted to electronic format requires an enormous amount of human labour. If the conversion can be automated using handwriting recognition, it would increase efficiency and a significant cost can be saved. In most of the researches the characters are segmented and recognized. Many applications require identifying words rather than individual character modifier combinations. When the identified characters are put together to create a word, if the characters are not identified correctly from the character recognition algorithm, the word as a whole is going to be incorrectly identified. In this research, a method to improve the recognition rates using a dictionary, consonant and vowel information is used. The recognition rate could be improved from 63% to 79%.

Keywords: *Sinhala, Handwriting Recognition, Word Recognition*

Covid 19 Issues and Solutions

 ISSN 2362-0412

Crystalising Marginalisation of Urban Waththa Dwellers: A Study Based on Matiwatta in "Angulana"

Suranjith Gunasekara *, Lahiru De Zoysa

Department of Sociology, Faculty of Humanities and Social Sciences, University of Ruhuna

*Corresponding author: *suranjith@soci.ruh.ac.lk*

ABSTRACT

COVID-19 pandemic situation affected every social, political, economic and cultural sphere in the world. It was not merely a healthcare crisis, but its complications were multidimensional. In the Sri Lankan context, the urban waththa (slum) dwellers were also severely affected by the COVID-19 pandemic. As a marginalised community, they encountered several complications when adhering to new healthcare practices. Therefore, "how urban slum/waththa dwellers were marginalised while crystalising their social exclusion during the COVID-19 pandemic in Sri Lanka" was the identified research problem of this study. The main objective of this research was to identify influential factors of crystalising marginalisation and social exclusion of urban waththa dwellers during the COVID-19 pandemic in Sri Lanka. This research was conducted as qualitative research, and a Case Study research design was used. Matiwatta Slum in Angulana South Grama Niladhari Division was the selected research area, and data was collected by snowball sampling method through purposive sampling method. Twenty respondents were chosen for the data collection, and in-depth interviews and focus group discussions were conducted for primary data collection. Data analysis was conducted by using the thematic analysis method. The research findings described that urban waththa dwellers were a marginalised community even before the COVID-19 lockdown period. The influence of new lockdown experiences, encountered social, economic and cultural issues, the role of non-slum dwellers and role of political agencies, issues of adhering to new healthcare practices and re-shaping social identity were some identified influential factors that determined the social exclusion and marginalisation of urban waththa dwellers during lockdown period. In conclusion, these factors influenced to make the social exclusion and marginalisation to a worse level, and therefore, it was identified, as a marginalised community, waththa dwellers' marginalisation and social exclusion were crystallised during the COVID-19 period.

Keywords: *COVID-19, Crystallising, Marginalization, Social Exclusion, Urban, Waththa Dwellers*

 ISSN 2362-0412

Do the Undergraduates Have Infrastructure Facilities Necessary for Online Education at Their Personal Dwellings? A Survey in Faculty of Allied Health Sciences, University of Ruhuna

S.M.D.U. Silva, H.W.A.S. Subasinghe, V.M. Pathiraja*, D.G.P. Prasadi

Department of Pharmacy, Faculty of Allied Health Sciences, University of Ruhuna, Sri Lanka

*Corresponding author: *vindyampathi@gmail.com*

ABSTRACT

Online learning has become a new experience to most of the Sri Lankan undergraduates. Computer, internet and other infrastructure is important for effective online learning. This study evaluated the availability of physical and infrastructure facilities necessary for online education at the personal residences of undergraduates. Data were collected from undergraduates of the Faculty of Allied Health Sciences, University of Ruhuna using a content and face validated questionnaire in a Google form. Sample (n=238) composed of Pharmacy, Nursing and Medical Laboratory Science undergraduates who were in their first (37.0%), second (42.4%), third (11.3%) and fourth (9.2%) academic year. Approximately 73% of participants had desktop or laptop computers while others used mobile phones to join online academic activities. Only 53% students had access to good quality internet connection. Headphone and microphone were the most commonly available (75.6%) computer accessories while 42.4% had webcam. Only 9.7% had a printer at their home. A quiet separate place for studies (70%) a separate table and a chair (92.4%) and sufficient stationaries (84.9%) were available. Students having a computer (70.2%) were able to use basic software such as MS office to complete academic activities such as assignment and presentations. 58% had additional reference material. Majority of students (88.5%) were skilled in using online communication modes such as e-mail, WhatsApp and SMS. Students (45.5%) had least confidence in using online platforms such as Moodle a Blackboard. Majority (84.7%) reported confidence in using online platforms such as Zoom and MS Teams. In conclusion, a considerable number of undergraduates have limited computer and quality internet facilities at their residences. Instead, they use mobile phones, which obviously the small screen could affect the learning. Students have less confidence in using online platforms as Moodle. Overall, these could restrict the student engagement in online academic activities and performance in the exams as well. Therefore, special attention should be paid in this group of students in continuing online teaching.

Keywords: *Infrastructure facilities, Moodle, Online platforms, Online teaching*

 ISSN 2362-0412

Forecasting COVID-19 Daily Infected Cases in Sri Lanka by Holt-Winters Model

S.S. Wickramasinghe [a]*, K.M.U.B. Konarasinghe [b]

[a]*Department of Microbiology, Faculty of Medicine, University of Ruhuna, Galle, 80000, Sri Lanka*
[b]*Institute of Mathematics and Management, Sri Lanka*

*Corresponding author: *subodhawick@med.ruh.ac.lk*

ABSTRACT

Since December 2019, the novel coronavirus disease (COVID-19) has spread from China and around the world. In Sri Lanka, as of December 29, there had been 586,183 confirmed cases and 14,944 deaths due to this viral infection. This study was performed to forecast the daily infected cases of COVID-19 in Sri Lanka by using Holt-Winters three parameter with additive or multiplicative models. Forecasting may help relevant authorities for better preparedness against the pandemic. The daily infected cases in Sri Lanka for the period of 22nd January 2020 to 22nd December 2021 were obtained from the publicly available databases of Epidemiology Unit of Sri Lanka and World Health Organization. Analysis was performed using Minitab statistical software (18th version). The pattern recognition of the daily infected cases was examined by time series plot and Auto Correlation Function (ACF). The model validation was performed by the Anderson Darling test which confirmed the normality of residuals ($p > 0.05$) and ACF that confirmed the independence of residuals of the model. The forecasting ability of the model was assessed by the three measurements of errors; Mean Absolute Percentage Error (MAPE), Mean Absolute Deviation (MAD) and Mean Square Error (MSE). Holt-Winters additive and multiplicative model with α (level) 0.61, β (trend) 0.4 and γ (seasonal) 0.3 at a length of repeating behaviour of 3 days, had the least relative and absolute measurement of errors during the model fitting and verification. İn the multiplicative model, MAPE, MAD and MSE were 0.2847, 0.0187 and 0.0005 respectively. Similarly in the additive model, corresponding values of MAPE, MAD and MSE were 0.0207, 0.0187 and 0.0005. The fits and the forecast of these models followed a similar pattern of the actual daily infected cases concluding that this model can be used to forecast the COVID-19 outbreak in Sri Lanka.

Keywords: *Holt-Winters, COVID-19, infected cases, forecasting*

 ISSN 2362-0412

Impact of Practising Safety Measures for Covid-19 on the Education of Undergraduates of University of Ruhuna

A. Karunanayake*, K.W. Dharmaratna, H.W.W. Nirmavi, D.M.Y. Amerasinghe, J. Karunarathna

Department of Physiology, Faculty of Medicine, University of Ruhuna

*Corresponding author: *a2222nath@gmail.com*

ABSTRACT

Covid-19 has caused a severe impact on different aspects of life including health, the economy as well as education. The universities are trying to gradually re-establish the education of their students in new normal. This study aimed to determine the impact of practising safety measures (wearing a face mask, hand washing, using hand sanitizers, social distancing) on the education of undergraduates of University of Ruhuna. An online questionnaire was administered to collect data for undergraduates of the University of Ruhuna who had resumed academic activities under the new normal. Of 267 participants 68.5% (183) were female and 31.5 % (84) were male students. The median age was 23 years. 34.2% were affected due to Covid-19. 8.7 % had not practised any safety measures. Not practising safety measures was higher among males (15.5%) than females(6.6%). 38.7 % practised all four main safety measures. 93 % had the perception that their education was affected to some degree by practising safety measures. 59.6% reported difficulties in communication with wearing a face mask. 11.5% mentioned that handwashing was a time-consuming act that caused a distraction for studies. The social distancing was associated with less input from peers during working in study groups (52.6%) and ineffective practical sessions (60.6%). Tiredness due to the monotonous routine (51.9%), lack of enthusiasm to study (33.8%) and the difficulty in coping with stress (22.6%) were reported with the social distancing .44.1.% reported that the cost of purchasing safety products was a burden. Feeling optimistic for not contacting the virus (70.1%) , Reduced respiratory tract infections (45.9%) , less disturbances (noise) while studying (16.4%) more individual attention (13.2%) , reduced asthma exacerbations (6.9%) were mentioned as the advantages that experienced from following the safety measures. The practising of safety measures for Covid-19 has both negative and positive impacts on the education of undergraduates of the University of Ruhuna.

Keywords: *Covid-19, Education, Safety Measures, Undergraduate*

 ISSN 2362-0412

Psychological Disturbances and Associated Factors Among Professionals and General Public During COVID-19 Pandemic in Sri Lanka

S.M.T.D. Sundarapperuma*, M.W.K. Gamage, R.H.M.P.N. Rathnayaka, S.M.E.B. Weerathunga, H.J.H. Madushanthi

Department of Nursing, Faculty of Allied Health Sciences, University of Ruhuna

*Corresponding author: *chamudi2006@yahoo.com*

ABSTRACT

Introduction: Globally, the growing prevalence of COVID-19 is a major public health concern. This pandemic has made numerous psychological disturbances among professionals and general public in the whole world, including Sri Lanka. This study was conducted to identify the psychological disturbances (i.e., depression and anxiety) among the general public and professionals, including healthcare professionals and military personnel during the COVID-19 pandemic in Sri Lanka. Materials and methods: A cross-sectional descriptive study was conducted in selected three districts with 367 participants (general public n=134, healthcare professionals n=128, military personnel n=102) during the 1st to 4th waves of COVID-19. Depression and anxiety were assessed using the Peradeniya Depression Scale (PDS) and Generalized Anxiety Disorder 7 scale (GAD-7) respectively. Binary logistic regression was used to determine the factors associated with depression and anxiety. Results: Mean age (+SD) of the study population was 35.02 (+10.63) years and 51.8% were females. Higher level of depression and anxiety were observed among 39.2% and 55.3% participants respectively, and they were predominant among military personnel (73.5% vs 89.2%). Gender, professional engagement and level of education are associated with both depression and anxiety ($p>0.05$) further explaining that males, military personnel, and those who educated below A/L had higher levels of depression and anxiety ($p<0.05$). Those who educated below A/L (OR=2.92, 95% CI) and professional engagement (i.e., military and healthcare) (OR=4.4, 95%CI) emerged as the associated factors for higher level depression while the similar factors associate with the anxiety as well (those who educated below A/L; OR=3.44, 95% CI and professional engagement; OR=3.9, 95% CI). Conclusions: A reasonable proportion of general public exhibited higher level of depression and anxiety during the pandemic of COVID-19 in Sri Lanka. Frontline workers, including healthcare professionals and military personnel and those who educated below are more likely to exhibit depression and anxiety compared to the general public and those who had tertiary education respectively.

Keywords: *COVID 19, Depression, Anxiety, Professional, General public*

Economics, Finance, and Management

 ISSN 2362-0412

Constructing an Area-based Index to Evaluate Sustainable Development for Southern Province, Sri Lanka: A Principal Components Analysis Approach

A.J. Jayasekara [a*], B.M. Sumanarathne [a], Leslie Jayasekara [b]

[a] *Department of Economics, Faculty of Humanities and Social Sciences, University of Ruhuna, Sri Lanka*
[b] *Department of Mathematics, Faculty of Science, University of Ruhuna, Sri Lanka*

*Corresponding author: *anne@econ.ruh.ac.lk*

ABSTRACT

The current sustainable developmental literature lacks a uniform approach to combine indicators that result in a composite index and its application in capturing inequalities in area based development outcomes. Rather than using various abstract variables in the form of numbers or proportions separately, a single index quantifying complex conditions can be more meaningful in understanding area-level factors that shape sustainable development. The paper focuses on developing an area based sustainable development index for Southern Province, Sri Lanka, in order to understand differences in developmental outcomes and would be a very valuable opportunity to identify the current situation by comparing the region-to-region in a multivariate context. The area-based index was formulated by two different methods, z-scoring method and factor scoring method based on twelve selected variables which measuring multiple aspects of development status. Secondary data were gathered through the statistical handbooks related to the divisional secretariat's divisions in districts which published in 2018 and 2020. A Kaiser-Meyer-Olkin test and Bartlett's Test of Sphericity were used to assess the appropriateness of using Principal Components Analysis. Three factors were discovered which together explained 88.6 per cent of the total variation. Pearson's correlation coefficient of both indices is 0.99 and it showed that there is a very high positive correlation among values of both composite indices. The computed scores have ranged from 0 to 100 and divided into four developed groupings, such as "High" (75-100), "Medium-high" (50-74), "Medium-low" (25-49), and "Low" (0-24). Four Gravets in Galle district is achieved the highest rank in both indices in both years with indicating "high" development. Matara division is achieved "medium-high" development. The development has changed among in divisions in the time lag; it has caused to change the rank of the indices. However any of division in Hambanthota district couldn't enter to the top 10 Divisional Secretariats' Divisions according to the level of sustainable development obtained under both statistical methods. The multi-dimensional composite index developed here within both frameworks are provided a better picture of economic, social, cultural, and related structural conditions, and thereby, sustainable development stratification of areas across major development groupings.

Keywords: *Multivariate Analysis, Principal Components Analysis (PCA), Sustainable Development, Southern Province, Z-Score*

 ISSN 2362-0412

Empirical Analysis of Relationship between GDP Growth Rate and Expenditure on Both Education and Health in Sri Lanka Using Multivariate Time Series Technique.

Anuradha Gamage

Department of Economics, Faculty of Humanities and Social Sciences, University of Ruhuna, Sri Lanka

Corresponding author: *anuradha@econ.ruh.ac.lk*

ABSTRACT

Gross Domestic Product (GDP) is one of the major keys in measuring countries development. Development does not stand only for financial prosperity. Among number of facts that make impact on GDP and its growth over years, education and health can be considered as important factors. This study has been carried out to analyse how the expenditure on education and health, as a share of national expenditure have been behaving throughout past 59(1962-2020) years on GDP growth in Sri Lanka. Since three data series were not representing stationarity, values were log transformed and tested for stationarity. According to the results *lgdp, ledu* and *lhealth* were unit root non-stationary, therefore first difference of data taken and then all three variables Δ*lgdp,* Δ*ledu* and Δ*lhealth* were stationary. Thus, the requirement for VAR modelling was satisfied. AIC, BIC and HQ criteria have been conducted to find the VAR order as 3. VAR(3) model satisfies the accuracy condition of non-cross correlated residuals. Granger causality could be identified in the direction GDP to both Education and Health expenditure. GDP was not granger caused from both variables. This one-way causality is common for mid and low-income countries. Per capita income arises when GDP grows, then people have money to be spent on education and health while it helps to grow the GDP growth rate. According to model VAR(3) which has short term of 3 lags, GDP growth rate is having positive impact on both education and health in second and third lag. According to the results GDP growth rate cannot by developed only by education, it needs all other economic sector improvements. Making investments in other economics sectors will automatically increase the development in health and education. Health and education are having positive impact on each other. Johansen cointegration test was performed for unit-root non-stationary data according to the results, it could be concluded that there is no cointegrating relationships among variables. That implies there exists no long running or stable equilibrium among three variables. In 2021, 1.29% GDP growth rate could be predicted using VAR(3) model. However, the Covid-19 impact can make changes in the results as the impact was partially touched by the pandemic.

Keywords: *Cross Correlation, Education, Gross Domestic Product, Health, Variance Auto Regressive model*

 ISSN 2362-0412

Factors Affecting Consumer's Purchase İntention of Green Products in the Context of Sri Lankan Food and Beverage İndustry: A study based on Theory of Planned Behavior

W.A.D.M.S. Wijesekara, T.S.L.W. Gunawardana *

Faculty of Management and Finance, University of Ruhuna

*Corresponding author: *gunawardana@badm.ruh.ac.lk*

ABSTRACT

This study aims to investigate the factors affecting consumer purchase intention of green products in the context of the Sri Lankan food and beverage industry. It attempts to give a better understanding of the reasons to purchase green products to minimize the harmful effects for the environment. Moreover, the study was conducted by using the extended Theory of Planned Behavior (TPB) including environmental consciousness and health consciousness with other three prevailing constructs in TPB (i.e., attitudes towards green products, subjective norms, and perceived behaviour control). The literature to measure the effect of these additional constructs on green purchasing intention with the TPB model was very limited and carried out in Sri Lanka also very limited. Therefore, this study attempted to filling the research gaps regarding the green products purchase intention. This study targeted the consumers who are in 18 years or above in Sri Lanka as the population and consumers who purchased green products recently and live in Sabaragamuwa province selected as respondents using a random sampling method while 200 questionnaires were distributed among the respondents using emails and personally. The achieved sample consists of 178 questioners. Out of 178 questioners 150 were usable. An online questionnaire survey was conducted for collecting data via Google form and data analysis was conducted by using both SPSS and Smart PLS 3 software. Then, the study found that attitudes, environmental consciousness, and health consciousness positively and directly affect the purchase intention of green products while subjective norms and perceived behavior control did not statistically significant. Further environmental consciousness and health consciousness positively affect the attitudes and perceived behavior control but not the subjective norms. This study highly contributes for the academics, managers and policy makers to understanding the consumer purchase intention of green products in the context of the Sri Lankan food and beverage industry that was proven by this contemporary study.

Keywords: *Attitudes, environmental consciousness, green products, and health consciousness, perceived behavior control, subjective norms, theory of planned behavior*

The Influance of Emotional Intelligence on Pro-social Behaviour of Sri Lankan Universities' Management Undergraduates: Evidence from a Sri Lankan State University

Isuru Chandradasa*, B.L. Galhena

Department of Human Resource Management, Faculty of Management and Finance, University of Ruhuna

*Corresponding author: *isuru@mgt.ruh.ac.lk*

ABSTRACT

Undergraduates in Sri Lankan state Universities confront with highly competitive education experiences which lead them towards more individualistic competitive learning and working culture in the university system. Sri Lankan state universities enroll undergraduate is land with different demographic and socio-economic backgrounds. They attempt to survive in an unfamiliar environment with a bond that build with their nobles. This highly competitive academic system does not bring the same experience to all of them, and it varies from one to another. Therefore, maintaining ethical and emotional obligation towards their colleagues is significant to others as it helps them survive in challenging periods in their academic lives as well as a virtuous practice in their future roles. The recent literature on organizational behavior emphasized on emotional intelligence as the skill that the 21st century mostly needs, and it creates a positive mindset of individuals towards pro-social behavior. Thus, understanding how emotional intelligence influence the pro-social behavior of undergraduates is paramount, and evidence about this phenomenon from the past literature is lacking. Thus, this study was carried out to explore how emotional intelligence influences undergraduates' pro-social behavior during the undergraduate period. From past literature identified four variables named emotional perception, emotional use, emotional understand and emotional management model developed by Salovey & Mayer in 1990 that for exploring emotional intelligence influence for pro-social behavior. The quantitative deductive research approach was employed as the study tested existing theory in a different context. A self-administered questionnaire was distributed among 200 management undergraduates of the University of Ruhuna by employing the convenience sampling technique. 175 responses were gathered, and empirical analysis was performed by using SPSS 25 version. The results of the study revealed that emotional perception (β=.218, sig = 0.04), emotional understand (β=.322, sig = 0.02), emotional use (β=.422, sig=0.00), and emotional management (β=.385, sig=0.00) have a positive influence on the prosocial behavior of university undergraduates. The findings of the study further revealed vital implications to the educational practitioners. First, from the student's perspective, it is necessary to develop their ability to identify others' emotions and generate and facilitate their thoughts towards others' emotions. Moreover, developing undergraduates' ability to integrate what they feel into their thoughts and improving their ability to efficiently manage emotions towards others is of necessity for developing better pro-social behavior among university undergraduates. Through ethical and emotional development will strengthen undergraduates for pro-social behavior and finally lead to a humanistic society. In the current study, a sample is limited to the one-state university management undergraduates and future studies are suggested using a larger sample from other universities and different academic fields for exploring the same phenomena from a broader understanding and generalisability.

Keywords: *Emotional intelligence, Emotions management, Emotional use, Humanistic society, Pro-social behavior*

Education, Humanities, and Social Sciences

 ISSN 2362-0412

A Crıtıcal Evaluatıon of the Phılosophıcal and Methodologıcal Implıcatıons of Posıtıvısm ın Research ın the Dıscıplıne of Teachıng Englısh as a Second Language

C. M. Arsakulasuriya [a]*, Himesha Prabodini Alahakoon[b]

[a] *Department of English and Linguistics, University of Ruhuna*
[b] *English Language Teaching Unit, General John Kotelawala Defence University, Southern Campus*

*Corresponding author: *chandulaarsakulasuriya@gmail.com*

ABSTRACT

This study aims to critically evaluate the effect of positivism as a research paradigm on studies done by Sri Lankan scholars in Teaching English as a Second Language (TESL). Theoretically and pragmatically, TESL is situated under Applied Linguistics and in Sri Lanka under the faculties of Humanities and Social Sciences. There are multiple state and private universities in Sri Lanka where Teaching English as a Second Language is offered to undergraduates as a Bachelor of Arts degree programme under fully-fledged Departments of English Language Teaching (DELT). This research is a mixed method study incorporating research participants and a meta-analyis of TESL/ELT (English Language Teaching) studies published in 2020 and 2021 in Sri Lanka. Researchers who are engaged in research in TESL and ELT were selected as research participants and their responses were analysed against the theoretical perspectives of Lincoln and Guba (1994), Holliday (2004) and Weideman (2012) on the impact of positivism on research in applied linguistics. The majority of the research participants focus on qualitative aspects in their research focusing on subjectivity and individualism. The research participants' primary methodological and philosophical foundations are largely influenced by post-positivism. In categorizing the previosuly published TESL studies into qualitative, quantitative and mixed method studies, 90, 30 and 51 studies were identified respectively. The majority of the TESL studies were done employing the qualitative and mixed method approaches. Therefore, the analysis of interviews and the meta-analysis of previously published studies show that the current research in Teaching English as a Second Language as a discipline in Sri Lankan context is not significantly influenced by positivism. However, with the emergence of the discipline of Teaching English as a Second Language as a unique discipline under fully-fledged departments separating from English Departments, there is a possibility of TESL research being more inclined to positivist research methods and quantitative research tools.

Keywords: *Positivism, Research Methodology, TESL, Applied Linguistics, Sri Lanka*

 ISSN 2362-0412

Acquisition of Vocabulary Knowledge through Reading among Second Language (English) Adult Learners

S.G.S. Samaraweera

English Language Teaching Unit (ELTU), University of Ruhuna

Corresponding author: *sanjaya@eltu*.ruh.ac.lk

ABSTRACT

Although vocabulary knowledge is vital in constructing meaning in language, enhancing vocabulary knowledge is a challenging task for both teachers and learners of a second language. One of the predictors that can be argued to address this challenge is reading. Reading may facilitate language learners to enrich their vocabulary knowledge as they are exposed to written language in reading. Therefore, this study examined whether reading contributes to enhancing the breadth and depth of vocabulary knowledge of ESL learners. The study was conducted with a group of undergraduate students from a state university in Sri Lanka. In the research implementation, measures of reading and vocabulary knowledge were administered to 189 participants to assess their reading and vocabulary knowledge. Additionally, a questionnaire was used to collect demographic information of the participants in order to perceive the level of their prior exposure to the target language. Multiple regression analysis showed that reading significantly contributed to both breadth and depth of vocabulary knowledge. However, the results indicated that reading can contribute more to the breadth of vocabulary knowledge than to its depth. Therefore, it can be argued that although reading can contribute to vocabulary knowledge, the contribution can vary across the types of vocabulary knowledge. In conclusion, the findings help to establish that reading significantly boosts the acquisition of vocabulary knowledge among adult learners of English as a second language.

Keywords: *Acquisition, Adult learners, English as a Second Language, Reading, Vocabulary knowledge*

 ISSN 2362-0412

Ethno-Religious Segregation in Plural Societies: Impact of Post –Easter Sunday Attack of Sri Lanka

Suranjith Gunasekara *, Rohan Thimbiripola

Department of Sociology, Faculty of Humanities and Social Sciences, University of Ruhuna

*Corresponding author: *suranjith@soci.ruh.ac.lk*

ABSTRACT

This paper explores the nature of societal beliefs of Sinhala-Catholics to understand if there is any ethno- religious fragmentation from Sinhala Catholics' perspective in the post-Easter Sunday attack context. The study was qualitative in design with a constructivist philosophy. The in-depth interview technique was employed to collect data from twenty respondents selected through purposive sampling from the Galle Catholic parish. The inductive approach of thematic analysis was used to analyze the data. The main focus was to examine the Sinhala Catholics' perspective on the Muslim community. A group of Muslim suicide bombers who were believed to have links with international Muslim extremists engaged in the attack in the name of Islam, which took the lives of innocent Catholics. They attended holy mass in three different churches and some civilians in Sri Lanka. The transcriptions of the responses were coded and analyzed for themes. As a result, three themes emerged: religious value anxiety, fundamentalism phobia, and a positive sense of security appeared high intensity. The spiritual value anxiety being the highest intense theme shows a collective memory fluctuation among Sinhala Catholics in the Galle parish between religious teachings and the practical application of those in real-life situations. However, the results of this study show that there is no apparent ethno- religious fragmentation between Sinhala-Catholics and Muslims in the Galle parish as far as the out-group relationship and the sense of security are concerned, though the Sri Lankan pluralistic society has ethnoreligious divisions.

Keywords: *Ethno-Religious Segregation, Parish, religious fundamentalism, Societal beliefs*

 ISSN 2362-0412

LIBSEE: An Evaluation Framework for Effectiveness of Library Services Based on Multi-Criteria Analysis

J.A. Ajith [a*], K.H. Ramanayaka [b], W.A. Weerasooriya [c]

[a] *Library, Faculty of Technology, University of Ruhuna, Sri Lanka.*
[b] *Faculty of Humanities and Social Sciences, University of Ruhuna, Sri Lanka.*
[c] *Department of Library and Information Science, University of Kelaniya, Sri Lanka.*

*Corresponding author: *ajith@lib.ruh.ac.lk*

ABSTRACT

Library systems are transforming into hybrid library systems that provide traditional and electronic services with the rapid advancement in technology. For insightful planning towards the benefit of the community, there is a need for continuous assessment of the effectiveness of library services. Based on the above concept, this research proposes a multi-criteria decision-making framework to evaluate the effectiveness of library services by investigating the indicators of the library service. The study conducted a comprehensive literature review related to the effectiveness of library services to identify, determine and suggest evaluation criteria that can be affected the effectiveness. Ten key criteria and 45 measurement indicators were identified after examining the names and definitions of the identified key criteria considering synonyms and homonyms, which designed the basis of the evaluation framework abbreviated LIBSEE (Library Service Effectiveness Evaluation). Furthermore, 10 subject experts, including library science professionals, participated in formal and informal conversations to assess relative relevance and guarantee that content validity meets the defined criteria and measurement indicators. The contribution weightage of key criteria and measure indicators to the effectiveness was examined with the help of experts in the field. The study employed Analytic Hierarchy Process Multi-Criteria Decision-Making theories with the expectation of examining the relative weightings. The framework was designed based on the key criteria, measuring indicators, and their contribution to the effectiveness. Then the framework has converted to the real-time web-based system that will produce the overall effectiveness score and scores regarding each evaluation criteria. The effectiveness level of the services given by the library network of the University of Ruhuna was evaluated to test the applicability and practicality of the framework. The findings of this pilot study show that the proposed framework can assist librarians in providing more effective library services. In contrast, the framework minimizes the ambiguity and unclearness of human judgments due to Analytic Hierarchy Process (AHP) theories.

Keywords: *ahp, effectiveness, library, evaluation, service quality*

 ISSN 2362-0412

Political Cartoon, Facebook Community and Formation of Public Opinion in Sri Lanka

K.H. Lakmali

Department of Public Policy, University of Ruhuna, Sri Lanka.

Corresponding author: *hiroshilakmali@gmail.com*

ABSTRACT

As a developing country, Sri Lanka faces a different economic, social, political crisis. When the citizens are suffering from different issues, there are different ways they use to express them to the government. Therefore, media is the most powerful tool, plays a vital role in bridging the communications between citizens and governments. Jurgan Habermas (1991) explains the importance of having a public sphere in forming public opinion. Therefore, the research identifies Facebook cartoon communities as an effective way of creating public opinion. Facebook communities use both printed medias cartoons as well as web cartoons. Creative cartoons draw pictures to enhance the awareness of important incidents to get the public's attention. It has been believed that pictures speak louder than words. Therefore, regardless the age, education, people get informed by cartoons. This research aimed to investigate how cartoons transform messages to the public and how it affects public opinion. The qualitative research methodology used in this research and the major data collecting tools were participant observation and unstructured interviews. The research conducted as a web-based research and therefore the primary data collected via Facebook Social Media's Cartoon community. The data were analyzed using thematic analysis. The research findings revealed that the cartoons' main purpose was to send a message blended with sarcasm, allowing people to resonate with their experiences and existing knowledge they have. Further, the results revealed that the Facebook community allows people to communicate on different issues, share them on their Facebook page and build conversations with their friends' circle and discuss further on that. Interestingly, they tend to predict and forecast future political trends. Moreover, Facebook cartoon communities act as a new public sphere, which opens new ventures for both members and non-members to develop discussion on current issues. Ultimately this has led to create public opinion in the society in different issues.

Keywords: *Political Cartoons, Political Communication Political Culture, Public Opinion, Public Sphere*

 ISSN 2362-0412

Relatıonshıp between Soft Skılls and Academıc Performance of Bachelor of Arts Undergraduates in University of Ruhuna: A Case Study

E.V. Danushka Dilhani

Department of Economics, Faculty of Humanities and Social Sciences, University of Ruhuna

Corresponding author: *evddilhani@email.com*

ABSTRACT

In order to enhance the employability of graduates, higher education institutions have incorporated soft skills course modules into the curriculum of their academic programmes. This study aims to determine the relationship between soft skills and academic performance among students in the Faculty of Humanities and Social Sciences of the University of Ruhuna. A sample of 53 undergraduates from 242 was selected, applying the random sampling technique. quantitative and qualitative data analyzing techniques have been applied to grow the conclusions. The conclusions of the study are even though soft skill is a leading upcoming subject in practice, that has not been occupied maximal in Art degree course in university yet. To solve the unemployment problem among Art degree holders' soft skills can make a significant role by changing the attitudes of them. The sample provides enough evidences to prove that Art's degree holders expect to do government job as tradition so far. That courses to increase the unemployment rate also among educated females either. Soft skills development course should establish in the orientation programme of students' at the beginning of their university life. They can plan their life and work to achieve that successfully. Finally at the end of their university life students will not be waiting only for government scheme jobs, they will become inventors, innovators and entrepreneurs as well. That's is the true outcome of which can be expected through the effective higher education system of the country.

Keywords: *Academic performance, Arts' Degree Programme, Employability, Higher education, Soft Skills.*

 ISSN 2362-0412

Students' Perception on Similarity Detection Service of University of Ruhuna: A Case Study of Faculty of Allied Health Sciences

P.G. Nishantha*, S.L. Gammanpila, K.T.S. Pushpakumara

Library, University of Ruhuna

*Corresponding author: *nishantha84@ahs.ruh.ac.lk*

ABSTRACT

In the last two decades, development of information technology in the conversion of printed materials to digitalize forms has transformed the worldwide community's access to information. This technological advancement has brought the undergraduate community to undergo plagiarism and dishonesty in the classroom. Therefore, the present study is designed to analyse the students' perception of the similarity detection service offered by the University of Ruhuna and their awareness of plagiarism in academic activities. A stratified random sampling method was used to select a sample of 120 allied health sciences undergraduates representing three departments and each academic year. Data was collected during August 2021 using a pre-tested English medium online questionnaire. To achieve results based on the study objectives, the data were analysed using descriptive statistics in the SPSS 25.0 edition. According to the results, most of the participants were females (75.00%) and the majority of the respondents were First-year students (33.33%). The considered sample awareness on the similarity detection software service offered by the University was varied as a well-aware group (12.50%) and non-aware group (37.50%). Undergraduates have used the Turnitin service to check assignments (26.66%), testing/training purposes (53.33%) and check research publication (20.00%). It is important to note that 45.00% of the undergraduates are not aware of how to avoid of plagiarism. Most of them believe that plagiarism is unprofessional and unethical 79.16 %. A majority (54.00%) considered that plagiarism should be a punishable offense at university and preferred punishment was to resubmit the work without deducting marks (66.66%). Plagiarism is complex and a mixture of factors might cause a student to plagiarize work once or multiple times. This study recommends the university to conduct awareness programmes to avoid plagiarism in undergraduate academic activities.

Keywords: *Academic, Plagiarism, Similarity index, Student, Tunitin*

 ISSN 2362-0412

The Impact of School Library Services on Students' Academic Performance in the Technology Stream: A Case Study for the Faculty of Technology, University of Ruhuna

J.A. Ajith

Library, Faculty of Technology, University of Ruhuna, Sri Lanka.

Corresponding author: *ajith@lib.ruh.ac.lk*

ABSTRACT

The existing research literature reveals the contribution and need for a library as a learning resource and the school library plays a significant role in inculcating students' library habits. Based on this, there is a need to assess school library use and service contribution to the latest technology stream of secondary education. This paper engages in a case study to evaluate the contribution of school library services to academic performance under the technology stream and to analyze the use of library resources for academic purposes. The study findings that, modern electronic information services in school libraries have not been adequately improved. However, the good quality of traditional library services and the high level of student satisfaction have been identified as potential factors in school library service. Although students' reading habits and academic priorities remain at a good level, further awareness programs should be implemented to enhance their borrowing skills. However, the bivariate correlation analysis result indicated the positive relationship between the subject that mostly read at the library and the subject that obtained the best results in the G.C.E. (A/L) examination. The Pearson correlation coefficient (R) value was 0.563 significant at the 0.01 level (2-tailed) thus, indicating a positive association. The R-Square result indicated that can be predicted the school library usage had a 31.7% impact on the academic performance of the technology stream. As a learning resource, the school library makes a significant contribution to the academic performance of students in the technology stream. Therefore, there is a need to improve new technology and digital information sources at the school libraries in Sri Lanka by establishing a networked collaboration service islandwide.

Keywords: *Academic performance, School library, Technology stream, Library services*

 ISSN 2362-0412

The Untold Narration of the Discourse on Militarisation in Post-Conflict Sri Lanka

Aruni Samarakoon

Department of Public Policy, University of Ruhuna

Corresponding author: *arunisamarakoon@gmail.com*

ABSTRACT

"A post-conflict context can be conceptualised as a transitional period bounded by past war and future peace, a period which introduces several new challenges. Whether a war was civil or international in scope, concluded through a peace agreement of by a military victory, for states, a war's conclusion is a time to consolidate political gains" (Cunningham, 2017, p. 2). Based on Cunnigham's interpretation of post-conflict, this research is therefore to understand the process of post-conflict politics which aims to transform past war stories into peace and its impacts on Tamil, the major victim group in Sri Lanka. The literature of Sri Lanka post-conflict points out that militarisation, the presence of the military in everyday life and militarism in civil administration are new political development in the post-conflict context (Thambiah,, 2005; Goodhand, 2012). The literature future reveals that at the end of the civil war in 2009, the military took over the civil administration in the North and East Sri Lanka and in the Covid 10 Global Pandemic, the military became the tool of implementing civil affairs in the South as well. The literature describes the transformation of civil power and functions to the military in an emergency or a disaster though the political ideology behind this transformation is yet to be explored. This paper is therefore to examine the political ideology of militarisation in the agenda of liberal peace in the post-conflict context. The research problem is that despite promoting de-militarisation, why the post-conflict liberal peace policy of the Government of Sri Lanka reinforces military role in civil tasks. The research question is how the Government of Sri Lanka fosters the military in governing process? The qualitative data has been collected through a library survey. The qualitative data has been analysed through Feminism. The key finding of the research is that militarisation in post-war Sri Lanka is defined as a humanitarian operation, locating it in the politics of ethnonationalism which mentions the military as necessary for securing territorial integrity. Also, the Sinhala-majoritarian politics justifies the presence of the military and run the capital accumulation project at the micro-level in the North and East where the civil war occurred. However, the criticism on militarisation gradually emerges from South Sri Lanka recently due to its intervention in implementing the neoliberal-capitalist projects i.e. privatisation of free education.

Keywords: *Feminism, Militarisation, Post-Conflict, Sri Lanka, Trade-Unionism*

 ISSN 2362-0412

Undergraduates' Perception on Online Exams: A Case of Faculty of Agriculture, University of Ruhuna, Sri Lanka

D.M.M. Sandeepani, P.N.M.M. Wijerathna, M.G.T. Lakmali, G.C. Samaraweera*

Faculty of Agriculture, University of Ruhuna, Mapalana, Kamburupitiya, Sri Lanka

*Corresponding author: *gangani@agecon.ruh.ac.lk*

ABSTRACT

As online learning has become vital in current formal educational settings in Sri Lanka universities, online examinations are emerging as inevitable assessment methods. However, there are limited studies on how students perceive online exams in the Sri Lankan context. Hence, the current study aimed to identify students' perceptions of online exams within Sri Lankan university education. Stratified random sampling technique was utilized to select 100 undergraduate students from each batch of Faculty of Agriculture, University of Ruhuna, Sri Lanka. The scale-covered major themes; validity and reliability, teaching and learning, practicality and security, production and adoption that influence the undergraduate perception of online exams. Primary data were analyzed using SMART PLS 3.0 software using bootstrapping re-sampling method (using 500 samples). The study revealed that the majority (83%) have no prior experience on online exams. Results further indicated that the factors that influenced undergraduates' perceptions on online exams differed in terms of their batch. Accordingly, validity and reliability have a positive influence on the students' perception of online exams of all four batches; 1st year (p=0.000), 2nd year (p=0.016), 3rd year (p=0.000) and 4th year (p=0.000) respectively. Students' perception of teaching and learning has a significant and positive influence on 2nd year (p=0.000), 3rd year (p=0.013) and 4th year (p=0.001) students' preference for online exams. Only 3rd year students (p=0.000) have a positive perception towards production and adoption of online exams while only 4th year students (p=0.000) have a positive perception towards practicality and security of online examinations. Therefore, administrators should ensure that the test measures related to content and testing conditions are similar for each learner to enhance the validity and reliability of online exams. Moreover, the study recommends including courses that raise the computer literacy rate would increase the knowledge base of learners and thus, improve the online exam experience.

Keywords: *Online exams, Perception, Undergraduates*

 ISSN 2362-0412

නව සංවර්ධන ව්‍යාපෘති සහ පරිසර කළමනාකරණය: හම්බන්තොට මත්තල ජාත්‍යන්තර ගුවන්තොටුපළ ආශ්‍රිත ප්‍රත්‍යෙයික අධ්‍යයනයක්

නිෂාදි තාරකා මාරසිංහ*, අයි. රේණුක ප්‍රියන්ත

රාජ්‍ය ප්‍රතිපත්ති අධ්‍යයනාංශය, රුහුණ විශ්වවිද්‍යාලය, මාතර

*Corresponding author: *nishadimarasinghe1995@gmail.com*

සංක්ෂේපය

සංවර්ධනය ක්‍රියාවලිය තුළ රටක තිරසාර පැවැත්ම තීරණය වන්නේ විවිධ මට්ටමේ සංවර්ධන ව්‍යාපෘති ජනතා කේන්ද්‍රීය සහ පරිසර හිතවාදී එළැඹුමකින් සැලසුම් කොට ක්‍රියාත්මක කිරීම හරහා ය. මෙහිදී මහා පරිමාණ සංවර්ධන ව්‍යාපෘති මිනිසාගේ සංවර්ධනයට පමණක් නොව සමස්ථ ජෛව පැවැත්මට ද සෘජුව බලපෑම් එල්ල කරති. සංවර්ධිත සහ සංවර්ධනය වෙමින් පවතින රටවලට මුහුණ පෑමට සිදුව ඇති තීරණාත්මක අභියෝගය වී ඇත්තේ කාලගුණ වෙනස්කම් සහ ඒ හේතුකොට ගෙන නිර්මාණය වී ඇති අවතැන් වූවන්ගේ ගැටළුවයි. වරින් වර බලයට පත්වන ආණ්ඩු පාලනය සහ ඒකාබද්ධ නොවූ ප්‍රතිපත්තීන් හේතු කොටගෙන මෙම තත්ත්වය තීව්‍රකිරීමට හේතු වී ඇති බව පහැදිලි ය. ශ්‍රී ලංකාවේ සංවර්ධන ව්‍යාපෘති සම්බන්ධව 1980 අංක හතළිස් හත දරණ පරිසර පනත මගින් හා එහි සංශෝධන පනත් මගින් පරිසරය සම්බන්ධව කටයුතු කිරීමට අදාළ නීති විධිවිධාන දක්වා තිබුණ ද අද වන විට බොහොමයක් සංවර්ධන ව්‍යාපෘතිවල අර්බුධකාරී තත්ත්වයන් නිර්මාණය වී තිබේ. මෙම අධ්‍යයනයේ අරමුණු වූයේ ශ්‍රී ලංකාවේ මහා පරිමාණ සංවර්ධන ව්‍යාපෘති ක්‍රියාත්මක කිරීම සහ ඒ සම්බන්ධ පරිසර කළමනාකරණයේ අභියෝගාත්මක මුහුණුවර විශ්ලේෂණය කිරීමයි. මෙම පර්යේෂණයේ අධ්‍යයන ක්ෂේත්‍රය ලෙස යොදාගනු ලැබුවේ මත්තල ගුවන් තොටුපොළ ව්‍යාපෘතිය මගින් බලපෑමට ලක් වූ හම්බන්තොට ගොන්නොරුව ප්‍රදේශයයිග මිශ්‍ර අධ්‍යයන ක්‍රමය යොදා ගනිමින් පර්යේෂණය සිදුකළ අතර ප්‍රාථමික සහ ද්විතික දත්ත ඒ සඳහා උපයෝගී කර ගනු ලැබීය. තෝරාගත් පවුල් 150 ක් ප්‍රශ්නාවලි ක්‍රමය හා සම්මුඛ සාකච්ඡා මගින් අධ්‍යනයට යොදා ගනිමින් දත්ත රැස්කිරීම සිදු කරන ලදි. මෙහිදී ප්‍රමාණාත්මක දත්ත විස්තරාත්මක සංඛ්‍යාන ශිල්ප ක්‍රමය ඔස්සේ ද ගුණාත්මක දත්ත උද්ගාමී ප්‍රවේශය ඔස්සේ ද විශ්ලේෂණය කරන ලදිග සංවර්ධන ව්‍යාපෘතිවලට පෙර සහ පසුතත්ත්වයන් විමසා බැලීම මෙන්ම පාරිසරික කළමනාකරණය වෙත අවධානය යොමු නොකිරීම නිසා පාරිසරික වශයෙන් ජනතාව සහ පරිසරය මුහුණ දෙන ගැටලු ප්‍රධාන වශයෙන් හඳුනා ගත හැකි විය. දිගු කාලීන පාරිසරික ඇගයීම් වාර්තාවකින් තොරව නිර්මාණය කරන ලද මත්තල ගුවන්තොටුපළ ව්‍යාපෘතිය විශාල පාරිසරික හානියට මන් විවර කර ඇති බව මෙම අධ්‍යයනයේ දී තහවුරු වියග පූර්ව පරිසර වාර්තාවට අනුව පරිසර කළමනාකරණය සිදුවිය යුතු වුවත් එවැන්නක් සිදුව ඇති බවක් අධ්‍යයනය මගින් අණාවරණය නොවීයග අධ්‍යයනයෙන් තහවුරු වූයේ පාරිසරික කළමනාකරණ තීන්දු ගැනීම ඒකාබද්ධ රාමුවක සිදුකර නොගැනීම නිසා එහි අතුරු ප්‍රතිවිපාක ලෙස වනඅලි ගැටුම ද නිර්මාණය වී ඇති බවයිග

Keywords: *පරිසරය, පරිසර කළමනාකරණය, රාජ්‍ය ප්‍රතිපත්ති, සංවර්ධනය, සංවර්ධන ව්‍යාපෘති*

 ISSN 2362-0412

ශ්‍රී ලංකාවේ පැරණි වාරි උරුමයේ සිදු වූ සංරක්ෂණ හා නඩත්තු ක්‍රියාවලිය : ආරම්භක යුගයේ සිට ක්‍රි.ව. 1948 දක්වා.

ඩී.සී. චිත්‍රානන්ද*, ලක්මිණී ගමගේ

ඉතිහාසය හා පුරාවිද්‍යා අධ්‍යනාංශය, මානව ශාස්ත්‍ර හා සමාජීය විද්‍යා පීඨය, රුහුණ විශ්ව විද්‍යාලය

*Corresponding author: *chithranandac@yahoo.com*

සංක්ෂේපය

ශ්‍රී ලංකාවේ ජාතික අනන්‍යතාවය හා බැඳුණු පොදු සංකේතය පුරාණ වාරි උරුමය යි. එය ආසන්න වශයෙන් ක්‍රිස්තු පූර්ව පහ හෝ හය සියවස්වල ආරම්භව ක්‍රිස්තු වර්ෂ දොළොස් වන සියවස පමණ වනවිට සංවර්ධනයේ උපරිම අවස්ථාවට ළඟා වී තිබුණි. වාරි කර්මාන්ත වටා ලාංකීය ශිෂ්ටාචාරය හා සංස්කෘතික උරුමය වැඩී වර්ධනය විය. ලංකාවේ වාරි උරුමය වැව, අමුණ , ඇළ, ආශ්‍රිතව ඇතිවූ ඉදිකිරීම් සහ ඒ ආශ්‍රිතව ගොඩනැගුණ භූදර්ශනය, ජනාවාස රටාවන් ආදී ස්පර්ශනීය උරුමය මෙන්ම වාරිමාර්ග හා බැඳුණු සිරිත් විරිත් වාරිත්‍ර, පූජාකර්ම, ජන කතා හා ජන ගායනා මෙන්ම වාරිමාර්ග හා බැඳුණු ජනවහර ආදී අස්පර්ශනීය උරුම අංගයන් ගෙන් ද සමන්විත වේ. බොහෝ පැරණි වාරි කර්මාන්ත සජීවී උරුමයන් ලෙස වර්තමානයේ දී ද ක්‍රියාකාරී ස්වරූපයෙන් පවතී. ඒ සඳහා බලපෑ ප්‍රධාන හේතු සොයා බැලීම මෙම පර්යේෂණයේ අරමුණයි. මෙහි පර්යේෂණ ගැටලුව වන්නේ ලංකාවේ පැරණි වාරි කර්මාන්ත පද්ධතියේ ආරම්භක යුගයේ සිට ක්‍රි.ව. 1948 තෙක් කිනම් ආකාරයක සංරක්ෂණ හා නඩත්තු කටයුතු සිදුවූවා ද ? යන්න ය. මෙම පර්යේෂණය ගුණාත්මක ප්‍රවේශය තුළ ස්ථානගත වී ඇති හෙයින් සිද්ධි අධ්‍යයනය යන ක්‍රමවේදය තුළ භාවිතවන ලේඛනාගාර වාර්තා, ලියකියවිලි, සෘජු නිරීක්ෂණය , භෞතික පුරාවිද්‍යා අවශේෂ පරීක්ෂා කිරීම, යන මූලාශ්‍රන් මේ සඳහා භාවිත කළේය. ඉතා ඉහළ සෘණත්වයකින් වියළි කලාපීය තැනිතලා භූමිය පුරා ව්‍යාප්තව පැවති වාරි පද්ධතිය මුල්ම අවධියේ ඒවා ඉදිකළ ජනතාව විසින්ම සිදුකළ නඩත්තු කටයුතු මගින් ආරක්ෂාවූ ආකාරය ද, පසුව බලයට පත්වූ සෑම පාලකයෙකුම රාජ්‍ය මැදිහත්වීම මත සිදුකළ වාරි කර්මාන්ත සංරක්ෂණය කිරීම්, නඩත්තුකිරීම, පවත්නා වාරිමාර්ග පුළුල් කිරීම්, අළුත් වාරිමාර්ග ඉදිකිරීම්, හමුවේ දිගින් දිගටම ආරක්ෂාවූ ආකාරය ද, ලංදේසි, ඉංග්‍රීසි ආදී බටහිර ජාතීන්ගේ පාලන කාල තුළ දී , ලංදේසී ලංකාවේ දකුණු හා නැගෙනහිර මුහුදුබඩ ප්‍රදේශවල පැරණි වාරි කර්මාන්ත සංරක්ෂණය කිරීම ද, ඉංග්‍රීසී ලංකාවේ වියළි කලාපය පුරා සියවස් ගණනාවක් තිස්සේ අතහැර දමා තිබූ දැවැන්ත වාරි කර්මාන්ත ජාලය සංරක්ෂණය කිරීමට ගෙන තිබූ බොහෝ සාධනීය ක්‍රියාමාර්ගයන් ද ඓතිහාසික හා පුරාවිද්‍යා මූලාශ්‍රයන් පදනම් කරගනිමින් හඳුනාගතහැකිවීම මෙම අධ්‍යනයේ ප්‍රතිඵලයයි.

Keywords: *සංරක්ෂණය, වාරිමාර්ග, උරුමය, පුරාණ, කර්මාන්තය*

Engineering, Technology, and Applied Sciences

 ISSN 2362-0412

Day ahead Forecasting of Solar PV Generation: Case of Sri Lanka

M.H.M.R. Shyamali Dilhani [a*], K.J.C. Kumara [b] and K.M.S.Y. Konara [c]

[a]*Department of Interdisciplinary Studies, Faculty of Engineering, University of Ruhuna, Galle, Sri Lanka*
[b]*Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, University of Ruhuna, Galle, Sri Lanka*
[c]*Electrical and Information Engineering, Faculty of Engineering, University of Ruhuna, Galle, Sri Lanka*

**Corresponding Author: rasika@is.ruh.ac.lk*

ABSTRACT

In Sri Lanka, the Ministry of Power and Renewable Energy (MPRE) is working towards achieving the status of carbon neutrality by 2050 and the total energy demand of the country by using renewable sources by 50%. Hence, there has been a substantial increase in the penetration of renewable energy resources, mainly solar and wind. However, grid integration of renewables is challenging due to the intermittent and uncontrollable nature of renewable energy resources. Integration of Photovoltaic (PV) systems to the utility grid introduce significant volatility to the grid, resulting in system instability, electrical power imbalances, variation in frequency response in the modern electric grid. As a result, customers are allowed to consume electricity in arbitrary quantities at any time. However, when aggregating all the buildings and households, the demand variation is highly predictable. This demand variation is constantly monitored, and the generators are dispatched according to the requirement to satisfy the demand. This research work is conducted to forecast day-ahead PV power output of solar arrays installed in the Faculty of Engineering, the University of Ruhuna, considering the effect of solar irradiance and cell temperature of the solar panels as variables. These two parameters are directly affected by the power generation efficiency of PV panels. The input data set with 5-minute interval data points were pre-processed by interpolation and exponential smoothing to fill in the missing values caused by the system faults. These data cleaning methods are proven to be resourceful in the short-term time series forecasting models. This research work used an Artificial Neural Network (ANN) to create a day ahead solar forecasting model. The model was trained and tested using January and February data sets and verified with the March data set. The ANN uses three input parameters: the previous day output power, irradiance, and temperature. The final result shows that the monthly average mean absolute error (MAPE) of output power is 2.069 %.

Keywords: *ANN, day ahead solar forcasting; solar PV integration*

Design and Fabrication of an Automated Pen Barrel Collecting and Packing Machine

K.T.K.M. De Silva *, H.S.N. Ariyawansha, M.I.I. Ahamed

Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, University of Ruhuna

*Corresponding author: *muthumalidesilva@gmail.com*

ABSTRACT

Automation is an efficient method to achieve cost effective solutions in manufacturing plants, as well as in the process industry and many other industrial areas. Assembling of parts in manufacturing industry is generally the largest single cost element. Assembly cost is the major cost in overall cost of ball pen manufacturing since pen manufacturing requires too many parts to be assembled together. To reduce the overall cost of the product it is required to observe each and every assembly process, and analyze each process with various parameters like efficiency, productivity, lead time, delivery precision, investment cost, capacity, maintenance, running cost. Based on this kind of analysis, Atlas Axillia (PVT) Ltd which is one of the leading stationery manufacturing industries in Sri Lanka has decided to automate the pen barrel assembling process. The manufacturing of pen barrels at the Atlas plant is done using injection moulding and the pen barrel collecting and packing processes were done by manually. The aim of this research is to design and fabricate an automated pen barrel collecting and packing machine. With this automated system, 6000 pen barrels can be packed in a specific order, within an average time of 75 minutes. In addition, the company can save LKR 300,000 of labour cost annually from one such machine. Compared to the existing manual process, the proposed design mainly assists in improving the productivity, quality, safety, flexibility as well as the accuracy of the particular process. This automated system, carries the pen barrels in sets, using a pneumatic gripper movable in XY bed, and packs them in 12 positions inside the crate. A Human Machine Interface (HMI) was designed and implemented for the machine for easier overall operation, improved communication, and easier controlling of the process.

Keywords: *Automated System, Collecting and Packing, Human Machine Interface, Injection Moulding, Pen Barrels.*

 ISSN 2362-0412

Developing an Adaptive Audio-Visual Cue System for Gait Improvement in Parkinson Disease

P.P.M. Harshani[a], H.A.S.K. Jinaranshi[a], R.P.S. Tharaka[a],
K.D. Pathirana[b], N.W. Prins[a]*

[a] *Department of Electrical and Information Engineering, Faculty of Engineering, University of Ruhuna*
[b] *Department of Medicine, Faculty of Medicine, University of Ruhuna*

*Corresponding Author: *prins@eie.ruh.ac.lk*

ABSTRACT

Freeze of gait (FOG) is a common gait abnormality of Parkinson Disease (PD). The occurrences of FOG negatively affect the Activities of Daily Living (ADL) and quality of life. Physiotherapy-based treatments are more effective in managing the FOG events of the PD, enjoy an active lifestyle and an ordinary life expectancy. The aim of this research is to develop an adaptive audio-visual cue system for gait improvement in PD. The main technological approaches used in this project are a wearable device that has accelerometer sensors and a deep learning (DL) algorithm for real-time FOG detection. The wearable device was implemented using 3 accelerometers which were placed on the ankle, knee and waist of the PD subject and data were recorded. In order to find the optimal DL algorithm for FOG detection, Artificial Neural Network (ANN), Convolutional Neural Network (CNN) and Long Short-Term Memory (LSTM) were compared using 8000 examples (7000 for training and 1000 for testing). Feature extraction was not necessary for these models. This was similar to data accessed from online database with (Daphnet Freezing of Gait Dataset). Comparison results indicate that DL algorithms are effective tools for FOG with excellent sensitivity and specificity. We conclude that the CNN is the best of the three approaches with sensitivity of 0.93, specificity of 0.96, F1 score of 0.96, and accuracy of 0.96. Even though the system is a simple binary classification, it can be easily modified for complicated tasks. An adaptive audio-visual cue system was used to distract the PD patient from FOG episode and initiate a gait. Through this solution, we anticipate for PD patients to maintain the quality of their lives by reducing the gait abnormalities through adaptive audio-visual cueing and gait improvement.

Keywords: Audio-Visual Cue System, Convolutional Neural Network (CNN), Freeze of Gait (FOG), Parkinson Disease (PD)

 ISSN 2362-0412

Development of a Prototype Lower Limb Exoskeleton System to Assist Tea Plantation Workers

J.I.K. Jayakody [a], M.G.S.S.B. Manchanayaka [a], K.J.C. Kumara [a*],
R.W. Senevirathne [b], R.K.P.S. Ranaweera [c], R.A.R.C. Gopura [c]

[a] *Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, University of Ruhuna, Galle, Sri Lanka*
[b] *Department of Surgery, Faculty of Medicine, University of Ruhuna, Galle, Sri Lanka*
[c] *Department of Mechanical Engineering, Faculty of Engineering, University of Moratuwa, Katubedda, Sri Lanka*

*Corresponding author: *kumara@mme.ruh.ac.lk*

ABSTRACT

"Ceylon tea" is famous worldwide because of its quality and unique characteristics. At present tea supply to the global market is decreasing and the production rate is dropping. The Sri Lankan tea industry uses selective tea plucking methods in tea harvesting to produce high-quality tea. In the process of tea leave harvesting, the tea workers have to carry loads over 20kg, maintaining awkward postures, and climb steep terrain. These movements cause several health issues. Among that, Spondylolisthesis disease that is affected on the lower part of the backbone is common. This study mainly aims to develop a lower limb exoskeleton system to assist in carrying the heavy load while climbing a terrain up and down. In this study, initially, a biomechanical analysis was carried out to identify a tea worker's lower limb joint forces. The lower limb exoskeleton was functioned with three main functions; supporting and bearing the weight on the back luggage, supporting the forward and lateral walking patterns, and maintaining the system's stability with varying loads on the back luggage. The weight support mechanism has been introduced to support the heavy load on the design and ground it through the system instead of the wearer's body. The developed exoskeleton is an underactuated system in which only the knee joint has been actuated. A Control system has been introduced to synchronize the system motion with the wearer's natural gait pattern. The best components for the exoskeleton were selected by a morphological analysis that takes the study of design requirements and the system's functions into account. The prototype was tested in the laboratory, measuring muscle power wearing and without wearing a lower limb exoskeleton system with 10kgs on the back luggage. The results show that muscle power is reduced after wearing the system. And also, motor torque assists approximately 37% of total knee joint torque.

Keywords: *biomechanics analysis, lower limb exoskeleton system, underactuated system, weight supported mechanisms*

 ISSN 2362-0412

EO/IR based Ship Detection using Machine Learning

Chatura Seneviratne*, Thulitha Senevirathna, Isuru Tennakoon, Oshana Dissanayake, Lochana Marasinghe

Department of Electrical and Information Engineering, Faculty of Engineering, University of Ruhuna, Sri Lanka.

*Corresponding author: *chatura@eie.ruh.ac.lk*

ABSTRACT

Maritime Domain Awareness (MDA) is essential for many applications in both civil and military fields in order to avoid non-traditional threats such as drug trafficking, illegal unreported and unregulated fishing and human smuggling. Real time ship detection mechanisms are needed for MDA and conventional ship detection mechanisms are not efficient, reliable, and economical due to the complexities in the sea and large scale human interventions. Therefore, there is a high demand for automated on-board ship detection mechanisms that can operate on a ship, unmanned aerial vehicle (UAV) or shore. The overall objective of this work is to lay the stepping stones to build an automated real-time ship detection system for MDA. Here, popular MobileNet V2 and MobileNet V2 - FPN lite machine learning models are trained, deployed and tested. They have the portability to run on portable embedded systems smoothly. In this work, the training data set is prepared using publicly available Electro Optical (EO) dataset and Near Infra-Red (NIR) dataset. Both models are deployed in a portable embedded platform called Jetson Nano. In our experiments, MobileNet V2 and MobileNet V2 - FPN lite models show mean Average precision (mAp) of 0.708 and 0.882. The Frames Per Second (FPS) rates of the video streams in MobileNet V2 and MobileNet V2 - FPN lite are 40 FPS and 5 FPS.

Keywords: *Maritime Domain Awareness (MDA), mean Average precision (mAp), MobileNet V2, ship detection*

 ISSN 2362-0412

Evaluating the Performance of Single Cylinder Diesel Engine Running on Blends of Diesel and Alcohol

H.C. Ambawatte*, A.K.C.I. Kodithuwakku, R.W.K. Anjana, K. Dilushan

Department of Mechanical & Manufacturing Engineering, Faculty of Engineering, University of Ruhuna

*Corresponding author: chithral@mme.ruh.ac.lk

ABSTRACT

This study is supposed to identify the applicability of alcohol, which blend with gasoline but not with diesel, and diesel blend for a diesel engine without any modifications to control the emissions. The study was conducted upon samples of ethanol and diesel which were mixed at percentages from 5 to 20 of the total volume. The most prominent issue with this blend is that the two fuels are immiscible at room temperature and behave as a microemulsion under normal conditions. To overcome the effect of microemulsion the fuels are blended with an emulsifier; biodiesel is produced by transesterification of discarded coconut oil which showed the best stability among biodiesel extracted from used palm olein and used white coconut oil. A stirring system feeds the blends of fuels while the performance of the single-cylinder, the 4-stroke diesel engine was tested. Each sample of 50ml fuel was rapidly stirred in a homogenizer while feeding to the engine. While maintaining the engine speed at 1000 rpm the engine performance was recorded against varying loads. Because this is an immiscible fuel blend, constant blending is required until the combustion. Up to 20% ethanol when the solubility is enhanced with an additive in the mix may retain stability until complete combustion.

Keywords: *Alternative Fuel, Diesel, Ethanol, Renewable*

 ISSN 2362-0412

Free Energy Calculations of FCC Aluminum Using Classical Density Functional Theory and a Perturbative Approach.

B.H.C.S. Thilakarathna [a], Xueyu Song[b], K.G.S.H. Gunawardana [c*]

[a]*Department of Engineering Technology, Faculty of Technology, University of Ruhuna*
[b]*Iowa State University, Ames, Iowa, USA*
[c] *Department of Engineering Technology, Faculty of Technology, University of Ruhuna*

*Corresponding author: *harshadewa@fot.ruh.ac.lk*

ABSTRACT

Helmholtz free energy is one of the most important thermodynamic property in studying crystalline systems. A theoretical approach combining classical Density Functional Theory and a Perturbation approach to the attractive interactions was used to calculate Helmholtz free-energies of pure FCC Aluminum at three different temperatures between room temperature and the melting temperature using Embedded Atomic Model(EAM) potential. The free-energies were minimized to obtain relaxed structures for each temperature by letting only the lattice parameter to vary so the lattice symmetry would be preserved. The calculation was carried out by varying the atomic number density in between 0.052-0.062. The lattice parameters calculated for each relaxed structure showed a good agreement with the experimental values published in the literature, supporting an overall validity to the theoretical approach.

Keywords: *Helmholtz Free-Energy, Lattice parameter, Temperature*

 ISSN 2362-0412

GLASS WASTE as an ALTERNATIVE RAW MATERIAL for CONCRETE MIXTURES – A REVIEW

D.H.A. Maduranga*, J.M.R.S. Appuhamy, W.M.K.R.T.W. Bandara, T.M. Bandula Heva

Department of Civil and Environmental Engineering, Faculty of Engineering, University of Ruhuna, Hapugala, Galle, Sri Lanka

*Corresponding author: *dhamaduranga@gmail.com*

ABSTRACT

In modern construction, environmental issues have been taken into account as a major concern. Only reusing and recycling waste are considered viable options for reducing waste production. Concrete is a strong compressive composite that is commonly employed in the building sector today. The concrete consists of cement, fine aggregates and coarse aggregates. In addition, the cement manufacturing industry emits 7% of greenhouse gases into the environment, contributing to global warming. To address these environmental effects, substantial research is being conducted into the usage of cement substitutes and aggregates, which include a variety of waste materials [such as waste glass, plastics, and fly ash] as well as industry by-products. On other hand, millions of tonnes of glass garbage are generated each year, posing serious environmental issues around the world due to the non-biodegradable form of the waste glass**.** Silica makes up the majority of the glass. Due to increased disposal costs and environmental concerns, the use of recycled waste glasses in concrete has generated a lot of attention around the world. Many researchers investigated different options for valuing glass waste by substituting aggregates and cement in concrete mixes. In the main context of researches in this sector, its impacts on mechanical properties were investigated. Main drawbacks of using crushed glasses as aggregates in concrete are the expansion and cracking that occurs as a result of the glass aggregates due to ASR (Alkali-Silica-Reaction). The use of glass in concrete still has to be improved. Laboratory tests were carried out to further investigate the usage of waste glass as coarse and fine aggregates in concrete for both ASR mitigation and decorative purposes. This scientific paper reviews researches on the topic of reusing glass waste in the construction field as a partial replacement for cement and aggregates in the concrete. The impact of particle size and content, as well as the proportion of waste replacement and mitigation of ASR, on concrete's fresh and hardened qualities, is also explored.

Keywords: *Alkali-Slica reaction, Concrete, Glass waste, Mechanical properties*

 ISSN 2362-0412

Numerical Modelling and Performance Analysis of an Oscillating Wave Surge Converter for Renewable Power Generation Applications

N.H.D.S. Manawadu [a], I.D. Nissanka [b], H.C.P. Karunasena [c*]

[a]*Department of Mechanical Engineering, Sri Lanka Institute of Advanced Technological Education, Sri Lanka*
[b]*Department of Mechanical Engineering, Faculty of Engineering, University of Moratuwa, Sri Lanka*
[c]*Department of Mechanical and Manufacturing Engineering, University of Ruhuna, Sri Lanka*

*Corresponding author: *chaminda@mme.ruh.ac.lk*

ABSTRACT

Energy is the driving force of the modern world and attention for renewable energy increases day by day due to various disadvantages associated with fossil fuels in addition to the risk of depletion of fuel sources. Wave energy is a freely available high-density energy source around the clock which attracts the interest of researchers all over the world. In this study, Oscillating Wave Surge Converter (OWSC) type wave energy converter was numerically modelled and investigated using Smoothed Particle Hydrodynamic (SPH) method. OWSC is based on a mechanism of bottom-hinged floating flap attached to a damping system which enables to absorption of energy from the incident wave. Basic rectangular-shaped flaps with different damping coefficients were simulated in a 3-D regular wave tank for a given wave condition. The simulation results revealed that the energy conversion efficiency of the OWSC is a strong function of the damping coefficient and there is an optimum damping coefficient for given wave parameters of a particular OWSC. Proceeding the study, an optimum damping coefficient was calculated and keeping the flap volume constant another series of simulations was carried out for different geometric shapes of the flap to analyse their effect on the energy extraction efficiency. The study reveals that a concave-shaped flap could increase the energy conversion efficiency by 27% with a small increase in hydrodynamic forces acting on the flap compared to a rectangular flap. On the other hand, a semi-cone-shaped flap reduced the hydrodynamic forces by 42% while energy conversion efficiency was also reduced by 33%. The findings of this research will facilitate the engineer to choose which geometric shape of the flap to be used in OWSC while compromising between the energy conversion efficiency and devise survivability or cost of device structures.

Keywords: *Damping coefficient, Geometric shapes, OWSC, SPH, Wave energy*

 ISSN 2362-0412

Review on Executing OpenCV Based Computer Vision Programmes in C++ with Windows Environment

H.M. Supun Sanjaya

Department of Mechanical and Manufacturing Engineering, Faculty of Engineering University of Ruhuna

Corresponding author: *supunsanjaya05@gmail.com*

ABSTRACT

There are many software packages available in Python in computer vision. Nevertheless, in order to deal with more low level faster algorithms and embedded systems, C++ is preferable. Installing and configuring an OpenCV environment may not be included in a teaching module's learning outcomes. This review involves finding the feasibility of properly executing OpenCV-based computer vision programmes in C++ in a Windows environment with minimal pre-configuration. The OpenCV libraries were built using the C++ source, and the generated libraries and header files were attached to a Visual Studio project which can be easily distributed among others. Building and configuring OpenCV may need an experienced user, but a simple tutorial or guideline is enough to train and use. Bilateral filtering and edge, face, HOG detection were the chosen algorithms that were run with parallel processing in CPU and with and without OpenCL support to run the algorithm in both CPU and GPU. These algorithms deal with image data stored in 2D matrices. All the tests were done on every frame of a one-minute long video, and the time taken to process all the frames were recorded. The test results show that turning the debug option makes the algorithms run faster. Furthermore, bilateral filtering shows about 3 minutes of reduction in execution time when using both CPU and GPU, while other algorithms show minor reductions in execution time except face detection.

Keywords: *OpenCV with C++, OpenCV with OpenCL, OpenCV in Windows*

 ISSN 2362-0412

Safety Risk Assessment for Drill & Blast Tunnel Construction in Sri Lanka

S.W. Seneviratne [a*], G.K.P. Wickramasinghe [a], R.D.D. Dayawansha [b]

[a]*Department of Civil and Environmental Engineering, Faculty of Engineering, University of Ruhuna*
[b]*Broadlands Hydropower Project, Central Engineering Consultancy Bureau*

*Corresponding author: *samanthi@cee.ruh.ac.lk*

ABSTRACT

Construction industry has been responsible for a significant amount of accidents, injuries and other safety related issues at work place, of which the consequences can be fatal or severe. Tunnel construction is one of the most advanced fields of subsurface constructions in the world. However, the tunnel construction works lead to serious safety challenges due to their semi enclosed environment. Hence, continuous improvement of safety provisions at tunnelling work is vital for preventing hazards. This research study is aimed at conducting a safety risk assessment for drill & blast tunnel construction which is the commonly used tunnelling method in Sri Lanka. Tunnel Construction in Broadlands Hydropower Project is taken as the main study area. A questionnaire survey is conducted with tunnel experts in order to identify the most critical hazardous events. It uses hazard severity and hazard likelihood rating categories developed for the drill & blast tunnelling method to come up with a risk score for each hazard. The risk score value for a hazardous event is calculated multiplying the hazard severity and hazard likelihood ratings. Based on the resultant risk score values, critical hazardous events are identified. Here 'being exposed to noxious dust' and 'direct spraying of concrete on eyes or skin' have been identified as critical hazardous events. A detailed risk assessment which specifically addresses what are sources/causes of the hazard, their preventive measures (prior to event), recovery measures (post- event) and the consequences is conducted and graphically represented using a Bow Tie diagram. A probabilistic risk assessment is also planned to conduct via Event Tree Analysis. Finally, using the Bow Tie and Event Tree analysis results, a set of recommendations are presented to develop a proactive safety culture in the drill & blast tunnel construction industry in Sri Lanka.

Keywords: *Bow Tie Method, Drill & Blast Method, Safety Risk Assessment, Tunnel Construction*

Human Health, Pharmaceuticals, and Medicine

 ISSN 2362-0412

Correlation between Lower Extremity Function and Quality of Life of Athletes with Lower Limb Pain

Sanka Theekshana Thebuwanaarachchi [ab*], Sampath Gunawardena [c], Y.H.S. De Silva [ab]

[a] *Sports and Exercise Medicine Unit, Teaching Hospital, Karapitiya.*
[b] *Sports Physicians' Panel, International Olympic Committee, Switzerland.*
[c] *Department of Physiology, Faculty of medicine, University of Ruhuna.*

*Corresponding author: *sankatheekshana@yahoo.com*

ABSTRACT

Assessment of functional ability is a useful parameter of overall health and is frequently assessed in clinical practice to ensure the athletes' lower extremity function (LEF). It is directly linked to the quality of life (QoL) of individuals, and its assessment is very useful in clinical practice. The Sinhala version of the Lower Extremity Functional Scale (S-LEFS) is one of the most extensively used scales in Sri Lanka. It consists of five possible numeric response categories ranging from 0 to 4 for each of its 20 questions, for a total mark ranging from 0 (poor) to 80 (excellent) points. Higher values indicate optimum lower limb function. WHOQOL-BREF is a widely used tool for assessing generic QoL across four domains: physical capacity, psychological attributes, social collaboration, and the living environment. Each item is rated on a five-point scale. The score ranges from 0 to 100, and the higher value indicates a higher level of QoL. The study aimed to evaluate the correlation between LEF and QoL of athletes with lower limb pain who attend the sports and exercise medicine clinic of Teaching Hospital Karapitiya (THK). Two questionnaires were administered among the 112 consecutive athletes with lower limb pain who presented to the sports and exercise medicine clinic of THK after obtaining ethical clearance from the ethics review committee of the Faculty of Medicine, University of Ruhuna. Pearson's correlation was used to identify the correlation between the total scores of questionnaires. The correlation between the total score of S-LEFS and WHOQOL-BREF was weak ($r = 0.28$, $p = 0.003$). The correlations observed between the total score of S-LEFS and the domain scores of WHOQOL-BREF also ranged from weak to non-significant correlations: physical ($r = 0.39$, $p = 0.000$), social ($r = 0.20$, $p = 0.032$), psychological ($r = 0.16$, $p = 0.075$) and environmental ($r = 0.09$, $p = 0.327$). The correlation between the total score of S-LEFS and WHOQOL-BREF was weak.

Keywords: *Lower Extremity Function (LEF), Quality of Life (QoL), The Sinhala version of the Lower Extremity Functional Scale -(S-LEFS), Teaching Hospital Karapitiya (THK), World Heaalth Organisation Quality of Life (WHOQOL-BREF*)

 ISSN 2362-0412

Cost-effective, Robust Prosthetic Knee Joint Designed for Active Trans-femoral Amputees

Nuwan Chanaka Gunarathne

Faculty of Allied Health Sciences, University of Ruhuna

Corresponding author: *mailtosrinuwan@yahoo.com*

ABSTRACT

The most effective way to improve mobility and life quality following an amputation is by the use of a properly designed prosthetic system. However, many amputees are priced out to receive customized modern prosthetic services in Sri Lanka. This study is focused on developing a resilient, homemade four-bar prosthetic knee with readily available two types of Nylon material, Hard Nylon and Oil Impregnated Nylon, which are very affordable costing approximately £29 per unit, and sustainable. Our four-bar linkage polycentric knee design has several new advancements, to address the shortfalls of previous versions. Following the biomechanics of the polycentric knee joints with 4 bar mechanisms, the link dimensions of this model were designed specifically by, shortening the top linkage (25mm) and extending the bottom linkage (40mm) subsequently raising the Instantaneous Center of Rotation and moving it posterior to the weight line offering natural stability. These link dimensions were offered 18mm ground clearance. The geometric angle between the top linkage and the horizontal line is optimized to 330 to enable effortless push-off without disturbing the stability. Adjustable top and bottom attachments facilitate modifications to individual requirements. This model knee autonomously depends on the muscle action of the residual limb to swing through during the swing phase thus, avoiding inconsistency and unreliability of the braking action. In conclusion, we have shown that there is scope for improvement in currently existing knees in terms of their functionality and cost-effective production for developing countries and have designed a knee that provides greater stability and toe clearance to better navigate uneven terrain. It is expected to transfer the lesson learned from this study to future work including gait studies with prosthetic users to evaluate kinematics, kinetics, and energy consumption, along with other gait parameters through full-scale clinical trials to validate the results of this knee.

Keywords: *Four-bar knee, Prosthetic knee, Transfemoral prosthesis.*

 ISSN 2362-0412

Dynamic Variation of Multiple CagA EPIYA-C Motifs in East-Asian *Helicobacter pylori*

Kavinda Tissera [ab*], Hanfu Su [b], Jeong-Heon Cha [bc]

[a] *Department of Medical Laboratory Science, Faculty of Allied Health Sciences, University of Ruhuna, Galle, Sri Lanka*
[b] *Affiliated Stomatology Hospital of Guangzhou Medical University, Guangzhou Key Laboratory of Basic and Applied Research of Oral Regenerative Medicine, Guangzhou, Guangdong, P. R. China*
[c] *Department of Oral Biology, Oral Science Research Centre, Department of Applied Life Science, The Graduate School, Yonsei University College of Dentistry, Seoul, Republic of Korea*

*Corresponding author: *kavindatissera@ahs.ruh.ac.lk*

ABSTRACT

The polymorphic bacterial oncoprotein, CagA bears different types of C-terminal Glu-Pro-Ile-Tyr-Ala (EPIYA) motifs depending on its geographical distribution: ABD type for East-Asian and ABC type for Western *H. pylori*. The multiple EPIYA-C motifs were associated with a disease severity. Some East-Asian *H. pylori* isolates carried Western ABC-type CagA. Hence, to gain better understanding, whole genomes of four Korean *H. pylori* clinical isolates carrying ABC-type CagA were sequenced via Pac-Bio SMRT sequencing technology, and the phylogenetic analysis was performed, which identified that three of four isolates indeed belong to hpEastAsia group with typical East-Asian polymorphism of virulence factors and one is grouped to HpAfrica with typical Western polymorphism. Furthermore, the variation of multiple EPIYA-C motifs in East-Asian *H. pylori* background was investigated using a Korean clinical isolate, K154, belonging to hpEastAsia but possessing CagA EPIYA-ABCCCC. Due to the sequence homology for CagA multimerization sequence located at the EPIYA-C segment, we predicted the possibility of changing the number of C motifs via homologous recombination. To test this hypothesis, 287 single colonies after culturing 1st generation were screened for the detection of multiple EPIYA-C motifs by PCR-based screening method and further verified by DNA sequencing. Three out of 287 single colony isolates (1%) showed polymorphism in the number of EPIYA-C motifs *in vitro*: increasing EPIYA-C motifs in five and decreasing EPIYA-C motifs in three and even in complete deletion. The mechanism of dynamic change of EPIYA-C repeats may play a part in generating an intraspecies diversity in East-Asian *H. pylori*.

Keywords: *Helicobacter pylori, CagA, geographic diversity*

 ISSN 2362-0412

Elevated Urinary KIM-1 Levels May be an Early Indication of Renal Injury among School Children in Regions with High Prevalence of CKDu in Sri Lanka.

T.D.K.S.C. Gunasekara[a], Sudheera Jayasinghe[b], E.P.S. Chandana[c], Sisira Siribaddana[d], P. Mangala C.S. De Silva[a]*

[a]*Department of Zoology, Faculty of Science, University of Ruhuna, Matara 81000, Sri Lanka.*
[b]*Department of Pharmacology, Faculty of Medicine, University of Ruhuna, Galle, 80000, Sri Lanka.*
[c]*Department of Biosystems Technology, Faculty of Technology, University of Ruhuna, Matara 81000, Sri Lanka.*
[d]*Department of Medicine, Faculty of Medical & Allied Sciences, Rajarata University, Saliyapura 50008, Sri Lanka.*

*Corresponding author: *chathura@zoo.ruh.ac.lk*

ABSTRACT

Paediatric renal injury is an emergent health concern, particularly in the regions with high burden of Chronic Kidney Disease of uncertain etiology (CKDu) in global hotspots. Kidney injury molecule (KIM-1) appears more sensitive and specific particularly at early diagnosis of renal injury. Hence, the aim of the present study was to assess the utility of KIM-1 in diagnosing renal injury against the conventional marker, albumin creatinine ratio (ACR). We conducted a cross sectional study with 200 school children (boys: 92, girls: 108; 12-16 years of age) from CKDu endemic regions in North Central Province and 154 children (boys:67, girls: 83) from regions where CKDu is not evident in Moneragala District. First void, non-fasting early morning urine samples were collected from the children and the samples were analysed for creatinine, albumin and KIM-1. The median (IQR) ACR values of boys, 2.81 (1.65-4.79) and girls, 2.68 (1.94-4.17) mg/g in CKDu endemic areas showed no significant difference ($p>0.05$) compared to the ACR values of boys 2.09 (1.40-3.22) and girls, 3.09 (1.93-4.77) in CKDu non-prevalent areas. However, median (IQR) urinary KIM-1 level of boys 0.16 (0.06-0.28) ng/mgCr in CKDu affected areas was significantly higher ($p=0.0012$) than the median KIM-1 level of boys 0.09 (0.001-0.21) ng/mgCr in CKDu non-affected areas. Further, Similarly Significantly increased ($p<0.0001$) KIM-1 level was observed in girls 0.29 (0.14-0.49) ng/mgCr in CKDu affected regions compared to the girls 0.05 (0.001-0.15) ng/mgCr in CKDu non-endemic areas. Urinary ACR of children was very low and indicated no albuminuria. However, significantly high levels of urinary KIM-1 in children in CKDu affected regions, may indicate abnormal renal function in the absence of albuminuria, rendering high sensitivity over ACR. Our study provides evidence on potentially high risk of developing renal injury, for the children in CKDu prevalent areas and we recommend further interventions on this concern.

Keywords: *Children, Chronic Kidney Disease, KIM-1, Renal injury, Rural Sri Lanka.*

 ISSN 2362-0412

Evaluation of Antibacterial and Dısınfectant potency of Bıogenıc Sılver Nanopartıcles Synthesized Usıng *Cyprus rotundus* Agaınst Methıcıllın Resıstant *Staphylococcus aureus* (MRSA)

W.S.G. De Soyza[a], W.M.D.G.B. Wijayaratne[b*], M.T. Napagoda[a], S. Witharana[c]

[a]*Department of Biochemistry, Faculty of Medicine, University of Ruhuna, Sri Lanka*
[b]*Department of Microbiology, Faculty of Medicine, University of Ruhuna, Sri Lanka*
[c]*Department of Mechanical Engineering, Faculty of Engineering, University of Moratuwa, Sri Lanka*

*Corresponding author: *gayabw@yahoo.co.uk*

ABSTRACT

Methicillin-Resistant *Staphylococcus aureus* (MRSA) is responsible for nosocomial infections and become resistant to most of the antibiotics commonly used. Therefore scientists have taken an extra effort to invent new anti-MRSA antibiotics. However, prevention of the spread of microorganisms is one of the best ways to control nosocomial infections. Silver metal has been used as an antimicrobial agent since ancient times, hence, the development of an effective disinfectant using nanosilver could be an innovative approach to fight against drug-resistant *Staphylococci*. Therefore the present study aimed at the development of a nanosilver preparation using aqueous extract of *Cyprus rotundus* (Kalanduru) and evaluation of its antibacterial and disinfectant potency. *C.rotundus* is widely employed in folk medicine as an antiseptic and also to treat wounds. Here, an aqueous extract of *C.rotundus* whole plant was prepared and the antimicrobial sensitivity test was carried out against *S. aureus*. The crude extract did not show any antibacterial activity. This extract was then utilized for the green synthesis of silver nanoparticles (AgNPs). The formation of metal nanoparticles was monitored by the measurement of the absorbance of the reaction mixture at different time intervals for a period of 72hrs. The silver nano-preparation displayed a high absorbance in the range of 240-260 nm and 420- 440 nm and the absorbance of the reaction mixture increased with time. The scanning electron microscopy (SEM) images confirmed that preparation contains silver nanoparticles of <10 nm size. The preparation was dried by a hot air oven and the antimicrobial activity and Minimum Inhibition Concentration (MIC) of the AgNPs were evaluated. MIC of the preparation was determined as 31.25 µg/mL against *S. aureus* and all five different MRSA strains. Further, the disinfectant activity of the nanopreparation was calculated by conducting a disinfectant assay on rough and smooth surfaces. The mean disinfectant activity of the preparation on rough and smooth surfaces was determined as >99% and >90% respectively. Therefore biogenic silver nanoparticles synthesised from an aqueous extract of *C. rotundus*. show great promise to be developed into a commercial disinfectant.

Keywords: *Antimicrobial, Disinfectant, MIC, Silver nanoparticles*

 ISSN 2362-0412

Factors Associated with Quality of Life among Patients with Chronic Plaque Psoriasis in Southern Sri Lanka

P.L.A.N. Liyanage[a]*, P.L.G.C. Liyanage[a], B.S. Wijenayake[b], P.B.D.L. Yapa[c], R.L.M. Pushparani[d], P.V. De Silva[a], S. Imafuku[e], S. Lekamwasam[a]

[a] *Faculty of Medicine, University of Ruhuna, Sri Lanka*
[b] *Teaching Hospital Galle, Sri Lanka*
[c] *General Hospital Matara, Sri Lanka*
[d] *General Hospital Hambanthota, Sri Lanka*
[e] *Fukuoka University, Fukuoka, Japan*

*Corresponding author: *achalaliyanage@yahoo.com*

ABSTRACT

Chronic plaque psoriasis (CPP) is an inflammatory skin disease with considerable negative impact on quality of life (QoL). This study investigated the sociodemographic and disease characteristics associated with QoL of patients with CPP. A cross-sectional study was conducted among 297 patients, aged >18 years attending dermatology clinics of Teaching Hospital Karapitiya, General Hospitals Matara and Hambantota. The QoL was assessed by generic and disease specific tools; Sinhala validated versions of Dermatology Life Quality Index (DLQI) and Psoriasis Disability Index (PDI), respectively. Median age (IQR) of study subjects was 55 (42-63) years and 57.6% were males. Nearly 80% had completed secondary school and 46% belonged to the Social class 4. Median psoriasis area severity index (PASI) and the body surface area (BSA) were 4.8 (2.8-10.2) and 9% (4.5-21). According to DLQI, 8% had no impairment of QOL while 57%, 24% and 11% reported mild, moderate and severe impairment of the QoL, respectively. Median PDI score was 6 (3-10) BSA and PASI showed a significant positive correlation with DLQI and PDI (spearman rho BSA_DLQI 0.240, PASI_DLQI 0.183, BSA_PDI 0.32, PASI_PDI 0.31, $p<0.01$) while age was negatively correlated (spearman rho Age_DLQI -0.26, Age_PDI -0.25, $p<0.01$) with both DLQI and PDI. Men compared to women, and those with the involvement of head and neck region compared to those without, had greater impairment of QoL. There was no association between the duration of the disease and the QoL. In patients with CPP, greater skin involvement, male gender, head and neck involvement and being young are associated with poor QoL determined by both generic and disease specific tools.

Keywords: *DLQI, Psoriasis, Psoriasis Disability Index, Quality of life*

 ISSN 2362-0412

Genome-wide Linkage Search for Cancer Susceptibility Loci in a Cohort of non BRCA1/2 Families in Sri Lanka

Prabhavi Wijesiriwardhana [ac*], Anthony Mark Musolf [b], Joan E. Bailey-Wilson [b], Kalum Wettasinghe [c], Vajira H. W. Dissanayake [c]

[a] *Department of Medical Laboratory Science, Faculty of Allied Health Sciences, University of Ruhuna, Sri Lanka*
[b] *Computational and Statistical Genomics Branch, National Human Genome Research Institute, National Institutes of Health, Baltimore, MD 21224*
[c] *Human Genetics Unit, Faculty of Medicine, University of Colombo, Sri Lanka*

*Corresponding author: *prabhavimls@yahoo.com*

ABSTRACT

Introduction: Identification of pathogenic variants will open up an opportunity to implement surveillance and risk reducing measures that mitigate or prevent diseases. Although linkage studies have been utilized for the investigation of genetic variants associated with risk of hereditary breast cancer in many countries in the world, little is known about their role in non *BRCA1/2* individuals and their family members in the Sri Lankan population. Our objective was to identify the susceptibility loci related to the inherited risk of cancer in a cohort of Sri Lankan women affected with breast cancer. Method: Forty-eight members from four families, in which at least three individuals within third degree relatives affected by breast cancer, were selected. Genotyping using the Illumina Global Screening Array having 654,027 single nucleotide polymorphism (SNP) markers was performed. Merlin software was used to conduct two-point parametric linkage analysis with cancer at any site as the trait. An autosomal dominant model with a disease allele frequency of 1% was assumed. Penetrance was set at 90% for carriers with a 10% phenocopy rate. LOD (Logarithm Of Odds) scores were calculated for each of the four families and heterogeneity LOD (HLOD) scores were calculated across families. Results: Thirty one variants exhibited genome-wide suggestive HLODs. The top overall HLOD score was at rs1856277, an intronic variant in *MYO16* gene on chromosome 13. The two most informative families also suggested several candidate linked loci in genes, including *EXOC1*, *HUS1B*, *STIM1* and *TUSC1*. Discussion and conclusion: This study provides the first step in identifying germline variants that may be involved in risk in cancer-aggregated non-*BRCA1/2* families from the understudied Sri Lankan population. Several candidate linked regions showed suggestive evidence of linkage to cancer risk. However, additional studies are required due to low power in the existing families and probable genetic heterogeneity across families.

Keywords: *breast cancer, genotyping, hereditary cancer, linkage analysis, variants*

 ISSN 2362-0412

Medication Errors in Paediatric Inpatient Settings: A Narrative Review

W.P.K.H. Subasinghe, V.M. Pathiraja, G.A.M. Prasadi *

Department of Pharmacy, Faculty of Allied Health Sciences, University of Ruhuna

*Corresponding author: *maneeshaprasadi@ahs.ruh.ac.lk*

ABSTRACT

Children are particularly susceptible to experiencing a medication error (ME) because they vary in weight, body surface area and which can affect their ability to metabolise and excrete medications effectively. It may occur any of the paediatric healthcare facilities resulting from no harm or even associated with very serious outcomes and may lead to even death. In order to improve medication safety, MEs and practices which potentially contribute to medication errors must be explored. The aim of this study was to review published studies regarding MEs among hospitalized paediatric patients. A search of studies published from 2011 to 2021 related to MEs in paediatric inpatients was performed using two databases: PubMed and Google Scholar. Seventeen articles were identified from data extraction. MEs were detected by incident reporting, chart review, observations, by attending ward rounds, interview of children/parents and by asking with paediatric ward staff. Prescribing errors, dispensing errors and administration errors were reported from studies. MEs were associated with wide varieties of medicines including antibiotics, narcotic analgesics, digoxin, anticoagulants, analgesics, chemotherapeutic agents, sedatives and hypnotics and anaesthetics. Many studies have reported prescribing errors in paediatrics rather than administration, transcribing and monitoring errors. Performance deficit and knowledge deficits were responsible for most of MEs. Errors were reported related to dispensing, prescribing and medication administration. Medication errors associated with different types of medications including high alert medications. Hence it is important to implement medication safety practices in hospital setting to prevent potential MEs such as a computerized physician order entry system, clinical decision-support systems, ward-based clinical pharmacists, and improved communication among physicians, nurses, and pharmacists.

Keywords: *Children, Hospital, Inpatient,Medication errors, Paediatric*

 ISSN 2362-0412

Melanogenesis Inhibition by Anthocyanin Rich Extract of *Hibiscus syriacus*

Wisurumuni Arachchilage Hasitha Maduranga Karunarathne [ab], Yung Hyun Choi [c], Kyoung Tae Lee [d], Gi-Young Kim [b*]

[a]*Department of Biosystems Technology, Faculty of Technology, University of Ruhuna, Matara, Sri Lanka*
[b]*Department of Marine Life Science, Jeju National University, Jeju 63243, Republic of Korea*
[c]*Department of Biochemistry, College of Oriental Medicine, Dong-Eui University, Busan 47227, Republic of Korea*
[d]*Forest Biomaterials Research Center, National Institute of Forest Science, Jinju 52817, Republic of Korea*

*Corresponding author: *immunkim@jejunu.ac.kr*

ABSTRACT

Hibiscus syriacus is the national flower of South Korea and grows in varied climates range from mild to tropical temperatures. In the Korean herbal medicine, the bark and roots of *H. syriacus* have been used to cure diarrhea and bacterial infection, and its seeds were reported to effective for fever and cold. Recently, native flowers of *H. syriacus* possessed promising potential as a new edible colorant with various anthocyanins. In the current study, anthocyanin-rich extract of two varieties of H. *syriacus* namely Pulsae and Paetanshim (PS and PTS, respectively) were evaluated for, inhibition of melanin biogenesis. Results showed that PS and PTS did not strongly downregulate mushroom tyrosinase activity in vitro; but significantly decreased the extracellular and intracellular melanin production in B16F10 cells accompanied by the inhibition of α-melanocyte-stimulating hormone (α-MSH)-induced microphthalmia-associated transcription factor (MITF) and tyrosinase expression. It is also found that PS and PTS attenuated pigmentation in α-MSH-stimulated zebrafish larva without any severe toxicity. Furthermore, PS and PTS activated the phosphorylation of extracellular signal-regulated kinase (ERK) and a specific ERK inhibitor, PD98059, which resulted in the recovery of intracellular and extracellular melanin downregulation induced by PS and PTS in B16F10 cells and of melanogenesis in zebrafish larvae. These findings suggest that anthocyanins from PS and PTS inhibit melanogenesis in vitro and in vivo by activating the ERK signalling pathway.

Keywords: *Anthocyanin; ERK; Hibiscus syriacus L.; Melanin; Tyrosinase*

 ISSN 2362-0412

Minor Allele Frequencies of Single Nucleotide Variants Associated with Diabetic Peripheral Neuropathy in a Cohort of Sri Lankan Population

L.B.L. Prabodha [a*], N.D. Sirisena [b], V.H.W. Dissanayake [b]

[a]*Faculty of Medicine, University of Ruhuna*
[b]*Faculty of Medicine, University of Colombo*

*Corresponding author: *lahiruprabodha@gmail.com*

ABSTRACT

There is increasing evidence that genetic factors could contribute to the development of Diabetic Peripheral Neuropathy (DPN). The objective of this study is to estimate the minor allele frequencies (MAF) of single nucleotide variants (SNV) associated with DPN in the Sri Lankan population and to compare the corresponding MAF in five different populations reported in the 1000 Genomes database. The genetic variants associated with DPN were identified by an extensive search of scientific literature published in PubMed and were annotated using the SnpEff software to filter the exonic and splice-site variants. MAF of the 11 selected variants in the Sri Lankan population were calculated from available data of 50 individuals in the genomic database in Human Genetics Unit, Faculty of Medicine, University of Colombo, Sri Lanka. The MAF of these variants were compared with the corresponding frequencies in 5 different populations reported in the 1000 Genomes phase 3 release (http://www.1000genomes.org) database. The MAF of exonic and splice-site variants of *BDKRB2*, *ADIPOQ*, *VEGFA* and *HSPA5* genes in the Sri Lankan population reported statistically significant ($p<0.05$) MAF with all the other globally represented populations of Americans of African Ancestry in SW USA (ASW), Bengali from Bangladesh (BEB), Utah residents with North and Western European Ancestry (CEU), Han Chinese in Beijing, China (CHB) and British in England and Scotland (GBR). *MTHFR* variant in CEU, CHB and GBR, *CYBA* variant in CHB and *PPARG* in ASW populations were reported statistically significant ($p<0.05$) MAF. *KCNJ11* and *APOE* gene variants of Sri Lankan population showed no statistically significant MAF with all the other globally represented populations. This study shows that MAF of some important exonic and splice-site variants of key genes associated with DPN in the Sri Lankan cohort had statistically significant differences compared to other global populations.

Keywords: *Diabetic peripheral neuropathy, minor allele frequency, exonic and splice site variants, diabetes mellitus, susceptible and prognostic genes.*

 ISSN 2362-0412

රෝග කළමනාකරණයෙහි ලා බෞද්ධ ආහාර සංකල්පය උපයෝගී කරගත හැකි ආකාරය පිළිබඳ විමර්ශනාත්මක අධ්‍යයනයක්

දිල්ෂාන් මනෝජ් රාජපක්ෂ*, රංජනී එම්. පතිරණ

රුහුණ විශ්ව විද්‍යාලය

*Corresponding author: *dilshanmanojrajapaksha@gmail.com*

සංක්ෂේපය

රෝග කළමනාකරණය යන්න නූතන ලෝකය තුළ ඉතා වැදගත් මාතෘකාවකි. විශේෂයෙන් ම ආහාර සංකල්පය ඇසුරින් රෝග කළමනාකරණය පිළිබඳ අවධානය යොමු කළ යුතු ආකාරය පිළිබඳ වැඩි අවධානයක් යොමු නොවීම මත රෝග වළක්වා ගැනීම හෝ සුව කර ගැනීම පිළිබඳ ගැටලු මතු වී ඇත. එහෙත් මේ පිළිබඳ බෞද්ධ ත්‍රිපිටකාගත අධ්‍යයනයක් තුළින් හෙළි කර ගත හැකි උපදේශ සමාජගත කිරීම මත රෝග කළමනාකරණයට මනා පිටුබලයක් සැපයිය හැකිය, යන උපන්‍යාසය මත මෙම පදනම් ව මෙම පර්යේෂණය සිදුකරන ලදී. පාළි සාහිත්‍යය තුළ බුදුරදුන්ව හෙසජ්ජගුරු, සල්ලකත්ත (ශල්‍ය වෛද්‍යවරයා) හා භිසක්ක (චිකිත්සකවරයා) යනාදී පර්යායවලින් ද හඳුන්වයි. ත්‍රිපිටකයේ අන්තර්ගත ප්‍රතිකාර ක්‍රම බෙහෝමයක් සූත්‍ර පිටකයේ ද දැකිය හැකි වන අතර මේ සම්බන්ධ පුළුල් විවරණයක් දැකිය හැකි වන්නේ ත්‍රිපිටකයේ විනය පිටකයේ මහාවග්ගපාළියේ සයවන පරිච්ඡේදය වන භේසජ්ජක්ඛන්ධකයෙනි. අංගුත්තරනිකායේ චතුක්ක නිපාතයේ රෝග සූත්‍රයේ දී පුද්ගලයාට වැළඳෙන රෝග වර්ග දෙකක් පිළිබඳව බුදුරදුන් පෙන්වා දී ඇත. එනම්, කායික රෝග මානසික රෝග යි. කායිකව වැළඳෙන රෝගවලට කායික වශයෙන් ප්‍රතිකාර කිරීම හා මානසික වශයෙන් ප්‍රතිකාර කිරීම යනුවෙන් ප්‍රතිකාර කරන ආකාර දෙකකි. කායික රෝගවලට ප්‍රතිකාර කිරීමේ දී අනුගමනය කළ හැකි ප්‍රවේශ දෙකක් සැළකිල්ලට ගත හැකි ය. එනම්, ශරීරයේ ධාතූන්ගේ (පෝෂකයන්ගේ) ඌණතාවක් හෝ ඌණක්‍රියාකාරීත්වයක් වේ නම් එය යථාර්ථයට ගැනීම හා ශරීරයේ ධාතූන්ගේ (පෝෂකයන්ගේ) අධිකතාවක් හෝ අධික්‍රියාකාරීත්වයක් වේ නම් එය සමතුලිත කිරීම යනාදිය යි. බුදුරදුන් කායික රෝග සඳහා ප්‍රතිකාර නියම කිරීමේ දී භාවිතයට ගතයුතු හා ගතහැකි බෙහෙත් වට්ටෝරු නිර්දේශකොට ඇත. භෙසජ්ජක්ඛන්ධකයේ දී සරත් කාලයේ දී කාලගුණ වෙනස්කම්වලට (වැස්සට තෙමී යාම, මඩ පෑගීම, තද අව්වට නිරාවරණය වීම ආදිය නිසා පිත කුපිත වීමට ලක් ව පීඩාවට) මුහුණ දුන් භික්ෂූන්වහන්සේලා ආහාර ජීර්ණය නොවීමේ ගැටලුවකට හෙවත් සාරාදිකාබාධයට (ආයුර්වේදයේ එන අම්ලපිත්ත රෝගයට) මුහුණ පා ඇත. එවිට එම භික්ෂූන්ට බෙහෙත් වර්ග පහක් වැළඳීමට නියම කොට ඇත. කැද-බත් යනු රළු ආහාර යි. ඒවා ජීරණය නො වීම නිසා එම භික්ෂූන් ආහාර ප්‍රතික්ෂේප කරන්නට වූහ. කෙටි කලකින් වැහැරීගිය උන්වහන්සේලාට උක්ත මෘදු ආහාර නිර්දේශ කළ බුදුරදුන් උදේ සවස ආහාරයට ගත යුතු ආකාරය ද පෙන්වමින් උපදෙස් දී ඇත. ගිලන් වූ භික්ෂූන් හට බුදුරදුන් වසා බෙහෙත් හෙවත් චුරුණු තෙල් අනුදැන වදාරා ඇත. එම තෙල් සකස් කරගැනීම පිණිස තෙල්වර්ග කිහිපයක් භාවිත කළ යුතු ආකාරය පෙන්වා දී ඇත. ඖෂධ නො වන කිසිවක් පරිසරයේ නොමැති අතර ගස්වැල් ඖෂධ ලෙස පරිහරණය කළ යුත්තේ කෙසේ ද යන්නත් ශාකයක විවිධ කොටස් කායික රෝග සමනය කොට ස්වස්ථතාව ඇති කිරීම පිණිස යොදාගත හැකි ආකාරය පිළිබඳවත් බුදුරදුන් සතුව පැවැති ආයුර්වේදීය හසළ ඥානයත් මෙම මූලාශ්‍රය අධ්‍යයනයෙන් ගම්‍යවේ. එසේ ම බුදුරදුන් ශරීර ක්‍රියාකාරීත්වය කෙරෙහි උපකාර වන ධාතු (පෝෂක) වැඩි වී ගිය විට ගිලන් භික්ෂූන් වහන්සේලාට අංශ තුනකින් ප්‍රතිකාර නිර්දේශ කොට ඇත. එම ප්‍රතිකාර නම්, පූර්ව ප්‍රතිකාරය, ප්‍රතිකාරය හා පශ්චාත් ප්‍රතිකාරය යි. බුදුරජාණන් වහන්සේ ප්‍රතිකාර නියම කිරීමේ දී ආහාර කෙරෙහි විශේෂ සැලකිල්ලක් දක්වා ඇති බව භේසජ්ජක්ඛන්ධකය තුළින් විද්‍යමාන වෙයි. ජීවීන්ගේ පැවැත්ම පිණිස ආහාර අවශ්‍ය බවත් ආහාරයෙහි පමණ දැන පරිභෝජනය කළ යුතු බවත් අල්පාධාබව පිණිස ආහාරය හේතුවන බවත් උන්වහන්සේ තවදුරටත් පෙන්වාදී ඇත. ඒ අනුව බෞද්ධ ආහාර සංකල්පය ඇසුරින් රෝග කළමනාකරණය පිළිබඳ බෞද්ධ ඉගැන්වීම් හෙළි කිරීම මගින් රෝග වළක්වා ගැනීම හෝ සුව කර ගැනීමට උපදෙස් සැපයීමට හැකිවේ. පාඨ විශ්ලේෂණ ක්‍රමය ඇසුරින් ප්‍රාථමික හා ද්විතියික මූලාශ්‍රය කෙරෙහි ද අවධානය යොමු කරමින් මෙම පර්යේෂණ සිදු කරන ලදී.

Keywords: *ආහාර, බුදුන්වහන්සේ, භෙසජ්ජක්ඛන්ධකය, බෞද්ධ, උපදේශ, රෝග කළමනාකරණය*

Pure Sciences, Mathematics, and Statistics

 ISSN 2362-0412

Assessing the Effects of COVID-19 Control Strategies and Their Implementing Time through a Mathematical Model

L.W. Somathilake

Department of Mathematics, Faculty of Science, University of Ruhuna, Matara

Corresponding author: *sthilake@maths.ruh.ac.lk*

ABSTRACT

Social distancing, quarantining suspected individuals, isolating infected people, wearing masks and hand sanitizations were the main control strategies for COVID-19 before vaccinations are introduced. According to WHO, vaccines available for COVID-19 do not have fully immunizing ability but prevent people from getting seriously ill or dying from COVID-19. Therefore, vaccination plays an important role in reducing the death rates of COVID-19 patients. This paper aims to find the effects of the above-mentioned control strategies and their implementing time on the spread of the disease based on a mathematical model. The proposed mathematical model consists of seven subclasses (susceptible(S), Vaccinated (V), exposures (E), infectious (I), quarantined (Q), isolated (J), and recovered (R)). Next Disease spreading behavior when control strategies are implemented at different time levels are explained. Variation of the effective reproduction number when control strategies start at different time levels is interpreted Based on the proposed model the effect of vaccination on the suppression of the disease and Critical vaccination rate is determined. It is observed that in order to suppress the disease, vaccination should be done at a rate higher than the critical vaccination rate. Most affecting model parameters were determined by performing sensitivity analysis of the disease-free reproduction number. It is observed that the first three parameters as in their order of effectiveness are infectious rate, the recovery rate, and vaccination rate. It is observed that earlier implementation of control strategies is highly beneficial in controlling or suppressing the disease. The disease can be controlled more effectively by taking actions to decrease infectious rate, increase recovery and vaccination rates. Also, while implementing other control strategies, implementing the vaccination process earlier, accelerating the vaccination process to a higher rate than the critical vaccination rate, and continuing it for a sufficient period are very important in the disease control process.

Keywords: *Disease modelling, Disease control strategies, COVID-19, Critical vaccination rate*

 ISSN 2362-0412

Improved Advanced Oxidation Process for the Removel of Crystal Violet Dye in Wastewater

H.M.M.J. Rathnayake, S. Wanniarachchi*

Department of Chemistry, Faculty of Science, University of Ruhuna

*Corresponding author: *sarathwan@chem.ruh.ac.lk*

ABSTRACT

Along with the modern lifestyles of the developing society, the contamination of the domestic water resrvours is being a growing threat. Advanced oxidation processes (AOP) involve a highly competitive and promising technology for the treatment of wastewaters containing non-easily removable compounds such as persistent organic pollutants (POP) that are known for their bio-accumulative and recalcitrant natures that require more effective treatment methods. Crystal Violet is a mutagen and a potent carcinogen. It can prevent light penetration and hinder the photosynthesis process.in the aquatic environment. The main objective of this research is to investigate the treatment of wastewater containing Crystal Violet dye by heterogeneous Fenton oxidation process using Fe(II) impregnated sawdust as a catalyst. Fe-sawdust catalyst was prepared and successfully used in the removal of Crystal Violet in synthetic wastewater. The optimum heterogeneous Fenton reaction conditions for the decolourization of Crystal Violet were found as 0.3 g of catalytic amount with an initial pH value of 3.0 at 3 mM concentration of H_2O_2, 50 ppm initial concentration of Crystal Violet, and at a stirring rate of 600 rpm. A 96% decoloration efficiency was achieved under these reaction conditions. An iron loading percentage of 0.81% on sawdust was achieved in the catalytic preparation. The re-usage study revealed productive decoloration efficiency up to five cycles. In conclusion, cost-effective Fe-sawdust catalyst can potentially be an effective catalyst for the treatment of Crystal Violet in wastewater.

Keywords: *Crystal Violet, Wastewater, Fenton oxidation*

 ISSN 2362-0412

Investigations of Chemical Compositions and Antioxidant Potential of Essential Oils Extracted from the Leaves of Seven Guava Varieties

S. Kokilananthan, Vajira P. Bulugahapitiya *, H. Manawadu, C.S. Gangabadage

Department of Chemistry, Faculty of Science, University of Ruhuna, Matara 81000 Sri Lanka

*Corresponding author: *vajira@chem.ruh.ac.lk*

ABSTRACT

Psidium guajava (Guava) is known to have diverse pharmacological propertites and numerous varieties/cultivars of guava are widely available in Sri Lanka. However, no research on the chemical compositions (CCs) and antioxidant activities of leaf essential oils (EOs) based on their varieties have been reported so far. Especially, since antioxidants play a vital role in the prevention of degenerative diseases, it is important to explore the antioxidative potential of natural substances. Therefore, the purpose of this study was to investigate the antioxidant activities and the CCs of EOs extracted from the leaves of seven guava varieties grown in Sri Lanka, namely two wild varieties (Getta-pera and Embul-pera), Common-guava, Apple-guava and three introduced varieties (Kanthi, Pubudu, and Costorican). The EOs were obtained by hydro-distillation, and their CCs were investigated using GC-MS analysis. The hydro-distillation yielded EOs of 0.44-0.04 percent (v/w). Each guava EO has a high concentration of pharmacologically significant components, the amount of which varies according to the variety. Nerolidol (7.9-70.2 %), D-Limonene (14.1-30.3 %), (-)-Globulol (7.0-21.0 %), Caryophyllene (1.4-20.4 %), Eucalyptol (0.3-10.6 %), α-Pinene (0.2-8.0 %), α-Cubebene (0.7-6.1 %) are some of the prominent compounds found in EOs. Nerolidol levels in Embul-pera were shown to be high. D-Limonene and Eucalyptol were discovered to be rich in Kanthi. Getta-pera has high levels of caryophyllene and α-Cubebene. (-)-Globulol was discovered to be abundant in Apple-guava, whereas α-Pinene was abundant in Costorican. Most noteworthy, 28 compounds which include Isodurene, Cadinadiene-1,4, Allylbenzene, E,E-Farnesal, Epiglobulol, β-Maaliene, Espatulenol were suggested for the first time in guava leaves' EOs. EOs have antioxidant capacities ranging from 329.56±2.01 to 85.70±2.01 μL Trolox Eq/L where *P. guineense* exhibited stronger antioxidative ability than others. In a conclusion, the CCs and anti-oxidative properties of guava varieties differ based on variety and 28 CCs were detected for the first time in the EO of guava varieties cultivated in Sri Lanka.

Keywords: *Antioxidants, chemical compositions, essential oil, guava varieties, GC-MS.*

Acknowledgment: Authors wish to thank the AHEAD/RA3/DOR-05/RUH/SCI/CHE project for financial support.

Student Poster Sessions

 ISSN 2362-0412

A Review of Contribution of Green Marketing to Fulfill Corporate Social Responsibility.

A.P.H.J. Silva

Faculty of Agriculture, University of Ruhuna, Sri Lanka

Corresponding author: *2016ag4386@agristu.ruh.ac.lk*

ABSTRACT

Green marketing is defined as efforts of companies to innovate in products, production processes, packaging modifications to minimize the environmental impact. Performing theoretical studies on how green marketing is implemented as initiatives to fulfil CSR, assessing green marketing strategies implemented by selected private sectorial companies in Sri Lanka were the objectives of the study. Archival method enabled the researcher to build up a conceptual framework based on the literature review. More than fifty research publications relevant to the study were employed. Top ten corporate citizens of 2020 selected by Ceylon Chamber of Commerce was selected via purposive sampling and content analysis was used to determine green marketing practices followed by these selected companies. As a whole, this study recognizes the importance of green marketing to fulfil CSR goals. As Green products developed by the selected companies, incorporating ESG (Environmental, Social, Governance) concerns to lending activities and firms involving in agriculture, supporting organic growers who supply raw materials in production processes, partnering with Governmental, International organizations in company's journey of sustainability, in hotel industry LEED (Leadership in Energy and Environmental Design) certified hotels where economic development coexists with environmental and social sustainability. As Green Internal processes, strategies to reduce water consumption, energy consumption, fuel consumption and solid waste management were prioritized. As Green Philanthropy, waste management programs initiated at schools, reforestation, marine conservation, mangrove restoration, beach clean-up programs with staff and external parties were followed by the selected companies. Green product development, Green internal processes, Green Philanthropy are the key aspects of green marketing to achieve Green CSR. This review brings out how selected companies have followed numerous green marketing practices to achieve green CSR. Moreover, emphasizes the significance of prioritization of Green CSR through green marketing strategies over philanthropic CSR. Further studies can be conducted on impact of Green CSR on company's performance.

Keywords: *Corporate Social responsibility, Green marketing, Green Philanthropy*

An Ontology Based Process Mining Framework for Logistics Domain

Sugara Kithmini De Alwis Weerasiriwardana*, Jeewanie Jayasinghe Arachchige

Department of Computer Science, University of Ruhuna

*Corresponding author: *weerasiriwardana9914@usci.ruh.ac.lk*

ABSTRACT

Process mining is emerging new field and it is a set of techniques referring to the fields of data science and process management to assist the analysis of operational techniques primarily based on event logs. Process mining techniques replace traditional business process management. Process mining is applied in many domains specially in healthcare, manufacturing etc. and there are only a few studies are done in the logistic domain. As the nature of the processes in the logistics domain is very complex, unstructured, and often changing and fluctuating, the need of better management is critically essential. Therefore, process mining is one of fruitful approach to discover and analyses the processes in logistic domain. However, there is no comprehensive and standard approach for process mining in logistic domain. By identifying this research gap, we provide better guidance by defining an ontological-based framework for process mining in the logistics domain in this research. This research follows the design science research methodology and the framework and the Ontology are the two main artifacts. The proposed framework covers most of the activities in process mining starting from extracting event logs then selecting suitable pre-processing techniques and process mining algorithms, deriving the process model and evaluating the model. Each stage in the framework guided with best suitable approach to the logistic domain. For example, the Ontology developed for logistic domain used in the pre-processing stage to filter the relevant events. This research uses Prom tool for evaluation, pre-processing, and mining process models. The proposed ontology and the framework are validated with a real logistic dataset. This framework will help logistics companies to improve the handling of business processes efficiently and increase the productivity.

Keywords: *Event log, Logistics, Ontology, Prom Tool, Process mining*

 ISSN 2362-0412

Anticandidal Potential of *Jasminum officinale*, *Leucas zeylanica*, *Cassia auriculata* and *Cinnamomum zeylanicum* Extracts against Selected *Candida* Strains

D.N. Wanigasekara [a*], S.S. Wickramasinghe [b], G.B. Wijayaratne [b], M.T. Napagoda[a]

[a]*Department of Biochemistry, Faculty of Medicine, University of Ruhuna, Galle, 80000, Sri Lanka*
[b]*Department of Microbiology, Faculty of Medicine, University of Ruhuna, Galle, 80000, Sri Lanka*

*Corresponding author: *dharaninirasha@gmail.com*

ABSTRACT

Emergence of resistance to antifungal drugs among *Candida* species is reported at alarmingly high rates. This limits severely the treatment options available for invasive and superficial candida infections. Despite many studies dedicated to develop novel treatment strategies, in depth exploration of antifungal medications used in indigenous medicinal practices would lead to a fruitful path rationalizing the pharmacological and phytochemical significance of them. Thus the current study was undertaken to investigate the anticandidal potential of four plant extracts commonly used in indigenous medicinal systems as antifungal remedies; *Jasminum officinale* flower, *Leucas zeylanica* whole plant, *Cassia alata* flower and *Cinnamomum zeylanicum* leaf methanol extracts against three *Candida* type cultures namely *Candida albicans* (ATCC 10232), *Candida krusei* (ATCC 200917) and *Candida parapsilosis* (ATCC 22019).The anticandidal activities of these plant extracts were evaluated by agar well-diffusion method. Standard fluconazole was used as the positive control and 80% dimethyl sulfoxide (DMSO), the solvent was used as the negative control. The obtained results indicated that all three *Candida* species were inhibited by *C. zeylanicum* leaf extract yielding mean inhibition zone diameters of 16.67±0.58 mm, 18.00±0.00 mm and 19.33±0.58 mm for *C. albicans*, *C. krusei* and *C. parapsilosis* respectively. No inhibition was reported for remaining extracts to all three *Candida* species. A mean inhibition zone diameter of 40.33±0.58 mm, 42.00±0.00 mm and 37.67±0.58 mm were obtained for standard fluconazole positive control accordingly. The growth of all three species was not affected by the negative control. The preliminary observations suggest that *C. zeylanicum* leaf extract has the potential to be further studied and to be developed into potential herbal medication for *Candida* infections.

Keywords: *antimicrobial, antifungal resistance, Candida, plant extracts*

 ISSN 2362-0412

Application of Rice Straw Ash as a Cheaper Filler in Rubber Compounds

Nirmani A.A. Fernando*, Ayomi W.G. Pabasara, Yashoda K. Gayashini, Dulani N. Liyanage

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Kamburupitiya, Matara, Sri Lanka

* Corresponding Author: *nirmanianuradha516@gmail.com*

ABSTRACT

Sri Lanka is an agricultural country since ancient times and rice is the most cultivated food crop. As a result, rice straw is generated in larger quantities annually. In most cases, rice straw is discarding without using effectively. Rice straw ash contains 62% to 82% of silica. Silica is a major reinforcing filler that is used in the rubber industry. In this research, the incorporation of rice straw ash into natural rubber (NR) by using a laboratory scale two roll mill. Different ratios of rice straw ash have been incorporated with selected rubber compounds replacing the silica filler loading. Curing characteristics were determined by a dynamic rubber process analyzer. Tensile and tear strengths, hardness, and compression set properties of NR vulcanizates were determined to analyze the effect of rice straw incorporation. According to tensile test data, the sample which contains an equal amount of silica and rice straw ash filler shows the highest tensile strength of 26.09 MPa. All experimental samples have higher tensile strength values than the reference sample. The tear strength of all the rice straw ash (RSA) incorporated samples are lower than the control sample. Hardness values of rice straw ash loaded samples are lesser values compared with the reference sample and the least value is accounted for by the sample of 20phr rice straw ash filler loading. Compression set values get drastically decreased with rising the rice straw ash filler until 30 phr and again shows a slight increase of the compression set at 40 phr. The 10 – 20 phr rice straw filler loading gives optimum properties. When considering the overall results, RSA can be utilized as a cheaper filler for rubber products where tensile properties are essential such as conveyor belts. The incorporation of RSA reduced the filler cost by reducing silica filler. Rice straw ash-filled rubber product gave cost reduction and this will prevent the damage to the environment caused by burning straw.

Keywords: *filler, rice straw ash, rubber compounding, silica.*

 ISSN 2362-0412

Automated Kokis Making Machine

A.G.A. Sandakalum, M.P.U. Isuranga [a*]

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Kamburupitiya, Matara, Sri Lanka

*Corresponding author: *uditha@fot.ruh.ac.lk*

ABSTRACT

"Kokis" plays a significant part in Sri Lankan household at all special occasions. Nowadays, as a result of their hectic lifestyles, people frequently purchase "Kokis" from the market for special occasions. Traditionally, Kokis are made by hand, which requires a higher level of ability and expertise. Commercial production of Kokis is extremely challenging due to the handcrafted nature of the procedure. This study suggests a more cost-effective, user-friendly, and hygienic automated system for small and medium-sized businesses. The machine is composed of the following essential subsystems, including a kokis mold moving system, a liquid mixture inlet mechanism, an oil inflow system, an oil heating system, a temperature control system, and a conveyer system for removing kokis. A resistive heating element is utilized to deliver heat to the frying oil. Further, this procedure is monitored by temperature sensors to ensure that the appropriate warmth is maintained to correctly cook the kokis. The device undergoes a three-minute preparatory process to ensure a flawless kokis-making operation. It is capable of producing kokis at a pace of two kokis every 90 seconds. However, it can be expanded to four kokis per sequence by increasing the number of integrated kokis modules to four. When manufactured using this technology, a single kokis weighs approximately 20g. This proposed machine could be used to change the perception of commercial kokis manufacturing among small-scale enterprises.

Keywords: *Automation, cooking, food processing, kokis*

 ISSN 2362-0412

Automated Mechanical Workshop Tools Management System

W.T.J. Soysa [a*], M.P.U. Isuranga [a]

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Kamburupitiya, Matara, Sri Lanka

*Corresponding author: *thilina_2016044@fot.ruh.ac.lk*

ABSTRACT

In recent years, due to the advancement of technology, there have been several types of tools introduced to workshops to make duties easier. But improper use of workshop tools can lead to many problems for both labour and tools. As a result, adequate tool management is required. Conventional tool management methods have several drawbacks, including labour reluctance to put the tools back in the correct position on the tool board or toolbox, and no proper way to trace the tools' availability. Labour may encounter issues when tools are not in the proper location and have difficulties locating the tool. It leads to requiring additional time and effort to locate the instrument when it is needed again. Due to lower variable costs associated with tool retrieval, tool return, and tool inventory management, it outperforms the manual process in terms of accuracy and efficiency. It also frees up human labour to focus on their primary responsibilities. Available automated tool management storage devices require the tool to be selected manually when replacing and tool retrieval. This study proposed an automated tool management system capable of automatically detecting, replacing, and recovering tools with less time and effort than human labour and controlled by a computerized system. The Brute-Force Matchers technique was used to accurately detect the tools using image feature matching. This algorithm achieved promising results when matching different tools with the saved image descriptors. A tool feed to the system was identified to perform automatic replacement, and a moveable tool bed was used to store the tools in a specific location. The system takes about 45 seconds to deliver the selected tool and one second to identify a tool. The proposed system provides a cost-effective and efficient solution to the tool management crisis.

Keywords: *computerized system, feature detecting, tools identifying, tools repositioning, tools retrieving*

 ISSN 2362-0412

Automated Multiple Woven Label Attaching Machine Using Impulse Heat

Nathali.T.Jayasuriya [a*], Uditha.M.P.Isuranga [b]

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Kamburupitiya, Matara, Sri Lanka

*Corresponding author: *nathalitharuka01@gmail.com*

ABSTRACT

The trend of automation improves production efficiency by reducing waste and increasing productivity. The goal of this research is to figure out how to automate the cutting and temporary stitching of several woven labels that are used to attach to the back neck area of clothes. Before sending label rolls to the sewing process, the selected apparel sector must cut them and temporarily store them in order. As a model, this automated multiple-label heat stitching machine was suggested. Furthermore, the existing procedures are expensive and time-consuming. Simulation research was used to assess the performance of manpower and an automated multiple-label heat stitching machine. This machine is divided into two portions for cutting and stitching woven labels. Woven labels were cut and stitched using impulse sealer technology. To feed woven labels and move the arms of the cutter and sealer sections, two gear motors were employed. Three contactors and limit switches were used to convey signals between the cutting and stitching portions, with the signal of the limit switch being attached to the arms of the cutter and sealer parts, which are moved upward and downward in turn with the assistance of a cam inside the timing technique. To keep the heating temperature constant, the operator must control the temperature levels of the impulse sealers. This machine will be able to cut and put labels together, reducing time waste, and needless human labor. The efficiency of the process was evaluated using average outputs per week as the key performance indicator. It was manually measured at 57.6%, then it was boosted to 96 percent in the simulated system. This efficiency disparity might be due to the employees' performance within their job cycle. Finally, this machine will increase productivity in the garment industry's manufacturing department.

Keywords: *apparel, automation, cutting, stitching, woven label*

 ISSN 2362-0412

Automated Small Scale Powder Dispensing System

P.M.D.K. Pathiraja, K.K.L. Pradeep, M.P.U. Isuranga*

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Kamburupitiya, Matara, Sri Lanka

*Corresponding author: *uditha@fot.ruh.ac.lk*

ABSTRACT

Powder dosing is a widespread practice in a variety of industries, including food processing, sail manufacturing, and material handling. There is a global trend toward automating manufacturing line handling operations in order to improve product quality and save labor costs. Powders should be weighed and distributed as part of the standard manufacturing process in various industries. In these scenarios, employees must individually prepare power batches according to material requirements. The overall efficiency of manufacturing is degraded by this manual procedure. Existing powder dispenser systems have issues such as waste of material and time, as well as human-caused measurement inaccuracies. Due to their toxicity, employees should avoid direct contact with specific powders. This research proposes a screw conveyor system with a digital weight measuring technique. Automatic quantitative and speed control elements are also included in the suggested system. Screw conveyors also have an agitator that creates vibrations to ensure that the powder reaches the screw conveyor in an efficient way in less time. The powder then leaves the container and continues dispensing into it through the screw conveyor. The load cell system keeps track of data and calculates how much powder falls through the conveyer. The conveyor's speed is controlled by a PID controller. Food additives, tastes, and perfumes, flour, milk powder, protein powder, solid drinks, sugar, monosodium glutamate, pesticides, veterinary drugs, detergents, catalysts, and other powders can be measured with this equipment. The dispenser system is 85% more efficient and 90% more precise than the methods currently in use in local manufacturing facilities.

Keywords: *Powder, Screw conveyor, Dispenser, Weight measurement*

 ISSN 2362-0412

Autonomous Solar Panel Cleaning Robot

K.M.D. Dilanka, J.N.T. Jayasuriya, M.P.U. Isuranga*

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Kamburupitiya, Matara, Sri Lanka

*Corresponding author: *uditha@fot.ruh.ac.lk*

ABSTRACT

Solar power becoming major sustainable source of power supply for various industries and households. To maximize the benefits of solar energy, mitigating derating factors are critical. One of the more problematic de-rating factors is dirt and other unwanted debris covering the solar panel. Dirty panels result in power loss. Grime and debris impair the solar array's ability to operate at full capacity. To ensure optimal solar panel power generation, those certain debris should be cleaned on a regular basis. Traditionally, this process is carried out by human labor, which results in a time-consuming and costly operation due to the inability of human labor to meet the demand of large solar farms. This study proposed a solution to this problem in the form of a non-human interacted robotic system. This robotic system is equipped with autonomous capabilities, a cleaning mechanism, and an adhesion mechanism. Additionally, this proposed device is a portable device capable of navigating through the inclined plane of the solar panels installed. The proposed robot features a novel design with two rotating cleaners on either side. A power assisted anti-slip feature is included to ensure precise cleaning motions. To enable autonomous movement, a pair of sensor systems has been established to facilitate precise navigation and environment recognition. GPS feedback is also included in the count for localization purposes, as the robot needs to know its position for both itself and the user. By utilizing a technique that incorporates water-assisted cleaning, a wider surface area can be cleaned than is possible with dry-cleaning procedures. Fully autonomous action tends to reduce the excess labor and higher accuracy with robust processing. The prototype was built and tested once the controller was integrated, and the results were good. As a result, it can be argued that the project's goals have been met.

Keywords: *Solar Panel, Cleaning, Robots, Autonomous control*

 ISSN 2362-0412

Bıodegradatıon of Polycyclıc Aromatıc Hydrocarbons by Endophytıc Fungı Isolated from *Prosopis juliflora*, *Acacia auriculiformis*, and *Annona glabra*

D.K.D.G. Dissanayake [a], H.C. Manawadu [a]*, K.A.S. Kodikara [b], V.P. Bulugahapitiya [a]

[a] *Department of Chemistry, Faculty of Science, University of Ruhuna, Wellamadama, Matara, Sri Lanka.*
[b] *Department of Botany, Faculty of Science, University of Ruhuna, Wellamadama, Matara, Sri Lanka.*

*Corresponding author: *harshicm@chem.ruh.ac.lk*

ABSTRACT

Polycyclic aromatic hydrocarbons (PAH) are considered as organic pollutants and occur naturally in fossil fuels. The burning of fossil fuels, garbage, or other organic substances causes the accumulation of PAHs in the environmental components such as air, water, and soil causing both short-term and long-term environmental issues. Bioremediation of environmental pollutants has gained momentum during the last few years. The symbiotic relationship between endophytes and host plants involves both mutualism and antagonism. Catabolic enzymes excreted by endophytic fungi to increase their adaptability can be utilized to degrade PAHs efficiently. In the present study, endophytic fungi grown in three well established invasive plants; *Prosopis juliflora* (Kalapu Andara), *Acacia auriculiformis* (Acacia), and *Annona glabra* (Wel atha) collected from Kalamatiya Sanctuary, Rekawa lagoon, and Kirala Kale of the Southern province respectively, and have been studied for bioremediation of PAH contamination. Endophytic fungi were successfully isolated and identified from the root suspension of above mentioned invasive plants. Five pure cultures were confirmed among twelve isolated samples and pure cultures were analyzed for their potential in degrading PAHs on Bacto Bushnell-Haas medium. The model PAHs, Naphthalene, and Anthracene were used as the carbon source separately. The spectrophotometric analysis confirmed acceptable degradation of both model PAHs by *Penicillium* sp1, *Penicillium* sp2, *Aspergillus* sp1, *Aspergillus* sp2, and *Aspergillus* sp3. The highest naphthalene and anthracene biodegradation percentages were shown by *Penicillium* sp2 and *Aspergillus* sp2 with values of (85.13±0.27) and (70.17±0.41) respectively, where the biodegradation percentages were significantly different compared to the control (Kruskal-Wallis; $P<0.05$). The findings of the study provide insight into how these endophytic fungi could be used for bioremediation of PAHs in environmental sites where contamination prevails and open avenues for future research in the relevant field. Further, the invasive plants can also be exploited beneficially by using them for bioremediation.

Keywords: *Bioremediation, endophytic fungi, polycyclic aromatic hydrocarbons*

 ISSN 2362-0412

Comparision of Restored Diesel IC Engine Performance with Brandnew Engine

S.R. Illangasinghe [a*], M.A.P. Chathuranga [a], B.L.S. Thilakarathne [a], D.R.B.K.K. Weerasekara [b]

[a]*Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Karagoda-Uyangoda, Kamburupitiya, Sri Lanka*
[b]*HNDE, Sri Lanka Institute of Advance Technological Education, Labuduwa, Galle, Sri lanka*

*Corresponding author: *ilangasinghes@gmail.com*

ABSTRACT

To meet the present requirements of the automotive industry, there is continuous improvement in the performance and exhaust emission of restored internal combustion (IC) diesel engine. This research presents the experimental data regarding the effect of exhaust gas temperature, cooling temperature, fuel consumption and emission gases of the restored and brand-new diesel IC engines. Catalytic convertor with modified muffler was installed to exhaust manifold to reduce emission. Exhaust gas tester (EGT) probe and temperature sensors were installed to muffler, upper & lower trunk hoses respectively. Arduino based sensors were used to this scenario. Dust sensor, carbon monoxide (CO) sensor and hydrocarbon (HC) sensors were used to test emission gases through the modified muffler. Researchers were developed a customized emission tester based on Arduino. The results show same values for cooling system temperature. The emission test data such as CO, HC & K-Factor of brand-new and restored engine were tested with ideal and high RPM conditions and there is a significant variation in exhaust gas temperature test data. However, those values do not surpass the vehicle emission standards in Sri Lanka. Addition of customized parts, change of mechanical properties due to the oldness of the engine, advance injection pump or retard angle, adjustment of injection timing can be caused for those variations. The results strongly indicate that modification of restored engine can be used for vehicle by maintain the Sri Lankan emission standards. Authors recommended restoring old engines by installing customized versions of modern technological components. Ultimately authors can conclude that old engine can be restored to satisfy the Sri Lankan motor traffic standards and emission standards with minimum cost and the result of the research proved that the performance parameters provide a solution to vehicle scraps and give an idea about restoring an old vehicle in profitable way

Keywords: *Diesel IC engine, EGT, Emission, K-Factor, Catalytic Convertor*

 ISSN 2362-0412

Demographic Background, Family History and Periconceptional Folic Acid Supplementation Associated with Primary Subfertility in Females Attending A Fertility Clinic, Galle, Sri Lanka

P.T. Dayawansha [a], L.B.L. Prabodha [b]*, K.B.S. Gunawickrama [a]

[a]*Department of Zoology, Faculty of Science, University of Ruhuna, Matara*
[b]*Department of Anatomy, Faculty of Medicine, University of Ruhuna, Karapitiya, Galle*

*Corresponding author: *lahiruprabodha@gmail.com*

ABSTRACT

Human reproductive health is recognized as a prioritized global health concern that involves many kinds of surveys and research in different aspects. Subfertility stands out among those studies as primary subfertility is identified as a significant problem in many countries. Although the ratios may vary, significant incidences such as one in every four couples have been reported. Being a poorly addressed issue in Sri Lanka, primary subfertility and its associated determinants were investigated in this study under three major categories, namely, socio-demographic, reproductive health factors, and periconceptional folic acid supplementation for a group of selected females attending to the fertility clinic, Teaching Hospital, Mahamodara, Galle. A cross-sectional study with convenient sampling was carried out to screen out data from 98 female subjects of subfertile couples during the period of April-November 2021. Subjects were interviewed by using a reviewed structured questionnaire. Data analysis was carried out by central tendency analysis, frequency analysis, and binary regression analysis to find out the most prevalent strata under each determinant. Regarding socio-demographic factors, mean age and age at marriage were recorded as 31.9 ± 6.2 (years) and 26.7±5.88 (years) respectively. Most females had a healthy BMI value. Behavioral factors like alcohol and tobacco consumption were represented by the minority which is 1% of the sample. The mean cycle length and duration of menstruation were 28.9±2.2 and 3.7±1.1 days respectively. The odds ratio showed that females who suffer from other clinical conditions such as asthma and heart diseases are less likely to be suffering from primary subfertility. The present study was conducted on the treatment-seeking female group, yet 9.2% of females were not receiving any treatment at that time. Inconsistent with previous studies, results showed that periconceptional folic acid consumption and family history of subfertility cases had no positive relationship with primary subfertility as 88.8% of females had a continuous supplement of folic acid, while 92.9% of females had no family history of subfertility. Larger sample size and a detailed questionnaire regarding other relevant aspects will facilitate a clearer interpretation of associated factors in female primary subfertility in Sri Lanka.

Keywords: *Folic acid, female subfertility, Socio-demographic determinants, Reproductive health*

 ISSN 2362-0412

Design and Development of an Automated Dosa Making Machine for Medium Scale Productions

W.I.M. Jayaweera, M.M. Srinath, M.P.U. Isuranga*

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Kamburupitiya, Matara, Sri Lanka

*Corresponding author: *uditha@fot.ruh.ac.lk*

ABSTRACT

Dosa is a typical South Asian meal that is frequently found in South Asian households. Dosa is often prepared on a nonstick pan with a spatula, which demands patience and constant attention while cooking. Manual processing is inadequate to cope with the increased demand for small and medium industries. These systems must be streamlined in order to meet demand and supply more effectively and efficiently. This study proposes an automated device that is more cost effective, user friendly, and hygienic to be used in mall and medium industries. The proposed system incorporates four distinct mechanisms for completing the various stages of the dosa-making process, which include dispensing, spreading, cooking, and removing. During the cooking process, one side of the Dosa is baked using the heatgenerated by an induction eater, while the top is steam baked cycle time taken to prepare one dosa from the developed automated system was measured 1 min. As a result, approximately 58 dosa can be prepared per hour. On average, a dosa weighs roughly 110 g. The mass flow rate of the dosa batter is calculated to be 36.67 g/s. This proposed technique is capable of making dosas measuring 6 to 8 cm in diameter.the main aim of this work is to conceptualize,design and fabricate a fully functional automated, to make dosa easily throughout its working cycle without requiring human intervention, and to modernize the traditional dosa-making process in order to create a lightweight and portable dosa-making machine. This automatic dosa-making machine is ideal for restaurants and household kitchens, as it significantly reduces the amount of time spent on the procedure.

Keywords: *Dosa, Food processing, Automation, Cooking*

 ISSN 2362-0412

Design and Development of a Prototype Armature Coil Removing Machine for Small Scale Single Phase Motors

J.H.R. Wimalaweera*, H.L. Subasinghe

Department of Engineering Technology, Faculty of Technology, University of Ruhuna

*Corresponding author: *roshan_2016022@fot.ruh.ac.lk*

ABSTRACT

Motors are widely used in many industrial types of machinery for different purposes such as traction systems and power generation. Therefore, these motors need to be properly maintained or repaired to ensure continuous operation of the machinery. The current practices for manual motor repairing employed locally are more time-consuming and unsafe for the workers. Removing and replacing the armature coil is one of the main tasks of repairing defective motors. According to the literature survey, there were no specially designed tools and types of machinery for removing the armature coil. Therefore, to fulfill the requirement specially designed armature coil removing machine was developed to operate more safely and efficiently. First the armature is attached to the machine armature holding system manually. The armature removal process is carried out in two different stages in the developed machine. In the first stage single point lathe cutting tool is fed to the rotating armature coil to cut the coil. After the first stage armature coil is fed to a specially designed ring, that is situated at the lower part of the developed machine to remove the coil from the armature. The size of the ring needs to be adjusted manually by adjusting the screws. The developed machine can be used to remove the defected armature coil as a safer and more efficient method instead of the conventional manual method.

Keywords: *Armature coil removal, Semi-automatic, Machine design*

 ISSN 2362-0412

Design and Fabrication of a Sewer Line Clog Removing Machine to be Used in Sri Lankan Dry Docks

R.M.D.P. Rathnayaka*, H.L. Subasinghe

Department of Engineering Technology, Faculty of Technology, University of Ruhuna.

*Corresponding author: *dinuka_2016029@fot.ruh.ac.lk*

ABSTRACT

Copper slags are primarily used as a blasting material in the removal and refining of old coated paint on maritime ships and boats. During this cleaning process a small amount copper is mixed with the wastewater system. The copper slags and wastewater mixture which known as slag will get solidifies over the time and eventually blocks the drainage pipes in dry dock areas. In Sri Lankan dry docks these blocked pipes are removed, and new pipes are replaced without cleaning the drainage pipes. There are no such cleaning mechanisms or machineries that have been introduced for the specific application according to the litreature review carried out. As a solution for the identified problem a simpler, semi-automatic, more efficient sewer line clog removing machine was designed and developed. The fabricated machine composed of two main components, one for removing the clog and one component for driving the removing mechanism. The clog removing mechanism is equipped with a specially designed drill bit for clog removing, driving mechanism of the drill bit, the supporting wheel mechanism of the drill bit. The clog removing mechanism is spring tensioned and can be adjustable for the pipe size and was designed considering a range of diameters for drainage pipes. The driving mechanism which drives the clog removing mechanism forward and backwards is driven by pulley mechanism and using a retractable cable mechanism, the spring cable is wrapped and unfolded around the rolling disk. The speed of the rolling disk is also adjusted using the pulley mechanism and belt drive mechanism. The clog removing mechanism and driving mechanism of the developed clog removal machine worked well when tested and can be used for clog removal successfully in dry dock areas. The Proposed machine also represents a cost-effective replacement for the current practice.

Keywords: *Clog removal, Semi-automatic, Sewer line cleaning*

 ISSN 2362-0412

Design and Fabrication of a System to Measure Thermal Conductivity of Compressible Materials

D.G.G.V. Udayakumara [a], I.R. De Silva [a], L.G. Chamath [bc], L.K.T. Srimal [a*], R. Gallage [a]

[a]*Department of Mechanical and Manufacturing Engineering, University of Ruhuna*
[b]*Department of Materials Science and Engineering, University of Moratuwa*
[c]*Institute of Technology, University of Moratuwa*

*Corresponding author: *srimal@mme.ruh.ac.lk*

ABSTRACT

Compressible materials are popularly applied in thermal insulation applications. Measuring the thermal conductivity of those materials is a challenge. Existing measuring methods are mostly focused on measuring the thermal conductivity of rigid materials. It causes in-accuracies due to several reasons such as externally applied pressure, change of dimensions of the specimen, and change of density of the specimen while being tested in the case of compressible materials. Therefore, in this research work, a dedicated concept of measuring the thermal conductivity of compressible materials was developed and fabricated a device complying with the industry standards. According to the literature review which was conducted initially, several thermal conductivity measuring devices which can be possibly used for compressible materials were identified. Based on the literature review, several conceptual designs were finalized. A heat flow meter apparatus that is currently available at the author's affiliation was then studied and tested to identify the inaccuracies and difficulties of the heat flow meter method when utilizing incompressible materials. From all the conceptual designs developed, a concept similar to the hot wire method was identified and developed as a steady-state method. A mathematical model for the finalized concept was then developed based on the theories of heat transfer. A computer simulation was also done by using ANSYS simulation software to identify the design parameters of the device. Finally, the device was fabricated and tested for accuracy using a coir-based composite. Thermal conductivity tested with the currently available heat flow meter of compressible coir-based composite material was less than 0.5 W/mK. For the same material, the method developed by this project gave an acceptable thermal conductivity value which is 0.211 W/mK.

Keywords: *Compressible materials, Heat flow meter, Heat transfer, Hot wire method, Thermal conductivity*

 ISSN 2362-0412

Design and Manufacturing of Soral Cement Base Sheets by Considering the Orientaion, Size and Shape of the Additives

W.L.N. Wickramarathna, W.D.S. Wickramasinghe, R. Gallage *, L.K.T. Srimal

Department of Mechanical and Manufacturing Engineering, University of Ruhuna

*Corresponding author: *rgallage@mme.ruh.ac.lk*

ABSTRACT

Nowadays most of the production of engineering materials are focus on eco-friendly concept due to environmental issues which are arise by traditional engineering materials. Sorel cement which was discovered by Stanislas Sorel in 1867 is used for many construction applications nowadays. Since this is an environmental friendly product it has a potential of replacing asbestoses and Portland cement. But due to some of its poor properties, applications of soral cement are more concentrated in to indoor usages. Magnesium Oxide and Magnesium Chloride are the main raw materials of this Sorel cement mixture. To use this Sorel cement mixture in outdoor construction applications, cured cement mixture should be used. Both ordinary Portland cement and Sorel cement has better compressive strength but weaker in tensile strength. Steel reinforcement are used to Portland cement in order to overcome that problem. But steel reinforcements cause corrosion in Sorel cement due to chloride iron which comes from Magnesium chloride. This research mainly focused on possibility of using natural fibers like Bamboo, Coir and Arica as a reinforcement material for Sorel cement with other possible additives to produced composite board (sheet). Water absorption, water permeability, density and flexural strength tests results show effects of those additives. Density value of asbestos reinforced samples is 1.6 gcm^{-3} and that value is almost same for all of the samples (with natural reinforcements). Sample with Arica fibers showed minimum value of 1.18 gcm^{-3} while minimum water absorption of 2.74% showed from coir fiber sample with fly ash additives. In contrast, asbestos based sample shows 19.37% of water absorption. Water permeability of all the test samples (both asbestos and natural reinforcement) showed smaller value and it can be considered as zero. Maximum flexural strength was reported by the coir fiber based sample and the average value is 4.89 MPa while asbestos based samples having 20.09 MPa. Further studies is going on to enhance the flexural strength of sheets.

Keywords: *Composite, Natural fiber reinforced sheets, Sorel cement*

 ISSN 2362-0412

Developing a Cement Tile Using Needle Waste

K.L.R.T. Gunawardena *, V.H.P. Vitharana

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Karagoda-Uyangoda, Sri Lanka

*Corresponding author: *raveen_2016053@fot.ruh.ac.lk*

ABSTRACT

Needle waste is an unavoidable waste generated from textile industry. Since the reduced degradability, this type of waste may cause for severe environmental problems. Through this study needle waste converts into a profitable material. Moreover the study suggests an effective method to dispose needle waste and ensure the reusage of high carbon steel containing in needle waste. The study aimed to develop a profitable cement tile by utilizing needle waste. To attain this purpose, selected mechanical properties after 7 days curing and manufacturing cost of cement tile were analysed. Cement tile was manufactured by using a combination of 30% Ordinary Portland Cement (OPC), 60% river sand and 20% water. Granite powder was replaced with needle waste upto 10% by weight at a gap of 2% (i.e 0%, 2%, 4%, 6%, 8%, and 10%). Sample with 0% needle waste constitution was considered as the control. For each constitution, two replicates were tested. Then the samples were submitted to the non-destructive (water absorption) and destructive (flexural strength) testings. According to the results, the highest water absorption rate (6.27%) was recorded from control and the lowest (5.18%) was recorded from 6% needle waste constitution. Each sample contain needle waste was shown the lower water absorption value than the reference value (10%). The highest flexural strength (9.90MPa) was observed at 10% needle waste constitution and the lowest (5.93MPa) was observed at control. In here also, all constitutions of needle waste were shown higher flexural strength than reference value (5.5MPa). According to the local retail market prices in July 2021, 150×150×15 mm sized cement tile can be manufactured with 20.69% of profit than a ceramic tile. In conclusion, the utilization of needle waste in cement tiles is an innovative method to enhance the mechanical properties of cement tile with a reduced manufacturing cost.

Keywords: *Cement tile, Flexural strength, Needle waste, Profitable tile, Water absorption*

 ISSN 2362-0412

Development of a Test-rig to Investigate the Effectiveness of a Hydraulic Oil

Ravindu Siriwardhana, Charith Wanigasekara, Kalpani Pathmasiri*, Indika Perera

Department of Mechanical & Manufacturing Engineering, Faculty of Engineering, University of Ruhuna

*Corresponding author: *kalpani@mme.ruh.ac.lk*

ABSTRACT

Hydraulic systems are energy transfer systems that employ fluid to move energy from one location to another. Mineral-based hydraulic fluids are the most common, however research is presently undertaken on renewable, biodegradable, and non-toxic hydraulic oils such as vegetable oil. Some essential qualities of hydraulic oil include optimum viscosity, compressibility, material compatibility, filterability, demulsibility, flammability, foaming tendency, thermal/oxidation stability, pour point, and specific gravity. Power transmission is considered as hydraulic fluid's most important function. When hydraulic oil is produced, simple yet acceptable pump tests are necessary to evaluate power transmission under varying pressures and speeds. The main aim of this project is to develop a system that can be used to investigate hydraulic oil performance in a specific system. Following a thorough literature review, a conceptual design with required test rig components (oil sump/ reservoir, strainer, level indicator, pressure gauge, motor, pump, pressure relief valve, direction control valve, flow control valve, flow meter, filter, check valve, and thermocouple) was developed. The system was built with components that met the feasible specifications. The test rig's performance was analyzed by observing how the temperature of the oil, discharge flow rate, and pump discharge pressure changed over time at various speeds (2400, 2700, and 3000 rpm) . The test equipment can be used to evaluate a hydraulic oil's performance with respect to speed and pressure as well as to compare the performance of different hydraulic oils. It can also be utilized as a laboratory unit to study relationship between different pump system parameters ((pressure, speed,flowrate, and efficiency)

Keywords: *Hydraulic oil, Perfomance, Presure, Speed, Test-rig*

 ISSN 2362-0412

Diversity, Distribution and Co-occurrence of Genus *Aedes* (*Culicidae*) through Rural and Urban Settings in Kalutara District, Sri Lanka

C.S. Kariyawasam [a*], H.C.E. Wegiriya [b]

[a] *Office of the Regional Director of Health Service, Kalutara*
[b] *Department of Zoology, University of Ruhuna*

*Corresponding author: *chathumali11@yahoo.com*

ABSTRACT

Most of the entomological surveys target only the vector mosquitoes and distribution of different species were limitedly documented. So, this study was designed to understand diversity, distribution and co-occurrence of *Aedes* species through rural and urban settings in Kalutara district. Palindanuwara and Walallawita were the selected rural areas and Panadura and Wadduwa were the selected urban areas. In every two month from January 2019 to December 2021 larval survey was carried out. For each survey 20 premises including houses, institutions, open areas and croplands were examined. *Aedes* mosquitoes were identified upto species level based on morphology using taxonomic review. Species diversity was calculated by Shannon Weiner Diversity Index (H) and Simpson Index of Diversity (1-D). During the study 4238 *Aedes* mosquito larvae belonging to 12 species were identified. Those species were *Ae*. (*Collessius*) sp.1 (n=336, 7.93%), *Ae*. (*Downsiomyia*) *albolateralis* (n=28, 0.66%), *Ae*. (*Do*.) sp.1 (n=4, 0.09%), *Ae*. (*Fredwardsius*) *vittatus* (n=283, 6.68%), *Ae*. (*Hulecoeteomyia*) *chrysolineatus* (n=243, 5.73%), *Ae*.(*Stegomyia*) *aegypti* (n=441, 9.46%), *Ae*.(*St*.) *albopictus* (n=2825, 66.66%), *Ae*.(*St*.) *krombeini* (n=53, 1.25%), *Ae*.(*St*.) *w-albus* (n=27, 0.64%), *Ae*.(*St*.) sp.1 (n=10, 0.23%), *Ae*.(*St*.) sp.2 (n=7, 0.17%), *Ae*.(*St*.) sp.3 (n=21, 0.5%). There was a significant difference in the species richness ($p = 0.0006$, $f = 12.744$) and species diversity in terms of H ($p = 0.012$, $f = 6.530$) and (1-D) ($p = 0.043$, $f = 4.248$). *Aedes aegypti* was not found in rural sites ($p = 0.001$, $f = 11.483$). Co-occurrence of *Aedes* species more frequent in rural areas (n=35, 65%) compared to urban settings (n=19, 35%). *Aedes aegypti* and *Ae. albopictus* co-occurrence were more common in urban areas (n=13, 68%) and *Ae. albopictus* and *Ae. chrysolineatus* co-occurrence were more common in rural areas (n= 14, 40%). So, before implementing vector control measures it is better to be deliberated those variations.

Keywords: *Aedes, Co-occurrance, Diversity, Kalutara, Species Richness*

 ISSN 2362-0412

Dormancy Breaking of Selected Weed Species in Sri Lanka

D.U.V. Gunathilaka [a], W.D.S.K. Aberathna [a], P.H.S. Shalika [a], K.A.S. Kodikara [a*], P. Ranasinghe [b], D.P.D. Ranawaka [a] and L.P. Jayatissa [a]

[a] *Department of Botany, University of Ruhuna, Wellamadama, Matara, Sri Lanka.*
[b] *Industrial Technology Institute, Colombo, Sri Lanka.*

*Corresponding author: *sunandaruh@gmail.com*

ABSTRACT

Seed dormancy is a phenomenon that prevents an undamaged viable seed from germinating under favourable conditions. Various techniques have been applied to break dormancy in many weed-seeds based studies. The present study aimed to seek the most appropriate dormancy breaking method for six selected common weed species namely *Cardamine hirsute* (walaba), *Tridax procumbens* (Kurunegala desi), *Ageratum conyzoide* (Hulanthala), *Amaranthus viridis* (Kura), *Echinicholoa glabrescens* (Bajari) and *Sida acuta* (Nanu) found in Sri Lanka. Germination test was performed in triplicates where thirty seeds were used for each replicate. Four dormancy breaking treatments such as hot water treatment (80^0C, 5-minutes), cool scarification (4^0C, 24-hours), mechanical scarification (sharp cutting on a seed coat) and acid scarification (treated with H_2SO_4; pH-4 and pH-5 as two separate treatments) were used for separate seed lots and level of germination was assessed daily for two weeks. Weed seeds treated with water at room temperature, was used as control. As percentage data were used, non-parametric Friedman test was performed. According to the results, *T. procumbens*, *A. viridis* and *S. acuta* showed 53%, 10% and 23% natural germination, respectively. However, natural seed germination was not observed in rest of the species. Germination of *T. procumbens*, *S. acuta* and *E. glabrescens* significantly increased ($p<0.05$) by 14%, 20% and 52%, respectively, under mechanical scarification compared to the control treatment. Whereas, no significant increment in the percentage germination was observed for hot water treatment and cool scarification. Moreover, significantly higher ($p<0.05$) germination percentages (16% and 14%) were observed for *A. viridis* under respective acid scarification treatments at pH-4 and pH-5. The current study revealed mechanical scarification as the most effective method in breaking dormancy of *T. procumbens*, *E. glabrescens* and *S. acuta* while acid scarification for *A. viridis*. Further studies, employing methods/treatments which are not investigated during the present study are recommended to assess the dormancy breaking ability of *C. hirsute* and *A. conyzoide*.

Keywords: *Acid scarification, Dormancy breaking, Mechanical scarification, Weed seed*

 ISSN 2362-0412

Effects of Different Combinations of Organic and Inorganic Fertilizers on Marginal Oil Palm (Elaisguinensis) at Talgaswella Estate in WL2a Agro Ecological Zone, Sri Lanka

H. Bulugahapitiya [a]*, I.R. Palihakkara [b], A. Balasuriya [c]

[a] *Elpitiya Plantations Plc., Talgaswella Estate, Talgaswala.*
[b] *Department of Crop Science, Faculty of Agriculture, University of Ruhuna.*
[c] *114/2, Thumbovila, Piliyandala, Sri Lanka*

*Corresponding author: - *hiranjan@aitkenspence.lk*

ABSTRACT

Palm oil (Elais guinensis) is the most consumed edible vegetable oil in the world. Commercial scale Oil palm cultivations mostly depend on quality planting materials, correct management practices. Due to the recent price hikeon chemical agricultural inputs in Sri Lanka, palm cultivation faced different hardships to maintain their plantations. An experiment was carried out at Talgaswella estate of Elpitiya Plantations PLC, in WL2aagro-ecological zone of Sri Lanka to investigate the possibility to apply organic fertilizer for a marginal conventional oil palm field for achieving a profitable yield with the integration of organic fertilizer. Ten years aged oil palm field was selected for this experiment. Three treatments namely 100% organic, 100% inorganic and a combination of inorganic fertilizer with a portion of organic fertilizer that provides the nutrients as same as the recommended inorganic fertilizer for oil palm were tested rom September 2019 to September 2021. The experiment was carried out according to RCBD with three replicates and each replicate consisted of six palms. Empty fruit bunches (EFB) of oil palm, palm oil mill effluent (POME) and poultry litter (PL) were used for preparation of organic fertilizer. Fresh fruit bunch yield and the leaf chlorophyll values were recorded, and the data were analyzed with SAS statistical tool. The results revealed that the treatment with 100% organic fertilizer showed significant increments in average fresh fruit bunch weight (41kg) compared to that of the100% inorganic fertilizer (26 kg) and 50% to 50%inorganic-organic mixture (23 kg). The leaf chlorophyll values in the 17th frond of 100% inorganic and 100% organic treatments were 75.57 and 75.91in SPAD units respectively while it was 74.62 in the inorganic-organic mixture and there's no significant different among the treatments. Soil organic carbon percentage varied from 100% inorganic to 100% organic (1.99 and 2.05) respectively and it clearly showed the gradual increment of soil organic carbon levels, which will directly affect to the fertilizer use efficiency. Therefore, the application of organic fertilizer showed better yield (10030kg/ha/year) in oil palm compared to inorganic fertilizer (9234kg/ha/year) in Talgaswela estate, Sri Lanka.

Keywords: *Oil Palm, Organic fertilizer, Plant Growth, POME, Sri Lanka*

 ISSN 2362-0412

Elevator Guide Rail Cleaning Robot

D.A.P.P.D. Dissanayake*, M.P. Prabodhi Mithila

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Karagoda-Uyangoda, Kamburupitiya, Sri Lanka

*Corresponding author: *pasindu_2016008@fot.ruh.ac.lk*

ABSTRACT

This paper is dedicated to the construction of an elevator guide rail cleaning robot. During the elevator guide rail installation period, paint, dust, rust, and other impurities are deposited on the elevator guide rails. Because of that, it needs to be well cleaned without any deposited impurities on guide rails to make the elevator more efficient. Risky, unsafe, harmful, time-consuming, and basic manual methods are used by the workers to carry out the elevator guide rail cleaning process. Therefore, a fully automatic and efficient elevator guide rail cleaning robot is introduced. This robot has consisted of three systems. They are hardware system, control system, and power supply system. In addition, the hardware system has consisted of seven subsystems. The whole operation of this robot is controlled by the control system. And it is operated by the Arduino microcontroller. 12v DC power supply has been used to supply power to this robot. Moreover, when the robot is fitted and activated on the guide rail, it automatically stops at the top or bottom of the guide rail after the guide rail has been fully cleaned. Therefore, a person is not required to operate the robot. This robot can be developed at a low cost, and it saves time rather than cleaning the guide rails manually. Another important benefit of this robot is that the workers can stay healthy by protecting themselves from dust and other impurities when they are cleaning elevator guide rails automatically.

Keywords: *Elevator, Microcontroller, Arduino*

 ISSN 2362-0412

Employee Management Application for Dock Workers

K.D.H.C. Kariyawasam*, P.H.H.C Dewduni, W.B.H. De Silva, K.M.N. Apsara, W.A. Mohotti, W.K. Shajith

Department of Computer Science, Faculty of Science, University of Ruhuna

*Corresponding author: *hansanikariyawam33@gmail.com*

ABSTRACT

Software applications have been used in different industries to support the operations of employees with the advancement of information technology. They streamline employee management and payroll activities which are manually complex and time-consuming. These applications accurately calculate salaries, simplify employee tracking and generate reports for administration minimizing manual efforts and increasing productivity. Dock labour systems operate with a large pool of less educated and casual workers to have a high degree of operational flexibility. In contrast to educated workers who have the potential to adjust to new technologies, implementing information technology services for dockworkers needs careful requirement analysis and simple design that cater to end-users. Therefore, the objectives of this study are to design and implement an effective employee management application for a company that deals with non-tech dockworkers in calculating employee absences, leave, overtime, salaries, payslips and generating reports for owners to view employee data and attendance for strategic planning. The methodology used for the study includes systematic requirement analysis using interviews with employees and company owners, and Software-Development-Lifecycle. We have selected BPES company which provides services to all the container terminals in Sri Lanka. It hires more than one hundred employees to provide the service and dealt with manual management processes wasting time. Thus, the proposed novel web-based solution for BPES design to efficiently handle the employee management, payrolls and administration support dealing with dockworkers. The front end of the proposed solution uses HTML, CSS, JS and jQuery to give simple and effective user interfaces while the back end of the system is developed using Apache server, PHP and MySQL database server which is free and open-source to support low cost. A thorough system testing by developers and acceptance testing by users was done to validate the acceptability. The results revealed end-users requirements are satisfied by the proposed solution.

Keywords: *Employee Management System, IT, Web-based*

 ISSN 2362-0412

Factors Associated with Better Achievements in Mathematics: A Study on Technology Stream Students in University of Ruhuna

A.A.R.P. Abeysinghe [a*], Leslie Jayasekara [a], Sanjaya Thilakarathne [b], M.K. Abeyratne [a], Gayanthi Malika Wadanambi [c]

[a]*Department of Mathematics, Faculty of Science, University of Ruhuna*
[b]*Department of Engineering Technology, Faculty of Technology, University of Ruhuna*
[c]*Nilwala National Collage of Education, Wilpita, Akuressa*

*Corresponding author: *ridmalaabeysinghe@gmail.com*

ABSTRACT

This study was conducted to determine the effect of affective some learning and teaching variables on test scores in mathematics achievement test used for technology stream students at the University of Ruhuna. The study was a descriptive study in which a survey research design was adopted. A total of 181, Level I students from the faculty of technology participated in the study. Data for the study was collected through a questionnaire that included a mathematics achievement test. A reliability analysis was done to assess the internal consistency of the survey questionnaire. The values of Cronbach's alpha ranges from 0.841 to 0.868 for all the scales. Student questionnaires were analyzed by using principal component analysis to obtain different dimensions that are expected to be related to students' mathematics achievement. Final model was designed and tested by structural equation modelling technique (SEM) using R software. Students' interest in mathematics, students' attitudes towards mathematics, students' motivation towards mathematics, teacher's involvement towards students' performance in mathematics, and students' involvement towards their performance in mathematics were identified as factors associated with test scores. The teacher's involvement in students' mathematics performance had a positive impact on mathematics achievement. Students' involvement towards their performance in mathematics were found to be positively related to the students' success in mathematics. On the other hand, students' attitudes towards mathematics do not have any relation with mathematics achievement. Students' interest and students' motivation towards mathematics also have positive infact on their mathematics achievement.

Keywords: *Principal component Analysis (PCA), Structural Equation Model (SEM), Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), Reliability*

 ISSN 2362-0412

Fault Detection System for Underground Telecommunication Cables Facilitated with Website, Map, Mobile Application and SMS Alerts Systems

H.P.N. Nayanamali*, W.T.J. Soysa, M.P.U. Isuranga

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Kamburupitiya, Matara, Sri Lanka

*Corresponding author: *nishadi_2016024@fot.ruh.ac.lk*

ABSTRACT

In telecommunication maintenance process can be defined as one of the main processes. At large scale for telecommunication most of the service providers were using underground cabling basically. Through this study, mainly trying to focuses on to detect the exact fault location in underground copper cables which are used for telecommunication transmission frequently can be seen in urban areas. However, it is very difficult task to find out the exact faulty location while maintenance process of underground cables. Today, service providers are using some equipment which are very expensive as well as more manpower to recover them at first time. Other than that, it was a difficult task to identify both open and short circuit faults. A system which is integrated with fault location detector with the help of the Ohm's law detection the voltage behaviour. To achieve the main intension of this study, a SMS which is derived through the GSM module and a web page and the mobile application will be updated through the firebase which is done within the time period of less than one minute that can be mentioned as the huge advantages achieved from the usages of the firebase database instance. Through this system, all the responsible individuals of the maintenance team will be informed when there is a fault occurred in an underground cable by sending an SMS (Short Message Service) to the technician as well as updating of the web page and mobile applications showing faulty location through a Google map which will be a great assistance for the maintenance teams.

Keywords: *Detection, Fault, Handhole, Ohm's law, Underground cable.*

 ISSN 2362-0412

Formation of Purple Reddish Colour in Salt Pans: Case Study of Hambantota Salt Pans

H.K.A.E. Prasadika [a*], D.K.A.I. Suranga [b], H.P.L. Guruge [a], K.S.S. Atapaththu[a], H.B.Asanthi [a]

[a] *Department of Limnology and Water Technology, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna*
[b] *Lanka Salt Ltd., Hambantota*

*Corresponding author: *erandi.prasadika@gmail.com*

ABSTRACT

Sudden appearance of a whitish scum appeared during the seasonal pinkish coloration of the salt pans in the C area (evaporation area at salinity 6%to 11%) of Lanka Salt Ltd., Hambantota during October 2021, and this study was conducted to study the causative factors on this sudden color change. Water samples were taken from inlet of C area (n=3), C area salt pans (n=5) and outlet (n=3) of C area salt pans. The salinity level of the water samples was approximately in the range of 6% and 11%. Collected water samples were filtered through 30 µm mesh and the filtrate was examined under light microscope. Algae observed under the microscope were isolated using a dropper and those algae were cultured in BG-11 culture medium for subsequent identification. Absorbance of the samples at the wavelengths of 200 nm to 800 nm was detected using a UV visible spectrophotometer. The dominant planktonic organism was *Dunaliella* sp. (500 cells/mL) followed by *Euplotes* sp. (150 cells/mL) and *Fabrea salina* (100 cells/mL) respectively. The optimum population density of *Dunaliella* was observed in the laboratory culture after ten days of inoculation. The absorbance spectrum of both water samples collected from the salt pans and laboratory cultures exhibited a peak absorbance at the wave length of 400 to 600 nm, which has been identified as the range that includes the peak for carotenoids. Therefore, the observed reddish colour in the samples was explained by the presence of *Dunaliella* cells. Furthermore, this could be the reason for the pink coloration which appears in the normal salt crystallizer pans at the harvest. Present study identified a potential to extract carotenoids using *Dunaliella* and thus, further studies are recommended to develop procedures to extract carotenoids.

Keywords: *absorbance, Dunaliella sp., pigment, salt pans, spectrum*

 ISSN 2362-0412

Growth and Yeild Performance of Withania somnifera (Amukkara) as Affected by Phosphorous, Potassium and Potting Media

E.M.D.C.M. Dharmasena, R.H.G.B. Prabhashini*, S. Subasinghe

Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Mapalana, Kamburupitiya, Sri Lanka

*Corresponding author: *bhagya.prabhashini@crop.ruh.ac.lk*

ABSTRACT

Amukkara is most important medicinal plant grows well in dry areas of Sri Lanka. There are two varieties of *Amukkara* as local variety and Indian variety. When quality and quantity of *Amukkara* do not meet the requirement of Sri Lankan medicinal sector, large bulk of *Amukkara* from India should be imported to cater the local demand. Due to that reason, the present study was carried out to study growth and yield performance of *Amukkara*; Indian variety in Mapalana- low country wet zone under greenhouse condition using different Phosphorous and Potassium fertilizer & potting media. The experiments were conducted according to three-factor factorial Completely Randomize Design with four replicates. Two different potting mixtures (sand: top soil: compost-1:1:1 -medium 01 and 2:1:1-medium 02) were used. Fertilizer was applied as Phosphorous (recommended rate-level 01 and 50% of the recommended level-level 02) and Potassium K40 were applied 0mg/Kg, 6mg/Kg, 12mg/Kg and 18mg/Kg starting from flowering stage and continuing at one-week interval and there were 16 treatment combinations for the experiment. Plant height, number of branches per plant and number of leaves per plant were taken as growth parameters starting from 6 weeks after planting and continued with 2-week intervals. The dry weight of tap root, fresh and dry weight of the shoots were taken as yield parameters at harvesting (18 weeks). Data were analyzed by ANOVA using SAS software. Results revealed that the best treatment combination is medium 01 (sand: top soil: compost 1:1: 1) and phosphorous level 2 (50%+ recommended phosphorous level) to get the highest plant height and highest leaf growth of *Amukkara*.

Keywords: *Growth and yeild, Phosphorous, Potassium, Potting mixture, Withania somnifera*

 ISSN 2362-0412

Impact of Organic Liquid Fertlizers on Growth and Yield of *Abelmoschus esculentus*, *Raphanus sativus* and *Amaranthus* spp in Container Gardening

E.M.U.I. Ekanayake, K.M.C. Fernando*

Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Mapalana, Kamburupitiya 81100, Sri Lanka

*Corresponding author: *menaka@crop.ruh.ac.lk*

ABSTRACT

The benefaction of container gardening on food security is its main strength while it fulfils an essential fraction of nutritional requirements. The effect of five organic liquid fertilizers prepared using banana waste, weeds (mixing equal proportions of *Lantana camara*, *Mimosa invisa* and *Mikania micrantha* by weight), Gliricidia leaves, fish waste and cow dung together with inorganic liquid fertilizer (Albert's solution) was tested. Three separate experiments were conducted to evaluate the treatment effect for *Abelmoschus esculentus*, *Raphanus sativus* and *Amaranthus* spp. arranged as randomized complete block designs with six replicates. The average plant height, stem girth, number of leaves and pods per plant, pod girth and length and fresh weight of the pods were significantly different between treatments for *Abelmoschus esculentus*. The highest plant height, stem girth, number of leaves and pod length were recorded when treating plants with Albert's solution. However, the number of pods per plant and pod girth was not significantly different between the Albert's solution, banana liquid fertilizer and weeds liquid fertilizer. In *Raphanus sativus*, the average plant height, fresh weight of leaves, diameter, length and weight of the tuberous root were significantly influenced by the treatment. The greater diameter and the length of the tuberous root were observed when treating plants with Albert's solution and cow dung liquid fertilizer while the lowest values were recorded in weed and Gliricidia leaves liquid fertilizers. Cow dung liquid fertilizer treated *Raphanus sativus* plants recorded the highest tuber fresh weight while it was not significantly different from Albert's solution. The lowest tuber weight was observed when treating plants with weeds and Gliricidia liquid fertilizers. The average plant height, stem girth, number of leaves, leaf length, leaf width and root length were significantly different among treatments ($P < 0.01$) for *Amaranthus* spp. However, the volume of the roots per plant was not significantly different among treatments. When treating plants with Albert's solution, banana and fish liquid fertilizers the plant height was not significantly different from each other. The economically important characteristics of the *Amaranthus* spp such as the number of leaves per plant, leaf length and leaf width were not significantly different among Albert's solution, banana, weed and fish liquid fertilizers. According to the results of the present study, it could be suggested that banana and weeds liquid fertilizer could be used to achive good yield of *Abelmoschus esculentus* same as Albert's solution. Cow dung liquid fertilizer and Albert's solution could be effective for *Raphanus sativus* while Albert's coution could be replaced by banana, weed and fish liquid fertilizers for high yield of *Amaranthus* spp.

Keywords: *Abelmoschus esculentus, Amaranthus spp, container gardening, organic liquid supplements, Raphanus sativus*

 ISSN 2362-0412

Influence of Selected Soil Properties on Soil Organic Carbon (SOC) Levels in Mangrove Soil: A Study from Rekawa Lagoon, Southern Sri Lanka

G.G.N.K. Wijeratne[a], D.P.D. Ranawaka[a], N.V.K. Chamika[a], D.U.V. Gunathilaka[a], W.M.I.C. Wijesundara[a], N.K. Abeysinghe[a], N.D.S.D. Thilakarathna[a], A.J.D. Perera[a], N.P. Dissanayake[a], N.R. Kankanamge[b], L.P. Jayatissa[a], J. Andrieu[c], K.A.S. Kodikara [a*]

[a]*Department of Botany, Faculty of Science, University of Ruhuna, Matara, Sri Lanka*
[b]*Ryan Institute, School of Natural Sciences, National University of Ireland, Galway*
[c]*GEOSpatial Monitoring & amp; Information Technology (GeoSMIT) department, French Institute of Pondicherry (IFP), Pondicherry, India*

*Corresponding author: *sunandaruh@gmail.com*

ABSTRACT

Carbon that is stored and sequestered in marine coastal ecosystems, such as mangroves, salt marshes and seagrass meadows is termed as Blue Carbon, which plays an important role in the global carbon cycle and climate change mitigation. It has long been known that mangroves which are confined to tropical and subtropical latitudes, have higher rates of net primary production and carbon sequestration capacity. This study, therefore evaluated the influence of some selected soil physicochemical properties on the soil organic carbon (SOC) content in mangrove soil, in Rekawa mangrove forest in Southern coast of Sri Lanka. The effects of pH, soil salinity, conductivity, soil moisture content (%), soil bulk density, soil porosity, phosphate content and nitrate content on soil organic carbon were examined along selected six transects covering periphery, middle and water edge zonation and the influence was quantified as correlations. Results indicate that soil organic carbon content was positively correlated with soil salinity, conductivity, soil moisture content, and soil porosity, (Spearman rank correlations; $P<0.001$) while it was negatively correlated with soil bulk density and nitrate content (Spearman rank correlations; $P<0.05$). Among the measured properties, pH and phosphate content showed no significant correlation with SOC. Final Generalized Linear Model (GLM; AIC = 142.04), improved by stepwise elimination, significantly explained the SOC as a function of soil porosity, soil salinity and soil bulk density ($P<0.05$). Furthermore, it is recommended to investigate the influence of other soil physicochemical factors which were not discussed in this study on SOC content and stability in future studies and the outcome/s will be highly beneficial in future to challenge the environmental crisis conditions such as global warming and climate change.
Acknowledgement: FSPI-SEDRIC project provided the financial assistance for the research.

Keywords: *Blue carbon, Mangroves, Physico-chemical, Rekawa, SOC*

 ISSN 2362-0412

Level of Salinization in the Walawe River and Its Impacts on Associated Agricultural Lands

N.V.K. Chamika[a], A.R.P.E. Athapatthu[a], G.T.G. Arachchi[a], D.P.D. Ranawaka[a], G.G.N.K. Wijeratne[a], D.U.V. Gunathilaka[a], W.M.I.C. Wijesundara[a], N.K. Abeysinghe[a], N.D.S.D. Thilakarathna[a], A.D.T.I. Madushanka[a], S.K. Madarasinghe[b], D.D.N. Sripal[a], L.P. Jayatissa[a], J. Andrieu[c], K.A.S. Kodikara[a]*

[a]*Department of Botany, Faculty of Science, University of Ruhuna, Matara, Sri Lanka*
[b]*Department of Physics, Faculty of Science, University of Ruhuna, Matara, Sri Lanka*
[c]*GEOSpatial Monitoring & amp; Information Technology (GeoSMIT) department, French Institute of Pondicherry (IFP), Pondicherry, India*

*Corresponding author: *sunandaruh@gmail.com*

ABSTRACT

Walawe river, which is located in Ambalantota, belonging to dry zone of Sri Lanka is highly exploited for domestic and irrigation purposes. Seawater intrusion in the river adversely affect the livelihood of bordering communities by hindering freshwater availability and salinization of agricultural lands. Present study determined the level of salinization in Walawe River and its impacts on associated agricultural lands (paddy) during the dry season where the salinization is profound. Data collection was carried out during the period from March to April, where water samples were retrieved from 50 locations along the river starting from the river mouth to 8 km upstream, and salinity levels were examined. Soil samples (n=44) of immediately adjacent agricultural lands were collected from random transects (n=10; length=200 m) which were placed perpendicular to the river, starting from the shoreline. Such that 4-5 soil samples were collected along each transect at 50 m interval. Physicochemical properties of soil samples; salinity, pH, organic matter content, moisture content, nitrate concentration and phosphate concentration were measured. Current status of agricultural productivity was evaluated employing a questionnaire survey using 30 farmers. Salinization through river water, seepage of saline water through river banks and direct spray were identified as major causes of salinization in adjacent agricultural lands. Salinity of the river water ranged from 0.17 to 5.95 ppt (maximum level recorded at the mouth) while soil salinity ranged from 0.10 to 0.44 ppt. Significant correlation was not observed between soil salinity and other physicochemical parameters (Spearman's rank; $P>0.05$). Further, significant variations were also not observed between variables (Kruskal-Wallis; $P>0.05$). Findings suggest that at present the impact of salinity has no significant effect on the physicochemical properties of soil and productivity of associated agricultural lands. However, continuous long-term studies are required to assess the long-term salinization effects.

Acknowledgement: FSPI-SEDRIC project provided the financial assistance for the research.

Keywords: *Salinization, Agricultural lands, Saltwater intrusion, Walawe River*

 ISSN 2362-0412

Low-Cost Smart Precipitation Gauge with a Weather Station

R.A.D.T.T. Rupasinghe, W.T.J. Soysa, M.P.U. Isuranga*

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Kamburupitiya, Matara, Sri Lanka

*Corresponding author: *uditha@fot.ruh.ac.lk*

ABSTRACT

Rain gauges are used to measure rainfall. For the rainfall data collection, manpower is required. In that scenario, the person needs to go where the rain gauge is located and download data from the data logger and calculate the rainfall. Some places are difficult to reach and need a flat surface to install the rain gauge. In addition, systematic and human errors, defective instruments, non-recorded data are some difficulties in the rain gauges. The number of internet-enabled loggers is currently limited in the market. While doing those, different types of rain gauges under different price points were identified. Most of the rain gauges and their material cost are expensive. Those rain gauges need special training and experience to operate and calibrate. This study introduces a low-cost tipping bucket rain gauge to overcome the problems associated with conventional systems. The 3D printed device is specially designed to use the minimum amount of raw materials possible, and all the raw materials can be easily found. A water collector is designed to collect water 10 ml on one side. An adjustable base is used to install the rain gauge in unbalance surfaces. Consequently, temperature, pressure, humidity, moisture, and altitude parameters also can be measured to operate as a fully functional weather station. Reed switch counts the number of tips that make a temporary electrical connection each time the bucket tips. The measured parameters are stored in the cloud server and displayed on the web interface. The Root Mean Square Error is a commonly used metric for calculating the difference between the values predicted by a model and the values observed in a controlled environment.

Keywords: *Internet of things, Rain Gauge, Weather station*

 ISSN 2362-0412

Machine Learning and Data Mining Based Botnet Attack Detection Framework

O.A.S.P.O. Arachchi *, M.W.T.B. Aththanayake, L.L.G.M.P. Bandara
W.G.C.A. Sankalpa, K.L.K. Sudheera

[a]*Department of Electrical and Information Engineering, Faculty of Engineering, University of Ruhuna, Galle, Sri Lanka*

*Corresponding author: *eg162819@engug.ruh.ac.lk*

ABSTRACT

Internet of Things (IoT) provides an attractive surface for attackers to initiate large scale network attacks due to inherent vulnerabilities such as default usernames and passwords in the IoT devices. As can be seen by recent massive scale attacks such as Mirai, bots make use of this weakness to compromise vulnerable IoT devices and launch targeted attacks towards critical network infrastructure. Botnet attacks consist of multiple stages starting from scanning and progressing until specific attacks such as Distributed Denial of Service (DDoS). These individual stages leave traces in the underlying network traffic which can be extracted as patterns. To this end, we propose a framework that first extracts patterns from network traces using data mining and subsequently, trains a machine learning model to classify the extracted patterns to corresponding attack stages. The patterns are mined locally at gateways of each network and then, federated learning is used to train a global model at a centralized security manager by exchanging the weight parameters without violating the privacy concerns. We demonstrate the effectiveness of the proposed framework through multiple experiments using the OpenStack platform.

Keywords: *Association Rule, Botnet, Data Mining, Federated Learning, FIM*

 ISSN 2362-0412

Machine Monitoring System to Predict Potential Failures

Anjalee W.M.A. Jayarathna*, K.G.S.H. Gunawardana

Department of Engineering Technology, Faculty of Technology,

University of Ruhuna, Karagoda, Uyangoda, Kamburupitiya, Sri Lanka.

*Corresponding author: *anjaleeanuththara1996@gmail.com*

ABSTRACT

Fault prediction and maintenance of equipment plays a critical role in today's industry. Failures should be identified as soon as possible because if the equipment continues to run under abnormal conditions, it could damage equipment and the employees. Many of the previous studies were focused on developing mathematical model predicting the machine's operating conditions. During past years, machine learning techniques have been widely applied in machine fault diagnoses. Many studies have demonstrated that analyzing the vibration spectrums of machines can be a useful tool for detecting faults at early stage. Moreover, analysis of acoustic waves generated from machines could also be a reliable methods in detecting faults. This study is focused on developing an external data acquisition unit and fault detection system that utilize acoustic waves produce by the machine in identifying the potential faults. Further, the proposed unit is a portable unit that can be used in wide range of machines. The primary objectives of this research are to acquire acoustic signals at higher sampling rate and analyze the data using machine learning algorithm. In this study acoustic data is collected using a sound sensor module and Arduino development board. However, the vibration signal could not be detected accurately at higher sampling rates with the KY-037 acoustic sensor module and Arduino Thus, Case Western University bearing data are used in machine learning algorithm to study the accuracy of the fault prediction. The data is converted to frequency domain and it is extracted the frequencies and amplitudes of dominant peaks as the main features for the machine learning algorithm. Those selected features are analysed using K-Nearest Neighbor and Support Vector Machine classification algorithms. The overall accuracy of 90.1% and 81.8% were obtained using KNN and SVM algorithms.

Keywords: *Acoustic Signal, Data Acquisition, Fast Fourier Transformation, K-Nearest Neighbor, Support Vector Machine*

 ISSN 2362-0412

Manglicolous Lichen Diversity and Their Spatial Distribution in Rekawa Lagoon, Southern Coast of Sri Lanka

D.P.D. Ranawaka[a], D.U.V. Gunathilaka[a], W.M.I.C. Wijesundara[a], G.G.N.K. Wijeratne[a], N.V.K. Chamika[a], N.D.S.D. Thilakarathna[a], H.D. Wijayathilaka[b], S.K. Madarasinghe[c], G. Weerakoon[d], J. Andrieu[e], K.A.S. Kodikara[a]*

[a] *Department of Botany, Faculty of Science, University of Ruhuna, Matara, Sri Lanka*
[b] *Department of Zoology, Faculty of Science, University of Ruhuna, Matara, Sri Lanka*
[C] *Department of Physics, Faculty of Science, University of Ruhuna, Matara, Sri Lanka*
[d] *National History Museum, London, United Kingdom*
[e] *GEOSpatial Monitoring & amp; Information Technology (GeoSMIT) department, French Institute of Pondicherry (IFP), Pondicherry, India*

*Corresponding author: *sunandaruh@gmail.com*

ABSTRACT

Lichenology has received much attention in recent decades due to two major reasons; functioning as bio-indicators and having chemicals with industrial significance. However, Manglicolous lichens (i.e., mangroves lichens) have not yet been extensively studied compared to other terrestrial lichens, particularly in Sri Lanka. Hence, this study was aimed to investigate the lichen diversity in Rekawa mangrove forest to strengthen the baseline database of Manglicolous lichens. In addition, we studied whether the spatial distribution of Manglicolous lichens is salinity-driven. Lichen diversity was assessed in eight sites which consisted seventeen plots, by calculating Lichen diversity value (LDV). In addition, other factors linked with lichen diversity including; tree height, girth, diameter, crown height, inclination, bark properties (pH, salinity, conductivity, moisture content, texture) and, canopy closure were considered. According to results, 24 lichen genera belonging to 14 families were recorded. *Graphis* sp (Graphidaceae family) and *Dirinaria* sp (Caliciaceae family) were the most abundant. The highest LDV recorded was 35.1, and the lowest was 1.5. Notable pattern was not observed among the lichens and host mangroves. However, the *Avicennia* sp recorded the lowest number of lichens, probably due to the bark peeling. Principal Component Analysis (PCA) of LDV and variables suggested that variables except girth and inclination have a negative effect on LDV. Moreover, PCA biplot showed most lichen species clustered around the variables tree height, canopy closure, crown height, bark pH, and bark texture. According to the Generalized Linear Model (AIC = 80.9), the LDV of the selected sites was best explained by canopy closure ($p<0.05$), which was negatively correlated to LDV. Considering the scale of the study, the results suggested that the study area (intermediate climate zone) has a considerable amount of lichen diversity, which is worthy of further exploration. Bark salinity was not the main factor that drives the spatial distribution of lichen diversity of the study area, but the canopy closure.

Acknowledgment: FSPI-SEDRIC project provided financial assistance for the research.

Keywords: *Lagoon, LDV, Lichens, Mangroves, Rekawa*

 ISSN 2362-0412

Microbiological and Molecular Characterization of methicillin-resistant *Staphylococcus aureus* in Clinical Cultures Collected from Two Tertiary Care Hospitals in Southern Sri Lanka

M.R.P. Kurukulasooriya [a*], W.M.D.G.B. Wijayaratne [a], L.G. Tillekeratne [b], C.K. Bodinayake [a], B. Piyasiri [c], A.A.D. Priyanthi [d], A.D. De Silva [e], B.P. Nicholson [b], T. Østbye [b], C.W. Woods [b], A.De.S. Nagahawatte [a]

[a] *Faculty of Medicine, University of Ruhuna, Galle, Sri Lanka*
[b] *Duke University, Durham, North Carolina, USA*
[c] *Teaching Hospital, Karapitiya, Galle*
[d] *District General Hospital, Matara*
[e] *Faculty of Medicine, General Sir John Kotelawala Defence University, Ratmalana, Sri Lanka*

*Corresponding author: *ruvini.sara@yahoo.com*

ABSTRACT

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a multidrug-resistant pathogen causing life-threatening infections. It can be classified as community-associated (CA) or healthcare-associated (HA), based on antibiotic susceptibility and molecular analysis. The objective of this study is to describe MRSA prevalence and predominant MRSA types identified in clinical cultures collected from patients admitted to Teaching Hospital-Karapitiya and General Hospital-Matara in Southern Sri Lanka. *S. aureus* isolates from consecutive clinical cultures and associated demographic data were collected from September 2019 for fourteen months from microbiology laboratories of the two hospitals. All *S. aureus* and MRSA isolates were confirmed using standard microbiological methods. Based on antibiotic susceptibility profile, isolates were classified as HA-MRSA (generally resistant to β-lactam antibiotics, erythromycin, clindamycin and fluoroquinolones) and CA-MRSA (generally resistant only to ß-lactam agents and erythromycin), as described by the Centers for Disease Control and Prevention, USA. These two types were further confirmed as HA-MRSA (generally habour SCC*mec*I, II and III) and CA-MRSA (generally harbour SCC*mec*IV and V) using Staphylococcal Cassette Chromosome *mec* (SCC*mec*) typing using standard methodology. *S. aureus* was isolated from 366 clinical cultures and 59.3% of them were MRSA (respiratory-70.83%, pus-60.4%, blood-54.8%, sterile fluids-50% and urine-50%). Majority of MRSA were from males (52.5%) and adults (≥18years) (78.3%). Resistance to non-β-lactam antibiotics was observed as 96% to erythromycin, 68% to ciprofloxacin and 55% to clindamycin. Based on the ABST profile, a total of 96 (44%) isolates were classified as HA-MRSA and 90 (41%) as CA-MRSA. SCC*mec* typing showed that 59.6% of isolates that were classified as HA-MRSA carried SCC*mec*III/ Scc*mec*I and 81% classified as CA-MRSA carried SCC*mec*IV/ SCC*mec*V. A total of 10.6% of isolates were none-typeable. The majority of *S. aureus* isolated from clinical cultures were MRSA. Prevalence of HA-MRSA and CA-MRSA was relatively similar. Further clinical and molecular investigations are needed to determine the implications of these findings.

Keywords: *CA-MRSA, clinical cultures, HA-MRSA, prevelance, SCCmec type*

 ISSN 2362-0412

Preclinical studies on the Immunomodulatory Property of *Alpinia calcarata* (s. Araththa) and *Solanum surattense* (s. Ela batu) in Rats

K.K.A. Kithmini [a], E.P.S. Chandana [b*], P.M.C. de Silva [a], M. Hettiihewa [c]

[a]*Department of Zoology, Faculty of Science, University of Ruhuna, Wellamadama, Matara, Sri Lanka.*
[b]*Department of Biosystems Technology, Faculty of Technology, University of Ruhuna, Matara, Sri Lanka.*
[c]*ImmunoPharmacologist, Dean Faculty of Health Sciences, CINEC CAMPUS, Malabe, Sri Lanka*

*Corresponding author: *epschandana@gmail.com*

ABSTRACT

Both herbalism and conventional synthetic medicines provide options for immunomodulation. However most of the synthetic drugs accompany undesirable side effects. Apparently, plant-based medicines leave no side effects and provide more safe therapies. The present study was undertaken to elucidate toxic effects, anti-oxidant capacity and immunomodulatory potential of ethanolic extracts of *Alpinia calcarata* (dried rhizome) and *Solanum surattense* (dried root bark) which are used by traditional and Ayurvedic practitioners of Sri Lanka to treat various ailments. No significant behavioral or morphological changes were observed in rats after treating with high doses (1000mg/kg, 500mg/kg) of both plants. In these rats, liver enzymes namely Alanine Transaminase (ALT) and Gamma Glutamyl Transpeptidase (GGT) levels were measured using ELISA. Crude extracts of both plants were tested using DPPH method, TAC assay and Cayman assay to survey antioxidant potential. *A.calcarata* was further investigated to study its effects on cytokine expression in rats and IFN gamma expression on cultured human leukocytes. In those studies rats were orally fed with *A.calcarata* extract for a period of 45 days at dose of 200mg/kg in 2 days intervals while control group was given normal saline. Cultured human leukocytes were treated with different concentrations of *A.calcarata* for 2 days. No significant increase of ALT and GGT were observed in *A.calcarata* treated rats ($p > 0.05$). However, high doses (1000mg/kg, 500mg/kg) of *S.surattense* treatment elevated ALT and GGT levels significantly ($p < 0.05$). Both extracts possess significantly high anti-oxidant capacity when compared with commonly known anti-oxidants ($p < 0.05$). IL2, IL5, IL17, IFN-ɣ cytokine secretions were significantly increased after 30 and 45 days of administration ($p < 0.05$). *A.calcarata* extracts stimulated the increase in TH1 cytokine (IFN-γ) level in cell culture supernatant in a dose dependent manner. According to the results of this study *A.calcarata* rhizome extract is a positive immunomodulator in all aspects.

Keywords: *A. calcarata*, Anti-oxidant, Cytokines, , Immunomodulation, *S.surattense*

 ISSN 2362-0412

Preliminary Assessment of Biomarker Responses in Oreochromis Niloticus from Selected Water Bodies with Reference to the Trophic Status

K.M.L. Madushika [a], S.H.N.P. Gunawickrama [b], K.B.S. Gunawickrama [a*]

[a] *Department of Zoology, Faculty of Science, University of Ruhuna, Matara*
[b] *Institute of combinatorial advance research and education, General Sir John Kotelawala Defence University, Ratmalana*

*Corresponding author: *suneetha@zoo.ruh.ac.lk*

ABSTRACT

Fish biomarkers are useful detection tools in aquatic biomonitoring. This study aimed to assess selected biomarkers of feral Nile tilapia (*Oreochromis niloticus*) in two irrigational water bodies, namely, Lunugamwehera reservoir and Pannagamuwa Lake in Hambanthota district with reference to trophic status. Water quality parameters including dissolved oxygen, temperature, pH, alkalinity, salinity, biological oxygen demand, chemical oxygen demand, and determinants of the trophic status (nitrates, total phosphorus (TP) and orthophosphate (OP), chlorophyll-a and Secchi disc depth) were measured (n=3). A fish culture pond at University of Ruhuna was used as the reference. Adult *O. niloticus* (n=11-15) was sampled and Liver Somatic Index (LSI), Fulton's condition factor (K), erythrocyte nuclear abnormalities (ENA), total leukocyte frequency, carbonic anhydrase activity (CAA) and gill histopathology were examined. There was no significant difference in pH, salinity, and nitrate among all sites. Highest OP and TP concentrations were observed in Pannagamuwa Lake and the lowest in reference water. Estimated Carlson trophic status index (TSI) revealed Pannagamuwa Lake as eutrophic (62.55 ± 0.86), the reference as moderately eutrophic (58.20 ± 0.80), and Lunugamwehera reservoir as mesotrophic (50.60 ± 1.37). Within the context of this study, these preliminary findings on trophic status were assumed to be representative of long term status. A significantly low condition factor was observed in fish from the reference pond and Pannagamuwa Lake, and highest in the mesotrophic Lake. The LSI value was significantly high in fish in the reference site and significantly lower in Pannagamuwa Lake. Greater total ENA frequency and leukocyte count ($p<0.05$) was reported in the fish inhabiting Pannagamuwa lake compared to the others. However, CAA was not significantly different among all sites. Further, fish in Pannagamuwa and Lunugamwehera sites showed toxicopathic signs in gill filaments such as inter-lamellae hyperplasia, epithelial lifting and lamellae fusion. Biomarker responses revealed that the fish inhabiting eutrophic sites may be subjected to stress due to gill damage and genotoxicity among other causes compared to the mesotrophic site. Some pathological changes seen in fish from mesotrophic water body necessitate additional research to screen different contaminants affecting fish. Monitoring the trophic status of water bodies, therefore, is mandatory to ensure the wellbeing of the aquatic biota, and an integrative approach of biomarker responses will be useful in this regard.

Keywords: *Biomarkers, Gill histology, Oreochromis niloticus, Tropic status*

 ISSN 2362-0412

Preparation of Biochar and Activated Carbon Granules from Cinnamon Wood

Devinda Karunathilaka, Mahesh Alahakoon and Ruwan Gallage*

Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, University of Ruhuna, Hapugala, Galle

*Corresponding author: *rgallage@mme.ruh.ac.lk*

ABSTRACT

Sri Lanka is the third largest cinnamon exporter in the world. But Sri Lankan cinnamon industry only consumes cinnamon bark as the product and the leftover cinnamon stem is used as biomass for energy generation by burning. In this study, value addition for remaining cinnamon wood is carried out by converting cinnamon wood into activated carbon granules. Activated carbon granules are widely used in many industries as filter materials and, one of the example is purifying contaminated (by chemicals and heavy metals) water. According to the literature review, It is rare to find the study about the preparation of activated carbon granules from cinnamon wood. The chemical activation process was used with two-step pyrolyzing under an oxygen-deficient environment at 700°C and 800°C respectively. For that, a stainless furnace was designed and fabricated to produce biochar from cinnamon wood. Biochar granules in a range of 0.6 -1.18 mm were sieved for the preparation of activated carbon. Biochar yield from the cinnamon wood is calculated and the microscopic structure of biochar particles was examined. The chemical activation process was conducted at 700°C and 800°C using NaOH and KOH as activation agents under impregnation ratios of 1:1 and 1:3. Surface morphology of the biochar and activated carbon granules prepared under different conditions was observed using a scanning electron microscope (SEM) to examine the developed pore structure. SEM images represented a considerable difference between pore structures after chemical activation. Both KOH and NaOH can be used to activate biochar and NaOH may lead to a reduction of the surface area with compared to the KOH as observed by the SEM images. During the comparison of SEM images with the previous case studies about producing activated carbon based on coconut shell, cinnamon wood activated carbon represents diversity in pore sizes and the majority of the pores were observed as larger than activated carbon produced from coconut shell.

Keywords: *Activated carbon, Biochar, Chemically activated, Cinnamon*

 ISSN 2362-0412

Preparation of Titanium Dioxide Nano Particles from Sri Lankan Rutile Mineral Sand

K.K.L. Pradeep *, Yashodha G. Kondarage

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Sri Lanka.

*Corresponding author: *lahiru_2016055@fot.ruh.ac.lk*

ABSTRACT

Minerals are non-renewable resources, and the problem is further aggravated due to the export of minerals in near raw form with the minimum level of value addition. Pulmoddei beach deposit contains 75%-80% of Ilmenite and 7%-8% of Rutile. Rutile is a major ore of titanium, a metal used for high-tech alloys because of its lightweight, high strength, and corrosion resistance. Owing to their high photo catalytic activity and chemical stability Nano Titanium Dioxide is used in cleaner technologies and solar energy conversions. This research is dedicated to prepare Titanium Dioxide nanoparticles from Sri Lankan Rutile sand. In the methodology, initial Rutile samples were characterized using Furrier Transform Infrared Spectroscopy (FTIR), X-ray diffraction (XRD) and X-ray fluorescence (XRF) techniques. Titanium Sulfate precursor from raw Rutile was prepared via acid leaching. Nano Titania particles were prepared via sol gel method. The prepared material was further characterized using XRD and XRF techniques. According to the FTIR graph, peaks present at 596 cm-1, 1297 cm-1, 1517 cm-1, and 3700 cm-1 wave positions are corresponding to the Ti-O, Ti-OH, and Ti-O-Ti bond vibrations. Hence the collected sample is consists of Titanium dioxide. According to the XRF analysis, initial Rutile sand contains 89.50% of Titanium Dioxide. In the prepared Nano Titania material the Titanium Dioxide composition is much higher and it is 94.90%. According to it, the JCPDS card number (29-1360); (110), (111), (220) peaks are corresponding to the Rutile. It implies that the sample contains Titanium Dioxide in high purity. This novel Titanium Dioxide nanomaterial can be considered as a value added product prepared from Sri Lanka Rutile sand. Further this is intended to be utilized as a photocatalytic material as a useful application.

Keywords: *Rutile Sand, Titanium Dioxide, Nanomaterial*

 ISSN 2362-0412

Pump Based Chocolate Extruder for Food 3D Printing Technology

R.R.A.K. Nethma Rajapaksha*, B.L.S. Thilakarathna, Yashoda G. Kondarage

Department of Engineering Technology, Faculty of Technology, University of Ruhuna

*Corresponding author: *kalaninethmarajapaksha@gmail.com*

ABSTRACT

In the food industry, 3-Dimensional (3D) printing, also known as Digital fabrication (DF) or additive manufacturing (AM), has limitless possibilities for fabricating complicated geometries, customization, and on-demand production. As a reason, 3D technology is driving significant changes in the food business. The development of a chocolate 3D printer using the pressure pump approach and chocolate as a printing material is described in this study. Here the conventional 3D printer's design was developed as a chocolate 3D printer. As an improvement, a new extruder mechanism was introduced. The extruder was developed to print the chocolate materials. In the working mechanism, the 3D printer reads the design instruction and chocolate material is extruding accordingly, through the nozzle of the pump to the bed of the 3D printer followed by the design (layer by layer). The special part of this chocolate 3D printer is the pressure pump in the extruder part. That pressure pump provides pressure on melted chocolate from the chocolate container to the nozzle point. Sample designs were used to test the 3D printer's usability and efficiency. The obtained results were presented and discussed. Together with these advances this 3D printer can be used to produce complex food models and design unique patterns in chocolate-based sweets by satisfying customers.

Keywords: *3D printing, Additive manufacturing, Food printing, Hot melt extruder, Pressure pump*

 ISSN 2362-0412

Rethinking Site Characterization in Tropical Residual Soil Profiles

Achini S. Bamunuvitharana, Anuruddhika G. Jayasinghe*

Department of Civil and Environmental Engineering, Faculty of Engineering, University of Ruhuna, Sri Lanka

*Corresponding author: *anuruddhika@cee.ruh.ac.lk*

ABSTRACT

Residual soils are generally known to be heterogeneous compared to transported soils. However, despite the recognition of their heterogeneity, the fact does not seem to receive adequate attention within general geotechnical engineering practice of site characterization in residual soil profiles. This communication investigates the need for rethinking site characterization to accommodate heterogeneity of these soils based on a study carried out at two sites located in the Galle district of southern Sri Lanka. The study collected bulk and relatively undisturbed soil samples; a conventional set of soil index testing were then conducted with the use of 'representative' samples as a part of a higher order testing series for strength-deformation behaviour of the soils; the index testing included particle size distribution analysis, Atterberg limits tests, specific gravity tests, and determination of in-situ dry unit weight. Upon observation of strength-deformation behaviour with direct-shear testing, a secondary set of index testing was carried out with the constituents of each specimen that underwent direct-shear testing. These sets of tests recognized significant deviation from the 'representative' sampling-based characterization. For soils from one of the sites, the overall classification changed from Silty Sand (SM) to Sandy Elastic Silt (MH) as per Unified Soil Classification System (USCS) and the fines content reported by individual direct-shear specimens were 26% more on average with respect to the bulk sampling-based classification. Locating the specimens on intergranular/interfine matrix phase diagram highlighted the differences in grain-scale load transfer mechanisms that apparently varied from (1) coarse-dominated with little or no contribution of fines through (2) some contribution of fines to (3) significant contribution of fines with fines acting as separators between coarse grains for the soils from the other site. Therefore, this communication concludes that deviation from general practice of site characterization is needed to accommodate the heterogeneity of tropical residual soils. Particularly, when site characterization is performed to facilitate designs involving use of soil material at in-situ state an indexing process similar to that used in this study may be used; also relatively undisturbed samples may be used whenever possible to make visual observations on in-situ state of particle packing.

Keywords: *Site characterization, Soil behaviour, Soil index properties, Tropical residual soils*

 ISSN 2362-0412

Smart Needle Management System for Apparel Industry

W.P.P.A. Induranga, T. Mithurshan, M.P.U. Isuranga*

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Sri Lanka

*Corresponding author: *uditha@fot.ruh.ac.lk*

ABSTRACT

The apparel industries are now competing for the world's best position in the competitive world. They were highly focus on forced to reduce costs, save time, increase their productivity, adapt to the demand cycle, and improve quality because of increased competition and product diversification. A needle is a critical component of the clothing manufacturing process. Most of the apparel industries including BEL are using manual needles issuing method. Therefore, needle management is critical to achieving high production efficiency. The garment sector has always relied on registers and manual data sheet-based for monitoring and management practices. It can have a detrimental effect on the manufacturing process, resulting in unannounced production shutdowns and difficulty in comparing actuals to forecasted figures. This study proposed an automated web-based needle management system with a needle issuing device. This system has three major parts, including web application, database, and needle issue device. All these components work together to improve the efficiency of the process. The proposed system would provide real-time, accurate, and more organized information on needle issuing process. It provides daily, monthly, and annual reports and charts, as well as current needle stocks, to aid in data analysis and decision making. Authorized users can operate and monitor the needle management system by logging into the platform. Also, remote control of the needle issuing apparatus is possible via the web application. Through the online application, all data is kept in the database, and the necessary analytics are displayed in the web application using that data. It takes around ten seconds to issue a needle using the system. This technique is 50% more effective than the manual method. The needle management system can be considered effective and reliable for the apparel sector based on the results of the tests conducted.

Keywords: *apparel industries, needle management system, needle issuing device, web application*

 ISSN 2362-0412

Smart Power Demand & Consumption Analyser

T. Mithurshan*, A.J.S. Ahamed, D.N. Liyanage, R.M.L. Chamari

Department of Engineering Technology, Faculty of Technology, University of Ruhuna, Sri Lanka

*Corresponding author: *msnmithu@gmail.com*

ABSTRACT

In Sri Lanka, electricity is generated by Ceylon Electricity Board (CEB). customers need to pay bill according to the user/customer categories and the usage. There are some parameters effect the bill. Such as maximum demand and power factor etc. When the demand is high, suppliers must produce more electrical energy. That's why the maximum demand charge imposes on industrial /bulk customers. Another consideration is the power factor. Poor power factor is directly reflected on electricity bill and reduced the system capacity. Another one is, there are many power interruptions from the CEB side. So, this project is proposed to identify abnormalities in the electrical system, determine Maximum demand pattern in real-time, as well as can minimize the unwanted power consumption via realtime data, plan the backup power and monitoring the power consumption. Some primary electrical parameters are needed to achieve our goals. Such as voltage, current, power factor. So, this project/ gadget built-up with current and volage sensing circuit to capture the waves pattern. Then inputs are processed by microcontroller and derive the electrical essential data, such as Power-factor, Maximum demand, Apparent power, consumption, and Real power. After that, all electrical parameter values are uploaded to cloud via internet of things (IoT), and the analysis part will be carried out using real-time and historical data and plot the load curve. Through that analysis, the client can identify the abnormalities in the electrical system and monitor the power factor variation. According to the test, more accurate data can be generated from this system. This system more user-friendly because there more features added in the centralized dashboard to customer get idea or decision from historical and real-time data analyzation. Through the dashboard client monitor the power factor variation, load curve, power demand and consumption details.

Keywords: *Apperent power, Internet of Things, Maximum demand, Power factor, Real-time data.*

 ISSN 2362-0412

Structural Integrity Analysis of Blade Profiles for Fibre Reinforced Plastic (FRP) Waste Shredder

A.D.H.T. Wijerathne, M.T.T. Ranjan*, U.I.K. Galappaththi

Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, University of Ruhuna, Sri Lanka

*Corresponding author: *ranjan@mme.ruh.ac.lk*

ABSTRACT

Fibre Reinforced Plastic (FRP) structures and components are widely used in the modern world as they offer significant advantages compared to traditional raw materials. As a result, leading sectors such as aerospace, automobile, marine, naval architecture, civil, and energy have adopted FRP manufacturing techniques to produce required structural components. However, FRP products negatively affect the environment since they add harmful waste materials to nature in different stages of their lifespan. The wastages generated at manufacturing and disposal phases become significant and a proper mechanism is required to manage them. Therefore, the applicability of the waste management hierarchy was considered and the mechanical shredding technique was finalized as the most practical and reliable method to recycle the FRP wastage. Then, a prototype machine was designed by integrating the shredder mechanism. The blade profile used for the shredder mechanism was identified as the most critical component of the machine as it directly related to the properties of recyclates. As a result, structural integrity analyses were undertaken for five different blade profiles which were developed varying the hook angle of the cutting tools (0°, 13°, 18°, 16°, and 0°) and three teeth were considered for the blade profile. The selection of hook angles was based on the experiences of the authors. The maximum working stress and the deformation pattern of the blade profile were the main criteria considered and Finite Element Analysis (FEA) was conducted for all the blade profiles to identify their structural integrity for selecting the most suitable blade profile. Based on the FEA results, it was able to observe lower working stress and deformation pattern from the blade profile which consisted of body part and tool tip and has a 0° hook angle as it was selected to manufacture 24 blade profiles to fabricate the shredding section of the machine.

Keywords: *Blade profile, Finite Element Analysis, FRP waste shredder, Structural integrity*

 ISSN 2362-0412

SWOT Analysis of Marine Ornamental Reef Fishery Sector in Trincomalee District of Sri Lanka.

M.S.V.H. Priyashadi [a]*, K.H.M.A. Deepananda [a], U.A.D. Jayasinghe[b]

[a] *Department of Fisheries and Aquaculture, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Matara, Sri Lanka.*
[b] *Department of Limnology and Water Technology, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Matara, Sri Lanka.*

*Corresponding author: *priyashadimsvh@gmail.com*

ABSTRACT

Marine Ornamental Reef (MOR) Fishery largely relies on the coral reef ecosystem and highly contributes to the global economy. Although MOR fishery in Trincomalee is being carried out from the beginning of the industry in Sri Lanka, comprehensive studies on the internal and external factors that affect the sector are scarce to date to a establish proper management system. The present study analysed Strengths, Weaknesses, Opportunities and Threats (SWOT) of the MOR fishery in Trincomalee focusing fisher communities fishing in Sampur, Kuchchaweli and Pulmodai reefs over two years period from February 2019. Data were collected from full-time fishers (n=90) and other stakeholders of the value chain (n=36) through direct interviews, focus group discussions and participant observations. The data on average income and cost were gathered by monitoring the harvest of fishers at landing sites and using fishers' logbooks, respectively. The monthly average gain per fisher were 101278 LKR and 114524 LKR while incurring 27172 LKR and 27367 LKR per month in 2019 and 2020, respectively. The strengths to gain such an income were Pigeon Island National Park, plenty of reefs for fishing and high biodiversity while lack of proper pricing mechanism, lack of training and knowledge, poor management system and post-harvest mortalities due to poor storage facilities were the weaknesses. In contrast, the fishers were having opportunities including global marine aquarium trend, higher income level than food fisheries and sharing knowledge & experience with researchers. Moreover, the risky nature of the occupation, coral reefs destruction through illegal fishing methods, the low market price at fishers level, lack of financial supports from the government, absence of legal background for registering fishers or operational license issuing system, collection of very small & extra-large individuals and Covid 19 pandemic situation were the threats to the MOR fishery. A proper management system and pricing mechanism of MOR fishery should be implemented to overcome the weaknesses and threats, while enhancing opportunities of the industry with the help of their strengths.

Keywords: *Coral reefs, Ornamental reef fishery, SWOT analysis, Trincomalee*

 ISSN 2362-0412

Wet Clay Crusher Machine for Tile Manufacturing Industries

T. Sajarupan*, D.W.K.M. Witharana, Hasini Ganege

Department of Engineering Technology, Faculty of Technology University of Ruhuna, 81100, Sri Lanka

*Corresponding author: *tharumaraja_2016023@fot.ruh.ac.lk*

ABSTRACT

Tile manufacture is a leading developing industry in Sri Lanka. A tile is manufactured using ceramic, stone, metal, baked clay, or glass. It is commonly used to cover objects such as roofs, floors, walls or tablets and it has great demand in markets. Clay important material for making porcelain and ceramic tiles. When using clay, the clay needs to crush for a specific scale. There are several clay crushing machines available in markets such are traveling breaker plate mills, high tonnage hammer mills, pulverisers, impact dryer mill and others. The existing machines facing issues in crushing wet clay. The machines get sticky, and it reduces the machine efficiency. The machines need additional labour support to remove all the sticky clay from the machines. The wet clay crusher machine is proposed to the title manufacturing industries for increase efficiency, reduce production costs, and reduce maintenance costs. The proposed machine has two types of special shafts. Two shafts with ratchet wheels, it's placed bottom of the machine and a block shaft is placed on top of the ratchet wheel shafts. Ratchet wheels use to crush the clay. Block shaft uses to push the clay into the middle of the ratchet wheel shafts. These shafts are rotating by a three-phase motor. The motor connects to the shafts through a gearbox. There is a gearbox for reducing the motor speed and increasing torque. The mechanical design avoids the sticky problem. The rates of the clay crushing process are significantly higher more than labour-power. The final shafts rotation speed is 128 rpm. This constant speed helpful the good crushing process and, this machine's power consumption is 0.745kwh. The machining process crushes 2kg of wet clay within 5 seconds and the machine maintenance cost and power consumption are lower than labour costs for the crushing process.

Keywords: *Block shaft, Ratchet Wheel Shafts, Stickly Clay,Tile Manufacture, Wet Clay Crusher Machine*

 ISSN 2362-0412

List of Reviewers

Senior Prof. C.M. Navaratne, University of Ruhuna
Senior Prof. D.A.L. Leelamanie, University of Ruhuna
Senior Prof. K.K.I.U. Aruna Kumara, University of Ruhuna
Senior Prof. K.L. Wasantha Kumara, University of Ruhuna
Senior Prof. Mala Amarasinghe, University of Kelaniya
Senior Prof. Mangala De Zoysa, University of Ruhuna
Senior Prof. N.S.B.M. Attapattu, University of Ruhuna
Senior Prof. Upali Amarasinghe, University of Kelaniya
Senior Prof. Vajira P. Bulugahapitiya, University of Ruhuna
Prof. A.B. Sirisena, University of Ruhuna
Prof. A.L. Ranawake, University of Ruhuna
Prof. Asiri Abeygunawardana, University of Peradeniya
Prof. C.M. Wickramathilaka, University of Ruhuna
Prof. Chamari M. Hettiarachchi, University of Colombo
Prof. G.C. Samaraweera , University of Ruhuna
Prof. G.D.K. Mahanama, University of Ruhuna
Prof. G.H.M.J. Subashi De Silva, University of Ruhuna
Prof. Gayani Liyanage, University of Colombo
Prof. H.I.G.C. Kumara, University of Ruhuna
Prof. Indunil Pathirana, University of Ruhuna
Prof. J.W. Hewage, University of Ruhuna
Prof. K. Masakorala, University of Ruhuna
Prof. K.R. Koswattage, University of Sabaragamuwa
Prof. K.R. Ranjith Mahanama, University of Colombo
Prof. Kamani Jayathilaka, University of Ruhuna
Prof. (Mrs.) S.R. Hettiarachchi, Open University Sri Lanka
Prof. N.Y. Hirimuthugoda, University of Ruhuna
Prof. Nilanthi Dahanayake, University of Ruhuna
Prof. Niroshan Dahanayakka, University of Ruhuna
Prof. P.W.A. Perera, University of Ruhuna
Prof. Ruwani Hewawasam, University of Ruhuna
Prof. S. Geekiyanage, University of Ruhuna
Prof. S. Wijethunga, University of Ruhuna
Prof. Sudhira De Silva, University of Ruhuna
Prof. Upali Pannilage, University of Ruhuna
Prof. U.S. Amarasinghe, University of Kelaniya
Prof. Vijitha Liyanage, University of Ruhuna
Prof. W.G.D. Lakmini, University of Ruhuna

Prof. W.N. De Silva, University of Ruhuna
Dr. (Mrs.) A.P. Hewaarachchi, University of Kelaniya
Dr. (Mrs.) K.M.W. Rajawatta, University of Ruhuna
Dr. (Mrs.) M.A. Poorna C. Piyathilaka, University of Colombo
Dr. (Mrs.) V.H.P. Vitharana, University of Ruhuna
Dr. (Ms.) Rasika Wanigatunge, University of Kelaniya
Dr. A.C. Karunaratna, University of Ruhuna
Dr. A.G.S.S. Darshani, University of Wayamba
Dr. A.M. Ajward, University of Ruhuna
Dr. Amani Mannakkara, University of Ruhuna
Dr. Anoja Atthanayake, University of Ruhuna
Dr. B.I. Anuradha Mendis, University of Ruhuna
Dr. B.L. Galhena, University of Ruhuna
Dr. B.L. Sanjaya Thilakarathne, University of Ruhuna
Dr. Bilesha Perera, University of Ruhuna
Dr. Bimba Wickramarachchi, University of Ruhuna
Dr. Buddhi Fernando, University of Ruhuna
Dr. Buddhika Annasiwaththa, University of Ruhuna
Dr. C. Gunasinghe, University of Ruhuna
Dr. C.S. Paththinige, University of Rajarata
Dr. Chatura Seneviratne, University of Ruhuna
Dr. D.L.C. Kumari Fonseka, University of Ruhuna
Dr. D.P.P.G. Liyanage, University of Ruhuna
Dr. D.V.N. Harischandra, University of Ruhuna
Dr. D.V.N. Harischandra, University of Ruhuna
Dr. D.W.C.P. Kumari, University of Ruhuna
Dr. Dilanthi Koralagama , University of Ruhuna
Dr. G.T.W. Sriyani, University of Ruhuna
Dr. H.C. Y Jayathunga, University of Colombo
Dr. H.C.P. Karunasena, University of Ruhuna
Dr. H.W.A.S. Subasinghe, University of Ruhuna
Dr. Harshani Peiris, University of Ruhuna
Dr. Hemamali Ganewatta, University of Ruhuna
Dr. Imalke Kankananarachchi, University of Ruhuna
Dr. J.A. Jeewani, University of Ruhuna
Dr. J.K.A. Kanthi, University of Ruhuna
Dr. K.G.S.H. Gunawardana, University of Ruhuna
Dr. K.H. Dhanuja Mahesh, Metro South Health, Australia
Dr. K.H. Ramanayake, University of Ruhuna
Dr. K.M.C. Fernando, University of Ruhuna
Dr. K.N. Nadeeshani Silva, University of Ruhuna
Dr. Kumara Jayawickrama, University of Ruhuna

 ISSN 2362-0412

Dr. Kushan Sudheera, University of Ruhuna
Dr. L.K.T. Srimal, University of Ruhuna
Dr. Lahiru Praboda, University of Ruhuna
Dr. Lanka Dasanayake, University of Ruhuna
Dr. M.A.P.D.P. Wickramarathna , University of Ruhuna
Dr. M.B.F. Fafasia, University of Ruhuna
Dr. M.K.S. Madushika, University of Ruhuna
Dr. N.D.N. Priyadarshani, University of Ruhuna
Dr. N.H. Priyankara, University of Ruhuna
Dr. N.P. Liyanawaduge, University of Sabaragamuwa
Dr. N.S. Ariyarathna, University of Ruhuna
Dr. Nadeesha Sandamali, University of Ruhuna
Dr. Nirmala Rathnayake, University of Ruhuna
Dr. Nirmala Sirisena, University of Colombo
Dr. Nisantha Kalutharage, University of Ruhuna
Dr. P.B. Ratnaweera, Uva Wellasa University
Dr. Pabasara Kalansuriya, University of Ruhuna
Dr. R.G.U. Jayalal, Sabaragamuwa University of Sri Lanka
Dr. Rasanga Gunawardana, University of Ruhuna
Dr. Rashmi Lewkebandara, Teaching Hospital Mahamodara
Dr. Ruwan Appuhamy, University of Ruhuna
Dr. Ruwan Gallage, University of Ruhuna
Dr. S.G.S. Samaraweera, University of Ruhuna
Dr. S.R. Amarasinghe, University of Ruhuna
Dr. Saranga Perera, University of Ruhuna
Dr. T. Kelum Wetthasinghe, University of Colombo
Dr. T.S.L.W. Gunawardhana, University of Ruhuna
Dr. Thilina Weerasinghe, University of Ruhuna
Dr. Thusitha Sugathapala, University of Moratuwa
Dr. Thyagi Ponnamperuma, University of Colombo
Dr. W.K.C. Neetha Dayanthi, University of Ruhuna
Dr. W.K.V. Dayalatha, University of Ruhuna
Dr. W.M.C.J. Wijekoon, University of Ruhuna
Dr.(Ms) Thilini M. DeSilva, University of Ruhuna
Ven. Nahalle Wajiragnana, University of Ruhuna
Ven. Taldena Aruyawimala, University of Ruhuna
Mr. Asela Hewapathige, University of Ruhuna
Mr. Chamila priyankara, University of Ruhuna
Mr. Chatum Sankalpa, University of Ruhuna
Mr. E.M. Ranatunga, University of Ruhuna
Mr. G.C.K. Jeewantha, University of Ruhuna
Mr. Geeth Priyankara, University of Ruhuna

 ISSN 2362-0412

Mr. H.L Subasinghe, University of Ruhuna
Mr. I. Renuka Priyantha, University of Ruhuna
Mr. J.C.U. Arachchige, University of Ruhuna
Mr. K.G. Priyashantha, University of Ruhuna
Mr. K.M.S.Y. Konara, University of Ruhuna
Mr. M.P.U. Isuranga, University of Ruhuna
Mr. M.T. Tenis Ranjan, University of Ruhuna
Mr. Nilmantha Wijesekara, University of Ruhuna
Mr. Nimal Hettiarachchi, University of Ruhuna
Mr. Nishantha Gamage, University of Ruhuna
Mr. P.N. Rathnayake, University of Ruhuna
Mr. S.B. Manathunga, University of Ruhuna
Mr. T.M. De Silva, University of Ruhuna
Mr. Tharindu Gamage, University of Ruhuna
Mrs. D.N. Liyanage, University of Ruhuna
Mrs. Nimalshanthi Gunarathne, University of Ruhuna
Ms. Eranthi Weerathunga, University of Ruhuna
Ms. H.C. Ganage, University of Ruhuna
Ms. Kanchana Wijesekara, University of Ruhuna
Ms. Mevuni Jayathilaka, University of Ruhuna
Ms. P.K.C. Denesha, University of Ruhuna
Ms. Thedushika De Silva, University of Ruhuna
Ms. Vindya Pathiraja, University of Ruhuna
Ms. W.G.A. Pabasara, University of Ruhuna

 ISSN 2362-0412

Author Index

 ISSN 2362-0412

 ISSN 2362-0412

 ISSN 2362-0412

 ISSN 2362-0412

Y

ABSTRACTS

19th Academic Sessions

"Overcoming Challenges in The Next Decade"

https://www.ruh.ac.lk

University of Ruhuna
Sri Lanka

ISSN 2362 - 0412