INFORMATION, COMMUNICATION AND CREATIVE TECHNOLOGY

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UNIMAS 25 years of transformation towards excellence
UNIVERSITI MALAYSIA SARAWAK 1992-2017

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UNIMAS Innovation

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Foreword

It is my pleasure to welcome you to our latest issue of Research Update. In this issue, we highlight our researchers' efforts in the field of "Information, Communication and Creative Technology".

In every issue of Research Update, we endeavour to highlight efforts by our researchers, with the hope that the sharing of knowledge through this publication will impart valuable information, generate interests and potentially create research opportunities and collaborations.

In this day and age, ICT plays an ever increasing role in our daily lives. ICT is no longer considered as a privilege but rather has become a necessity. From the research perspective, ICT is one of our university's niche area and we have embarked on various multiple disciplinary research. It is with the hope that the current issue will emphasise our comprehension on the impacts of ICT that would enhance the socio-economic well-being of the society and ultimately thrust UNIMAS into greater heights within the research and innovation ecosystem.

I would like to express my heartfelt appreciation to the researchers who provided articles to this edition of Research Update. It is my wish for you to maintain your research initiatives and I hope to see more interdisciplinary research endeavours that would benefit all stakeholders of UNIMAS.

Thank you.

Professor Dr Wan Hashim Wan Ibrahim
Deputy Vice Chancellor (Research & Innovation)
Universiti Malaysia Sarawak

CONTENTS

ROBOTIC AND AUTOMATION CERTIFICATION TOWARDS IR 4.0

Researchers: *Annisa Jamali[1], Shahrol Mohamadan[1], Norazian Mohamad Hamdan[2], Wan Hashim Wan Ibrahim[1]*

[1] Faculty of Engineering, Universiti Malaysia Sarawak
[2] Faculty of Computer Science & Information Technology, Universiti Malaysia Sarawak

The team of inventors is to continue the research and development of robotics technology and to extend the knowledge to become a teaching module. Collaborating with FAME International College, the teaching module also promotes the applications of robotic technology for enhancing life comfort. The team has been involving in the field since 2007 and to date, they have secured more than ten (10) research grants related to robotics.

MoA signing with Digital Economy Hub (DEH) for Robotic and Automation Certification towards IR 4.0 in conjunction with the International Digital Economy Conference Sarawak (IDECS2018) on 14 May 2018 (Photo Courtesy of Azlandy Mohammid Ali Tuah)

The team of inventors has produced a Robotics Teaching Module based on their experiences and expertise. The module has 16 lessons, covering the basic of robotics to building of simple robots.

Lesson	Course
1	Chill Out Robotics Fundamental
2	Code Easily Via Blocky: For Programmers of All Ages
3	Dobot Robot's Arm Positioning and Handling
4	Help Dobot Robot to Move in the Obstacles Area!
5	Dobot Robot Plays Domino!
6	Build and Train Dobot Robot to Feed Elderly or Sick People Via Feeding Assistive Activity
7	Build and Train Dobot Robot to Help Stroke Patients Texting or Calling!
8	Dobot Robot Giving Warning through Light Blinking and Sound!

Lesson	Course
9	Dobot Robot Intelligently Sorting Via Color Detection
10	Dobot Robot Accurate Movement and Fast Positioning
11	Dobot Robot Run Perfect Stacking Activity in Factories
12	Playing with Built-in Robot Dobot Multi Language Writing Skill
13	Exploring with Built-in Robot Dobot 3D Printing
14	Build and Train Robot Dobot as a Master-slave Application
15	Build and Plan for the Competition
16	Show Off Manipulator Skill through Competition

ast R&D projects from the team include:

PK/04/2010: Dual Functional Automated Guided Vehicles in Flexible Manufacturing System

RGS/02(12)/733/2010(19): Human Walking Behaviour Based on Different Layout Design Using omputer Animation

GS/02(S115)/897/2012(28): Control Algorithm for Hyper Redundant Robot on Constraint Area

AGS/TK01(1)/1050/2013(7): Parametric Study on Rehabilitation Robot of Upper Limb Impairment for omestic Setting

RGS/TK01(01)/1136/2014(03): Investigation of the Required Parameters for Club Foot Treatment Based n Non-Invasive Medical Approach

RGS/TK01(01)/1167/2014(01): Development of Finger Rehabilitation Device for Post Stroke Patient

02(S164)/1197/2015(01): Development of In-Pipe Robot for Piping Operations

UNIMAS INTEGRATED DIGITAL TOURISM 4.0

Researchers: *Lo May Chiun[1], Abang Azlan Mohamad[1], Wan Hashim Wan Ibrahim[2], Wang Yin Chai[3], Zulkalnain bin Zainal Abidin[4], Loh Ngiik Hoon[4] and Louis Laja Uggah[4]*

[1] Faculty of Economy and Business, Universiti Malaysia Sarawak
[2] Faculty of Engineering, Universiti Malaysia Sarawak
[3] Faculty of Computer Sciences and Information Technology, Universiti Malaysia Sarawak
[4] Faculty of Applied and Creative Arts, Universiti Malaysia Sarawak

UNIMAS Integrated Digital Tourism 4.0 was launched during the Digital Tourism Forum 2018, held on 9th March 2018 at Pullman Kuching. The application functions as a platform to assist industry players to migrate from the traditional and conventional tourism format to a digitised tourism industry. The launching ceremony was done by Minister of Tourism Arts, Culture, Youth and Sports Sarawak, Datuk Haji Abdul Karim Rahman Hamzah representing Chief Minister of Sarawak, Datuk Patinggi (Dr) Abang Haji Abdul Rahman Zohari Tun Datuk Abang Haji Openg.

Launching Ceremony (Photo Courtesy of Azlandy Mohammid Ali Tuah)

The application performs as a centralized database to capture, manage, and generate significant information for users (tourists and industry players). It acts as a directory/locator of food and services, embedded with mapping capability to provide directions to the locations of products and places of interests. The application has the ability to provide information on tourists' behaviour (big data), and enable service providers to respond to tourists' suggestions and feedback. It is also fitted with Virtual Reality (VR), Augmented Reality (AR), multi-language translator, transportation, street view & underwater view features to enhance tourists' experience. It incorporates real time data on attractions for early detection of potential problems, such as congestion and environmental pollution; and delivers a centralized biodiversity mapping to distinguish biodiversity attractions.

This project was supported by NRGS/1091/2013(05) Sustaining the Environment through Eco-Tourism Initiatives.

OPINIONS ON THE MALAYSIAN MEDICAL AND HEALTH INFORMATION SYSTEM

Researcher: Muhammad Hamdi bin Mahmood

Department of Para-Clinical Science, Faculty of Medicine & Health Sciences, Universiti Malaysia Sarawak

Implementing the Evolving Malaysian Medical and Health Information System

Telemedicine Blueprint in 1997 was aimed to strengthen health delivery using Information Communication Technology (ICT). Parallel with the plan, Telemedicine Act 1997 was enacted. Integrated Health Enterprise (IHE) framework updated Telehealth in 2007 into five major components which were Lifetime Health Plan (LHP), Health Online, Teleconsultation (TC) and Continuing Professional Development (CPD). Aware of the needs for integration, Malaysian Health Information Exchange (MyHIX), which only included consented patients' information based on the earlier Lifetime Health Record (LHR), had been set up and integrated into this MyHIX platform.

The system was established with the idea of systematically expediting long process associated to the government hospital. It was designed to manage all the hospital's medical and administrative information in order to enable health professionals to perform their jobs more effectively and efficiently.

In order to have an idea about integration of data in healthcare context, an examples of clinical scenario is considered, whereby an attending doctor receives a road traffic accident patient with massive bleeding and head injuries which requires emergency surgery (see Figure 1). Here the blood bank is needed to group-screen-and-hold blood pack, and this requires traceability system within the blood bank department. However, if the patient dies, the case goes to forensic department of the same hospital. This may involve law enforcement agency before the deceased could be released for burial. Thus at least this case involves emergency department, surgery department, radiology department, blood bank department, forensic department and the police. In another scenario, a doctor would consider a thyroid function test and lipid profile for a 40-year-old patient with a healthy physical build who is presented with excessive sweating palpitation and hand tremor. If the laboratory results shows an increased thyroid hormone level and normal lipid profile, and progressive thyroid gland enlargement, the doctor would consider thyroid scan. If the scan image identifies nodules, the patient's biopsy would be needed to establish diagnosis. Once a diagnosis has been established, the patient might go for surgery and be prescribed with medication. In this scenario, integrated information in the form of text and images is crucially needed between pathology department, radiology department, nuclear medicine department, surgery department and pharmacy department (see Figure 2).

At present, 10 hospitals in the peninsular and one hospital in Bintulu Sarawak, reequipped with Intermediate Hospital Information System (IHIS), clinical documentation medical imaging and reporting tool. Hospital Keningau and Lahad Datu are the two hospitals implementing IHIS which comprises of Lifetime Health Record (LHR), personal Lifetime health plan (PLHP), Lifetime Health Plan (LHP), Health online, Teleconsultation (TC) and Continuing Professional Development (CPD). Five hospitals in the Peninsula and Pitas, Kuala Penyu and Kunak hospitals in Sabah are equipped with Basic Hospital Information System (BHIS) that comprises of patient management, patient billing, order & result management, medical records management and discharge summary. In total, 21/138 (15.2%) of the public hospitals are equipped with HIS.

Figure 1: Patient registration is the initial step for HIS data acquisition. Each patient will have individually assigned registration number (RN). Each time when receiving treatment, the patient will be referred to by the assigned RN. A registered patient enables the hospital to keep track and monitor types of treatment; for example blood type and numbers of blood pack supplied in an operation (a-b).

Figure 2: In a hospital, treatments given vary such as prescription of antibiotics based on blood investigation or surgery guided by radiological imaging and others. Those intervention details are physically recorded in a patient folder and identified by the assigned RN. This standard approach of compiling patient data in a folder enables medical professionals to follow up treatment and management for each case respectively. However, this physical data archival approach consumes a lot of time & space for data storing (a-b).

The Way Forward

Undeniably, the Malaysian medical and health information system has evolved over the last 20 years, and to assimilate and incorporate HIS is indeed not easy. Now that the Iindustrial Rrevolution 4.0 (IR 4.0) takes place, it opens up new opportunities such as medical transcription. Globally, this service was valued at USD41.4 million in 2012, and is expected to grow into USD60.6 million. At an early stage, Malaysian HIS is dominated by multinational vendors such as IBM, Microsoft and HP. With IR 4.0, the local vendors such as academic institutions should grab the opportunity to provide more assimilated HIS solutions that better fit examples of the earlier stated scenario.

Library-In-A-Box: Low Cost, Offline And Small Footprint Knowledge And Learning Platform

Researchers: *Johari Abdullah[1], Nurul Zawiyah Mohamad[1] and Japri Bujang Masli[2]*

[1]Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak
[2]Pustaka Negeri Sarawak

Focusing on the issue of providing reading materials to rural areas, the current method through hardcopy of books in rural libraries is not cost effective and logistically challenging (physical space, maintenance, and transportation of the books). Due to these factors, the number of books is limited, and are not updated to the latest version or content. This, in turn, creates knowledge divide in the affected community. Therefore, there is a need for a solution which is low power, robust, and low cost as a complement to many existing telecentres, which can provide offline content to the rural areas, mainly targeting educational content for children and other stakeholders. Thus, the main objective of the Library-In-A-Box (LiaB) project is to provide offline access to reference and reading material, targeting children, and to be deployed in remote/ rural areas as a new deployment to complementa the existing telecentres project. The LiaB platform consists of three main components: (1) the hardware component consists of low power and low cost Single Board Computer in the form of Raspberry Pi, and (2) software component consists of the web server and other software, and (3) content, which can be customized to the needs of the end users and community.

Current prototype of the Library-in-a-Box system

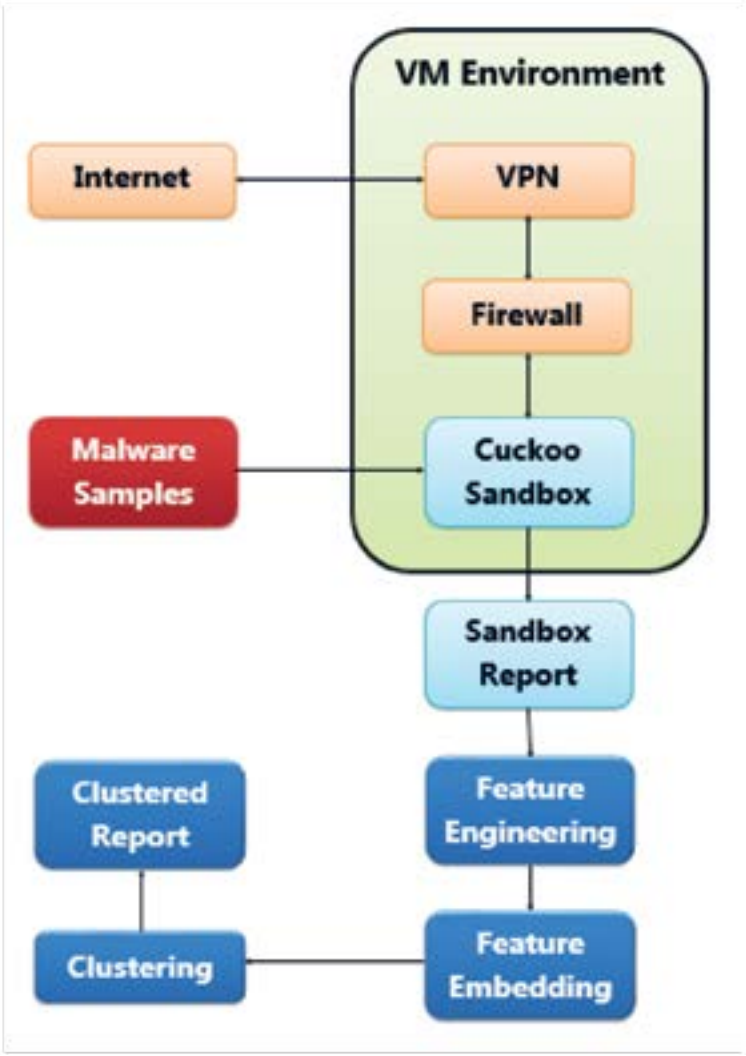
MalZeroML
MALWARE BEHAVIOUR ANALYSIS USING MACHINE LEARNING

Researchers: *Johari Abdullah and Navein Chanderan*

Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak

The numbers and diversity of malware variants grow exponentially over the years, and there is a need to improve the efficiency of analysing large number of malware samples efficiently. To address this problem, we propose a framework for the automatic analysis of a given malware's static and dynamic properties using clustering technique. The framework also provides outlier discovery, abnormal behaviour analysis and discrimination of malware variants which increase the accuracy of the analysis. We also explore normalisation of malware labelling based on the labels we get from VirusTotal, which provides consistency of malware labels for accurate analysis of malware families and types. Ultimately, the proposed framework ensures rapid analysis of malware samples and leads to better protection for various parties against malicious malware.

This research was funded by Grant F08/ SpFRC/1432/16/6, rendered by the Universiti Malaysia Sarawak.



Proposed framework

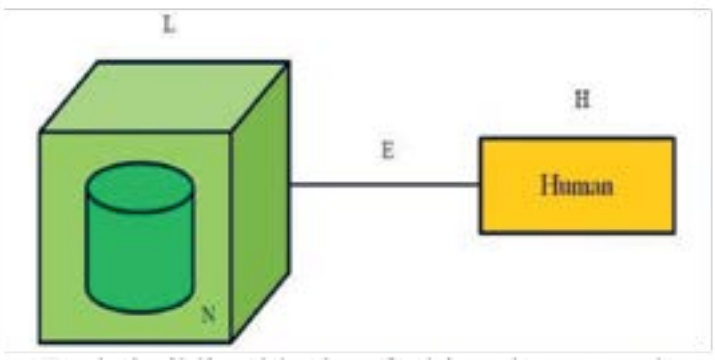
A COMPUTATIONAL APPROACH TO PREDICT THE SPREAD OF DENGUE

Researchers: *Jane Labadin[1], David Perera[2] and Kok Woon Chee[1]*

[1]Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak
[2]Institute of Health and Community Medicine, Universiti Malaysia Sarawak

Dengue disease poses a large economic burden in Malaysia among other endemic countries. At the point of writing, Malaysia had not adopted the dengue vaccine. In the absence of dengue vaccine, it is important to identify dengue hotspot for vector eradication. Several computational methods for example compartmental modelling, agent-based modelling and other scientific methods have been used to detect hotspot. Network modelling approach, in particular the bipartite network is hypothesized to be the most appropriate method to solve the research problem. A contact network model of dengue transmission was thus formulated. Understandably for bipartite network, two distinct entities were identified, namely human and location nodes which are always interconnected. The relationship between these two nodes is quantified by using a summation rule. When the resources such as budget and manpower are limited, control strategies are prioritised according to the risk area of higher vector density. Dengue Hotspot Ranking (DHR) values are generated for location nodes in a network model to capture the human heterogeneity, environmental properties and the vector characteristic. The location nodes are then ranked according to the DHR value, which is also a measurement of vector density. In previous study, the researcher attempted to model malaria hotspot by using the same method, but there was no adequate model validation with real data performed. As before, the model verification was done by comparing the results generated by UCINET 6.0 and the analysis reported a root mean square error (RMSE) of 6.419× 10 ^(-4) and 9.188× 10 ^(-4) for the location and human nodes respectively, which was much lower than the acceptable threshold value of 0.05. Validation analysis revealed a strong ranking similarity with good Spearman rank correlation coefficient of above 0.80 ($\rho>0.80$; $p<0.001$) which was greater than the threshold value set at 0.70, indicating strong correlation between the model targeted result and the observed data. Through parameter significance analysis, this study has identified significant parameters to detect possible dengue hotspot which include mosquito's life cycle, survival and biting rate, precipitation, humidity, altitude, the number of times human visited the location, duration of human stay at the location and the frequency of a human visited the location. This study also developed a polynomial model to represent the life cycle and survival parameters by using polynomial curve fitting due to the fact that there is no primary data available from any data source. Consequently, the bipartite network modelling approach has been successfully formulated and the ranked locations are believed to be applicable to help public health authorities to prioritise the locations for vector control. Eradication of dengue in the risk areas can help in the reduction of the spread of dengue disease.

This research was supported by Universiti Malaysia Sarawak through the research grant with ID No. F08/ SpFRGS/1601/2017 awarded to Jane Labadin.



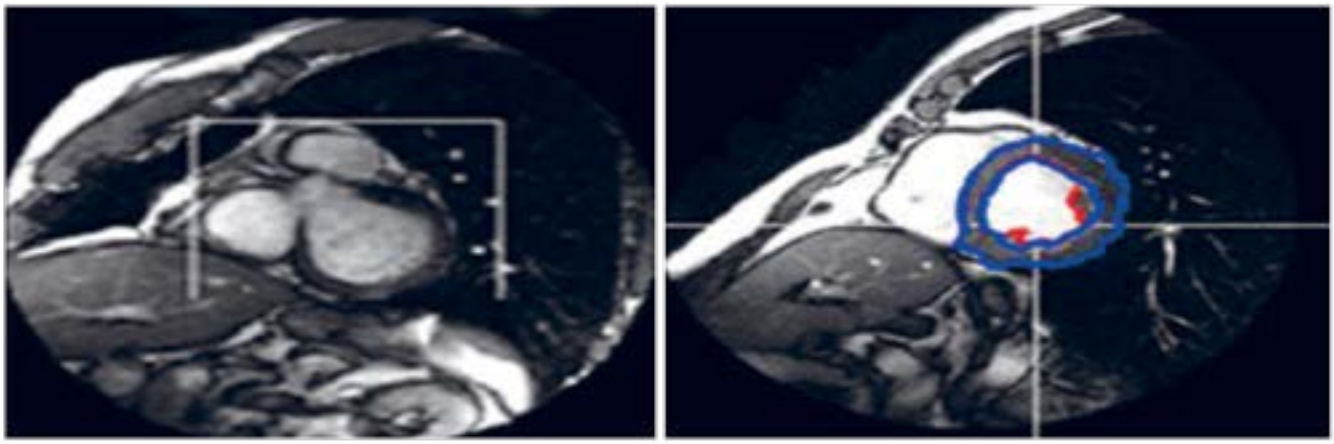
Basic building blocks of a bipartite network

NEW TECHNIQUE FOR CARDIAC OEDEMA IDENTIFICATION

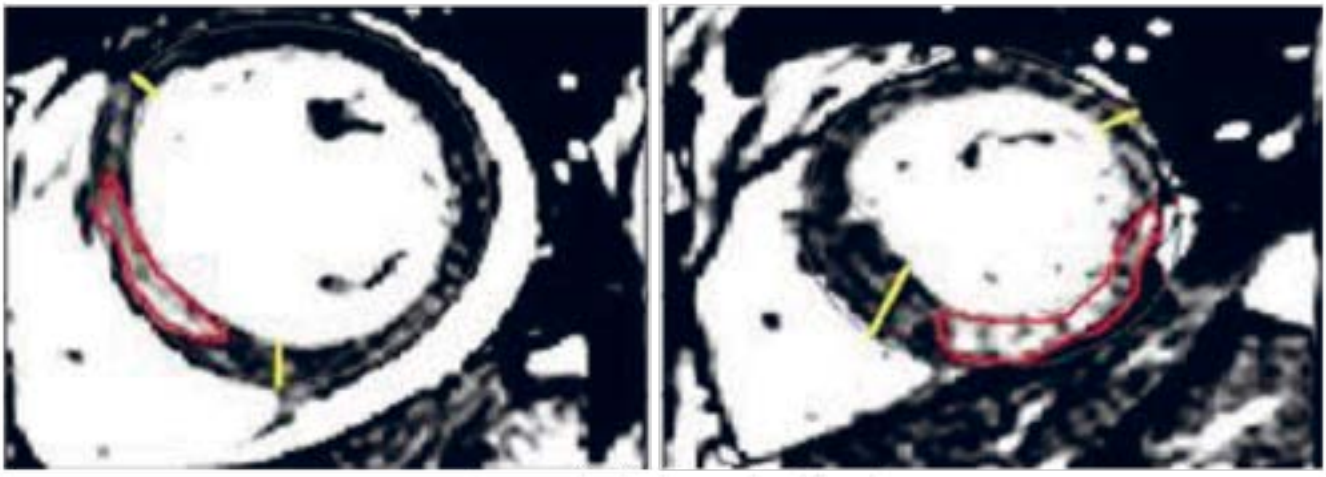
Researchers: *Dayang NurFatimah Awang Iskandar[1], Amjad Khan[1], Asri Said[2], Nor Hanim Mohd Amin[2], Wang Yin Chai[1] and Hamimah Ujir[1]*

[1]Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak
[2]Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak

Coronary Artery Disease still is the main cause of death worldwide despite the recent improvements in therapeutic and intervention methods. On shelf commercial software used by the cardiac experts are semi-automatic and therefore causing a patient assessment to be time consuming and labour intensive. Through in-depth research, we reached a solution for automatic myocardial oedema detection and assessment for CMRIs. We have developed a new framework, method, algorithm that incorporate standard measurement parameters and new measurement parameters. This methodology enables fully automatic detection of oedema percentage based on the image analysis performed using the CMRIs. This work contributes to the social impact and has a very high potential for commercialisation.



Automatic Localisation of LV



Automatic Oedema Identification

This research was funded by Exploratory Research Grant Scheme, Grant No: ERGS/ICT07(02)/1019/2013(16), rendered by the Ministry of Higher Education.

THE eBORNEO KNOWLEDGE FAIR: COMMUNITY ENGAGED RESEARCH FOR IMPACT

Researcher: *Roger W. Harris*

Visiting Professor, Institute of Social Informatics and Technology Innovation, Centre of Excellence for Rural Informatics, Universiti Malaysia Sarawak

Creating value for local communities from education and research sits at the heart of the UNIMAS mission and it has long been a priority for the Institute of Social Informatics and Technological Innovations (ISITI). The Institute's research involves innovative uses of Information and Communication Technologies (ICTs) to deliver socio-economic benefits that local communities appreciate, especially those that are remote and isolated from public services and economic opportunities. In most cases, these comprise indigenous people whose cultures differ from mainstream society and from each other and whose views of development are not always the same as those that are promoted within mainstream processes. Moreover, academic research is often criticised for being aloof and disconnected from the problems of daily life and not relevant to the concerns of policy makers and professionals who might otherwise be able to make use of the knowledge that it generates.

Minister of Higher Education, YB Dato' Seri Idris bin Jusoh launched the eBorneo Knowledge Fair book.

UNIMAS/ISITI addresses these issues by ensuring that its research is tailored specifically to the development aspirations and priorities of its partner communities. Arising from its experience with the multi-award-winning eBario project that delivered ICTs to the remote and isolated Kelabit community of Bario in the highlands of central Sarawak, ISITI has evolved decolonized methodologies for working collaboratively with indigenous peoples that ensure their free, prior, and informed consent for the action research projects with which they work in partnership and for ensuring equitable benefit sharing of the fruits of the results. The eBorneo Knowledge Fair is a key component of its means of achieving this. It has been held every other year since 2007 in a remote village in the centre of Borneo; initially in Bario but lately in Ba'kelalan. By immersing researchers, government officials, policy-makers and development professionals into a rural and remote community where the residents feel comfortable, the event turns

much of the process of research and development design and evaluation on its head; by empowering the residents and giving priority to their views.

As a knowledge fair, in contrast to orthodox workshops and seminars, the techniques that are used to stimulate collaboration mean that all participants are afforded equal opportunity to contribute. The event serves as a forum for agreeing the design of action-research interventions intended to address local development problems and opportunities as well as recruiting residents to participate in their implementation as equal partners. It is also used to deliver research results for reflection and evaluation by those whom they are intended to benefit with a view towards replication and scaling up for wider impact. The fair allows minority cultures to articulate their particular development aspirations and it ensures their inclusive participation in the digital economy. To explain and promote the event, ISITI has published the eBorneo Knowledge Fair book which was officially launched by the Minister of Higher Education, YB Dato' Seri Idris bin Jusoh during the opening ceremony of the UNIMAS Silver Jubilee Conference 2017.

Highland community members converse with researchers, officials and professionals during the eBorneo Knowledge Fair.

TIED AND CONNECTS PROGRAMMES FOR SOCIAL AND HUMAN CAPITAL DEVELOPMENT IN EAST AND WEST MALAYSIA

Researchers: *Jane Labadin, Tariq Zaman, Chin Chee Hua, Farina Binti Othman, Alexander anak Sigau, and Franklin George*

Institute of Social Informatics and Technology Innovations, Universiti Malaysia Sarawak

In 2017, Institute of Social Informatics and Technological Innovations embarked two projects on Technopreneurship, Innovation & Enterprise Development (TIED) and Community Opportunities & Needs Supported Through Networked Entrepreneurship, Innovation & Communication Technology Strategies (CONNECTS), which leveraged on the concepts of social entrepreneurship and enterprise development to benefit society. The contents of the programmes were tailored to the changing needs of Pusat Internet 1 Malaysia (PI1M) telecentres, local communities, government agencies, and members of the industries as well as academia. The programmes focused on the five strategic thrusts, namely, the institutional capacity buildings, digital services, local innovation, new media and contents, and community wide integration and outreach for socio-economic development of the communities. Specifically, both the programmes were structured to develop the capacity of PI1M staff and extended the outreach of PI1M services at 3 levels, Micro-Level (Staff capacity building), Meso-Level (PI1M outreach extension and partnership development to cater community needs) and Macro-Level (Community at large and emphasize on socio-economic developments). The expected outcome of the programmes was threefold, namely (i) increased skilled and competitive ICT human resource base for PI1M and partner communities, (ii) positioned PI1M as service providers of capacity building program for local communities, and (iii) enhanced the impact and quality of PI1M services.

These two projects were under the Centre of Excellence for Rural Informatics Universiti Malaysia Sarawak and UNIMAS Holdings Sdn Bhd, grant No. UHSB/I – CP2017/10 (TIED) and UHSB/I – CP2017/09 (CONNECTS).

A session in Community Engagement Training held at PI1M Parit Othman at Johor Bahru.

Participants were planning for video taking with digital devices and application of ICT technologies to produce promotional materials for their respective PI1M.

MO-LEARN: LEARNING THROUGH MOTION

Researchers: *Irwandi Hipiny and Hamimah Ujir*

Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak.

Young and kinaesthetic learners learn best by doing physical activities. The activities preferably involve frequent mobility and whole-body movement with shorter passive intervals. We developed THREE (3) markerless augmented reality (AR) games based on motion detection and face tracking. The player interacts with AR objects appearing on the screen by gesturing with their hands. Game menus are seamlessly controlled via the face tracking feature. The setup uses a single RGB camera as input and is well-suited for large-screen displays. Our product had won a Gold medal (Open Category) during the recent Sarawak Invention, Innovation & Design Expo (SIIDEX2018) at PCC Demak, Kuching, Sarawak.

This research was supported by the Ministry of Higher Education Malaysia (MOHE) and Universiti Malaysia Sarawak through research grant No. RACE/c(2)/1253/2015(09).

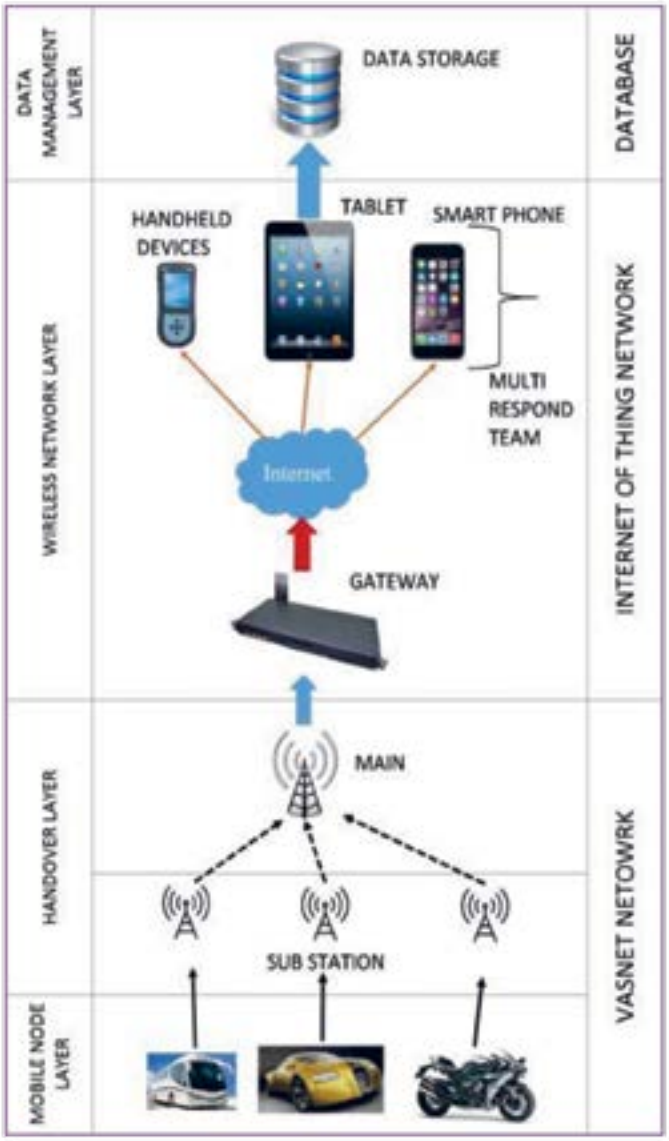
A screengrab from one of the Mo-Learn games.

Another screengrab from one of the Mo-Learn games.

A VASNET FRAMEWORK TO SUPPORT DEVICE-TO-DEVICE COMMUNICATION IN DISASTER MANAGEMENT SYSTEM

Researchers: *Mohamad Nazim Jambli[1], Sinarwati Mohamad Suhaili[1], Mohd Khairun Nasir Saadi[1] and Sia Chiu Shoon[2]*

[1]Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak
[2] Taiyo Yuden (Sarawak) Sdn Bhd



VASNET Framework

The implementation of wireless technologies based on the Vehicular Ad-hoc Sensor Network (VASNET) may provide support to the Search and Rescue (SAR) team to operate effectively in natural disaster events, such as landslide, earthquake, flooding, and tsunami. VASNET has been suggested as an appealing communications technology that deals with the unexpected condition emerging during or after the disaster. The operations of SAR team are very challenging in such events due to the possible damages of the existing telecommunication infrastructures. The existing deployment of the cellular communications infrastructure may be partially or completely destroyed after the occurrence of these natural disasters. Thus, the current VASNET infrastructure must be able to support the infrastructure-less network by integrating other green wireless technologies that can benefit the SAR team, which can indirectly save more human lives and reduce the number of casualties. The proposed integration of green wireless technologies and VASNET is to form a heterogeneous framework for data dissemination in SAR operations. Such VASNET framework based on VASNET and wireless technologies are feasible to be applied on the real-time situation to reduce the number of casualties during the natural disaster. The use of the right mobile devices or smartphones within the Internet of Things (IoT) network on the proposed framework seems to be crucial in achieving the objective. Therefore, an open solution is required to combine the efforts of the SAR team members in such critical situation.

This research was supported by Special Research Grant Scheme F08/SpFRGS/1531/2017, rendered by the Universiti Malaysia Sarawak.

IMPROVED MULTIPLE FAULTS-AWARE PLACEMENT STRATEGY: REDUCING THE OVERHEADS AND ERROR RATES IN DIGITAL CIRCUITS

Researchers: *Mohamad Imran bin Bandan[1], Samuel Pagliarini[2], Jimson Mathew[3], Dhiraj Pradhan[4]*

[1] Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak
[2] Carnegie Mellon University
[3] Indian Institute of Technology, Patna
[4] University of Bristol

State-of-the-art commercial placement tools have the goals to optimize area, timing, and power. Over the years, several reliability oriented placement strategies have been proposed with distinct goals, such as to improve the error rate. However, we found that there are still improvements that can be made for this type of approach, to improve not only the error rates but also the performance of the placer itself. Thus, this research proposes several improvements toward an efficient multiple faults-aware placement strategy. First, an analytical method to profile pair of gates is proposed. The initial technique proposed uses a simulation-based approach. It requires simulation time close to 30 hours for exhaustively assessing large circuits. Therefore, this research proposed an analytical approach that significantly reduces the time required for this profiling process. This advantage permits the evaluation of all the pairs of gates and their error rates much more rapidly. Second, we add another level of optimization to reduce the amount of wirelength observed after the placement is completed without jeopardizing the main objective (reliability). We propose a refined multiple faults-aware placement strategy that incorporates a Hill Climbing step (a simple local search) after the completion of the Simulated Annealing's steps of the original placement strategy. Hill Climbing cannot guarantee the finding of the global optimal solution. However, for this problem, it still brings a significant improvement while requiring a fraction of the execution resources. Such type of local searches can be very effective if applied to the right problem. Third, we propose a way to smartly manipulate white spaces between gates, to separate the gates that are profiled as the most likely to reduce the error rate when paired adjacently in the circuit. The original placement strategy only promotes the maximum number of good pairs. However, it does not guarantee the separation of bad pairs entirely. Results show that a wirelength reduction of up to 61% is achieved by adding the Hill Climbing step. Also, additional reduction of the error rate of up to 23% is observed with only an overhead on placement execution time through smartly manipulating the 'empty spaces' within the circuit itself.

This research was published in IEEE Transaction on Reliability, Volume 66, No. 1, March 2017.

INTERNET OF THINGS ENABLED SMART GARBAGE BIN

Researchers: *Lau Sei Ping and Eric Wong Ing Koh*

Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak.

An extravagant amount of 30,000 to 33,000 tonnes of domestic wastes is produced per day. It could lead to hygiene problems and, pollutions like water and soil contaminations. Normally, garbage / waste collection bin could be emptied periodically according to a pre-defined schedule. At times, this conventional method cannot determine the optimum times, places and routes, thus leading to overflow and late-to-be-cleaned garbage bins.

Smart Garbage Bin Sensing

Web Portal for Storing, Monitoring and Big Data Analytics

Real-Time Truck Tracking to Ensure Quality of Services

Smart Garbage Bin Solution

A Smart Garbage Bin, on the other hand, enables real-time tracking of waste levels, garbage collection status, exact location of garbage bins and their sustainability by having a solar panel installed on the bins. Such application:

a) Serve as input for a better waste collection scheduling and planning;
b) Improves the efficiency use of resources for waste collection.

DETECTION OF FLOOD THROUGH TWITTER DATA MINING

Researchers: *Stephanie Chua and Sonia Frances Gopal*

Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak.

This project presents a framework designed to detect flood in Malaysia using Twitter data mining. Using tweets posted by users from Malaysia, the content is analysed using a set of flood-related keywords. The geo-information available in tweets is used to determine if flood is occurring in a certain location. This can be visualized on a map using the geo-information of the tweets.

The framework allows a platform to detect occurances of flood. As demonstrated above, the keyword "flood" and geo-locations around Kuching City could be used as a generic detector of flood event.

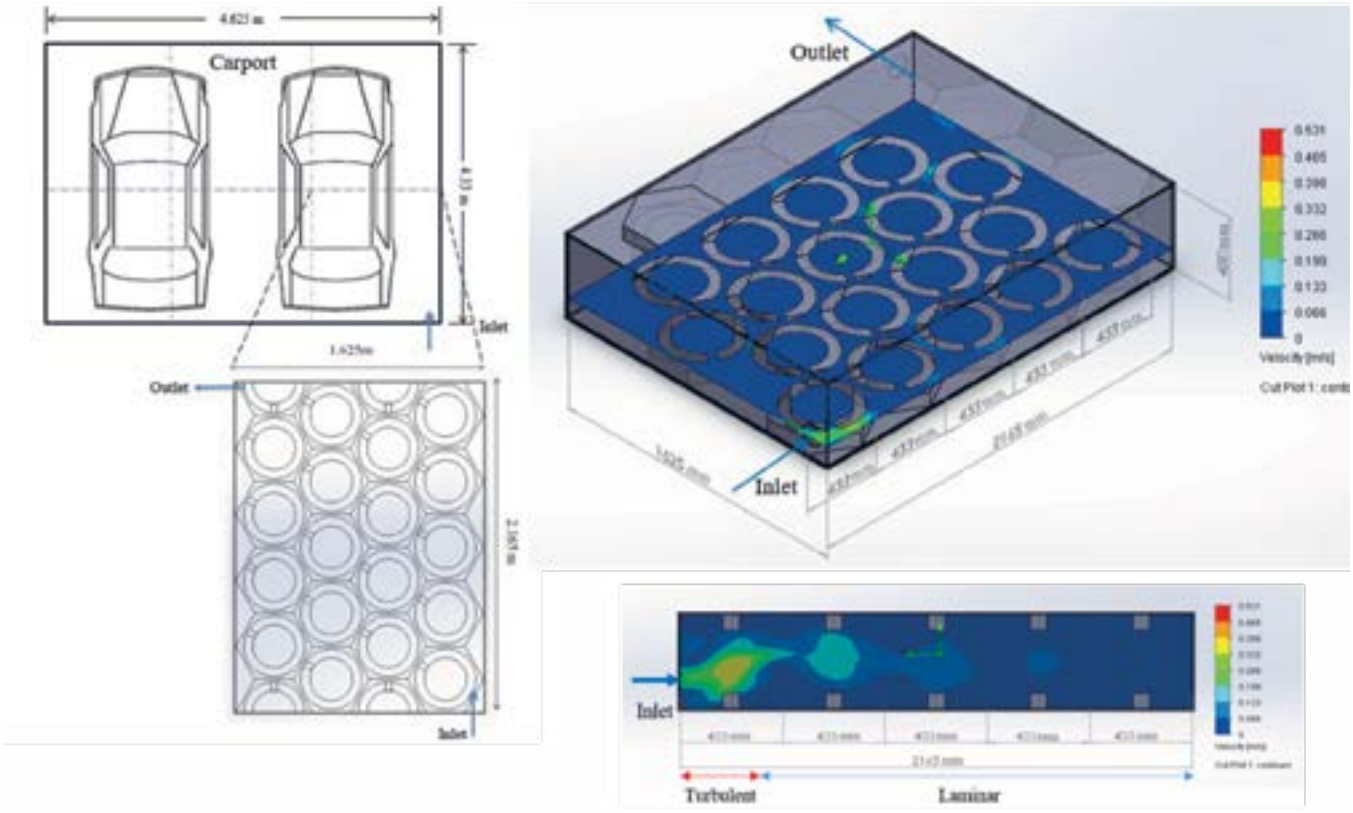
3D MODELLING TO ASSIST DESIGNING OF STORMWATER DETENTION STRUCTURE

Researchers: *Darrien Yau Seng Mah and Johnny Ong King Ngu*

Department of Civil Engineering, Faculty of Engineering, Universiti Malaysia Sarawak.

Flow characteristics of stormwater were analysed as it travelled from a roof gutter-down pipe and the turbulent flow generated on entering an individual lot On-site Stormwater Detention (OSD) beneath a residential car porch. Comparison was made between a full-scale model and Computational Fluid Dynamic (CFD) simulations to determine the flow characteristics. These modular tanks with multi-unit chambers captured the roof run-off from a 15-minute, 10-year return period storm. The results from the physical and CFD models matched well, suggesting that turbulent flow occurred when stormwater was directed to an individual lot stormwater detention tank. However, turbulence in the OSD was concentrated around the inlet, after which the pattern changed from turbulent to laminar flow. This work implied that the use of underground storage modular tanks was practical for managing stormwater from a roof.

This research was supported by the Malaysian Ministry of Higher Education (MoHE) through Research Acculturation Grant Scheme (RAGS) RAGS/TK01(01)/1315/2015(09).



Computer Aided Outcomes for Engineering Design

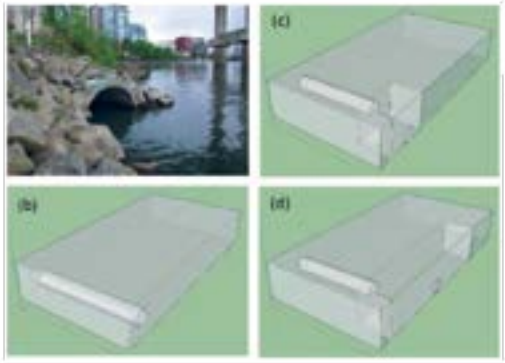
3D MODELLING TO ASSIST DESIGNING OF STORMWATER OUTLETS

Researchers: *Darrien Yau Seng Mah and Evon Ee Wen Tang*

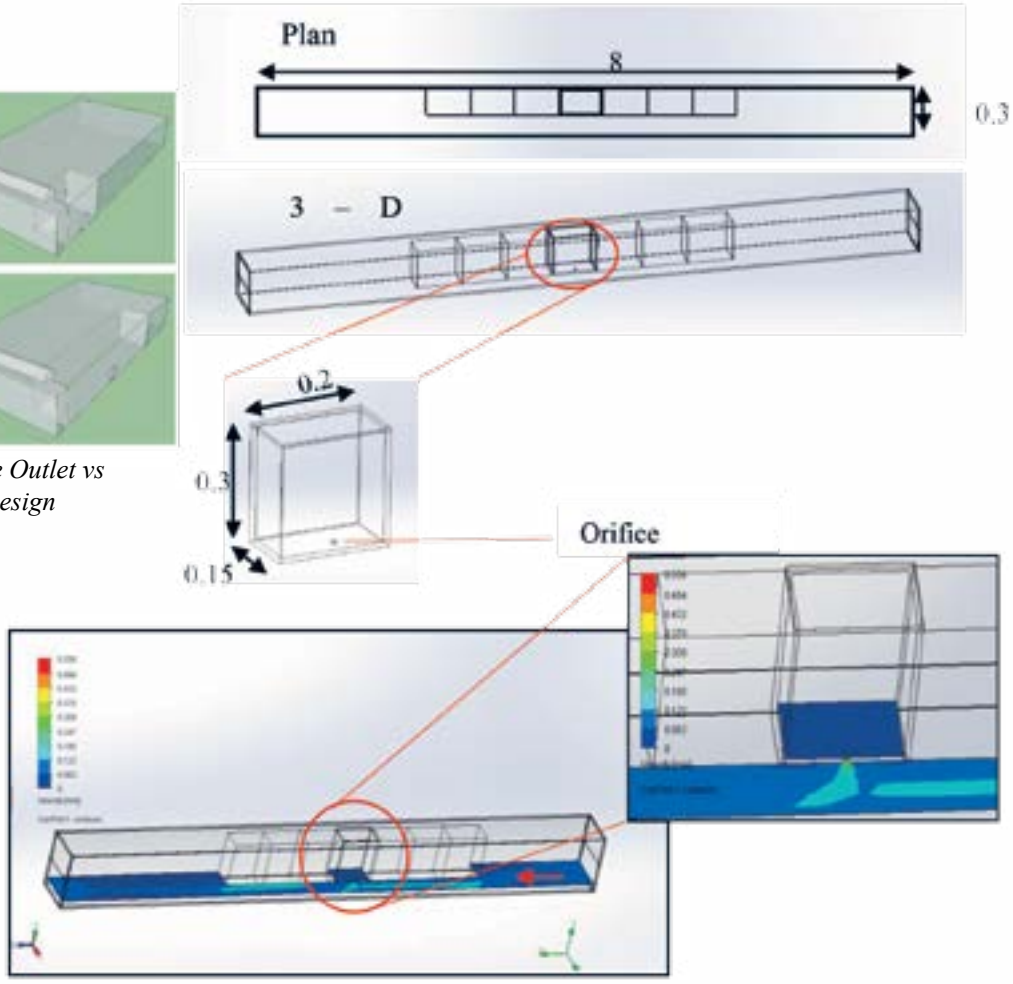
Department of Civil Engineering, Faculty of Engineering, Universiti Malaysia Sarawak.

Drowned outlets are common in riverine areas and sometimes unavoidable. Due to site restrictions, drainage discharge outlets are often submerged as the water level fluctuates during high tides or during the monsoon. As the runoff cannot be discharged through the outlet the drainage system fills up faster, leading to flash floods caused by overspill from the drains. This research focused on the application of an on-site detention system with submerged orifice to improve the runoff delay from a drowned outlet. The application was investigated through a reduced-scale laboratory set up and then visualized with Computational Fluid Dynamics (CFD) simulations. The model was tested under different perpendicular flow velocities to analyse the workability and flow characteristics of the submerged orifice. The study showed that, with different headwater and tailwater levels, the energy level can be restored upstream of the orifice and can ensure full flow of water from the submerged orifice even when hindered by perpendicular tailwater flow. Besides, the orifice jet's pattern changed with high velocity tailwater flow, although it did not slow down the discharge rate.

This research was supported by Special Grant Scheme F02/SpGS/1405/16/6 rendered by the Universiti Malaysia Sarawak.



Conventional Drainage Outlet vs Proposed Outlet Design



Computer Aided Outcome for Engineering Design

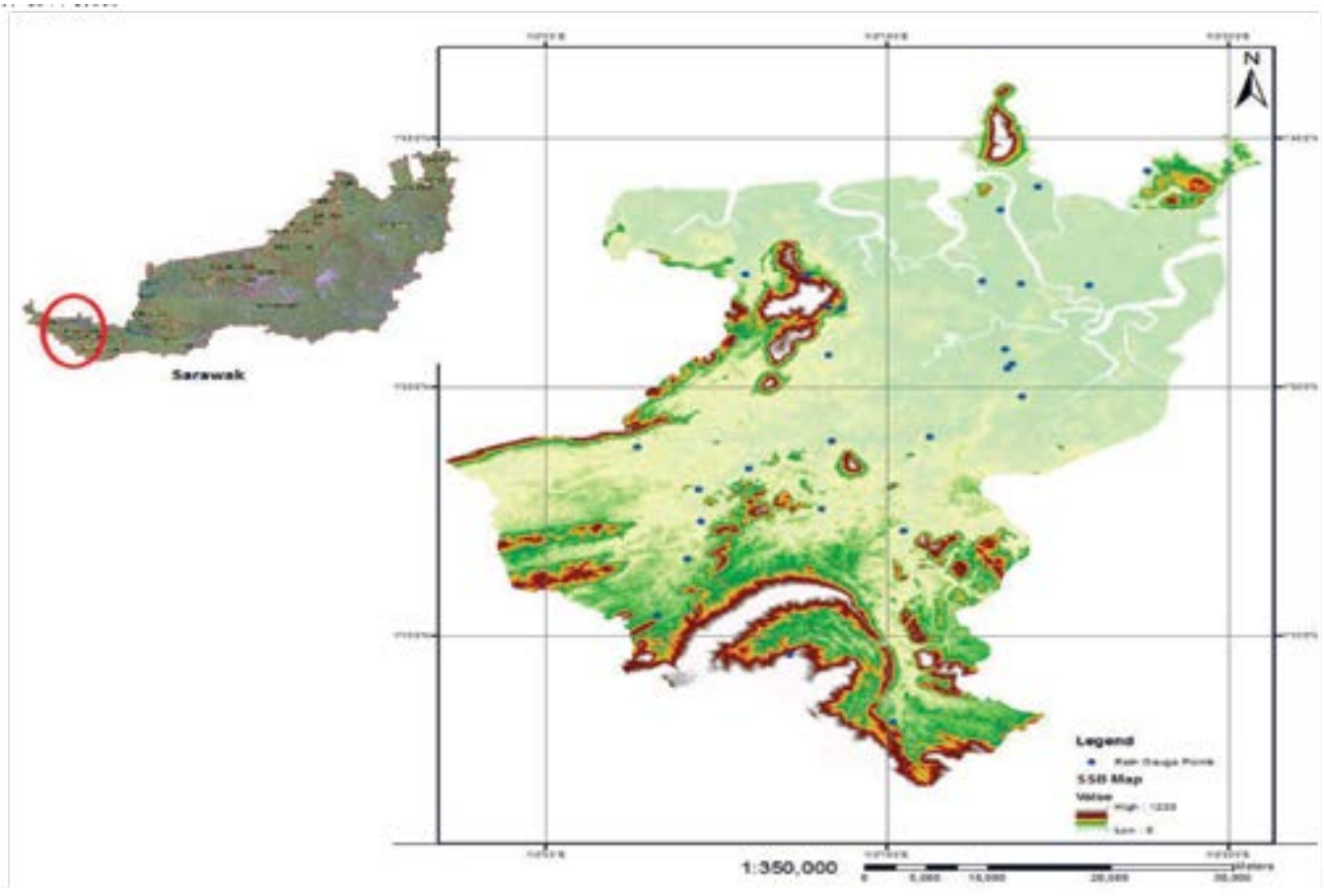
SPATIAL AND TEMPORAL VARIABILITY OF RAINFALL ANALYSIS USING REMOTE SENSING AND GIS APPROACH

Researchers: *Marina Patrick[1], Darrien Yau Seng Mah[1], Onni Suhaiza Selaman[1] and Yin Chai Wang[2]*

[1] Faculty of Engineering, Universiti Malaysia Sarawak
[2] Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak

Dense network of rain gauges is required to accurately characterize the variation of rainfall over a region which is not an ideal condition for areas such as in Sarawak, Malaysia. This research aimed to develop depth-area-duration (DAD) relationships of selected rainstorm event over Sungai Sarawak Basin by using public domain satellite-based precipitation data from Tropical Rainfall Measuring Mission (TRMM) product. Geographic Information System (GIS)was used to manipulate the 3-hourly accumulated precipitation dataset from TRMM to investigate spatial and temporal pattern of rainstorm. The findings suggested that rainfall depth decreased with the increasing area for a given duration. This also implied that the remotely sensed information from TRMM product can be used as an alternative source of dataset to envelop rainfall DAD curves. Future work suggested would be to use the plotted DAD curves to estimate the probable maximum precipitation for the purpose of hydraulic structure designs.

This research was supported by DPP Grant Scheme F02/DPP64/1445/2016/11 rendered by the Universiti Malaysia Sarawak.



Study area (Sungai Sarawak Basin) showing the locations of rain gauges over the DEM of SSB. The blue dots is representing represent the rain gauge points.

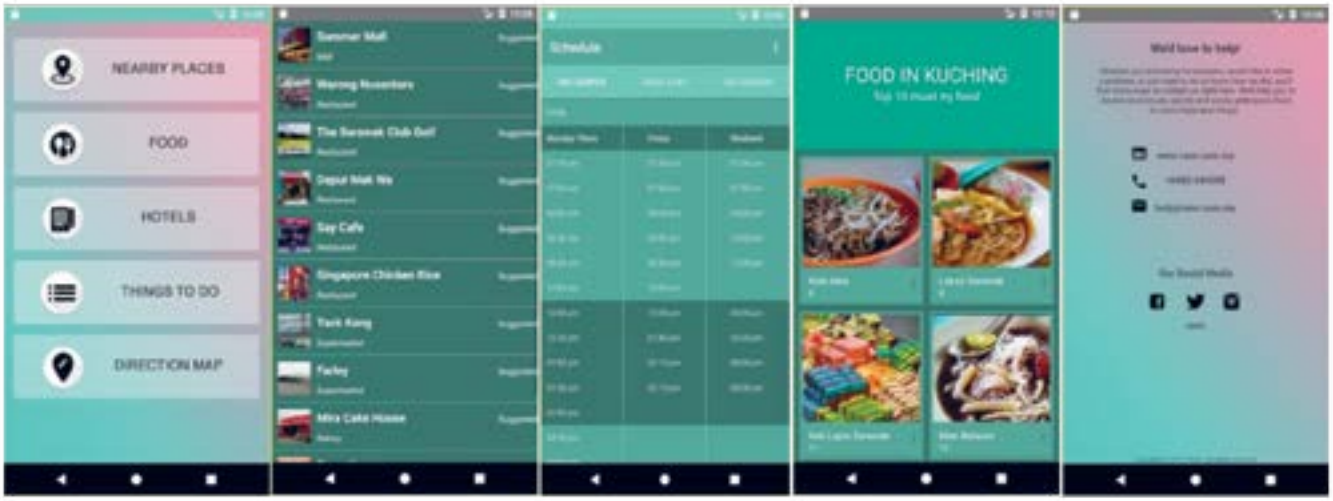
PUBLIC TRANSPORT JOURNEY TRACKER

Researchers: *Shafrida Sahrani, Mohd Nazreen Khalid, Mohd Helmi Mustafa, Khairilzamrie Rosle, and Mohamad Roffizal Romali*

Faculty of Engineering, Universiti Malaysia Sarawak

Public Transport Journey Tracker is developed by using Raspberry Pi and works on Android Studio platform to detect the current location of public transport in a real time. This tracker is able to estimate the time of arrival of the transportation and hence, will improve the time management of public transportation services. The development of this tracker will also assist user/passenger with planning trips according to the schedule. The proposed tracker would be placed inside the public transport whose position will be tracked on the Android application, namely RAON. RAON has additional features such as tour guide, maps direction, local food rating, nearby accommodation and public transport schedule to help users to manage their trip. This tracker can also be used as a vehicle locator.

Raspberry Pi-Android Communications



RAON Application Features

CIVIL ENGINEERING PROJECT SCHEDULING INCORPORATING RISK ASSESSMENT PROCEDURES

Researchers: *Ting Sim Nee, David Bong, Charles Bong, and Loh Woei Tan*

Faculty of Engineering, Universiti Malaysia Sarawak

For all civil engineering construction projects, time is one of critical success criteria for the measurement of overall project success. Keeping a project on the time track requires not only good time monitoring and management techniques but conscientious time planning via the identification, understanding and the management of potential causes of delay, risks and uncertainties that underlines all construction projects. This project seeks to bring together time planning and scheduling with risk management procedures. A Risk Assessment Model is firstly developed in order to execute the identification, measurement and assessment time related risks that can contribute to project delays. The model is then systematically incorporated into traditional project scheduling in order to achieve a project schedule that has well taken into account of project time risks; leading towards a more accurate and well thought through assessment of the project activities' time and schedule. A computer program has been created to put together this theory of time-risk integration and to enhance the potential application of risk assessment procedures during project scheduling among general engineering practitioners. A sample project of scheduling for the construction of the water work project, mainly pipeline project, is used to show the application of the designed mode and to prove its validity. The program effectively pinpoints activities that need to be managed in order to avoid delays and eliminate unrealistic determination of activities' time and ultimately produce a much reasonable project schedule.

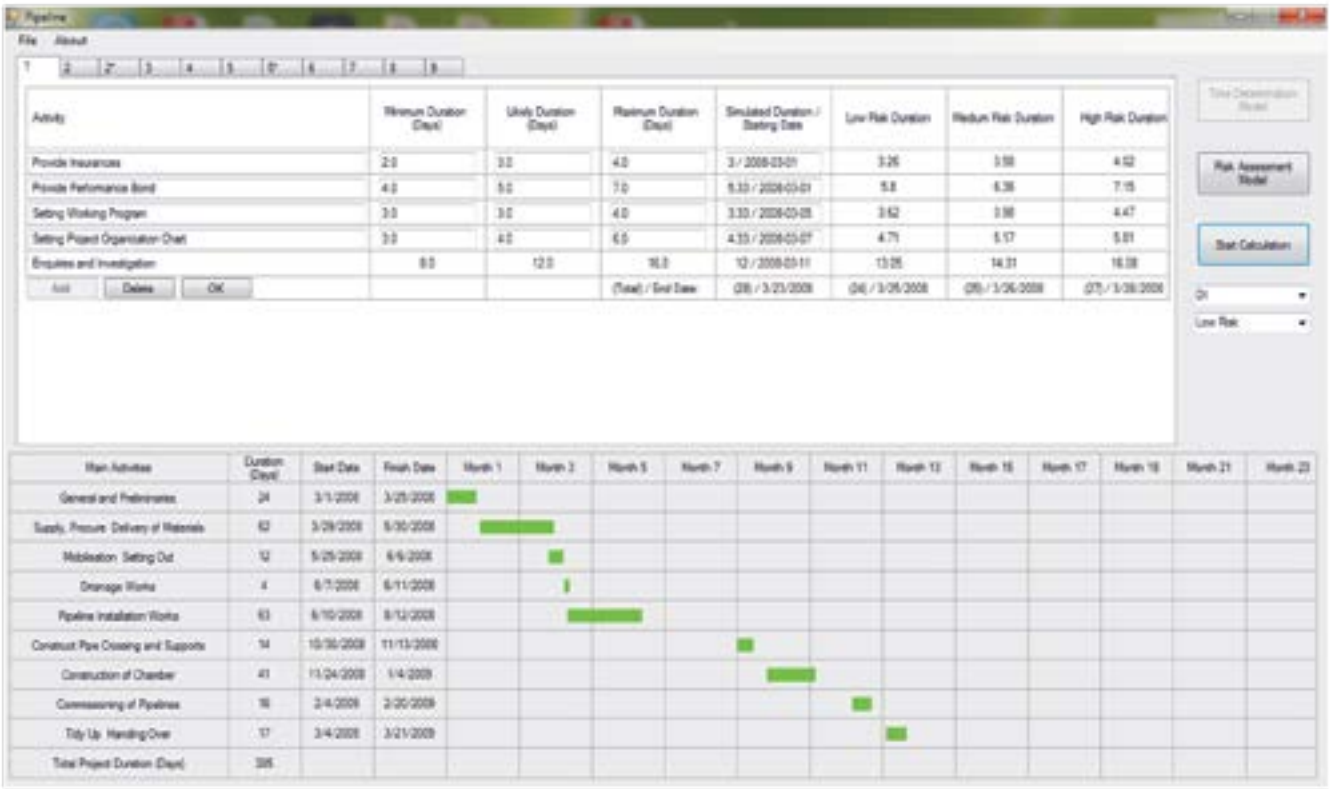


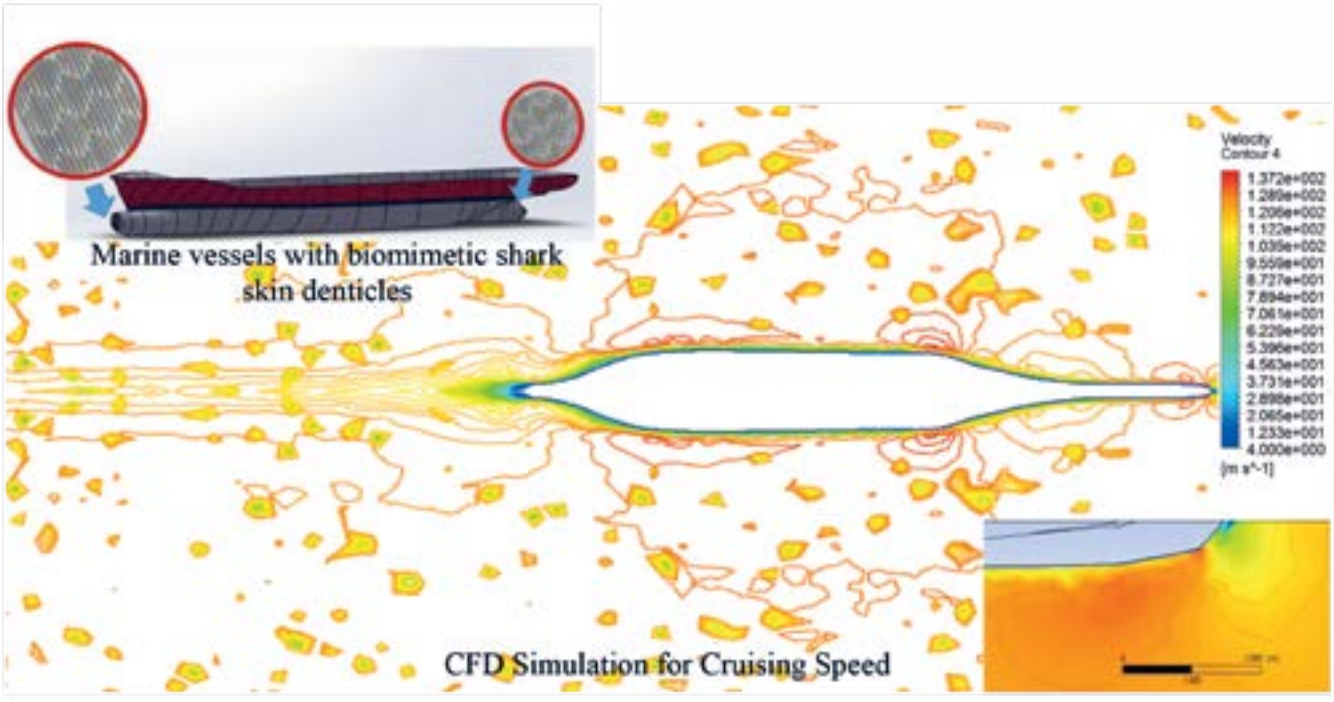
Diagram showing the program created to incorporate risk assessment procedures to civil engineering pipeline construction scheduling

STREAMLINED VESSELS FOR SHIPPING INDUSTRIES: MACRO APPLICATION OF SHARK SKIN DESIGNS

Researchers: *Mohd Danial Ibrahim[1], Siti Nur Azizah bt Amran[1], Nobuo Watanabe[2] and Azham Zulkharnain[3]*

[1] Faculty of Engineering, Universiti Malaysia Sarawak
[2] Shibaura Institute of Technology, Japan
[3] Faculty of Resource Science and Technology, Universiti Malaysia Sarawak

Functional properties of shark denticles have caught the attention of engineers and scientist today due to the hydrodynamic effects of its skin surface roughness. The skin of a fast swimming shark reveals riblet structures that help to reduce skin friction drag, shear stresses, making its movement to be more efficient and faster. Inspired by the structure of the shark skin denticles, our team has come up with an idea of improving the hydrodynamic design of marine vessels by applying the imitated shark skin on the surface hull of the vessels. Models used for this study were constructed and computational fluid dynamic (CFD) simulations were then carried out to predict the effectiveness of the hydrodynamic effects of the biomimetic shark skins on those models. Interestingly, the numerical calculated results obtained showeds that the presence of biomimetic shark skin implemented on the vessels gave significant increase in the maximum speed up to 11 % as well as reducing up to 4% in drag force experience by the vessels. Theoretically, as force drag can be reduced, it can lead to a more efficient vessel with a better cruising speed. Experimental analysis also showed promising effects to help the ship glide better on the ocean surface.



This research was partially funded by Fundamental Research Grant Scheme, Grant No: FRGS/TK01(01)/1059/2015(05), rendered by the Ministry of Higher Education.

MEGALITH CULTURES OF THE KELABIT HIGHLANDS THROUGH SPACE AND TIME; UTILIZING DIGITAL TECHNOLOGY IN ANTHROPOLOGICAL EXHIBITION

Researchers: *Yakup Mohd Rafee1,[2], Awangko' Hamdan Awang Arshad[2], Hishamuddin Siri[2], Sylvester Wielding Jussem[2], Poline Bala[3], Mohd Zamhari Abol Hassan[2], Hakimi Halim[2], Sarah Naemah Aman Leong[2] and Doris Maying[2]*

[1]Institute of Borneo Studies, Universiti Malaysia Sarawak
[2]Faculty of Applied and Creative Arts, Universiti Malaysia Sarawak
[3]Faculty of Social Science and Humanities, Universiti Malaysia Sarawak

An exhibition entitled 'Megalith Cultures of the Kelabit Highlands through Space and Time' was curated by researchers from UNIMAS and the Rurum Kelabit Sarawak in conjunction with the 12th Pesta Nukenen (Food Festival) at the Teripun Museum, Bario. The main aim of the exhibition is to highlight the outstanding features of the Kelabit Highlands, which is its 'monumental' landscape consisting of various types of stone monuments and landscape modifications. The exhibition was held to share research findings on the megaliths to the local community as well as to test the hypothesis on the carved figure by getting feedbacks from the local community and visitors. The exhibition has established a knowledge interchange between researchers and the public. An important feature to this exhibition is the use of both Augmented Reality and Virtual Reality whereby layers of multimedia content such as videos, animated graphics and sound are embedded to enhance the users' experiences. The use of Information and Communication Technology (ICT) is an alternative approach in anthropology and cultural studies to deliver accurate perception of the representation of cultural practices and well-documented heritage.

This research was supported by the Dayak Chair Grant, Institute of Borneo Studies, Universiti Malaysia Sarawak (F03/DRC/1457/2016) and Ministry of Higher Education Malaysia, Fundamental Research Grant Scheme (F03/FRGS/1500/2016).

Artist sketches on site of four different site view

THE APPLICATION AND POSSIBILITY OF 3D HOLOGRAM TO ENHANCE COGNITIVE SKILLS TOWARDS PRIMARY SCHOOL LEARNERS

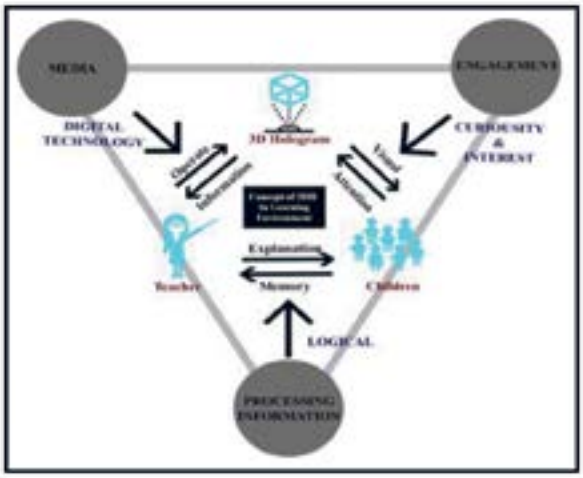
Researchers: *Siti Shukhaila Shaharuddin and Loh Ngiik Hoon*

Faculty of Applied and Creative Arts, Universiti Malaysia Sarawak

Three-dimensional hologram (3DH) had been introduced for several decades with proven advantages;, to motivate and engage students in their learning skills. This study showed that 3DH provided superior visual capabilities of information that were either not present or difficult to process in the textbook handouts. Teachers could use 3DH technology as a teaching material to explain subject's information to the students in an easier way. In addition, 3DH allowed the object to appear floating in the free air. This exciting learning environment that stimulated curiosity and , interest while sustaining purposeful engagement could increase children's motivation during learning process. In spite of engagement, students were also allowed to viewing the object or subject learned from different angles via the 360-degree hologram of 3D images. The understanding allowed the students to think logically to process and remember the content of information. Indirectly, this would increase the students' achievement and finally involve the cognitive development of students.

This research was supported by research grant No. F03/DPD/1642/2018 rendered by the Universiti Malaysia Sarawak.

Concept of Teaching and Presentation Using 3D Holograms in School



Proposed Concept of Application 3D Hologram in Learning Environment

GREEN TURTLE TOURIST INTERACTIVE KIOSK (INTERACTOUR) FOR ECO-TOURISM AND CONSERVATION OF SARAWAK HERITAGE

Researchers: *Ruhana binti Hassan[1], Aslina binti Mohd Jainal[2], Anuar bin Ayob[2], Zulkalnain bin Zainal Abidin[2] and Siti Haslina binti Hussin[3]*

[1] Faculty of Resource Science and Technology, Universiti Malaysia Sarawak
[2] Faculty of Applied and Creative Arts, Universiti Malaysia Sarawak
[3] Faculty of Social Sciences and Humanities, Universiti Malaysia Sarawak

Approximately 4 to 5 million people visit Sarawak yearly for its wild life in natural settings, which is one of the tourists' attractions. Local people and tourists know more information about proboscis monkey, hornbill, orang utan, and crocodile, compared to the information on the green turtles nesting in Sarawak Turtle Islands. Therefore, this study established an app named Green Turtle Tourist Interactive Kiosk (InTERACTour), a digital platform, containing information related to green turtles nesting in Sarawak Turtle Islands. Information displayed on the kiosk comprises of biology, ecology, life cycle and nesting behaviour of green turtles, where users can enjoy the "tour" in a digital form. Besides that, this kiosk also highlights conservation activities (past and present) carried out by agencies in Sarawak, to attract tourists to visit and participate in such activities.

This research was supported by F07(DPP18)/1186/2014(18): Population dynamics and genetic structure of green sea turtle (Chelonia mydas) in Sarawak.

CONSERVATION EFFORTS WERE DOCUMENTED IN THE KIOSK

LAND USES SURROUNDING SELECTED HYDROPOWER RESERVOIRS IN SARAWAK

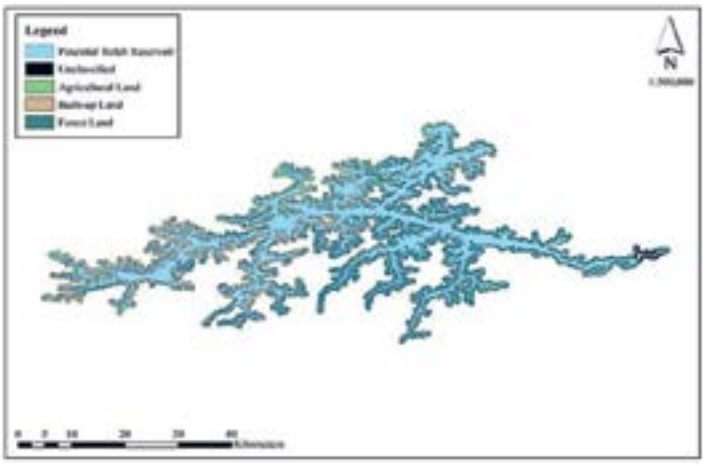
Researchers: *Joana Alicia Joseph Blandoi[1], Jayasilan Mohd-Azlan[1] and Mohd Azizul Hafiz bin Jamian[2]*

[1] Faculty of Resource Science and Technology, Universiti Malaysia Sarawak
[2] Faculty of Social Science and Humanities, Universiti Malaysia Sarawak

Sarawak is blessed with abundance of water resources. The state is drained by forty major river basins and has a combined installed capacity of hydropower potentials of approximately 20,000 MW. In view of these potentials, this study was aimed to understand the general land use composition surrounding the existing and planned hydropower reservoirs in Sarawak. A total of ten sites was selected and the land use surrounding these study sites was identified using the Remote Sensing and Geographic Information System tools. The primary source of data was the United States Geological Survey (USGS)'s Earth Explorer. The remote sensing data were pre-processed by using ERDAS Imagine 2014 and were analysed by using ArcGIS 10.3. The satellite images were classified by using both unsupervised and supervised classification tools. A detailed assessment on land use changes was conducted for Batang Ai site. The study found that a total of six sites had higher forest land (>50%) compared to the built-up and agricultural lands. The regression analysis also found that 85% variation in built-up land was explained by the reservoir area and there was a strong correlation between the two variables. The detailed assessment found that agricultural land was calculated to have increased at the mean rate of 2.25% within 500-m buffer width from Batang Ai reservoir shoreline. The findings of this study shall contribute to the knowledge on hydropower reservoir planning and management. Therefore, the design of riparian buffer zone for future hydropower reservoirs shall take into considerations the size, function, management objectives, and the adjacent land uses surrounding each reservoir. The understanding on land use composition within 500-m width from the reservoir shoreline may contribute to the potential establishment of riparian buffer zone that serves various ecological functions and reservoir management objectives.

Code	Land Use	Colour	Description
1	Built-up Land		Residential areas, longhouses, facilities, access roads, logging road, mixed development or other built-up land
2	Agricultural Land		Cropland, orchards, shifting cultivation, monocrop cover
4	Forest Land		Undisturbed forests, secondary forest

Signature Editor Files for Supervised Classification



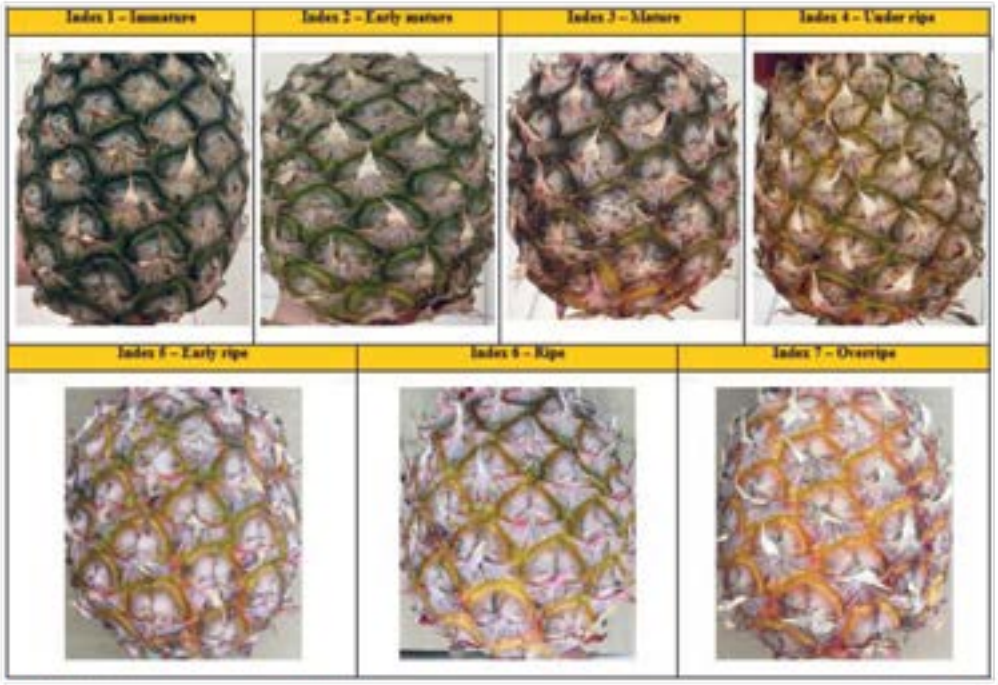
Land Use Classification within 500-m width for potential Baleh Reservoir in year 2016

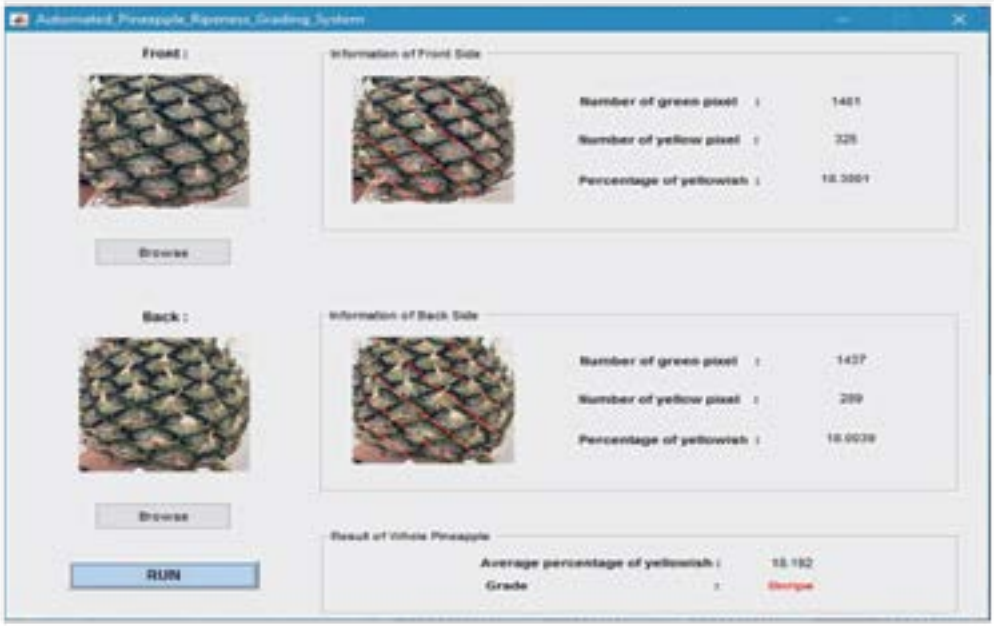
AUTOMATED PINEAPPLE RIPENESS GRADING SYSTEM

Researchers: *Wang Hui Hui and Chai Sze Ye*

Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak

This project is an automated pineapple ripeness grading system that is mainly used to replace the traditional method of manually identifying the ripeness of pineapples. The colour features are extracted from the front and back view images of a pineapple that can be used to identify and classify the pineapple into three main grades; unripe, ripe and fully ripe. This system helps to improve the efficiency, accuracy and user subjectivity satisfaction in pineapple ripeness classification process.





PRODUCTION OF GLUTEN FREE NOODLES FROM SAGO STARCH

Researchers: *Kopli Bujang and Nurain Ismail*

Faculty of Resource Science and Technology, Universiti Malaysia Sarawak

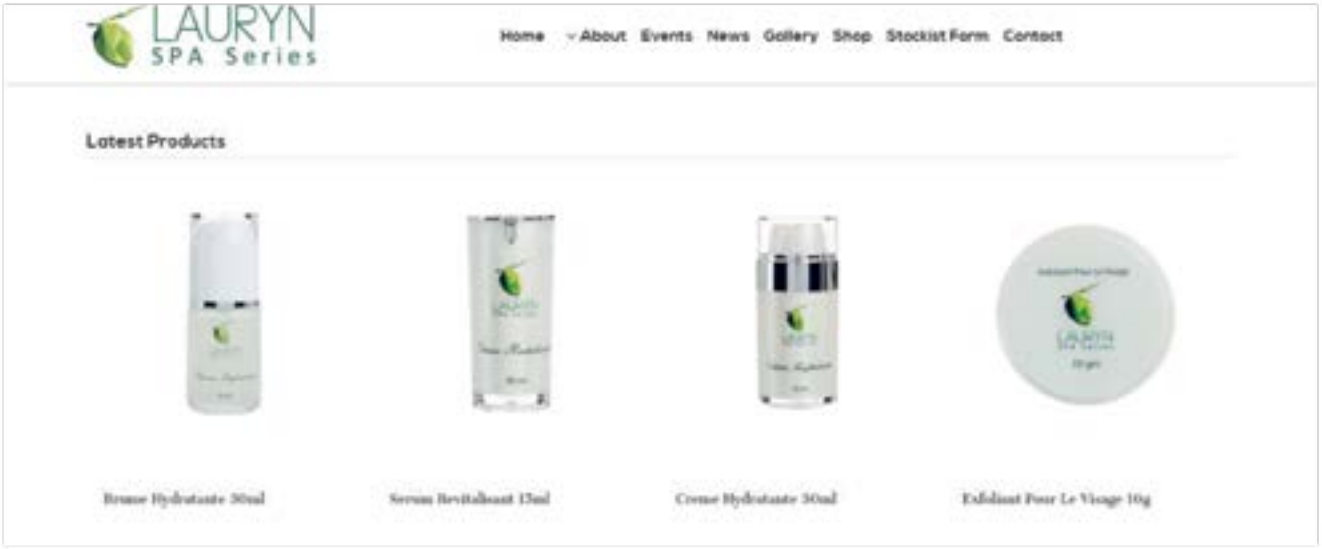
Malaysia spends about RM30 billion to import foods every year which continues to rise due to depreciation of the ringgit. In this view, utilization of local agricultural commodities must be enhanced to produce more food which will concomitantly reduce our dependency on imported products. study intends to produce noodle solely from food grade sago starch, a type of noodle which is totally safe for consumption especially for gluten intolerant consumers. All noodles are made from wheat starch, which is an imported commodity. The use of sago starch will certainly reduce the capital for the noodle industry. Physicochemical properties, cooking quality and sensory characteristics of noodles produced from purely sago starch flour were evaluated. From our study, it was concluded that noodles produced using 100% sago starch were of inferior quality in terms of colour, cooking losses, texture and sensory acceptability in comparison to noodles prepared from 100% wheat flour. At this moment, of all the wheat flour and sago starch mixing ratio, the most acceptable in terms of colour and texture from both instrumental and sensory assessments is the ratio of 60:40 for sago starch and wheat flour, respectively. Since sago starch is cheaper than wheat starch, mixing it with wheat starch will reduce some of the production costs. Currently we are modifying our cooking and processing methods by variations in cooking time and temperature together with addition of enzyme so that 100% sago starch will produce noodles of the same quality, taste and shelf-life as 100% wheat starch.

This research was supported by the Kursi Tun Openg (Res. Grant No. F07/TOC/1515/2016) at the Faculty of Resource Science and Technology, Universiti Malaysia Sarawak.

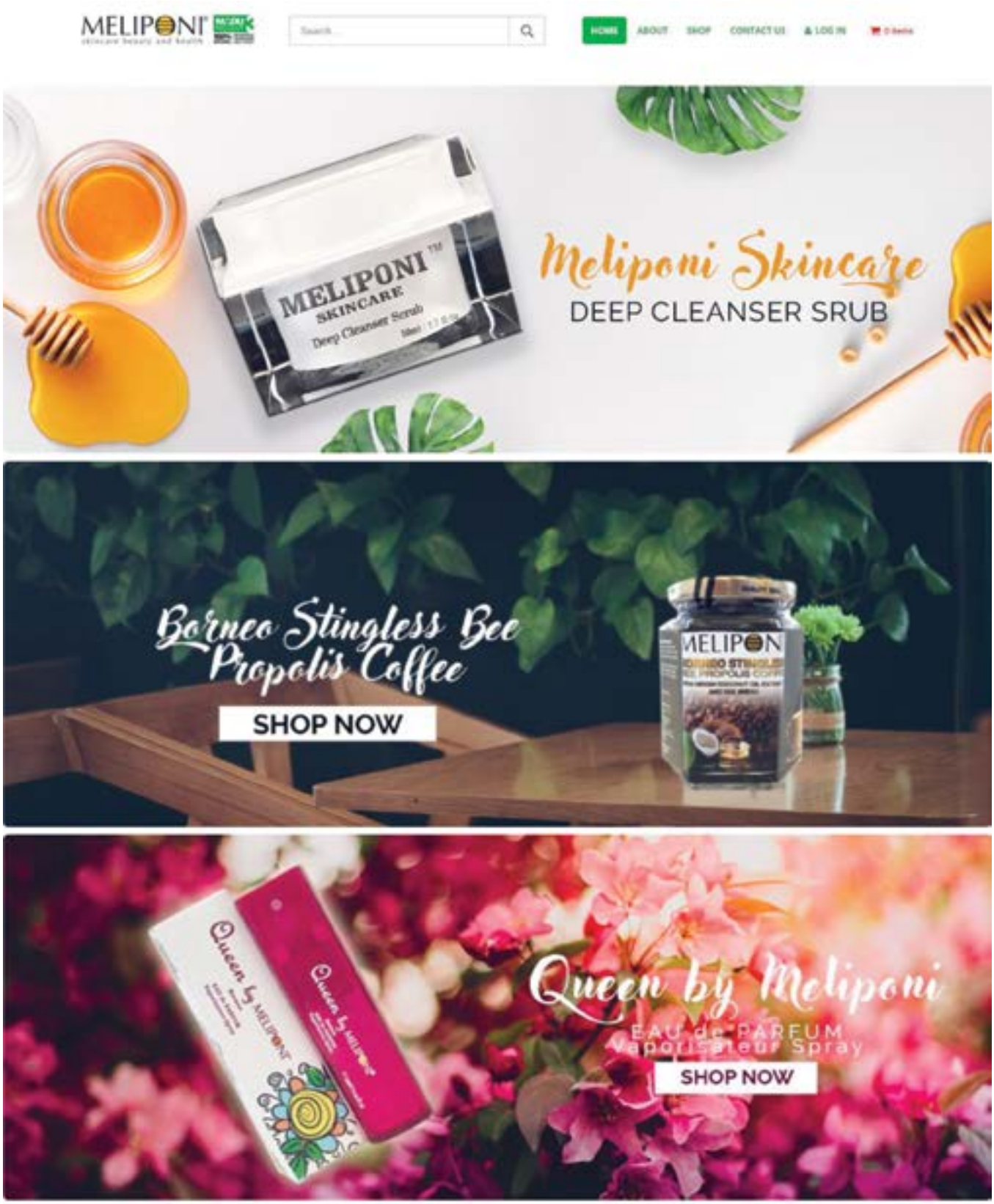
Production of sago noodle in our lab, and dried noodle made from 100% sago starch

COMMERCIALIZATION OF UNIMAS RESEARCH PRODUCTS

UNIMAS Innovation would like to highlight the commercialization of two R&D products, namely VCO (Virgin Coconut Oil) marketed by Lauryn Global Sdn Bhd and Meliponi (Borneo Stingless Bee Honey) marketed by Sophia Taha Holdings Sdn Bhd. Both products are invented by Dr Mohd Razip bin Asaruddin.



VCO cosmetic products are packaged as LAURYN SPA Series
Available at https://www.laurynvco.coms



Meliponi products are available at https://meliponie.com