KDUIRC
INTERNATIONAL RESEARCH CONFERENCE

13TH INTERNATIONAL RESEARCH CONFERENCE

HOLISTIC APPROACH TO NATIONAL GROWTH AND SECURITY

15TH - 16TH OCTOBER 2020

Computing

ABSTRACTS

General Sir John Kotelawala Defence University

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Message from the Hon. Minister of Education

It gives me immense pleasure to send this message on the occasion of the 13th International Research Conference of the General Sir John Kotelawala Defence University (KDU). I would like to congratulate the KDU for being able to conduct its International Research Conference in 2020, consecutively for the 13th time. It is not an easy task to organize such a momentous event particularly under many difficulties and challenges posed by the COVID 19 pandemic situation. It is gratifying to witness that KDU, the only Defence University in the country, has been able to transform a challenge into an opportunity, as it usually does.

The theme of the conference, namely the "Holistic Approach to National Growth and Security," is very timely and of great significance for deliberation in expert panels of this conference. The nexus between National Growth and National Security is closely interwoven. The 'development' and 'security' of a country cannot be compartmentalized and discussed in isolation of each other. There is no security for a nation without economic and social progress, and likewise, economic and social progress cannot be achieved without stability and a secure environment. I hope various panels of this conference will be able to discuss many facets of national growth and security and their interconnectedness. These two areas have a direct bearing on the development of Sri Lanka, a country which succeeded in ending a 30-year long separatist war. In the context of the present need for robust development, it is absolutely necessary to engage in serious research which leads to discoveries as well as policy-oriented recommendations. Therefore, all academic establishments must provide a conducive space for their intellectuals to reach new frontiers in research. I am glad that KDU is setting an example for all other universities in Sri Lanka in this regard. I hope this year's conference will produce significant research outcomes and I wish this conference all the success.

Hon. Professor GL Peiris,
Minister of Education

Message from the Secretary, Ministry of Defence

I am delighted to send the best wishes to the KDU on this significant occasion of the annual international research conference. I would also like to congratulate the Vice-Chancellor and the team for continuing the tradition of organizing this conference consecutively for the 13th time, despite the emerging contested health environment.

This years conference theme: "Holistic Approach to National Growth and Security" focuses on the National Growth and National Security as core concepts, and it, further, suggests that 'development' and 'security' of a country should always go hand in hand. Therefore, this conference would undoubtedly become a vital forum to discuss an area of study which has a direct bearing on the development interests of our motherland.

I am glad that KDU, under our ministerial guidance, is setting an example for all other universities in Sri Lanka in progressing research in many academic fields. I hope this year's conference will produce a significant research outcome that the policy community of Sri Lanka could utilize to support the present development drive. Further, I would like to urge the conference organizers to see the possibility of distributing the conference outcome to all the relevant Ministries and Departments of the country so that these entities could link with the researchers and employ their valuable research outcomes for the benefit of the nation.

I wish that KDU IRC 2020 will enhance the wisdom of all the participants to serve Mother Lanka for a better tomorrow.

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

Message from the Vice-Chancellor

The International Research Conference taking place for the 13th consecutive time is a landmark in terms of keeping continuity of events at KDU. This year's conference attracted a large number of paper submissions and it indicates the enthusiasm growing in the country on development and security research.

KDU, from its inception, was instrumental in handing down the core values of security to the development paradigm in Sri Lanka. This year's theme 'Holistic Approach to National Growth and Security" highlights the importance of maintaining a harmonious blend in security and development in all national projects.

I believe the efforts of security-based education aiming at strengthening national development should be more cooperative in the future and KDU has always facilitated any research efforts that strengthens the national security of our nation. We urge the academic community of Sri Lanka to join hands with us in all our future endeavours to support the nation especially through productive research in diverse disciplines.

The organizers of the KDU international research conference intend to set the tone to initiate more collaborative research at national and global levels. This research conference is an ideal platform to make connections. I hope that authors of KDU and various other local and international universities will take the opportunity to interact and develop friendly relationships, establish networks and to explore win-win situations. I wish all the very best for the presenters and hope you will enjoy every moment of this academic fusion taking place on two whole days.

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

Message from the Conference Chair

For the thirteenth consecutive year, General Sir John Kotelawala Defence University organizes its International Research Conference (KDU IRC 2020), and this year it is held on the theme 'Holistic Approach to National Growth and Security'. It is with great pleasure and honour, the organizing committee extends its greetings to all of you taking part in KDU IRC 2020. Holding the KDU IRC 2020, under the patronage of the Vice Chancellor, amidst many challenges encountered throughout the year, was memorable experience for me, and I believe that the organizing committee was able to accomplish a very successful mission.

KDU IRC 2020 is a tremendous opportunity for researchers all over the world encompassing various disciplines such as Defence and Strategic Studies; Medicine; Engineering; Management, Social Sciences and Humanities; Law; Built Environment and Spatial Sciences; Allied Health Sciences; Basic and Applied Sciences and Computing to present their research to fellow scholars, professionals and students.

Interestingly, the theme of KDU IRC 2020 is dedicated to the national growth and security, and it reflects the prime concerns of contemporary Sri Lanka as a nation and researches based on a holistic approach towards the national growth and security would enhance the quality in all aspects in a timely manner. In this backdrop, the esteemed speakers of all plenary sessions and research presenters of all technical sessions will cater to the same objective.

Finally, I would like to extend my best wishes to all the authors, participants and the organizing committee of KDU IRC 2020, and I encourage all of you to enjoy the KDU hospitality during these two fruitful days.

Dr. L. Pradeep Kalansooriya
Dr-Eng, MSc, BSc, MIEEE, MCSSL
Conference Chair

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Factors Affecting Post-ERP Implementation in Sri Lankan Apparel Industry

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An Enterprise Resource Planning (ERP) system plays a vital role in any organization to achieve the required speed, efficiency and accuracy of daily business operations through automation and integration, providing a centralized and integrated system to increase organization productivity while reducing time and labour costs. However, most leading manufacturing organizations end up adopting ERP systems without having expected results, and fail to gain true benefits as expected because of the lack of attention in the post stage of implementation. Since it takes a while to reap full benefits, it is critical to have a successful ERP life cycle. Therefore, the importance of post-implementation success factors is critical for any organization. Garment manufacturing organizations have adopted the same trend by implementing new ERP systems by replacing their legacy systems. It seems that garment industries were successful when adopting ERP systems than other manufacturing organizations in Sri Lanka, but this research focuses on developing post-implementation success factors by analysing those which have helped according to literature and industry knowledge and experience. Both qualitative and quantitative approaches have been used to analyse the data, interviews and surveys used to capture the data in this research. Research has shown that not only technical issues but also some problems such as not using effective change management, top-management support and business process reengineering have affected post-implementation. Moreover, the proposed framework can be used as a guideline for successful ERP implementation at garment manufacturing organizations.

Keywords: *Post ERP Implementation, Multicollinearity, Stepwise Analysis, Principal Component Analysis*

Clustering Crimes Related to Twitter Posts using WordNet and Agglomerative Algorithm

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Crimes are a major threat to society. They adversely affect the society's quality of life and the economic growth of the country. Identifying crime patterns and predicting future threats by using historical data will be useful to reduce the rate of crimes. It is observed that social media users sometimes convey crime related messages to their surrounding environment. In this paper, a machine learning approach is examined to cluster crime-related twitter posts based on crime category. The empirical study of the prototyping proves the effectiveness of the proposed clustering approach.

Keywords*: Clustering, WordNet, Agglomerative algorithm, SVM*

SherLock: A CNN, RNN-LSTM-Based Mobile Platform for Fact Checking on Social Media

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Today, false news is easily created and distributed across many social media platforms. Due to that, people find it difficult to choose between right and wrong information on those platforms. Therefore, a strong need emerges to develop a fact checking mechanism to overcome this problem. Fact checking means the process of verifying information for corrections. A CNN, RNN-LSTM-based mobile solution is proposed from this study to verify information on social media using many features. CNN, RNN-LSTM-based hybrid model is able to capture high-level features and long-term dependencies from the input text. Some of the features of the mobile application include fact checking, daily news updates, news reporting and social media trends. Mobile solution is developed using Flutter as the front-end framework and Firebase as the back-end framework including REST APIs to gather daily news articles. The proposed hybrid model achieved a 92% accuracy when checking information circulating on social media.

Keywords: *Fake News Detection, Fact Checking, Deep Learning Techniques, Hybrid Approach*

Ontology-Driven Decision Making for Subfertility of Female

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Failure to conceive after 12 months of unprotected and regular sexual intercourse is called subfertility. In the medical domain, at first, males are checked for subfertility causes. Then, females need to check for their subfertility cause. Here, female subfertility is a broad area than male subfertility. So, it is difficult to perform decision making. Therefore, an ontology-based method will help to make decisions to diagnose the cause and treatment method for causes in subfertility, which has been investigated in this study. Subfertility of female information were collected from the doctors, medical students, and publications in the very first stage. The ontology for this purpose was developed and implemented using Protégé OWL Ontology Editor 5.5. Finally, the developed ontology was evaluated in two ways; by using inbuilt tools and by ontology experts as an iterative approach. This approach to subfertility of female ontology can support medical students, doctors and their assistants to enhance their knowledge and is helpful in decision-making.

Keywords*: Subfertility, Ontology, Decision Support*

A Mix Model Approach for Identifying Occupational Stress among Information Technology Employees: A Case Study

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The aspiration of involving the growth, maintenance and use of computer systems, software and networks for the processing and diffusion of data can be identified as Information Technology (IT). Being a much useful field of knowledge in storing, retrieving, manipulating and communicating information, IT has grown as a commercial industry today, where millions are actively engaged as a labor force in companies globally. Employee training and adoption in the industry is a time-consuming task, which affects employee turnover of the industry. When the turnover rate goes high, it affects the company profit. Here we focus on mapping reasons that affect turnover and suggest a solution. This paper reports the results of Systematic Literature Review (SLR) related to software and systems. This SLR is a preliminary one that analyses articles only in ACM digital library and IEEE computer society digital library that show interesting trends about employee turnover research conducted by SLR published between 1999 to 2019, which formulated and applied specific inclusion and exclusion criteria to determine the most relevant studies for the research goal. The three main phases of planning, conducting and reporting used in this study as guidelines were given by Kitchenham and Charters. Research questions were created to find out answers about the employee turnover rate. Research articles were analyzed and filtered according to the year, country and type of research such as journals, conference papers or paradigm papers. This literature review will be useful to design a relevant questionnaire for an effective survey. The factors that should be considered were gained from the literature review.

Keywords: *Occupational Stress, IT Industry, Employee Turnover, Systematic Literature Review, IT Personnel*

Air Quality Predicting System for Colombo City using Machine Learning Approaches

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Air pollution is one of the biggest threats to the environment and human beings. Meteorological and traffic factors, the burning of fossil fuels, industrial activities and power plant emissions act as major effects for air pollution. Therefore, governments of developing countries like Sri Lanka primarily focus on the effects of air pollution and create rules and regulations to minimize the level of air pollution. The main purpose of this study is to design a Machine Learning Approach to predict air pollution status and levels in Colombo city by analyzing the previous dataset of $PM_{2.5}$ air pollutants. This paper presents how previous researches predict the air quality level using different types of technologies and data collection methods used to analyze air quality. Also, it demonstrates the design and implementation of an air quality predicting system. A simple Linear Regression-based supervised machine learning algorithm is used for the predicting process and gives 8.578 average Root Mean Squared Error (RMSE) value with higher accuracy. This system can be implemented in both web and mobile platform and will provide a better user experience.

Keywords*: Machine Learning Approach, $PM_{2.5}$Air Pollutant, Air Quality, Root Mean Squared Error*

Real-time Animal Detection and Prevention System for Crop Fields

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Every year, crop damaged by wild animals is dramatically increasing in Sri Lanka. It often poses risks to humans and animals. Since more and more wild animals are causing damage to their cultivation; humans cannot tolerate it. Therefore, they require an effective mechanism to overcome this situation. With that background, the objective of this study is to detect wild animals before entering the crop fields and implement appropriate scare-away mechanisms in real-time. The presence of the animal will be sent to the farmer via a mobile application. In this study, two Convolutional Neural Network (CNN) classification models have been developed using the transfer learning approach with the VGG-16 as a pretrained model to detect elephants, wild boars and buffalos. Both models were combined and run on Raspberry pi, which acts as the processing unit for the system, captures the images of animals and predicts it. Whenever the presence of the animal is sensed by the thermal sensor installed on Arduino, it sends a trigger to capture the image. Based on the prediction, sudden flashes of light, ultrasound and bee sound will be produced to scare away the animals. The mobile application was developed using react native which is used to alert the user about the animal, connected through the Firebase database. The findings of this research indicate that the accuracy rate of the classification model is 77 percentage. This system significantly reduces human-animal conflict in crop fields by automatically implementing scare-away mechanisms based on prediction.

***Keywords**: Animal Detection, Scare-Away Mechanism, User Alert, Convolutional Neural Network, IoT*

Diabetes Prediction System using Machine Learning

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Diabetes is a deadly chronic disease which harmfully affects the entire body system. Millions of people are affected by this disease and a considerable number of patients die every year because of its side effects. A diabetic patient suffers from a high level of blood sugar in the body. Undiagnosed diabetes may cause nerve and kidney damage, heart and blood vessel disease, slow healing of wounds, hearing impairment and several skin diseases. Early detection of diabetes is very essential to have a healthy life. The recent development of Machine Learning approaches solves this kind of critical problems. The main objective of this study is to present a Machine Learning based solution (Artificial Neural Network) to solve the above problem. Also, the technologies and approaches used in previous researches to predict diabetes have been reviewed with their accuracy levels. All previous studies have used "Pima Indian Diabetes Dataset" (PIDD) as the dataset but this research is based on a newly collected dataset. The overall development process can be categorized into four major development phases; namely data collection and preprocessing, statistical analysis, development of machine learning model and development of front-end. Artificial Neural Network model has been developed and deployed while the model provides more than 92% accuracy on the sample testing dataset.

Keywords*: Diabetes, Machine Learning, Artificial Intelligence, Artificial Neural Network, Android, TensorFlow, Firebase*

Finger-Spelled Sign Language Translator for Deaf and Speech Impaired People in Sri Lanka using Convolutional Neural Network

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Sign language is a visual language used by people with speech and hearing disabilities for communication in their daily conversation activities. It is completely an optical communication language through its native grammar. This paper presents an optimal approach, whose major objective is to accomplish the transliteration of 24 static sign language alphabet words and numbers of Sri Lankan Sign Language into humanoid or machine decipherable English manuscript in real-time environment. Since Sri Lanka has a native sign language, deaf/signers become uncomfortable when expressing their ideas to a normal person which is why this system is proposed. Artificial Neural Networks (ANN) and Support Vector machines (SVM) have been used as the technologies of this proposed system. Pre-processing operations of the signed input gestures are done in the first phase. In the next phase, the various region properties of the pre-processed gesture images are computed. In the final phase, based on the properties calculated of the earlier phase, the transliteration of signed gesture into text and voice is carried out. The proposed model is developed using Python and Python libraries like OpenCV, Keras, and Pickle.

Keywords*: Artificial Neural Networks, Static Gestures, Gesture Recognition, Support Vector Machines, Gesture Classification*

Automated Generation of Sinhala Lyrics using Recurrent Neural Networks

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This paper discusses the approaches involved in implementing automated song lyrics system in the Sinhala language, which includes an overview of the complexity of writing song lyrics and develops an automated application for Sinhala song lyrics generation. Before implementation was carried out, a set of Sinhala song lyrics has been collected to create a corpus, and it has been used to develop an RNN model with LSTM layers using different temperatures and epochs. Then the created models were used to carry out a comparison process to evaluate the effect of the corpus size and the number of epochs per model training to get a better understanding of the RNN training behaviors. Finally, the system was served to a web host to give the user a friendly UI, where the user can enter desired keywords and generate new Sinhala song lyrics. The initial results were obtained through different models and it was seen that with the increment of the number of epochs and the number of song lyrics trained in each model, the generated output had a clear growth in terms of accuracy and meaning of the song.

Keywords*: Recurrent Neural Networks, Deep Learning, Lyrics Generation, LSTM*

A Software-based Solution to Estimate the Angles of Incidence of AK Bullets using Bullet Hole Features on 1mm Sheet Metal

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Bullet holes and their characteristics are considered important evidence in shooting incidents and can play a major role in the determination of a fired bullet's trajectory. This research aims to design a software-based tool for bullet trajectory determination in shooting investigations. The development of the tool was based on the analysis of data from previous empirical test results of two research papers from the authors relating to the numerical relationship of AK bullet hole features and the angles of incidence when AK bullets (7.62mm x 39mm) perforate and ricochet off 1mm zinc coated automotive sheet metal. The proposed solution suggests an alternative method to existing bullet trajectory estimation methods used in shooting investigations through a novel software-based approach.

Keywords: *Forensic Ballistics, Shooting Incident Reconstructions, Bullet Trajectory Determination*

Disease Identification in Leafy Vegetables using Transfer Learning

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Plants are the major source which gives foods for human to survive. In developing countries like Sri Lanka, agriculture plays a major role in the economic success of people who live there as well as for the whole country's success. In such a situation, disease causes huge loss to farmers. The key concept of maintaining quality and quantity of crops is to detect diseases in early stages at the correct time and to take preventive actions against the disease. Usually, farmers recognize diseases through naked eye observation. This may not be the right way and it tends to spread wrong pesticides and creates over-dosages of pesticides. Hiring expertise in this area costs highly and it is not possible to find that many experts. There are many researches done to identify diseases in various types of plants. But those research do not address the area of Sri Lankan leafy vegetable disease identification. This research proposes a system with a learning approach for disease identification procedure named transfer learning and fine-tuning, which was partially tested and obtained better results. InceptionV3 and VGG16 are the two pre-trained models used to retrain the model. InceptionV3 gain 0.95 training accuracy and 0.79 validation accuracy. VGG16 gain 0.91 training accuracy and 0.86 validation accuracy. At the initial stage, the tested system is capable of recognizing brown-spot disease at 0.43 and 0.48 testing probabilities in Gotukola, and leaf-spot disease at 0.58 and 0.90 testing probabilities in the Mukunuwanna plant through VGG16 and InceptionV3 respectively.

Keywords*: Convolutional Neural Networks, Transfer Learning, Fine-Tuning, Crop Diseases*

Plant Recognition System based on Leaf Images: A Systematic Literature Review

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Plants play a vital role in the environment. Nature has enormous types of plants and identifying them and classifying them is an important task for botanists. They still find difficulties in recognizing those plants and it is complex and time-consuming. The use of specific botanical terms is frustrating for non-experts. There are various ways to recognize a plant, like a flower, root, leaf or fruit. But usually, plants are recognized by leaf and their characteristics like shape, texture, vein structure and color. The availability of relevant technologies, such as digital cameras, new techniques in image processing and pattern recognition, lead to researching plant leaf recognition systems using image processing techniques rather than using other parts of plants. Research papers related to the domain were accessed through the IEEE computer society digital library, Springer Link, Science Direct, ACM Digital Library, Academia and other research sites, using search terms like plant leaf identification, plant leaf prediction, plant leaf classification, plant leaf recognition and image processing techniques. The study then worked on the Systematic Literature Review (SLR) with forty research papers considered. Out of forty, most articles are related, while some are not. Then these articles are filtered and sorted to SLR. Nineteen papers published in the past ten years and mostly related to our topic and methodology, were selected to perform SLR. Then the methodologies of the studies were analyzed to identify different preprocessing and feature extraction methods that researchers have employed to identify leaves. The classification accuracy was compared with related papers and the optimal range of the accuracy for leaf recognition was traced, which will be the benching accuracy level for the suggested study.

Keywords*: Plant Leaf Recognition, Image Processing Techniques, Feature Extraction, Systematic Literature Review*

CNN-Based Image Detection System for Elephant Directions to Reduce Human-Elephant Conflict

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Human-Elephant conflict has been a major issue in the forest border areas, where the human habitat is destroyed by the entry of wild elephants. This conflict occurs due to the shared field of humans and elephants. Conflicts often occur due to over-access to water, competition for space and food. Economic losses happen due to agricultural destruction or loss of cattle during predation. The major aim of the study is to minimize the human-elephant conflict in the forest border areas and to conserve elephants from human activities as well as to protect human lives from elephant attacks. Humans use various technical and non-technical methods to reduce this conflict. As this research is using neural networks and image processing technologies, forest authorities can detect how many elephants are in the nearby forest border areas, and distinguish elephants from other animals easily. Then authorities can inform villagers and tourists thereby reducing human-elephant conflict. Convolutional Neural Network (CNN) plays a major role in elephant detection by supporting efficient image classification. CNN's performance is evaluated by training and testing the dataset by increasing the number of training and testing images. The dataset includes 5000 images of elephants. The trained model is designed for identifying the elephants. The conclusions drawn from work prove that the achievement percentage has 92% accuracy.

Keywords*: Human-Elephant Conflict, Elephant Detection System, Convolutional Neural Networks (CNN)*

Computer Vision-Based Approach for Traffic Violation Detection

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The ever-growing number of vehicles in a country present a variety of problems including but not limited to; infrastructural problems, air and water pollution and accidents with the latter being the most apparent. The main cause for this is traffic violations. This research was carried out with the intention of detecting motor traffic violations using CCTV footages. While there have been attempts to create automated traffic violation detection systems over the years, these studies have mostly been focused on more streamlined and sparse traffic conditions such as highways. But, the type of traffic conditions observed in Sri Lanka among other developing countries is unruly and chaotic. This paper proposes an automated real-time traffic violation detection system for highly congested and unruly road traffic conditions. The proposed system uses computer vision techniques, machine learning technology in creating a traffic violation detection system.

Keywords *- Computer Vision, Traffic Violation Detection, Kalman Filter, Haar Detection.*

Projection Profiling-Based Sinhala Braille Character Recognition and Conversion

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The instantaneous conversion of written Braille characters to readable, colloquial text of the particular language it was written in, has been a hurdle for many sighted personnel. Various solutions have been proposed in this regard and many solutions are available to convert Braille to different languages. However, there are very few attempts to do the same for Sinhala Braille symbols. At present the widely used conversion method is to use an individual well-versed in both Sinhala language as well as Sinhala Braille characters. As such, a considerable delay occurs in the translation process. Hence visually impaired academics and students, as well as visually impaired soldiers due to war, who work with Braille, encounter many hardships. Their teachers and superiors also have faced numerous problems as they are unable to understand Braille. One such consequence is that students sitting for exams face delays in receiving exam results as translation from Braille to Sinhala introduces additional delays in addition to the context often being lost in translation. The proposed conversion engine will easily convert Sinhala Braille text on papers to the corresponding Sinhala text and will assist the learning and communication processes of visually impaired citizens of Sri Lanka. The Braille printed documents to be converted through this software need to be subjected to image pre-processing, projection profiling and Braille recognition processes, capturing a picture of the Braille characters on a sheet that initiates the process. Six dots are used to create Braille symbols. This system identifies these distinct symbols using a specially constructed framework and algorithms, followed by comparing them against a database of symbols in the recognition process and the final output is derived using the Sinhala alphabet.

Keywords: *Braille Symbols, Image Pre-Processing, Projection Profiling*

Real-Time Traffic Controlling Through Multi-Agent Technology

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In Sri Lanka, most of the traffic controlling happens through fixed-time controlling and runs on a static environment. However, these traffic control systems are not much effective compared to human-based traffic control. This research is focused on the design and development of a multi-agent-based real-time traffic controlling system that should be capable of controlling traffic effectively. The proposed multi-agent system is one of the modern software techniques, capable of handling complexity in the dynamic environment. Thus, the multi-agent system has been designed with a vehicle, junction and passengers are considered as agents. Traffic control has been arranged through communication among agents. As the initial stage of the research, traffic behavior was simulated through the NetLogo simulation tool. The efficiency of the traffic controlling was calculated for the three different approaches including, an uncontrolled way, time-based static method, and agent-based controlling. According to the simulated results, agent-based traffic control provides remarkable efficiency than other existing methods.

Keyword: *Traffic Congestion, Multi-Agent Systems, Control*

Domain-Based Similarity Calculation Method for Calculating Document Similarity

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Document similarity is important in different areas dealing with textual data such as knowledge management, information extraction, natural language processing and artificial intelligence. Several methods exist to calculate document similarity. But the results of most approaches are unsatisfactory because specific domain and contextual similarity are not taken into consideration. In this paper, a domain-based similarity calculation method to calculate document similarity is proposed by integrating context, World Wide Web (WWW), and WordNet Similarity. Context is gathered by implementing a topic modeling algorithm and generating a domain context. There are many topic modeling algorithms available and Latent Dirichlet Allocation (LDA) is used in this study. The World Wide Web is used to capture latest knowledge. The method makes it possible to get a similarity value to the words in different domains. The quality of the obtained model is compared and evaluated using human judgment to ensure accuracy of the calculation. Results indicate the accuracy of the calculation and the proposed model can achieve the limitations of existing measures.

Keyword: *Domain-Based Similarity, Topic Modeling, Wordnet Similarity, World Wide Web*

Thematic Relations Based QA Generator for Sinhala

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Question-Answer generation is one of the research areas in the field of Natural Language Processing. This paper presents how the Sinhala question-answer generator operates through the thematic relation on the given input sentence. This Sinhala question generator operates on an input of a well-defined Sinhala sentence with the subject, object and verb along with some specifically identified POS tags for the system like Nouns, Pronouns, Adjectives, Verbs and Adverbs which can make noun phrases and verb phrases from all the possible combinations. The system uses a Sinhala tokenizer, Sinhala POS tagger, Chunker and the semantic relationship identifier with the support of the NLTK libraries. Through the syntax analysis, it can identify thematic relations for the Sinhala input sentence. Through these semantics relations, it has the ability to generate Sinhala questions and related answers through a rule-based approach. The present system has been tested with 56 sample sentences. According to the evaluation, the system shows a 93% correctness rate.

Keywords: *Question Generation, Sinhala, Thematic Relations, Natural Language Processing*

E-commerce Model for Visually Impaired Entrepreneurs

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According to WHO there are around 280 million visually impaired people and out of them 246 million have low vision and 82% are all blind, as well as most of them are women. These people get help from someone else for all their activities. In terms of entrepreneurship, they must go to customers to sell their products with someone's assistance. Sometimes they face a lot of adversities when they meet customers. Most customers have compassion on such person's career because of their disability. According to above facts, there is no specific system that can be used to sell their products and communicate with customers directly on an online platform. To accomplish this task, this research developed an E-commerce system for visually impaired entrepreneurs, as android and web application using android studio, angular and firebase. The system provides an online way of solving problems faced by entrepreneurs with visual difficulties by saving their time, communication cost other difficulties, generating satisfaction. The system helps visually impaired persons to sell their products by using automated speech recognition module, with deep learning method. Through that written words were translated in to spoken words. For entrepreneurship development for visually impaired persons, the system makes employees to sell their products and makes it easier for them to coordinate, monitor, track and resolve customer problems and other matters with an effective tool. The system mainly consists of three sections such as Visual impaired person, Customer and the Coordinate assistant and provides login, registration, complaint and comment.

Keywords: *Entrepreneurship, Visually Impaired, Automated Speech*

eRemote: A Remote File Downloader for Low-Speed Network

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Downloading is generally copying data from one computer to another over the Internet. A download manager is a software or hardware tool used to manage downloading files on computer devices from the Internet. When it comes to downloading large-sized files, many mechanisms have been invented so far to accomplish the downloading task. A hardware-level device equipped with Raspberry Pi zero module can be remotely controlled through an android mobile application capable of downloading large scale files to local storage from any network at any time frame. Thus, a remote file download manager named eRemote has been developed to download files as an offline downloader. This device has been tested in a different network including wired and wireless networks, and has shown efficacious results. This paper presents the design and implementation details of the remote downloader and offers a comparative study on existing downloaders.

Keywords: *Remote, Downloading, File Downloader, Remote File Downloader*

The Internet of Things for Health Care: A Comprehensive Survey for State-of-the-art Architecture

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The internet of things (IoT) is a massive area that makes smart gadgets and captures the development of smart cyberphysical networks. Healthcare is the most important factor which is directly connected with the community and development of any country. Latest example is Covid-19 virus and it has directly affected the economy and the day-to-day life of many countries. This survey advances IoT-based innovative solutions and technologies in healthcare and analyses applications, platforms and network architectures (state-of-art), new industry trends in IoT-based healthcare, and data security and privacy. As per now ambient intelligence, big data, wearable devices and augmented reality are the new innovations in the field. The survey is based on a literature review and information collected representing the data. In this survey, the authors review the IoT-based healthcare technologies, solutions, applications, issues and challenges in state-of-the-art architecture and how IOT will affect sustainable development in the economy and society.

Keywords*: Internet of Things, Health Care Services, Architectures, Platforms, IoT Security*

Optimum Shirt Design Prediction Tool for Apparel Industry

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The apparel industry is one of the world's major upcoming trends of industrial and economical science. Apparel industry has interconnected design producing, and manufacturing issues have become a greater concern. In the domain of apparel product manufacturing and marketing optimization and prediction the design has played a significant part of increasing productivity, overall profit, consumer demand and requirements towards the actual factory. The industry has been challenged over and over before it adopts new methods of designing and it predicts the optimum garment based on past records and analytical data sets. In this research, Time Series Analysis and a trained model is used to determine and predict the optimal product under various production constraints. Time Series Analysis, one of the most accurate data analysis and forecasting techniques, is used in this research. There are various kinds of both traditional statistical methods and more advanced artificial intelligence (AI) techniques that have been used in various existing systems relevant to this domain. Both methods may suffer considerable drawbacks in which the former's performance depends highly on time series data's features whereas the latter ones are slow. Hence, attention needs to be paid for development of an intelligent time series forecasting system which is fast, versatile and can achieve a reasonably high accuracy. However, with the development of computer technology, automated apparel management systems and Machine Learning models are the latest and popular, especially in products classification and prediction. The proposed work provides analytical inferences from historical data of sales records for apparel industry, modeling them using time series analytics to make effective decisions by predicting and visualizing.

Keywords*: Machine Learning, Apparel Management, Design Prediction, Time Series Analysis, Products Classification, Artificial Intelligence (AI)*

Development of Automated Aquatic Taxi for Sri Lanka using Kansei Engineering Concept

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Transport is essential because it allows for contact, trade and other types of people-to-people exchange. Transport plays a crucial role in economic development and civilization. When it comes to transportation media mainly, air, water and ground are used. As Sri Lankans, very commonly, we use ground roads to travel between cities. Most of the time, we apply waterways only to export and import between counties. Waterways are rarely used within the country as a transport service. Nowadays ground roads are quite busy because the number of vehicles is growing daily. Therefore, this study introduces the new technology "Automated Aquatic Taxi (AAT)" service to use natural waterways for transport in Sri Lanka. The main aim is to reduce ground road traffic and save passengers' time while providing a new experience. As AAT, authors introduce a small or medium size enclosed boat designed to automatically ferry passengers between and around cities. It is planned to also automate the manual control system. Automation allows "autonomous identification" and safe navigation around stationary objects in the water, i.e. swimmers and any other obstacles. Sri Lanka has a great history of waterway experiences. Its ancient people used boats and small barges for transportation. Therefore, this new AAT service will be a good experience in future aquatic transportation.

Keywords*: Kansei Engineering, Aquatic Taxi, Transportation.*

The Future Directions of the Learning Management System: A Review

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Education is the most powerful weapon for a person's life which can never be stolen throughout the journey of one's own life. Being educated will never be perishable as it is a lifetime validity given for one's personal career. Therefore, it is obvious that education plays a vital role. In the process of being educated, higher education takes a prominent place as it is a life indicator. A serious and a growing problem was identified in higher education where geographical barriers, venue and time hinders higher education with the passage of time. As a solution to all these problems, current educational trends have more technologically influenced higher education to enhance learning processes. This review intends to carry out a detailed analysis on Learning Management Systems and find out the untouched areas or else the points that are not discussed and not yet developed to a good level. The review is conducted with the objective of investigating the success of LMS, features of existing LMS, how educational institutions make use of new technology and what are the areas that need further attention in future or in other words what are the features that should be developed further with the aim of looking for advancement. Identifying available spaces for further enhancement or development is the main aim of this review paper and this study investigates more about Learning Management Systems in advance.

Keyword: *Education, LMS, Future, Technology, Development, LXP*

Adaptive, Interactive and Distributed E-Learning portal with Resume and Asynchronous Learning Features for Colombo Stock Exchange

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Development of Information Communication Technology has paved the way to the evolution of educational industry with the concept of digitization. With the radical development of smart, IOT devices and communication technologies have paved the way for rapid development of the education system. E-Learning is a methodology which uses advanced technologies by exploiting digital network dynamics and the giant digital flow of information across the internet. E-Learning processes explain the ability of individuals to view online materials over the internet with the revolution of digitalization. Thanks to digitization, the ubiquities of education have been improved. In this situation Colombo Stock Exchange (CSE) has a desperate requirement of increasing the number of investors in the share market and to provide knowledge on share market transactions. To facilitate the said requirement with the collaboration of CSE, an E-learning portal is developed for potential investors to learn about CSE and to share market transactions. The portal is developed using various E-learning techniques to provide a potential learner/investor to understand subject matters with minimum cognitive effort. E-learning portal comprises of Wizard-oriented chapter courses, Video tutorials, online publications, E-books purchasing ability, notifying CSE announcements, Live market transactions viewing capabilities, feedbacks and online webinar features. As the main framework ASP.NET(MVC) is used along with various supportive frameworks in order to develop a highly responsive web app on both mobile as well as desktop platforms.

Keywords*: Digitization, CSE, Electronic-Learning*

E-Performance Management Process for Athletics in Sri Lanka

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Automated systems have indeed become indispensable in our daily lives. More varieties are introduced into automated systems all the while and existing applications are being enhanced and broadened. Due to rapid growth, it is the right time for athletic management professionals to tap into the power of web context to provide correct information effectively and efficiently, keeping the athletes' loyalty and faith. An automated system will contribute to change the way of existing manual athletic system in Athletic Association. Athletes currently seek for non-complicated services which are simultaneously faster. Through this research paper, the focus is on the potential implications of improved efficient athlete registration procedure, coach-athlete communication, timing detection and storing procedure, and displaying performance evaluation procedure. Finally, this research paper provides an evaluation of the performance of all athletes in Sri Lanka by addressing the topic of Sri Lanka athletic performance and registration web-based system to improve athletics in the country. Using this system, athletics can prepare for future championships like the Olympics.

Keywords: *Athletic Performance, Athlete Registration, Database, Web Development, Timing Detection, IOT Module*

Introducing E-Farmer Management System for Dedicated Economic Centres in Sri Lanka to Reengineer the Current Marketing Process

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Dedicated Economic Centers are established all around the country. The long-term objective of such is to improve and enhance the sustainability of the agriculture sector in Sri Lanka; such as to ensure obtaining reasonable prices for agriculture producers and farmers for their crops by providing a targeted market for their valuable crops, and to create an opportunity to distribute area-specific agricultural products among people in all parts of the island. However still, there are some serious problems which have not come up with feasible solutions. The major problem in the current system is the lack of coordination between economic centers, farmers and buyers. Thus, the main objective of this research paper is to give a feasible solution for those identified problems and enhance the productivity of Sri Lankan agro-business. The proposed system will connect farmers, buyers and economic centers into one platform and provide information about current production, price indexes and current market condition. The farming information management system for agricultural dedication centers is developed as a web-based application and uses a centralized database system where all clients (farmers, agrarian officers and other users from the economic center) can connect to the system.

Keywords: *E- farmer Management System, Agro Economy, Dedicated Economic Centers*

Intensive Care Unit (ICU) Management System for Dengue Ward

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Intensive Care Units (ICU) in Sri Lankan hospital systems are generally managed manually. Using a manual system for the ICU can cause many difficulties as the ICU is the main department in a hospital. After analyzing the current procedure at Kalubowila Teaching Hospital, it was observed that it normally takes 24 hours to identify and direct a seriously ill dengue patient to the ICU from the High Dependency Unit (HDU). Patients with the Dengue virus will have similar symptoms. Thereby the next patient who needs to be admitted into the ICU has to be more ailing than the rest of the patients in the HDU. If the correct patient to be admitted is not identified, another patient in the unit could fall into a more severe case. ICU Management System is a web-based system that has the ability to identify the next most critical Dengue patient that should be treated in the ICU using a specific score. The score is calculated by monitoring the symptoms of the patient and giving a separate value to each symptom. The calculated score depends on the severity of the patient. This paper presents the design and implementation of this ICU Management System and offers a comparative study about existing Hospital Management Systems.

***Keywords**: Intensive Care Unit, High Dependency Unit, Score, Dengue, Hospital*

Improving Web Service Recommendation using Clustering and Model-Based Methods

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With the development of the World Wide Web (WWW), the number of people who can deal with their work through the Internet is increasing and it helps to do their tasks effectively and efficiently. In this case, a very important task is fulfilled by Web services. But the main problem is users struggling to select their favorite Web services quickly and accurately among available Web services. Web service recommendations help to solve this problem successfully. In this paper, a collaborative filtering (CF)-based recommendation technique is used, but it suffers from data sparsity and cold-start problem. Therefore, an ontology-based clustering approach is applied to overcome said problems. This effectively increases data density by assuming the missing user preferences comparing the history of user favored domains. Then, user ratings are predicted based on the model-based approach such as singular value decomposition (SVD). The result showed that the clustering approach can overcome CF problems effectively and the SVD method can predict user ratings with lower prediction error compared to existing approaches.

Keywords: *Web Services, Recommendation, Collaborative Filtering, Singular Value Decomposition, Sparsity, Cold Start*

A Systematic Review and Comparative Study of Electronic Medical Record (EMR) Systems to Support Healthcare

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The need for an Electronic Medical Record (EMR) system has grown exponentially with the vast increase in population, where it is strenuous to deal with patients' medical records physically. EMR grants the electronic entry, upkeep and perpetuation of medical information of patients over long periods, which in turn provides quality care and safety in healthcare organizations. Nevertheless, EMRs have been a huge leap in the medical field, where hospital records are computerized for the betterment of patient care. In fact, EMRs are ought to reduce the manual work done and upgrade the efficiency in healthcare systems. This paper focuses on the significance of EMRs in healthcare organizations with the help of a review on research done on EMR systems and a comparison between the EMR systems which have been implemented so far. Also, through this study, it is aimed to identify the insights along with the features and functionalities to be included when implementing a qualitative and innovative EMR by bridging the gap in knowledge for improving EMRs in the healthcare sector.

Keywords: *Electronic Medical Record (EMR), Healthcare, Hospital Records, Patient Care*

Lawyers' Work Management Through Digitization

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With the technical renaissance, every single process has become automated, with the shift from manual ways to digitization. This research emphasizes the digitization of business processes within a law chamber. The main issue that leads to propose an automated system for lawyers is the bulk of unorganized workload and file cabinets. The system is to be developed with functionalities such as maintaining separate client folders depending on each clients' case category. Furthermore, the system will be embeded with the functionalities of time reminders and alerts, chatbots, saved templates and e-versions of the reference books. All aforesaid capabilities are to be maintained in cloud storage, enabling always-on access through the application. However, organizing workloads and file cabinets is not enough to optimize efficiency and effectiveness. It is useful to provide search queries to past similar cases and their results that have been handled. This research is to emphasize the digitalization of work at a lawyer's chamber in order to reduce the number of physical interactions and to optimize efficiency and effectiveness of the manual processes and working patterns.

Keywords: *Digitization, Lawyers, Case Files, Automation, Attorney, Advocate*

An Analysis of Applying Software Development Methodologies in Military Software Development

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The precise selection of the most suitable software development methodology is crucial to any small or enterprise-level software application. Specifically, considering the development of military software applications, which ranges from training, management, planning and operational scenarios, the proper usage of software development methodologies could significantly affect the decisions made regarding national security. Research carried out in this particular domain is very limited and, in an era, where military software applications are growing and making a heavy impact on military strategies, it is vital to understand the importance of selecting and adhering to the best methodology, and the need to follow software engineering guidelines. The main objective of the research is to study the features of existing software development methodologies and evaluate the application of such in various military scenarios. The research was carried out primarily using qualitative methods supported by quantitative methods where necessary. The result of the research provides clear understanding to military software developers in planning, developing and implementing future software projects.

Keywords*: Software Methodologies, Software Engineering, Defence Applications, Mission Critical Systems*

Web-Based Workload Monitoring System for Midwives in Sri Lanka

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Public health has always been an information-intensive field. Public Health Midwives (PHM) is the 'front line' health care provider responsible for the provision of maternal and child health, and family planning services at the community level in Sri Lanka. Several recent research and studies have revealed that midwives have faced undue burden due to maintaining number of routine documents manually, without having a proper system. Maintaining registers and records have in turn, badly affected the quality of their services. Therefore, introducing a web-based system for midwives through a simplified solution for easy documentation, and online data management will give opportunity for them to involve in more field activities. Furthermore, it is useful for midwives to notify daily tasks, and to self-monitor and evaluate field activities. In addition, a web-based system would lead to notify mothers about their clinics, vaccinations and activities by sending messages to mothers from eligibility for registration to the whole pregnancy, prenatal, childbirth and postpartum period. Considering rural families, the system provides message service to any mobile phone with Sinhala, Tamil and English languages without difficulty. Moreover, the facility of storing information and access to the system with any device during their visits without referring to large documentation makes the system more user-friendly. In a subsequent set of studies, all the midwives gave positive comments indicating that they were happy with the developing system and that they would like to continue using it to enhance their service. The system seems to be a practical solution for the daily activities of midwives in Sri Lanka.

Keywords: *Midwife, Information Management, E-Health, Health Care, Maternal Health*

A Review of Blockchain Consensus Mechanisms: State of the Art and Performance Measures

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Blockchain is an emerging digital technology for creating decentralized systems which disrupt the digital world with its complex and robust architecture. It has a range of application domains; from cryptocurrencies to decentralized software applications, which are commonly known as DApps. The consensus mechanism is the core of Blockchain technology. Reaching a common agreement among the nodes of a decentralized distributed network is a vital but challenging process in consensus mechanisms. Consensus mechanism enables adding a new block to the blockchain making it transparent, trustworthy and immutable. This paper presents a systematic review of existing mainstream consensus mechanisms to highlight their strengths, impulsions and limitations and the evolution of consensus mechanisms. Based on their canonical properties, each consensus mechanism has its own performance characteristics. The performance of a consensus mechanism is determined in various criteria such as throughput, mining power, energy consumption and fault tolerance. However, there is no fixed common scale yet to measure the performance. At present, a particular consensus mechanism is adopted by an application domain, purely based on subjective criteria including trial and error. Therefore, selecting the most appropriate consensus mechanism in a particular application domain requires a systematic set of guidelines to be developed. By exploring the existing literature on various consensus mechanisms and their performance characteristics, this paper facilitates the researchers to identify the most appropriate consensus mechanism for a given application domain.

Keywords: *Blockchain, Consensus Mechanisms, Decentralized Applications, DApps*

Social Media Sentiment Analysis for Customer Purchasing Behaviour – A Systematic Literature Review

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Social Media Sentiment Analysis is a field of study with a vast number of applications. One important application is analyzing customer behaviors using the results of social media sentiment analysis, which is a great tool that decision-makers can utilize. There are several studies conducted about this field. This paper presents the results of a systematic literature review (SLR) conducted on the existing studies which would be beneficial for developers and researchers interested in this field. This is a preliminary SLR in which, research papers published in journals and conferences until 2020 were collected from 7 electrical databases. Initially, 86 studies were found, and 5 most relevant studies derived through specific inclusion and exclusion criteria were investigated to analyze the current status of research, approaches and methods used, results, limitations, existing gaps and future recommendations by researchers. The results of this study suggest that hybrid models that combine lexicons and machine learning classification models produce more accurate results in sentiments analysis. Researchers have attempted to conduct sentiment analysis considering various components of social media text data such as punctuation, emoji and emoticons, negations, acronyms and slangs. Most studies focus on various applications of social media sentiment analysis beneficial for understanding and interacting with customers, such as identifying how cultural and economic differences, and occurrence of various events impact consumer purchasing behaviors, how to deal with negative sentiment shifts, segmenting consumers into groups and even predicting sales performance. This study makes a significant contribution by providing a comprehensive and up-to-date review of the previous attempts made in the selected domain to the existing literature.

Keywords: *Systematic Literature Review, Sentiment Analysis, Social Media, Purchasing Behavior*

An Alternative Approach to Authenticate Sub Flows of Multipath Transmission Control Protocol Using an Application Level Key

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Multipath Transmission Control Protocol (MPTCP) is an extension to Transmission Control Protocol (TCP) proposed by the Internet Engineering Task Force (IETF). The intention of MPTCP was to use multiple network interfaces in a single network connection simultaneously. Researchers have identified that there are a considerable amount of security threats related to connections initiated by MPTCP. This research studies the security threats generated by sharing authentication keys in the initial handshake of the MPTCP in plain text format and investigates the applicability of external keys in authenticating sub-flows with minimum modifications to the kernel and socket APIs. To pass external keys from user space to kernel space, sin_zero padding in TCP socket data structure is used. Through the experiments it is found that MPTCP sub-flows can be authenticated and certain vulnerabilities can be avoided with the proposed approach.

Keywords: *MPTCP, Computer Networks, Linux Kernel, Authentication Keys*

An Ontology-Based Data Mining Approach for Predicting Research Ideas using Past Research in the Wildlife Sector of Sri Lanka

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Sri Lanka being a global biodiversity hotspot, places great value for biodiversity owing to ecological, socio-economic and cultural factors. However, the wildlife of Sri Lanka is critically threatened due to several factors, mainly human activities, and needs dire conservation measures. Inadequate knowledge and technical support also hinder wildlife management activities. Findings of wildlife research studies could be integrated into data-driven conservation and management decisions, but the current contribution is not satisfactory. This research shows a novel data mining approach for finding hidden keywords and automatic labelling for past research work in this domain. Latent Dirichlet Allocation (LDA) algorithms to model topics and identify the major keywords are used in the study, while an ontology model to represent the relationships between each keyword is also developed. Both approaches are also useful for potential research ideas, to identify research gaps and can classify the subjects related to a publication by non-professional related fields. The experiment results demonstrate the validity and efficiency of the proposed method.

Keywords: *Wildlife, LDA, Ontology, Topic Modelling, Data Mining*

Citizens' Acceptance of Online Services in Sri Lanka Police: A Study on Police Clearance Online System

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The Police, as the main law enforcement agency in Sri Lanka, assures a society which is free from fear of crimes and violence by its vision statement. Ensuring state security is vital because threat to the security is, undoubtedly, vulnerability for everything. The Police Clearance Certificate (PCC) is one of the proactive measures to assure security and social tranquility. PCC must be free from fraud and errors. The criticism towards issuing agency was to delay of processes, bureaucracy and corruption. In order to expedite the clearance process, in 2015, an E-governance approach was introduced. The aim of this study was to evaluate the efficiency and effectiveness of this new on-line system and review the level of customer satisfaction. This is the first and only research made on this new Police Clearance Certificate Issuing System (PCCIS) in Sri Lanka. The data in this qualitative research were gathered through questionnaires, interviews, literature survey and observations. The samples were selected in a manner which can generalize the results to the whole population. Though the Sri Lanka Police (SLP) assure the issuing of PCC within 14 days, this research revealed that 58% of the applicants do not receive it within that period. But it was revealed that corruption and organizational bureaucracy have been remarkably reduced with the online mechanism. The attractiveness and user-friendliness of the system is comparatively good. The recommendations made by this study will contribute for further enhancements. Unfortunately, majority of the people in Sri Lanka are not conversant with available police online services. At the same time, unavailability of National E-government Platform and Data Warehouse, and connecting public and private agencies, is a big imperfection in the country.

Keywords- *E-governance, Police Clearance Certificate, Police Clearance Certificate Issuing System*

POSTER PRESENTATIONS

Recursive Image Segmentation for Vehicular Traffic Analysis

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Many methods have been proposed for image segmentation in vehicular traffic analysis using traffic camera video footage. However, isolation of moving objects with perfect object boundaries has been a challenging problem in vehicular traffic analysis. Usually these vehicle objects are extracted inside rectangular boundaries with extra irrelevant background image pixels from other objects included in the analyzed image. Thus, using such segmentation methods in the vehicle identification video is not favorable for feature extraction for classification of vehicle category. This work proposes a method to deal with irregular-shaped image segmentation for vehicle identification using a recursive algorithm. A binary threshold image composed of white and black pixels is filtered with a 2D low pass filter to isolate irregular-shaped image boundaries of objects. Then recursive image segmentation is applied on the filtered binary image. White pixels in the 2D filtered image are used to identify the presence of the object. If the neighboring pixels of the pixel of interest are also white, then those neighboring pixels are recursively processed the same way to account for the extent of the object. This recursive collection of pixels bounded by an irregular shaped boundary is continued until neighboring pixels are significantly different in color from the pixel of interest. From this recursive image segmentation algorithm, extraction of all pixels of odd shaped objects are done in an efficient manner. Accordingly, pixels count, height and the width of the object are recorded. This image segmentation method has been successfully applied to identify vehicle categories in traffic video sequences.

Keywords*: Image Segmentation, Vehicle Identification, Irregular Shape, Traffic Analysis*

"TrainGo App" - Mobile Based Train Ticketing System for Railway Department in Sri Lanka

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The Railway Department in Sri Lanka uses a traditional method to issue tickets to their passengers through counters for passengers who use short distance travel. Because of that they have to wait a long time in the queue to get their ticket and there is a possibility of missing the train. Hence, most of the passengers have a bad impression of the train service in Sri Lanka. The purpose of the system is to provide better service to the passengers by enhancing the ticket issuing process and improving good impression about the railway service in Sri Lanka."TrainGo" mobile-based train ticketing system uses a QR Code scanning mechanism to reserve and purchase tickets. The mobile-based train ticketing system provides a better service to the passengers by enhancing the ticket issuing process. Dynamic QR codes, E-Wallet system, Ticket booking system, Report generating system, and Admin backend panel are the main processes of the mobile-based train ticketing system. The QR Codes for the stations are generated by the devices dynamically based on the station and date. The React framework, the Vue-electron framework, and node.js were used to develop the "TrainGO" app. Couch DB and the Pouch DB were used as the databases for the development purpose. Marvel App was used to design the App. A few similar types of systems were identified in other countries during the literature review, but those systems have not used the technology used in the "TrainGo" app.

Keywords *- Mobile App, Railway Ticketing System, QR Codes*

Journal or Book? : The HydroGIS Perspective on the Engineering and Computing Debate

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There are numerous opinions and guidelines to select the most suited literature on state of the art reviews. Even though they brew the most important articles aligned with the availed guidelines, some literature may provide controversial ideas. Whilst reviewing the literatures' outcomes, the common practice is to assign equal weight to each literature. Eventually, these important controversial ideas conclude as a neutral concept in state-of-the-art scenario, whilst the real is different. The initial discussion with worldwide academics and professionals found that the novelty of the result and soundness of interpretation needs to be given a weight rather than a source of publication. In the case of young students, such qualitative evaluation may direct error-prone conclusions due to less experience. Hence, to handle the controversial factors, novices require an accepted prioritization of sources with credible weights to each. Then, the authors attempted to ask for the opinion of the academics from different streams and found there is a contradiction on prioritization. The academics from the discipline of engineering mostly trusted books and guidelines, whilst computing academics' trust was won by indexed journals. As the focus of the present work is a multidisciplinary research on HydroGIS framework development, it faced a problem of prioritizing the literature sources. By virtue of the identified possible sources of publications through the collected literature to the literature review for the work, the rationale for each source was developed using the source credibility theory. The rational was evaluated with thirty-four academics and practitioners from different disciplines. Further it gathered their prioritization and weights for each source. The findings were then evaluated with other ten experts and the outcome was discussed with three senior academics and practitioners for confirmation. The present work found that indexed journals are the most trusted source of information with a weight of 4.32 (out of 5), whilst web documents were with the least trust (1.49/5). Nevertheless, evaluation and confirmation discussions stressed to utilize a ratio of weights rather than numbered weights.

Keywords: *Scientific Weight of Literature, Credibility Theory, HydroGIS, Review Study*

Use of Security Culture to Contribute on Enterprise Information Security for the Small and Medium Scale Enterprises (SMEs)

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The great use of technologies and flexible work environment introduce complex scenarios for enterprises to consider to assure Enterprise Information Security (EIS). Further, the success/failure of EIS effectively rely on the behavior of stakeholders of an enterprise irrespective of the available comprehensive-enough technical infrastructure. Therefore, it is recommended to implement the Security Culture (SC) at the initial phase to reduce the risk of unacceptable behavior of stakeholders. Moreover, the SC is further important for Small and Medium Enterprises (SMEs), because comprehensive technical implementation to assure information security is not affordable with limited budget, resources and technical staff. The SC can be introduced as an iterative process which must start from somewhere based on primary considerations and improve as required through multiple iterations to fulfil EIS need. The frequent evolvement of SC is essential to addresses consequences of technological development. The SC can be introduced as a subculture of organization culture, because each stakeholder of the enterprise has active part on assuring EIS in their regular tasks. The mature SC delivers the understanding of the importance of assuring information security, individual responsibility in security aspects which is way over the general organizational culture, as people are the weakest (only link) for EIS (the technology). Further, people are the first line of defence in any attack, so they must be aware and prepared to represent "Human Firewall". As a result, analyzing assets, analyzing threats, analyzing vulnerabilities, risk assessment, standards and framework, policies and procedures, responsibility, maintenance, stakeholder awareness aspects should be prioritized for implementing SC. Nevertheless, the effective ways to deliver awareness among stakeholders within a SME for enterprise security management should be identified. The successful implementation of SC contributes effectively to EIS for SME.

***Keywords**: Security Culture, EIS, SME, Vulnerabilities, Threats, Human Firewall*

IoT-based Health Monitoring and Activity Detection for Elderly Care

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It is very important to monitor the health condition and activity of elderly people especially when they are living alone or due to reduced connection with their children and relatives. To automate the elders' activity monitoring, we developed an IoT-based (Internet of Things) health monitoring system by integrating various technologies of wearable and non-wearable devices that are connected to the wireless communication network. Heart-rate sensor is wearable and fixed PIR sensors are used to find the location. All sensors will communicate and send data to a cloud storage through a home Wi-Fi network. In this system, doctors or guardians can monitor elders' heart rate and are able to track their real-time location through the data given by the sensors when they are living alone at home. Also, these data will be recorded in a remote IoT cloud and can be used for data-driven predictions. A mobile application is used to monitor the real-time health condition as well as the actual location of the patient at home. Also, this app is configured to push the notification when abnormal conditions are detected.

Keywords*: Assisted Living, Internet of Things, Smart Systems for Elderly Care, Sensors*

Analyzing the Influence of Various Factors for Vegetable Price using Data Mining

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The price fluctuation of vegetables is an economic problem faced by every country, including Sri Lanka. Many factors such as environmental conditions as well as supply, demand, social, cultural and political situations of the country cause the price of vegetables to fluctuate. In this study, the Waikato Environment for Knowledge Analysis (WEKA) tool and association based Apriori algorithms are used to identify the most influential factors that affect price fluctuation. Results show that low supply from cultivation areas is caused by an increased vegetable price and favorable supply from cultivation areas is caused by decrease in vegetable price. Prices of vegetable varieties demonstrate mixed movements because of supply variability from respective areas. The findings of this study can be used by farmers to make their production plans, customers to plan their budget, and sellers to make their marketing plans.

Keywords: *Data Mining, Association Rule, Apriori Algorithm, Vegetable Price Patterns*

UECS: University Eligibility Checking System for State Universities in Sri Lanka

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Most systems regarding the submission of application are merged with the official website of the education institute/university or organization. When selecting courses, the most eligible course should be mentioned as the first option in the application form. So, to make the right selection, the applicant should be more aware of the available degree programs suitable for his/her Z-Score. The requirement of the UECS system emerges as a solution to overcome the inconveniences caused during the selection of a suitable degree program when applying to government universities in Sri Lanka. The current process of University Grant Commission (UGC) university application and the difficulties faced by applicants are identified, and the modules of the proposed system are discussed through the functional and non-functional requirements identified by analyzing the existing system. The introduced application will help students to check their individual eligibly for degree programmes offered under state universities of Sri Lanka. The system is developed by using an open resource platform such as PHP, Hyper Text Markup Language and Cascading Style Sheet. The system was able to guide the students to select the most suitable degree programme and the universities which offer the degrees according to their eligibility criteria.

Keywords*: University eligibility, University Grant Commission, Z-score*

IMAGIBOT – An Image Recognition Chatbot for Sri Lankan Ancient Places

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Ancient artifacts of Sri Lanka are used as major sources of getting historical information about Sri Lanka. Acquiring the necessary information about those artifacts becomes a huge challenge for the visitant of artifacts. Text-based search engines are typically used to retrieve information about ancient artifacts of Sri Lanka. These systems require the user to formulate a text query that provides information such as the place, where the object is placed, where it can be found, or to what century the object belonged. Contrarily, visual search systems can be used. They provide information to users of the system such as scholars, tourists, local explores in a most intuitive and immediate way by using an image as a query. This research involves developing a chat application along with Convolutional Neural Networks for image recognition of ancient artifacts. The image recognition model will be a part of the chatbot that has the ability to retrieve more information about recognized images. Convolutional Neural Networks, Recurrent Neural Network, TensorFlow and Keras have been used as core technologies in this research project. As the research involves developing a chat application with image recognition capabilities, the application will improve the knowledge sharing of Sri Lankan ancient legacy to the world in an effective way.

Keywords*: Chatbot, Convolutional Neural Networks, Ancient Artifacts, LSTM*

Survey on Deep Learning-Based Network Intrusion Detection and Prevention Systems

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The world is moving towards digitalization; it is crucial that network intrusions detection and prevention is addressed in ordered to create a secured network. This paper covers why deep learning is considered and what are the deep learning approaches for network intrusion detection. For each approach, the challenges, missed elements and unique features that are found in the current domain state are highlighted. As a conclusion this paper highlights why CNN and LSTM would be a successful approach for intrusion detection and why it is required to create scalable solution with both intrusion detection and prevention involved in the current domain context.

Keywords*: Network Intrusion Detection, Prevention System, Deep Learning, NSL- KDD*

ATM Detail Protection using Geofence Technology

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GPS technology enables devices to utilize the location information. Geofence technology is a novel technology which implements an area with a certain radius and gets information through it. This paper represent how Geofence technology can be used to improve the existing security mechanism relevant to ATM systems. Current security mechanism for ATM system is a pin-based authentication which does not provide the expected outcome. It has been currently been facing many threats due to fraud activities performed by attackers. The proposed system will provide much more accurate procedure compared to the existing system.

Keywords: *ATM, Security, Geofence, GPS Technology, Android*

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Introducing a LSTM-based Flood Forecasting Model for the Nilwala River Basin with a Mobile Application – A Review

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Flooding is one of the most devastating natural disasters in the world. The impact of flooding damages property, agriculture, infrastructure of a country and destroys human life. Flood Forecasting models and proper awareness about floods, and sufficient communication between flood victims and responsible authorities are important to safeguard the life of humans and the infrastructure of a country. This paper contains a review of different Machine Learning methods and Algorithms like Artificial Neural Networks (ANN), Support Vector Machine (SVM), Multilayer Perception (MLP), Convolution Neural Networks (CNN) and Long Short-Term Memory (LSTM), which are used to forecast floods. Long Short-Term Memory is one of the Recurrent Neural Network models to forecast Flood. According to the reviewed literature, Long Short-Term Memory networks are better than ANN, MLP and SVM because Long Short-Term Memory models can learn long-term patterns better.

Keywords: *Flood Forecasting, LSTM, Mobile Application*

Feasibility Study of Hologram Gamification in Sri Lankan Higher Education Distance Learning

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When a global pandemic occurs, every industry faces the risk of being unable to continue their usual processes and must go to business process continuity with instant change management. The education industry also needs an alternative solution to keep moving without failure. As experienced in such case, distance learning is the best solution to conduct lessons. But the issue with normal distance learning is the learner's interactivity with lessons. To improve learners' interactivity with the help of technological advancement, higher education needs to deploy innovative teaching-learning methods including having games, simulations and holograms. Meanwhile, research has proven that learning is not only a response to delivery but is more than an active, constructive, cognitive and social process by which the learner strategically manages the cognitive, physical and social resources to build their knowledge. To enhance these aspects, gamification can be used for a great deal, providing users with instant access to vast amounts of information without effort, regardless of geographical or economic boundaries. Holographic technology might be another resource that could change the way of creating and sharing knowledge. Gamification has been used for the learning and teaching process, but the hologram projection for learning is still new to the education industry but has the potential to revolutionize aspects of teaching and learning experience. The sole purpose of this review study is to determine whether learners would perceive the gamification activities inbound with hologram technology positively which would help to enhance the interactivity in the teaching-learning process. Finally, this would increase the engagement of the distance learning process. To gain this outcome, one must study the feasibility of gamification in line with hologram technology regarding achieving distance learning objectives.

Keywords: *Game-Based Learning, Simulations, Holographic Projection, Distance Learning*

Web-Based Application for Mothers and Midwives

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Web-based applications have become the most common platform for developing information and services via the internet. Because of the evolution of these web-based applications, people can communicate with different kinds of applications. Therefore, this project has been designed to help parents, especially mothers and midwives through a web-based application. Currently parents must take their children to meet midwives and doctors up to two or three years since their birth, and have to keep a book to record the details of their children. This is a very critical situation, since they have to carry their children and keep a record book. Sometimes parents may not remember all the instructions given by the midwife and have to repeat about previous reports and the baby's condition at the next clinic date. When the midwives want to visit the mom's places, they have to face lots of difficulties like forgetting to bring the documents and inability to find the exact location. Thus, this research optimizes the relationship between parents and midwives through a web-based application, interconnecting mothers and midwives. The requirement analysis part has been done via an interview parents and midwives. To enhance the relationship between mother and midwives, this system attempts to set all requirements into a web-based software solution.

***Keywords**: Motherhood, Mother - Midwife relationship, Mother and Baby*

Smart Pest Recognition System for Sri Lankan Crop- Growing

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Sri Lanka is a developing country and agriculture is the main livelihood in Sri Lanka. Paddy cultivation is the major crop production among it. The main problem in paddy cultivation is pest defect. Every month, any pest defect may occur annually in paddy cultivation. Therefore, a sustainable cultivation concept is needed to compete with the modern world, in terms of not only insect hazards, but also in relation to floods and rats who can also damage the paddy field. Paddy farming uses a variety of chemical remedies to prevent insect damage and hazards. This results in loss of yield and a reduction in yield. The answer to this question is how to teach insect destruction by local chem methods. Details of unknown insects are readily available. Another major problem for farmers is the lack of identification of insects as farming is concerned. Farmers have no idea about the threats or hazards that happen to crops by the insects which currently is a big issue faced by society, due to the delay in obtaining information about it. There is also ignorance of the traditional medicines needed for these insects. For all these reasons, with the use of the smart pest recognition system, farmers are able to make choices easily. This will help the farmer to identify the pest infestations that come to the farm and destroy the insects with the conventional methods of chemistry and other medicines needed to prevent them. It also educates the farmer on how to make cam methods and how to use other medicines. A demonstration system will be developed to address the reasons discussed above. Also, research is being conducted using the proposed system to evaluate and compare existing systems. It can provide the farmer with the most reliable, efficient, smart and convenient services.

Keywords*: Paddy Cultivation, Sustainable Cultivation, Insect Hazards*

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Implementing a Biometric Electronic Voting System for Sri Lanka

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Web applications are the most popular platforms that deliver information and services through the Internet these days. This paper introduces a Web-based Biometric Electronic Voting System Software to Sri Lanka. In the past few years, there was a big improvement in the technology field. This research introduces the use of technology for the voting system and presents the development and implementation of the electronic voting system. By using this system, during the registration period, candidates, political parties and voters are registered to the system. Biometric fingerprint machines scan the fingerprints of eligible voters and saves them in the system. On election day, it processes to do the verifications. The fingerprint is a biometric identifier, because fingerprints are unique for every individual. Automated biometric fingerprint identification can take into consideration the most reliable biometric technology that is used in the present society. This system replaces the paper-based traditional voting process. Some democratic countries already have moved to these kind of electronic voting systems, because of many defects that happened in the traditional paper-based voting system. Sri Lanka's contiguous country India also uses this kind of electronic voting system. Sri Lanka is a democratic, developing country, and it better to go for a web-based electronic voting system for an efficient and secure election.

Keywords: *Biometric Electronic Voting System, Fingerprint, Verification, Web-based Application*

Survey on Wearable Sensor Technologies on Driver Drowsiness Detection

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Intoxicated driving is dangerous, while drowsiness is another form of fatigue which claims hundreds of lives every year in fatal crashes. US National Highway Traffic Safety Administration has estimated that a total of 100,000 vehicle crashes each year are a direct result of driver drowsiness. In order to prevent these devastating accidents, there is a need to identify the drowsy moment and control it before mishap happens. For this, a driver's state of drowsiness should be monitored. But detecting drowsiness using face image behaviour or drivers' eye blinking is not accurate enough. Though it is possible to measure rapid eye movement sleep and slow eye movement sleep, we cannot measure no-eye movement sleep. Researchers have found that eye open sleep is quite common, so this human drowsy behaviour should also be measured through the system. Drowsy behaviour can be classified as normal, slightly drowsy and highly drowsy. The mentioned drowsy detection methods identify drowsiness when highly drowsy. But it is rarely possible to prevent from the highly drowsy state. Even if drivers prevent from this, it is too late to prevent from mishap. So, the exciting drowsiness detection system is absolute. This research uses accurate sensors to detect heart rate, EEG and EOG. Through such it is possible to measure drowsiness in normal and slightly drowsy states where there is possibility to prevent from mishap. Sensor signals will be processed by a desktop application which would identify whether the driver is drowsy or not. For more accuracy it is decoded to place the sensor in the steering wheel. The aim of this research is to develop an accurate drowsiness detection system which covers the weakness of absolute systems.

Keywords: *Drowsiness Detection, No-Eye Movement, Highly Drowsy, Heartrate*

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Analysis on Emotion Classification Methods

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Emotional intelligence is the ability to understand changing states of emotion, which is an important aspect of human interaction. With upcoming developments, emotion identification is an important aspect in HCI. Ideally if a computer can identify a human's emotions and respond to it accordingly, human computer interactions would be much more natural and more convenient. But even from a human's perspective emotions are hard to identify and track. Hence, it can be challenging for a computer to identify accurate emotions. Nonetheless few methods exist to classify and label emotions into categories. Hence this research is an analysis of methods used to classify emotions, which discusses the strengths and weaknesses in communication cues such as facial expression classifiers, gesture movements, acoustic emotion classifiers and emotion mining in text. It argues that an increment of accuracy exists when two or more systems are paired to extract the features in different situations. Hence, results show that while each model has its advantages and disadvantages, when integrated to classify, it gives better, more accurate prediction and improved results. Additionally, this paper mentions some of the practical issues that exist when it comes to emotion recognition and HCI. Furthermore, it is identified that emotion identification via text is a research area which holds great potential and among many approaches, hand-crafted models with the use of machine learning gives the best results. Finally, this research proposes a mobile application for emotional support using emotion identification via text messages.

***Keywords**: Modules, Unimodal, Bimodal, Multimodal, Emotion Mining*

Challenges in Investigating Cybercrime in Social Networks: A Sri Lankan Perspective

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With the explosive growth of social networks, modern society has found itself in the midst of a transformation from pre-social network age to a new world, where social networks influence everything from democratic processes such as elections to the mental health of the members of the society. While arguing that the net cost and benefits of social networks are out of the scope of this case study, the study also argues that social networks have introduced a new threat surface that challenges the current status quo on legal protection and investigative techniques on citizens. These challenges equally affect citizens who request justice and protection, and people who are hiding and avoiding law enforcement. From the perspective of a developing nation, especially a nation that does not host any technical infrastructure for any leading social network companies, this work presents the challenges which Sri Lanka could face and discusses their impact on law enforcement investigations. We believe this case study will open up discussions on the proper legal framework to support future investigations.

Keywords: *Social Networks, Social Media, Law Enforcement, User Privacy, Privacy Expectations, International Jurisdiction*

A Study on the Ayurvedic Plant Recognition for Remedial Medications Using Image Processing Techniques

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Plants are considered as an essential part of our ecosystem and Sri Lanka has a long history of using plants as a source of medicine in Ayurveda, in addition to some herbaceous plants that serve as a food source with medicinal values. In the Ayurveda medicinal industry, it is very important to identify the correct herbs that help in the preparation of remedial medicines. The identification of these suitable herbaceous plants is often done by skilled specialists. However, the problem is since identification is based on human cognition, it can lead to misjudgment. So, it is a waste that humankind cannot use the herbal power for remedial medications. To address this question this paper proposes a simple and effectual methodology for identification of Ayurveda's herbaria, using mobile devices in the android platform by using image processing techniques. The main characteristics required to identify a medicinal herb are the shape, color and texture of the leaf. The color and texture of the leaf cover vital parameters that are unique to a particular plant. Preprocessing, feature extraction and classification are the three major phases in the suggested methodology. In order to train the image processing model, images of herbal plant leaves were captured under the supervision of an Ayurveda doctor. For all, the image's backgrounds are removed and resized before applying the classification techniques. According to the methodology, the leaf images are trained and the result can be shown through the mobile application. The study received 94% accuracy for the proposed methodology.

Keywords: *Ayurveda Herbs, Image Processing, Feature Extraction*

Automate Timetable Scheduling with AI: A Review

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Scheduling timetables is one of the most complex and time-consuming processes when constructing and using manual methods. These manual methods do not always promise the optimum schedule plan and lead to countless conflicts. Recently, there have been many state-of-the-art systems proposed for task scheduling using Artificial Intelligence (AI). This paper reviews the recently proposed timetable scheduling systems with AI. The result of the analysis shows that evolutionary techniques have been used in many studies to generate optimized timetable schedule, specially using the Genetic Algorithm. Most of the studies proved that the Genetic Algorithm optimizes most of the constraint and fitted to automate timetable scheduling.

Keywords: *Scheduling, Timetable Automation, Artificial Intelligence, Genetic Algorithm*

Impact of Traditional Supply Chain Management on Green Supply Chain Management

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In the industrial arena, Supply Chain Management is the process of converting raw materials into finished goods and services within a quick delivery time with a minimized wastage capacity. The concept of Green Supply Chain Management is an upgraded process of Traditional Supply Chain Management which mainly focuses on green manufacturing, green packing, green delivering and marketing. Surveys state that Traditional Supply Chain Management is a main reason for hazardous problems like environmental degradation, pollution, carbon emission, resource depletion and massive wastage of raw materials. To suppress and reduce these harmful problems, logisticians and consultants introduced the concept of Green Supply Chain Management. After the implementation of the Green Supply Chain Management process, experts found that the level of above-mentioned harmful problems have been reduced. The first part of this paper discusses the concepts of traditional and Green Supply Chain Management. It also discusses about the vital issues in Traditional Supply Chain Management and how Green Supply Chain Management was introduced to overcome those problems. Next part discusses the transition barriers and challenges that are encountered when implementing Green Supply Chain Management. Finally, the paper reveals the main objective of the research; the impact of Traditional Supply Chain Management on Green Supply Chain Management and the suggested solutions for those impacts.

Keywords: *Traditional Supply Chain Management, Green Supply Chain Management, SCM, GSCM*

E-commerce Personalization for Local Music Instruments Market in Sri Lanka

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The Internet is most important for people all over the world because they can search anything through the Internet, and it gives many kinds of conveniences to human lives. E-commerce web applications are one of the most important technologies for information, services, buying items and selling items over the Internet today. So, it is a more powerful technology in the modern world rather than traditional commerce. The main objective of this research paper is to point out the difficulties of a small-scale business (local musical instruments business) and give a technical solution to maximize their profit and business opportunities. Under this research, the major problems of that business have been identified and this is a little effort to develop their business with the concept of personalization which can be used as a business strategy. The personalization aims at satisfying the customer needs and provides original and innovative research on business information systems. The customized market and product categories provide a comprehensive investigation of the business processes to receive the maximum output of the business. Hence, this solution provides a huge advantage to bloom the local music instruments industry in Sri Lanka.

Keywords: *Local Musical Instruments, E-Commerce, Personalization*

Automated Hospital Clinic Maintaining System for Government Hospitals in Sri Lanka

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The healthcare system is the most important factor in the development of the country. When considering healthcare, hospitals' contribution is priceless. There are two types of hospitals in Sri Lanka; government hospitals and private hospitals. Most people in this country use government hospitals for their treatment. One of the aspects of this treatment is to treat age-long diseases. To treat these age-long diseases hospitals conduct clinics. These clinics are divided based on the majority of the disease type. This research is based on the difficulties of the existing manual hospital clinic management system and the way it is upgraded to the automated computerized system. The methodology used to conduct this research is a qualitative and quantitative-based survey. The online survey was circulated through Email and the survey was completed by a sample of 300 people covering the Western Province of Sri Lanka.

Keywords*: Manual, Automated, Clinics*

Use of Distance Learning Technologies Efficiently in a Crisis or Pandemic Situation

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Since the outbreak of the COVID-19 pandemic situation in the world, distance learning plays a huge role in the education sector. Several shortcomings can be seen in this method since it was started as an alternative. This survey involves both students and teachers in Sri Lanka. Altogether the survey was passed to 300 individuals and 234 successful responses were obtained within a week. The survey helped to identify the shortcomings and barriers to effectively conduct distance learning in Sri Lanka. The lack of enough advisors online, marketing advantages, physical facilities to go online for the students and teacher, and the non-readiness of teachers and parents for change were identified. The paper allows to sort out the identified problem and form a set of guidelines on how to use distance learning hereafter in a pandemic/crisis by overcoming the shortcomings.

Keywords*: Distance Learning, Online Educational Management, Covid-19 Pandemic*

Focus Assistant: Identifying the Level of Motivation in Computer Users

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Focus Assistant is a software that will help the user to be concerned about their health and refrain them from overworking. It will also guide them back to work when they get distracted for a prolonged time. The system consists of two specific parts as the user should be alerted when distracted and should be notified to take a break if overworking. One of the main objectives of this paper is to identify the features and requirements that should be implemented in the system. The aim of this research is to review articles and other works related to the topic, to get an understanding of the features that could be implemented in the system, and technologies that could be used regarding the system. By gaining a thorough understanding of the related work, the expected results of the system would be that it helps the user to focus on work by alerting them when they are distracted and as well as keeps their health unaffected in stressful work environments by advising them to practice some tasks such as to have water breaks, to move, stretch and relax their muscles and take eye rests. There are software applications and systems that guide the user to take breaks if overworking and to practice ergonomic guidelines and also there are tools and chrome extensions that keep the user from getting distracted from their tasks. But Focus Assistant will be the first desktop application that would have both the options, so the user can focus on their health as well as not be distracted from their tasks for long periods. Finally, suitable features for the system are reviewed based on the information gathered from the related work.

Keywords— *Focus Assistant, Distracted, Overworking*

Sri Lankan Currency Recognition Device for Visual Impaired People

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The identification of several currency denominations is not an easy task for people with visual impairments. This study presents a Currency Recognition Device that can be used to help blind and visually impaired people to recognize the new range of Sri Lankan bills and verify whether they are fake or not. The proposed system is based on simple image processing utilities and machine learning algorithms. The basic techniques used in this proposed system include image pre-processing, feature extraction and finally, matching templates between the captured image and data set. The system easily identifies various currency conditions including occlusion, rotation, scaling, cluttered background, illumination change and worn or wrinkled bills and counterfeit bills. The proposed system applies to Sri Lankan paper currencies, including six types of paper money. Therefore, this system proposes an efficient, portable and profitable banknote recognizer for Sri Lanka.

Keywords - *Visual Impairment, Currency, Recognition, Fake Detection*

Monitoring Mental Health of Sri Lankan Youngsters During COVID 19 with Passive Mobile Sensing

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Smartphones are key devices that offer the collection of behavioral data without the users' knowing because it is the closest and frequently used accessory of daily life. Youngsters in Sri Lanka who are suffering from mental illnesses are not aware of their disease as well as the symptoms. In this research, the main aim is to monitor the behavior of the young people in Sri Lanka at the time of COVID 19 and come up with an analysis of the mental health status and the symptoms of mental disorders that they show. Data can be collected in various ways like, from the default sensors and questionnaires. Mobile phone usage patterns, like the duration of time spent at various locations are factors that may provide evidence for their behavior. In addition, daily activities like physical activity and sleep are also affected by the said defined mental disorders in this pandemic time. The study expects to provide sufficient remedies for those who suffer from mental disorders during COVID 19 with the use of data collected through the sensors and surveys. Confidentiality is ensured when receiving sensitive data. The researchers believe that through smartphone sensing, the study could contribute to avoid obstacles in behavioral studies, especially in the area of mental health detection.

Keywords: *Smartphone Sensing, Mental Health, Behavioral Science*

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