INSIGHT INSTITUTE OF MANAGEMENT AND TECHNOLOGY

INSIGHT INTERNATIONAL RESEARCH CONFERENCE (VIRTUAL) 2024 (IIRC2024)

21st January 2024

Sri Lanka. insight.centre@gmail.com +94 76 175 3553

INSIGHT INSTITUTE OF MANAGEMENT AND TECHNOLOGY

Proceedings of the
Insight International Research Conference 2024 - IIRC2024

Application of Technology in Sustainable Development

21st January 2024

All abstracts in the proceedings are reviewed and accepted for publication.

Responsibility for the contents of the abstract's rests with the authors.

ISSN 3021-6672

LIST OF REVIEWERS

Prof. M.H. Thowfeek
Prof. (Mrs.) M.U.Z.N. Farzana
Prof. Indira Wickramasinghe
Prof. S. Sabraz Nawaz
Prof. U.S. Amarasinghe
Prof. Anton Perera
Prof. Kandiah Pakeerathan
Prof. (Mrs.) N. Fahamiya
Prof. (Mrs.) V.P.A. Weerasinghe
Prof. U.P.K. Epa
Prof. (Mrs) M.D.M.D.W.M.M.K. Yatawara
Prof. Renuka Silva
Prof. Rameez Aboobacker
Prof. Ahmed Jalal Khan Chowdhury
Dr. Kesavan Manoharan
Dr. Kayarvizhy N.
Dr. K. Sathyarajasekaran
Dr. Thangaraja J.
Dr. Lahiru Udayanga
Dr. S.S.K.Chandrasekara
Dr. Hassan Ammouneh
Dr. Shajahan Anver
Dr. Dattatray Gandhmal
Dr. M.A.C.M. Haniffa
Dr. M. Firose
Dr. Pratibha Yalagi
Dr. F.H.A. Shibly
Dr. Uzzal Sharma
Dr. D. Akila
Dr. R. Kannadasan
Dr. A. Selvaraj
Dr A.S. Anakath
Dr. R. Naresh
Dr. M.M. Muneeb
Dr. B.G.N. Sewwandi
Dr. Kumar, K.
Dr. M.N.M. Fouzi
Dr. U. Farook
Dr.M.G. Mohamed Thariq
Dr. Sumudu Senanayake
Dr. M.S. Mohamed Nafees

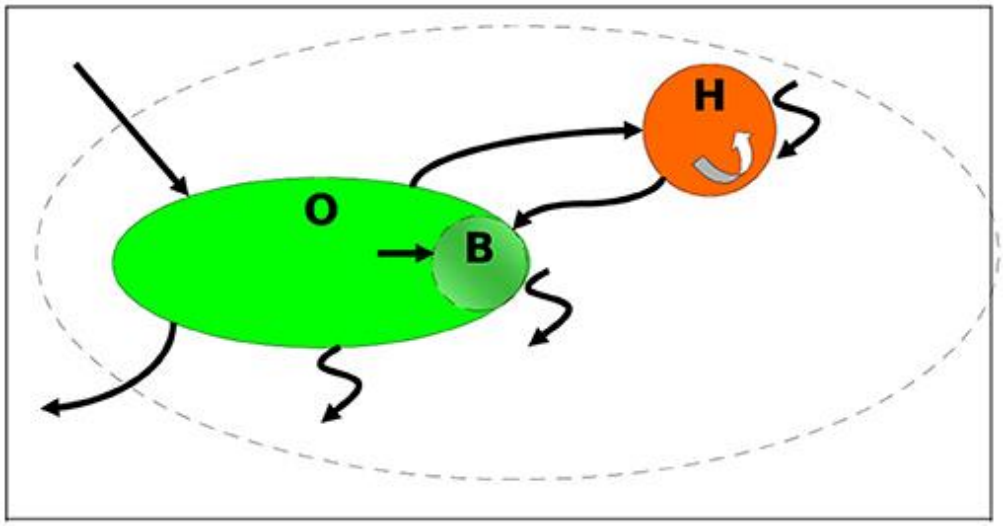
Mr. M.F. Nawas
Mr. M.S.S. Razeeth
Mr. P. Pirapuraj
Ms. M.S. Shafana
Ms. M.I. Fathima Nihla
Mr. K. Muhammad Rifthy
Mr. A.M.M. Irfeey
Mr. R.K. Ahmadh Rifai Kariapper
Mr. L. Thasanthan
Mr. A.M.A. Sujah
Ms. R.M.N.S. Ranundeniya
Ms. A.I.S. Juhaniya
Mr. M.J.M. Fari
Mr. M.J. Ahamed Sabani

PROCEEDINGS

Sustainability Solutions with Thermodynamic Basis

M. Razi Nalim,
Chancellor's Professor and Associate Dean of Engineering & Technology
Purdue University, Indianapolis, USA

There are many aspects of sustainability, which are broadly captured by the 17 Sustainable Development Goals (SDGs) of the United Nations. These include issues of clean energy and environmental quality, as well as issues of poverty, hunger, education, peace, and justice. Human needs related to food, water, shelter, transport, as well as physical and digital infrastructure related to health, education, information, and security, all require sustainable production and delivery of energy.



H = Human Society
B = Biosphere
O = Outside Environment
Fig. 1 The closed-system model of society/environment interaction [1]

Thermodynamics can be thought of as the science of energy, and its laws emerged historically through efforts to create new engines to transform fuel energy into work output and electricity. Today, the implications of thermodynamics extend to information science, cosmology of the universe, and all of the natural sciences, with strong implications for the economic sciences. In the context of the sustainability on the planet Earth (Fig. 1, Sciubba, 2021), the growth and prosperity of humanity (H) is intricately connected to the biosphere (B) and must be consistent with the finiteness of reservoirs of resources in the outside environment (O) of the Earth. The Earth itself is a closed system (but not isolated system) in the thermodynamic sense, with negligible exchange of matter with its surrounding space.

The Earth's exchange of energy (Fig. 2) must be kept in balance to maintain its climate, particularly its atmospheric and oceanic temperatures. Currently, the excess emission of greenhouse gases – particularly carbon dioxide (CO2), loss of biodiversity and forestland, and ocean acidification are all at critical levels that threaten the habitability of the planet. Plans and actions for solving these problems must carefully consider the implications of thermodynamic laws, which may not be obvious or which may be ignored by vested interests in maintaining the profitability of fossil fuel sectors.

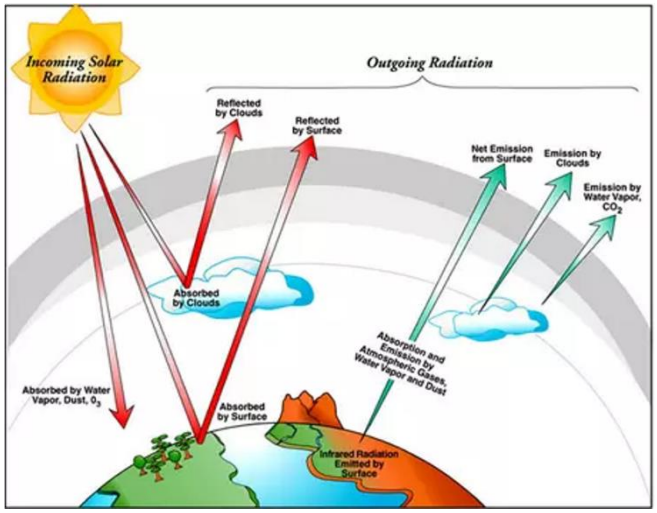


Fig. 2 Earth's Energy Balance [2].

The first law of thermodynamics posits that the total energy of an isolated system is conserved, but can be converted among its different forms. The second law of thermodynamics posits that heat moves spontaneously and irreversibly from hot to cold objects or systems, generating a property called 'entropy'. Similarly, entropy is generated by mixing of different substances (such as waste products with the environment). Ultimately, this implies that no real process can be completely reversed, because energy is required for the work to transfer heat to a colder system, to unmix wastes or to clean up the environment. The generation of that work energy itself results in additional waste production.

Examples of the application of this work by the author include the following:

a. Thermodynamic Analysis of Post-Combustion CO2 Capture [3]
b. Shale Gas to Carbon Fiber – A Cleaner Pathway from Fossil Fuels to the Hydrogen-Carbon Economy [4]
c. Pressure-Gain Combustion for Cleaner Power Generation and Propulsion [5,6]

The first study will be briefly summarized here, and the others are published works with references provided.

The Intergovernmental Panel on Climate Change (IPCC) has recommended reduction of human-made CO2 emissions by 45% before 2030 to reach the goal of net zero by 2050. Reducing CO2 can be approached in different ways. Firstly, the use of fossil fuels can be reduced by improving the efficiency of energy systems and reducing energy demand. This includes the use of renewable energy sources and "green" hydrogen using such sources. Secondly, engines and furnaces can shift to fossil fuels with low C/H ratio such as natural gas to lower CO2 emissions from combustion processes, provided that methane is not released unburned during production, transport, and use of natural gas. Methane is a much more potent GHG than CO2. Thirdly, CO2 from industrial and power plant sectors (point-source capture), or plausibly from the atmosphere (direct air capture), can be captured and permanently stored, usually underground, either in natural hollow structures or oil-bearing formations to enhance oil recovery (Carbon Capture Utilization and Storage, CCUS) [3,7]. Fourthly, reducing deforestation will help store more CO2 from the atmosphere naturally in biomass.

Given the slow progress in transitioning to renewable energy, CCUS may be necessary to reduce CO2 emissions. Very few point sources produce pure CO2, unless oxygen is used as oxidant. Most point-sources of CO2 are industrial furnaces or power plants using air as oxidant for combustion, thus producing exhaust containing up to 10% CO2. On the other hand, the atmospheric concentration of CO2 is currently about 400 ppm, or 0.04%. While this is a dangerously high concentration that causes trapping of the Earth's infrared emission, it is a low concentration for the purpose of separation and capture.

Thermodynamic principles can be applied to show that the minimum energy needed to separate CO2 directly from the atmosphere is more than double the minimum energy needed for typical point source exhaust capture. Furthermore, the capital cost per kg of CO2 is also much higher for direct air capture because the volume of air to be processed per kg is 250 times more than exhaust gas. Thus, it is advisable to focus CCUS efforts on exhaust stack of power plants and furnaces using fossil fuels.

In practice, recent direct air capture systems use about 2-3 kWh per kg of CO2 removed, far more than the theoretical minimum [3,8]. If this electricity came from coal-fired power plants, they would indirectly produce about twice the amount of CO2 that they remove directly. Thus, such direct air capture is only feasible if done with renewable energy. Even then, a life cycle cost study should be done to consider capital equipment cost and emissions impact. Moreover, there is a danger that promotion of direct air capture and storage will lead to complacency about the urgent need to stop emissions of CO2 into the atmosphere.

References

1. Enrico Sciubba, 2021, “A Thermodynamic Measure of Sustainability”, Frontiers in Sustainability, 17 December 2021, Sec. Quantitative Sustainability Assessment, Volume 2 – 2021. https://doi.org/10.3389/frsus.2021.739395
2. Steve Ackerman and John Knox, “Meteorology: Understanding the Atmosphere “, Jones & Bartlett Learning, 2011, as depicted in https://serc.carleton.edu/earthlabs/weather_climate/lab_2.html
3. Shahrzad Ghadiri Jafarbeigloo, Michael Nunez, Wyatt Highland, M. Razi Nalim (instructor), “Thermodynamic Analysis of Post-Combustion CO2 Capture”, ME 52500 – Combustion – Final Report, Department of Mechanical & Energy Engineering, IUPUI, Fall 2022.
4. M.R. Nalim & S. Ghadiri, "Review of Large-Scale Potential for Carbon Fiber from Gas Liquids for the Carbon-Hydrogen Economy", International Conference on Innovation and Technological Advances for Sustainability, March 2023, Doha, Qatar.
5. M. R. Nalim, H. Li, & P. Akbari, "Air-Standard Aerothermodynamic Analysis of Gas Turbine Engines Using Wave Rotor Combustion," ASME Journal of Engineering for Gas Turbines & Power, vol. 131, p. 054506, Sep 2009.
6. M.R. Nalim, P.H. Snyder, M. Kowalkowski, "Experimental Test, Model Validation, and Viability Assessment of a Wave-Rotor Constant-Volume Combustor," AIAA Journal of Propulsion & Power, Vol.33: 163-175, 2017.
7. Suleyman G. Gizer, Osman Polat, Manoj K. Ram, Nurettin Sahiner, "Recent developments in CO2 capture, utilization, related materials, and challenges," WILEY Energy research, 2022.
8. “Carbfix and Climeworks' large-scale plans to capture CO2 and inject it into basalt formations in Iceland involve high consumption of scarce resources and potential risks,” Geoengineering Monitor, 28-Oct-2021. [Online].

An Inventory management system to optimize the pack inventory

Niroshan T.S.

Department of Engineering Technology, Faculty of Technology, University of Jaffnasamt@tech.jfn.ac.lk

Apparel industry is undergoing major challenges due to inefficiencies in excess fabric removal processes. Though they adopt lean manufacturing concepts, unexpected wastes are being identified in each department. A considerable time is consumed in raw material stores due to excess fabric handling. This research aimed at increasing the efficiency of excess fabric removal procedures in a selected apparel plant. A process diagram has been developed highlighting the raw material acquisition stage to the disposal stage. The survey results depicted that nearly 546 minutes on average are spent for all the processes such as entering, locating, delivering, and removing fabric tubes. It was found that, within a 3-day timeline, the store is getting 150 packs on average to be entered into the inventory. Out of these 150 packs, most of them are excess tubes,that is around 100, which is nearly 67%. The observations during a three-day data collection period highlighted that the process in the store consumes more time and also the records on the processes that are taking place are not available. To remove the excess tubes, it is required to check each style number and their submission types. A systematic approach has been developed and analyzed for a week to minimize the time that constitutes the major portion of the workload.A similar data collection has been done to compare the time taken for each step and those were recorded during the data collection process. The research outcome suggests utilizing boxes for storing fabric rolls rather than using a rack system while utilizing a systematic software for inventory management. A color-coded indicator has been used to identify the excess fabric removal process. The results showed that the use of appropriate inventory management with software assistance in entering and locating the process of fabric rolls saved around 50 minutes while delivering and removing outdated inventory items saved approximately 41 and 165 minutes, respectively. In total, there is a remarkable saving of 256 minutes. Thus, efficiency has been increased by 64.5% in the subsequent operations. The identified lean concepts modified the intensive actions along with the appropriate application of the software-based inventory management system. Further, a bar-coded system could be introduced to improve the pack inventory management in the selected apparel industry.

Keywords: Inventory Management, Excess Fabric, Rack system, Pack inventory, Software

A Novel Needle Feeder for Sewing Machines

Niroshan T.S.

Department of Engineering Technology, Faculty of Technology, University of Jaffnasamt@tech.jfn.ac.lk

The apparel industry is trying to discover alternative processes to maximize the production. The uncertainties reported by the operators on the production floor have been identified as one of thereasons that obstruct production improvements. One of the reported incidents that hinders production improvements is identified as needle feeding. Apparel manufacturing companies fromSri Lanka have highlighted that approximately 45% of their production loss is due to the consequences related to the sewing thread feeding process. Thus, this study aimed to design a systematic way of a needle feeder to minimize inefficient circumstances in sewing operations. This design is targeted to reduce the time consumed for the thread insertion process while lowering thread wastage. The design also expects to minimize hazards while threading and assistpoor-visioned operators. The product has been designed using a syringe along with a piece of monofilament. In the process of needle feeder development, the sharp edges of the syringe have been blunted. The blunted needle along with the monofilament, has been attached securely to form the needle feeder product. The results have been analyzed under three process parameters such as the time taken for thread insertion, thread wastage, and a rated scale approach from the operators' feedback to identify the perspectives of the operators on this application. The post- analysis has been performed with a population of 170 sewing operators selected randomly from different plants. This easy needle feeder could minimize thread insertion time by 15% compared to previous cases. This needle feeder is beneficial when changing to different colored threads and when unexpected breakage of threads occurs. The wastage of thread was lowered by 0.75%. About 80% of the operators reported their willingness to use this design and its safe use with sufficient training. The remaining population did not opt for change stating the time consumed toget trained hence preferred to follow the traditional practices. Operators are reluctant to use this design due to the sharpness of the syringe tip even though it is made blunt. Further, the operatorsreported that it took some time to fix the device. However, this design paves the way for further improvements in terms of simplifying the process along with appropriate training for the sewing operators. Therefore, this proposed solution for the thread-feeding process would be an added advantage for the minimization of process difficulties on the production floor along with the improvement of operational productivity.

Keywords : Needle feeder, sewing operation, apparel industry, thread consumption, monofilament

Design of a Speed Detection and Control System for Two-wheelers

Wijenayake V.V., Wanasinghe W.M.U.J. and Niroshan T.S.* Department

of Engineering Technology, Faculty of Technology, University of Jaffna

samt@tech.jfn.ac.lk

Motorbike accidents account for over 30% of overall road crashes. The tremendous growth in motorcycle use has resulted in a huge increase in motorcycle-related accidents and deaths. Motorcyclists in Sri Lanka face approximately twice as many risks compared to motorcyclists around the world. Hazardous conditions of the road surfaces have been identified as one of the main reasons for the accidents and fatalities. Wet conditions of the roads reduce friction which leads to hydroplaning. Moreover, the visibility during rainy days reduces lighting efficiency. Thisstudy was conducted to design and implement a safety system for two-wheelers to control the speed of the motorbike. The safety system was designed with an indication system to prevent the possibility of slippage and fatal road accidents under wet road surface conditions especially on rainy days. The electronic control unit fixed to the bike measures the speed with the assistance ofa wheel speed sensor while the rain sensor is acclimated to detect the nature of the road surface by measuring the wetness of the road using analog to digital conversions. Subsequently, the accelerator and carburetor aligned with the electronic control unit limit the fuel supply while thebike is throttled to 50 km/h on a wet surface. When it rains and after rain, rain sensors detect the wet conditions and simultaneously switch on the headlights to increase the visibility of the road for the rider. The electronic control unit was fixed to selected bikes and data were collected. Collected data were evaluated graphically with lean angle, acceleration, and decelerations being major variables with the coefficient of friction along the road surface. A liquid crystal display hasbeen accustomed to witness the variations. An automatic indication system is activated during rainy days which displays a message to the driver while activating the headlight with the display message “WET SENSOR ON” and “WET SENSOR OFF”. According to the results, the lean angle was set to the range of 0-70° that exhibited the variation in a stipulated condition. The technologies namely, adaptive cruise control, electronic braking system, and traction control can be combined with the developed detection system. This design can be further improved by synchronizing the system with the vehicle speed-sensing mechanism while utilizing an in-built anti-lock braking system for faster and more accurate measurements. User feedback from 270 randomly selected bike riders was obtained to evaluate the usage of the developed mechanism. The survey elucidated that 95.6% of the targeted population was satisfied with the improvement in minimizing accidental hazards.

Keywords: Speed control, Indication system, Wet condition, Micro-controller, Motorbikes

Water pollution in Valaichchenai Lagoon due to non-point and point source pollutants from surrounding locations

L. Aslam Suja[1*] and M.M.M. Najim[2]

[1] Department of Zoology and Environmental Management, Faculty of Science, University of Kelaniya, Sri Lanka
[2] Faculty of Agriculture, Sultan Sharif Ali Islamic University (UNISSA), Kampus Sinaut, Km 33, JlnTutong, Kampong Sinaut, Tutong TB1741, Brunei

*aslamsuja10@gmail.com

Water pollution is one of the major environmental issues in many parts of the world and Valaichchenai lagoon in Batticaloa district, Sri Lanka is no exception. This lagoon is the main source of income for thousands of fishing families. Now the lagoon is heavily polluted due to multiple sources of effluents from the surroundings. The ecological and socioeconomic importance of this lagoon is not fully understood by the local community. This research aimed to investigate the causes and impacts of pollution in the Valaichchenai lagoon. The primary data was collected through a questionnaire survey employing fishing community and local people who live around the lagoon. Fifty fishermen and fifty non-fishermen living adjacent to the Valaichchenai lagoon were randomly selected for the data collection. Direct observations were also recorded during the questionnaire survey. Based on the findings, the major sources of pollutants entering the lagoon were identified as discharge of untreated wastewater from prawn farms, vehicle service stations and rice mills, effluents from the slaughterhouse, dumping of garbage by fishermen and neighborhood community, leakage of oil from boats / fishing vessels and discharge of waste effluents from the fishing harbour. Among the respondents, 45% stated that dumping of garbage by nearby residents, outsiders and fishermen caused the pollution. Another 37% stated that untreated wastewater from prawn farms, vehicle service stations and rice mills caused the pollution. Another 10% and 8% stated that waste effluents from nearby abattoir and oil leakage from boats, respectively caused the pollution.

These pollutants have many negative effects on the lagoon, including: heavy eutrophication, deterioration of water quality, fish kills, reduction in fish yield, extinction of prawns, crabs and some fish species, the decline of seagrass and health problems to the fishermen. Fish production is heavily reduced in the lagoon near the prawn farm and this has caused to lose the livelihood of nearly 300-400 fishermen. Sand mining activities which happened in the harbour area is another big threat to the lagoon environment. The pollution level in the lagoon seems to be increasing day by day as no proper mitigation measures are implemented. There is a need to implement already available legislation to control the pollution of the lagoon. Proper monitoring and development of efficient strategies to reduce the discharge of industrial effluents into the lagoon is of paramount importance.

Keywords: *Valaichchenai Lagoon, Water quality, Wastewater, Pollution, Deterioration*

Assessing the Effectiveness and Efficiency of a Wastewater Treatment Plant: A Study of Capacity Discrepancy for Waste Reduction and Management

S.A.P.T. Samaraweera [1*] and M.M.M. Najim [1, 2]

[1]Department of Zoology and Environmental Management, Faculty of Science, University of Kelaniya, SriLanka
[2]Faculty of Agriculture, Sultan Sharif Ali Islamic University (UNISSA), Kampus Sinaut, Km 33, JlnTutong, Kampong Sinaut, Tutong TB1741 Brunei Darussalam najim.mujithaba@unissa.edu.bn

*pamudisamaraweera@gmail.com

Greater Kurunegala Sewage Treatment Plant (GKSTP) plays a pivotal role in transforming polluted wastewater in Kurunegala City into safe water and releasing it back into the city canals.Despite establishing a GKSTP in 2018, the canals remain polluted prompting community complaints. This study investigated whether the discrepancy between planned and actual workingcapacity contributes to canal pollution. Physicochemical parameters (temperature, pH, EC, TDS,salinity, pH, TSS, DO, BOD_5, COD, nitrate) of water samples from five sites downstream to the GKSTP were assessed. The General Linear Model was used to assess temporal and spatial variation of water quality parameters and the water quality index (WQI) was used to compare theimprovement of water quality along canals after establishing the GKSTP with the results from previous literature. The WQI was calculated based on measured pH, temperature, BOD_5, TDS, and nitrate values. The planned capacity of GKSTP is 4500m^3/day. This study highlights the impact of underutilization on the efficiency of the GKSTP. Based on the findings, despite the significant improvement of WQI ($p<0.05$, ANOVA) from 35(2005) to 49(2023), persistent "bad" water quality in city canals (50>WQI>24) may be linked to the capacity discrepancy. This is evidenced by no significant improvements in water quality parameters such as pH, TDS, and conductivity. If the sewerage network of GKSTP had been increased, then it would have reached the planned capacity minimizing one of the prevailing reasons for recontamination of the treated water by different pollution sources that are not connected to the existing sewerage network. The existence of a treatment plant in the community holds substantial long- term benefits, including the amelioration of public health conditions, a substantial reduction in environmental pollution levels, and the facilitation of heightened accessibility to potable water resources. These collective improvements are pivotal in the pursuit of effective waste reduction and management within the city's canals. However, addressing the present capacity discrepancy within the wastewater treatment plant is crucial to fully unlock these advantages. Therefore, a more comprehensive evaluation of the treatment plant's success should take into account both itscapacity utilization and the broader benefits it provides to the community by ensuring the efficientmanagement of waste within the city's canal systems.

To comprehensively address the wastewater treatment challenges in the remaining 10% of the city, it is recommended to employ a multifacetedapproach. This includes strategic infrastructure expansion, community engagement initiatives, deployment of mobile treatment units, and robust public awareness campaigns. This integrated strategy aims to enhance the efficiency of wastewater management, ensuring sustainable and equitable solutions for the entire urban landscape.

Keywords: Capacity, Community Benefits, Technology, Wastewater treatment, Water quality

Chronic Kidney Disease of Unknown Aetiology (CKDu): A Comprehensive Analysis of a Public Health Crisis in Sri Lanka

M.H.N. Nafeesa[1], A.N.F. Thahyeena[2], M.H.F. Sabrina[3], I.L.M. Sabri[4*]

[1]Base Hospital of Sammanthurai, SRI LANKA.
[2]South Eastern University of Sri Lanka, SRI LANKA.
[3]Ministry of Education, SRI LANKA
[4]Central Engineering Consultancy Bureau, SRI LANKA.
* cemsabri@gmail.com

Chronic Kidney Disease of Unknown Aetiology (CKDu) has emerged as a substantial and intricate public health concern in Sri Lanka. The objective of this extensive review was to conduct a comprehensive investigation into CKDu which is a significant public health issue in Sri Lanka. This review utilised a systematic and a comprehensive examination of existing literature of CKDu in Sri Lanka. This study comprehensively examined the complexities of CKDu over a 50 years span and analysed the historical progression of CKDu, its epidemiological characteristics, potential causative factors, the impact it has on affected populations, and interdisciplinary interventions on control and mitigations. The prevalence of CKDu demonstrates regional variations within the epidemiological context, with rates ranging from 2-3 % to 20 %. It is worth noting that CKDu incidences are observed more among male individuals and older age groups. The prevalence of CKDu is affected by occupational and socio-economic determinants exerting a disproportionate influence on individuals engaged in agricultural occupations. The analysis elucidates the complex interplay of various determinants, encompassing the existence of high levels of metallic elements in potable water reservoirs, the utilisation of agricultural chemicals, the ramifications of elevated temperatures and water deprivation, and the sway of genetic susceptibility. The experience of patient distress is notably heightened by the coexistence such as hypertension and diabetes where 30-40 % of individuals diagnosed with CKDu are suffering with hypertension, while 15-20 % are with diabetes. The economic consequences involve increased healthcare costs and reduced labour productivity. Simultaneously, individuals affected by the disease and their families experience psychological distress. Various interventions and mitigation strategies have been implemented by the Sri Lankan Government and International Organisations in order to address the issue of CKDu. These endeavours encompass proactive measures, educational initiatives in healthcare and comprehensive strategies for healthcare provision. The examination of success narratives and the identification of obstacles encountered provide valuable insights that can inform future endeavours. Attention to the limitations of current research emphasises the importance of unanswered questions and suggest potential directions for future research and policy efforts. Despite attempts to intervene, CKDu still poses a mystery, requiringongoing research involving multiple disciplines, long-term monitoring of patients, and specific policy actions. Given the ongoing prevalence of CKDu as a significant public health issue, it is crucial to adopt a comprehensive and transdisciplinary approach to understand its complexities and improve the health of those impacted.

Keywords: Chronic Kidney Disease, Unknown Aetiology, Public Health Crisis, Healthcare Impact, Enigmatic Disease

Analysing the Effects of Digital Marketing on Promoting Sustainable Growth in Construction Firms in Sri Lanka

I.L.M. Sabri*

Central Engineering Consultancy Bureau, SRI LANKA

*cemsabri@gmail.com

In the dynamic and constantly evolving context of the construction industry in Sri Lanka, there is a strong emphasis on achieving sustainable growth. The integration of digital marketing strategiesis increasingly recognized as a pivotal driver of transformation. The objective of this review is to provide a thorough analysis of the digital marketing strategies used in the construction industry of Sri Lanka. This study was done through an in-depth review of digital marketing strategies thatare being implemented in the Sri Lankan construction industry over a period of two decades up to 2023. This study highlights a significant shift towards digital marketing within the construction industry, considering its substantial impact on Sri Lanka's economy. It has been observed that a significant proportion of firms have adopted online strategies. The findings reveal a significant increase in conversion rates (20%), as a result, a substantial rise in the number of social media followers and website optimization. The major barriers that hinder the successful implementation of digital marketing strategies were identified as cultural resistance (40%) and organizational inertia. The sustainability in the construction industry of Sri Lanka emphasizes its significant contribution to carbon emissions (30%) and Sri Lanka's commitment to achieving an 80% reduction in emissions by 2030. The notable reduction of 50% wastes has been accomplished by adopting circular economy practices. This achievement serves as a compelling illustration of the sector's dedication to promoting sustainability. Construction firms face with a variety of intricateobstacles, including cultural opposition and organizational resistance, constraints in digital infrastructure and a significant dearth of digital marketing expertise among industry professionals.Furthermore, the research findings indicate a complex environment characterized by numerous regulatory and ethical factors. The budgetary limitations that impact over half of construction firms, along with the considerable ambiguity surrounding the prospective gains from investmentsin digital marketing are currently estimated at 65%. This study offers a comprehensive collection of recommendations and best practices designed to enhance the foundational elements of digital marketing in the specific context of construction firms in Sri Lanka. Construction firms in Sri Lanka are required to adopt digital marketing as a mandatory requirement, rather than a choice. This command enables businesses to establish consumer connections, foster brand allegiance, andthrive in a highly competitive market. Adaptability is essential for maintaining a competitive edgein a constantly changing digital environment. Acknowledging the crucial role of digital marketingin promoting sustainable growth strategically positions construction firms for success in a rapidlyevolving, technology-driven future.

Keywords: Constructions, Construction Industry, Sri Lanka, Digital Marketing, Sustainable Growth

Concentration of Algal Toxins in Drinking Water in Irakkamam DS Division of Ampara, Sri Lanka where Chronic Kidney Disease of Uncertain Etiology (CKDu)is Prevalent

AMM. Asmath[1], MMM. Najim[2], MM. Musthafa[1*], UL. Abdul Majeed[1], LF. Zisath Shama[3]

[1]Department of Biosystems Technology, Faculty of Technology, South Eastern University of Sri Lanka.
[2]Faculty of Agriculture, Universiti Islam Sultan Sharif Ali, Sinaut Campus, Brunei Darussalam, Brunei.
[3]Department of Information and Communications Technology, Faculty of Technology, South Eastern University of Sri Lanka.

muneeb@seu.ac.lk

Chronic kidney disease of uncertain etiology (CKDu) and CKDu related deaths have risen exponentially in Dehiattakandiya, Padiyathalawa and Mahaoya District Secretariat Divisions (DSD) in Ampara District in the Eastern province. An increasing number of CKDu cases were recently reported from Irakkamam DSD in Ampara District. Even though Irakkamam DSD is not identified as a high-risk DSD for CKDu, there has been an increasing trend of CKDu recently as per the preliminary surveys conducted. No studies have been reported from Irakkamam DSD to find out the influencing factor associated with CKDu. Algal toxins play an important role among the suspected contributing factors to CKDu. Therefore, the present study aimed to analyse the concentration of algal toxins in drinking water to find out the association with the occurrence of CKDu. Ten different geographical locations were selected to collect water samples from various water sources including dug wells, tube wells, canals, reservoirs, and water supply from the national water board in Irakkamam DSD in April 2022 during the dry season to determine the concentrations of algal toxin. Enzyme-linked immunosorbent assay (ELISA) method was used todetermine the algal toxins of Cylindrospermopsin and Microcystin. The statistical analysis was performed using SPSS software. Algal toxin was only found in one certain point of the reservoirarea out of the ten locations sampled. Further, the concentration of Microcystin was detected as 1.576±0.06 µg/L in that location, which did not exceed the standard level of 2.0 µg/L (SLS 614:2013). Moreover, Cylindrospermopsin was not detected in drinking water samples analysed. Further, serum creatinine levels of the CKDu patients were non-significantly ($p > 0.05$) correlatedwith the concentration of algal toxins. So, algal toxin is not a significant key determinant related to CKDu in Irakkamam DSD. Therefore, to identify a potential etiological causing factor for theCKDu in Irakkamam DSD, other hypotheses should be developed.

Keywords: Algal toxin, drinking water, lifestyle, kidney disease

Demographic characteristics and iron deficiency anemia at KalmunaiBase Hospital

Afreen S.M.M. S[1, 2], Muneeb M.M[1], Rajavarthani S[3], and Roshanth S.N.[4]

[1]Department of Biosystem Technology, Faculty of Technology, SEUSL.
[2]Al- Manar Central College, Maruthamunai.
[3]Department of Human Biology, Faculty of Health-Care Sciences, EUSL.
[4]Pediatric Unit, Base Hospital, Kalmunai North.

muneeb@seu.ac.lk

Iron Deficiency Anemia (IDA) is still a global public health concern that affects people of all ages. However, its frequency in pediatric groups is particularly a concern, given the potential forlong-term developmental and health effects. This study aimed to examine the associations between various demographic characteristics and IDA in children in Kalmunai, Sri Lanka. A cross-sectional study was conducted with 101 (according to the sample size calculator) children hospitalized at the Base Hospital Kalmunai North, Sri Lanka. The ethical approval for this study was obtained from the Ethical Review Committee of the Faculty of Health-Care Sciences, Eastern University of Sri Lanka. A 5 ml blood sample was collected from each child to measure the C-RP, Hemoglobin and serum ferritin. Hemoglobin level was used to measure the presence of IDA, and demographic factors such as age, gender, dwelling sector, mother's educational attainment, number of children in the household, birth interval, and monthly income were examined in connection with the presence of IDA. The associations between IDA and demographic characters were evaluated for significance using the Chi-square test. The total prevalence of IDA among thestudy sample was close to 8%. According to the data, there were no occurrences of IDA in the 10-14 age group of children and they had the highest mean hemoglobin levels (12.79 ± 0.9 g/dl).There was no significant difference in the frequency of IDA between male and female children. Compared to children in rural areas (11.8%), the prevalence of IDA among urban children was marginally lower (4.0%). The lowest prevalence of IDA (4.5%) was seen among children whose mothers have greater levels of education. The lowest prevalence of IDA was found in families with one kid (2.3%). The prevalence of IDA was significantly higher (at 50%) among children in families where childbirth interval was 1 year compared to those with longer intervals. Children from families with an income of less than 20,000 rupees per month were more likely to have IDA (15.6%) than those are from families with higher income levels. In summary, this research indicates that multiple demographic variables could impact the frequency of IDA among children. The results highlighted the significance of identifying susceptible individuals. It can be recommended to implement measures to treat iron deficiency anemia, particularly among children from low- income families with more children and shorter birth intervals.

Keywords: Iron Deficiency Anemia, Children, Demographic Characteristics, Hemoglobin Levels

Blockchain Based Steganography (BBS) for securing medical records in Healthcare 5.0

Ra. K. Saravanaguru*, Kumar K.

*School of Computer Science and Engineering
Vellore Institute of Technology, Vellore 632014

*saravanank@vit.ac.in

The advent of Healthcare 5.0, characterized by the integration of cutting-edge technologies and data-driven healthcare systems, has raised the demand for innovative solutions to safeguard the privacy and integrity of sensitive medical records. In this context, the evolving landscape of healthcare data management, security and privacy are paramount. This paper aimed to introducea robust solution leveraging blockchain-based steganography to safeguard patient information. The proposed approach integrated three advanced techniques: Least Significant Bit (LSB) substitution, Discrete Wavelet Transform (DWT), and Redundant Pattern Encoding (RPE), ensuring a multi-layered concealment strategy. Healthcare providers utilize Advanced EncryptionStandard (AES) for encrypting sensitive patient data, and then employ LSB to subtly embed information within the least significant bits of non-sensitive data. The integration of DWT introduced an additional layer of concealment by embedding encrypted data into high-frequencycomponents, minimizing perceptual impact. Furthermore, Redundant Pattern Encoding (RPE) was incorporated to introduce patterns that mimic cover data characteristics, enhancing the resilience against detection. The system was implemented on a blockchain platform using smart contracts, ensuring transparency, immutability, and decentralized access control. Transactions aresecurely stored on the blockchain, with additional medical documents or images stored on the Interplanetary File System (IPFS) for decentralized and efficient retrieval. This innovative amalgamation of steganography techniques, encryption, smart contracts, blockchain, and IPFS presents a comprehensive solution for safeguarding patient data in healthcare systems. The proposed model addresses privacy concerns, complies with regulatory standards, and provides a resilient framework for secure and transparent healthcare data management. In conclusion, the implemented research underscores the effectiveness of Blockchain-Based Steganography in securely storing medical records in the context of Healthcare 5.0. The hybrid approach offers a robust solution, ensuring data integrity, resistance to unauthorized access, and a high level of privacy. These findings hold significant implications for advancing healthcare data security in thedigital age.

Keywords: Blockchain, Steganography, Distributed ledger, Medical records, Healthcare 5.0

A Next Generation IoT-Based Eco-friendly Smart Fish Dryer: A Sustainable Solution for Ensuring Safe and High-Quality Processed Product

Md. Masud Rana* [1, 2] , Roslianah Asdari [1] and Mohammad Bodrul Munir [3]

[1]Faculty of Resource science and Technology, Universiti Malaysia Sarawak, Malaysia.
[2]Faculty of Fisheries, Aquaculture and Marine Science, Sher-e-Bangla Agricultural University, Bangladesh
[3]Faculty of Agriculture, Universiti Islam Sultan Sharif Ali, Sinaut Campus, Brunei Darussalam, Brunei

randof.bd@gmail.com

Traditional methods of drying fish in open air are still widely practiced in several developing nations, such as Bangladesh. Notwithstanding their prevalent application, these techniques frequently result in unsanitary circumstances and substandard commodities owing to the influence of impurities, irregular meteorological patterns, and vermin. The current study introduces a novel and eco-friendly approach to fish drying, which involves the utilization of solar energy and Internet of Things (IoT) technology. The system under consideration operates as a solar greenhouse during daylight hours, utilizing solar energy to activate a heating mechanism for nocturnal use. The Internet of Things (IoT) controller enhances the drying procedure by controlling the temperature and airflow, leading to a more effective and sanitary drying process. It takes 30 hours to dry 500 kg of fish and decrease the moisture content from 88% to 10% withinthe processing period. The initial findings indicate that the newly developed eco-friendly system has the ability to enhance the quality of dehydrated fish substantially, while also complying with sustainable energy principles. The present study not only offers a pragmatic resolution for the drying of fish but also makes a noteworthy contribution towards the attainment of sustainable development objectives by endorsing the adoption of clean energy in the food processing sector.

Keywords: Eco-Friendly, Green House, Sustainable Technology, Smart Fish Dryer, IoT.

Stimulation of immune response (Hemocytes, SOD, proPO) of female brood Mud Crab (*Scyllaolivacea*) fed with dietary Lacto-sacc

Md. Abdul Hannan[1,2*], Mohammad Bodrul Munir[4], Roslianah binti Asdari[1], Md. Shoebul Islam[3],Rabina Akther Lima[3], Md. Jahidul Hasan[1], H M Rakibul Islam[3], Md. Harunor Rashid[3], Henry Wong Yip Hing[5]

[1]Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, Malaysia [2]Faculty of Fisheries, Aquaculture and Marine Science, Sher-e-Bangla Agricultural University,Bangladesh
[3]Bangladesh Fisheries Research Institute, Shrimp Research Station, Bangladesh

[4]Faculty of Agriculture, Universiti Islam Sultan Sharif Ali, Brunei

[5]Alltech biotechnology Private Limited, Malaysia

21010008@siswa.umimas.my

The innate immune response is a conserved trait of crustaceans. The circulating hemocytes play significant roles in host innate immune responses. During breeding season, disease outbreaks are very common and have chances to damage eggs and broods. The application of probiotics and prebiotics has a significant role in brood management and replaces the overuse of antibiotics. The gravid female mud crab (*Scylla olivacea*) with average length(6.61cm±0.21), width(9.39cm±0.46) and weight(122.33g±1.53) were collected from the local river of Sundarbans mangrove forest and randomly divided into three groups T1, T2 and T3 that contain 0%, 1%, and 1.5% lacto-sacc, respectively. Formulated feed contains 45% protein, 12% lipid, 40% carbohydrate, and 3% ash and combinations of prebiotics *Saccharomyces cerevisiae* and probiotics *Enterococcus faecium* and *Lactobacillus acidophilus.* After 12 weeks of rearing mud crab, samples were collected randomly from different treatment ponds and transferred to the laboratory of Shrimp research station, Bagerhat. The immune parameters i.e., numbers of total hemocyte cells (THC), clotting time, superoxide dismutase (SOD), and prophenoloxidase (proPO) were determined. The THC was $1.735\pm0.98\times10^6$, $5.53\pm0.29\times10^6$, and $5.75\pm0.23\times10^6$ cells/ml observed for the treatment T1, T2 and T3, respectively. The result implies that the application of 1.5% lacto-sacc (T3) increased the numbers of total hemocyte cells to 30.17% higher than the application of 0% lacto-sacc (T1). The clotting time is also little bit higher in T3 compared to other treatments but not significantly different (*P<0.01)*. On the other hand, the immune parameters SOD and proPO enzyme were recorded higher in T3 comparative to T2 and T1. The optical density (OD) value of SOD was 1.93±1.39, 3.07±1.18 and 4.89±3.42, whereas the optical density (OD) value of ProPO was 0.03±0.03, 0.04±0.02 and 0.12±0.01 for the treatment T1, T2 and T3 respectively that was significantly different from 0% lacto-sacc (T1) to 1.5% lacto-sacc (T3) at *P<0.01.*

Keywords: Immunity, Orange mud crab, Gravid crab

Natural breeding performance in different salinities, crablets rearing and cannibalism injuvenile phase of mangrove crab, *Scylla olivacea.*

Md Abdul Hannan[1,2*], Mohammad Bodrul Munir[3], Roslianah binti Asdari[1], Kazi Ahsan Habib[2], Showmitro Nondi[4], Md Jahidul Hasan[1], Meherunnessa Jamy[2], Cristalina Binti Jalil Marsal[3], El-Sayed Hemdan Eissa[5], Moaheda E. H. Eissa[6]

[1]Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, Malaysia.
[2]Faculty of Fisheries, Aquaculture and Marine Science, Sher-e-Bangla Agricultural University, Bangladesh.
[3]Faculty of Agriculture, Universiti Islam Sultan Sharif Ali, Brunei.
[4]Japan Fast Trade Limited, Satkhira, Bangladesh.
[5]Fish Research Centre, Arish University, Egypt.
[6]Fish Farming and Technology Institute, Suez Canal University, Egypt

21010008@siswa.umimas.my

The current study focused on natural breeding techniques using locally available mud crab broods during breeding season. The breeding trial was tested in artificially created earthen pens that were designed with mangrove plants and salt tolerance grass. Nine matured brood mud crabs (av. wt. 126.33±2.78) were collected from a local river and equally distributed in 20 L black color plastic containers in three different salinities (T1= 24 ppt, T2= 26 ppt, and T3=28 ppt) and covered with black cloths to ensure dark habitat. The river salinity was 26ppt during breeding season that is considered as control(T2), and treatment T1 and T3 were prepared artificially mixing with water and sea salt, respectively. Broods were reared in plastic containers until hatching and zoea was transferred to earthen pens immediately after hatching containing similar saline concentration of the containers with three replicates of each treatment. Zoea were reared in earthen pens until they turn to crablets (0.027±0.005g). The broods were collected from wild sources and species were identified for confirmation. Initially, the mud crabs were identified through morphometric and meristic approaches and confirmed as *Scylla olivacea* species. Besides, the broods as well as crablets were also identified through molecular barcoding technique and confirmed as *Scylla olivacea*. The highest hatching rate was observed in T2(91.34±4.61^{a}) and lowest hatching rate was observed in T1(57.98±1.38^{c}), whereas the highest survival rate was recorded in T2(10.53±1.56^{a}) and lowest survival rate was observed in T1(2.87±0.68^{b}). The order of incubation was T1(12.3±1.53^{a} days)>T3(11.0±1.00^{ab} days)>T2(8.67±1.15^{b} days) observed during the experiment.

The cannibalism rate was also estimated in this experiment and observed cannibalism rate was 71.20±2.08. Natural mud crab breeding is a simple technique and can be applicable in fields at low cost with significant survival rate. This is the first attempt at rearing indigenous mud crabs in natural ponds.

Keywords: Orange mud crab, *Nannochloropsis*, Rotifer, Sundarbans

Power Quality Upgrading In A Grid-Associated RenewableEnergy System

Anantrao V. Patil*, Vijaykumar Biradar, Manik T Shinde

Department of Electrical Engineering, NBN Sinhgad COE, Solapur. India.

anantpatil17@gmail.com

Renewable energy sources (RES) are used in distribution systems using power electronic converters. The high penetration level of renewable energy sources produces power quality issues such as current unbalance, current harmonics, etc. This paper provides a control strategy for grid interfacing inverters when installed in three three-phase four-wire distribution systems. The inverter serves multiple functions; it acts as a power converter and also as a shunt active power filter to compensate for current unbalance, load current harmonics, load reactive power demand, and load neutral current. For this purpose, this paperanalyses a current-controlled four-leg voltage source inverter made of an insulated-gate bipolar transistor connected to a combination of three-phase non-linear and single-phase linear and non-linear load. The hysteresis controller is used to produce switching pulses. The reference current generation is based on PQ theory. This control strategy allows thecombination of grid interfacing inverter and the three phases four-wire linear or nonlinear unbalanced load at the point of common coupling to appear as a balanced linear load to the grid. The four-current controlled voltage source inverter is actively controlled to achieve balanced sinusoidal currents at unity power factor (UPF) even when the unbalanced nonlinear load is connected to it. This enables the grid to supply or receive sinusoidal and balanced power at UPF. The grid interfacing inverter has been analyzed under three conditions. When RES power is zero, it acts as a shunt active power filter. When RES power is less than the load power demand, it acts as a rectifier. When RES power is greater than the load power demand, it injects power into the grid and acts as an inverter. This control concept has been simulated using MATLAB/Simulink.

Keywords: Power Quality, Shunt Active Power Filter, Power injection, Grid Interfacing Inverter.

Using Image Processing and Machine Learning to Identify Diseases in Tomato and Potato Plants: A Review

NS Wisidagama[1], FMMT Marikar[2], and M Sirisuriya[1]

[1]Department of Computer Science, General Sir John Kotelawala Defence University, Sri Lanka
[2]Staff Development Centre, General Sir John Kotelawala Defence University, Sri Lanka
faiz@kdu.ac.lk

Agriculture plays a vital role in the Sri Lankan economy. Cultivation of crops like tomatoes and potatoes, which are being used as both fruits and vegetables will contribute significantly to farmers' earnings. However, tomato and potato crops face numerous challenges, such as diseaseinfection, which can significantly reduce the yield. Early identification of these diseases is crucial for implementing timely interventions and minimizing the potential damage. The current study aimed to analyze the existing methodologies and identify the most effective approaches for disease detection in tomato and potato crops. Image processing techniques enable the extraction of relevant features from digital images of infected plants, aiding in the identification of diseases accurately. Additionally, machine learning algorithms have proven to be valuable tools for analyzing complex datasets and distinguish between healthy and diseased plants. The review explores various image processing techniques, including image segmentation, feature extraction, and classification algorithms (support vector machines, random forests, and convolutional neural networks). Suitability of these techniques assured the disease identification in tomato plants based on their accuracy, efficiency, and robustness. This review laid the groundwork for developing a software application that accurately identifies tomato leaf diseases. This study paves the way for developing an app that accurately identifies tomato and potato leaf diseases, improving their resilience and productivity of potatoes and tomatoes in Sri Lanka. This will contribute to a more sustainable agricultural sector.

Keywords: Agricultural automation, Image processing, Machine learning

Semicarbazide Occurrence in the Meat and Shell of Bangladeshi Soft Shell Crab (*Scylla olivacea*)

Md. Jahidul Hasan[1,2*], Sheikh Tanvir Akhter[2], Md. Bodrul Munir[1,3], Md. Abdul Hannan[1], S.M. Rezaul Karim[2], Roslianah Binti Asdari[1]

[1]Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, Malaysia
[2]Ministry of Fisheries and Livestock, Department of Fisheries, Bangladesh
[3]Faculty of Agriculture, Universiti Islam Sultan Sharif Ali, Brunei

[*]jahidufo@gmail.com

A breakdown product of azodicarbonamide, semicarbazide (SEM) is a protein-bound metabolite of banned nitrofuran nitrofurazone, and it is known that the marker SEM occurrences can arise from various unrelated sources. In soft-shell crabs (*Scylla olivacea*), SEM occurrences are reported to be comparatively higher in carapace shells than in muscles. To study the SEM occurrences in the soft shell crab, three samples each from natural breeding ground in Bay of Bengal, a river in mangrove area, and three different farming companies from Khulna and Satkhira district were analyzed at an accredited Quality Control Laboratory in Khulna. Following 0.50 µg/kg Minimum Required Performance Limit of SEM, the concentration of the marker in crab carapace shell is found to be about 11 times higher than that of crab muscles. The findings showed that the SEM concentration in the crab's muscle and carapace fluctuated with locations. The concentrations in the natural breeding ground were 0.278±0.006 µg/kg and 3.163±0.092µg/kg, while the concentrations in the river and inland farms were 0.316±0.009µg/kg and 3.303±0.039µg/kg and 0.353±0.029µg/kg and 3.636±0.38µg/kg, respectively. The use of snails as food for the culture of crabs in farming companies might be the reason for increased SEM concentration due to the known presence of markers in snails. As the crabs' epidermal muscle stuck to their carapace, the SEM concentration might be arisen from crab shells and also varies within their muscles. Epidermal muscle excluded crab might be regarded as safe, while the shell-associated muscle might be considered as aberrant.

Keywords: Semicarbazide, Nitrofuran, Soft Shell Crab, Mangrove

Developing Vegetable Oil Based Metal Working Fluids for EnvironmentallyFriendly Machining

Perera G. I. P.

Faculty of Engineering, University of Ruhuna, Sri Lanka.

indika@mme.ruh.ac.lk

Most of the Metal Working Fluids (MWFs) used for machining are mineral oil-based liquids. It has been identified several health hazards relate to the continuous usage of these fluids. The natural oil based MWFs has been identified as unique resolution for inescapable negative effectsinitiated by mineral oil based MWFs while machining. Considering several plant-based oils, andits properties, coconut oil (white) is selected as the base material for the development of MWFs. After adding two nontoxic and ecofriendly food grade surfactants, it was developed as a water- soluble emulsion. Machining experiments with different materials (AISI 304, Mild Steel) were conducted with the developed fluid under minimum quantity lubrication. Tool flak wear, tool tip temperature and the surface roughness were measured on turned workpieces with Lathe MachineCM6241×1000. Further the fluid properties were enhanced by adding nano graphite and nano Aluminium Oxide particles and machining experiments were repeated. Different weight percentages of 0.1%, 0.2%, 0.3%, 0.4% and 0.5% w/w resulting in ten different MWFs with suspended nanomaterials were separately added to the developed fluid and machining experiments were conducted with each of these nano enhanced fluids. Straight turning with existence of new MWF without nano additives has shown 19% reduction of tool-tip temperature for AISI 304, 75% improvement in surface finish for mild steel, 36% improvement in tool flank wear for AISI 304, 14% and 45% decline in tool nose wear for AISI 304 and mild steel, respectively. Best results were obtained with the nano additives 0.3% (w/w) for both nano graphite and nano Aluminium Oxide. However, adding nano graphite changed the overall colour of the fluid. The nano enhanced fluid results were compared with test results with a commerciallyavailable mineral oil based MWF. At machining speeds 330rpm and 1175rpm, mineral oil based MWF shows 59.6^{0}C and 74.2^{0}C temperatures whereas Aluminium Oxide nano enhanced fluid shows 40.7^{0}C and 50.4^{0}C temperatures, respectively. This liquid can be used as a MWF to minimise tool flank wear, to minimise the temperature rise during machining, and to improve thesurface quality on the machined surface.

Keywords: Metal Working Fluids, machining, vegetable oil, nanomaterials, machined surface

Determination of brine shrimp lethality of different solvent extracts of *Terminalia catappa* L. Seed kernel

H.F. Fahmidha[1,2], J.M.N. Marikkar[1*] and U.L.B. Jayasinghe[1]

1. National Institute of Fundamental Studies, Hanthana Road, Kandy, Sri Lanka.
2. Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka.

*nazrim.ma@nifs.ac.lk

Terminalia catappa L. (TC), a large spreading tree is widely distributed in the tropical and the sub-tropical regions in the world. Different parts of this tree possess various medicinal properties. The present study was planned to determine whether the seed kernels of TC have potential toxiceffects using a brine shrimp lethality assay. Powdered seed kernels of purple and yellow cultivarsof TC were sequentially extracted with different solvents including hexane, ethyl acetate (EtOAc), and methanol (MeOH). The active nauplii of two days old brine shrimp *Artemia salina,* were usedin the bioassay. The brine shrimp lethality of plant extracts was reported as lethal concentration (LC_{50}). The plant extracts were dissolved in artificial seawater to create a concentration series of crude extracts (62.5-2000 mg L^{-1}). Ten active nauplii were introduced into each 1 mL of each extract in a 24-well semi microplate, and the plates were then left at room temperature for 24 hours while being illuminated. The number of surviving nauplii after 24 hours was counted to determine the LC_{50}. Data were analysed by one-way ANOVA using Minitab 17 software package. In this work, seawater was used as a negative control, and potassium dichromate was used as a positive control. No brine shrimp lethality was observed in hexane extracts of seed kernels of TCPurple cultivar while moderate brine shrimp lethality was observed in hexane extracts of seed kernels of TC Yellow cultivar with LC_{50} of 1370.58 ± 148.75 mg L^{-1}. Between EtOAc extracts, the highest brine shrimp lethality was detected from TC Yellow with LC_{50} of 234.18 ± 13.79 mg L^{-1} while TC Purple showed a moderate brine shrimp lethality with LC_{50} of 997.57 ± 4.92 mg L^{-1}. Between MeOH extracts, the highest brine shrimp lethality was observed from TC Yellow (LC_{50}=880.20 ± 3.92 mg L^{-1}) while TC Purple showed a moderate brine shrimp lethality with LC_{50} of 1744.69 ± 5.77 mg L^{-1}. When compared with all crude extracts, the positive control ($K_2Cr_2O_7$) exhibited the significantly ($p < 0.05$) highest brine shrimp lethal activity (LC_{50} = 13.33 ± 0.45 mg L^{-1}). According to the study, TC yellow demonstrated higher brine shrimp lethality than the TC Purple. As such, TC yellow may have the possibility of toxicity on other biological activities which will be worth of investigating.

Keywords: *Artemia salina*, Brine shrimp lethality, Lethal concentration, *Terminalia catappa* L.

Comparative Review of Blockchain Protocols : Quantitative Analysis

S. Manikandan[1,*], A.L. Haneesa[2] and Wong Wai Kit[3]

[1]Department of Information Technology, E.G.S. Pillay Engineering College, Nagapattinam, Tamil Nadu, India
[2]Department of Computer Science, Faculty of Applied Sciences, South Eastern University of Sri Lanka, Sammanthurai, Sri Lanka.
[3]Faculty of Engineering and Technology, Multimedia University, Melaka, Malaysia

*profmaninvp@gmail.com

Blockchain Protocols play a vital role in providing effective and secure services. The designed protocols have to fit existing platforms and initiate chain code-based services. The new business environments are increasing day by day. Ultimately, we need to provide desirable Blockchain Protocols for various projects. To make effective decisions, these services are evaluated using quantitative and ranking-based services. The objective of this paper was to review the different blockchain protocols by using quantitative analysis. Blockchain-based topological results of protocol standards such as chain codes, block models, and secure socket-level service were selected in this study. We proposed Comparative analyses and enabled technology-based layered services where layer 1 and 2 protocols were compared, and the results were evaluated. The proposed methods were evaluated using Chain codes, and each layered result was also evaluated. Later, one process was selected for each data, and preprocessing were done. Layer 2 was performed by specifying multiple data object values and formulating the results. A 215x215x3 deep model was set from the experiments to choose the dataset as 3000 training datasets and 1000 test datasets for evaluation. TensorFlow was used to simulate the environment and set up the protocol stack. 96% accuracy index was received and it compared with other designs based on the result. Each protocol is incorporated based on services, key generation and execution. Finally, the protocols are evaluated and compared with existing protocols. The protocols that were reviewed and simulated by using TensorFlow gave better accuracy values.

Keywords: Blockchain, Chain codes, Comparative analyze, Keypair, Protocol

Use of remote sensing to observe the relationship between vegetation cover and the land surface temperature of Colombo Municipal Area of Sri Lanka

A.R. Gunawardena[1*], T.T. Fernando[1] and M.A.A.M. Jayarathne[2]

[1]Central Environmental Authority, Denzil Kobbekaduwa Mawatha, Battaramulla, Sri Lanka.
[2]Ministry of Wildlife and Forest Resources Conservation, Sri Jayawardenapura Mawatha, Rajagiriya, Sri Lanka

[*]ajithr@cea.lk

Colombo, as the bustling commercial hub of Sri Lanka, exhibits a warmer environment comparedto its rural counterparts due to its high population density, numerous buildings, and increased vehicular activity. Recognizing the importance of enhancing green cover in such urban settings, it becomes crucial to analyze the spatial distribution of vegetation types and monitor changes in Colombo's green landscape. This research focused on the Colombo Municipality area, covering an expanse of 37 km². Various methods can be employed to study vegetation cover withtraditional field sampling being one such approach. However, this method is both time-consumingand costly. Alternatively, satellite remote sensing provides an efficient solution to gather information about vegetation and land surface temperature. Hence, this study aimed to establish the correlation between green vegetation cover and land surface temperature in the Colombo Municipal Council area, that were derived from Landsat 8 satellite imageries. Landsat 8 satellite imagery (March 2022) from NASA Earth Explorer was utilized to observe the spatial distributionof vegetation cover in relation to different land use types. The Landsat imagery underwent analysis using ERDAS Imagine software, deriving and applying the Normalized Vegetation Index(NDVI). The accuracy of the spatial distribution findings of NDVI was validated using field sampling data, which included observing percentages of canopy cover through digital photographs captured with a wide 16 mm angle lens. The digital numbers from the satellite image were converted to radiances, followed by Kelvin and Celsius conversions using remote sensing modeling using ERDAS imagine software and developed the spatial distribution of land surface temperature of the study area. Vegetation areas typically play a role in moderating microenvironments, contributing to a reduction in ambient temperatures. Literature suggests a correlation between lower temperatures in areas with abundant vegetation and higher temperatures in built-up regions. The above hypothesis was proved in this study and a strong correlation was observed between temperature and vegetation cover with an r^2 value of 0.86. These findings hold potential applications in future urban planning and environmental conservation efforts, guiding the decision makers on optimizing locations for tree planting initiatives.

Keywords: Remote sensing, temperature, vegetation, urban, NDVI

Supervised Machine Learning Model for Stock Exchange Prediction

S. Dinushan*, M. Carmel Wijegunasekara

Faculty of Computing and Technology, University of Kelaniya, Sri Lanka
Faculty of Computing and Technology, University of Kelaniya, Sri Lanka

*sdinushan1998@gmail.com

The stock market plays an essential role in improving the quality of investment decisions and reducing financial risks in a nation's economy. This research focused on predicting the next month's Sri Lankan stock market index rates (ASPI and S&P20) more accurately by analyzing influential factors and using machine learning algorithms. The objectives of the study were to identify the influential variables on ASPI and S&P 20 separately, build ML models utilizing them, and determine the best-performing model. Various factors were examined to identify the influencing variables, including macroeconomic variables, global economic conditions (S&P 500), and Twitter sentiment data. Sentiment analysis was conducted using the Transformers (RoBERTa) NLP model. Correlation tests, forward stepwise regression, and p-value tests were performed to identify the influential variables. During the correlation, each variable was lagged month by month to identify the optimal lag with the most significant impact. Utilizing influential variables, models were developed by employing various machine learning algorithms such as DecisionTree, RandomForest, SVR, ANN, CNN, and multivariate-LSTM. Shuffling and non-shuffling methods were deployed during the dataset splitting. In addition, it was attempted to build models by including the previous month's index value to the influential variables' dataset. The best-performing model with the lowest Mean Absolute Error (MAE) rate was individually selected for ASPI and S&P 20 prediction. The findings revealed that AWLR, SL Exports, Twitter, Exchange, S&P 500, M2b, and Currency in Circulation significantly influence the ASPI index. Conversely, Twitter, Unemployment Rate, Tourist Earnings, and Industrial Production significantly influence the S&P 20 index. During model building, a noteworthy impact of the previous month's stock index rate on prediction was observed. Furthermore, shuffling the dataset significantly enhanced the prediction accuracy. In ASPI stock prediction, the ANN model, built using the shuffled dataset that included both influential variables and the previous month's stockdata, performed well with an MAE value of 272.13. Meanwhile, in S&P 20 stock prediction, the CNN model, built using the shuffled dataset that included both influential variables and the previous month's stock data, performed well, yielding an MAE value of 147.86. Finally, a web application was developed to implement the results of this research. In the future, it is expect to delve into reinforcement-learning and extend effects to forecast the stock markets of other countries.

Keywords: Stock market, Prediction, Machine learning, NLP

Grey water footprint in the textile and apparel industry: A review on assessment of ecological and human health impacts on water resources in Asia

G. R. Diwyanjalee[1*] and B. K. A. Bellanthudawa[2]

[1]Southern Provincial Office, Central Environmental Authority, Galle 80630, Sri Lanka
[2]Department of Agriculture Engineering and Environmental Technology, University of Ruhuna, Matara 81000, Sri Lanka

[*]rashmitha.diwya@gmail.com

The textile and apparel industry, particularly prevalent in Asia, is a major economic contributor that confronts significant water usage and pollution challenges, particularly in the context of the grey water footprint. Therefore, this study focused on exploring the insights about wastewater management in textile and apparel industry. Hence, a thorough review of primary research was conducted to delve into the sector's water consumption, wastewater discharge, and management strategies, aiming to comprehensively understand its impact on water resources and explore potential solutions. The process of article screening was executed by adopting search keywords such as “grey water footprint", “textile industry ", "sustainable practices ", "apparel landscape", “health impacts”, and "regional interventions" using the Web of Science database. 50 peer- reviewed articles published in English from 2018 to 2023 were considered and a contentanalysis was carried out to analyze data. The study findings revealed that, across the diverse textile and apparel landscape in Asia, the water-intensive nature of production processes, particularly in dyeing, finishing, and washing, has amplified concerns about water scarcity and pollution. In terms of main human health impacts, occupational respiratory issues (spinning, weaving, and processing), dermatological conditions, chemical exposure and toxicity affecting organs such as the liver, kidneys, and nervous system, noise-induced hearing loss, and psychosocial health concerns were recorded across countries. Also, organic and inorganic pollution of water, soil contamination, greenhouse gas emissions, and microplastic pollutions are some substantially important ecological concerns found during the analysis. The grey water footprints within China's textile industry underscore the pressing need for targeted interventions and enhanced water management strategies. Despite these initiatives, the rising water stress in Asian countries necessitates more concerted efforts in adopting eco-friendly practices, water reuse technologies, and stringent wastewater treatment measures. Therefore, the review highlights the significance of initiatives like the comprehensive grey water footprint assessment, and the exploration of regional grey water footprints in addressing the ecological and health implications of water usage and pollution. Comprehensive water management strategies, including sustainable practices, technological innovations, and regional interventions, are imperative to safeguarding water resources in the face of escalating global water pollution challenges. As the industry continues to evolve, a proactive approach towards water sustainability will be paramount for balancing economic growth with environmental responsibility.

Keywords: Apparel and textile industries, Ecological and human health risks, Grey water footprint, sustainable practices

Functional Properties and Physiochemical Characteristics of Coconut MealProtein Isolate for Development of Meat Alternatives

B.C.Prabhashi[*]*, K.D.P.P.Gunathilake*

Department of Food Science & Technology, Faculty of Livestock, Fisheries & Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila NWP, Sri Lanka.
[*]*chamathkaprabhashi@gmail.com*

The world population is showing an escalating demand for protein and presents a significant challenge on global food production. Religious concerns, an increasing number of vegetarians, and environmental impacts led to further utilization of plant-based protein sources in many foodapplications. This study aimed to evaluate the functional properties and physiochemical characteristics of Coconut Meal Protein Isolate (CMPI) and gain more insights into applying CMPI in different food applications. Soybeans and coconut meal were used to make flour usinga similar grinding method. The protein content of coconut meal and soybean (Kjeldahl method) were 33.94% and 17.73% respectively. Alkaline extraction and acid precipitation method was used to produce protein isolates. Protein content in CMPI and SPI were 68.64% and 79.58%, respectively. The isoelectric point of CMPI and SPI was confirmed at pH 4. One-way ANOVA was used to determine the statistical differences among SPI and CMPI. In comparison to SPI, CMPI exhibited significantly higher ($p<0.05$) water absorption capacity (4.09 g/g), oil absorption capacity (5.56 g/g), emulsifying activity (73.33%), emulsion stability (46.67%), and foaming capacity (71.33%). This confirms the suitability of CMPI in food applications. Both SPI and CMPI had 14% least gelation capacity. CMPI contained particles from 84.2µm - 86.1µm in diameter. These were nearly spherical and had slightly rough surfaces, while SPI had a particle size of nearly 38.8µm. FTIR spectra of CMPI and SPI showed remarkable similarity. Based on the results, CMPI was selected for the development of meat alternatives, due to its excellent functional properties. Veggie meatballs were produced with baby jackfruits and the incorporation of 0%, 2%, 4%, and 8% CMPI. The protein content of meatballs with 0%, 2%, 4%, and 8% CMPIwas 1.33%, 2.72%, 4.15%, and 6.82%, respectively. All meatball groups had pH values between 5.64-5.06 and water activity between 0.61-0.81. A total of twenty-five untrained members were recruited as untrained sensory panel. The four veggie meatball formulations were evaluated in terms of the aroma, appearance, flavor, texture, and overall acceptance of the products on a seven-point hedonic scale (7, extremely like; 1, extremely unlike). Meatballs with 4% CMPI were recorded as the ones with the highest overall acceptance. This confirms that CMPI has a high potential for use in food applications, particularly in the development of meat alternatives.

Keywords: Coconut meal, Protein isolate, Food applications, Functional Properties

In vitro Establishment and Proliferation of *Stevia rebaudiana* Bertoni Nodal Explants: A Standardized Media Protocol

M.B.F. Samla* and P.S. Warakagoda
Department of Biotechnology, Faculty of Agriculture and Plantation Management,
Wayamba Universityof Sri Lanka.

fathishamlabuhari@gmail.com

Stevia rebaudiana Bertoni is a valuable medicinal plant recommended for diabetic patients and obese people. Although it is currently not commercially cultivated in Sri Lanka, the country has a high potential to open the niche market for stevia products. The conventional way of propagationof *Stevia rebaudiana* is not adequate to fulfill the required demand for large-scale production. Inthis study, the effect of Plant Growth Regulators (PGRs) and additives on *in vitro* shoot inductionand multiplication from nodal explant was studied towards micropropagation. Single nodal cuttings were established on Murashige and Skoog (MS) basal medium and MS medium supplemented with 2 mg/l 6-benzylaminopurine (BAP). This experiment was done to determine whether the basal MS medium is sufficient or not when compared to a medium supplemented with cytokinin for bud breaking. The highest shoot bud initiation was obtained on MS medium supplemented with 2 mg/l BAP. The maximum mean number of shoot buds per explant (4.20 ± 1.28) was recorded in this medium after three weeks. The induction of shoot buds was reduced inbasal MS medium, and the nodal explants only produced a maximum of two shoot buds, which were grown longitudinally. *In vitro* shoot proliferation was tested on MS medium supplemented with previously identified optimal additives, 40 mg/l adenine sulphate and 200 mg/l carbendazimand different concentrations and combinations of BAP, Kinetin (Kin) and 1-naphthaleneacetic acid (NAA). Due to the combined effect of PGRs, the number of shoots per explant, number of leaves per explant, and average length of shoots showed significantly ($P \leq 0.01$) different values.MS media supplemented with 2 mg/l BAP was found to be the best treatment for shoot proliferation, with 6.8 mean shoots per explant, 25.2 mean leaves per explant, and a mean averagelength of 2.36 cm after four weeks. This study evaluated the impact of combining BAP with low levels of Kin and NAA on *S. rebaudiana* shoot proliferation. Most studies suggest that the combination of BAP and Kin gives best shoot proliferation in *S. rebaudiana*, but in this study, BAP alone was found to be superior to BAP combined with Kin. Also, relatively low number of shoots were formed with the addition of NAA, especially in combinations like BAP + NAA and BAP + Kin + NAA. The study found the importance of having a cytokinin for shoot bud initiation and MS medium supplemented with 2.0 mg/l BAP, 40 mg/l adenine sulfate, and 200 mg/l carbendazim for subsequent shoot multiplication of *S. rebaudiana.*

Keywords: Additives, *In vitro* shoot proliferation, Micropropagation, Plant Growth Regulators, *Stevia rebaudiana*

Impact of *Pongamia pinata* crude oil-based fuel additive in a two-wheel Petrol engine

Azhar W.M.*, Madushan E.K. and Niroshan T.S.

Department of Engineering Technology, Faculty of Technology, University of Jaffna

mohammedazharr99@gmail.com

Fuel Additives have been identified as the stimulators for the improved performance and efficiency of conventional engines. Improving the fuel efficiency through an additive is an important concern. Research is being performed to introduce fuel additives that can increase the fuel usage efficiency in petrol engines. This research aimed to analyze the applicability of a selected fuel additive for improving the performance of petrol internal combustion engines which could be a milage booster for two-wheelers. The transesterification reaction has been performed for the *Pongamia pinata* crude oil with a small amount of Diesel. It is then added to a motorbike engine and the results were evaluated for both petrol alone and a mixture of petrol and novel additive. The data collection has been performed on three different road surfaces along with twovehicle conditions. The road conditions were selected as concrete roads, gravel roads, and earthenroads while the vehicle conditions have been adopted with the driver alone and the driver with a passenger. The mileage of the vehicle has been the notable outcome of this research. The experiment has been performed for 15km in each case to compare the fuel efficiency. It has been highlighted that the milage with a driver alone has increased by 49% on the concrete roads with an 18% and 42% increase in the gravel and earthen roads, respectively. A similar increase has been observed with the driver and a passenger with 23%, 12% and 35% milage increase, respectively. The results from this study provides an opening for further research to analyse the impact on vehicle emissions using the selected fuel additive. It can be concluded that the selectedfuel additive performs well in terms of vehicle milage of the bike used.

Keywords: fuel additive, milage, road condition, conventional engines, *Pongamia pinata* crude oil

Design and analysis of Reconfigurable Frequency Selective Surface unit cell for X-band and C- band applications with angular stability

Rajasri S[1]*, Thilaga V[1] and Rahul Gandh D[2] [1]EGS

Pillay Engineering College, Nagapattinam
[2]National Institute of Technology Puducherry, Karaikal

rajasri2307@gmail.com

The increasing demand for wireless communication has led to a growing need for efficient and reliable frequency selective surfaces (FSSs). FSSs are metamaterial structures that can be used tocontrol the propagation of electromagnetic waves. However, a conventional FSSs are fixed in frequency, which limits their versatility. Reconfigurable FSSs (RFSSs) are a type of FSS that canbe dynamically reconfigured to different frequencies. This makes them ideal for applications where the desired frequency response may change over time. Tradeoff between good angular stability and compact size in RFSS are the most important in the design analysis. In this study, we present a novel design for an RFSS unit cell. The proposed unit cell is based on a Swasthi-shaped geometry, which is known for its good angular stability. The unit cell is reconfigured using PIN diodes, which allow it to resonate at four different frequencies. The RFSS is designed for X-band and C-band applications. The unit cell is reconfigured to 4 different frequencies using 8 PIN diodes without altering the symmetric nature. It is designed for resonant frequencies at 9.24 GHz, 8.75 GHz, 7.45 GHz and 4.75 GHz. The applications of proposed resonances include Indian National Satellite System (4.5 GHz - 4.8 GHz), Fixed-Satellite and Mobile-Satellite (7.25 GHz - 7.75 GHz) and radio locations in military applications (8.5 GHz - 10.5 GHz). By changing the location of the PIN diodes, it can be made to resonate at any frequency of interest in C- or X-band. The overall dimension of the unit cell is 7.2 x 7.2 x 1.6 mm^3. The proposed unit cell has been placed in a square shaped FR4 substrate and analyzed by sending the electromagnetic waves using scattering Parameter Retrieval Method. It has been used for obtaining the transmission/reflection coefficients of the proposed RFSS unit cell. In addition, the Angular stability is estimated by analyzing TE and TM polarizations and found as 40° which signifies the stable characteristics of the proposed FSS even the FSS is offset from its original location. The designed unit cell is compact, ultra-thin (only $\lambda_0/15$ thick corresponding to center frequency) andprovides an alternative to construct broadband reflector for many potential applications.

Keywords: Reconfigurable Frequency Selective Surfaces, PIN diode, TE/TM polarization

Influence of knot points on multi-criteria trajectory planning of an IndustrialRobot

S. Mahalakshmi*, S. Ramabalan# and V. Sathiya&

*Department of Computer Science, Angappa College of Arts and Science, Coimbatore-641105, Tamil Nadu, India
#Department of Mechanical Engineering, E.G.S. Pillay Engineering College, Nagapattinam-611002, Tamil Nadu, India
&Department of Electronics & Communication Engineering, E.G.S. Pillay Engineering College, Nagapattinam-611002, Tamil Nadu, India

#cadsrb@gmail.com

The critical problem of robot-trajectory-planning is addressed in this study. Choosing the ideal quantity of knot points on a trajectory curve is a problem. The MTAB ARISTO 6XT industrial robot's multi-criteria optimal trajectory planning together with three uses for the robot were taken into consideration in this study. The robot's surroundings were examined for stationary, moving, and oscillating obstacles. The robot trajectory was defined by a cubic B-spline curve. Four scenarios with varying numbers of knot points (5, 20, 40, and 60) were analysed. The six criteria for the problem under discussion are: end effector travelling time; robot actuator effort; obstacle avoidance; jerk and acceleration of the robot joints; and singularity avoidance; 32 constraints including gripping force, kinematic parameters, obstacle avoidance, and dynamic parameters; and maximum number of 372variables (coefficients of B-spline functions) were also considered. To solve the issue, two clever optimization algorithms— PSO (Particle Swarm Optimization) and DE (Differential Evolution) were used. PSO is a well-liked population-based optimization technique that is built on mature meta-heuristics. DE is a significant Genetic Algorithm variation. The advantages of PSO and DE are easy to use, population-based, quick convergence, straightforward code, etc. Based on findings of this study, it can be concluded that it is not a good practice to take more than 20 knot points in multi-criteria trajectory planning of an industrial robot. Furthermore, it increases the trajectory planner's computing load makes the issue more complex to solve.

Keywords: Multi-criteria, optimal robot-trajectory-planning, PSO, DE, Number of knot points, obstacle avoidance

Multi-Objective optimization of Mobile Robot Trajectory Planning by considering Velocity Obstacles

V. Sathiya[1*] ,S. Ramabalan[2] ,S. Mahalakshmi[3] and K. Nagalakshmi[4]

[1]Department of Electronics & Communication Engineering, E.G.S. Pillay Engineering College, Nagapattinam-611002, Tamil Nadu, India
[2]Department of Mechanical Engineering, E.G.S. Pillay Engineering College, Nagapattinam-611002, Tamil Nadu, India
[3]Department of Computer Science, Angappa College of Arts and Science, Coimbatore-641105, Tamil Nadu, India
[4]Department of Information Technology, E.G.S. Pillay Engineering College, Nagapattinam-611002, Tamil Nadu, India

[*]sathiyav2105@gmail.com

In both indoor and outdoor situations, mobile robots frequently encounter velocity obstacles thatcross their trajectories. Obstacles with varying velocity cause the robot's speed to change. There is still much to be done to enhance the methods currently in use for precisely predicting the trajectory of robot motion. It is necessary to close this gap. To close the gap, this manuscript suggests two multi-objective optimization techniques based on evolutionary algorithms: Elitist non-dominated sorting Genetic Algorithm (NSGA-II) and Multi-objective Differential Evolution(MODE). A mobile robot that resembles an automobile is conceived, built, and tested. Time spent for traveling and energy used are taken into account as performance requirements in the problem that the suggested methods address. The problem takes into account the bounds of kinematic features, geometrical parameters, and dynamic parameters. There were impediments in the robot's surroundings that were both stationary and moving. Therefore, when the algorithms planned the robot's path, they took into account the motion of both obstacles. The trajectory of the mobile robot is characterized by a third order NURBS function. The outcomes of the algorithms were also validated by experiments. The inferences made from the experimental results are both algorithms result in practically and technically feasible pathways and along the path specified byboth approaches, all geometrical, dynamical, and kinematical requirements are satisfied. The difference between the simulation and the experiment is not very great.

Keywords: Multi-objective trajectory planning, NSGA-II, MODE, Mobile robot, Velocity obstacles.

Method Development for the Determination of Total Fatty Matter and Synthetic Surface Active Agents in Bathing Bar

T.Harshani Lakma Silva, Rohini De Silva, K.M.Nalin De Silva

Department of Chemistry
University of Colombo, Sri Lanka

harshanilsilva@gmail.com

A bathing bar is a product containing both soap and non-soap detergents. It contains soap of fattyacids and synthetic surface active agents as the active ingredients. Generally in Sri Lanka, the amount of these substances is verified at the Sri Lanka Standard Institute. However, the results obtained from the test methods available in SLS 1220: 2016 are found to give a higher variation in both total fatty matter (TFM) and synthetic surface active agents. Therefore, the objective of this study was to develop a modified test method to reduce the variations. In our finding we managed to reduce the variation of synthetic surfactants from 63.9% to 39.7% by using the centrifuged portion of the sample solution at the very initial step of the protocol. For the determination of TFM, two modifications have been made. The first modification was to use diethyl ether for petroleum ether at the solvent extraction step, which enabled the variation to reduce from 17.7% to 1.48%. The second modification was to use anhydrous sodium sulphate atthe final stage of the analysis, which reduced the variation from 11.2% to 3.60%. From this study, it was found that the variation could be reduced by following the suggested modifications, especially for TFM determination.

Keywords: Bathing bar, Total Fatty matter, synthetic surface active agents

Effects of Physical Activity and Sleep Quality on the Overall Health and Wellbeing of University Students in the Colombo District, Sri Lanka

D.S.Nadeesha, M.D. Kassier, P. Sivarajah, R.P.C.D. Perera*

Department of Health Sciences, American International Campus, Colombo, Sri Lanka

spashammi@gmail.com

University students live through a period of many psychological challenges and adaptations, since the transition from school to an independent professional life, which could lead to a frequent undervaluation of any form of physical activity or sleep hygiene, thus resulting in outcomes thatcould impact their overall health and their lives as adults. This study was aimed to examine the relationship between physical activity, sleep quality, and overall health in a sample of Sri Lankan university students in Colombo Sri Lanka., where a cross-sectional study was conducted and thedata was obtained from a sample of 80 University students, age range from 15 to 30 years, including both genders, male and female. All participants were subjected to complete four questionnaires distributed through Google forms as an online survey: General Health Questionnaire, the International Physical Activity Questionnaire-Short Form, Leeds Sleep Evaluation Questionnaire, and Perceived Stress Scale. The results revealed concerning rates of poor sleep quality, moderately elevated psychological distress, and predominantly low to moderate physical activity levels among the students surveyed. However, limitations of this study include its cross-sectional design. More rigorous longitudinal research with objective sleep and activity monitoring is needed to clarify directional relationships over time. Nonetheless, these preliminary results underscore the need to prioritize sleep quality and physical activity to improve wellbeing among university students. Findings can inform institutional efforts to enhance student health and success through addressing modifiable lifestyle factors like sleep and exercise emergesas an impactful strategy to reduce rising rates of mental health issues in this critical population.

Keywords: University students; Overall health; Physical activity; Psychobiological health; Sleep quality

An improved deep learning technique for skin cancer detection and classification based on Artificial Intelligence

S. Senthilkumar*, M. Kavitha

Department of Electronics and Communication Engineering, E.G.S. Pillay Engineering College, Nagapattinam, Tamilnadu, India - 611002.

*senthil.lanthiri@gmail.com

Skin cancer, which arises in the uppermost layer of the skin, is one of the most prevalent types ofcancers. Skin cancer is a deadly condition brought on by unchecked growth of body cells. It has been described as one of the most serious problems affecting public health because a large numberof people die annually due to skin cancer. Due to high similarity in the early stages of skin cancer, diagnosis of various types of skin cancers are delayed. Deep learning (DL) algorithms are well- known solutions in this diagnosis; where, feature sequences and various imaging modalities wereused in conjunction with machine learning techniques to detect skin cancer. In the past, deep learning architectures like deep convolutional neural networks (DeepConvNet) have proven to besuitable for the automated extraction of complex features. An ensemble network based on the integration of DeepConvNet and handcrafted features based on multi-layer feature is proposed inthis work to further enhance the efficiency of the DeepConvNet models. Skin cancer segmentation Multi-Scale Attention U-Net (MSAU- Net) is used in this study. By incorporating an attention mechanism at the network's feature selection to model the hierarchical representation, a specifically enhanced typical U-net was used. The attention module uses a channel- wise normalization technique to rebalance the feature vectors based on their contribution to the object recognition level after receiving multi-level feature maps from the encoding model. The dermatologist can use a visual rationale to identify new classes and add good examples to the existing datasets using the proposed method, which combines the DL model with AI for improvedperformance in the early detection of skin lesions. This is a significant contribution to both increasing the accuracy of skin cancer detection and identifying the new classes.

Keywords: Deep Learning, Image Processing, Segmentation, Artificial Intelligence, Neural Networks

Green Space for Healthy Minds of Urbanites: Identification of the Impact of Urbanization on Mental Health and Future Research Needs

D.S.B. Ratnayake

Industrial Engineering Training Institute, National Apprentice & Industrial Training Authority
Katubedda, Moratuwa-Sri Lanka

ratnayakeduminda394@gmail.com

Rapid urbanization and urban life of the people make series of negative impacts on the mental health of the individuals. There is a pivotal role in the planning of green space for environmental quality enhancement and living standards of the residents. Green parks, green gardens, trees grown near streets and riversides and backyards can positively affect on the stress reduction of the human minds. The aims of this paper were to present the usefulness of green space for the wellbeing of urbanites, its effect on the suppression of mental issues and identification of the future research needs. The methodology adopted in the study was qualitative in nature with a content analysis of literature. Analysis of the impact of urbanization on the mental health through social, economic, and environmental factors is needed. Pervasiveness of the common mental disorders is found in the cities. Disparities and insecurity in the society, environmental pollution and minimum environmental exposure were the recognized factors affecting the situation.Poverty, fear of crime and ethnicity like factors result in some mental issues of urbanized people,such as depression and aggregation in mind, anxiety and sadness like situations and, abuse for substances while improving the personality disorders of individuals. Further, sexual problems, gambling and corruption behaviors like issues are frequently found in urbanites. Green space established on urban areas uplift the various points of thinking together with attention, memory and creativity in people both with and without depression. It also provides a guide, reference, and inspiration for policy suggestions to enjoy ecology. There is a positive association between exposure to green space and better mental health by directing to the policy suggestions through researches.

Keywords: Green Space, Mental health, Urbanization, Research

Mapping and Assessing Degraded Mangrove Species in Muthupet Mangrove Forest, Tamilnadu, India, Using Hyperspectral Data: A Remote Sensing Approach

Ayyakkannu Selvaraj[1], Subbarayan Saravanan[2]

[1]Associate Professor, UDICT, MGM University, Chh.Sambhajinagar
[2]Associate Professor, Department of Civil Engineering, NIT Trichy

aselvaraj@mgmu.ac.in

The degradation of mangrove ecosystems due to insufficient freshwater inflow and anthropogenicactivities threatens their health and vitality. This study aimed to map and assess degraded mangrove species in the Muthupet mangrove forest in Tamil Nadu, India employing hyperspectral data from the L1Gst Hyperion sensor. The methodology involved preprocessing the Hyperion data, analyzing data dimensionality for bands and pixels, extracting endmembers using an n-D visualizer from pure pixels, and comparing them with a reference spectral library generated by a FieldSpec3 spectroradiometer. The unique optimized endmembers for each species were then applied to Hyperion reflectance data using the Spectral Angle Mapper (SAM) algorithm. The Spectral Angle Mapper (SAM) algorithm was utilized to assess how closely the spectral signatures of pixels in a hyperspectral dataset match with reference spectra (endmembers). This method proved valuable in characterizing mangrove, as it helped identify and differentiate specific mangrove or types of vegetation based on their unique spectral properties. SAM calculated the spectral angle between the reference spectra and the spectral characteristics of individual pixels. Lower spectral angles implied greater similarity, aiding in the classification of land cover types, such as mangrove species in this study. The resulting classified image unveiledsignificant degradation in the Muthupet mangrove forest. Despite the provision of endmembers in pure pixels rather than object-based regions of interest for classifying Hyperion data, the approach yielded reasonable accuracy. Through this extensive study, it was identified that *Avicennia marina* occupies the largest degraded area with 340.7 hectares, followed by *Rhizophora mucronata* covering 272.4 hectares. Other degraded mangrove species include *Acanthus ilicifolius* (167.1 ha), *Aegiceras corniculatum* (191.7 ha), *Rhizophora apiculata* (72.5 ha), and *Excoeceria agallocha* (54.5 ha). The overall classification accuracy for identifying mangrove species was determined to be 85.6%, with Kappa statistics reaching 0.79.

Keywords: *Avecennia marina*, SAM, Hyperion, Muthupet mangrove, FieldSpec3, endmembers

INSIGHT

Technology Campus
Insight Institute of Management and Technology
Udathennawatta, Ganetenna, Hingula,
Mawanella,
Sri Lanka.
insightedu.lk