General Sir John Kotelawala Defence University
Sri Lanka

KDU IRC
INTERNATIONAL RESEARCH CONFERENCE

ABSTRACTS

Engineering Excellence through Collaborative Research and Innovation

11TH INTERNATIONAL RESEARCH CONFERENCE

Securing Professional Excellence through Collaboration

13th - 14th SEPTEMBER 2018

This book contains the abstracts of papers presented at the 11th International Research Conference of General Sir John Kotelawala Defence University, Ratmalana, Sri Lanka held on 13th - 14th September 2018. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form, without prior permission of **General Sir John Kotelawala Defence University, Ratmalana, Sri Lanka**

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MESSAGE FROM THE SECRETARY TO THE MINISTRY OF DEFENCE

It is with great pleasure that I am issuing this message to the International Research Conference 2018 of the General Sir John Kotelawala Defence University (KDU) as the Secretary to the Ministry of Defence and the ex-officio Chairman of the Board of Management, KDU.

I wish to place on record my sincere appreciation to KDU for playing a leading role in molding the future of the military as well as civilian youth who are in pursuit of high quality tertiary education in Sri Lanka. Today, KDU has gained recognition as an excellent seat of learning and disseminating knowledge that empowers attitudes and develops skills of the young graduates. It also contributes immensely to the much needed research and innovation.

KDU IRC is an annual event in its calendar eagerly anticipated by many due to the significance it holds in providing a platform for both local and international intelligentsia to congregate, confer and disseminate knowledge. I am sure that, under this year's theme, securing professional excellence through collaboration, the conference will encompass a wide range of topics that are of utmost benefit for potential scientific and socio economic advancement in Sri Lanka.

While expecting to see great minds from all over the world meet and share their thoughts and knowledge at this event, once again I express my sincere appreciation to the Vice Chancellor and KDU staff for the enthusiasm and commitment shown towards making this scholarly experience a memorable one for its participants.

I wish that this international research conference would be highly productive for all participants – a conference that enriches the much needed research culture to ensure the nation's growth enabling to face its future challenges.

Kapila Waidyaratne
President's Counsel
Secretary

MESSAGE FROM THE VICE CHANCELLOR

I am delighted that we have been able to organize the 11th International Research Conference of General Sir John Kotelawala Defence Univeresity (KDU IRC – 2018) conducted on the overarching theme, "Securing Professional Excellence through Collaboration" and convened over two days, 13th and 14th September 2018 at the university premises. Hence, it is with great pride that I pen down my thoughts on this Abstract Book of KDU IRC-2018.

KDU IRC-2018 is a world class forum that brings professionals and researchers of various disciplines to a common platform to disseminate their valuable research findings. They are able to present, discuss and deliberate their research findings with peers and experts, both local and international, as well as engage in lively discussions on contemporary matters. The resource personnel of the conference are eminent Sri Lankan and foreign researchers, academics and professionals with international recognition including those of our own staff at KDU.

We are proud to have internationally eminent, Sri Lankan born scientists, such as, Prof. Mohan Munasinghe and Dr. Sarath D. Gunapala, as guest speakers at the inauguration of the conference. They have made our motherland proud in the international arena as renowned experts and intellectuals in their respective fields. Further, this conference is enriched with the participation of many local and foreign academics in varied disciplines; along with personnel from the tri-services and the police, thus making our conference the only research conference in Sri Lanka that brings together civilian professionals and their counterparts in security forces.

What is special about this conference is that the research papers are automatically uploaded to Google Scholar with H-Index Citations. The best papers are published in journals and others as proceedings. In addition, provision is given for live telecast of oral presentations through YouTube, and presentations on Skype, for international authors. The plenary sessions, pre/post-conference workshops and oral and poster presentations, would no doubt generate productive discussion and constructive criticism which would in return instigate thoughts for development in future.

I wish to record our gratitude to the Ministry of Science, Technology and Research and the National Science Foundation, not forgetting the Ministry of Defence, for their consistent support in co-organizing our conference, and my sincere appreciation of the academic and administrative staff of KDU together with our well-wishers for their invaluable contribution towards the success of this mammoth event.

Finally, I wish you, the presenters, good luck with your scholarly presentations at KDU IRC-2018 and the participants a memorable and thought provoking experience.

JJ Ranasinghe VSV, USP, psc, MSc (DS) Mgt
Rear Admiral
Vice Chancellor

MESSAGE FROM THE CONFERENCE CHAIR

On behalf of the Executive Committee, I am honoured and delighted to welcome you to the 11th International Research Conference of General Sir John Kotelawala Defence University (KDU IRC-2018); bearing the theme, Securing Professional Excellence through Collaboration. Over the past 11 years, KDU IRC has grown to be a major international research conference, continuing with its tradition of high-quality and broad international participation in all areas of research. Hence, it is a pride and honour to preside over this prestigious research conference in Sri Lanka.

I am very pleased to welcome you to KDU IRC-2018 which is based on fundamental concerns to all scientists and non-scientists alike. This conference also enables the exchange and dissemination of useful information on multilateral initiatives. Therefore in bringing us together, KDU IRC -2018 allows to seek out and forge new partnerships, and to engage relevant sectors in advancing the social and economic well-being of mankind.

KDU is gratified to have a line-up of highly renowned keynote and plenary speakers consisting of experts who would shed light on research and issues. In addition, this is an opportunity for undergraduates, researchers and practitioners to share their research and contribution towards the success of the respective professions, through oral and poster presentations.

The successful organization of KDU IRC -2018 required the talents, dedication and invaluable time of many academic and administrative staff of KDU, volunteers and strong support from our sponsors; the Ministry of Science, Technology and Research, and the Ministry of Telecommunication, Digital Infrastructure & Foreign Employment. Special gratitude and appreciation goes to the Presidents, Coordinators and the members of the numerous committees of the faculties. Without their wise advices and suggestions; outstanding organization, planning and performance, we would not have had such an excellent conference.

I hope KDU IRC -2018 would offer the participants a platform to exchange ideas, discover novel opportunities, reacquaint with colleagues, meet new friends and broaden their knowledge.

Dr Upali Rajapaksha
Conference Chair
11th International Research Conference

MESSAGE FROM THE SESSION PRESIDENT

It is with great pleasure that I deliver this message for the Engineering Session of the 11th International Research Conference of General Sir John Kotelawala Defence University, which is conducted on the theme "Engineering Excellence Through Collaborative Research and Innovation". The Conference will provide a sound platform to discuss issues and challenges encountered by Engineers in the present environment, and it will also provide inputs for developments in the global sector.

The conference places great emphasis on bringing in more and more research articles that address issues in a wide range of Engineering fields. The variety of papers cover a broad range of more specialized fields of engineering. The significance of the session has been endorsed by progressive increment of papers submitted by researchers from various institutions.

Engineering is always facing numerous challenges of its own, and hence it is really needed to enhance the focus on innovation. This Engineering session is an attempt to analyze those challenges. This session will also provide a great opportunity for scholars and professionals to share various innovations and research findings and thus the participants will be able to gather vital information and learn from one another on different strategies how to secure engineering excellence in the future. I am confident that this session will provide significant insights and contributions on different research and innovation in the field of engineering. This will, no doubt, also be of considerable benefit for a better Sri Lanka.

At the Engineering Plenary Session, the guest speakers will share the technical know-how to add further value to this timely conference. On the second day, five Technical Sessions, followed by a Poster Session will give ample opportunities for participants to get insights into a wide variety of engineering research and innovation.

I would like to thank all session chairs, guest speakers and authors for their immense contribution and my sincere appreciation goes to conference organizers and faculty members for their dedication and hard work to make this event a success. I hope that everyone will enjoy a stimulating and productive conference, IRC 2018.

Eng (Dr) WCDK Fernando
President
Engineering

Plenary Session

AIRBORNE MEASUREMENT – ADVANCED INSTRUMENT DEVELOPMENT METHODS AND INSIGHT

Prof Nicholas Lawson

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National Flying Laboratory Centre, Cranfield University, UK

Airborne measurement is required in many fields of aerospace, ranging from aircraft development and flight test, to atmospheric sciences. It involves the use of aircraft mounted instruments to measure quantities ranging from simple parameters such as pressure and airspeed, to more complex quantities such as atmospheric aerosols and solids. Although well-established traditional methods are available to design instruments in the airborne environment, the application of new advanced methods and sensors to refine instrument design, has seen slow adoption by most of these fields. The following paper presents examples of new approaches, which are used to refine a number of airborne instruments, including the measurement of sideslip angle and angle of attack using traditional instruments and strain and pressure using advanced fibre optic sensors. An example of the application of these methods to aerosol measurement is also discussed. In most cases, it is concluded instruments can be readily and quickly refined using these new techniques, including computational fluid dynamics and new sensors also offer potential improvements in the measurement of many airborne measurands.

TECHNICAL AND NONTECHNICAL EFFECTS OF ROAD SIGNING AND MARKINGS

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Highways play an important role for an economic and social development of a country. Due to various technical developments many improvements introduced to highways as well as transportation section contributed to increase the average speed of moving vehicles along roads. For the same reason, time to make decisions while driving also reduced considerably.

Different kinds of driver assistance systems evolved to improve the efficiency as well as safety on roads. Road signing and markings together with new rules and regulations were introduced at different stages to fulfill the above requirements. The purpose of this presentation is to highlight the importance of road signing and markings on roads to control driver behavior as well as guide drivers because it is vital for efficient function of newly constructed roads.

Road signing and markings improved during last decades with numerous technical and psychological concepts. Materials used, new concepts to address driver attitude, control misbehavior of drivers were few to mention. Modern road signing and markings are there to control drivers mentally as well as physically.
To have the expected benefits of newly built roads, these road signings and markings play a very important role.

ENGINEERING RESEARCH FOR A BETTER COUNTRY, BEYOND THE SEEING EYES

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A country invests in universities and research institutes in developing the know-how for development and seeking solutions to the issues at national level, rather than providing employment to her adult population. Out of many such higher education streams "engineering" is specifically designed to produce experts that could address technological needs with short- and medium-term solutions. Thus, an engineer is expected to keep his eyes open to start from a real problem, then march towards the best potential solution, in the shortest possible time. However, in many so-called "developing countries" a majority of researchers, even in the field of engineering, tends to work in their own comfort zones rather than looking for the needs of the nation. Until this psyche of the research community is totally amended, a country will remain underdeveloped with the self-pacifying label of "a developing country". A nation that is prepared to get away from this vicious path needs to build up a clear vision and mission that is well-tailored for the country of concern. Framing the vision is anyone's job but strategizing the mission is for someone with high intellectual capacity.

UPLIFTING QUALITY OF LIVING OF PHYSICALLY WEAK INDIVIDUALS: ROLE OF POWER ASSIST ROBOT SYSTEMS

Prof Ruwan Gopura

Head of the Department
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In the world today, a considerable number of persons have become physically weak as a result of full or partial loss of functions in upper and lower limbs. The common reasons for occurrence of such weaknesses are trauma, sports injuries, occupational injuries, spinal cord injuries, strokes, congenital disorders, and aging. The healthcare industry is facing major issues in providing support for activities of daily living of the physically weak individuals. Moreover, the diminishing working population also affect the socio-economic growth of the country. In this situation, power assist robot systems play an important role to uplift the quality of living of physically weak people in numerous ways. An exoskeleton robot is a power assist robotic system which can be used to rehabilitate patients or assist limbs of physically weak individuals to carry out activities of daily living. Bionics Laboratory of University of Moratuwa is developing exoskeleton robots to assist physically weak people. This talk will outline selected recent developments in power assist robot systems. Compatible mechanisms developed at the Bionics Laboratory of University of Moratuwa for the lower limb exoskeleton robots will also be introduced. Future directions of the power assist robot systems are also discussed considering the recent studies.

Technical
Sessions

METHOD TO DEVELOP NOVEL DIGITAL VIDEO SURVEILLANCE FEATURES TO ENHANCE HOME AND BUSINESS SECURITY MANAGEMENT

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Human detection in images and videos have been one of the most challenging and important research topics in computer vision and machine learning. A security application for automatic human detection using video streams from surveillance cameras in home and business places is discussed in this paper. The main objective of this study was to identify the object motions in real-time video surveillance and identified information send an alert message to the user. The proposed prototype was used to capture foreground image frames and detect objects using background subtraction algorithm. The shape-based object classification was used to differentiate human objects from other objects. Three Haar-Like classifiers; Head and shoulder, Upper body and Full body classifiers are used to abstract the human features on real-time image frames. The video surveillance security algorithm calculates specific threshold value. The threshold value concludes the image frame as the specific human. The system creates a log file, wrote count of detected human objects, date and time. This video surveillance security method was developed using OpenCV that detect people's basic postures and immediately send an email and a message to the user. This system is proposed as a novel feature of digital surveillance to be used for security purposes to record unauthorized physical access, and to detect and identify relevant objects.

Keywords: Background subtraction, Haar-Like classifier, Human detection, Video surveillance

DEVELOPMENT OF A BUDGET ROOF FAIRING USING A CFD ANALYSIS OF DIFFERENT ROOF FAIRING SHAPES

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Semi-trailer trucks are commonly used in Sri Lanka for long distance transportation. These trucks are subjected to an unfavourable high drag which makes a huge impact in fuel consumption. In order to reduce this drag, semi-trailer truck cabins are implemented with a roof fairing which provides a perfect air flow over the entire vehicle. Purpose of this research was to evaluate the efficiency in drag reduction of different roof fairing shapes by conducting a computational fluid dynamics (CFD) analysis. Simulations were done on a 1:1 scaled semi-trailer truck model which was modelled using the blueprint of a commonly used truck model in Sri Lanka. Initial simulation was done without the roof fairing and results were compared with the values of coefficient of drag provided by the manufacturer to improve the accuracy of the research. Different roof fairing shapes were then modelled and attached to above mentioned cabin model and CFD simulations were performed. Subsequent simulations were done using three truck speeds which were 30, 60 and 100 kilometres per hour. The efficiency of each roof fairing was analyzed during the post-processing phase after the estimation of the coefficient of drag values. Effect of other coefficients such as coefficient of lift and moment were also considered during the analysis. Results which were achieved through the simulations illustrated a drag reduction excess of 10-25% due to the impact of the geometry and the deflection angles of the roof fairing. Based on the analysis, an effective roof fairing shape was proposed which can be manufactured at a lower cost compared to the roof fairing shapes that are available in Sri Lanka. Final outcome of this research will be helpful for designers to design more effective roof fairings for semi-trailer trucks with improved drag reduction.

Keywords: CFD, Drag Reduction, Wind Shield

DESIGN AND DEVELOPMENT OF A FLYING OBJECT FOR INSPECTION AND CLEANING OF DISTRIBUTION POWER LINES IN SRI LANKA

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Inspection, detection and cleaning are essential for the maintenance of distribution power lines (DPL). Developed countries use helicopters and unmanned automated vehicles (UAVs) for this purpose. Helicopter usage is efficient but costly, ineffective and affordable for developing countries. Manual inspection and cleaning is the current method used in Sri Lanka. Most research on UAVs in the developing world are at experimental level; practical appliances have been slightly neglected. It is possible to use UAVs to inspect, detect and rectify the issues occur in DPLs in Sri Lanka. This method can reduce costs, risks and the logistic problems of manual inspection and cleaning of DPLs. Aim of the main project was to design and develop an Unmanned Automated Flying Object (with a Robot Arm) and test its' applicability in inspection and cleaning of DPLs in Sri Lankan context. This paper describes the design of the model aircraft and preliminary test results of flying, video transmitting and receiving performances of the Quadcopter. Design of the system architecture of the model aircraft encompasses a flight control system, Xbee module, inspection camera and a robot arm. The flight control system was tested by practical demonstration. Flying route was recorded from the ground station. The inspection system was tested by the visual images transmitted to the ground station. The Quadcopter demonstrated safe flying. Minor errors caused in inspection and detecting may be due to sudden winds, poor GPS signals or electromagnetic interference. Testing of the robot arm is still underway. Upon completion of the experiment this Quadcopter can be used in Sri Lanka to detect contaminations and clean DPLs.

Keywords: Unmanned Automated Vehicle (UAV), Quadcopter, Distribution power lines (DPL), Inspection, Cleaning

IMPACT OF HUMAN FACTORS ON AIRLINE OVERALL MAINTENANCE EFFECTIVENESS: AN ANALYSIS OF MAJOR AIRCRAFT OPERATORS IN SRI LANKA

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Skill based error and mistakes form a significant part of the effect of aviation human factors as far as maintenance is concerned. Many air and ground incidents have been traced back to have occurred due to lapses that occurred during handling and maintenance of aircraft, which resulted in such human errors. Proper identification of the possibility of such mistakes and errors to occur in a given maintenance environment and finding steps to mitigate the same is crucial in order to increase the effectiveness of the airline's maintenance programme. This research focused on the maintenance environments of two of Sri Lanka's leading aircraft operators. For diversity, a civil and military maintenance organization was selected. Information was gathered by means of a structured questionnaire and existing records of aircraft related incidents and occurrences. Quantitative and qualitative analysis of data was conducted. Quantitative analysis was done using SPSS software and comparisons were made between different indicators such as workplace design, fatigue, routine violations etc.

It was found that mistakes amount to a higher percentage of errors caused, whilst skill-based errors have a significant contribution as well. Identification of the probable causes and prevailing condition of human factor contributions to maintenance effectiveness will provide insight to the respective organization to find better solutions to overcome existing shortcomings.

Keywords: Human factors, Mistakes, Maintenance effectiveness, Skill Based errors.

OPTIMAL CREW PLANNING THROUGH VARIABLE CAPACITY ASSIGNMENT FOR COMMERCIAL AIRCRAFT FLIGHT LINE MAINTENANCE

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Crew planning and scheduling is researched intensively as it affects the aviation operational costs substantially. Maintenance crew planning is an integral part of the same, where less emphasis is paid compared to flying crew scheduling. This paper presents an optimal framework for commercial aircraft flight line maintenance labour planning. A mathematical model combined with a management framework named "variable crew assignment" is used to discover optimal crew combinations, shift sizes and shift starting times. Maintenance workforce is used as the main variable and is applied variably to suit the fluctuating demand. The framework is articulated in such a way that it can accommodate different types of aircraft with different maintenance certifications. This optimal framework would enable aircraft maintenance planners to identify most appropriate combinations of crew sizes, shift patterns and respective shift staring times to fulfil varying maintenance demand.

Keywords: Line maintenance, Manpower planning, Integer Programming, Variable crew assignment

LIGHT INTERFACE FOR 3D HAND MOTIONAL GESTURE RECOGNITION IN HUMAN COMPUTER INTERACTION

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Hand gestures play a significant role in Human-Computer Interaction (HCI) where traditional interaction method like Keyboard, Mouse or Joystick induce stress and fatigue to the user when interacting with computing environments. Technique like smart wearable glove, able to capture gestures more accurately compare to image- based recognition but it disturbs the user's way of living. In this proposed light-based technique, simple motions of a hand like up, down, left, right, combine fingers motion like zoom in, zoom out, left rotation, right rotation, forward & Backward will be interfere with light-medium. The reflections of light from hand motional actions capture to process as interaction into computing environment. The technique, interact user's hand motion with Infrared (IR) light medium. And through an array of Photodetectors (IR), the reflected light intensity measure to extract various distances from the array to hand and fingers. The sensor array directly coupled with the processing device, which convert light various intensities into voltages. Through programming and Machine Learning techniques, the proposed method able to identify the gestural aspect of the hand. The technique able to overcome the problems like background conditions, proper exposure towards the camera, start/stop aspect of the gesture and noise in image based HCI techniques. By continuous processing of IR reflections, the method able to identify various hand 3D motional gestures with easily compare to direct and indirect based interaction techniques. The technique easily able to customize for different users' requirements and different environment to support human Computer Interaction. Further, this method supports simultaneous multiple user 3D interaction with the computing environment.

Keywords: Hand Gestures, Light-medium, Interaction, IR, Customize

EARLY WARNING SYSTEM FOR LANDSLIDES USING WIRELESS SENSOR NETWORKS

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Landslides are main problem which occurs in many areas in Sri Lanka. It causes a considerable damage to the natural habitat, environment, economy and other resources. Monitoring, predicting and controlling are the three major challenges associated with landslides due to the randomness of the event. Yet, developing an accurate prediction mechanism with an effective early warning system has become a need of the hour since the damages and the losses done by the landslides are intolerable. Although there are expensive, advanced mechanisms deployed in foreign countries to predict the possibility of occurring landslides such as; satellites and radar systems with artificial intelligence capabilities, Sri Lanka find it difficult to afford them due to the high cost and the advanced technologies used. When compared with the existing high-end systems, a simple wireless sensor network which is capable of identifying the underground movements and soil conditions is a cost effective, practical solution. But, dealing with a large number of variables manually with no proper understanding about their contribution for the occurrence of a landslide is difficult. Machine learning, which is a method used to create complex models and algorithms that lend themselves to predict; is a fruitful solution for that issue. This research work is carried out to develop a cost-effective early warning system for land slide using WSNs incorporating machine learning.

Keywords: Wireless sensor network, Machine Learning, Landslide Prediction, Early Warning

LOW COST REAL TIME TEMPERATURE MONITORING SYSTEM FOR CONCRETE USING WIRELESS SENSORS

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Structural health monitoring (SHM) has become an inevitable part in a life span of a structure due to its potential to ensure the public safety and to increase the life span of the structure. Monitoring any kind of structures for various parameters, using wireless smart sensors has gained popularity in the recent past. This paper discusses the development of low cost real time wireless smart sensor monitoring system to monitor early age concrete temperature in real time. Internal temperature of two standard size concrete cubes cast using two concrete mixes (Mix1, Mix2) were measured in real time for 24 hours using DS18B20 sensors connected with the NodeMcu, which is an open source IoT platform. Temperature measurements were saved and visualized in real time using ThingSpeakTM which is an open IoT online platform with MATLAB analytics. The temperature sensor DS18B20 was selected such that it is suitable to measure temperature readings of the concrete without any interference of the chemical reactions in concrete. Calibration methods and temperature variation with different concrete mixes are also discussed. It could be seen that wireless temperature monitoring system performed adequately, and it can be considered as a better low cost alternative for traditional wired temperature monitoring system.

Keywords: Structural Health Monitoring, Wireless smart sensors, Wireless temperature monitoring system, Concrete, low cost.

INVESTIGATE THE NECESSITY OF USE OF NUCLEAR POWER AS AN ENERGY SOURCE IN SRI LANKA WITH SPECIAL CONCERN ON PRESENT NUCLEAR TREND

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The escalation of electricity demand in a country has become an unavoidable factor. Technological development and raising people's living standards are the main reasons for increasing electricity demand. Electricity demand in Sri Lanka has grown at an annual rate of about 6% over the past ten years. Therefore, it is important to increase the total installed capacity through appropriate power generation combinations. Clean, reliable, affordable, balanced and sustainable energy structure by giving priority for renewable energy generation while minimizing the contribution of diesel and coal is the strategy of Government of Sri Lanka (GoSL). The unreliability of renewable energy sources such as solar, wind and hydropower questions their contribution to sustainable energy mix. Concerns about environmental issues have limited the development of fossil fuel power plants. Hence, Nuclear Power Plants (NPPs) can be considered as strong and competitive candidate in Sri Lankan energy industry. Ceylon Electricity Board (CEB) has included their proposal to consider nuclear power plant (NPP) in Sri Lanka after 2030. The higher plant factor, capacity, efficiency, reliability, zero or less emissions of greenhouse gases are the advantages of NPP while high capital and maintenance cost, complexity of technology, possible radiation threat are main disadvantages of NPPs. Political, social, environmental, cultural and economic bottlenecks are mainly connected with complexity of technology. There are many technologies being used for NPPs, but most of them are more complex, costly and accidents-prone. This research examines the necessity of nuclear energy to Sri Lanka with special concern on nuclear trends which are growing in Sri Lanka and all over the world favourably with nuclear technology.

Keywords: Nuclear Power, Energy mix

SMART DEVICE FOR CLOSE-MONITORING IN ELDER CARE

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Elder care is an area in modern society where a series of issues are encountered. There is a feasibility to find solutions pertaining to the issues of elder care by using wearable sensors and telemonitoring devices. This paper will discuss monitoring of critical diagnosis parameters of the elders who are bedridden using Internet of Things (IOT). A survey was conducted to identify the environmental factors which affect the elder care service and the management of sudden accident and making alarm under conditions of emergency. It was identified from the survey that blood pressure, body temperature, pulse rate, heart rhythm and Electro Cardio Graph (ECG) are highly important for diagnosis procedure by doctors. In the same way this parameter can be obtained via telemedicine even though the doctor is a long distance away from the patient. Further, elder care service providers can monitor many elders from a long distance by checking critical environmental factors such temperature, humidity and fall detection by using IOT. All these requirements can be fulfilled by confining all sensors in a wearable jacket.

Keywords: Eldercare, IOT, Wearable Sensors

EIGENFACES-BASED FACE RECOGNITION DEVICE FOR VISUALLY IMPAIRED PEOPLE

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This paper proposes to develop an embedded system-based instrument for visually impaired.It is a wearable device in the form of a badge holder of the patent which is designed using Raspberry Pi in addition to visual and hearing sensor. This system works to detect the human faces. With this help user can identify the person in front of the vision sensor. Python programming and OpenCV computer vision and machine learning library was used to simulate a system that aids the blind person to recognize his family and friend's facial images that are stored in a database, and if a match is found on the database, the system will announce the name of the person via sound sensor to the blind person. Further, for this system modelling we used various algorithms, Viola–Jones object detection framework as known as Haar Features for face recognition and principle component analysis (PCA), Eigenfaces for face detection and python text to speech library used for audio output. The simulation considered the recognition of a static facial image (photo) and a live facial image. The results showed that the Eigen face algorithm and Viola–Jones object detection framework perform better. It has a small recognition time and work properly under different face orientation. This system is beneficial in terms of its portability, low cost, low power consumption.

Keywords: Visually impaired, Computer vision, Haar features, Eigenfaces, PCA, Raspberry pi, Open CV

COMPARISON ON VIRUS DYNAMICS MODELS WITH DIFFERENT FUNCTIONAL RESPONSES INCLUDING TIME DELAYS

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A virus can be identified as an infectious mediator consisting a core of genetic material and an envelope of protein. The behavior of viruses can be modelled through mathematics, and those viral dynamics can consist a class of differential equations which describe the effect of the virus on uninfected and infected cells, in a body compartment over a period of time. Even though many mathematical models have been proposed for various viral infections, a proper assessment on them has not been done throughout the literature. In this paper, dynamics models with bilinear, Michaelis – Menten, saturated and Beddignton-DeAngelis functional responses have been compared, with respective to the time delays and the basic reproductive rate (R_0). For the considered models, the populations of uninfected cells, infected cells and free virus were calculated to find solutions for respective infection free and infected equilibriums. By carrying out numerical simulations through literature reported parameter values, the effect of intracellular and maturation time delays on the corresponding reproductive rate of each model was analyzed. Since a reproductive rate, less than unity represents an infection free host, the primary target of the treatments for viral infections is to decrease the reproductive rate as possible. The graphical representation showed that the model with Beddignton-DeAngelis functional response, possessed a greater capacity in reducing R_0, with the effect of time delays. This qualitative analysis on models will have the capability to give the drug producers more significant guidance in recognizing the most appropriate viral dynamics model.

Keywords: Viral dynamics, Delay differential, Reproductive rate

A COMPUTER-BASED ANALYSIS OF ACOUSTIC PROPERTIES OF SRI LANKAN *PIRITH* CHANTS USING VOICED TO UNVOICED RATIO AND PROBABILITY DISTRIBUTION FUNCTIONS

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'Pirith' is a special type of chanting believed to be a protective doctrine preached by the Load Buddha in Pali language. Generally, a voice signal consists of the fundamental frequency, F_0 and a series of harmonic frequencies called as formants, F_n. As reported by several other studies, characteristic formant frequency distributions are identified in chanting, in contrast to normal speaking. This work is dedicated to developing a phonetic picture on Pirith chants, investigating probability distribution of formants and quantifying voiced to unvoiced ratio utilizing computer-aided tools. In this study, 25 samples of each Rathana, Karaneeya Metta and Angulimala Suttas recited by male monk chanters were recorded using high precision microphone array and then it was subjected to splitting of smaller voiced segments of frame length 10 ms sampling at a rate of 44.1 kHz. In the computational speech model, a pre-emphasis filter is applied to the sampled time series of voiced segment to cancel out the effect of glottis. Then frame-by-frame analysis was used with hamming windows and liner predictive coding (LPC) and auto correlation to extract the formant values. Voiced to unvoiced ratio is assessed using zero crossing rate and energy content of the acoustic signal. Results of the Voiced to Unvoiced ratio wasover 75% of voiced frames in all types of Suttas despite number of monks involved in chanting. Having a high percentage of voiced frames, interpret strong contribution of vibrating vocal folds involved in chanting of Pirith Suttas. Further, Probability Distribution Functions (PDFs) of each Sutta is generated and compared for first five formants. Angulimala Sutta and Ratana Sutta show similar patterns in terms of PDFs while Karaneeya Metta Sutta indicates a clear discrepancy demonstrating a unique set of characteristics.

Keywords: Formant frequencies, Voiced to unvoiced ratio, Probability distribution functions

A UNIT CELL APPROACH TO REDUCE COMPUTATIONAL TIME OF MESHFREE-BASED PLANT TISSUE MODELS

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'Plant tissue modelling and simulation has become one of the popular research topics in the field of computational mechanics. In this regard, numerous numerical modelling techniques are being researched to study real tissue mechanisms with the help of High Performance Computing (HPC). Among such numerical modelling techniques, meshfree methods have a higher capability, particularly in modelling critical plant tissue deformations during drying. However, existing meshfree-based models are computationally expensive in modelling real tissues made out of large number of cells, limiting their applications in the real world tissues having thousands of cells. Such limitations are mainly due to the computationally inefficient conventional neighbourhood treatment methods used in above numerical methods. Accordingly, this research aimed to develop a meshfree-based unit cell approach which can be used as a building block to model large tissues. Here, a novel Fixed Neighbourhood-based SPH (FN-SPH) method was involved to setup a unit cell representing several real cells (seven cells here). Compared to the original tissue with seven cells, the tissue made out of the unit cell approach resulted in approximately 80% of overall computational time reduction, highlighting the capability of this approach in reducing the computational cost in simulating large-scale plant tissues.

Keywords: Fixed Neighbourhood based Smoothed Particle Hydrodynamics (FN-SPH), High Performance Computing (HPC), Meshfree Methods, Numerical modelling, Plant tissues

BRAILLE BLOOD PRESSURE INTERPRETER FOR HOME BLOOD PRESSURE MEASUREMENT FOR VISUALLY CHALLENGED INDIVIDUALS

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Hypertension has slowly secured its place as the severest disease burden in the world among Global Burden of Diseases (GBD). Hypertension management programs which are employed to control the disease have identified Home Blood Pressure Measurement (HBPM) to be the most efficient blood pressure monitoring tool to effectively control hypertension. This paper presents an innovative, low cost and user friendly universal technological solution for the visually challenged community who are seeking hypertension management programs without compromising the independency and privacy with regard to sensitive medical data. In place of an exclusive and high cost blood pressure meter with Braille output, an external USB compatible tactile interpreter has been proposed and implemented. Systolic and diastolic readings isolated using a commercially available Device Monitoring Software, verifies that such a device is indeed realizable with a micro-controller based tactile feedback system especially designed for this purpose.

Keywords: Blood Pressure, Braille, Hypertension management, Visually impaired

EVALUATING THE EXISTING CONDITIONS OF BORUPANA ROAD AND IDENTIFYING MEASURES TO REDUCE THE TRAFFIC CONGESTION THEREIN

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'Traffic congestion is a major problem in many roads in Sri Lanka. In Colombo and main cities, this occurs during certain time periods. It has been found that average speed of traffic within the Colombo Metropolitan Region has dropped down to 20km/hr. This congestion mainly affects the Sri Lankan economy as Colombo is the main economical center in Sri Lanka. This study took into consideration the traffic congestion on Borupana Road, which is situated in Rathmalana area in Colombo district. Current congestion on Borupana Road is a critical problem during the peak periods. Therefore, current (2017) Level of Service (LOS) was evaluated in the course of this study and for that, few Manual Classified Traffic Counts (MCCs) were conducted on the Borupana Road after dividing the road into few sections. With the aid of these traffic counts, the contribution from each vehicle type towards the congestion was identified. The effects from heavy vehicle and the existing three-wheeler system towards the congestion was also identified through this study. Then, different LOS improvement scenarios were tested on the Borupana Road. Finally, it was found that a four-lane road is required to carry the existing traffic on the Borupana Road. It is estimated that the four-lane road is sufficient for another 20 years with average annual traffic growth rate of 4%.

Keywords: Traffic congestion, Traffic counts, Level of Service

FACTORS AFFECTING PEDESTRIAN VISIBILITY AT NIGHT TIME FOR MOTOR CYCLISTS

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'In Sri Lanka, most of the motorbike-pedestrian accidents happening in the night time are due to the insufficient visibility of pedestrians. Even though number of researches has been carried out globally regarding improving pedestrian visibility at night for other vehicles, unfortunately few researches have been carried out for motor bikes. In this study, factors affecting the recognition of pedestrians at night such as clothing colour of the pedestrian, rider's age, rider's gender and head light beam condition of the motor bike are considered. For this study white, black, green and red colours were considered as pedestrians clothing colour and four age groups of riders were taken into account. Moreover, head light beam condition of the motor bike was also regarded as head or dim. Experiment was carried out to find the visibility distances in relation to above mentioned factors and data collection method was time duration method and visibility distances were calculated with the help of measured time duration and speed of the motor bike. Experiment was carried out for constant speed of 30 kmph. Findings revealed that the rider's pedestrian recognition distance is affected strongly by the clothing colour of the pedestrian, head light beam condition of the motor bike and rider's age. Rider's gender does not affect pedestrian recognition distance strongly. It was also revealed that Black pedestrian clothing cannot be identified by the rider at a long distance in comparison to other colours. Meanwhile, green and red pedestrian clothing were identified in average distances. Findings showed that white can be identified by the rider at a longer distance than any other selected colours. Furthermore, statistical models were derived for visibility distance in the functions of considered factors.

Keywords: Pedestrian visibility, Road safety,Motorcyclists

INTRODUCING A NEW TRAFFIC OPERATIONAL STRATEGY TO MINIMIZE CONGESTION ON GALLE ROAD; DEHIWALA – WELLAWATTA

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'The increase in private traffic demand coupled with a number of issues such as reduced utilization of high occupancy vehicles, lack of capacity of public modes of transportation, and inefficient road capacity leads to highly congested roads in Colombo city. Traffic control infrastructure has led to a degradation in the speed of vehicles on the roads of Colombo city, resulting in higher operating costs for vehicles and greater congestion and pollution throughout the city. This study intended to suggest proposals to reduce the traffic congestion on Galle road by introducing designing and planning strategies ensuring optimum utilization of Marine Drive. Level of Service (LOS) estimations on Galle Road and Marine Drive clearly indicated that the traffic condition in Galle Road in the section from Dehiwala to Wellawatte, was very poor during peak times. It can be seen that traffic control measures that have already been undertaken, have not answered this traffic congestion problem completely. Even though Marine Drive has been introduced as a solution for this traffic congestion, and has resulted in reducing traffic, it should be optimized to take maximum advantages. Field observations and Level of Service estimations indicated that the level of utilization of Marine Drive to avoid traffic was poor. In this case, three proposals have been introduced by this study and they are; structural design of Marine Drive extension from Wellawatte to Dehiwala, bus route plan accompanied with re-routing of long distance bus services and intersection plan for Dehiwala junction. Findings and proposals of this project will be helpful to minimize traffic congestion in Galle Road during peak times, at the same time reducing the negative social, economic and environmental impacts.

Keywords: Congestion, Traffic Management, Marine Drive

FEASIBILITY STUDY FOR A SHUTTLE SYSTEM ON KANDAWALA ROAD FROM KOTELAWALA DEFENCE UNIVERSITY TO GALLE ROAD

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'It cannot be denied that providing a proper public transport mode to road users is essential. Shuttle bus service is an efficient transport mode at present because of its reliability. In order to implement such a service on a certain road, a feasibility study should be done and such a necessity exists on Kandawala Road of Ratmalana, Sri Lanka. Kandawala Road provides access to factories, warehouses and educational institutes including Kotelawala Defence University. Since there is no public transport service on Kandawala Road, implementation of a shuttle service will help for the betterment of transportation on that road. In this research, a feasibility study was done to inquire of a shuttle service from Kotelawala Defence University to Galle Road. Mainly, a count of pedestrians and passengers was needed and accordingly a Manual Classified Count (MCC) and a pedestrian count was carried out.

Three-wheeler passengers were given special significance because the percentage of three-wheelers in the traffic flow on Kandawala Road is visibly high. Public opinion was taken by a questionnaire survey with a sample size of 80. The total demand was predicted according to the counts and by the analysis of questionnaire survey. Further, the bus schedule was prepared according to the predicted demand to the shuttle service. Feasibility was then checked by the predicted income and expenses to the service. Thus, the improvements were made by studying similar cases and nearby shuttle services in order to fulfill user satisfaction. The development of road LOS was shown with the reduction of traffic by replacement of shuttle.

Keywords: Shuttle service, Level of service, University bus service

CHARACTERIZATION OF INDOOR AND OUTDOOR AIR QUALITY IN TERMS OFNON-METHANE HYDROCARBONS OF SRI LANKA

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Air pollution, both indoors and outdoors, is increasingly recognized as hazardous to public health in the majority of developing countries. Indoor air pollution is primarily related with exposure to emissions from biomass combustion which causes to generate hydrocarbons (methane - CH4 and non-methane - NMHCs) in developing countries. Outdoor air pollution arises from different sources, namely; stationary, mobile, and area emission sources. Consequently, this experiment was carried out with objectives to evaluate temporal and spatial emitted NMHC concentrations from outdoor and indoor and to find out reasons for their variations. Field trials were carried out in four locations (urban, semi-urban, rural, and industrial) with three time durations (07:00-09:00hrs, 11:00-13:00hrs and 15:00-17:00hrs) for indoor and outdoor locations. Sample collection and analysis were done by using standard sampling bags and Flame Ionization Detector, respectively. Split Plot Design was use with 25 replicates. Experiment results revealed that highest concentrations of NMHCs were reported in indoor locations, when compared to outdoor locations. During 11:00-13:00hrs showed 1.95 ppm of NMHCs concentration in indoor location and there was a significant difference when compared with 07:00-09:00 hrs (1.74 ppm)and 15:00-17:00 hrs (1.61 ppm), respectively. Furthermore, semi urban locations reported the highest significant average concentrations of NMHCs in indoor locations compared to all other three locations and rural locations given the lowest average amount of NMHCs concentrations. Semi urban locations reported 39% of NMHCs increment compared to rural locations. Second and third average highest indoor concentrations of NMHCs were given by industrial and urban locations, respectively.

Keywords: Air pollution, Hydrocarbons, NMHCs

INFLUENCE OF VERTICAL GREENERIES TO SCORE POINTS IN GREEN RATING SYSTEMS FOR MULTI-STORIED BUILDINGS IN SRI LANKAN CONTEXT

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'Green rating systems have become a more significant factor to enhance green construction practice and saving energy of a building. Vertical greens and its influence on green rating systems to score more points, is the key concern of this research. Especially, the vertical greenery component which gives more benefits to the facility by making use of natural processes such as temperature control, indoor air quality and lighting of a building as previous studies have proven. It will significantly influence green rating systems to score more points to reach higher ratings.

This research compares three most commonly used green rating systems in Sri Lanka and how those are influenced by the vertical greenery to reach high scores. Three Green Rating Systems, namely, GreenSL® Rating System for Built Environment, GM ENRB :2017 (BCA Green Mark for Existing Non Residential Buildings) and LEED V4 for Building Design and Construction are evident to be mostly used rating tools in Sri Lanka. Considerable percentage of points can be obtained with the positive effects of the vertical green façades, both direct and indirect methods, with above three rating systems, especially in energy saving, greenery, air quality aspects.

Application of comprehensive vertical greenery will result in significant difference between in and out temperature of a room and help to increase the thermal comfort and some other aspects too. Mainly, this improvement can score more points in all three rating systems in varying degrees. GM ENRB: 2017 score card related to aspects in concern shows reasonably high possibility of scoring more points compared to and Green SL and LEED rating tools. Among latter two tools least potential is with LEED, which seems assessing more indirect influences with respect to technical aspects concerned in the study.

Keywords: Vertical greenery, Energy consumption, Thermal comfort, Rating systems

SEEKING PROFESSIONAL EXCELLENCE IN WATER MANAGEMENT: CASE STUDY ON TRINCOMALEE WATER SUPPLY SCHEME

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The Naval Dockyard, Trincomalee is considered to be the most strategic and important Naval Establishment of the Sri Lanka Navy. Naval Dockyard, Trincomalee was established by the British, during the colonial era. Trincomalee naval water supply scheme was constructed in 1942 to accomplish the water requirement of naval dockyard and Trincomalee town area. Although this system is more than 75 years old, it fulfills purified water requirement of Naval Dockyard and few other users within Trincomalee town, even today. The raw water source is Kalamatiyankulam reservoir, which has a capacity of 47,029,300 Cubic meters. The water transmits to the Andamkulam purification plant only through the gravitational force and the energy increment by reducing the diameter of pipe. Similarly, the purified water also distributes to Naval Dockyard and other surroundings. The entire process is free from pumping, though the pumping station has been designed in original drawings. At present, water demand of Naval Dockyard has increased due to the rapid expansion of military infrastructure with community.

The objective of the study is to analysis the sustainability of the Trincomalee naval water supply scheme with the emerging demand of water. This study concerns direct relationship of the current water demand with existing water supply in order to determine the factors such as flow rate, wastage, etc. Whilst analysing the best feasible solution for improvement, the existing scheme will be determined based on the quantitative data such as rainfall, population, and flow rate. The possibility of contributing to the national water distribution network through state agencies will also be analysed in reaching conclusions of this study. Finally, the paper presents a substitute plan for water transmission and distribution considering the future demands of Naval Dockyard and Trincomalee town area. This study focuses on how best to collaborate professionalism to the social demand in view of balancing and sustaining the water resources.

Keywords: Water resource management, Sustainability, Substitution plan

TIME-SERIES ANALYSIS OF MONTHLY RAINFALL DATA FOR THE NUWARA ELIYA DISTRICT, SRI LANKA

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One of the most important climatic elements is rainfall, which directly influences on the agriculture. As a real world practice, the rainfall data has a seasonal trend with short term and long term oscillations; especially, monthly rainfall forecasting is significant to make decisions in management of agricultural schemes and daily human activities.

In this current study, monthly average rainfall of Nuwara Eliya district, Sri Lanka, since 1996 to 2015 was considered. According to the unit root study, original observations are non-stationery. Thus, we moved 1st difference for further study. Furthermore, Seasonal Autoregressive Integrated Moving Average (SARIMA) model was fitted for analyzing and validation of 228 monthly observations. According to minimum Akaike information criteria (AIC), SARIMA (1, 0, 0) (1, 0, 2) (12) is selected as a best model for forecasting rainfall in this selected region.

Keywords: AIC, Rainfall, SARIMA models, Unit root

USE OF ACTIVATED CARBON (AC) TO FILTER WASTEWATER TO TREAT LANDFILL LEACHATE

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'This research addresses the issue of water pollution due to landfill leachate discharge (point source water pollution) and the use of Activated Carbon (AC) to minimize the severe impacts on water bodies. The approach was a quantitative in nature and both primary and secondary data were included in this research. The suggestion is to promote AC production using non-valuable bio-degradable Municipal Solid Waste (MSW), having a high calorific value. To carry out experiments, tests and data collection, the right type of AC which was specifically designed for water filtration was used. The study was based around AC's ability to adsorb particles to its exposed surface. The primary objectives were to compare AC's filtration capacities with clay bricks and quarry dust, study the mechanism of AC, to compare the effectiveness of filtration due to order of filtration materials are set and to compare the efficiency of filtration of each setup. This was determined by conducting 3 tests; pH test, turbidity test and COD test. The influent was slightly acidic (5.70~5.90). The tests were carried for 30 sets from each reactor and samples S1 and S2 (having AC in their reactors) show closer values to pH 7 but weigh towards alkalinity. Turbidity variation is extremely satisfying again in samples S1 and S2 with an average removal efficiency of turbidity of 84.92% and 90.90% respectively also indicate high removal of COD having the lowest slopes (3.13 & 2.44 respectively) out of all 4 effluent samples. The test results showed that S1 and S2 performances are satisfying but S2 has given highest removal efficiencies throughout the experiment also proved the fact that, when the surface area of AC is increased it allows more filtration to occur. Therefore, it can be assumed that AC surface area is directly proportional to its filtration capacity (y = kx).

Keywords: Activated Carbon (AC), Leachate, Bio-degradable MSW, Removal efficiency, COD, Turbidity, pH.

Poster
Sessions

NOVEL HEATING-SUSTAINABLE AUTOMATED TWO-WAY VALVE FOR RE-UTILIZATION OF AUTOMOBILE OR FABRIC INDUSTRY WASTE HEAT

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Steam-powered mechanisms were widely used in the time of industrial revolution before the beginning of the modern inventions of power energy sources. Currently, up to 65% of the heat energy produced in internal combustion engines used in motor vehicles is wasted. This research study lead to the design and implementation of an automated low-cost waste heat reutilization device which guides us to reduce the electrical energy consumption. This prototype model of waste heat utilized steam engine is designed to rotate a fly wheel with the use of steam power in order to power the AC Compressor motor. For this purpose, a specially designed heat sustainable 2-Way steam solenoid valve was designed where the valve is driven by a microcontroller programmed stepper motor. Whenever the engine temperature is high or the wasted heat due to steam generated by turbines of fabric manufacturing industry is high enough, the AC Compressor motor connects to such steam powered mechanism enable lesser fuel consumption and less emission to the environment.

This heat sustainable 2-way automated steam solenoid is a novel design which is not available in the literature. This novel design and implementation with further enhancement will not only be useful in saving energy consumption of automobiles but also be beneficial for the fabric manufacturing industry where the steam generated by turbines can be reutilized.

Keywords: Two-way novel automated steam solenoid, Waste heat re-utilization, AC Compressor motor

IMPACT OF MUNICIPAL SOLID WASTE DISPOSAL ON SOIL AND WATER QUALITY: A CASE STUDY FROM MUTHURAJAWELA WETLAND

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Muthurajawela is one of the famous marshy wetlands in Sri Lanka with a highly diverse ecosystem. In the present context, detrimental environmental issues have occured in Muthurajawela wetland due to improper waste disposal. As Muthurajawela consist of many distinct water bodies, there is a high possibility of groundwater contamination through the leachate originated from the wastes. This will pose a substantial risk to local groundwater resources, soil, biodiversity and natural ecosystem. The study was conducted to assess the impact of municipal waste disposal on physico-chemical characteristics of soil and water in Muthurajawela. Radius sampling method was used to collect samples from 8 different locations at 300m, 250m and 1 km distance, respectively for surface water (SW), soil and groundwater (GW). Distance, time and directions were considered as variables to analyze the data with water quality parameters. The SW samples of 6 and 8 locations and GW samples of 2 and 3 locations indicated higher Nitrate, Sulphate, Phosphate, Calcium and Magnesium values compared to the others which were exceeding standard permissible levels. Soil samples at locations of 1, 4, 5, 6, 7 and 8 showed lower pH values than 6.5 and location 4 recorded the lowest value (2.7) which means the soil was highly acidic. The soil samples at 2 and 6 locations exceeded the standard permissible EC level as they were close to the waste dumping area. The study revealed that quality of the soil, GW and SW of Muthurajawela have been affected due to improper waste dumping.

Keywords: Electrical conductivity, Ground water contamination, Leachate, Waste dumping

ASSESSMENT OF PHYSICO-CHEMICAL PARAMETERS OF DRINKING WATER QUALITY IN SELECTED DS DIVISIONS - HAMBANTHOTA DISTRICT

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Inhabitants in Hambantota district are severely affected by the non-availability of quality water for consumption. The quality of water may vary with the source, water treatment process and the location. Therefore, the present study was conducted to assess the variations in physico-chemical parameters such as pH, Electrical Conductivity (EC), Total dissolved solids (TDS), Phosphate (PO_4^{-3}) and Nitrate (NO_3^-) in domestic water supply in three selected divisional secretariat (DS) divisions (Walasmulla, Angunakolapalassa and Beliatta). Water samples were collected from eight sources in each DS divisionsand 25 households were selected to analyse the drinking water quality. Little alkalinity in water was recorded in Beliatta division when compared to other divisions. Maximum EC (421µs/cm) and TDS (304ppm) values were recorded at the water source of Beliatta division. But all the values of pH and EC were under the drinking water quality standards of SLS (6.5 - 8.5, 750µs/cm). NaCl values varied in between 0.97% - 0.35% and the highest and the lowest were recorded at Beliatta and Agunukolapelessa, respectively. Phosphate values of the treated water were higher than the water source in Walasmulla and Beliatta divisions. Maximum Nitrate values were reported at Beliatta. But treated water (8.60mg/L) had lower concentration of nitrate with compared to the source (9.65mg/L). Results indicated that the distribution system has affected the quality of water. However,the household water of three locations was safe for consumption when considering the drinking water quality standards. It was under the permissible levels of the SLS for potable water (50 mg/L).

Keywords: Domestic water supply, Physicochemical parameters, Water quality

URBANIZATION AND SOLID WASTE MANAGEMENT CHALLENGES: A REVIEW OF LITERATURE

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The aim of this study is to find out the challenges of urbanization and Solid Waste Management urbanized city areas in developing countries most of these urbanizing cities and also a commercial hub, providing employment opportunities and accelerating the pace of urbanization, resulting in a corresponding increase in municipal solid waste (MSW) generation. Solid waste management is a one of main challenge for the any developing city and its authorities in developing countries mainly due to the increasing generation of waste, the burden posed on the municipal budget as a result of the high costs associated to its management, the lack of understanding over a diversity of factors that affect the different stages of waste management and linkages necessary to enable the entire handling system functioning. With the rapid urbanization of a developing city and Municipal waste is a term coined to the solid waste produced by the people and the society in their day to day operations. Secondary data was collected from books on this subject matter, publications, research studies, journals, and websites published by the local and foreign intellectuals of the subjects. It presents rich data results from literature review methods. This study describes and evaluates the present state of municipal solid waste management in municipal council area and identified the challenges face due poor management of the solid waste. Finally, also summarizes the proposed policies and initiatives of the solid waste management in any urban council to improve the existing MSW management system in order to find the feasible solution for overcome the challenges.

Keywords: Municipal solid wastes, Municipal solid waste management, Integrated solid waste management, Solid waste management strategies, Municipal Council

REDESIGNING THE KANDAWALA ROAD TO IMPROVE THE FLOW OF TRAFFIC AND INCREASE ITS LEVEL OF SERVICE

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The objective of this paper is to investigate the various methods available to increase the Level of Service (LOS) of the Kandawala road, which connects the A2 highway (Colombo-Wellawaya Road) and the Kandawala estate. From obtained traffic counts of a 12-hour window from 6:00 am to 6:00 pm, the team identified the peak hour and peak hour traffic volumes in order to perform required calculations to find the current LOS of the road. The team found the LOS of the Kandawala road to be class E, which is below the expected LOS from roads of the same class. After further investigation, research and design, the team developed three separate solutions to enhance the level of service of the road under the current traffic conditions. These solutions can be applied independently or in conjunction with each other to produce synergistic outcomes. These solutions are, firstly redesigning the Kandawala road (including pavement, footpath, and bicycle path and drainage system) with wider shoulders incorporating the currently wasted space on roadside canals. Secondly, opening the poolside entrance of KDU, which will grant an alternative route to a sizable portion of the current Kandawala road users. Finally, declaring Kandawala road one-way paired with the Airport road.

The above solutions would increase LOS of the road by either improving existing road conditions or diverting the traffic flow and minimizing it. However each of these solutions come with their own inherit limitations. These limitations of the solutions, practicability of the solutions and their implementation will be discussed in detail with supportive calculations in this report.

Keywords: Kandawala Road, LOS Improvement

APPLICATION OF CONSTRUCTION PROGRAMME IN PROJECT SCHEDULING OF MAJOR BUILDING CONSTRUCTION IN SRI LANKA

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Time is a valuable thing which cannot be restored. In reality, most of the projects are not completed within the stipulated time. There are varieties of reasons for this, but generally poor time management is a significant reason.

The time can be well managed through construction programmes. It clearly describes the sequence and the relationship between the activities. Even though the construction programme is important some contractors think of it as a pesky document, but the Construction programme provides numerous advantages. Therefore, the research problem is to investigate and identify the application of construction programme and the significant factors that affect the scheduling of construction projects.

A mixed approach was carried out for this study. A comprehensive literature review was done to identify the factors affecting the scheduling process. Through the factors identified, interview guideline and questionnaire were prepared for data collection. Data was collected from the resource persons in the industry and analysed using QDA Miner Lite software and MS Excel software and the results were discussed in detail. Finally, a framework was developed with respect to the final outcomes of the data analysis. Most significant factors from the final outcomes such as barriers, purposes, advantages were included in the framework.

Staying with the construction project schedule is an important part of a project. A well planned construction schedule will facilitate the constructors to reduce downtime and guarantee that the activities are completed on-time and within the budget.

Keywords: Construction programme, Construction projects, Time.

GREYWATER TREATMENT FOR REUSING IN BATHROOMS

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Water is an essential source for all the living beings in the world. The usable fresh water percentage is decreasing day by day due to the careless attitude of people when using the water resources for their day to day needs. Therefore, it is our duty to use water in the earth in a sustainable way, so that the future generations will also be able to fulfill their needs without much trouble. Even though it is necessary to use clean water for drinking, bathing and cooking, for other purposes such as cleaning, bathroom flushing, horticultural and agricultural purposes, we can use less treated water. Therefore, we can use treated greywater for the flushing purposes of bathrooms. Greywater is relatively clean waste water generated after bathing, laundering, kitchen use etc. The aim of this study is to treat greywater which was generated from bathrooms and reuse it for bathroom flushing. The parameters which need to be treated before pumping into flushing tanks were identified and a filter system was designed to treat greywater coming out from bathrooms. After designing a new filter system, 40 samples were analysed considering four parameters namely Turbidity, Nitrate, Phosphate and colour, from both the influent and effluent of the designed filter system separately. Average values of the influent, for Turbidity, NO_3-, $PO_4^{3}-$ and colour are 134.86 NTU, 7.75mg/l, 0.29mg/l and 1158.25 Pt-Co respectively. Average values of the effluent, for Turbidity, NO_3-, $PO_4^{3}-$ and colour are 15.66 NTU, 1.36mg/l, 0.11mg/l and 415.18 Pt-Co respectively. As a result, the filter system had removal efficiencies of 88.45%, 82.38%, 61.43% and 63.26% in removing Turbidity, NO_3-, $PO_4^{3}-$ and colour respectively. Since the above values are within the permissible ranges, it is acceptable to use this water for flushing purposes.

Keywords: Greywater, Treatment, Sand Filter

SUSTAINABLE WATER SUPPLY MANAGEMENT SYSTEM FOR PANAGODA ARMY CANTONMENT

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Sustainable water management is identified as an important strategic approach to minimize unnecessary costs and for proper utilization of water resources. The Panagoda army cantonment was established five decades ago and current water supply system has deficiencies to cater the demand of water users. Due to malpractices of users, massive wastage of water supply has been observed. This study focused on the identification of the status-quo of the water management system in the cantonment. Then to be identified the customer's perspective on the current water management system in the cantonment and identified proper way to improve current water management system. The high value of water invoices and electricity invoices were received for the monthly usage. By introducing new water management, it will be possible to reduce the cost of water usage and cost of electricity usage that use for the pump operation. There are 4 Directorates, 7 Regiments, 31 Units, Army Base Hospital and Army Physical Training School operating at the cantonment and data has been collected from selected 19 establishments which are consist with higher no of staff. During the study qualitative and quantitative data was collected by using the questionnaire and evaluate the quantitative data by using Statistical Package for the Social Sciences (SPSS) software version 23. Both descriptive and inferential statistics were determined. According to the qualitative data, current status of the water management system was evaluated and recommendations were formulated. The conceptual framework consisted of sustainable management approaches such as environmental Sustainability, Affordability, Quality, Health and Safety, Reliability, and Responsibility of the operation. Those five independent variables were correlated with the dependant variable of customer satisfaction. Each independent variable was gathered in two perspectives such as customer expectation and the satisfaction of the aspect. Each factor was plotted to identify the gap area. It is recommended to carry out in-depth study to minimize loss and improve the current system to the sustainable way.

Keywords: Environmental sustainability, Affordability, Quality, Health and safety, Reliability and responsibility

TOWARDS SUSTAINABLE PRACTICES: IMPLEMENTATION OF PRIORITIES FOR CHALLENGES IN CONSTRUCTION

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Construction industry is an essential part of every country's economy because it helps to improve the socio-economic status of the country such as buildings, infrastructure, and services. Moreover, construction marks the biggest contribution in the developing countries, these countries face lots of challenges as economic and population growth, lifestyle changes, and global changes. This industry usually faces complex issues such as the extension of time and material wastage. As a result, the cost exceeds the contract sum. Traditional construction practices find it difficult to control these issues, so nowadays construction industries focus on sustainable practices. On the other hand, sustainable practices were combined with economic, social and environmental perspectives. Sri Lankan construction industry focuses on the sustainable practices also it shows the major challenges and sustainable implementation initiatives. They apply sustainable materials (eco-environment friendly material), upgrade the resource efficiency, plant productivity, work nature and mitigate the construction waste, cost, impurity, noise and vibration, CO_2 emissions, energy utilization and plant and equipment uses. The data analysis revealed the top four priority implementations for sustainable challenges, which are essential for sustainable initiatives. They are applying sustainable materials (eco-environment friendly material) 86%, upgrade the resources efficiency 83%, upgrade the plant productivity as the highest standard 83% and upgrade the work nature 80%. More than 86% percent of people have rated applying sustainable materials (eco-environment friendly material) as extremely and very important. This could be due to factors in Sri Lankan construction industry preferences. The paper concludes that identifying the priorities for implementation in sustainable complex approaches in Sri Lankan construction industry

Keywords: Sustainability, Challenges, Priorities

UPPER LIMB MOTION RECOGNITION BASED ON ELECTROMYOGRAPHY SIGNALS AND SUPPORT VECTOR MACHINE

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A large number of disabled people can be seen in the world due to various accidents, sports injuries and etc. Using traditional recovery system takes much time to recover. Hence people face many difficulties in their day-to-day activities. There are many forearm upper limb prosthetic devices in the market, and it could be applied for limited amputees. This reason tends to develop new novel methods to increase their living condition. To obtain accurate information on intended hand motions, human body generated Electromyography (EMG) signals were used. Four specific muscles were selected through the study by acquiring EMG signals. The EMG signals were recorded under six types of major wrist movement; flexion, extension, Radial deviation, ulnar deviation, Normal and close. Feature extraction was conducted under the Time Domain (TD) Statistical features. Mean Absolute Value (MAV) was concluded to be the best feature extraction method for the classification, as it has higher accuracy and the low computational power than other statistical features like Root mean square (RMS) in order to operate in real time. Data classifications and a model creating the system was utilized in machine learning. Classifications were done under the Support Vector Machines (SVM), and the model was trained using linear classifier. The model operated as a real-time working device and trained the model using 128 features of 128ms. The prediction speed of the models was ~330 obj/sec. the whole process of the model took only 131.030ms. The study has obtained zero error rates via the confusion matrix, and the accuracy of the model was 100%.

Keywords: Electromyography signals, Time Domain, Support Vector Machine, Upper limb

A REVIEW ON ULTRASOUND IMAGE PRE-PROCESSING, SEGMENTATION AND COMPRESSION FOR ENHANCED IMAGE STORAGE AND TRANSMISSION

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Imaging is one of the key medical diagnostic tools to observe internal organs and soft tissues. One such tool is ultrasound scanning, which is highly utilized in gynecology and echo cardiogram. This is due to the number of advantages of ultrasound scanning, such as being non-invasive, free of radiation, economical and real-time. However, access to ultrasound scanning facilities remain limited due to the scarcity of human and physical resources. Therefore, developing technologies to remotely perform ultrasound scans using mobile devices to extend medical imaging facilities to rural and less accessible areas is becoming an interesting research area. This requires efficient compression of ultrasound scan footage in order to facilitate real-time transmission over a mobile network. Careful selection of the Region of Interest (ROI) is essential to compress ultrasound footage efficiently. Yet, it is a challenge due to distributions of various intensities depending on the imaging conditions, boundary ambiguities and speckle noise.

This review paper highlights state-of-the-art technologies for the careful selection of ROI of ultrasound images to facilitate ultrasound image pre-processing, segmentation and compression. Furthermore, the paper proposes directions for future research to develop existing methods. It is envisaged that these technologies will pave the path to develop new technologies that would enable better patient care in the future.

Keywords: Ultrasound images, Region of interest (ROI), Image segmentation, Image compression, Speckle noise removal

SHIPBOARD VIBRATION DATA ANALYSIS AS AN EFFECTIVE MONITORING TOOL IN COMPUTERISED MAINTENANCE MANAGEMENT SYSTEM (CMMS) FOR SRI LANKA NAVY

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The maintenance strategy which most of the modern navies follows today is Predictive Maintenance (PdM) or Condition Based Predictive Maintenance (CBPM), which is a proven capacity multiplier/ economy booster. There is a selective list of techniques fall under the CBPM category. They are Vibration analysis, Oil analysis, Thermal imaging, Ultrasonic inspection, Non-Destructive Testing etc. CBPM is a transformation from a reactive maintenance policy to a proactive maintenance policy where it has displayed its effectiveness in a number of naval engineering installations. Implementing these CBM techniques for fleet maintenance in Navy must overcome additional challenges due to limited accessibility for data recording, amount of data volume, and incompatibilities in data sharing among industrial sector. Sri Lanka Navy (SLN) instituted the necessary procedures regarding promulgation of a comprehensive data base in all CBPM aspects with machinery health monitoring and recommendation for SLN ships/craft/machinery under the supervision of Directorate of Engineering and University of Moratuwa. Machinery Testing and Trials Unit (MTTU) is entrusted with the responsibility and the process of integrating the past records on all ships/craft had commenced in the form of a web based Computerized Maintenance Management System (CMMS). This paper is focused on to discuss practical techniques followed by MTTU to combine an interdisciplinary research on shipboard vibration monitoring to CMMS and reap the benefits for the Navy.

Keywords: Shipboard vibration, Computerized maintenance management system, Predictive maintenance