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INTERNATIONAL RESEARCH CONFERENCE

14TH INTERNATIONAL RESEARCH CONFERENCE

" Security, Stability and National Development in the New Normal "

09TH - 10TH SEPTEMBER 2021

COMPUTING

ABSTRACTS

GENERAL SIR JOHN KOTELAWALA DEFENCE UNIVERSITY

14TH INTERNATIONAL RESEARCH CONFERENCE

SECURITY, STABILITY AND NATIONAL DEVELOPMENT
IN THE NEW NORMAL

COMPUTING

ABSTRACTS

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Message from the Chief Guest

It is with great pleasure that I send this message to the publication of selected conference papers, under a theme that seems more relevant today than ever.

Throughout the history, security has always been the central notion of our existence as a nation. It will continue to be, as long as the geographical realities that define the country's location remains so. This centrality causes our development paradigm to always have a nexus with security, undeniably linking itself to the overall stability of the country.

As the world was compelled to enter into a 'new normal' with the COVID-19 pandemic, the traditional focus on maintaining the hard component of security was overshadowed by the need to replenish its soft component. The world has recently witnessed struggles of global powers with the highest military might, to maintain and uphold their health security. The less-talked about soft security has emerged to overshadow its counterpart, calling us to re-think and re-define the security-development nexus.

COVID-19 posed an unprecedented challenge to Sri Lanka and all developing economies, calling those States to experiment with new ways for achieving national development while managing the novel challenges to their security and stability. In this backdrop, I am delighted to see that the KDU has made allowance for this paradigm shift and hosted its International Research Conference - 2021 along the theme, 'Security, Stability and National development in the New Normal'.

I congratulate all scholars who have contributed to the conference, in particular, those who have shared their research and findings. My heartiest appreciation goes to the Vice Chancellor, Faculty and the staff of KDU whose undying commitment has made this event a reality, even during the pandemic situation.

Steering a country forward in turbulent times is a task that needs meticulous inputs from the country's intellectual body. I am certain that the KDU Research Conference – 2021 has made its mark in this endeavour.

Mr Lalith Weeratunga
Principal Advisor to His Excellency the President of Sri Lanka

Message from the Secretary, Ministry of Defence

It gives me immense pleasure to forward this message on the occasion of the 14th International Research Conference of the General Sir John Kotelawala Defence University (KDU). At the outset, I must appreciate the leadership and guidance which the Vice Chancellor has rendered to maintain the continuity of this highest academic event of the University despite times of great national and international challenges due to the COVID-19 pandemic which has devastated the world.

This year's conference theme: 'Security, Stability and National Development in the New Normal' has taken the current realities of our time into the consideration and how to achieve security and development in times of instability. In this context, I strongly feel that this is an important and commendable approach with innovation demonstrated by the KDU in focussing the attention towards a timely pertinent theme.

The national developments reiterate the importance of a Defence University especially when our motherland is facing unprecedented challenges due to the pandemic. Therefore, I must highlight that our ministerial guidance and blessings, have given the potential for the KDU to actively dwell on a developmental approach to research with Security and Stability as core drivers. This approach will enable the KDU to reach a leading position to guide and influence policy decisions through the knowledge and insights gained from its expansive research programmes.

Furthermore, I believe that the great minds that will lead research deliberations at this conference should actively contribute to aid the great endeavour of steering our beloved motherland towards greater heights in the security and economic spheres, as it is the ultimate responsibility of all Sri Lankans at this time of concern. Finally, I wish that the KDU IRC 2021 will provide a sheer guidance and lead the way towards national development mitigating all current and emerging challenges posed by this devastating pandemic situation. As I extend my sincere well wishes towards the Vice Chancellor, his team and all the participants of this conference for its successful execution and for their future endeavours, I would like to assure that my blessings and support will be with KDU at all times.

General Kamal Gunaratne (Retd)
WWV RWP RSP USP ndc psc MPhil
Secretary
Ministry of Defence

Message from the Vice Chancellor

As the KDU celebrates its 40th anniversary, the International Research Conference is entering its 14th year and adapting to the new normal conditions and unprecedented challenges that have forced many programmes to be called off indefinitely. The evolution and continuity of the research conference into the successive 14th year adapting to challenges bears testimony for the success of the KDU as a seat of learning that can withstand any challenge national or international in nature.

The sheer number of papers that the conference received this year demonstrates the enthusiasm shown by presenters both locally and internationally even at a time of a grave crisis that has put educational institutions under severe stress, and it affirms the faith scholars have had on KDU. As the only defence university in Sri Lanka, KDU has been committed to research and knowledge production that will influence and shape the policy deliberations of security and development. These are core pillars of the stability and existence of any society, and it is our national responsibility to provide such insights through the organization of premier research dialogues.

This year's theme 'Security, Stability and National Development in the New Normal' bears witness to the civil military fusion that KDU has created and its commitment to achieving balance and resilience in times of global crises to safeguard and advance the security and developmental interests of the motherland.

KDU IRC is a platform of cooperation and diplomacy, and it encourages academic collaboration across Sri Lanka's higher education institutions. Research conferences are the ultimate networking events, and we are proud to provide these spaces of engagement where Sri Lankan and international scholars can present their findings and deliberate on the way forward for the nation and for the global community to thrive at a time humanity's resolve is tested by the pandemic. I wish all the very best for the academics, practitioners and policy makers who want to showcase their research and experience at our research conference.

Finally, I appreciate the dedication and hard work of all those who worked tirelessly over the last several months contributing in diverse ways to make the KDU IRC 2021 a reality under the trying circumstances, especially the IRC Chair, the Secretary, and the organizing committees headed by the Deputy Vice Chancellor (Defence and Administration).

Major General Milinda Peiris
RWP RSP VSV USP ndc psc MPhil (Ind)
Vice Chancellor
General Sir John Kotelawala Defence University

Message from the Conference Chair

KDU International Research Conference in its 14th iteration is held amidst celebration of its 40th anniversary and situated in local and global environment that is challenged by a new form of microbial security threat in the form the Covid19 outbreak. KDU stands strong and unbowed to maintain the continuity of this apex academic event this year on the theme, Security, Stability and National Development in the New Normal.

Challenged with the most potent wave of the pandemic, we remain undeterred thanks to the leadership of the Vice Chancellor. The organizing committee has put their heart and soul into adapting and evolving the conference formats that could withstand and confront the new normal conditions in organizing the international research conference.

Academic communities in the world are beacons of hope and resilience and given the sheer number of research papers that were submitted to the conference this year is a testament that KDU remains a space of hope for such communities and a sacred ground where research is encouraged even at trying times.

The theme of this year was a conscious decision to confront the realities that Sri Lanka and the world had to encounter since March 2020, that Covid 19 was a harbinger for a new reality. Universities are centres of resistance and renaissance and the KDU in Sri Lanka sets an example to all other institutions to emphasize the will to confront any challenge.

In this context KDU research conference is nourished by the presentations and deliberations of esteemed plenary speakers and research presentations that will provide vital insights into the key themes of security, stability, and national development. I extend gratitude and best wishes to all presenters who believe in the research culture evolved by the KDU and may you be treated to the finest KDU hospitality that transcend from physical to the cyber space and may you all be contributors to a greater cause for the sake of all humanity.

Dr Harinda Vidanage
PhD (Edin)
Conference Chair

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PLENARY SESSION

Multi-step-ahead Influenza Prediction using Machine Learning Models

Prof Yukun Bao

School of Management- Huazhong, University of Science and Technology, China

The Epidemics of influenza are major public health concerns. This study proposes Comprehensive Learning Particle Swarm Optimization based Machine Learning (CLPSO-ML) framework for multi-step-ahead influenza prediction. A comprehensive examination and comparison of the performance and potential of three commonly used multi-step-ahead prediction modelling strategies, including iterated strategy, direct strategy and multiple-input multiple-output (MIMO) strategy, was conducted using the weekly Influenza-like illness (ILI) rate series from southern and northern China.

Techno-Socio-Psycho Challenges of National Development in the New Normal

Prof Tony Sahama

University if Victoria, Victoria BC V8P 5C2, Canada

The “new normal” in the next 2 to 3 years’ time would be tech-driven, led by more challenges of societal changes, with more connections and interactions digitally that result in “tele-everything”. With exponential growth and technological maturity, integrations of high-tech innovations are inevitable for most parts of the world. The acceptance and adoption of technical challenges are also confounded with several factors. Particularly, the socio-psycho factors are significant for digital infrastructure development and resilience. This talk comprises three case studies (e.g., Education, Health and Technology Integration) especially relevant to national development. Failure of the technology is a design guideline for the success of development hence, these challenges, including cultural and customary barriers are also critically reviewed in these case studies, which should be helpful for economic and sustainable development.

Making University Education Smart in the New Normal

Dr Shantha Fernando

Department of Computer Science and Engineering, University of Moratuwa

University education needs to be adaptive, whatever the circumstances may be. Be it industry revolution, technology enhancement, widespread use of the Internet, IoT-driven environments, or the current era of "New Normal". Unless the university education is smart, coping up with the challenges of the New Normal would be far from success. One may deliver the contents, but education does not mean mere content delivery. Outcome needs to be visible when the students go out to the society. An innovative learning environment that drives the learners towards achieving the objectives need to be created. It refers not only to the use of technology, but also to re-designing the learning process.

The Opportunity: ICT for a Sustainable Post- Covid Future in Sri Lanka

Mr Diyath Ariyarathne

General Manager, Pearson Lanka (Pvt) Ltd

World population stands around 7.8 billion today. There are over 264 million children who don't go to school. There are over 250 million children in school but not learning due to various difficulties ranging from lack of trained teachers, basic infrastructure, sanitation facilities or basic human needs such as food, water and clothes to wear. Covid-19 pandemic further deepened the inequalities in access to education around the world. While the "developed world" shifted to a "virtual" classroom, the underprivileged and poor in our part of the world are deprived of the basic opportunities to thrive in learning in a "digital world". Every day we see on the media how our own sons and daughters are risking their lives climbing trees or mountains in rural areas to catch a phone signal to attend a virtual classroom. As per United Nations Covid-19 has wiped out 20 years of education gains with an additional 101 million or 9% of children in grades 1 through 8 fell below reading proficiency levels just in 2020. Especially where Sri Lanka is at right now from a socio, economic and political standpoint, do we believe that we can "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all"? Education, that I have highlighted above, which is near and dear to you all at KDU and for me sitting at the intersection of education and technology, is the most important yet only one aspect in development of a country. IT/BPM sector developed immensely in Sri Lanka over the past two decades. Today over 80,000 young professionals contribute to our economy being employed in IT/BPM sector which stands as the fifth largest export earner for the country. Potential and opportunity for ICT sector in Sri Lanka post the pandemic is mammoth. However, I believe it is time that as Sri Lankans we take stock of where we are at right now, re-think how we leverage technology in developing our nation for a better future, sustainably.

Use of Blockchain Proofs for Building Trust in Business

Mr Dileepa Jayathilake

Director - Research & Special Projects, 99X

Blockchain emerged as the innovative technology that powered digital currencies, employing a mechanism that no longer needs notarization by centralized powers such as governments and central banks. The decentralized paradigm brought in by this wave of technology, which enjoyed notable success during the past decade, has triggered numerous branches of exploration into nurturing and managing trust in ways that are much faster and cheaper compared to the traditional approaches. The promise of technology-driven trust management via blockchain appeals to a wide array of domains such as supply chain, insurance, healthcare, cloud storage, content curation, micro-financing & prediction markets, to name a few. Such industrialization of trust can deliver high efficiencies while generating new kinds of value at the same time. This talk will provide details on core concepts around blockchain while referring to a recent practical application of using blockchain for enhancing trust in supply chains.

ORAL PRESENTATIONS

ID 193

Sinhala Chatbot with Recommendation System for Sri Lankan Traditional Dancers

JAWT Chandrasena#, ADAI Gunasekara and GAI Uwanthika

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Traditional dancing which originated in the 4th century B.C. is one of the most popular dancing styles in Sri Lanka. Though it has highly developed throughout the years, novel technologies are not much engaged with the development of traditional dancing. Therefore, Sri Lankans still use ordinary methods even for finding choreographers, dance track editors, props providers and costume providers. These have become the most common problems of Sri Lankan traditional dancers. With the objective of giving a computer-based solution for these problems, the paper proposes an information providing website that acts as a location and rating-based service provider recommendation system capable of solving the 'cold start problem'. Since most of the terms related to traditional dance are in Sinhala, the web system was created in English as well as in Sinhala for ease of use. A Sinhala chatbot has also been introduced to the system, making it easier for any local user to use and a user-to-user private chat system is also proposed to directly communicate with service providers. The system is able to identify the five closest service providers with the highest ratings for users and generate more user recommendations based on location and ratings. Chatbot has achieved a good level of accuracy in directing users and answering user questions.

Keywords: *information providing platform for dancers, place recommendation system, nearest place finding system, Sinhala chatbot*

ID 254

Classification of Software Frameworks Utilised in Water Resource Management Modelling

RMM Pradeep[1#] and A Edirisuriya[2]

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The framework of a particular unit or a system is the structure on which it is built or founded. There appears a conflict in the understanding of frameworks by water resource decision-making professionals and software development professionals. This contradiction affects the quality of the software systems developed for water resource management decision-making. Hence, the objective of the present work is to classify the available understanding of frameworks to contribute to a clear understanding to achieve better and sustainable framework classification to water resource management software system. The present work carried out a systematic review and conceptualised the principle of the framework through an evaluation of interdependencies between presently available understandings. The reviewed environmental modelling frameworks revealed the availability of four different categories such as, Software language foundation, Software on platforms, Techno-business platforms, and Building blocks frameworks. This classification allows the environmental system modellers to understand which framework they will develop and decide in which depth they need to explore technology and business domains.

Keywords: *software, system, framework, water resource management, environmental modelling, empirical literature review*

ID 283

Information Management for Sri Lankan Vegetable Farmers: Effectiveness of ICT Applications

SI Baddegamage[1#], LNC De Silva[2] and MDJS Goonetillake[2]

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The paramount scenario behind Sri Lankan agriculture is that one-third of the country's population which engages in agriculture contributes to only 7% of the GDP. The distribution of smaller amounts of income among large communities increases poverty among farmers in Sri Lanka. This limited income shrinks further due to sudden price drops, wastage, damages and oversupply. Various types of ICT-based solutions have been provided to eliminate poverty among farmers in Sri Lanka. However, research findings and literature show that most farmers are still suffering in poverty in the information age with the availability of many forms of information sources required for farmers. Due to some issues or reasons, farmers do not continuously use information systems and available information systems become obsolete within a short period due to lack of continued use. The research explores reasons for the low use of information and communication technology-based agricultural information systems among Sri Lankan farming community. The research collected data using literature review, questionnaires and interviews from 76 farmers in four districts of Sri Lanka. Weekly average prices of three selected vegetables and selling offer received for a digital classified AgriApp was observed for one year and collected data was analysed to identify farmers' and market behaviour patterns. Research findings will help increase ICT practices in agriculture, reduce wastage, control price fluctuation and eliminate oversupply. It will ensure a continuous supply of vegetables and food security to the nation.

Keywords: *ICT, agriculture, Sri Lanka, vegetable farmers*

Effort Estimation in Agile Software Development: An Empirical Study in the Sri Lankan Context

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In responding to the dynamic business environments, most software development organizations have shifted towards the practice of agile methodologies, due to their capability in undertaking change in requirements. Accurate and reliable effort estimates usually assist effective project planning. Effort estimation in agile software development differs from traditional approaches due its iterative nature. In this survey-based study, the main objective is to assess the status of effort estimation by agile software development teams in Sri Lanka. Hence, the investigation focuses on finding out the widely adopted agile effort estimation techniques, effort predictors, accuracy level of each technique, and the factors affecting estimation accuracy. The data was collected from software industry professionals using an online questionnaire and was statistically analysed. According to the results obtained, "Expert Judgment", "Planning poker", and "Use Case point" are the most used effort estimation techniques among Sri Lankan agile teams, and it was evident that "Expert Judgment" is the most accurate effort estimation technique among them. Further, a conceptual model on the effect of cost drivers on the accuracy of the effort estimation was proposed based on the results of correlation and linear regression analysis.

Keywords: *agile software development, software estimation, effort estimation, effort estimation techniques*

ID 399

Role of Workplace Cyber Incivility and Personality Traits on Employee Knowledge Sharing Behaviour

PRD Wijesingha# and RPS Kathriarachchi

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Knowledge sharing behaviour can achieve a greater level of innovation and creativity. Employees who were victimized with computer-mediated workplace incivility may hinder knowledge with rational justifications. The purpose of this paper is to identify the role of workplace cyber incivility on knowledge sharing behaviour. Additionally, this study identifies the mediating effect of personality traits (Extraversion, Agreeableness, Conscientiousness, Neuroticism, Openness to experience) on the relationship between them. The study is predominantly designed as a quantitative study based on the positivistic paradigm. Data were obtained from an online self-administered questionnaire from permanent employees in software development organizations in Sri Lanka, and 251 responses were analysed using correlation and SEM bootstrapping. The study draws attention towards workplace cyber incivility victims, who may negatively respond to knowledge sharing behaviour, creating hostile work environments. The theory of trait activation can be used to explain the individual differences of the said relationship. The study also proposes partial mediation on the same relationship. The findings of the study have several theoretical and practical implications. It advocates the necessity to address workplace cyber incivility to ensure employee knowledge sharing behaviour.

Keywords: *kowledge sharing behaviour, cyber incivility, personality traits*

Hatred Comments Detection in Twitter using Deep Learning

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Social media applications are the most popular web and mobile applications across the globe. In the meantime, however, this has resulted in the emergence of conflict and hatred by making online environments, particularly Twitter, uninviting for users. This issue typically affects individuals, organizations and governments because it can have a reasonable or unreasonable impact on someone's reputation, as well as could trigger discrimination, hostility and violence, which can lead to or include terrorism or atrocious crimes in society. Therefore, an accurate, efficient automatic model to detect and classify hate speech on Twitter is a particularly useful tool for the relevant authorities. This paper describes the detection and classification of hate speech on Twitter by using deep learning. This can fill in the gaps between current models with higher accuracy and reliability. Thus, this research is beneficial in several ways, such as the detection of hate speech in distinct categories, such as in toxic, severe toxic, obscene, threat, insult and identity hate. The developed application used deep-learning algorithms to find the number of occurrences of the words and semantic words. The LSTM model is used to train the data set and to get the probability values. The classes of hate speech were calculated against the training data set and were found to be above 72%. In conclusion, the developed method can help to detect and classify hate speech into six classes on Twitter.

***Keywords**: social media, Twitter, hate speech*

ID 224

Binary and Multi-Class Classification Using Supervised Machine Learning Algorithms and Ensemble Model

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Classification is a vital aspect in data mining, where vast quantities of data are segregated into discrete classes. Models based on different statistical and machine learning approaches are used for this task. However, the classification performance depends on multiple factors like selected algorithm, domain and features of the dataset. The objective of this study is to evaluate the classification performance of widely used supervised machine learning algorithms; Decision Tree (DT), Naïve Bayes (NB) algorithm, Support Vector Classifier (SVC), K-Nearest Neighbour (KNN) algorithm and the Ensemble Model (EM) based on soft voting technique. These algorithms are tested on 6 datasets in different domains, and the datasets contain both multi-class and binary class data as well as balanced and imbalanced data. Accuracy, Precision and Recall are used as evaluation metrics to evaluate the classification performance in balanced datasets, where F1-measure is used in imbalanced dataset for the same task. The evaluation results indicate that EM outperformed single algorithms at most instances. When comparing single algorithms, KNN performed best with multi class classification, where SVC performed best in binary classification in balanced datasets. Also, KNN showed the best classification performance when it comes to imbalanced dataset. All the algorithms performed well when the data set is balanced. However, the classification performance in all models including EM is below expectation, when the data distribution is highly imbalanced.

Keywords: *classification, machine learning, supervised algorithms, ensemble model, soft voting classifier*

ID 535

Communication Platform for Sri Lankan Board Game Nerenchi

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Nerenchi is one of Sri Lanka's oldest folk board games in which the board has diagonal lines joining the corners and horizontal and vertical lines joining three concentric squares in the centre. It is a strategic game between two players. The game is played by ensuring that one avoids his/her opponent in forming a mill. The player should block the counters of that mill by moving and taking one of his/her pieces every time. The player who has lost all the counters and is blocked from moving will be the loser. This folk game makes much fun, but with time the use of this game has rapidly decreased as a result of the development of online games. Therefore, joining hands with new technology, the implementation of an automated version of the "Nerenchi Board game" will be much impressive. The proposed system has 3 main stages; Detecting objects, Object movement and deciding the next turn of the object to be moved. System design mainly focuses on automating the system by using sensors to detect the exact location and colour of the Nerenchi object. The paper presents a way to detect the existing state of the physical board on the Nerenchi game, and this is a new approach for designing a computerized version of the Sri Lankan folk game called "Nerenchi".

Keywords: *Nerenchi, folk board game, automated version, sensors, detecting objects*

ID 583

Artificial Intelligence in the Criminal Justice System: A Literature Review and a Survey

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Companies, governments and security services around the world are now trying to use artificial intelligence to detect and prevent crime. Studies have shown that crime is predictable. The need is to just filter out large amounts of data to get useful legal patterns. These types of predictions were a dream just a few decades ago. However, there is much hope now, as we learn from the fast-paced development of Artificial Intelligence (AI). When it comes to why governments and corporations are willing to try to use AI in this way, a summary of the key findings is as follows: It is estimated that in 2018, national and local governments have spent $ 119 billion on the police, $ 81 billion on repairs (3%), and $ 49 billion on the courts (2%). AI has the potential to be a permanent part of our justice environment, providing assistance in investigating and allowing criminal justice professionals to better maintain public safety. The main intention and aspiration of this research is to let people be aware about AI and how it can be successfully applied to achieve excellent results in criminal justice systems, not only to detect crimes but to also predict them and prevent them from occurring. On the other hand, the extended part of this research explores the thought of measuring the ability and the possibility of applying AI in the Sri Lankan criminal justice system.

Keywords: *artificial Intelligence, criminal justice system, machine learning*

A Novel Personalized Mobile Application for Systematically Monitoring Cash Transactions

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Today many people face difficulties in having no proper method or technique to monitor their daily personal expenses, which finally lead to great wastage of money unknowingly. This has been a problem due to people's busy lives. They do not have time to manually record personal expenses and even if manual methods are there, they may not be efficient and reliable. At present, many systems to manage expenses exist such as web applications, mobile applications software, and other financial management systems. However, the question arises as to whether these applications give the required output for the user and if they are secure for the user to use. The proposed system works as a solution for this problem. With this system, the user can monitor financial expenses with the use of receipt images, without providing delicate information like credit card details or any other bank account details. Simply, the user does not need to link their bank or credit card accounts to analyze their transactions. The only thing needed to be done is to take an image of a receipt and upload it to the application. With the use of various image processing techniques, the text in the uploaded image is recognized and further processing is done to the recognized text to obtain details such as total cost, date of purchase, and receipt category. The user will receive a display of all these details in the mobile application and also an alerting system that would warn if one's expense goes beyond limit.

Keywords: *Natural Language Processing (NLP), information extraction, image processing, receipts, mobile application.*

ID 433

Implementation of Smart Pet Care Applications in an IoT Based Environment

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The idea of Information Technology and machines has become a rising demand, leading to the concept of interconnection between humans and machines. This concept has adopted a negative impact on human lives and their well-being. Because of this negativity, people tend to adopt pets to get emotional support. Pets require extra care and it is not easy as it used to be with today's busy lifestyle. As a result, one of the significant challenges has been figuring out how to grow pets in a simple manner. The best solution for this kind of problem is to use new innovative technologies. For this matter, an IoT-based solution should be included. The question that led to this research was, "How to implement a Smart Pet care Application within a proper IoT based Environment?". Implementation of a smart pet care application that satisfies every requirement of petting would ensure greater comfort and peace of mind for pet owners. This paper discusses the characteristics and technologies of the latest smart Pet Care applications and proposes solutions that satisfy the current requirements of pet owners. Before implementing this smart pet care application, a study was performed to identify features and facilities of existing pet care applications using related research papers. This research explores the impact of the IoT concept on the potential of smart Pet Care applications across modern technologies to facilitate human contact with pets. The outcome is an IoT-based mobile application that satisfies users' requirements by analyzing data.

Keywords: *pet care, Internet of Things (IoT), smart pet care system, monitoring systems*

Optimum Waste Collection System with Smart Mobile Application

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Irregular disposal and collection of wastage is a huge problem in cities. Due to rapid population growth and manipulation of urbanization, huge garbage emissions and environmental pollution may occur. It is effective and important to manage waste collection to get rid of the issues related to inefficient process of collections, irregular removal of garbage trash bins, overflowing bins and to prevent health issues. Another major challenge for daily life is the current pandemic situation that we have been facing with COVID-19. Therefore, during this pandemic, it is very important to carry out the garbage disposal and collection process in a well-safe and efficient manner at the right time, to minimize contact with outsiders and it will be immensely useful in preventing and controlling the spread of this epidemic. Without proper waste disposal, a home is vulnerable to the spread of disease. This research work plans to develop an optimum waste collection application for truck drivers and citizens. The system will facilitate truck drivers to find the shortest path for the only fullest bin by using route optimization. Arduino and ultrasonic sensors have been used to create the smart bins by facilitating relevant sensor data and Google map API for tracking the location in the proposed application. Mainly Firebase for backend resources to the device, including data storage, user authentication, static hosting has been used, while Flutter has been used as the mobile application development platform. As per the studies and analysis of the related technologies and platforms, the Flutter is used to develop cross-platform applications for Android, iOS, Linux, Mac, Windows operating systems. The proposed work provides an accurate, convenient, user-friendly Android mobile application as the final research output.

Keywords: *route optimization, urbanization, firebase, Google map API*

ID 489

Mobile-Based Feedback System for Undergraduates, Academic and Administrative Staff of Higher Education Institutes in Sri Lanka

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Student feedback is one of the good practices in Quality Assurance (QA) in Higher Education. At present, most of the Higher Education Institutes (HEIs) collect feedback for different purposes, such as lecturer evaluation by students and course evaluation by lecturers. A paper-based questionnaire is a method mostly used to collect feedback, which has many issues as it is costly, inefficient, erroneous and ineffective. Unlike other similar types of systems, the mobile-based feedback system maintains anonymity, collects results, generates reports and provides output. Further, the system is an eco-friendly and user-friendly platform for users and is available twenty-four hours and all round the year. The system is developed using Android studio, Android SDK, and NetBeans. The server-side language is Java and the database is based on cloud technology.

Keywords: *student feedback, quality assurance, higher education*

ID 496

Automated Software Bug Management System for Small-Scale Organization

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During software running, even errors due to system complexity and inadequate testing may occur. Troubleshooting plays an important role in software development and evaluation steps. Due to rapid changing technology, the whole system should adapt according to the situation, including matters such as well-skilful persons, technology and data. The bug management process has several steps, and controlling those steps is a huge challenge. Behind the situation, the small-scale Software companies need resources other than local organizations. This research focuses on identifying local small-scale organization behaviours, since they have fewer financial problems and less technological literacy of operating some licensed automation tools used in the software bug management industry. The research raises how automation techniques solve financial challenges faced by small-scale organizations. A research methodology approach which analyses previous studies and collected data is observed, and that information is validated according to the small-scale organization requirement. Finally, a proposed a system to overcome the situation is introduced, which is a web-based application that hosts the cloud. The proposed system implementation provides a facility for real-time communication between SQA, developers, and other team members via comments on each reported bug, while it assigns bugs to all the job roles represented by the agile software development life cycle, to reach historical bug records. Facility to embed the technical evidence as a report to the bug for a better understanding of the developer is also introduced. This facility generates reports for tracking each developer and tester's performance of that particular local organization. The proposed system uses an open-source development framework.

Keywords: *bugs, automation, management, financial, developer, literacy, small-scale*

ID 18

Investor oriented Stock Market Portfolio Management and Stock Prices Prediction Platform for Colombo Stock Exchange of Sri Lanka

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Over the past few years, various studies have been conducted to develop an optimum stock market-related portfolio management platform that will assist investors to actively perform the portfolio management process. Risk and level of investor participation are considered to be challenging aspects identified for optimum portfolio management. Along with portfolio management, stock price prediction is one of the key contributing factors that help an investor to arrive at mid-and long-term strategic investment decisions. Various deep learning concepts are evaluated to determine the most accurate algorithm to implement the stock price-based prediction system. Currently, Colombo Stock Exchange (CSE) has identified a desperate requirement of a portfolio management system with prediction capabilities to support local and foreign investors to actively engage in trading activities among different stock exchanges in different countries. A critical study has been conducted using supportive research papers, similar applications developed and using various requirement elicitation techniques to determine matters such as the functional requirements, non-functional requirements, investor requirements, and UI/UX considerations. The paper further describes various technological mechanisms implemented and system architectures used to develop the portfolio management and stock price prediction system. Accordingly, the implementation of the Brownian Motion algorithm-based model and LSTM (Long Short-Term Memory) model are in detail presented by the author. Finally, evaluation and testing results of the completed system and stock price prediction models are presented to prove the successfulness of the completed application and the accuracy of the models implemented.

Keywords- *stock, portfolio, prediction, LSTM, CSE*

Factors Causing Less Student-Teacher Interaction in Virtual Classrooms and Video Conferencing in Distance Learning: A Review

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As the COVID-19 epidemic forced people to stay in their homes, the field of education faced a major problem in conducting classes in the same educational style. Although distance learning provided the first solution, it could not replace the physical education methods. Synchronous distance learning is the most used and effective method, with video conferencing and virtual classes taking precedence. A survey was conducted to identify issues of effective interaction between students and lecturers with the participation of 243 individuals, including lecturers and students. Feedback reveals how lecturers and students experience systems and how satisfied they are. Both parties have a positive feedback average on the use of such systems. The research is concluded by proposing to develop additional features in current online learning platforms.

Keywords*: synchronous distance learning, distance learning systems, student-lecturer interaction, video conferencing, virtual classrooms*

ID 194

An E-Learning Platform for Hearing Impaired Children

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E-learning, also known as electronic learning, is a method of disseminating knowledge with the separation of teachers and students. Hearing loss and hearing impairment are common examples of disabilities that affect people. E-learning is found to be an effective method for hearing impaired children for their education as it gives them the ability to do their education at home without having to go anywhere else. Although the concept of e-learning gives a full idea of the opportunities it can offer, it has some shortcomings that need to be considered. For children who are learning letters and numbers, this online learning method would not be as effective as it would be for the older generation. Therefore, children under the age of five should have a proper solution to learn letters and numbers, even in times of crisis. The main objective of this research is to discuss the need for a proposed solution for hearing impaired children. The proposed e-learning platform will support both Sinhala and English languages. Therefore, children can get an education in the language of their choice. This platform will teach the children step-by-step how to write letters, in both Sinhala and English as well as numbers. The system uses machine learning with Support Vector Clustering (SVC) to identify the letters and numbers they provide. This algorithm is constructed by SVM (Support Vector Machine). In addition, the system will provide simple questionnaires and activities for them to complete, while doing their studies through the platform. The aim of this paper is to make e-learning more effective and efficient for hearing impaired children.

Keywords: *hearing impaired children, e-learning, distance education, crisis situation, education, deaf children*

ID 426

An Experimental Study on Computer-Based Virtual Classroom Learning, and Its Impact on Student Performance Based on Sri Lankan University Students

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Virtual Reality (VR)-based platforms have the potential to bridge the existing gap between educationalists and students. Computer-based simulators have the ability of Virtual Reality (VR), and it has a potential to take learning beyond the traditional online teaching-learning experience of educationalists and students together in the same room with the aid of online learning tools. VR-based educational applications were introduced to the market recently with the advancements and rapid growth of the pandemic to face 'new normal' ethics. VR-based simulators allow students to visualize or immerse the concepts taught in classroom textbooks, whether the student is at home, the library or anywhere in the world. In the global framework, many student learning reforms are initiated. However, modern VR learning delivery technologies, VR training methods, and gamification technologies are not yet addressed in Sri Lanka. Further, VR technology's influence on student performance is not profoundly studied in the Sri Lankan university context. Therefore, it is important to conduct an experimental study to find the student's mental behaviour, especially with the academic performance in the virtual paradigm. The research was developed via quantitative research techniques as a pre-post experimental study to achieve the research objectives with Quantitative data collection methods. Further, descriptive statistical analysis approach based on paired t-test analysis method was used and data analysis was done via IBM SPSS statistical tool. The main variables identified as Knowledge of Structures, Feedback, Mental Models and the conceptual framework were designed based on literature for the t-test. As pre-test, students were given a questionnaire to fill before the simulator training treatment. The questionnaire was designed based on available literature, while there were three-hypotheses based on the variables. The chosen VR learning platform was ‘Unimersiv’ ancient Rome visit for the students, and that lesson gives a great knowledge on ancient history. After the simulator learning, the same set of students was given the post-test questionnaire to fill. Significant correlation analysis proved that there is a positive and direct effect of each independent variable mentioned above.

Keywords: *virtual reality, learning, simulators, experimental study.*

ID 507

Student Activity Detecting and Reporting System for Online Learning Platforms

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After the onset of the COVID-19 epidemic, people had to bring their work home. The working from home concept is not good for everyone, yet is suitable for some industries. The lack of positive outcomes of online lectures in the field of education is due to the lack of interaction between lecturers and students, amongst students themselves, misbehaviour of students, and misuse of microphones and cameras by students. Therefore, there is an urgent need to develop an online learning system that focuses on the positivity of learning outcomes. Existing systems are developed focusing on business perspectives. At present, there is a requirement to develop an application to overcome the said problems. Requirements for the application development were captured from previous research done by the researcher. The system focuses on tracking student behaviours using web cameras and by monitoring computer tasks. Protecting the privacy and security of users and enhancing learning accuracy by improving lecturer-student interaction during the class is the main objective of the system. Attendance marking is also generated during the main process. While making space to develop multi-platforms and using modern technologies, the most important target of the researcher is to keep students attached during online lectures as an online learning system, and the research concludes with the definitions of technologies and features that enhance the existing online learning platforms.

Keywords: *distance learning systems, student-lecturer interaction, video conferencing, virtual classrooms, activity detection through webcam, activity detection through computer task monitoring*

Comparison of Trilateration and Supervised Learning Techniques for BLE Based Indoor Localization

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Location-based service is one of the primary services with high demand on the Internet of Things (IoT) applications. However, indoor position estimation is challenging due to interference and the inability to use GPS in indoor environments. Among few feasible solutions for this problem are Received Signal Strength Indicator (RSSI)-based indoor position estimation, one of the emerging best contenders. This research conducts a comparative study on trilateration techniques versus supervised learning models for estimating the position of a mobile node in an indoor environment. For the experiment, an existing dataset available publicly is used. The experiment testbed consists of three beacon sensor nodes designed using Bluetooth Low Energy (BLE) wireless technology and one mobile node. The RSSI readings at the mobile node from three stationary beacon wireless access nodes are used. Three popular regression models, namely, Decision Tree Regression (DTR), Random Forest Regression (RFR), and Support Vector Regression (SVR) algorithms were trained using the dataset. Also, trilateration techniques were performed to obtain the estimated location. The Mean Square Error (MSE) was utilized to analyse the model performance. Out of the three regression models and Trilateration tested, RFR showed better position estimation in indoor environments.

Keywords: *indoor localization, trilateration, bluetooth low energy, supervised machine learning*

ID 203

An Approach to Design a Smart Helmet Using Kansei Engineering

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Motorbikes have been a great medium of transportation among many people for decades. Nowadays, road accidents are much prominent on roads, and the tendency for motor bike users to get affected by those accidents is high. Owing to the reason that motorbike users are exposed to the outside world, their death rate is at a higher rate. Moreover, there is an increased rate of injury other than the deaths that occur as a result of road accidents. Though there are various helmet designs, they only ensure the safety of the motorbike riders to some extent. Therefore, there is the need to design a smart helmet that secures the lives of motorbike riders. Nevertheless, various smart helmets have been designed for the safety of motor bike riders integrating much more functionalities. This study mainly focuses on designing a smart helmet using the Kansei Engineering principles. This paper presents the design of a smart helmet that involves identifying the motorbike riders' emotions and integrating those results in designing the smart helmet.

Keywords: *Kansei engineering, smart helmet, human emotions, safety, designing*

ID 388

Mobile Applications for Precision Agriculture Practices: A Review

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In most developing countries like Sri Lanka, agriculture plays a vital role in economic and social aspects. Paddy cultivation is considered the most economically significant field of agriculture. Since farmers are the backbones of the paddy and rice industry, their satisfaction and efficient involvement directly affects the development of the paddy cultivation industry. As a result of the timely necessity of accessing information for decision-making in paddy cultivation, numerous paddy cultivation advisory services implemented in different regions can be identified worldwide. Access to continuously updated information on matters such as weather, machinery, diseases, pests and fertilizers at the right time allow farmers to make effective decisions. This review paper enhances details about software applications in paddy cultivation, developed to benefit farmers and other related stakeholders. A review of the system modules, features and technologies of providing timely information on paddy cultivation is mentioned by comparing prevailing systems. Moreover, factors that affect the prominence in using these types of systems are discussed in detail. This review shows that agriculture-based applications are highly demanded in countries like India, Sri Lanka, Myanmar and Africa. These applications have been developed to fit into their specific domain. Inefficient module functions, limited real-time services, complexity and lack of usability of prevailing systems are the main gaps identified through this review.

Keywords: *machine learning, mobile applications, paddy cultivation, precision agriculture, smartphone applications*

ID 485

Mobile-Based Animal Vaccination System for Sri Lanka

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Traditionally, animal vaccination is done by a veterinary doctor and the issue of vaccination record book/card is maintained by the pet owner. However, there are many issues in the traditional system, such as damaging the record book, forgetting to vaccinate their pets, and the veterinary doctor requiring to update manually. Although lots of pet care apps are available, hardly any pet vaccination app is found in other countries. Even in Sri Lanka, there is no digitalized method in the pet vaccination process. The mobile-based animal vaccination system covers the whole process of animal vaccination, and it can be used as a digital vaccine card. The system provides vaccine stock management, pet owner registration, pet profile maintenance, reminder alerting, and appointment management, event notifying, and reporting. Further, emergency and insurance claiming facilities available in the system have not been previously implemented for animals. Pet profile transferring is also possible in the system. The mobile-based animal vaccination system is developed using the ionic framework, and Geofencing is used to locate pet food and pet product shops. The system enhances the animal vaccination process in Sri Lanka, and the automated process will be a great benefit for pet lovers as well as veterinary professionals.

Keywords: *animal vaccination, vet clinic, IT in health*

Network Infrastructure Monitoring Tool for Small and Medium Scale Enterprises

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Modern SMEs utilize some form of computer network to accommodate both internal employees and external customers. Hence, managing the network infrastructure is crucial for SMEs. Network infrastructure monitoring is utterly important for network management, to attend to any critical situation as preventive measures for corrections. Eventually, a hassle-free network is introduced, assuring 24x7 availability. As a result, some form of a network infrastructure monitoring tool (NIMT) is an essential element for SMEs, despite the fact that commercially available high-end NIMTs are not affordable in any situation. On the other hand, many SMEs do not consider incorporating an NIMT with priority, since they can still survive with the primary business process, although there are significant interruptions of the network infrastructure. Nevertheless, the involvement of ICT experts is essential on either a full-time or part-time basis to operate high-end NIMT, due to the complexity to deploy and maintain it. As a result, "How to introduce comprehensive, user-friendly, affordable and maintainable NIMT for SMEs?" is the research question. In our methodology, the literature is evaluated for understanding the unique requirements of network management, and the available NIMTs are analysed under eight specific functionalities. Subsequently the design is finalized, focusing on the requirements of SMEs and the system development is based on python, whereas the operating system is Linux. More importantly, the user interface is based on PHP, while the database is on MariaDB. This all-in-one NIMT solution can be used by anyone for essential network analysis. Moreover, SMEs shall benefit from this solution in an effective manner, with neither extra software license cost nor the involvement of ICT experts.

Keywords: *utilising network, network monitoring, all-in-one*

ID 155

Sound Event Recognition and Classification Using Machine Learning Techniques

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Sound event recognition and classification are exciting and vital applications in the era of the Internet of Things (IoT). These Sound events carry information that is useful for our daily lives. The perception of surrounding events by humans depends strongly on audio signals. Awareness of what happens in the surrounding environment depends heavily on the ability of an individual to perceive sounds and accurately recognize events related to them. The subject of audio signal recognition is now very popular and has numerous applications. This paper presents machine learning approaches to classify sound events extracted through sound sensors, where the sound signals acquired by sensors will be processed using machine learning algorithms to classify them. The results show that the accuracy of CNN, SVM, MLP classifiers are 82%, 81%, and 79.48%, respectively.

Keywords: ***s****ound event recognition, Convolutional Neural Networks (CNN), Support Vector Machine (SVM), Multilayer Perception (MLP)*

ID 266

A Machine Learning Approach for Detecting Credit Card Fraudulent Transaction

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The world is reaching a cashless society with the increment of non-cash transactions. E-commerce has become an essential factor in every organization in global trade. Since financial institutions co-operate with billions of online transactions per day, identifying fraudulent transactions has become a challenge. This research was mainly focused on identifying the best intelligent adaptive authentication technique for credit card fraud detection. Areal-world transaction dataset of European credit cardholders and a synthetic dataset were used to extract the historical transactional patterns using Artificial Neural Network (ANN). Different classification algorithms, Logistic Regression, Decision Tree, Random Forest and XGBoost were also used for a comparative analysis to classify a real-world dataset. Among all, ANN and XGBoost have shown the highest performance in the binary classification of fraud and legitimate transactions. ANN has shown an accuracy of 99.94% and high adaptability in handling large datasets, by giving zero misclassification of fraud as a legitimate transaction by reducing the risk to its minimum.

Keywords*: fraud detection, ANN, adaptive authentication, random forest, decision tree, XGBoost, logistic regression*

ID 296

Neural Network Based Weight Prediction System for Bariatric Patients

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Obesity has become an epidemic condition in Sri Lanka as well as around the world. It is proven beyond doubt that Bariatric Surgery (BS) is the most effective option in treating morbid obesity patients, whose Body Mass Index (BMI) is greater than 40.0. After undergoing surgery, it is required to monitor a patient's weight for eighteen months until they reach a healthy weight that falls within the normal BMI range (18.5-24.9). This study has analysed records of bariatric patients registered at Colombo South Teaching Hospital, Kalubowila under three surgery types. Records show that due to the inability of tracking their weight loss throughout the post-surgery period and lack of continuous assessment after BS, majority of patients have lost their track of weight before reaching the eighteenth month. Therefore, some patients have to go through the same operation more than once, which creates a threat to their lives. This study aims to remotely track pre-and post-surgery bariatric patients and allow them to keep track of their weight loss until they achieve their expected weight using a web-based weight prediction system based on artificial neural networks. To predict the final weight bariatric patients might get after the surgery, pre-surgery and post-surgery data are taken as inputs. Mainly three predictions are aimed to be given as the outputs; namely pre-surgery, post-surgery and monthly weight. Machine learning algorithms like artificial neural networks provide an average of 85% accuracy in predicting the weight until the patient achieves the expected result in the final month.

***Keywords**: Bariatric Surgery (BS), Body Mass Index (BMI), obesity, morbid obesity, telemedicine, neural networks, machine learning, artificial intelligence*

Special Event Item Prediction System for Retails - Using Machine Learning Approach

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In the modern era, marketing, which can be defined as selling and buying, has expanded in a number of technological fields. Marketing becomes fruitful when it achieves its key points, which are called sales and profits. A most common place to see this selling and buying process is retailing. Information technology involves in various marketing fields such as in prediction processes, data analysis, item designing and profit calculations. In this study, a prediction process is primarily developed using machine learning approaches. Sales item data is analyzed to predict which items give maximum or expected profit margins and those which satisfy the customer the most. There are various machine learning approaches for aspects such as sales item prediction, prediction for item features and item price prediction. The novelty of this research is that it mainly focuses on special event items, such as those available in the Christmas season, items specialized for mothers' day, lovers' day and Vesak festival. The research process is divided into two main sub-parts; item classification and item prediction, while both processes are carried out using several machine learning approaches. Item classification is done using four supervised learning classifiers: linear support vector machine (svc), logistic regression, multinomial Naïve Bayes, and random forest classifier. Results prove SVC has maximum accuracy for classification section, accomplished using SVC machine learning approach. The prediction process has been done using the linear regression approach and according to the preferred data set, its results prove that database attribute directly affects the prediction accuracy and precisions.

Keywords*: item classification, item prediction, special event items, retail, machine learning.*

ID 351

Prevention of Cyber Bullying using Machine Learning Techniques

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Cyber bullying has rapidly increased in the past few years with the growth of social media usage and the COVID-19 pandemic. This study uses a dataset of 65000 tweets , splitting them into training and testing sets. Data pre-processing was done using feature engineering methods such as vectorizing, and Bag of Words to prepare data to test machine learning models or classifiers to build a model. Five different classifiers were tested with dataset and Naïve Bayes Model and linear support vector classification model provided the best accuracy and prediction times in sequence. The Sentiment Analysis System was built using Naïve Bayes Model and it is deployed to the web interface using Flask to get user input and predict sentiment in the three key aspects of negative, positive and neutral. System tested with user inputs and gained accurate sentiment Scores (comment: "listen to my most beautiful friend singing with her beautiful voice" Scores: Compound- 0.97 Neutral – 0.166 Positive – 0.834 Negative – 0.0) with three key aspects. The aim of this research work is to utilize man-made consciousness at a specific level to pre-empt exploitation by recognizing the riskiest clients and accounts.

Keywords: c*yber bullying, social networks, machine learning, sentiment analysis*

ID 70

Automated Hospital Clinic Management System for Private Hospitals

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The most essential aspect in the country's development is its healthcare system. Long-term disease treatments are one part of treatment. Private hospitals conduct different clinics to treat these long-term diseases. These clinics are separated into groups based on the types of diseases. Some people suffer from one or more diseases, and need to choose doctors for each disease type for their treatments in private hospitals in Sri Lanka. However, there are still several major issues in private clinic management systems, for which no effective solution has been found. The existing system's huge problem is poor coordination between doctors, patients and medical staff. The other problem is patients face lots of difficulties in maintaining their medical record books for each relevant clinic. Accordingly, this research paper mainly provides an effective solution to the issues highlighted in order to improve the efficiency of Sri Lankan private hospital clinic management systems. The proposed system will connect patients, doctors, pharmacy staff and medical staff into one platform and store information about patients, doctors, appointment details and all medical records. The research is based on the automated clinic management system for private hospitals and has updated it to a computerized automated system. The clinic management system for private hospitals will allow efficient creation and management of patient data, as well as management of doctor's schedules, seamless flow of information from one department to another, handling of the health center's accounting, and accurate archiving of patient information and diagnosis data.

Keywords: *manual, automated, clinics, private, disease*

ID 146

Cloud-Based Realtime Emergency Medical Service Platform

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In emergencies such as accidents, natural disasters and epidemics, immediate medical treatment in necessary, where patients need to be transported to the hospital from their location. In such situations, Emergency Medical Services (EMSs) as well as ambulances play an important role in saving people's precious lives. Presently, there are several systems in Sri Lanka to direct ambulance drivers to reach the patient's location in minimal time and to send the patient to the nearest hospital as soon as possible. But there are some limitations in these systems, such as the nearest hospital may not have the facilities to treat the patient, limited number of ambulances available for each of these systems, hospitals' difficulties in tracking ambulances and the fact that existing systems do not maintain patient health records. Therefore, the need for a Cloud-based Real time Emergency medical service Platform that can be used across the country is essential to address the said issues. The aim of this research is to provide a mechanism to reduce the latency of finding a suitable hospital for an emergency patient. The proposed platform is built using a Web application and an Android application that serve as the admin panel and user panel respectively. MySQL database hosted by a web server is utilized as a database connector between the Android application and the Web application. This paper presents design and implementation details of the proposed system and offers a comparative study on existing systems in Sri Lanka to understand the significance of the new system.

Keywords*: emergencies, emergency medical services, ambulance, latency, realtime, cloud-based, platform*

Finding the Best Feature Selection Method for Dengue Diagnosis Predictions

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Dengue is a mosquito-borne viral disease that has dramatically increased around the world in recent years. The spread of Dengue depends on the tropics, rainfall, temperature, relative humidity and unplanned urbanization. Severe Dengue can lead to circulatory system failure, shock and even death. The development of an effective Dengue fever prediction model is therefore essential for better Dengue case management. Feature selection is the predominant phase in developing the Dengue diagnosis prediction model. It is required to identify the most crucial attributes, as not all attributes have notable effects on the results. Therefore, this study focuses on the feature selection methods such as Principal Component Analysis (PCA) and Wrapper feature selections method with Naïve Bayes, K-Nearest Neighbor (KNN), and J48 algorithms. Simple Artificial Neural Networks (ANN) were developed to validate the performance based on the accuracy of each feature selection method, since it can work well with the partial dataset. Myalgia and Retro-Ocular Pain are the most expressive features chosen by all wrapper feature selection methods. In addition, with PCA, the initial 22-dimensional system was reduced to an 8-dimensional system with a cumulative variance of 59%. ANN with PCA resulted in the higher accuracy of 72.47% and ANN with Wrapper feature selection (KNN) showed the lowest accuracy of 54.47%. In conclusion, PCA is identified as the best feature selection method for the given dataset in this study based on the accuracy of ANN. In future, multiple Dengue diagnosis prediction models can be developed with higher accuracy and efficiency using the most vital attributes.

Keywords*: feature selection, artificial neural networks, dengue diagnosis prediction models*

ID 228

A Mobile Application for Blood Transfusion in Sri Lanka for Emergency Cases Based on Government Hospitals

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Blood is known as one of the most precious gifts that humankind can give to one another, and the need for blood is most felt when one begs for life from anaemia. In an emergency, the increase in the number of victims is uncontrollable and a victim may need more than 100 pints of blood. In today's challenging environment, a Mobile Application for the transfusion of blood is a great blessing, and the goal here is to find blood donors in the shortest amount of time. This paper is primarily concerned with the transfusion of blood in the shortest possible time in an emergency. The proposed Mobile Application allows blood donors to enter details, including blood type, the location used by Google Maps and contact information. This Mobile application enables hospital staff members to request blood from the donors in an emergency through voice input. Hospital staff can track where the donors are according to their predicted minimum time, and could contact them for blood needs. The hospital should be able to provide transport facilities to solicit accepted donors. This blood transfusion system is crucial in emergency blood distribution, because it allows for central and immediate access to donor data and location from any location. The primary goal of this paper is to maintain a well-informed group of blood receptors that can be used at any given time.

Keywords: *mobile blood transfusion system, emergency, blood shortage*

Smart Hospital Diabetic Clinic Patient Management System

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Sri Lanka provides health facilities freely for everybody and most individuals benefit from these free health services. One of the main problems captured with the significant ongoing clinical process is lots of time-wasting, because of the manual paperwork system. This research aims to automate hospitals' clinic patient management system and develop a diabetic prediction system using machine learning algorithms. The main objectives of this study are to make this manual clinic process an automated, time-saving and efficient one, and to add more value to this significant process of the health sector, with a newly added feature – the diabetic prediction system. This proposed system is highly beneficial for doctors in the process of updating or retrieving patients' records. The main focus here is to automate the diabetic clinic as the first step. This paper presents a clearer clarification of the objective of this study and the relevance and motivation of the study. The proposed solution is a web application with multiuser login. The backend of the web will relate to the MySQL database, which is created by PHP MyAdmin. Initially, it is kept at localhost and build by using Xampp server software. A smart ID card that contains barcode technology is used for the authentication process, and there is no need of maintaining manual records. Fingerprint scanning is used at a sudden admit of a diabetic clinic patient, who does not have to bring the clinic ID. The recommendation system included on the web can be used by both clinic patients and normal users.

Keywords: *smart hospital, diabetic clinic, web-based patient management system.*

ID 338

ETU Management and Patient Tracking System

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The Emergency Treatment Unit (ETU) in Sri Lankan Hospitals runs based on paper- based manual process and results in delays in delivering patient reports, losing them and delay in the treatments. In addition, due to the limited number of beds inside the Coronary Care Unit (CCU), it has become more important to identify the most severe patients to be admitted into the CCU. So, if the correct patient to be admitted is not identified properly, another patient in the unit could fall into a more critical condition. ETU Management System is a web-based system, which automates the current manual process inside the ETU and is capable of identifying the most suitable patient that should be treated inside the CCU, using a specific scoring system calculated by monitoring the symptoms of the patient at ETU assessment. Patient tracking system is a mobile application provided for patients and their guardians, which gives patients the facility to contact his/her guardian and doctor in any case of emergency, as well as enables Guardians to track the patient's location and notifies them via the mobile application, if the location of the patient is changed in any case. The proposed ETU management system helps to take the Sri Lankan medical field into another era by eliminating traditional paper-based manual processes.

Keywords: *ETU, CCU, score, hospital, automate*

Image Captioning in Tamil Language with Merge Architecture

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Image Captioning is the process of describing the content of an image using a natural language. This task that involves computer vision and natural language processing has been attempted on the English language with enormous success, owing to the presence of massive image-caption paired corpora as Flickr and Microsoft Common Objects in Context (MS-COCO). However, such developments in this arena have been a novelty for non-English languages with the exception of a few such as Chinese, Turkish, German and Arabic. In the case of Tamil language, this premise has been barely touched upon, due to the lack of a large, paired corpus. In this work, a paired corpus inspired from Flickr30K dataset has been created in Tamil language for the image captioning purpose. Along with it, this paper includes the experiments with an image captioning model, using a combination of Convolutional Neural Network (CNN) and Long Short-Term Memory (LSTM) architecture; specifically the Merge model for Tamil language caption generation. This methodology incorporates the image vectors in a layer following the LSTM layer. The results of the research have proven satisfactory in the evaluation with a Bilingual Evaluation Understudy (BLEU) score of 0.37, and this indicates further development with the presence of a more refined and improved dataset.

Keywords: *Tamil caption generation, convolutional neural network, long short-term memory, natural language processing*

ID 407

Comparison of Machine Learning Classifiers for Sentiment Analysis in Hotel Reviews

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Sentiment analysis or opinion mining refers to the process of identifying people's sentiments, opinions, attitudes and emotions behind a written text. In recent years, sentiment analysis studies have become an active research area under natural language processing. Understanding the opinion behind the user-generated text can be applied to various applications. When it comes to the hotel sector and travel planning, user reviews and comments are quite useful. Therefore, guest reviews are becoming a prominent factor, which influence people's booking decisions. In addition, knowing about these comments is important for quality control of the hotel management too, because it may be worth checking out some stats over time. The fundamental objective of this research is to compare several machine learning classifiers and find out the best classifiers to develop a sentiment analysis model for the hotel reviews, to tackle customers' sentiment. Under this research, a comparative analysis was established among Multinomial Naïve Bayes (MNB), Bernoulli Naïve Bayes (BNB), Logistic Regression (LR), Stochastic Gradient Descent Classifier (SGD), Linear Support Vector Classifier (SVC), Random Forest Classifier and Multi-layer Perceptron Classifier (MLP) classifiers. Moreover, two feature extraction techniques called Count Vectorizer and Term Frequency Inverse Document (TF-IDF)) are also compared to find out the best approach to perform the feature extraction. The result from this research shows that the highest results were obtained in Logistic Regression with TF-IDF method (Accuracy 87.39%) and SGD algorithms with TF-IDF (Accuracy 87.71%), while the lowest accuracy was obtained for Bernoulli NB classifier with Count Vectorizer (Accuracy 64.67%). Every time when using Count Vectorizer as the feature extraction method, the accuracies decreased, than when the TF-IDF method was used.

Keywords: *sentiment analysis, machine learning classifiers, feature extraction techniques*

Three Address Code Based Semantics Processor for Sinhala

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Semantic processing techniques have a wide interest in the field of Natural Language Processing. Processing a semantic from a natural language for human-machine communication is still a research challenge in this field. The Three-Address-Code is a type of intermediate code used by the compilers to identify the meaning of the source code or statements easily, with full accuracy. Therefore, the research captures the semantics of the Sinhala language text through this Three-Address-Code concept. This paper presents a Three-Address-Code based semantic processing system that can be used for human-machine communication using the Sinhala language. The proposed system comprises three components; namely Sinhala Part of Speech tagger, Sinhala chunker, and three-address-code based semantics generator. The system takes the Sinhala sentence as an input and generates the semantics information. This semantic processing system has been used under the PINA system for semantic processing.

Keywords: *three-address-code, semantics, tagging, chunking, ontology*

ID 642

A Review of Agent-Based Frameworks for Information Retrieval

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With the development of the Internet in the digital age, operative technologies that utilize automated tools for searching and retrieving information in any domain, even those not on the web, are in great demand. However, the enormity of the World Wide Web (WWW) poses a challenge for researchers to retrieve useful and precise information to meet their requirements. An Information Retrieval (IR) system is meant to form a stored knowledge base, with items accessible to the information seeker. A major problem of the traditional IR systems is their inability to provide users with a semantic description of the knowledge needed by them. This problem is addressed by this Intelligent Information Retrieval (IIR), which is capable to give much more relevant and accurate information. The need to discover and observe the real-time mutations in knowledge and information requires new techniques in the web IR process. The results of IR contain an abundance of information that matches with the queries or searches in varying degrees of relevance. The relevance of the results is an important concern and often associates with the volume of the results: the bigger the volume of information, the better the relevance, while a lesser volume of information may have less relevant content. Seeking solutions for this issue makes Web IR an active and interesting domain of research and development. Considering the past two decades, interest among many has arisen in software agent technology and its applications. With Intelligent autonomous agents being most suitable for numerous applications in a semantic web environment, many researchers have proposed different frameworks, which comprise of details such as information collecting agents, storing agents, reasoning agents and querying agents. These structures often take into consideration semantic web and intelligent agents research, and other technologies such as information retrieval and knowledge modeling. This study focuses on a brief survey of Agent-based IR Systems on semantic web and ontology. The performance of such intelligent systems is calculated by considering the productiveness, quality of the search and the results obtained, time performance, and whether users are satisfied with the search results.

Keywords: *intelligent information retrieval, intelligent autonomous agents, world wide web, knowledge modeling*

Building a Sinhala-English Parallel Corpus for Neural Machine Translation Based on Exam Questions

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In any neural machine translation between two natural languages, parallel corpus is a compulsory part of the training process. The most crucial step in an MT system is to develop an effective method for gathering parallel corpus. The construction of a parallel corpus, on the other hand, necessitates substantial knowledge of both languages and is a time-consuming procedure. Due to these limits, digitizing documents becomes extremely challenging, lowering the quality of machine translation systems. This research offers a method for producing an English to Sinhala parallel corpus that is both faster and more efficient, while requiring less human intervention. This system generates a parallel corpus for language pair using the following steps: scanning the exam question papers using a special type of scanner, Image optimization for Optical Character Recognition (OCR), text extraction from images and converting unstructured text into structured form as parallel corpus.

Keywords: *parallel corpus, image optimization, text extraction, neural machine translation*

POSTER PRESENTATIONS

ID 39

An Overview on Massive Open Online Courses (MOOCs) as an E-learning Platform: A Review

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Massive Online Open Courses (MOOCs) have peaked in popularity with the vast improvement in technology with minimum infrastructure to connect to the Internet, thereby allowing learners to access the massive number of courses available through accredited universities and academic institutes. Coursera, edX, Udacity are some of the platforms in MOOCs that enable learners to get certified and gain knowledge in relevant fields. This paper focuses on signifying the importance of assessing the ideal effectiveness of the MOOCs platform, while conducting a review and identifying motives to enrol, pros and cons, and factors to drop out of MOOCs. The authors have identified four research questions in relation to the above facts in concern regarding the MOOCs platform, and a literature review has been carried out in this study by addressing the said research questions. The results of this review suggest that there exist multiple motives for the learners to enrol in MOOCs, and there is also a considerable attrition rate of the MOOCs learners from those courses. The reasons to drop out of MOOCs is therefore a significant area that must be discussed, and there are both pros and cons of this e-learning platform. Further, there is no proper method to assess the effectiveness of MOOCs and therefore,such an assessing procedure is a timely need, due to the fact that it is an online education platform, where individuals can gain access to plenty of courses available, irrespective of geographical boundaries and time constraints.

Keywords: *MOOCs, online education, self-learning, affective education*

ID 154

On Scene Crime Reporting System for Law Enforcement in Sri Lanka

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Police may offer crime reporting also as a service. The number of reported criminal cases has increased over time. Law enforcement discovers a distinction between reported and unreported offenses, and a variety of factors could cause this gap. It is not an honourable thing to allow criminals to remain safely within the community as innocent persons, stimulating criminals to commit more crimes. This would result in the community being in grave danger of being victimized. Like criminal justice, members of the community would seem to be unable to do their tasks, although many crimes are not recorded. This may have an impact on ongoing investigations as well. In some cases, to cover this void from police killings, certain law enforcement authorities impact digital crime reporting platforms via the general public which could report offenses. This paper explains how crime reporting systems are assisting law enforcement and continuing investigations, and the general public's participation in any of these systems. The efficiency of the system in terms of policing is often explored in this study.

Keywords: *application, crime reporting, privacy*

ID 164

Use of an Improved Online Job Recommendation System to Search Job Roles and Vacancies

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Finding the perfect job is the main purpose of Higher Education for young individuals. For this purpose, nowadays, there are a lots of job portals available in Sri Lanka, where job seekers discover work opportunities and vacancies according to their preferred job titles. Yet for this, the seeker has to have a clear idea about at least several job titles or roles in a company. Not every person who uses these portals has knowledge of jobs and job positions, and most might know only a few job positions, while they might not have ever heard of some. With the outbreak of the COVID-19 pandemic situation, the whole world has been suffering for almost 2 years now. Changes have happened in every sector in continuing with daily processing during the pandemic. Many researchers have already proposed matching approaches by developing ontologies as a reference to mediate matching accuracy approximately. However, these approaches do not prove how closely matched applicants are in relation to their core skills. This research paper proposes a method that uses a proper approach for improved keyword searching, by influencing the comparability between concepts in the judgment, which represents the core skills and qualifications needed for a job to decide how closely matched an applicant is during the job searching process, mainly focusing on two recommendation processes; job role recommendation and job vacancy recommendation.

Keywords: *job portal, job search engine, online jobs, job role recommendation, job vacancy recommendation*

ID 176

SQL Injection Detection and Prevention Solution for Web Applications

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Presently, the most highly used method of global communication is web applications. It is used for long-distance communication, online marketing, health services, research and development, distance learning, e-banking and social media networks. Since web applications are available for global community with access for anyone at any time, web applications are confronted with numerous challenges that comprise of security issues, specifically owing to web-based cyber-attacks. The SQL injection attack is the most prevailing global web-based cyber-attack, and it belongs to high rank classifications. Because of the increased number of global online services with a high rate of cyber-attacks, SQL injection attacks also are amplified rapidly. Most of the SQL injection attacks are successful, due to lack of proper validation. However, a successful SQL injection attack highly interferes with integrity, availability and confidentiality of the data in the databases. Therefore, there is a vital global requirement to overcome SQL injection attacks. Towards overcoming predominant issues, a periodically and continuously running PHP based programme, which is able to identify patterns of SQL injection attacks recorded in PHP Apache log files, and is capable to block the identified suspicious IP addresses was designed as the adopted methodology. In this empirical research, statistics of total suspicious IP addresses and blacklisted IP addresses with their hitting counts and time were obtained, while preventing access of blacklisted IP addresses to the Apache web server. The proposed solution facilitates for continuous monitoring of suspicious activities, while blocking vulnerable hosts using its IP addresses automatically with securing web servers from the SQL injection attack.

Keywords: *SQL injection attacks, web applications, communication*

ID 195

An Interactive E-Commerce Website for the Beauty Industry in Sri Lanka

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The beauty industry has been gaining popularity for past few years, due to increasing social media trends in "self-care" with the use of beauty products. As a result, sales generated by the beauty industry spiked creating competition among vendors and sellers in the industry. With the COVID-19 pandemic, the traditional way of shopping for beauty products halted, creating a requirement to introduce customers with new methodologies to sell beauty products, which are similar in experience to traditional shopping. One such solution can be considered as e-commerce websites. E-commerce websites currently operating in Sri Lanka and are part of the beauty industry are dedicated to a singular brand or product line, not a marketplace with multiple brands. Also, considering the products sold, current e-commerce applications do not provide sufficient information regarding standards or ingredients used in the development of the product. This paper investigates an e-commerce solution to the beauty industry that allows customers to shop for safe beauty products that are suggested according to their personal preference by a variety of sellers.

Keywords*: e-commerce in beauty industry, e-commerce website, beauty industry*

ID 205

A Personalized Food Recommendation Application using a Hybrid Collaborative Filtering Approach

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With the increase of workloads, the usage of recommendation platforms for purchasing meals has increased. The diet patterns of individuals are influenced by a multitude of factors including age, health conditions, pregnancy, culture, religion, and location. Existing applications recommend restaurants to the user depending on the user's ratings and locations. However, these apps do not consider personal traits of a user during the recommendation process, so they cannot provide effective suggestions that match the user. None of the existing apps recommend individual food items that suit the user's preference. This research aims to provide a smart solution to this common issue encountered during online food purchases. Through the development of a personalized food recommendation system, the time spent on selecting food items can be decreased. This model will be implemented in 2 sections- a mobile application that allows the users to order food items based on the recommendations, and a web platform that can be used by restaurant owners to maintain their restaurant's profile. The customized recommendation process is implemented by using a hybrid collaborative filtering model, by addressing the data sparsity and scalability issues associated with the content-based and traditional collaborative filtering approaches.

Keywords: *personalized, food recommendation, hybrid collaborative filtering*

Knowledge Management Systems in the Agricultural Context to Face Resilience in the New Normal

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The COVID-19 pandemic has given a forceful full stop to all daily routines, while shutting downing workplaces, entertainments and meetings among others. Amidst the revolution of the Coronavirus, the active parts of the world are only the essential services such as health, food production and supply. The continuation of the pandemic has created a New Normal with lapses in the production lines evoking the value of cultivation and their need to engage in self-productions. Therefore, farmers and the public have attempted at taking steps to cultivate at their best as they do have to survive. Though the start-up was a success, issues arise with the continuation of their cultivation due to the lack of precise knowledge and experience. Primarily, the issue arises with the lack of know-how knowledge for cultivation. Therefore, this research provides a critical analysis of how knowledge management systems can support sustainable progress in cultivation. This paper attempts to define the meaning of knowledge management and knowledge management systems in national and international perspectives to guide the unguided public in critical New Normal conditions.

Keywords: *knowledge management systems, knowledge management, agriculture and cultivation*

ID 297

Toothcare: A Toothbrush Quality Identifying App Using Machine Learning and Image Processing

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Toothbrushes of varied qualities, designs and standards are globally available, yet majority of them do not conform to international standards. There is no proper guidance or awareness given for the people with this regard. So, generally people do not know to choose the suitable toothbrushes they need, when they require to replace the used toothbrush, and whether the existing toothbrush is suitable for use. Therefore, the Toothbrush Standard Monitoring App provides a solution for all the above mentioned issues. This app is capable to scan the user's toothbrush and identify its condition. Machine learning and one of image processing techniques, image classification are mainly used for development of the app. Android Studio, Java programming language and firebase are used as development platform, backend development language and database platform respectively. The main purpose of implementing this app is to improve the dental health of human beings with the help of modern technology, and this will be the very first such solution implemented, addressing the above-mentioned health and social issues. This app functions in order to make people aware about the quality of toothbrushes and the conditions, hence reducing dental health issues and acknowledging people regarding the time period when they need to replace the existing brush with a new one. Accordingly, the app suggests certified toothbrushes following the user's data, monitoring the quality and damaged capacity of the toothbrush using image processing and informs the user whether the toothbrush can further be used or needs to be replaced. For this process, a TensorFlow Lite model with 83.48% of accuracy has been developed.

Keywords: *image classification, machine learning, image processing, Tensor Flow Lite*

Air Quality Prediction Using Machine Learning

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The main basis of human survival is Air. The Air Quality Index is the value that qualitatively describes the condition of air quality. The greater the Air Quality Index, the more threatening risk to human health and environment. In Sri Lanka, poor air quality is a huge concern, especially in cities like Colombo and Kandy. Accurate Air Quality prediction will minimize health issues that can occur due to air pollution. This research has attempted to identify the best-suited machine learning algorithm-based approach to predict accurate air quality based on PM2.5 concentration in Colombo. In order to identify the most influenced air pollution concentrations for the air quality prediction purpose, correlation analysis was conducted. In this research, PM2.5 was predicted in Colombo city using 4 related air pollution concentrations including SO_2 concentration, NO_2 concentration, PM2.5 concentration & PM10 concentration. In order to get higher prediction accuracy, the gathered dataset was pre-processed by prediction beforehand. The prediction model trained and tested using machine learning algorithms such as KNN, Multiple Linear Regression, Support Vector Machines, and Random Forest. Multiple Regression was identified as the most suited prediction model which was able to gain 94% higher accuracy.

Keywords: *air quality, concentration, correlations, machine learning, pollution*

ID 461

An Optimum Train Selection and Management Platform

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Sri Lanka, as a developing country faces rapid urbanization, which leads to high mobility requirements. Due to increased traffic congestions during peak hours, people tend to select the railway system as their mode of transportation. As a considerable amount of people choose railway as their preferred platform in their daily routine, it is highly crucial to maintain an efficient and timely railway system. Unfortunately, the Sri Lankan Railway system is not known for its efficiency. As a result, considerable number of daily users of the system are affected in their daily routines. Increasing the efficiency of underlying infrastructure has been going on for decades, yet it has not been a solution for the inefficiency of the railway system itself. Hence, the only logical approach to address this issue is to introduce a common platform, which the users and Railway department can communicate, while maintaining a stand-alone system which can select optimum trains for the users. The objective of this research is to discuss the necessity of the proposed solution, ultimately providing a solution to the inefficiency of the railway system of Sri Lanka. The proposed platform will comprise of two parts; A web application for the railway department and an Android-based mobile Application for railway users. The web application will be powered by a ESP8266 and NRF-24 based hardware modules with a firebase Backend. A mobile application will gather required inputs via the hardware modules to provide users with an optimum train to travel at any given time of the day towards the required destination. System will be running using dynamic data acquired from the train stations with a dynamic train schedule. Users will have the opportunity to get notified about train delays, unavailability and breakdowns. The aim of this research is to provide a common communication platform to railway department and public, ultimately making railway platforms more efficient.

Keywords: *railway transportation, Arduino, long-distance communication, public transportation, android applications*

Feasible Solution to Manage Donations Intended for Community Service Responsibility (CSR) Projects

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The motive of this mobile application is to donate money and funds to trusted CSR projects. Searching for a trusted CSR project is the main problem that decreases the interest of the donors and prevents people from making donations. So, this application will help to solve the problem by including a list of trusted CSR projects which are admin-approved. Also, the application contains separate user profiles for CSR projects and donors. There is a function for counting how much funds the CSR project takes, and how many donations a single donor donates since he/she has registered to the application. One of the main features of this application is that donors can donate any amount of rupees ranging from Rs.1 to a maximum at the donor's discretion. In addition, the donor can choose any CSR project of his/her desire and can maintain a separate private profile. This research intends to mention how helpful this application is for those who are willing to donate, and the methodology uses quantitative and qualitative-based survey, experiments and interviews. The goal of this research is to mention that it is a platform that people can help each other within a minute's time and build up an easier process than a conventional donation.

Keywords: *donor, CSR projects, platform, funds, fundraising*

ID 503

Smart Ticketing and Seat Reservation System for Sri Lankan Railway

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This system is formulated to overcome the significant flaws in the present scenario and the consequences of traveller ticket buying and seat reservations, which frequently lead to mistakes and long queues. Long queues are a massive issue in the current railway system. The proposed system provides proper solutions for train passengers to make their daily travels easy, and most local and foreign travellers use trains to move to their travel destination. Nevertheless, there are some issues with the current train seat reservation system. The proposed system will be able to give a solution for these issues. The proposed method is an online application that allows travellers to buy ticket seat reservations from their mobile phones. The unique feature of the new proposed self-seat reservation system is that travellers can reserve any number of seats according to their preference. Moreover, in this research paper, we have discussed some solutions for people who cannot use smart phones, and who do not have the technical knowledge to use smartphones and modern technologies. A system dashboard is a separate application of a system used for management system works, reservation and database.

Keywords: *smart reservation, e-ticketing, train ticketing, e-transportation*

Impact of Social Media-Related Cybercrimes and Preventive Precautions

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The impact of social media on people's lives is enormous. Through social media, people can communicate and collaborate with anyone in the world and can entertain themselves. It is a good platform for entrepreneurs to promote their business too. As a result of the COVID-19 pandemic, people tend to work from home relying on computer systems, mobile devices and different social media platforms. The usage of social media platforms for communication, sharing information, business purposes and shopping increased to mitigate the impact of social distancing. Cybercrime will rapidly rise because of the widespread use of social media. The increase in volume, velocity, veracity and variety of data in social media networking are major concerns that may lead to privacy and security issues. Cybercrimes will create a massive impact on the security of people in future. To address this problem, the security of social media users should be improved using different techniques. This paper focuses on the usage of different social media platforms, types of social media-related cybercrimes, techniques, tips, recommendations and future precautions that can be used to prevent social media-related cybercrimes.

Keywords: *cybercrime, social media, cybersecurity*

ID 517

Six Thinking Hats Method for Lateral Thinking in Software Development Organizational Problem-Solving Process

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Six Thinking Hats is a method that presents different thinking styles required by an individual while effectively analysing a given problem. The method gives different thinking perspectives used in a systematic problem-solving procedure using different coloured hats. By considering each coloured hat, one is able to focus on the different styles of thinking patterns and scopes associated with each coloured hat, so that the same problem can be analysed in different angles. This method supports lateral thinking and new outputs during problem-solving processes. So, the optimum solution for the considered problem can be found. In this paper, the researcher discusses how to adopt the Six Thinking Hats technique in an organizational problem-solving process. Each Six Thinking Hat is considered to be an independent entity in the thinking process and contributes to predominant personality trait classification with various categories of personnel. In such cases, thinking styles are also associated with these particular personnel/major decision-makers such as CEOs, directors, project managers, administrators, software developers and business analysts. This paper also considers the importance of the Six Thinking Hats method in individual and group thinking in solving software development organizational problems. The paper contains the attitudinal relationship in decision-making using the Six Thinking Hat technique, particular personality types associated with the thinking hats process, and use of this technique in organizational problem-solving Processes.

Keywords*: Six Thinking Hats method, lateral thinking, managerial problem solving, organizational decision-making process*

Automated Web-Based Inventory Support System for Retail Shops in Sri Lanka

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The inventory of materials is the main piece of current resources and work in any association. The primary disadvantage of the current framework is the absence of information on present day advertising and stock administration keeping up client base, and because of this, it is hard to have a daily perception in the field of stock administration issues, and how to utilize it positively. Most retail shops are actually run with conventional paper-based frameworks because of the absence of information and consideration, helpless deal figures, staying aware of changing client assumptions and holding clients, and discovering innovation issues with the board in the retail shop. This framework requires every client and customer to get to the framework in anyplace and any time, and the framework is created as an entrance electronic application. Further, it tends to be distinguished the cycle the framework information sources. Accordingly, this research paper predominantly gives a powerful answer for the issues featured and to improve the effectiveness of Sri Lankan retail shop stock with emotionally supportive networks. The proposed framework will associate business persons and providers into one stage and store data about stocks, reordering, adding provider subtleties and stock status. The exploration is dependent on the mechanized online stock emotionally supportive network for retail shop, and it is refreshed to an electronic, computerized framework. This inventory support system will permit productive and overseeing of stock things, provider measures, and the treatment of the shop book-keeping and business.

Keywords: *inventory, framework, retail shop*

ID 526

Menstruation Cycle Information Analysis for Pattern Recognition: Determination of Algorithm on Stakeholder Requirement

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The menstrual cycle of a healthy woman is systematic and individually unique. As it is directly related to a woman's physical and mental health, the menstrual cycle plays a major role in individual nutrition, social and psychological decision-making. As women frequently forget the exact date of menstruation, lots of mobile apps are developed to assist them. All such apps use 28 as the approximate date, but the experiences are very dependent. Therefore, to utilize individualized menstruation cycle guidance app development, it is required to develop an algorithm to predict the date of menstruation. Then the objective of this work is to study the collection and analysis of field data to realize what model is suited for cycle prediction. The data was collected using 30 women between the ages of 20-35 with their menstrual cycle dates for one year. Then this time series data was analysed using cumulative moving average (CMA), and Auto-Regressive Integrated Moving Average (ARIMA). The analysis shows both methods can predict menstrual dates with an average accuracy of 90%, which is acceptable to the purpose of the work. However, it is decided to use either method to predict the menstrual date for users who newly registered or use the app for less than one-year period, as the utilized data set limitations. It is required to analyse more advanced seasonal level prediction models when the app is evolved with more users and collecting data.

Keywords: *menstruation cycle, prediction, women*

Fault Detection of Mechanical Components using Machine Vision

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In this paper, an automated system isolates defective bolts from conveyor belts to increase the efficiency and accuracy of detection compared to manual labor. This system consists of a conveyor system, a Raspberry pi development kit, and a high-quality pi camera. The image analysis is carried out using Convolutional Neural Network (CNN) to detect faulty bolts. Bolts that have dimensions outside the standard measurements are labeled as faulty in the proposed system. The prototype fault detection system implemented identifies bolts of various sizes from standards, with an accuracy of nearly 80%, which is a significant achievement.

Keywords: *machine vision, automation system, fault detection, CNN*

ID 547

Low-Cost Developing Board for PIC Microcontrollers

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Microcontrollers are single-chip computers that include a minimum of microprocessors, memory and input-output module. A number of experimental-level and commercial quality development boards are available for microcontrollers, because the cording process of the microcontrollers is difficult. This paper presents a comparative description of existing microcontroller development boards and proposes a new development board for the microcontroller programming, especially for school students. Further, this study also identifies related issues and challenges of the PIC microcontrollers, and why users are not much focused on them. Finally, the paper proposes a new design of the development board for the PIC microcontrollers, which is capable to reduce some of the said issues. The proposed microcontroller development board has been tested with a PIC 16F877.

Keywords: *microcontroller, microprocessor, bootloader, development board, embedded system*

An Automated Platform to Manage Customer Relationship in a Gymnasium

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In this advanced world, the computer turns out to be an increasingly famous and imperative to our way of life. The Gymnasium Management System is a collection of wellness centers designed to make dealings with clients easier and more efficient. The project is a computerized computer-based framework and is used to deal with gym members. This study expects to build a framework for people who want to maintain their health and physical wellbeing on a regular basis, relying on the gym. The manager can see all members from the gymnasium and also their details. This project proposes a strategy for an online knowledge base as well as executive exchanges. The plan framework can supervise recreation center members, gymnasium instructors, trainers, gymnasium gear, diet of gymnasium members, instalments of gym members, instalment of instructors, and equipment details. The framework additionally gives the capacity of search and progressed look for looking through records proficiently. The framework, which will store information, will check the legality of data provided by members, stores data of members as per their ID, and creates reports for various IDs.. This framework is much secured, and to login to the framework one's username and password is required. The framework administers the recreation center part's information exclusively for all activity and gymnasium instructor's information separately in terms of thinking about gymnasium needs, and stores information with respect to normal machines. This Automated Gymnasium Management System is reasonable than the manual information base, since it gives trainers automated framework support, huge capacity limit, more faithfulness and high safety.

Keywords: *gymnasium management, fitness, database management*

ID 556

Challenges of Manual Attendance System Towards Student Motivation

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Students must attend lectures to get their primary source of knowledge. Lectures and lecturers guide students to have a productive education. Students can be motivated to study by making them attend lectures. As shown in this paper, students' attendance is important, and they can be motivated to attend lectures. Attendance systems in Sri Lanka are mostly manual and paper-based, which means the process from marking attendance to calculating attendance is fully manual. The current attendance system only produces monthly reports, and some only show the final attendance report. It helps students to be aware of attendance, but is unable to motivate students to keep a better attendance percentage. There are many issues in the attendance systems that are currently in use. In current systems, attendance marking data can be manipulated by students. This is a major issue and will damage the accuracy of the attendance data. It will also decrease student motivation towards attendance. A survey was conducted to verify the problems in the current systems and to identify the requirement for a new system. To keep students attending lectures, they must be motivated and as a solution to this matter, an automated system can be built that allows students to see their attendance. The system should include proper methods to motivate students to reach their required attendance percentage for a semester. It should include an option that enables the student to mark and view attendance instantly. Also, there should be a method in the system, where students with lower attendance are identified and notified that their attendance level is low. QR code is a proper method to verify a student's identity in a lecture. From this method, students can be motivated to achieve their required attendance percentage and reduce attendance frauds. This paper shows an in-detail solution to all the above problems, by referring related research papers and by using analyzed data of a performed survey.

Keywords*: attendance management system, manual attendance, challenges, student motivation, attendance verification method*

Housing Price Prediction using Machine Learning

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As housing price increases annually, offering unusual prices for houses that are not worth so much is a current problem faced by those who plan to buy a house. Moreover, most property investors also mislead by using fake facts without knowing the trend of houses for a certain location. So, the proposed system allows to evaluate the performance and the predictiveness of a model that supervises collected data from a certain area. The system is stricter on providing accurate values for the houses than the existing systems. This project expects to build a good mutual understanding between buyer and seller. It will endeavor to give the best rates among different calculations when utilizing the public dataset in preparing real-world. The project shows the factors that are affecting Housing Price Prediction on real-world. Furthermore, the observational outcomes show that crime rates, store rates, and public spots impact the house costs contrarily, whereas expansion, year, and joblessness rate sway the house costs emphatically. Overall, in the modern world, with the rapid development of technology and digitalization, a software like this is really required to defend from sellers, who deceive customers verbally and physically by showing inaccurate prices for properties which are not worth that much. It will help investors to achieve their economic ideas without any doubt too.

Keywords: *prediction, machine learning, housing price, regression*

ID 595

Research Direction for Android Based Indoor Navigation Solution for Shopping Malls through Augmented Reality-EasyMap

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Shopping malls have become extremely popular among society because they are very convenient. A shopping mall is a collection of shops and stalls in one large space. When clients are unfamiliar with the shopping area, it can sometimes be difficult to determine where the store is located, hence time wasting. Requirement gathering and data analysis techniques such as surveys, interviews and literature survey clearly provide the best idea of existing systems, used methods, techniques and their pros and cons. Through the above-mentioned requirement gathering techniques, the best solution for a problem domain is the proposed application for visually indoor navigation. The mobile application is the best way to release it to the masses with indoor navigation to find the destination by using step-by-step directions. Augmented Reality is one of technologies that is rapidly evolving and can deliver new experiences to the world. It can guide visualized directions to users for navigating to the destination through the Augmented Reality environment. Other than the navigation feature, this application provides more different functionalities, such as the user can search the destination using a shop's name or product's name they need to purchase, and categorize the shops and stalls in a shopping mall. The development of this app involves a different variety of interesting tools and software such as IndoorAtlas, ARCore and Android studio SDK. Throughout this paper, a smart solution for the above-mentioned problem and design, used technologies and how they have evolved to the implementation of Android-based Indoor Navigation Solution using Augmented Reality for shopping malls are discussed.

Keywords: *mobile application, indoor navigation, shopping mall, augmented reality*

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