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# ***ICT Development & ICT for Development***



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Vol.8



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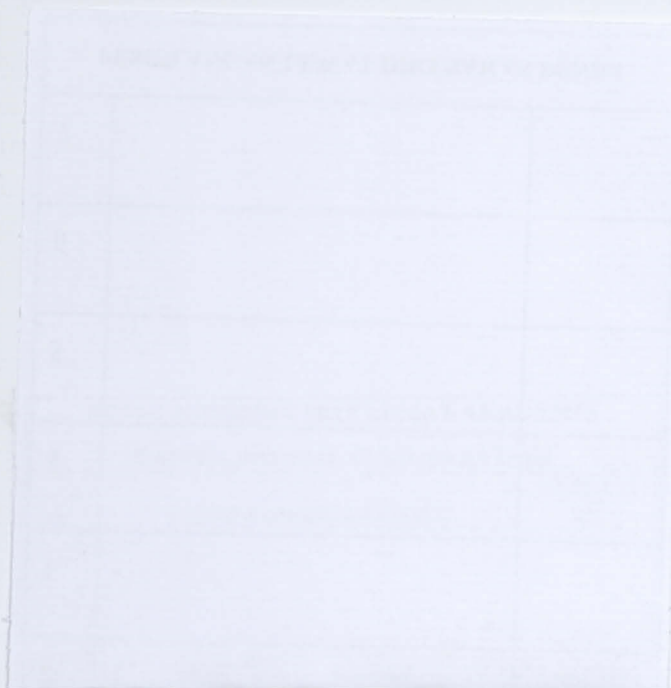
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## FOREWORD

P.KHIDMAT MAKLUMAT AKADEMIK

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Greetings. It is my pleasure to welcome you to our latest issue of the Research Updates, 2012. This issue is themed “ICT Development and ICT for Development” with the purpose of providing us an understanding of developing information and communication technologies (ICTD) and utilizing information and communication technologies for development (ICT4D). Furthermore it aims to disseminate the vast wealth of knowledge on Information and Communication Technologies (ICTs) available to a wider audience, and to generate interests beyond the core technical components of ICTs.

In this day and age, ICTs play a pivotal role in our society, such as for socioeconomic development, international development and human rights. With more and better information and communication, the effect will be the development of the society, resulting in enhanced income, education, health, security, or any other aspect of human development.

Continuous researches on ICTs would unearth new technologies that will overcome the barriers of distance and time, and will significantly improve the access to information and knowledge. It enables effective and quick sharing of information and knowledge and acts as a key element in achieving development goals, while allowing us to soften the impact of unforeseen circumstances, such as, natural disasters or outbreaks of disease. The emergence of ICTs provides enormous potential for the “disadvantaged populations”, as it enables the prospects of continuous learning. Online learning or distance education is one example of the many remarkable outcomes of ICTs development and it has certainly provided access to education for those previously excluded.

ICTs play a critical role in development efforts globally and it is a challenge for our researchers to develop new technologies for this purpose. It should be further noted that the invention of ICTs is creating ideas that are being facilitated and replicated in non-ICT sectors. ICTs remain an important challenge to our researchers, more so in their gallant endeavours to bridge the digital divide in many pockets of remote communities throughout the world.

The research efforts presented in this edition of Research Updates will undoubtedly accentuate our understanding on ICTD and ICT4D, and their impacts, and ultimately, bridge the existing digital divide that exists. It is my sincere wish that our research efforts in this field will result in improved socio-economic conditions of the society and eventually, propel UNIMAS to greater heights through our research endeavours.

Thank you.

**Prof Dr Peter Songan**  
Deputy Vice Chancellor (Research & Innovation)  
Universiti Malaysia Sarawak



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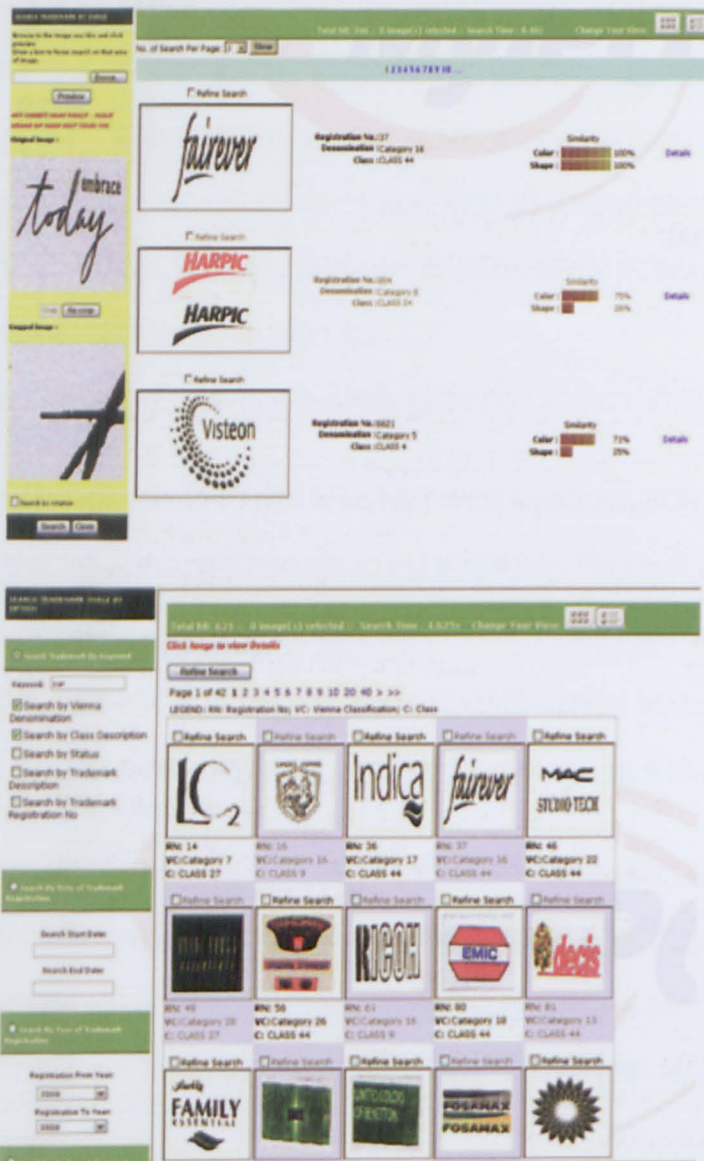
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## TRADEMARKS MANAGEMENT SYSTEM (TMS)

*Researchers: Wang Hui Hui, Tan Chong Sen, Wang Yin Chai, Tan Chong Eng and Bong Chih How  
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Screen snapshots of the trademarks query output.

Trademarks Management System (TMS) produces an automated trademark comparison engine to replace the human intensive comparison process aiming to increase the overall organizational and work process efficiency. Besides, it also provides a platform accessible anytime and anywhere for the public to conduct custom trademark checking prior to registration of trademark.

TMS contains comprehensive features and functionality. TMS provides full feature trademark image comparison where users could upload the query image and compare with the existing images. This system has an easy and interactive search interface which includes functions such as trademark image searching by using different categories or with combination of categories, batch processing and image cropping. In addition, TMS is equipped with prohibited traits check in order to determine whether the trademark image contains any prohibited traits. The system also provides reporting utility to print the search results into reports for future references. Easy online payment is another service included in the system where payment can be made online easily through credit card. Online help is also available to assist and support system users with more information.

### MARKETING POTENTIAL

The Content Based Image Retrieval technique used in TMS system has already been successfully tested in other application such as butterfly species classification and wood species recognition system. The present product has the advantages of ease-of-use, portability to different domain and ideal for industry application that requires speed in searching a huge collection of images. There is good market potential in medical and forestry domains.

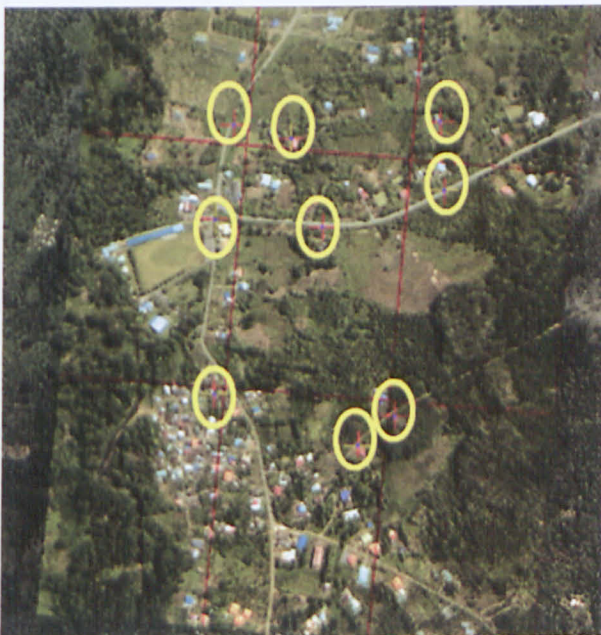


## AN INTELLIGENT APPROACH OF SPATIAL IMAGE RECTIFICATION FOR AERIAL IMAGES

*Researchers: Liew Lee Hung, Wang Yin Chai and Cheah Wai Shiang  
Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak*



A raw uncalibrated aerial image contains variations of geometric distortion which affect the relative position of objects in the scene.



An aerial image is rectified using control points by referring to satellite image.

With the development of digital technology, the study of uncalibrated aerial images acquired from a non-metric digital camera has become an active research nowadays. In an ideal case, accurate aerial images should be able to provide useful spatial information. However, a raw uncalibrated aerial image not only contains the real image details but also merged with the variations of geometric distortion caused by lens, earth curvature, topographic relief and inconsistencies in the attitude of the aircraft. Geometric distortions affect the relative position of objects in the scene. These effects are more serious in aerial images compared to satellite images. This is due to the difference of the two platforms in height relation to a distance from the Earth, and satellite's orbit is relatively stable compared to an aircraft which usually moves unsteadily, due to atmospheric perturbations. Consequently, the spatial information derived is incorrect and cannot be used directly. Image rectification is an important process of geometrically correcting an image. This research focuses on non-parametric method which uses a set of control points as reference points with an appropriate mathematical function to construct transformation approximation. Conventionally, global geometric transformation is applied for the whole image without considering the distortions rate occur differently in the image and few considered its appropriateness based on the distortions. However, experiments conducted have shown that lower order global transformation has limitation in rectifying images with complex distortions. Other factors that would affect the efficiency of the rectification include the selection, density and distribution of control points. The uncalibrated aerial images used in this research are taken from a non-metric digital camera carried by a helicopter with flying height of 3,000 to 4,000 feet. Research is being conducted to achieve a stable intelligent approach of spatial image rectification for aerial images.



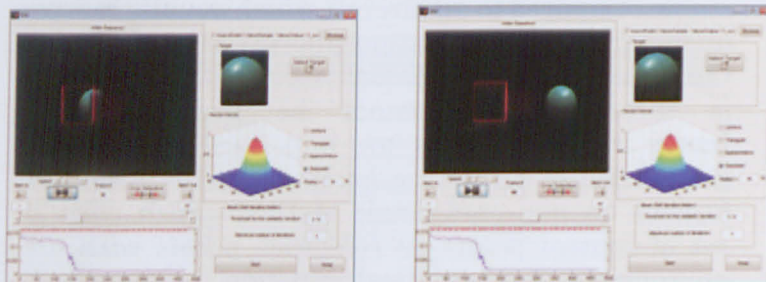
## IMPROVING OCCLUSION HANDLING IN INTELLIGENCE VIDEO SURVEILLANCE

*Researchers: Lee Beng Yong, Wang Yin Chai and Cheah Wai Shiang*

*Centre of Excellence for Image Analysis and Spatial Technologies, Universiti Malaysia Sarawak*



Tracking a target person in a crowd can be challenging when people are blocked from the camera view causing occlusion from time to time (source: Video frames from PETS dataset).



Mean shift tracking suffer from "lost track" when the tracked object (ball) is heavily occluded by foreground object (box).

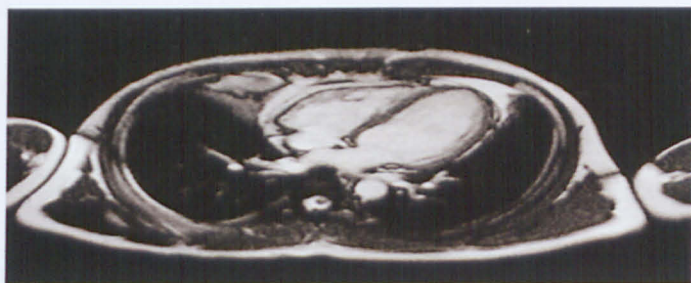
Intelligent video surveillance (IVS) involves the study of computer vision technologies to detect, to track and to understand objects and events in video monitoring. IVS is widely accepted in several applications such as security and business intelligence due to its ability to assist human supervisors to monitor many real time video feeds simultaneously. Typical IVS consists of several components namely video acquisition, recording, motion detection, object detection, object tracking, and event analysis. Some of these components such as video acquisition, video recording and motion detection are established and can be easily obtained from off-the-shelf commercial software. However, many current IVS solutions are designed with pre-requisite limitations and only work for a specific application or domain. For instance, the component of tracking in IVS, which is responsible to generate trajectory of objects over time by locating its position in every frame of the video, is often limited due to unpredictable direction change and obstruction of objects. In our research lab, a set of experiment has been conducted to benchmark some of the latest popular tracking methods i.e. the Mean Shift tracker (MS), Kalman Filter tracker (KF) and Particle Filter tracker (PF). The results of the experiment show that MS and KF would fail completely when full occlusion occurs. However, KF can recover from occlusion slowly after the full occlusion incident while MS remains lost track. The experiment also shows surprising result when PF, which was claimed as the most reliable tracker in many previous work failed to detect a moving object in our simulation video when the object changed its moving direction suddenly without occlusion. Encouraged by the results obtained from these experiments, our research aims to focus on improving the object recovery process after occlusion in video sequences. Through this improvement, the object tracking accuracy and performance could be enhanced and therefore the overall IVS operation could be improved uniformly across various environment. The proposed method is expected to be implemented and benchmarked with other existing methods to measure the performance and accuracy improvement. Dataset from Performance Evaluation of Tracking and Surveillance (PETS) by IEEE and ETISEO by the Techno-Vision evaluation network will be used to evaluate the implemented method.



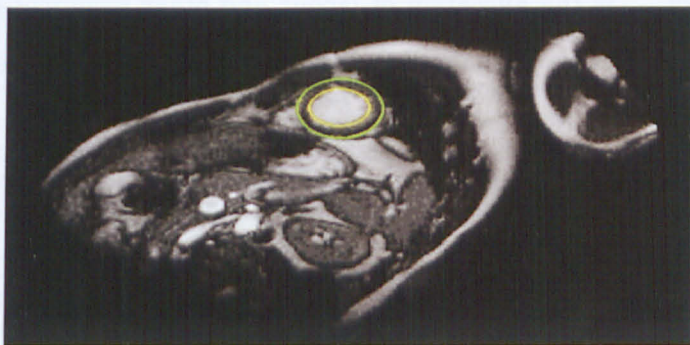
## 2D TO 3D SIMULATION USING MAGNETIC RESONANCE IMAGING (MRI) IMAGES FOR HEART

*Researchers: Eileen Yap Pin Pin, Wang Yin Chai and Jacey-Lynn Minoi*

*Centre of Excellence for Image Analysis and Spatial Technologies, Universiti Malaysia Sarawak*



Example of Cardiac MRI image.



Thickness of the wall between epicardial border (green) and endocardial border (yellow) is to be determined.

In recent years, new improvements have conquered the world of medical imaging, a general move from 2D slices to 3D models of organs has been observed. These improvements influence almost all existing imaging modalities, including Magnetic Resonance Imaging (MRI). MRI is based on the magnetization of water molecules, which are presented in different concentrations in most types of tissue in the body which is good to visualize soft tissue. It is almost impossible to visualize medical practice without imaging procedures. Cardiac surgeons, nowadays are dependent on 3D images of heart because they are not trained to practice the "2D thinking" like what the radiologists did previously. They are going through a non-invasive way to visualize the internal organ by using 2D slices of the images to detect and diagnose the problem of the heart. It is hard to explain to the patient about the condition of the heart by referring to the 2D images as the heart is a very complicated organ. With the help of 3D walkthrough, it is believed that both cardiologist and patient will have a clearer picture of the heart and better understanding of the heart condition. Besides that, the sequences of 2D images are basically encoded in the Digital Imaging and Communications in Medicine (DICOM) format whereby the thickness of the ventricle wall is hard to be determined other than capturing the heart image using grids as a guide. The inner details of the heart could not be seen clearly too. An improvement on 3D simulation applying to the inside of the organ and also auto detection of the thickness of the wall to identify dead tissues could be a great help to the cardiac surgeons.

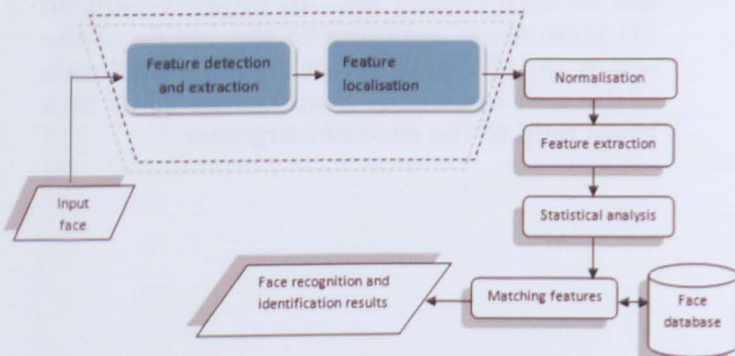


## GEOMETRIC FEATURE IDENTIFICATION INVARIATE OF SCALE AND ORIENTATION

*Researchers: Jacey-Lynn Minoi, Duncan F. Gillies, Jane Labadin and Terrin Lim  
Faculty of Computer Science and Information Technology,  
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Feature extraction and matching is a fundamental aspect of many problems in computer vision, including object representation and recognition. The feature properties are used for matching different images of an object or scene. The features, can either be global or local, define the whole or a part of the source signal. Hence, the extraction of representative information is crucial. In finding salient features, the extracted features should be invariant of any linear or nonlinear transformations, such as image scaling and rotation, changes in illumination and 3D camera viewpoint, so that the representation of the object based on the features can be correctly matched against a large database of features. The state of the art is that the feature extraction methods are scale and orientation invariance, and robustness to disruption by noise, clutter or occlusion. The principle aim of this project is to construct reliable and accessible tools for analysis of facial data from biometric and medical applications. This involves the automatic identification of key information such as well-defined anatomical landmarks and curves, as well as the investigation of convenient representations of the facial surface itself. It also involves the construction of methods of statistical analysis for these extracted data. The effectiveness of these methods will be evaluated on existing data, to analyse anatomical face shape. They will be used in two new investigations. The first study aims to quantify the change in facial shapes resulting from extreme generated facial expressions. Another involves schizophrenia and autism patients where potential relationships between anatomical shape and psychotic symptoms can be investigated. These tools which result from the project will also enable other projects and researchers to pursue effective quantitative investigation of a much wider variety of importance in other fields associated with facial data and other 3D object.

*This research was supported by Science Fund Grant 01-01-09-SF0097.*

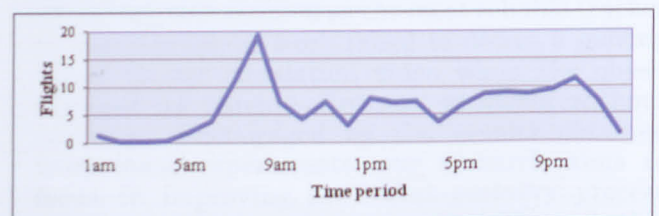


The general pipeline of facial analysis and recognition method.

## MANPOWER PLANNING AND SCHEDULING FOR IN-FLIGHT CATERING SERVICES

*Researchers: Sze San Nah and Chiew Kang Leng  
Faculty of Computer Science and Information  
Technology, Universiti Malaysia Sarawak*

The routing and scheduling of vehicles for crews are critical in distribution management. Many existing transport logistics problems can be modeled as vehicle routing problems (VRPs). The objective is to establish a planned route to serve a set of customers at minimum cost. However, real-life applications are often more complex due to specific requirements that naturally exist for practical operations, such as the limited capacity of vehicles, location facilities and time window. Another complicating factor is the allocation of labour and other resources or equipment to carry out an operation over time. In order to make full use of the available resources, management must plan precisely what has to be done, when, how and by whom. With dozens of teams and hundreds of tasks, the planning process quickly becomes immense. This research focuses on developing a computationally bounded heuristic that generates high quality solutions in a short time. We consider several variants of the problem under different operational constraints. By achieving this objective would benefit at least three parties: (i) management teams to save time and effort in planning and rostering operations (ii) airlines in risk reduction in emergency situations due to fast response times, and (iii) workers by providing them a proper meal break which must be allocated within a given time window.



An average of five days in-bound flight distribution at Kuala Lumpur International Airport.



## NETWORK MODELLING OF MALARIA TRANSMISSION

*Researchers: Jane Labadin, Terrin Lim and Monday Eze*

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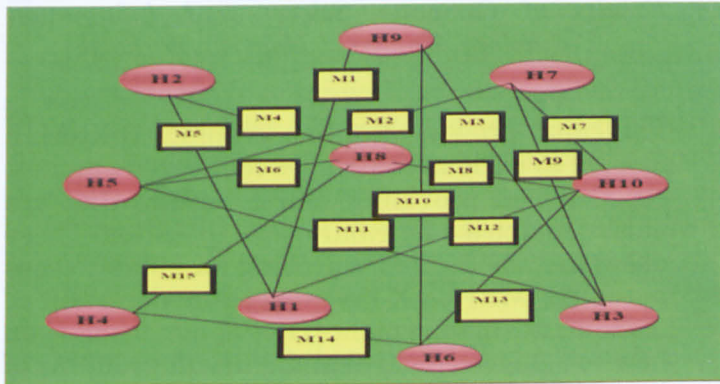


Figure 1: Conceptual model of malaria vectors and human interactions in public places.

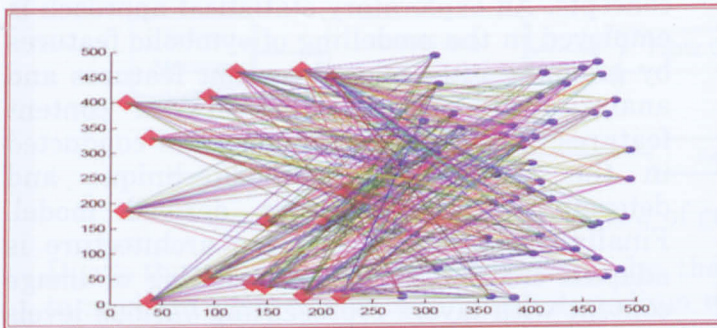


Figure 2: Sample contact network generated through computational modelling.

Malaria is a vector-borne disease that results from blood infection by protozoan parasites of the genus *Plasmodium*, which are transmitted from one human being to another by female *Anopheles* mosquitoes. Malaria is one of the most dangerous and widest spread tropical diseases according to Global Risk Forum 2009 reports. The World Health Organization (WHO) report for 2008 showed that there were an estimated 247 million malaria cases worldwide in 2006, causing nearly a million deaths, mostly of children under 5 years. These are some of the motivations for choosing to apply Computational Modelling to tackle this menace. The objective of this research is to evolve a computational model for predicting the public places which act as reservoirs of malaria vectors. It is based on the fact that every vector-borne disease transmission involves the vectors and its interaction with humans. For instance, every malaria transmission involves blood sucking bites by mosquitoes. The research seeks to utilize the pattern of the human contacts with vectors in public places to build a malaria network which is used as input to a search-engine-based analytical system. Figure 1 is a conceptual diagram of interactive relationship between malaria vectors M1, M2, ..., M15 and human beings H1, H2, ..., H10 in a contact network, while Figure 2 is a sample visualization diagram generated by computer program during one of the model runs. This system promises to be useful in vector control policy formulation and implementations since it is expected to give the ranking of the public places based on malaria vectors density. This study can be applied in any vector-borne disease caused by mosquito (e.g. Malaria, Dengue, etc).

*This research was supported by Fundamental Research Grant Scheme through FRGS/2/10/SG/UNIMAS/02/04.*



## STATISTICAL MODELLING OF CO<sub>2</sub> EMISSIONS IN MALAYSIA AND THAILAND

**Researchers:** Tay Sze-Hui and Shapiee Abd Rahman

Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak

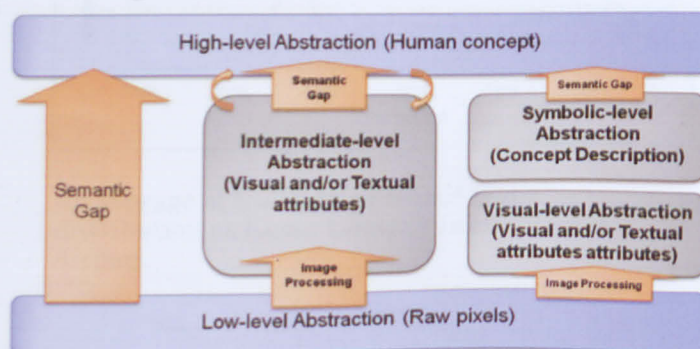
Carbon dioxide (CO<sub>2</sub>) emission is an environmental problem which leads to Earth's greenhouse effect. Much concern with CO<sub>2</sub> emission centre around the growing threat of global warming and climate change. This research presents a simple model development using multiple regression with interactions for estimating CO<sub>2</sub> emissions in Malaysia and Thailand. Five indicators over the period 1971-2006, namely energy use, GDP per capita, population density, combustible renewable and waste, and CO<sub>2</sub> intensity are used in the analysis. Progressive model selections using forward selection, backward elimination and stepwise regression are used to remove insignificant variables, with possible interactions. Model selection techniques were compared against the performance of eight criteria model selection process. Global test, Coefficient test, Wald test, and Goodness-of-fit test were carried out to ensure that the best regression model is selected for further analysis.

## SEMANTIC IMAGE ANALYSIS

**Researchers:** Narayanan Kulathuramaiyer, Wang Yin Chai, Dayang Nur Fatimah Awg Iskandar, Chiew Kang Leng and Lim Pei Chin

Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak

The rapid growth of online graphics (pictorial) has led to various challenges for search engines, especially in providing search results that are able to match a particular user's intention. These users include doctors searching for similar cases based on MRI or X-ray images or detection of trademark infringement. Hence, our focus is on how to achieve effective and efficient grouping of image results not only based on image content features but also based on image semantics by employing a symbolic-level abstraction for the mapping between visual features to semantic concepts. An exploratory statistical approach is employed in the modelling of symbolic features by grouping inter-related content features and analyzing the relationship between content features. Empirical experiments are conducted in the selection of method/technique and determining thresholds for derived model. Finally, an enhanced layering architecture is adapted for the semantic modelling of image content with layers representing various levels of information organization ranging from system-level visual features to high-level human friendly concept descriptions. We believe any user community who owns a large collection of images yet under-utilized can benefit from the modelling.



Different abstraction levels and evolution of approaches.



## A STEGANALYSIS-BASED APPROACH TO DETECT STEGANOGRAPHIC ARTEFACT IN HALF-TONE IMAGES

*Researchers: Chiew Kang Leng, Jane Labadin, Zaharin bin Yusoff, Sze San Nah and Sze Jeeu Fong  
Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak*

Many interesting steganographic techniques have been created and its continuing evolution is guaranteed. Inevitably, they are potentially open to abuse and can be used in certain kinds of criminal activity. Almost any form of digital media can be used for steganographic purposes. This media (carriers) can be classified (but not limited) to the following categories: image, video, audio, text, executable file, and computer file systems. The general framework for steganography is shown in Figure 1. There are two basic operations involved in steganography: embedding and extraction. During the embedding operation, the secret message is inserted into the medium by altering some portion of it. The extraction operation involves the recovery of the secret message from the medium. A secret message is the hidden information and can be plain text, cipher text, image or anything that can be converted into stream of bits. Key is the shared passphrase between sender and receiver.

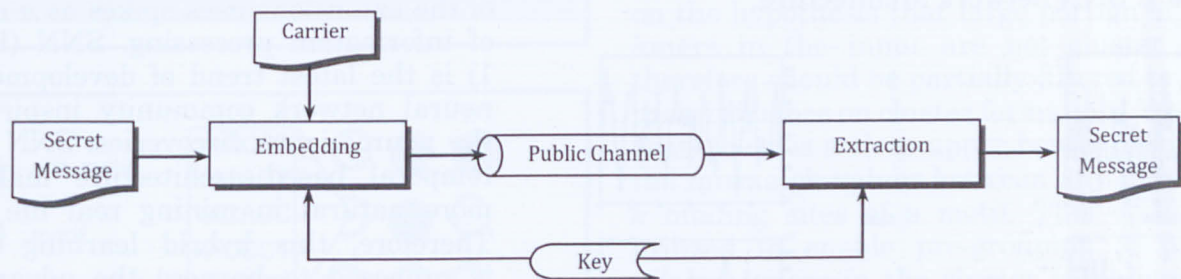


Figure 1: Overview of generic steganographic scheme.

Due to the covertness effect of steganography, the task of a warden (e.g., law enforcement agencies) to monitor, inspect and distinguish a medium with secret message from those without over the public channel as depicted in Figure 2 becomes very challenging. In particular, with the abundance of digital files, it is very difficult to identify which files that traverse through the public channel contain hidden messages. The underlying idea is to employ statistical techniques to analyse the given images. Most of the existing work on steganalysis focuses on the analysis of greyscale and colour image steganographic techniques. Rather than concentrate on this well explored area, steganalysis of half-tone image steganography was proposed. A half-tone image is a special type of binary image and is made up of a series of dots, which is varying either in size, shape or spacing to simulate continuous tone effect. Hence, this deserves a careful study and analysis.

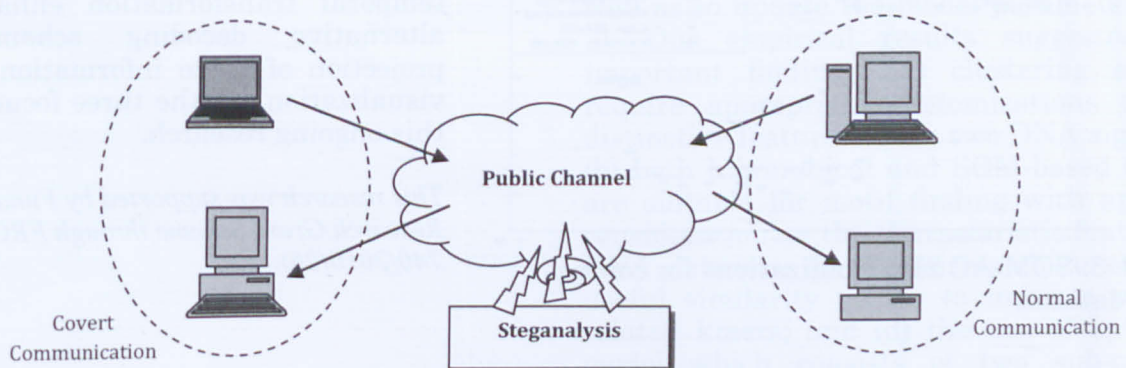


Figure 2: Simple steganalysis model.



# A HYBRID SPIKING NEURAL NETWORK MODEL FOR DATA EXPLORATION AND VISUALIZATION

*Researchers: Chee Siong Teh, Ming Leong Yui and Chwen Jen Chen  
Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak*

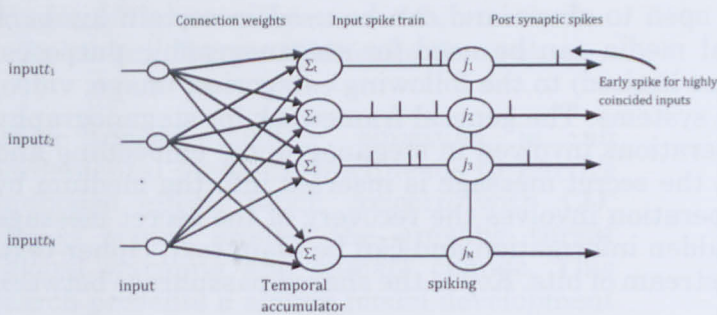


Figure 1: SNN network architecture.

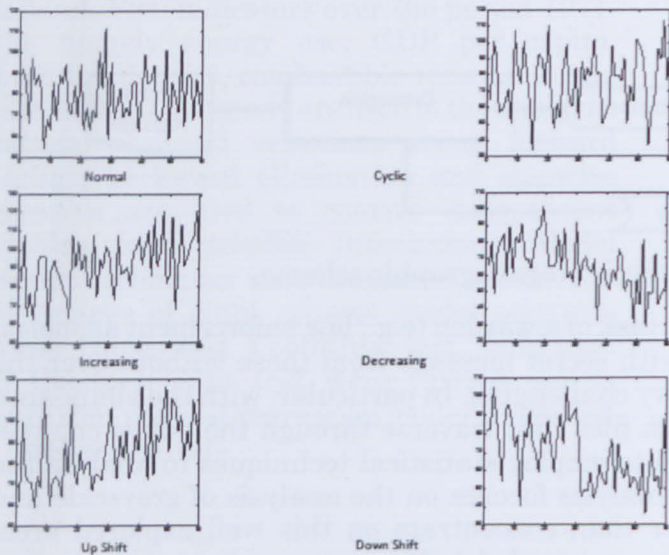


Figure 2: Six control chart patterns

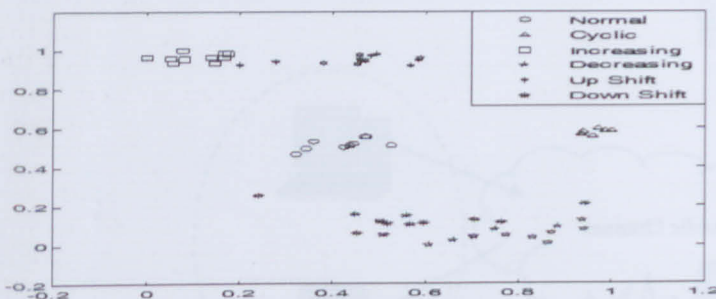


Figure 3: SOM-AC 2D visualizations for control chart dataset.

This study proposes a hybrid model of Self-Organizing Map with modified Adaptive Coordinates (SOM-AC) and Spiking Neural Network (SNN) for multivariate spatial and temporal data visualization and classification. SOM is one of the most prominent unsupervised learning algorithms. Recently, many extensions for SOM have been proposed for temporal processing. However, none of the extensions uses spikes as a means of information processing. SNN (Figure 1) is the latest trend of development in neural network community inspired by the neuroscience discoveries. SNN being temporal based architecture makes it more natural in mining real life data. Therefore, this hybrid learning model is proposed to harness the advantages of both SOM-AC and SNN to produce intuitive multivariate data classification and visualization. Empirical studies of the hybrid model using synthetic and benchmarking datasets yielded promising classification accuracy and intuitive rich visualization. The proposed hybrid SOM-AC and SNN model is able to produce rich visual information for intuitive decision making. This hybrid model shows promising performance not only for spatial data, but also temporal data (Figure 2 and Figure 3). Spatial to temporal transformation enhancement, alternative decoding schemes and projection of spike information into the visualization are the three focus areas of this ongoing research.

*This research was supported by Fundamental Research Grant Scheme through FRGS/02(19)/740/2010(26).*



## FINDING DNA MOTIF USING CLUSTERING TECHNIQUES

*Researcher: Syafiq Lee Nung Kion*

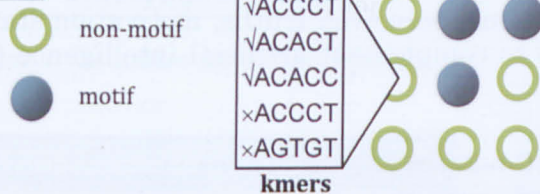
*Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak*

**Figure 1**



The algorithm starts with forming core motifs from a subset of input sequences. Selected core motifs are used to initialize clusters by grouping kmers having mismatch value smaller than a specified threshold. After initialization, each cluster is partitioned hierarchically to form a separate binary tree. Heuristic rules are proposed to determine the branching stopping criteria, select candidate motif, and discarding sub-cluster. Finally, the candidate motifs are ranked to identify putative motifs.

**Figure 2**



SOMEA projects kmers on the map which consists of nodes equipped with a novel hybrid model, based on their features to form clusters. The hybrid node model composes of two sub-components: the Position Frequency Matrix and Markov-chain. The members of a node are assumed to be composed of mostly motif or mostly background noises. Such different degrees of kmer composition in a node can be effectively represented by a mixing parameter.

Discovering functional elements such as binding sites of proteins is important to the understanding of gene regulation mechanisms and gene regulatory network. Two clustering frameworks were proposed to address the limitations of existing DNA sequences clustering frameworks. Miscluster is a hierarchical-based clustering which partitions kmers (an informative continuous  $k$  bases in a DNA sequence) into sub-clusters at different hierarchical levels that produce a tree-like structure (Figure 1). Our framework is founded on the hypothesis that large portion of the noise kmers in the input are not cluster able and therefore should be partially filtered to minimize their influence on cluster formation. We observed that, there is a clear upper bound (i.e.,  $\approx k/2$ ) on the mismatch values between any pair of length  $k$  binding sites of a motif. This observation is utilized to enable pre-grouping of potentially related kmers in the cluster initialization step. SOMEA is a motif finding tool based on Self-Organizing Map (SOM). It hypothesizes that improved representation of kmers distribution in the state space, which consists of kmers from supposedly motif and background noises, can be achieved by using cluster model that consider the characteristic features of each signal types. The novelties of our framework are: (a) proposed a hybrid node model to represent the two classes of kmers (motif and background) from a DNA dataset; and (b) heuristic learning rules are proposed to update the mixing parameter for the two sub-components in the hybrid model, as well as to update the model parameters (Figure 2). Our empirical results suggested several important findings: (a) clustering algorithms require appropriate customizations to handle distinctive features of the two DNA signal types; (b) both hierarchical and SOM-based clustering are suitable for motif finding with appropriate consideration on the characteristic feature of the DNA datasets; (c) the mismatch function is an useful similarity metric to indicate potentially related kmers; and (d) the use of hybrid node model which consists of two sub-component models improved the representation of kmers distribution.



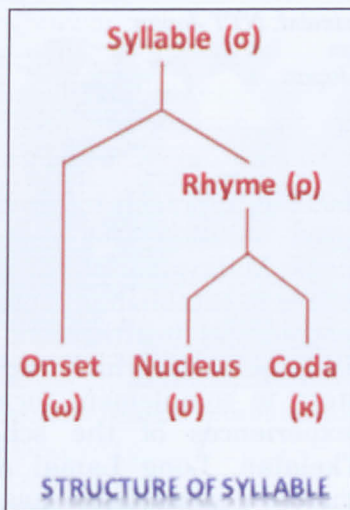




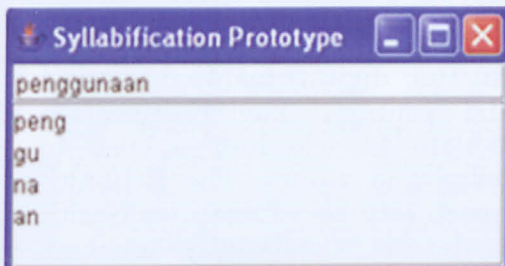
## SYLLABIFICATION AND WORD STEMMING FOR MALAY TEXT PROCESSING

*Researcher: Lee Jun Choi*

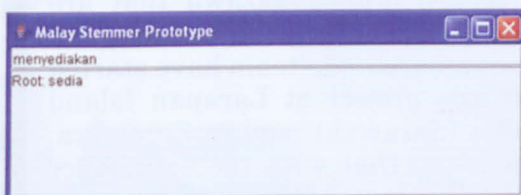
*Faculty of Computer Science & Information Technology, Universiti Malaysia Sarawak*



Syllable structure for syllabification.



Screenshot prototype for Malay syllabification.



Screenshot prototype for Malay stemmer.

Syllabification is a process that separates a word into smaller units known as syllables. This process is a fundamental process for several other Natural Language Processing (NLP) such as speech synthesizing (Text-to-Speech Conversion), and speech recognition. Traditional rule-based syllabification methods try to separate the syllables from the word through identifying both onset and rhyme in a syllable. These methods are based on the Onset Rhyme (OR) Theory developed by Eric Fudge in 1969. Through detailed study on the syllable structures for Malay language, a new syllabification method for Malay words have been identified. The new method uses only rhyme structure to determine the barrier of a syllable. An evaluation of the method shows promising accuracy and the possibility to extend the method to other languages like English. Although syllabification process is usually used in speech-related technologies such as speech synthesizer and speech recognition, syllabification process can be used in other NLP processes as well. One of the applications for the new syllabification method in Malay text processing is the Malay word stemmer. Word stemmer or lemmatization is a process to extract the root of a particular word. This process is important in text processing because the word stemmer is not only the fundamental tools in morphological study but also can be used in word-level context analysis. Malay words are hard to lemmatize or stem. This is due to the complex structure of Malay words with the existence of prefixes, suffixes, infixes and combination of affixes in Malay words. A rule-based stemming method had been implemented using the rhyme-based syllabification method developed. The syllabification method enabled the syllables to be correctly extracted from a word. From the syllables and the sequence of the syllables, the root word can be extracted from original word by removing the correct affixes. The correct syllables from the syllabification process also enabled the identification of transformations in word due to the prefix. For example, the character or consonant "S" in the word "sapu" is replaced by consonant "NY" and becomes "menyapu" when the prefix "me" is added to the word. Currently the word stemmer developed using this method have a very high accuracy in extracting root words from Malay words with prefix, suffix and combination of both. However, the stemming for words with duplication word and infix remains a challenge using the current method.



## E-EDUCATION AND E-HEALTH SOLUTIONS FOR REMOTE RURAL COMMUNITIES: A CASE STUDY IN BARIO

**Researchers:** Khairuddin Ab Hamid<sup>1</sup>, Peter Songan<sup>1</sup>, Alvin W. Yeo<sup>1</sup>, Fitri Suraya Mohamad<sup>1</sup>, Norazila Abdul Aziz<sup>1</sup>, Souba Rethinasamy<sup>1</sup>, Cheah Wai Shiang<sup>1</sup>, Tan Chong Eng<sup>1</sup>, Al-Khalid Othman<sup>1</sup>, Hushairi Zen<sup>1</sup>, Yuji Inoue<sup>2</sup>, Hideyuki Iwata<sup>3</sup>, Yasunori Harada<sup>4</sup>, Azman Osman Lim<sup>5</sup>, Yasuo Tan<sup>5</sup>, Tetsuya Yokotani<sup>6</sup> and Masayuki Koshino<sup>6</sup>

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The team at NTT Learning System Corporation, Tokyo.



Dr Azman Lim (JAIST) introduced the E-Health System to community members in Bario.



Children from SK and SMK Bario learning how to create their own animations using Viscuit, an application for E-Education.

This project used a multifaceted approach to provide efficient technology-enhanced solutions for remote rural communities in Sarawak, Malaysia. Specifically, the objectives of the project are to establish an optical LAN infrastructure for schools and health clinic in Bario; to develop e-education solution which serves as digital learning repository to complement formal teaching and learning experiences of the school community in Bario, Ba'kelalan, Long Lamai and Laraman Island; and to install a sustainable health check system for use by community members in these identified remote rural communities in Sabah and Sarawak. The project began in May 2011 and ended in April 2012. The research products are meant to enhance capabilities of remote rural communities to move forward in the digital knowledge-based economy of the 21st century. The E-Education solution provided tablets for children to use to capture local knowledge and values. The E-Health solution provided opportunity to educate on health issues using ICT-based tools. Community members learned how to create a health check database, which records weight, height and blood pressure levels of those in the local community. In January 2012, the research team went on a trip to Japan to visit key research centres in Tokyo and Kanazawa that are developing technologies for learning. To advance the ideas developed in the research, the team have started planning to replicate the project at Laraman Island (Sabah) and Ba'kelalan (Sarawak), and in Sumatera, Indonesia. It is anticipated that with the experience gained by deploying the proposed ICT solutions in Bario, transfer of knowledge and technology into the other identified remote rural areas can be expedited.

*This project was supported by Asia-Pacific Telecommunity (APT)J3 through UHSB/B-AM2011/81.*



## ICT ADOPTION IN COMMUNITY-BASED TOURISM: THE CHRONICLES FROM BARIO, SARAWAK

*Researchers: : Alvin W. Yeo<sup>1</sup>, Vikneswaran Nair<sup>2</sup>, Narayanan Kulathuramaiyer<sup>1</sup>, Peter Songan<sup>1</sup>, May-Chiun, Lo<sup>1</sup> and Abang Azlan Mohamad<sup>1</sup>*

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Kelabit women using a computer at the telecentre.



Bario Telecentre.



A homestay in Bario.

The eBario project has demonstrated a people-centred approach in providing information and communication technologies (ICTs) to an isolated rural community in Bario, Sarawak, Malaysia. The emergence of ICTs played a key role in alleviating poverty as it has the capacity to generate employment opportunities. It was found from reported research that the financial health and job opportunities of the local residents may depend on local residents' involvement in tourism activities. Community-Based Tourism (CBT), being a subset of the tourism industry, is growing in its importance as it is apparent that the economic growth, socio-cultural development, protection and improvement of both natural and built environment and infrastructure are the significant contributors. Hence, CBT has all elements to be regarded as "responsible tourism", which is tourism that conserves the environment, supports local economies, and empowers local communities. CBT can help the local community in generating income, diversifying the local economy, preserving culture, conserving the environment and providing educational opportunities. For the purpose of this study, the research design was planned in three phases: (i) Participatory Action Research (PAR), (ii) qualitative research approach by interviewing the local communities, and finally (iii) empirical examination was conducted on the tourists. Empirical results have supported the importance of ICTs on attracting more visitors and stressed the vital service quality dimensions as perceived by tourists. The findings illustrated that the implementation of eBario project has successfully assisted a remote community to provide a satisfactory tourism experience and there is a positive relationship between ICT development and tourists arrival in Bario, resulting from the introduction of telecentre and ICT development. The results accentuate the argument that the local communities' support in sustainable tourism development is critical, coupled with ICT as a crucial approach in enhancing the local communities' livelihood. This study underlines that policy implementers need to consider local communities when planning for tourism projects and to understand communities' aspirations in developing tourism. A proper planning and design of the tourism development especially in the rural tourism destination with the involvement of local communities will enhance the positive impact of tourism in the long run. Today, CBT enables a cross-cultural experience as they give the opportunity to travellers to spend time in local communities and learn about their way of life, their environment and their culture. The financial benefits resulting from CBT should equally be shared among the participants whose common goal is their community's development for cultural and heritage preservation. Only then a sustainable model can be achieved.

*This project was supported by Fundamental Research Grant Scheme through 05(30)784/2010(65) and Long Term Research Grant Scheme through JPT.S(BPKI)2000/09/01/015Jld.4(67)).*



## IMPROVING RURAL-URBAN INTERGENERATIONAL RELATIONSHIPS USING ICTS

*Researchers: Ng Choon See, Cheah Wai Shiang and Alvin W. Yeo*

*Institute of Social Informatics and Technological Innovations, Universiti Malaysia Sarawak*

Many youths from the rural communities have migrated to the urban centres in search of better job opportunities. After securing work in the towns or cities, they normally would settle and raise families in the urban areas. In general, the villagers who have stayed behind in the rural areas, are those of the older generation. What has resulted from this rural-urban migration is an intergenerational gap between the grandparents (who live in the village) and grandchildren (who live in the urban areas). In Malaysian Borneo, the grandparents would like to keep in touch with the grandchildren. However, the grandparents and grandchildren who may be from the same ethnic group, appear to be of two different cultures given their environment they were brought up in. The rural (older) community speaks the local tongue, is predominantly illiterate and has little exposure to technology, and the urban (younger) community who speaks either the language used in school or the dominant languages, and is mainly computer literate. This research employs ICTs to mainly bridge the intergenerational gap, which both generations speak the same language and are computer literate. In this case, we are faced with not only the intergenerational gap, but a divide in skills, language, and culture. The only commonality is that they are related – in these communities, the family bonds are strong. This bond is one aspect which our study will focus on, specifically identifying important facets of the communities which would motivate them to employ technology to improve and maintain these relationships. We employ a user-centred approach targeting the two generations. Focus groups and in-depth interviews were used to understand existing practices before the design of intergeneration tool. We believe the findings of this study will assist not only the communities in Malaysia but also that from other countries which share similar cultural background as Malaysia. A tool is being developed to support this intergenerational communication. Given that the older generation is predominantly illiterate, voice messages are being used to allow for the communication. In addition, the User Interfaces are designed to accommodate for this illiteracy.

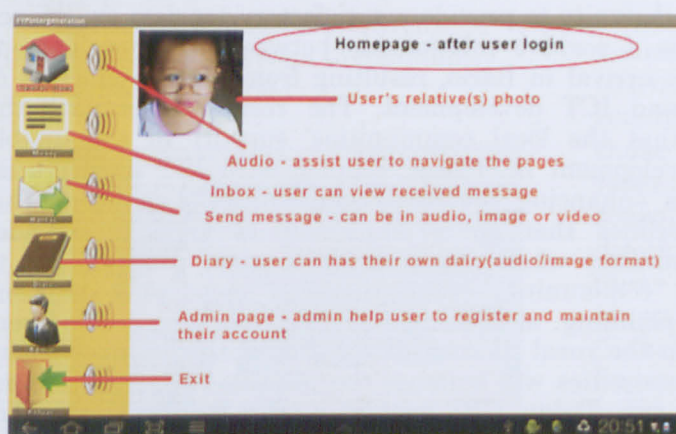


Figure 1: Intergeneration app homepage.

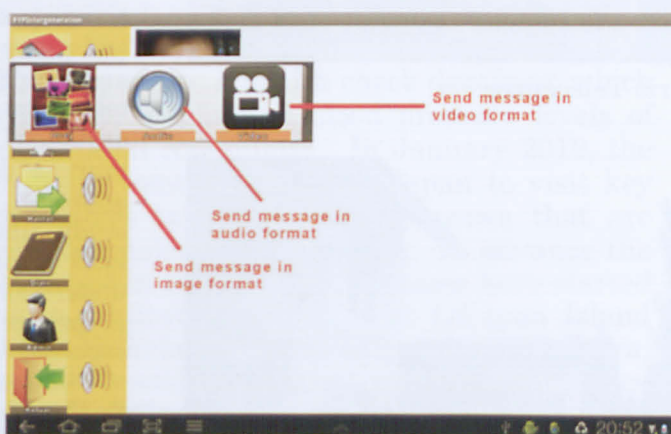


Figure 2: Page for message exchange.



## NEEDS ANALYSIS IN DEVELOPING TELECENTRE AMONG ORANG ASLI IN WEST MALAYSIA

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<sup>5</sup>Ministry of Regional and Rural Development (MRRD)

<sup>6</sup>Department of Orang Asli Development (JAKOA)



The research team conducting focus group discussion and presenting the research findings to the community at Pos Lenjang, Kuala Lipis.

The main objective of the project is to conduct preliminary assessment of actual Information and Communication Technologies (ICT) needs and uses in the communities to be served by these facilities and to provide training to all stakeholders on how to carry out community engagement activities when setting up telecentres for community development. Both activities are considered crucial stepping stones in developing telecentres as an important means to realize Malaysia's national IT policy and strategy, which has high expectations on the impact of IT on every Malaysian citizen's life and livelihood. Related to this is to ensure that these technologies function well and serve the needs of the communities. A holistic approach based on the eBario model was engaged for this study. It involved a multidisciplinary and interdisciplinary team with researchers from different disciplines and fields of expertise working together to understand a complex local context which has many dimensions: economic conditions, social conditions, traditions, access to resources, power structures within the community and the latter's relations to the outside world. Because of that an array of approaches in social sciences were employed: focus group discussions, interviews, community mapping, dialogue, oral life history by authority leaders as well as observations made on the physical and social environment of the target communities. Stakeholders training at all four sites were also conducted to facilitate data collection through surveys and selected local champions were sent to participate in the Third eBario Knowledge Fair community ICT Workshop at the Kelabit Highland to witness and experience existing telecentre development. The project findings indicate that a mediated access to ICTs in the form of community telecentres have a dual function as a technology hub: to bridge the digital divide by providing a practical means to cheap and accessible diverse telecommunications services and programmes for those who are in remote areas. The conventional mode of access whereby households own computers with access to the Internet will not be able to provide widespread delivery of ICT services because it is costly. As such community access through telecentres is relatively cheaper since it enables sharing of expenses (equipment, staff, skills and expertise) among users. In other words, it can cut costs in order to make these services viable in one location; and to provide social, economic and information support to drive economic development (as Rural Transformation Centres) in Orang Asli settlements of rural Kelantan and Pahang.

*This project was supported by Economic Planning Unit (EPU) through SHSB/B-AM2011/34(3).*



## eTORO: TOOLS AND STRATEGIES FOR MANAGING PENANS' INDIGENOUS BOTANICAL KNOWLEDGE

*Researchers: Tariq Zaman, Alvin W. Yeo and Narayanan Kulathuramaiyer  
Institute of Social Informatics and Technological Innovations, Universiti Malaysia Sarawak*



Figure 1: Testing eTORO data collection software.



Figure 2: Designing data collection instruments and analysis.

The formalised storage of indigenous knowledge (IK) is gaining increased currency across the globe. There are many initiatives of using ICT tools for documenting IK that are implemented by various government agencies and non-governmental organisations throughout the world. However, technology and databases alone do not provide adequate management system for IK. Technology and database management should only be seen as supportive elements or mechanisms in a wider system of IK governance that includes the application of customary laws, the institutional authority and structures and collaborative activity mechanism of the community where technology can be embedded. Numerous studies have been conducted to elicit, determine and analyze structures within the indigenous knowledge management systems, which fundamentally differ from technology supported systems. eTORO is a research project of the Centre of Excellence for Rural Informatics, at the Institute of Social Informatics and Technological Innovations (ISITI-CoERI), Universiti Malaysia Sarawak (UNIMAS) in collaboration with the Penan community of Long Lamai, Sarawak. Like other indigenous communities, the rapid change in the Penan's way of life has largely accounted for the loss of their IK. Other significant causes include the reluctance of elders to pass the IK down to the uninitiated youth, and disenchanting youths seeking solutions to their needs from modern science in place of IK. The main objective of the research project is to facilitate the Long Lamai community in preserving and transferring their indigenous botanical knowledge through proper recording and documenting processes. The researchers from ISITI-CoERI have worked with the community to explore specific needs of the community, to design the cultural protocols and ICT tools for managing the indigenous botanical knowledge and data (Figure 1). To clarify the roles and responsibilities of the stakeholders, a process flow diagram for the project has been developed. These diagrams were developed in a manner that is readily understood by community members since they are actively involved in designing the project activities. Local facilitators are actively involved in data instrument design, collection, and analysis (Figure 2). The research argues that information technology professionals need to better understand why and how community manages their indigenous knowledge and then uses this understanding as a basis for technology based IK management system. The methodology that we developed for eTORO project is of value to others who work with IK domain in indigenous communities whose literacy, social, cultural and spiritual logic and values profoundly differ from others.

*This project was supported by UNIMAS Dana Principal Investigator (DPI) through 02(DPI06)/822/2011 (06).*



## INDIGENOUS TECHNOLOGICAL INNOVATION IN MALAYSIA: REDUCING VULNERABILITY AND MARGINALIZATION AMONG MALAYSIA'S INDIGENOUS PEOPLES

*Researchers: Alvin W. Yeo<sup>1</sup>, Roger W. Harris<sup>1</sup>, Tan Chong Eng<sup>1</sup>, Al-Khalid bin Othman<sup>1</sup>,  
Tariq Zaman<sup>1</sup>, Jacey Lynn-Minoi<sup>1</sup> and Mus Chairil Samani<sup>2</sup>*

*<sup>1</sup>Institute of Social Informatics and Technological Innovations, Universiti Malaysia Sarawak*

*<sup>2</sup>Faculty of Social Sciences, Universiti Malaysia Sarawak*



UNIMAS Vice Chancellor Prof. Datuk Dr Khairuddin Abdul Hamid was interviewed on eBario Radio.

The goal of the project is to reduce the vulnerability and social exclusion and diminish the risk of economic marginalization among Malaysia's Indigenous People through Indigenous Technological Innovation. The research project design incorporates three project-wide unifying activities, A Policy Dialogue on Community Radio in Malaysia: Policy and Practice, the eBario Radio and eBario Village Innovation Incubator (eBVII). Community radio stations are emerging in nearly all South East Asian countries. Yet till 2011, there were no policies for community radio in Malaysia. The Policy Dialogue on Community Radio in Malaysia aimed to address this gap, and provided a forum of participatory face-to-face engagement between relevant stakeholders; senior policy makers, policy implementers, political leaders, media practitioners, international development practitioners, researchers and indigenous communities' representatives that ensures policies for community radio are advised and formulated through a process that allow for bottom-up perspective. The objective of the eBario Radio is to significantly diminish the voicelessness of the Indigenous Peoples of Sarawak and to provide them with a tool for addressing social exclusion, promoting community development and regeneration, encouraging cultural and linguistic sustainability. eBario Community radio is a form of low-power small-scale FM broadcasting that is run by and for the community it serves in the Kelabit Highland. The function of eBario Radio is to extend the information services of the e-Bario telecentre into the homes of the residents of the surrounding area. After waiting a year for government permission, Radio Bario began broadcasting in October 2011. Despite recent improvements, a significant proportion of the under-served Indigenous Malaysians are yet to participate in the information society and they are therefore unable to enjoy the fruits of the Nation's emerging knowledge-based economy. In particular, many remote and rural Indigenous communities remain without access to 24-hour electricity supply, the Internet or mainstream media. Lack of reliable supplies of electricity inhibits effective use of ICTs. The eBario Village Innovation Incubator (eBVII) operates as a living laboratory to conceive, implement, test, develop, and commercialise innovations applications of ICTs and renewable sources of energy.

*This research was supported by International Fund for Agricultural Development (iFAD) through L18403 F08 00.*







## REMOTE HEALTH MONITORING SYSTEM FOR RURAL AREAS

*Researchers: Jacey-Lynn Minoi, Alvin W. Yeo, Chin Saw Sian, Siew Siang Ting, Teh Lee Na, Mohamad Raili Suhaili and Kristen FitzGerald  
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Figure 1: A communication device (left) and a BP monitor (right).



Figure 2: The electronic health monitoring H website.

This research presents findings from a remote health monitoring, the challenges faced and the opportunities with emphasis on patients with hypertension in a rural area using a remote blood pressure health monitoring system. The health monitoring system stores and sends blood pressure (BP) data over wireless network to a remote server. Medical doctors can view the data at a regular basis remotely from a website. This community-based participatory research study carried out BP monitoring on eleven residents from a rural village in Sarawak, Malaysia, and did follow-up assessments on the available health care for them. The research methodology included structured questionnaires, observation of the BP monitoring and evaluation of roles of trained non-medical personnels. There is a need to determine the degree to which remote health monitoring interventions can be integrated into telecentres in rural areas to increase awareness in healthy living and wellness. This project is initiated by Maxis and Ericsson Malaysia in partnership with the Institute of Social Informatics and Technological Innovations, Centre of Excellence for Rural Informatics (ISITI-CoERI). The Ericsson Mobile Health (EMH) System is used in this Remote Health Monitoring project. The EMH consists of several components: Patient Units (several medical sensors embedded with bluetooth technology for blood pressure, pulse rate, body weight, oxygen saturation, ECG, spirometry, and a Communication Device), and Back-end System and Applications. We used only the BP monitor (Figure 1) in this case study. Figure 2 illustrates the EMH website for the non-medical personnels and for the medical doctors.

*This research was supported by Ericsson Malaysia through SHSB/B-AM2011/54.*



## ICT IN THE CHANGING LANDSCAPE OF HIGHER EDUCATION IN SOUTH-EAST ASIA

*Researchers: Kian-Sam Hong and Peter Songan*

*Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak*

Although higher education systems of countries in Southeast Asia appear to differ in many ways, many educationists believe that there are common strands within the challenges. Among these common strands are issues of massification, internationalization, diversification, and marketization of higher education. These issues are brought about by political, economic and social changes in the region and also by globalization and the global economic crisis. These issues result in various challenges for the higher education systems in the region such as increase in the number of students and demands for higher education from a broader segment of students, demand for more accessible and affordable higher education, increase in the number and types of higher education providers and concerns for quality, increase in transnational education both as importers and providers, rise in the number of open and distance learning institutions, increase in cross-border academic activities, students, and faculties, the use of entrepreneur and marketing approaches in higher education, enhancement of courses and programs to relate to career needs, and new content, knowledge and skills. As in the developed nations, developing countries in the region increasingly recognize the important role higher education plays in enhancing the human resource of a nation for the country's development in a world of depleting natural resources. Advances and pervasiveness of ICT in the society mean that higher education systems in the region are increasingly leveraging on ICT in handling the many arising challenges faced by higher education systems in Southeast Asia. Some of the possible roles of ICT in higher education in facing these challenges are: *what and how students learn, when and where students learn, who the new faces of students and lecturers are, and ways to reduce the cost of education*. However, research-based knowledge on how ICT has been and can be used to enhance the design, delivery and management of higher education programs in the Southeast Asia region is not readily available. Furthermore, countries in Southeast Asia are at different stages of development in the use of ICT in education. Thus, success stories, experiences and lessons learnt from the use of ICT in higher education will be of immense importance for educators and administrators who are at the forefront of integrating ICT for higher education in countries in the region.



## USING INTERACTIVE COURSEWARE IN SARAWAK LOCAL DIALECTS TO ENHANCE COMPUTER LITERACY TEACHING AMONG RURAL CHILDREN

*Researchers: Syazira Hanis Subri and Syahrul Nizam Junaini*

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



Computer hardware module.



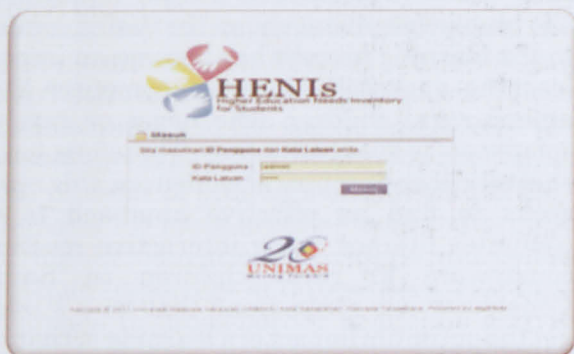
Answer response window.

Current development shows that using computers in the learning process has become an important learning approach. However, computer literacy among rural children who never or rarely use computers is not always easy. Therefore, based on theoretical and empirical evidences, this research seeks to find an effective approach to teach computer literacy using interactive multimedia courseware to rural children in Sarawak. Constructivists recommend that for a student to get the optimum impact of a learning activity, they must be involved in the learning process. In this paper we report the design and development of an interactive courseware to introduce computer literacy among Sarawak rural children. The courseware is designed in Sarawak local Malay dialect and *Bahasa Iban* (Iban language). We believe this is among the first attempt to create a comprehensive computer literacy courseware in local dialects. The courseware contains eight learning modules focusing on various topics related to basic computer literacy. Some of the important modules include computer terms definition, computer hardware introduction and computer ethics. In carrying out the testing and usability evaluation, data was gathered through questionnaires from the students. We involved real students and asked their comments about the courseware. We found that they viewed the courseware as effective and attractive for them to learn more about computer technology. The finding also showed there was a significant level of satisfaction expressed by the students. For example, out of 10 usability heuristics tested, they said that the courseware has good consistency and standard. The evaluation phase also revealed that students were satisfied with the computer literacy knowledge provided by our courseware. They also reported that they can understand the main learning modules presented with the courseware. We believe students can benefit from using our courseware. Furthermore, the proposed courseware promotes an interactive learning process and would appeal to the learners in rural areas as it was developed in their local dialect.



## HIGHER EDUCATION NEEDS INVENTORY FOR STUDENTS (HENIs)

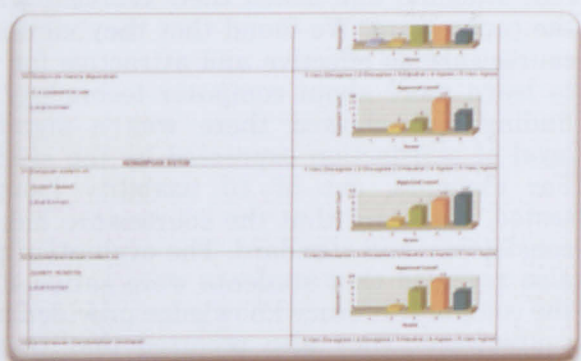
**Researchers:** Mohd Razali Othman, Aina Razlin Mohammad Roose, Sheilla Lim Omar Lim, Siti Norazilah Mohd Said, Mohamad Azhari Abu Bakar, Safi'ee Madian and Muhamad Izzat Shafiq Mohd Razali  
 Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak



Log in page.



Main page of management of student affairs.



Example of result from data analysis by HENIs – real time.

Higher Education Needs Inventory for Students (HENIs) is a feature-rich on-line tool of needs inventory that allows users, who are counselors from Higher Education Institutions, division of Student Affairs, professional helping in the field, and researchers to collect 'first hand' data on students. The main goal of implementing HENIs is to help students achieve as much success as possible while at Higher Education Institutions. Therefore, HENIs addresses students' concerns in eight important areas namely; self, health, spiritual, family, finance, peers, lecturer, as well as the learning environment. Such on-line tool provides immediate intervention services and incorporates practice awareness on students' issues and problems. With the students' real time information on hand, the users get to propose and implement specific solutions and/or interventions that cater to the needs of the students. In addition, students' information and reports on counseling services are strictly confidential whereby each user will only have restricted level of access on the information available on HENIs. For example, the management gets to access the overview and general information, whereas the counselors from Higher Education Institution could only obtain specific data of each student. With the usage of HENIs, student's issues and problems are easily identified due to its specific categorization. Once the student's basic information and questions are answered on-line, users get to access the information and analyze the available data. Consequently, the outcome of the result depends on the specific type of intervention suited to the student's needs, followed by quick referral for intervention purposes.



## AUGMENTED REALITY GOES MOBILE

**Researchers:** Edmund Ng Giap Weng<sup>1</sup>, Lina Lim<sup>1</sup>, Paulynn Chen<sup>1</sup> and Angeline Lee Ling Sing<sup>2</sup>

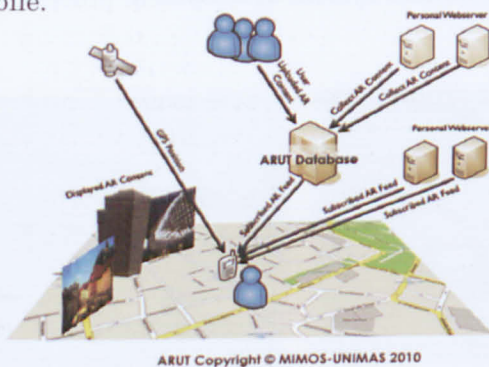
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ARUT Mobile Version 1.0 is a glimpse of the virtual or real future - through the viewfinder of our cell phone's camera! With ARUT Mobile Version 1.0, the team is developing fully-integrated Augmented Reality software for mobile devices. Using modern image processing techniques, 3D contents can be visualized in context within live video as recorded by a cell phone's built-in camera. This technique can be used to display virtual product animations, for example, or a navigational guide that is merged into the user's real-life environment. This technique layers 3D animations over 2D graphics on the cell phone's screen, presents virtual highlights superimposed on actual real-life street imagery, or displays animated objects within a real/virtual game. The ARUT Mobile Version 1.0 client software is the key to a fascinating future for an augmented state of reality.



Augmented reality planetarium character goes mobile.



## MOBILE ARUT ANDROID BROWSER™ VERSION 1.0

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Mobile Augmented Reality Utility Toolkit (ARUT) Android Browser™ Version 1.0 (Mobile ARUT Android Browser™) calculates users' current positions by using the Global Positioning System (GPS), a compass, an accelerometer and accesses the data set to provide geographic information (e.g. longitude and latitude), history, and contact details of points of interest to displays/overlay information about users' surroundings in a mobile camera view. Mobile ARUT Adroid Browser™ overlays the virtual 3-dimensional (3D) image and displays the information about users' surroundings in mobile camera real-time view. With the new version of the browser, users can now easily discover and experience Augmented Reality without the need to enter a search query or open a specific interface. This means that users can instantly see the most interesting content nearby upon launching the browser, effectively turning it into a potent location-based search and discovery service with an augmented reality element attached to it rather than the other way around. This browser taps into the trend of mobile applications that rely less on text input from users, and overlay information on the screen that is more natural to the mobile experience, such as, location awareness and camera-based visual input. Using augmented reality, users could be using their smartphone to glance around the main square of a city they are visiting and get up-to-date information about nearby restaurants, ATMs, real estate offers, and more on-screen, bolted on top of what they should be seeing if they were not looking through the lens.



Mobile ARUT Android Browser™.



## MOBILE AUGMENTED REALITY SOLAT SYSTEM

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Augmented Reality Solat is a convenient small mobile application for Android that shows the direction to the Qibla and also the five daily prayer times for Muslims using Augmented Reality technology. When the application is launched, it will automatically get the location of the device (for outdoor it uses the integrated GPS phone antenna, for indoor it uses WIFI or network provider to generate the coordinates) and open the camera view. When the user looks around using the camera view, he or she will be able to see the Qibla image being superimposed over the real environment thus showing the bearing of the Qibla. If the user requests for the prayer time, based on the location of the device, the time, date and also the position of the sun, the application will automatically calculate the five different prayer times and display it on the screen. Moreover, the application can also show the direction and distance to some of the famous Mosques, restaurants and hotels in Malaysia the same way it shows the direction to the Qibla through Augmented Reality technology. This means users can instantly see the most interesting content nearby upon launching the browser, effectively turning it into a potent location-based search and discovery service with an augmented reality element attached to it rather than the other way around.



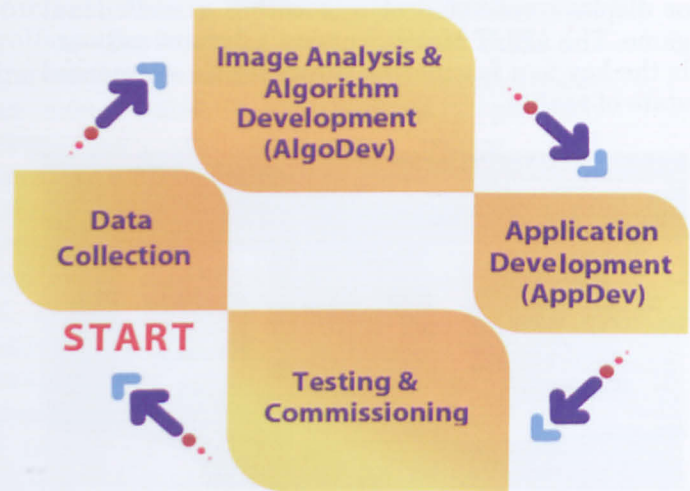
Qibla image being overlaid over the camera view

Augmented reality solat system.

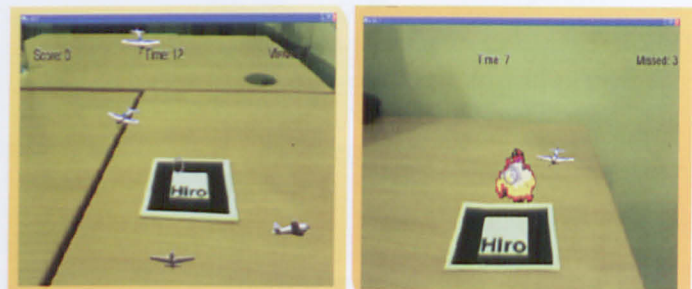
## AUGMENTED REALITY 3D AIRPLANE SHOOTING GAME

**Researchers:** Edmund Ng Giap Weng, Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak

The aim of this project is to build a real time Augmented Reality (AR) Airplane Shooting Game in 3D system. This system is enhanced from 2D system, allowing dedicated stereo-scopic depth views, individualized interaction and also does not hinder social communication. This 3DCoolPlane AR system is to maintain a high quality user experience, thus, fast and precise direct 3D object manipulations in such an environment are needed. Hence, the system introduces new type of automated applications to enhance the effectiveness and attractiveness of the 3D real time environment for the users in the real world scene. This system development and its application shows the concept of implementing shooting games in the real world scene by using AR technology.



Overall AR-builder system development process.



Augmented Reality 3D airplane shooting game.



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