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INTERNATIONAL RESEARCH CONFERENCE

13TH INTERNATIONAL RESEARCH CONFERENCE

HOLISTIC APPROACH TO NATIONAL GROWTH AND SECURITY

15TH - 16TH OCTOBER 2020

Built Environment and Spatial Sciences

ABSTRACTS

General Sir John Kotelawala Defence University

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HOLISTIC APPROACH TO NATIONAL GROWTH AND SECURITY

BUILT ENVIRONMENT AND SPATIAL SCIENCES

ABSTRACTS

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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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Pedestrian Movement Tracking and Tracing in Public Space

RGN Lakmali[1#], AABDP Abewardhana[2] and PV Genovese[2]

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Population increase in the Urban areas made crowd management a hot topic today. Mass event planning, mass gathering, individual location planning, and public space planning need to know how actual pedestrian movement happens. For planning such areas, architects and planners are keen on empirical data of the pedestrian movements. The paper discusses the investigation carried out in a workshop to capturing empirical data of pedestrian movements in China. It addressed the outcome of tracking pedestrian movement with traditional methods vs. available technology. Further, this is an attempt to discuss the pros and cons of current trends in technology of movement tracking and tracing and its implication towards Architecture, Urban Design, and Urban Planning.

***Keywords**: Pedestrian movement, Public space, Tracking and tracing*

ID 615

Liveability of Vertical Apartments: A Study of the Relationship between Environmental Psychological Satisfaction and Height of Living with Special Reference to Low Income Apartments in Colombo

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This study investigates the liveability of low-income vertical apartments in Colombo, by means of finding the relationship between environmental psychological satisfaction and height of living. The main objective of this study is to find out to what extent the environmental psychological satisfaction correlates with the height of living of the low-income apartments. A total of 144 individuals (36 from each apartment and 3 from each floor level) from different age groups were employed as participants among the residents of four selected low-income apartments located in Colombo. The primary data were collected using a structured questionnaire and the secondary data were collected by using layouts, floor plans and photographs of the apartment buildings. A Stratified random sampling method was used to select the participants. Safety, friendship and relationship with neighbours, basic residential infrastructure, attachment of residential area, open natural spaces, privacy, personal spaces and territoriality are the determinants that were used as the basis of the questionnaire. The primary data were analysed by using SPSS (Statistical Package for Social Science) and the study employed estimation methods of OLS (Ordinary Least Square) estimation. As the final outcome, the level of environmental psychological satisfaction was identified in relation to the height of living and the aspects of design response were emphasized and impacted on it.

Keywords: *Liveability, environmental psychological satisfaction, low income vertical apartments*

ID 375

Evaluation of Urban Compactness Indicators and Solar Potential in the Urban Environment

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One viable solution for clean on-site energy production and utilization is Building Integrated Photovoltaics (BIPV). The available area for installation may not be sufficient to meet the building energy demand in high-rise urban buildings in tropical climates, although rooftops are ideal for photovoltaic (PV) module integration. This causes a requirement for the utilisation of facades. Furthermore, the unplanned urbanisation in Colombo has resulted in a difficulty in quantifying urban compactness and solar potential in urban environments. Therefore, there exist a requirement to assess the applicability of urban compactness indicators in quantifying solar irradiation on building envelopes in the urban contexts. This paper attempts to evaluate the credibility of several urban compactness indicators in relation to solar potential and establish the most applicable indicators with regard to the context of Colombo. The results showed that the roof to envelope area ratio provides optimum accuracy for predicting solar potential in the urban context of Colombo, Sri Lanka, whilst the average heights ratio exhibited the lowest. These results are significant for urban planners and developers when considering urban design guidelines.

Keywords: *Urban, Solar Potential, Compactness*

ID 684

Sustaining 'Walkability' in the Future City: With Special Reference to Central Business District of Colombo, Sri Lanka

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Colombo was founded as an outpost by Portuguese in 1505. Later it fell in the hands of Dutch and British. This non-organically produced city later became the capital of the independent Ceylon. Throughout the history this colonial structure was in a constant negotiation with the indigenous community. Despite the historical prominence present city existence is at a risk. Streets congested with vehicles affecting the environment, economy, well-being of the community is the most prominent issue of modern Colombo. This situation was once common to most of the developed cities, and they termed this issue as an 'urban crisis'. Main reason behind this urban crisis was cities being oriented on auto mobiles. To overcome this crisis 'Walkability' was the best alternative. This study was basically aimed to find the compatibility of the Walkability concept with the Socio-spatial structure of Colombo.

Location specific indicators of walkability identified through a questionnaire survey and universal indicators identified through the literature were used to assess the four selected case studies within the limits of Central Business District (CBD) of Colombo, to list out the prospective and retro-prospective lies in the social-spatial structure of the city. As the number of prospective are greater than the retro-prospective and as most of the retroprospective are potential to be amended into prospective Walkability can be sustained in the CBD of Colombo. A change in planning conception, innovation to mix the land use and improvement in the physical attributes are the few needs to sustain walkability in the Colombo CBD.

Keywords: *Walkability, Colombo CBD, Sustaining*

ID 646

Factors Influencing the Adoption of E-procurement for Public Sector Works in Sri Lanka: A Case Study Analysis

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Public sector institutes inherently suffer from the information asymmetries, extra time and cost penalties, corruption, transparency issues, anti-competition, and too much documentation with utmost human interventions in traditional paper-based procurement practices. Recently, the Government of Sri Lanka induced public sector institutions to embrace electronic procurement (e-procurement) adoption for their procurement practices. E-procurement is revolutionary digitization of the public procurement process. Despite the potential benefits, a high percentage of public institutions as well as small and medium-scale construction companies in developing countries often slow to adopt e-procurement processes. However, its advanced applications are less prevalent even in developed countries. Hence, the study attempted to analyse the factors that affect the adoption of e-procurement for the public sector Works in Sri Lanka within the limitation of Works procurement practices of the XYZ public sector educational institute. A mixed method was used to carry out the research. At the outset, a detailed literature review was conducted and identified people, technology, internal organization, and external environment as key e-procurement adaptation variables. Moreover, three structured interviews accompanied to demystify the literature review findings by concerning the Sri Lankan context. Finally, a detailed questionnaire survey was conducted among a population consists of 70 respondents by following the census procedure and 72.9% of them were responded. Descriptive statistics were used to analyse the data with the support of SPSS software. According to the overall result of the analysis, 'Technology' was realized as the most significant factor which considerably influenced e-procurement implementation for XYZ public sector institute in Sri Lanka.

Keywords: *E-Procurement, External environment, Internal organization, People, Public sector, Technology*

ID 90

Discourse Process and Discursive Practices in the Profession of Quantity Surveying in Sri Lanka

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The discourse on profession of quantity surveying exhibits a multi-dimensional role in the construction industry. The defined vital role entails the significance of mounting the scope in contrary to the traditional role with stressing the contribution provided by quantity surveyors through the means of discourse process and associated power relations. Consequently, the present research aims at examining the discourse process and discursive practices allied in profession of quantity surveying in Sri Lanka. In the process, the study has adapted a qualitative research approach while proceeding on data collection through unstructured interviews focusing on 15 number of construction professionals at top-level management, bottom level management as well as quantity surveyors distinctly. The findings obtained by the profound content analysis concise a vast use of English language among quantity surveyors and top-level management and consequently the evaluation of discourse on profession of quantity surveying has discovered a considerable influence on the profession caused by the use of English language as a verbal communication tool in being creating power relations in the hierarchy of the construction organizations in Sri Lanka. Hence, the research emphasizes the need of enhancing the scope of this profession in being a mediator of discourse with improving the proficiencies of English language and communication to address the defined gaps.

Keywords: *Discourse process, Power relations, Quantity Surveying, Sri Lanka.*

ID 381

Impact of Covid -19 Pandemic to Construction Industry in Sri Lanka

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Covid -19 is a highly contagious global pandemic. Social distancing measures are the most successful tactic in combating the disease. Due to the disease itself and local and global pandemic combating measures, businesses have been compelled to operate in a new environment. Infrastructure investments are curtailed worldwide. This research was focused in identifying the risks posed by the pandemic to the construction industry in Sri Lanka. A questionnaire survey was done to identify major risk factors in the construction industry in Sri Lanka. Disruption in supply chain, prophylactic absenteeism, regional lockdowns, fear of a second wave and decrease in investments were identified as the risk factors. Disruption to the supply chain is the highest risk factor. Construction industry in Sri Lanka is highly reliant on the local and global supply chains. Organizations need to foster transiency in their supply chains – the ability to restore some processes and change quickly. Dependence on external entities and regions should be managed by reducing the dependency or at least increase their predictability. Prophylactic absenteeism – due to government regulations is the second most influential factor. It disrupts the movement of people. Associated issues have arisen due the disruptions of supply chain and prophylactic absenteeism.

Keywords *— Covid-19, Supply chain, Prophylactic absenteeism*

ID 40

A Study on Conflict Management Styles for Decision Making in Sri Lankan Construction Projects

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Traditional project managers believe that the conflicts among project stakeholders are a threat to project deliverables. This is because the traditional project managers believe that the conflicts may bring negative results for the project management success. Though the modern project managers believe that a sustainable decision-making process can assist to achieve the overall project success. In this study the data was collected through a questionnaire survey. Final conclusion for the research objectives was achieved by analysing the collected data from 68 respondents. This research was investigated based on different kinds of approaches and methods when dealing with conflicts with all the counterparts. Further, the research was focused on studying the project conflict management styles which assisted for better decision making for all major stakeholders of organization structure. Stakeholders of Sri Lankan construction projects mostly adopt active strategies to resolve the project conflicts. Further, the project conflict approach is problem solving but without bargain. Hence, most of the stakeholders actively participate to resolve the conflict while more are concerned about the fulfilment of the needs of counterparts. When considering the gender roles in adopting approaches, females have a tendency to adopt a slightly more positive approach than males. Additionally, males adopt the same conflict management approach for every management level; whereas conflict management approach used by females differ according to the counterpart managerial level.

Keywords: *Project Conflict, Conflict Management Approaches & Styles, Decision Making*

ID 372

Optimization of Conventional Land Survey Techniques Using Modern Technology

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As far as a land surveying project is being considered, the knowledge about the accuracy, precision, time consumption and the cost efficiency are factors that must be equally taken into consideration before conducting the project. The success of any surveying project relies upon all the above components and hence the choose of the most appropriate technique for data collection is vital in the mentioned scenario. In the current situation, the conventional land surveying techniques, GNSS Surveys and Drone surveys have emerged through the society and are widely being used for surveying applications. Yet, their applicability in the most fruitful manner in obtaining the best results is still not known. Hence, the objective of this study is to evaluate and compare the accuracy, precision, time expenditure and cost efficiency of the conventional land surveying techniques, Survey Grade and Mapping Grade GNSS Receivers and Aerial Drone Surveying techniques. This study attempts to investigate the best appropriate technique to be adopted for the surveying projects depending upon the requirements of the survey.

The data for this study is accumulated through the field surveys conducted using the considered techniques for a particular area selected. The same plot of land is surveyed using all the different techniques and the accumulated data is then analyzed and compared together in order to understand their accuracy and precision along with the respective time consumption and cost efficiencies. Hence, the most appropriate technique for the relevant surveying project can be investigated based on the project's requirement. Thus, the ultimate objective of this study is to analyze the different surveying techniques so that the best appropriate method of surveying can be inferred in order to yield the maximum harvest from the projects to be conducted.

Keywords: *Area Calculation, Drone Survey, GCP, GNSS, RTK*

ID 471

Mapping & Classifying Paddy Fields Applying Machine Learning Algorithms with Multi-temporal Sentinel-1A in Ampara District

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In Sri Lanka, Seasonal paddy field area mapping is still doing based on the traditional methods with poor technologies. Therefore, this research focuses on the machine approach of mapping paddy fields area accurately on remote sensing data taken from the satellite. Multi-temporal Sentinel-1A Synthetic Aperture Radar (SAR) data was used to map the spatial distribution of the secretary's divisions paddy area in the Ampara district during the period from April 2019 to September 2019. The classifying algorithms were mainly used under the multi-temporal spectral filter classification with 11 dual-polarization (VH/VV) SAR using SNAP, QGIS, ENVI tools. The Time series model was used for each VH and VV bands separately. According to minimum and maximum value of both VH and VV bands, paddy field area was classified using deference of min and max value respectively The overall precision of paddy fields is shown to be 0.92 Also use random forest classification method to processed images with ENVI and It shows 0.86 accuracy rate. Each divisional secretary area showed accurate paddy classification according to non-remote sensing data provided by the district agriculture office of Ampara. This method can easily be used to classify paddy cultivation areas than its traditional methods. Also, it is low cost and very fast method. As further development, Rice prediction model is proposed using the same classified area with vegetation indexes of Sentinel 2 imagery.

Keywords: *Sentinel-1A, Nearest Neighbour, SAR, VV, VH.*

ID 279

An Assessment of Wave Climate Variability Using Energy Flux Method: A Case Study in the Coastal Area of Negombo to Wadduwa

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Wave climate can be described as the distribution of wave characteristics averaged over a period of time and for a particular location. Coastal erosion has significant impact from the change of wave climate. The West coast of Sri Lanka is identified as a severely eroding coastline according to the Master Plan for Coast Erosion Management in 2006. This study quantifies the wave climate variability in the West coast of Sri Lanka using ECMWF (European Centre for Medium-Range Weather Forecasts) wave data, in particular, ERA 5 collected over the years from 1979 – 2019. The occurrence of wave classes in the study area and the temporal changes in the wave parameters such as significant wave height, wave period, wind speed and sea surface temperature were analysed. Then significant change in long-term wave climate variability (1979-2019) and short-term wave climate variability (2010-2019), and the variation of wave energy in the study area were assessed. The significant increment has been happened in occurrences of wave classes and the wave parameters of the study area within the short term of period. Results of wave energy computations clearly indicate increase in the residual changes of wave energy flux in the short-term period during the Southwest monsoon. In addition, the occurrence of wave heights events which are greater than 2m have increased during the short-term of period than in long-term period. The changes in wave parameters and subsequently the coastal retreats in study area and possible measures are discussed in the paper.

Keywords: *Wave climate, wave parameters, energy flux, coastal erosion*

ID 209

Geospatial Based Land Suitability Assessment for Waste Dumping: A Case Study on Kesbewa DSD, Sri Lanka.

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In the current context, waste dumping could be identified as one of the foremost and rising issues of Sri Lanka. Still, Sri Lanka has not followed a proper waste recycling system and as a result, the number of waste dumping sites was increased in nearby suburbs and those locations endangered to nature. Therefore, systematic waste disposal and scientific location selection for waste dumping is a national requirement.

This study investigated the waste dumping problem in the third most populated area in Colombo District, the Kesbewa Divisional Secretariat Division. The suitability of waste dumping of each land parcel was analysed by utilizing both raster-based and vector-based approaches. Data were collected from Survey Department of Sri Lanka and open-source satellite data platforms. There are eight data layers manipulated over the study such as Building, Land use, Slope, Waterbody, Road, Reservation, and Population. Further, an investigation performed by using the Geographic Information Sciences (GIS) environment with the use of ArcGIS 10.5 software.

Finally, the factor maps were prepared and identified the suitability of land parcels for waste dumping. Further, it was revealed that the existing Karadiyana waste disposal site only has 38% of suitability and not in suitable condition for waste dumping. In addition, it is directly connected to the nearby Bolgoda river and emphasized as a major warning to human and environment in future. Consequently, in order to overcome that issue, three suitable locations have been for waste dumping by the study in the Kesbewa area.

Keywords: *GIS, Karadiyana, Kesbewa, Waste dumping*

ID 269

Vegetation Condition Index Based Agricultural Drought Mapping over the Past Decade of Sri Lanka by Utilizing the Satellite Remote Sensing

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Drought is one of the main disasters that act as a silent killer among Sir Lanka and it is the disaster that affects the highest number of people over the country. Different types of droughts can be identified such as Meteorological drought, Hydrological drought, Agricultural drought, physical Drought, and Socioeconomic drought. This study explored the agricultural drought of Sri Lanka since Sri Lanka is an agricultural nation. It requires systematic and scientific investigation to study the magnitude of the Agricultural drought. Sri Lanka is one of the Asian countries which is often experienced drought risks, when drought has happened it is constantly changed into disaster making various antagonistic effects on the network. The integration between Remote sensing techniques and Geographic Information Systems (GIS) was used for the investigation which is sophisticated in environmental studies rather than field data collection. Integration between 10 years (2009 to 2019) of Moderate Resolution Imaging Spectroradiometer (MODIS) remote sensing images were utilized for Agricultural drought detection by using the Normalized Difference Vegetation Index (NDVI) and Vegetation Condition Index (VCI) for the study in ArcMap 10.1 software environment. As a result, the study presented an Agricultural drought risk assessment map for 2019 in Sri Lanka. Rendering to the results, it shows a considerable increase in drought conditions over the past decade of Sri Lanka while showing the dominant type is still no drought condition of 68% from the total area.

Keywords: *Agricultural Drought, GIS, NDVI, Remote Sensing, VCI*

ID 374

Principle Factors which Affect to the Proper Functioning of Urban Public Gathering Spaces with Special Reference to Recreational Parks in Colombo City

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Rapid urbanization and change of lifestyles require more public open spaces in cities to fulfil different socio, economic and environmental needs of the city. The urban park is a breathing space in a highly dense urban fabric for the public to recreational activities as well as physical health activities. The successful functionality of recreational parks in urban context will be determined by citizens' acceptance. A Sociologist and urbanist, William H. Whyte is the mentor who did long time research on public gathering spaces. Based on the research, he identified a set of principal factors behind the successful functionality and social acceptance of public gathering spaces. This paper will discuss the applicability of Whyte's Principles in Sri Lankan urban context. For this research, theoretical knowledge of urban public spaces, recreational parks, principle factors of Whyte's theory will be discussed through a comprehensive literature survey. Basically, the data collection was done by self-observation, photography survey and a semi structured questionnaire. Semi structured questioner was helped to have more requests and ideas from the visitors. Finally, the data will be presented through photographs, graphs and charts to have better clarification about the collected data. In the conclusion, effect of Whyte's theory on the function of these parks and the things which have to be improved will be discussed.

Keywords: *Urban public gathering spaces, Whyte's theory, Urban parks in Sri Lanka*

ID 689

The Impact of Workforce Diversity on Employee Performance in Sri Lankan Construction Industry

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Workforce diversity provides heterogeneity to a workforce thereby making it a strategic capability to provide competitive advantage to organizations. Effective management of diverse human resource in the right manner can attract profitability to organizations as human diversity enhances the flow of novelty, creativity and innovation. This research study aims to investigate employee performance in construction industry in Southern and Western provinces of Sri Lanka. Out of numerous workforce diversity factors, age, educational background, work experience and attitudes were selected as the independent variables for the study. When conducting the research, 120 questionnaires were distributed among employees engaged in the construction industry to collect data through simple random sampling technique. The results indicated that there's a positive impact of diversity in terms of age, educational background, attitudes and work experiences on employee performance. The outcome of this study would benefit organizations in providing potential considerations to the management and workforce from different perspectives which would enable the distinguishing of dimensions of workforce diversity variables to further improve employee work performance.

Keywords: *Workforce diversity, Employee performance, Construction Industry*

ID: 116

Identification of the Challenges Imposed by COVID-19 Pandemic on Sri Lankan Construction Projects

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Coronavirus (COVID-19) is a global pandemic which has been spreading all over the world, ruining the lives of hundreds of people & negatively affects on business matters over the world. This can trigger different kinds of challenges to all the industries while affecting the world economy. Thus, this paper aims to identify the challenges imposed by COVID-19 pandemic on Sri Lankan construction projects. This research was assessed through a detailed questionnaire survey and interviews. The number of distributed questionnaires were 50 and the response rate was 82% which added a positive mark on the research study. Frequency index method & content analysis were used to analyse the collected data. The findings highlighted the main challenges among construction industry due to coronavirus as delay of completion, issues with supply chain management & change the public perception on site. It is recommended to spend the period of working from home fruitfully & to start the site works stage wise with the involvement of lesser number of labours at the beginning stage. While this research focused on the challenges, further study can be done to investigate about the renaissance & the industry predictions of the construction sector for post COVID-19 world.

Keywords: *Coronavirus, COVID-19, Pandemic, Sri Lanka*

POSTER PRESENTATIONS

ID 252

Remote Sensing Based Habitat Mapping of Vankalai Coral Reef, Sri Lanka

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Coral reefs are an important coastal ecosystem in Sri Lanka. Current study was conducted in the Vankalai area regarding the development of a new method of remote sensing technique to map and monitor the particular coral reef ecosystem. Downloaded Landsat 8 satellite images were processed under the three headings which are preprocessing, processing and post processing. Image preprocessing is used to eliminate errors in satellite images. Depending upon the source of error, inadequacy revision and imperfection expulsion are separated into two types such as radiometric correction and geometric correction. In radiometric correction the foremost requirement is to convert DN values to spectral radiance values. The next step is the conversion of radiance values to Top of Atmospheric (TOA) reflectance which could be identified as a unit less ratio measurement. Normalized difference water index was used to enhance water features and suppress the land area. Different types of bottom substrates were identified using Depth invariant index (DII) for study area and which are classified according to the bottom substrate using unsupervised classification. Five types of different spectral classes were identified using developed methods which are coral reef, rough bottom, vegetation cover, sandy bottom and deep muddy area. These spectral classes are related to elevation of benthic habitat. Ultimately a map was generated with respect to the bottom substrate for a particular study area using Landsat 8 image. It is an extensive reef area but lacks details yet. This study is the first attempt to use Landsat 8 for coral reef mapping in Sri Lanka.

Keywords: *Coral reef, Depth invariant index, Landsat, Vankalai.*

ID 276

Review on National Geodetic Control Network - Sri Lankan Datum 1999 (SLD_99)

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Any country in the world has its own geodetic coordinate system and it is very useful in all types of surveying activities. Accuracy of the geodetic control network is very important in every aspect. In Sri Lanka (Early named as Ceylon), the systematic triangulation process began in 1857 and completed in 1885. This network was recomputed with some additional observation done in 1890 due to inconsistencies occurring mainly in the minor triangulation. But later found that, the new introduced fixing values have serious error. A new horizontal control network was established in 1999 using Global Positioning System (GPS) and there were included thirty two (32) old network points to calculate the transformation parameters between the old local datum (Kandawala Datum) and the new horizontal network. But new system and old system gives different coordinates for same control points. In this study, Kandawala network is compared with new SLD_99 network to find differences between these two networks. Scaled out figure of the ten secondary control points of SLD_99 was observed with GPS observations and analyzed to perform a network adjustment and for comparison.

Keywords: *GPS, SLD_99, Kandawala Datum, Network Adjustment, Triangultion*

ID 277

A GIS- Based Approach for 2D Noise Modelling Using 2D City Model

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Noise pollution of urban areas is one of the serious issues. The local and urban authorities have to consider decision making processes for establishing residential, newly construction of hospitals, schools and maintaining the public places etc. The national environment act, no. 47 of 1980 provides limitation about noise emission of Sri Lanka. Road traffic is a major sources of community noise in metropolitan cities. Road traffic noise mapping is described in this research. The main objective of this research is to find the noise levels where it is less than 63dB and sub objective is finding the suitable interpolation technique for road traffic noise mapping. Noise maps can be used to monitor the issues of noise effects. Most of the noise maps are available today in two dimensional (2D) in which noise effect is presented in x, y plane. The preparing of noise map is depending on noise calculation model and 2D city model. The noise calculation model is based on number of vehicles and speed, road type and noise absorption from the air etc. But in here considers only number of vehicles, speed of vehicles and noise reduction with the distance for the calculation of noise levels. Digital data layers which are digitized from satellite images, are used to prepare the 2D city model. The spatial analysis methods of GIS (Geographical Information Science) can play an important role to control noise pollution. GIS provides framework to integrate noise calculation models with spatial data. IDW (Inverse Distance Weighted) and Kriging interpolation techniques are used for the interpolation of noise levels. When checking the accuracy of noise levels with sample points, it recognized the IDW which better interpolation technique for noise mapping. There are 73% area is more than 63 dB sound levels and those area cannot be used for as silent areas in urban planning.

Keywords: *GIS, 2D City Model, Noise Mapping*

ID 278

Assessing the Accuracy of Terrestrial Laser Scanner Against the Total Station for Surveying Applications in Sri Lanka

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3D laser scanning or terrestrial lidar instruments have been in used in surveying task since the 1990's but it is very new technology for the Sri Lankan surveying field. Terrestrial laser scanners have been proven to be a very versatile surveying instrument with applications in many sectors of use like, Detail topographic survey, Road & Railway survey, Construction Site, Volumetric Survey/ Mining Survey, Monitoring Survey, Critical location survey, Crime Scene, Accidents, Tunnel Survey, BIM – Building Information Modelling & EMP – Electrical Mechanical Plumbing and Archaeological site survey.

The results of any surveying task must meet specific conditions to provide the required accuracy. Therefore, any surveying work includes not only the relative positions of points and objects but also an accuracy of the results. It is imperative that a new technology like terrestrial laser scanning instrument before been use in the actual field data collection to go under accuracy analysis for Sri Lankan field conditions.

One of the fundamental theories is "Practical is up on proven principal" in accordance with this theory the accuracy of the terrestrial laser scanner is going to be analysed against the most commonly used surveying instrument in the field the Total station. The comparison will be done in normal Sri Lankan field condition with weather, heat, and pressure to get much better accuracy comparison. The experiments are designed in the following way, two traverses from both the Total Station and the Terrestrial Laser Scanner are going to be run on the same set of ground points then 3D error of each measurement is going to analyse using adjustment theory. The calculation will be done using and computer algorithm.

Keywords – *3D laser scanning, 3D, terrestrial laser scanner*

ID 329

Construction Workers' Motivation and Skill Development: A Strategy for Improving Construction Productivity in Sri Lanka

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Human factors are important sources of increasing efficiency and performance in the construction industry which contribute to project success Human resource today has a strategic role for productivity increase in construction projects and this makes it superior in the industrial competition. This stems from the limited success in terms of completing projects in time, within approved cost and to a satisfactory quality. The study examines motivation and skill development factors as a strategy for construction productivity in Sri Lanka, whilst there are other human behaviour factors that could influence construction productivity. Descriptive research methodology using questionnaires to collect data was used. 35 behaviour factors of motivation and skills development were identified and investigated for improved construction productivity. The results showed that although all 35 factors are very significant and are more likely to exert a higher influence towards positive behaviours, there were 4 factors found to be extremely significant and the highest ranked factor was a motivation factor; on-time payment. Only one skill development factor was identified as extremely significant according to respondents' perspective. Conclusions drawn from this study are that when the 35 sub factors are present in a construction environment, they influence worker behaviours, thus improving construction productivity. Therefore, it may be necessary to consider these factors as a way of increasing success and productivity. Investigating these factors could thus be a way of unlocking human potential to enhance productivity because these factors reinforce behaviour that in turn contributes to project success.

Keywords: *Skill development factors, motivation factors, construction productivity*

ID 373

Architectural Attributes which Affect Rehabilitation and Reintegration of Juvenile Correctional Facilities

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The process of reintegrating juvenile delinquents to society from correctional facilities is as important as the process of rehabilitation. If the rehabilitation process is not conducted properly, it would rather be difficult to control the reconvicted /recidivism rates. Hence the correctional methods must adhere to certain attributes relating to the rehabilitation process, one key aspect being the built environment of the correctional facilities. Humans by nature have an undeniable connection with their environment through physical, mental, emotional and spiritual means. This connection is what helps keep a balance within ourselves. Most of the time, unlike adults' juvenile delinquents commit crimes without their consent. It is paramount that this is understood, and they are attended with the required special attention in the rehabilitation process. At the stage of admission to the correctional facilities, these youngsters are more likely to be in a very weak state of mind, with the need of protection, self-value, freedom and to obtain the sense of belonging in the society as they are reintroduced. This requires improvement of interpersonal and intrapersonal skills before leaving the correctional facility to avoid the reconviction /recidivism. The rehabilitation process influenced via architectural attributes followed at this research would be to understand level of lighting, usage of colours, enclosure of the space, outdoor-indoor relationships, level of privacy, architectural character of space and semiotics would lead to proper reintegration to the society.

Keywords: *Juvenile Delinquents, Rehabilitation, Architectural Attributes*

ID 376

Reconsidering Shophouse Architecture for Contemporary Times

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The shophouses were the elegant buildings that lined along the Sri Lankan streets from the past. The very fact that the shophouses and their proportions contribute to the growth of the evolution of tropical architecture is phenomenal feature. The shophouse is a development of the basic house from in Sri Lanka, it is not a new, alienated concept, and instead the basic house form has evolved to cater needs of the society during the different periods of history. These buildings are used for both the commercial and residential purposes. However, in the contemporary world these shophouses are diminishing in number and there need to be efforts done to preserve this beautiful historic building. This research investigates on the manner in which the evolution of the shophouse architecture is appreciated-the traditional and the modern variant of the shophouse is examined through a typo-morphological architectural analysis, as they justify the new urbanism principles when designing cities. Thus, proving that the shophouses can be reconsidered as it has evolved for contemporary times in creating sustainable townships.

Keywords: *Shophouses, sustainable, new urbanism*

ID 377

The Impact of Living in High-rises for the Cognitive Development of Early Childhood in Sri Lanka

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High-rise buildings have become a popular strategy for accommodating population growth in urban areas in Sri Lanka. Each and every building has different characters and personalities that offer different experiences to a person in their daily lives, but the most vivid to sharpen their psychological and social behavioral qualities is their home or permanent living space and surrounding characters. Different factors such as age, gender, educational level, economic status and social cultural background can be considered to categorize people. The main consideration in this research is the age. Childhood, puberty, adulthood and old age are the four main stages of human life. This study has been carried out to find the impact of living in high-rises during the early childhood. The age category was addressed throughout this analysis will be the age group from 1 to 5 years. Purpose for the gathering information three well-known nurseries were evaluated under Interview guideline for teachers and list of activities for children. Collected data were analyzed by case study approach and presented through descriptive statistics. Findings of this research indicate that living in high-rises during early childhood impacts negatively for the physical, psychological and psych-social development of the child. Recommended options that future architects can follow to minimize above issue have suggested in the end of this thesis.

Keywords: *High-Rises, Sri Lanka, Cognitive Development, Early Childhood*

ID 599

A Geo-Physical Investigation into the Colombo Port Seabed using Sub Bottom Profiler

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Traditionally, seabed layers were determined by using conventional mechanical methods like boreholing, which retrieved the strata at a single point at one time. Later, it was developed to various acoustic remote sensing techniques which can determine layers robustly, with less cost. Sub Bottom Profiler (SBP) is an effective method used to identify and describe the layers of sediments under the seabottom. SBP is almost similar to an echo sounder, but portion of the sound pulse is penetrating beneath the seafloor and reflected off of the strata layers. These refracted acoustic signals will show any sort of density disturbance. Sub bottom systems have been used to detect and measure the thickness of sediment deposits, identify buried objects, and define the bedrock layer of a basin. Transducer frequency and pulse length are the key aspects on the SBP system performance. Absorption losses are proportional to the transmitting frequency. Long sound pulse lengths required more energy and resulting deeper penetration but decreasing the system resolution. The Stratabox HD is a pinger type SBP having the capability of detecting the soft sediment layers in high resolution. The objective of this study was to carry out a geo-physical investigation of the Colombo Port using the SBP. Data was collected at the Jaya Container Terminal (JCT) basin. Sub-bottom fence diagrams were generated with Hypack software and results were validated using the existing borehole samples. The initial sub bottom soft layers were closely matched with the borehole sample data.

Keywords: *Sub Bottom Profiler, Geo Physical Investigation, Coastal Engineering*

ID 643

Causes behind Poor Written Communication Impact on Contractor's Quantity Surveyor Practices in Post Contract Stage

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Effective communication among different stakeholders is a vigorous characteristic of successful construction industry practices. Written communication provides documentary evidence for strengthening key contractual relationships among such stakeholders. Compared to other forms of communication, written communication is a source of great comfort to Quantity Surveyor's royalty in the field of construction. Although many researchers discussed the causes behind poor communication in the construction industry, there is a substantial gap in analysing the causes behind poorly written communication which impacts post contract quantity surveying practices. Hence, this research primarily focuses on investigating the significant causes behind poorly written communication which affect the contractor's quantity surveyor practices in the post-contract stage. A detailed literature survey was conducted and identified 26 causes behind poor communication in the construction industry. Then, 3 preliminary interviews were conducted and customized the literature findings in line with the contractor's quantity surveyor practices in the post-contract stage. Accordingly, 7 main contractor related causes, 5 sub-contractor related causes, 8 consultant related causes, 4 client related causes, and 4 communication tools related causes were formulated and tested with the use of a detailed questionnaire. Data collection was limited to a census of 60 quantity surveying professionals who were working on construction projects in the Colombo district who belonged to ABC major constructing company. 57 of them were responded and the Relative Important Index (RII) method was utilized to analyse the data. The study revealed the communication tools related causes as the significant causes behind poorly written communication in the post-contract stage of contractor's quantity surveying practices.

Keywords: *Client, Consultant, Main Contractor, Poor Written Communication*

ID 644

Significant Causes Behind Payment Delays in Public Sector Building Construction Projects in North Western Province of Sri Lanka

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Payment delay is one of the most significant issues experienced in public sector building construction projects. Correspondingly, most of the building construction projects in North-Western Province (NWP) of Sri Lanka are often characterized by delayed payments. Hence, the objective of this research is to identify the significant causes behind delayed payments in public sector building construction projects in NWP; as an initiation to develop a preventive framework for payment delays. First and foremost, a detailed literature review was carried out and 28 number of payment delay causes were identified, by including seven client related causes, nine consultant related causes, seven contractor related causes, and five other causes. Then a questionnaire was articulated and distributed among 100 (census) population of experienced professionals belong to the NWP Engineering Department and its 7 numbers of divisional engineers' offices in NWP. Sixty-five of them were responded.

The Relative Importance Index (RII) method was used to rank the most significant causes. Results indicated the client's failure to follow the pre-set procedure as the most significant client-related cause for payment delays. The results further portrayed that the delays in subcontractor's interim payment application, errors in contractors' claims, and delay in the evaluation of work done by the quantity surveyor as the prominent payment delay causes respectively fit into other, contractor, and consultant related category of causes. Besides, the client-related causes, the category with the highest average RII was identified as the highly influential group of causes behind payment delays in public sector building construction projects in NWP of Sri Lanka.

Keywords: Client, Consultant, Contractor, Payment Delays

ID 660

Robust Street Edges as an Extension of Shop Fronts; a Study with Special Reference to Area of Negombo

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Streets are providing a media for the moving elements such as pedestrians and vehicles, but it serves a place for myriad purposes and forming a major part of the cities. While streets offering multiple activities for multiple purposes of different type of people, this quality called robustness. According to Lynch, the contribution of elements on either side of the path, are highly Impact on the human behavioural pattern. Buildings where on either side of the streets effect on the robustness of the street edges. Some activities within the building used to extend towards outside and making connections with outdoor activities. As a result of this street edges being taken place for spectrum of activities and functions. To determine that how extended shop fonts contribute to street edges to become robust and as result of that, Robust street edges become not only limited to single fixed use, but taking place for multiple uses and activities. Market Street, Main Street and the Station road are the three streets selected from Negombo for the study where one of commercial city since the past. All three streets are Commercial corridors in three different locations of the city, and each has unique characters. An attempt to figure out from Plan view, elevations along the street and sections through the site revels how shop used to articulate their fronts with the help of other six factors such as; Legibility, Permeability, Variety, Visual Appropriateness, Personalization and Richness and how effects on outdoor activities on the street edge.

Keywords: *Streets, Robustness, Responsiveness*

ID 683

GIS Mechanism for Terrain Trafficability

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Geographic Information Systems (GIS) could be identified as a leading application mechanism that grows beyond in each and every aspect of the world. The GIS applications in decision making in the military field is being gradually increased in nowadays. This study oriented to compare the application of GIS in foreign armies and find a suitable GIS application for Sri Lanka Army. The design of this research was accomplished in three stages as reviewing the existing GIS application of foreign armies and developing the terrain trafficability model using model builder application of GIS. Therefore, by reviewing existing applications of other armies in foreign countries, it was clearly identified some of the applicable GIS applications for Sri Lanka. And then by using questionnaire survey including Sri Lankan army officers, it was figured out the appropriate application for the country. As per the results of the questionnaire survey, the terrain trafficability analysis method was found as the most suitable method for the country. Then Kalutara district was selected as the study area and land use, soil, elevation, used as raw data. At present, the Sri Lankan army doing terrain analysis using the Intelligence Preparation of the Battlefield (IPB). Terrain overlay is the part of IPB which identify go, no go, slow go areas of the terrain. This research wasS focused on the identification of GIS mechanism for this manual process using GIS accurately compared to the manual process. Therefore, the study suggests utilizing this analysis in the future for the terrain analysis in Sri Lanka Army.

Keywords: *GIS, Trafficability, IPB*

ID 685

Factors Affecting Contractor's Risk on Cost Overburden in Sri Lankan Construction Industry

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Cost overrun is one of the major issues faced by the construction industry at present. The contractor's cost overrun directly affects with the contractor's profit margin which has become a major burden within the contractor's scope of work. This study attempts to identify the severity of the factors affecting contractor's risk on cost overburden in Sri Lankan construction industry under the factors affecting cost estimate, factors affecting final cost and contract specific factors. Data collection was done by a questionnaire survey which a questionnaire was distributed among experienced quantity surveying professionals in Sri Lanka. Collected data was subjected to a quantitative analysis using the Relative Index technique and ranking of questionnaire was done. The findings elaborated that the factors affecting the final cost have the highest impact on contractor's cost overburden in Sri Lankan context. Proper consultation of clients on variations and on time payments and proper management of stability of the country's economy by the government will improve the contractor's cost performance and the project performance as a whole. Focusing on mitigation approaches to avoid the risk factors causing cost overburden will improve the efficiency of the construction industry in Sri Lanka.

Keywords: Contractor, Cost overburden, Sri Lankan Construction Industry

ID 687

Contribution of Built Environment on Inclusive Urban Design: with Special Reference to Selected Transport Related Public Spaces in Galle, Sri Lanka

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Designing architectural spaces is thought to contribute to social inclusion, eventually satisfying all components of the society. As the building characteristics have a powerful impact on the quality of the life choices that the planners, developers or architects make can either encourage or restrict people's well-being. Along with technological innovations to these built environment and sociological research, many characteristics have been added to the built environment that empowers availability, security and feeling of belonging. This scenario is widely apparent in developing nations as the majority is in lower income classes, governments provisions being restricted is further empowering this issue. With regard to all these problems, there have been numerous summits and conferences on achieving sustainable cities in all the aspects. Sustainable Development Goals 11 is one of the most prominent which highlights social inclusiveness as a major issue. Social exclusivity leads to social inequity, which is today's primary social problem. In overcrowded government areas such as the Galle bus stand and the Galle railway station, these problems are very evident. The objectives of this study are, to identify the inclusivity favouring sustainability over exclusivity and to study the compatibility of Galle city with this sociological concept. Research will adapt a mixed method in which the primary data will be collected through surveys and interviews. This study found that the Galle city's physical built environment is able to contribute positively in the process of sustaining social inclusion.

Keywords: *Social inclusion, Architectural spaces, Exclusive design*

ID 688

Impact of Colour on Worker Performance and Satisfaction in Sri Lankan Office Buildings with reference to Bank Buildings in Gampaha District

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Colours help to generate spatial qualities in architecture and affect the psychological and physiological condition of the user. Colours can influence on wellbeing and provide impact on human behaviour. Careful use of colours can create harmonious spaces and change the behaviour of the users positively. Colour schemes play an important role in office working environments. Office is a place where employees spend their majority of time. Banks are a specific office type which deals with money. Office environment affects directly, in shaping the day of a person, his moods, performance and satisfaction.

Main objective of this study is to enhance the awareness of designers and facility managers in the banks on the importance of colour schemes to improve bank employee's performance and satisfaction. Three Sri Lankan office buildings with reference to banks in Gampaha district selected and see how colours have been supportive or less conducive towards, performance and satisfaction and to find out most important colour scheme for the increase performance and satisfaction. Three different bank environments in Gampaha District were selected for this study.45, were employed as participants. Sample size was selected considering the People who facing directly to the selected colours while working. Primary data were collected using researcher made questionnaire regarding the factors related to respondent's (A) basic information, (B)comfortability regarding applied colour scheme and its effect on the performance (C) comfortability regarding existing physical environmental factors, (D)colour scheme preferences for the working environment. (E) job satisfaction. Data were analysed descriptively.

Keywords: *Gampaha District, Performance, Satisfaction*

ID 697

Auto-generate Landmine Path, Digitize and Visualize the Data for the Sri Lankan Context

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Landmines could be identified as affordable and effective defensive weapon, but it has many complexities. Human deaths and injuries, agricultural land degradation, destruction to infrastructure, environmental destruction, economic cost for demining humanitarian aid and etc. Those complexities cause due to the unconventional landmine fields which could be find it difficult to demine. To avoid that, landmines had to be laid according to universally accepted methods in a standard pattern. As per the International agreements, Sri Lankan security forces also follow the standards in warfare. But their data recording mechanism is manual and not efficient. The objective of this study is to introduce a new system to record positions of landmine data in digital format. The design of this research was accomplished in three stages, identification of current practice of data recording, develop the computer program to generate locations of landmines and data visualization and analysis using the result of the computer program. Therefore, through reviewing existing mechanism, lapses of existing system could be identified. By developing a computer program, we could be able to auto-generate locations of each landmine on a landmine pattern by two initial inputs. Matlab has been used to develop the program which is a very powerful platform. Qgis is a highly demanded spatial data manipulating system, which is utilized in the visualization and analysis of data. The proposed system will be more convenient, efficient, effective, and accurate system that will avoid the malpractices of recording landmines.

Keywords*: Landmine, Location, MATLAB, Minefield, QGIS*

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