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Special focus on Information & Communication Technology

FOREWORD

With networked computers, new software applications, and many other innovative tools, Information and Communication Technology (ICT) is changing the landscape of social and economic development all over the world. This issue of Research Update gives an unprecedented focus on the various potentials being explored at UNIMAS to maximise ICT in our economic and social development.

Most of the research here explores the application of ICT in our local economy and society. Some of the research is aimed at defining the needs and determine how to make information and communications technology benefits the communities as well as some of the economic activities in the country; various technological innovations are explored to improve the quality of life and work. The idea is to help achieve significant, measurable improvements in people's lives. Research is also conducted to maximise the opportunities ICT could present to some of the economic activities as well as in the control of disease.

There is a strong foundation for the expanded use of these technologies and for them to exert more influence on community and economic development. The important issue here, however, is how best to maximise the potential of both standard and more advanced ICT tools and to improve on their existing functions; and in the process to strengthen their services to the various economics and social activities in the country.

I hope that the some of the projects presented here would invite interest for the exchange of ideas and transfer of technology; or collaborations at the R&D level or product commercialisation.

Prof Dr Peter Songan,
Deputy Vice Chancellor
(Research and Innovation)

CONTENTS

A GENERIC TEXT TO SPEECH SYSTEM FOR INDIGENOUS LANGUAGES IN SARAWAK

A text-to-speech (TTS) system is an application to convert written text into machine generated speech. User will input text into the system and the system will process or analyse the text and then converts the text into speech. This research focuses on building a generic text-to-speech system for indigenous languages in Sarawak. The motivation of this project is to bridge the digital divide within the Sarawak communities via local contents and computer applications. Thus, this system is expected to reduce the digital divide and preserve these languages from extinction with the aid of computer technology. Besides that, the system may be beneficial to the locals with visual impairments or reading disabilities, as well as, people who are interested to learn to speak any local language. Those who are visually impaired will be able to listen to written texts in their local languages in computers. However, there are challenges in conducting this research, such as limited resources for data collection, lack of language experts and obtaining correct pronunciations for each language.

Figure 1 shows the proposed TTS system. The proposed system includes five components and these components are categorized into two categories, which are, language independent and language dependent components.

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Sarah Flora Samson Juan (Leader), Associate Professor Dr Alvin Yeo Wee, Dr Nooralamshah Bolhassan and Lee Jun Choi.

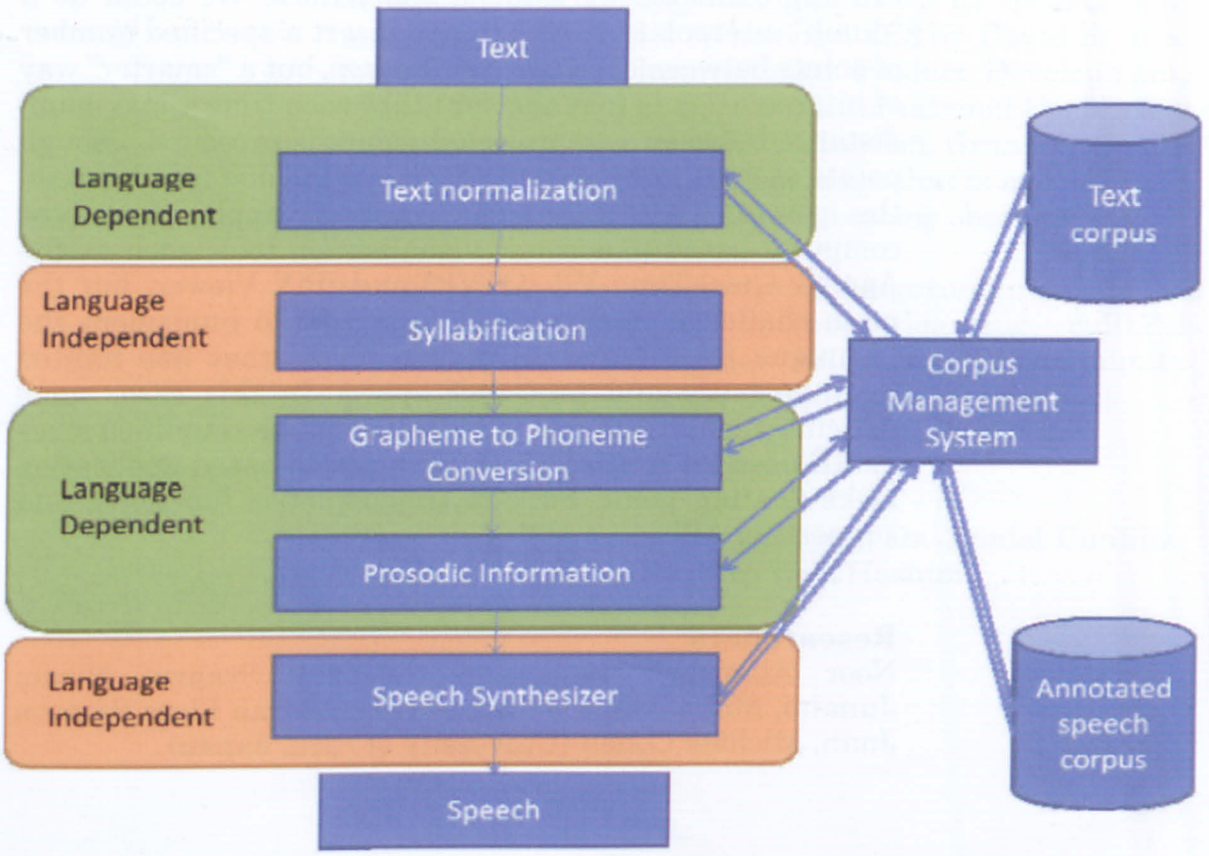

Figure 1: Framework to build the speech synthesizer

IMPROVING A 360 DEGREE PANORAMIC VISUALIZATION TECHNIQUE USED ON STANDARD MOBILE PHONES

A vivid color panoramic image requires a significant amount of memory size. Since a mobile phone has a reasonable-large common memory (storage device), there should be no problem of storage. However, a problem that will be encountered is regarding the process of displaying the image on the phone screen since the phone has very limited main memory (RAM) size as well as processor speed. Only data in main memory can be manipulated, so that every program we wish to execute and every file we wish to access must be copied from the storage device to the main memory. This research explores a unique imaging technique for displaying one rectangular part of a 360 panoramic image on a standard mobile phone screen.

In a cylindrical or spherical projection of a scene, a straight line will not be seen as a straight line, but a curve. This deformation is a direct result of the projecting and the rolling-open of the cylinder or sphere, producing a discourteous representation of a scene. One possible solution is to interpolate the coordinates of the image, in order to decrease the distance between the points so that the curves are approximated by a lot of short lines. We could do a "dumb" interpolation, which is to insert a specified number of points between each two coordinates, but a "smarter" way of interpolation is to make sure that each time a maximum distance between two projected points is exceeded, enough points are put in between to decrease the distance between the points. This technique has been applied on most computer-based panoramic visualisation tools such as the Apple's QuickTime VR (QTVR) and iPiX Viewer, but the main challenge in this research is how to implement the technique for a standard mobile phone that has limited main memory and processor speed. In this case, some difficult calculations and processes must be simplified since J2ME used for writing the mobile phone-based application lacks floating point, built-in trigonometric functions, and supporting APIs.

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PRESERVING CULTURES BY MOBILISING MINORITY LANGUAGES (OF SARAWAK) ONLINE: BUILDING THE CONCEPTUAL FRAMEWORK

The world's linguistic and cultural diversity is under threat. Many minority languages are on the brink of extinction and many minority language communities are further disadvantaged economically and socially. Revitalizing minority languages can bring economic and social benefits as well as cultural benefits. Successfully revitalizing or maintaining minority languages is complex and depends on many factors. One factor which has proven successful in some situations, e.g. Hawaiian (Warschauer, 1998) has been the use of technology. However the appropriate approach that should be followed and the factors that need to be considered are not well understood.One possible approach to preserve these languages (and in turn the culture), is an Information Technology approach; that is, getting the language online, and keeping it online.

This approach is supported by Crystal (2000), who posits: an endangered language will progress if its speakers can make use of electronic technology, and by David Brooks, former Director of International Product Development, Microsoft, who said at the First International Conference on Language Resources and Evaluation, Granada, Spain, (28-30 May 1998), that any language that is not captured in this electronic world will soon become obsolete

In addition to making minority language content available, opportunities exist for language learning, cultural repositories, introducing new skills into the community and raising the prestige of the minority language.

Researchers:
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MULTIMODAL INTEGRATION OF SKETCH AND MELANAU DARO-MATU SPEECH IN SPATIAL QUERIES

Human-to-human communication usually involves more than one modality. For instance, those modalities could be pen gesture, speech, eye gaze, hand gestures, lip movements, face expression, body gestures and so forth. With today's technologies, multimodal interaction is applied to spatial queries, spatial description, brain storming, robot navigation and augmented reality environment. To perform an effective multimodal interaction, it very much depends on the multimodal integration. Multimodal integration, which integrates different modalities, is very important to deliver more precise information. In past research, although English had been chosen to be the speech input, indigenous languages such as Melanau language could apply into the multimodal integration system today. In view of the fact that Melanau language does not have a writing system, multimodal integration of sketch and speech indeed could turn out to be one of the essential ways of preserving this language as many Melanau language tools would be developed along the research.

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MODELLING LEARNING BEHAVIOUR OF BRAILLE LEARNER USING E-DIARY

It is a challenge for visually impaired learners to study the Braille codes where they must have the ability to read the codes efficiently. For reading Braille, the learners must exhibit little hand movement either vertically or horizontally. However, not all novice Braille learners have the same level or ability to learn the Braille when taught at the same time. Some learners may take more time to master just the basic Braille codes. This is due to the different learning styles of each learner.

The aim of this research is to determine the learning behaviour of novice Braille learner. By identifying their learning style and behaviour, the instructor can determine the appropriate teaching strategy and content to the learner. Furthermore, this research hopes to develop a prototype that is able to analyse the time spent and the visually impaired learner accuracy in using Braille.

An important outcome of this research is to increase the learner reading and writing rates other than meeting the learner's different needs in learning Braille.

The main objective is to measure the learner's progress and help determine the appropriate teaching strategy for each learner. This is important because each learner have different learning rate and therefore cannot be taught with the same teaching style for the entire class.

We would also hope to identify the learning error and style of each learner so that we could measure their progress accordingly. We would measure the learner's output with the instructor's sample and other features such as the accuracy and rate of their reading and writing the Braille code.

Through the use of an e-diary, we would be able to keep a log file of both learner and instructor's work activity and evaluate on learner's style and behaviour.

Researchers:
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Supporting grant:
MOSTI 01-01-09-SF0062 (in process)

CONTEXT SPECIFIC SPATIAL ORIENTED SYMBOL RECOGNITION

Imagine if you are in an area, which you have never been before and have appointments within walking distance. As a sighted person, you need to know the current location and a map to guide your navigation within the new area. These needs are also the same for the blind and visually impaired people.

Many research have been conducted to assist navigation for the blind and the visually impaired. One such research area is known as way finding, where it focuses on the way people with varying abilities navigate the built environment. In this research, we aim to investigate the representation between symbols and spatial markers for independent navigation.

The outcome of this research will be a spatial context symbol representation framework that can be used by the sighted, visually impaired and the blind to navigate in an unfamiliar location. Apart from that, a simple and affordable prototype will be demonstrated as a proof of concept. This prototype will also include obstacle avoidance system, which is commonly not integrated as part of mobile navigation systems.

This research will also contribute to other research domains such as universal design, mobile communication technology and usability design for the disable people.

Researchers:
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METHODOLOGIES FOR TRANSLATION INTO MINORITY LANGUAGES: ENGLISH-IBAN

Indigenous Languages in Sarawak are slowly dying out given that English and the Malay Language are given greater emphasis because of its status as international and national language respectively. In addition, with the rural to urban migration of these ethnic groups, many of the younger generation do not speak their own mother tongue. There is concern that these languages are likely to become extinct, and with it, a large component of their culture will disappear.

One of the ways to help revitalise and maintain these indigenous languages is to produce more documents in these languages by performing translation of documents in from widely-spoken languages into these indigenous languages. This research aims to employ one of the MT approaches available in translating English to Iban language. We aim to identify and develop a technique that can be used to conduct translation from English to under resourced languages. Research is also conducted to investigate translation to closely related languages. The approach chosen was Example-Base Machine Translation (EBMT) and the approach that is going to be used in EBMT is the Synchronous Structured String Tree Correspondence (S-SSTC). Besides overcoming the language barriers, with this machine translation approach, more local content can be provided, specifically to the Iban community thus, preserving the language from becoming extinct. It is hoped that through this research, it will be possible to extend the system even further by adding a new target language in the same way as for Iban Language.

This research involves two phases; building the Iban Text Corpus and development of multilingual applications. Currently, the research is still on-going in implementation phase for development of various Natural Language Processing Tools such as Spelling Checker, Part of Speech Tagger and Morphological Analyser for Iban Language, whereas Iban documents are constantly being added into the corpus. This research was made possible through collaboration with Universiti Sains Malaysia, Multimedia University and Tun Jugah Foundation as well as financial support from the Federal Ministry of Science, Technology and Innovation Science Fund Grant Scheme.

Researchers:
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FORMAL VALIDATION OF UML MODELS BY USING VDM++ VIA THE MAPPING APPROACH

This research tries to produce precise, complete and unambiguous software models by producing VDM++ (Vienna Development Method ++) formal specifications from an easy, economic but inadequate UML (Unified Modelling Language) specifications. It is well documented that formal models are difficult and expensive to use, however, they can produce reliable software models. In order to encourage the uses of formal methods in industry, in particular in safety-critical systems, this project is trying to develop an automated software tool, which will enable the manipulation and transformation of insufficient and not precisely UML models to VDM++ models, from which further validation and verification of software models can be carried out via formal proof or model checker. However formal proof and model checker beyond the scope of this project.

This project will contribute to the definition of complete translation rules of UML models to VDM++, and the development of new supporting tool, which will be expected to generate a complete VDM++ formal specification from limited details of UML models. The support tool will be developed using Java, and XML will be used as an internal representation of UML models.

Researchers:
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Supporting grant:
eScience grant (MOSTI) 01-01-09-SF0064

Related publications:

- Edwin Mit, Farid Meziane & Wee Bui Lin, UML Dynamic Model Checker, 3rd Malaysian Software Engineering Conference (MySEC'07), 3-4 Dec 2007, Palace Beach & Spa (MINES), Selangor, Malaysia.
- Edwin Mit and F. Meziane, Generating the Body of Operation of VDM++ from the UML Specifications, Informatics Research Institute Workshop (IRIS'05), University of Salford, 6-7 Jun 2005
- Edwin Mit and F. Meziane, Rules for Generating VDM++ from UML Models, Proceedings of the International Computer System and Information Technology Conference (ICSIT'05), Algiers, Algeria, 19-22 Jul 2005

EFFICIENT ROUTING FOR DATA AGGREGATION IN WIRELES SENSOR NETWORK TO MINIMIZE ENERGY CONSUMPTION

Wireless Sensor Network (WSN) is a network made of many small computers (extremely basic in terms of their interfaces and components), which are employed in the processing of sensor data. Since sensor nodes may generate significant redundant data during communication, similar packets from multiple nodes can be aggregated to reduce the number of transmission. Aggregation is a process of combining several sensor readings (source) in intermediate nodes (sink) along the way towards the requester (destination) to reduce the amount of data to be transmitted in order to conserve energy.

One way to conserve energy in WSNs is by using efficient routing techniques. Routing in WSNs is very challenging due to their natural characteristics, which differentiate them from other wireless networks like mobile ad hoc network or cellular networks. One of the inherent characteristic is the sensor nodes are tightly constrained in terms of energy, processing and storage capacities. Since sensor are densely deployed based on common phenomena, so there is a high probability that this data has some redundancy and this will consume more energy. Thus, there is a need to manage properly data dissemination using efficient routing technique in-network processing in order to reduce the communication event. Indirectly, this will reduce energy consumption in WSNs.

There are many routing algorithms has been proposed in data aggregation to reduce energy consumption in WSNs. For example data-centric based routing such as SPIN and Directed Diffusion can save energy through data negotiation and elimination of redundant data. The hierarchical based routing such as LEACH and PEGASUS can be used to lower energy consumption within a cluster by performing aggregation and fusion.
The main aim of this project is to find ways of energy efficient route setup and reliable relaying of data from the sensor nodes to the sink so that the consumption of energy in WSNs can be minimized. Therefore, this project will study the performance (energy consumption) of different common WSNs routing techniques in data aggregation, then propose an efficient routing protocol with minimal overhead in WSNs.

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MODELLING THE SPREAD OF HFMD IN SARAWAK WITH CLIMATIC DEPENDENT TRANSMISSION COEFFICIENT

A simple deterministic mathematical model to describe the transmission of the Hands, Foot, Mouth Disease (HFMD) in Sarawak has already been formulated from our previous work (Chuo & Labadin, 2008). We constructed a system of nonlinear ordinary differential equations where all the coefficients of each term are assumed to be constant. We have verified our model theoretically and validated it using the actual HFMD cases in Sarawak for the year 2006. In this second phase of our work, an investigation on the transmission coefficient of the disease will be carried out. Transmission coefficient refers to the probability at which the disease may be acquired to a susceptible person from an infectious person. In other words, the rate at which new infections occur is equal to the transmission coefficient multiplied by the product of the number of susceptible and infectious individuals in the population at any one time. The transmission coefficient is disease- and population-specific because it depends on sociological and behavioural factors that influence the rate of contact between members of the population and on biological properties of the organism and host that influence the likelihood that a contact will result in transmission. Our hypothesis is that the biological properties of the organism may be affected by the climatic changes and thus may influence the transmission coefficient. In this project, weather data such as the monthly total rainfall and the monthly mean air temperature will be used for this purpose. Linear regression and correlation techniques will be applied on these data against the actual incidences of the HFMD in Sarawak.

Researchers:
Jane Labadin (Leader), Sarah Flora Samson Juan and Shapiee Abdul Rahman

Publications:
Choo, F. S. T. and Labadin, J. (2008), A Simple Deterministic Model for the Spread of Hand, Foot and Mouth Disease (HFMD) in Sarawak. The 2nd Asia International Conference on Modeling & Simulation, 13th – 15th May, Kuala Lumpur

iPepper: AUTOMATIC INTELLIGENT PEPPER GRADING AND QUALITY ASSURANCE SYSTEM

In Sarawak, processed pepper berries are grouped into white and black pepper berries. The colour and moisture content are among the two attributes that have been used by the Malaysian Pepper Board for grading the quality of the processed pepper berries, where six grades of white pepper berries and five grades of the black pepper berries are used in the current quality grading system. Existing automatic commercial colour sorter for the pepper berries is only for discriminating one grade, which is the best white pepper namely "Creamy white". The other ten grades are done manually in the lab. The manual, time consuming and error-prone pepper grading task can be improved using image processing, machine learning techniques and modeling approach that relates the colour and the moisture content of the pepper berries.

This work discusses the existing quality grading system for the processed pepper berries and proposes an intelligent and automatic pepper grading system to grade the white pepper berries according to its respective group based on the ISO pepper grading standard. In the proposed system, the colour of the processed berries will be evaluated based on image processing, and a modeling approach will be used to relate the measured colour to its moisture content. The end result of this project is a model for an effective and efficient automatic pepper grading. The output of this project can then be extended as a framework for other agricultural products.

Researchers:
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PROVIDING EQUAL ACCESS TO KNOWLEDGE: IPTV FOR REMOTE COMMUNITIES

Malaysia aspires to be a developed nation and a knowledge-based society by the year 2020. In its push to achieve this goal, many initiatives have been implemented by the Malaysian Government to provide access to Information and Communication Technologies (ICTs). These initiatives include not only the roll out of the latest technologies such as WiMax to the urban areas but also deployment of ICTs to the rural and remote hinterland. Special attention has been given by various Ministries, namely the Ministry of Science Technology and Innovation, the Ministry of Energy, Water and Communication, as well as the Ministry of Rural and Regional Development, to the underserved communities (e.g. rural communities) through funding and implementation programmes such as Demonstrator Application Grants Scheme, *Medan Info Desa, Pusat Internet Desa*, and the Universal Service Provision, in bridging the digital divide.

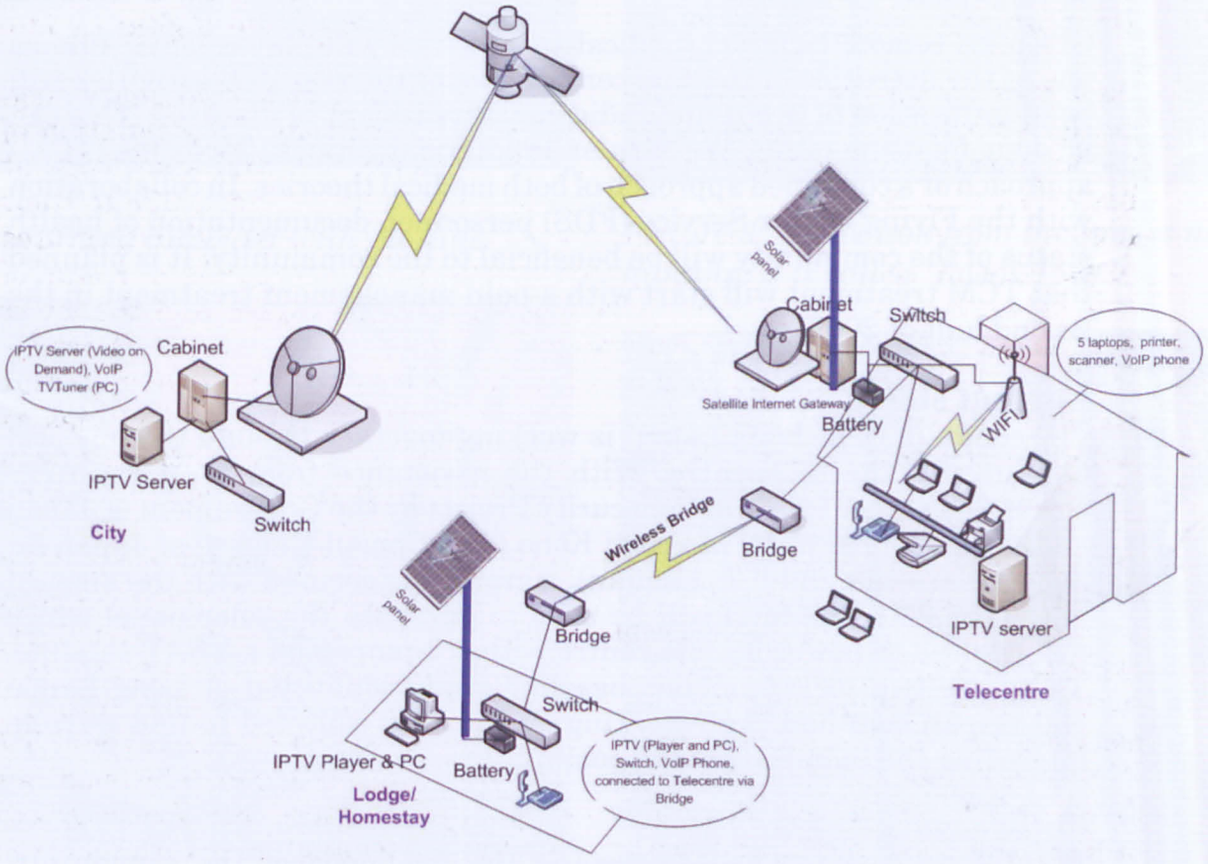
As a result of this push to keep abreast with technologies, challenges such as the knowledge gap have emerged. It would seem that the population of higher socio-economic status is able to gain information and knowledge at higher rate than those of lower socio-economic status, in part, due to their higher literacy, as well as better access to facilities and infrastructures (especially in the urban as compared to the rural areas). As a result of this better access, the gap in knowledge between the higher and the lower socio-economic segment is increasing rather than decreasing (Encyclo, 2009). To address this knowledge gap, those of lower socio-economic status should be provided with the same or similar technologies and facilities as accorded to those of higher socio-economic status. Specifically there is a need for fast Internet access, a need for distance learning, and communication.

A possible solution to address the digital divide and the knowledge gap is IPTV (Internet Protocol Television). IPTV is a system where a digital television service is delivered using Internet Protocol over a network infrastructure, which may also include the delivery by a broadband connection. In urban areas, IPTV is often provided together with Video on Demand in addition to Internet services such as Web access and VoIP. Another consumer service is the IPTV Network Personal Video Recording where real-time broadcast television can be recorded, stored, and accessed later. With IPTV, users can have access to higher bandwidth speed, and also access to VoIP to communicate with relatives and friends from all over the world. With access to broadcast (and or recorded videos), news and updates can be received quickly with ease. These features of IPTV would also allow the communities to use them for distance learning.

The objectives of this project are to investigate the vialibility deploying IPTV in a remote community and to explore the extent to which IPTV can be employed in the social and economic development of a remote community.
To deploy IPTV, the approach taken will adhere to the approach used in eBario, i.e., the people centred/participatory approach.In this approach,

the community is engaged throughout the process of project. To ensure that there is sustainability of the project, the community members are involved in the maintenance of the technologies deployed. They will be involved in the implementation and will be trained on how to maintain the various systems introduced. This ensures that the community can be the first line of trouble-shooters. The implementation will be at two locations, at the telecentre, the information hub of the community, and at potentially two lodges, where access to these lodges will be through the telecentre via wireless bridges.

Please refer to the diagram below. Video on demand (e.g. educational programmes such as training courses) can be accessed by the remote communities via the IPTV server which is either located in the remote site, or in the telecentre. VoIP connectivity allows calls between locations within the site, as well as with the communities outside. As it employs the Internet Protocol, these calls are by and large free. With the IPTV, Internet access is a given. The communities would be able to access the Internet at a higher bandwidth from the telecentre .



At the end of the project, we hope to determine whether it is financially and practically viable to deploy IPTV in a remote community. From the project, we expect that there would be activities that result from the deployment which would improve the socio-economic situation of the community. We anticipate there will be greater usage of computers given the faster bandwidth. In addition, there will be a group of users who are trained to provide technical support on the various systems available.

Lastly, a methodology which implementers can utilise to deploy IPTV in remote areas would be produced. Also, the telecentre and two homestays/lodges will have access to the better Internet access, VoIP and IPTV.

Brief Introduction

Long Lamai is a remote rural community which is located close to the Sarawak-Kalimantan border. To get to Long Lamai, you can take a flight from Miri to Long Banga and from there an hour boat ride will bring to Long Lamai. This Penan community has a population of around 500 people. They are one of the smallest ethnic minorities in Sarawak and are mainly farmers.

Importance of Medical Informatics

In 2008, a pilot research project conducted by UNIMAS' CoERI was started at Long Lamai to build a tele-centre (tobe know as e-Lamai). Using a people-centred/participatory approach of CoERI, ICTs were deployed and it hoped that Long Lamai community was empowered to apply ICTs in improving their income and quality of life. This e-Lamai project involved a multi-disciplinary research team, the community, the Government, private industries and schools.

Given its remote location, medical Informatics will play a major role as one of the activities of the tele-centre. One of the research activities will be identification of herbs and indigenous treatment of diseases. This can be done by using either Western or Traditional Chinese Medicine (TCM) approach or a combined approach of both medical theories. In collaboration with the Flying Doctor Service (FDS) personnel, documentation of health status of the community will be beneficial to the community. It is planned that TCM treatment will start with a pain management treatment in the second half of 2009.

Current status

The community at Long Lamai is working together to build the physical building for the tele-centre. With the assistance from the Grassroots Grant Assistance for Human Security Project by the Government of Japan and His Excellency Mr. Masashi Kono,(the Consul-General of Japan for Sabah, Sarawak and F.T. Labuan), a grant was secured with the amount of RM155,920. The fund will be used to purchase the solar panel which will be used to power its tele-centre with 6 laptops and a VSAT satellite. There are two socio-economic baseline study conducted at Long Lamai and researchers had been working on the data collected to find ways in improving the livelihood of the community.

Future work

Besides gearing towards improving the livelihood of the community, CoERI's mission is to generate, apply and disseminate knowledge that integrates technology through a holistic and multidisciplinary approach for empowering rural communities in a wider social and economic context. We would want to see the community embracing the ICT and use it to gain knowledge so that they can face the challenges of globalization..

Acknowledgements of Grant
Demonstrator's Application Grant Scheme (DAGS) from Ministry of Science, Technology and Innnovation (MOSTI) to replicate five other sites in Malaysia using the e-Bario model. The Grassroots Grant Assistance for Human Security Project by the Government of Japan

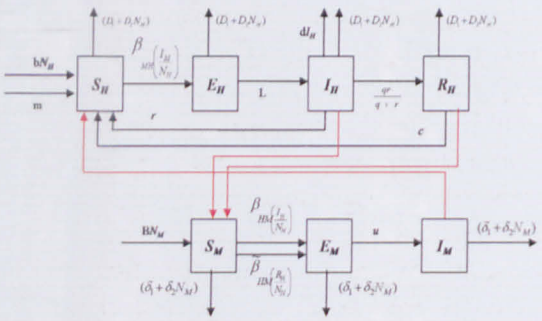
Picture 1: Learning computer with the kids

Picture 2: Some of the skin diseases affecting the kids

Picture 3: The poison from this tree is used for hunting. It is called "Pokok Ipoh"

Picture 4: Ezra's friend explaining the use of "tongkat ali" herb as it is widely grown at Long Lamai

COMPARISON OF SIMULATED MALARIA TRANSMISSION MODEL WITH ACQUIRED IMMUNITY WITH MALARIA CASES IN MALAYSIA



To date, mathematical modeling of the transmission of malaria with regards to Malaysia has never been done before. A mathematical model has been formulated for Malaria incorporating the acquired immunity. The model is first verified by comparing the numerical solutions obtained with the theoretical analysis that is by obtaining equilibrium solutions. Then the mathematical model is validated using the Malaria incidences in Malaysia. The numerical solutions is analyzed via sensitivity analysis so that questions such as "Under what circumstances can the disease be eradicated?"; "If the duration of recovery is shorten, will the spread of malaria heighten or decrease?", can be answered.

Through the simulations, a better understanding of malaria in the country would assist in the implementation of appropriate methods for malaria prevention and control.

Researcher:
Jane Labadin

Supporting grant:
UNIMAS Small Grant Scheme 02(S34)/691/2009(07)

Publications:
Kon, M. L. C. and Labadin, J. (2009), Mathematical Modeling of the Transmission Dynamics of Malaria, To be published in the Proceedings of the Asian Mathematics Conference, 23-26 Jun

AUTOMATED ONTOLOGY INDUCTION AND KNOWLEDGE DISCOVERY FOR THE SEMANTIC WEB

This research is to translate existing knowledge into a base ontology had been developed to represent domain concept that leads to a decision support system. By doing this, users would able to capture and utilize-domain specific knowledge across domains of application. This research consists of 3 basic modules. In the first module, users collect domain specific knowledge and associated documents. The se-automated system is able to characterize the document space from the collected data and generate a base ontology. Furthermore, the system is able to construct an ontological concept mapping based on cognitive modeling. In second module, the quality of the constructed ontology is emphasized. Therefore, a series of methods of concept map validation were studied in order to get the better solution for validating the constructed ontology. On the other hand, concept maps were collected from users from different knowledge levels. Therefore, a series of ontological concept mapping were constructed based on the experts' and novice cognitive modeling. After the concept map passed the quality assurance stage, it is treated as the criterion map. Then, it is used to compare the degree of similarities with the ontology that constructed by the semi automated system. In the third module, an ontology visualizer will be delivered to represent the ontology in graphical format. On the other hand, an intelligent agent to crawl the Web for related documents to populate and refine the ontology and knowledge bases will be delivered.

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ASSISTIVE SOFTWARE DEVELOPMENT METHODOLOGY: A NOVEL APPROACH FOR DESIGNING SOFTWARE FOR THE VISUALLY IMPAIRED

A number of design approaches exist for developing applications for users with impairments. These approaches can broadly be defined by the target user groups and how they aim to enable usability [1]. However, most of these approaches, which are being used for the development for the visually impaired, are methodologies, derived from other methodologies used for the development for the non-visually impaired.

The ultimate goal of this research is to develop a design approach that would be able to give the best inclusive and iterative solution through the implementation of the user-centered design theory to be used in developing the visual impaired computing system. Furthermore, this research also aimed to provide more informed understanding of the context of use, needs and requirements of the visually impaired users. Thus, this will allow the design to be more effective, usable and accessible assistive product. However, the effectiveness of the existing methodologies has to be identified as there a number of methodologies that has been used for the development of the visually impaired products. Hence, there is a need to identify the key phases of the methodology to be considered in developing the design approach. Besides, the participatory design method including the involvement of the end-users wants and needs are also the key factors of this research.

The research will be based on the proposed design approach for the visually impaired (VI) group which is based on the principles of user centered design [1] and inclusion design [2,3] where the visually impaired group is place in the centre of the design process. According to [2], an inclusive design approach results in better products with greater user satisfaction and greater commercial success whilst reducing product development risk. It emphasizes on the iterative process as depicted by the "two-way arrows" because each of the phases seeks user's feedback. This involve four phases: analyse, design, develop and evaluate.

The first phase is the Analysis phase where problem domain and user perceived needs are identified based on the input from the VI group. This phase involves understanding the user where user capabilities such as skills, experience, tasks and environment are being observed and analyzed [1]. Thus, user profile can be determined based on the information collected. Functional requirement specifications are based on the user needs and expectations matched with specified tasks.

The Design phase is where deliverables from the analyse phase serves partly as input. Usability goals and objectives are defined to ensure ease of use of the system

and the suitability of its purpose in an environment where it will be used. The scenarios will be based on the observation and tasks done by the user. An interaction design will be the outcome from this phase.

The development of prototype is suitable because sometimes misunderstandings occur between the designers and the users where users are unable to understand the language of the designers. So, it is recommended to use prototypes such as mockups (three dimensional paper-based representations) or a paper-based outline of the screen of a webpage, or a product [5].

Finally, the Evaluation phase where it involve there are not only quantitative methods but also qualitative evaluation methods such as user behavior; performance and satisfaction can also be done. By conducting walkthroughs specifically for accessibility, the use of personals with disabilities and scenarios that include adaptive strategies to complete the task as mentioned by [4] for our case, we can involve our own VI user from beginning.

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THE USE OF FUZZY CLUSTERING APPROACH FOR CHEMICAL COMPOUND SELECTION

The increasing number of chemical compound that needs to be screened requires the need for compound selection approaches. These approaches is now one of the main techniques in drug discovery, especially in lead identification process. Finding the best method in compound selection is needed for the pharmaceutical industry, to ensure accurate results such as in lead identification process. One of the best and commonly used methods in compound selection is cluster-based selection. However, little focus has been given to overlapping method (such as fuzzy c-mean (FCM) and fuzzy c-varieties (FCV) clustering) in compound selection research. Therefore, this paper focuses on these clustering methods where the effectiveness of the clusters produced with regard to compound selection is analyzed and compared. The analysis shows that the FCM gives the best results compared to FCV in terms of separation between actives and inactives, indicating that FCM has a promising use in compound selection algorithms.

Researchers:
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LINEAR STABILITY OF AXIAL FLOW BETWEEN ECCENTRIC CYLINDERS

Thread injection is a surgical technique that allows the injection of porous medical implants into the body in a minimally invasive way. This injection process has been modeled mathematically from our previous research work. We have confirmed that the discrepancies between experimental and theoretical results reported by other researchers are actually caused by the position of the thread which is slightly offset from the concentric position. In the current project, we extended the work by studying the stability of the fluid flow between the thread which is in eccentric position and the syringe walls.

To formulate the axisymmetric linear disturbance equations, a small axisymmetric travelling-wave disturbance is added to our obtained basic flow. This is substituted into the cylindrical Navier-Stokes equations and then is manipulated so that we will obtain the linear stability equation also known as the Orr-Sommerfeld equation. This equation is a fourth-order nonlinear ordinary differential equation which is solved using the collocation method using Chebyshev polynomials.

Researchers:
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and Andrew Walton (Imperial College, UK)

Supporting grant:
UNIMAS Small Grant Scheme 02(S33)/690/2009(06)

Publications:

Yiiong, S. P. and Labadin, J. (2009), Linear Stability of Axial Flow Between Eccentric Cylinders, To be published in the Proceedings of the Asian Mathematics Conference, 23-26 Jun

Labadin, J., Yiiong, S. P. and Walton, A. G.(2008), *Investigating Axial Flow between Eccentric Cylinders*, Proceedings of the 7th WSEAS International Conference on Applied Computers and Applied Computational Science, Hangzhou, China, 6th-8th April, pg:488-491

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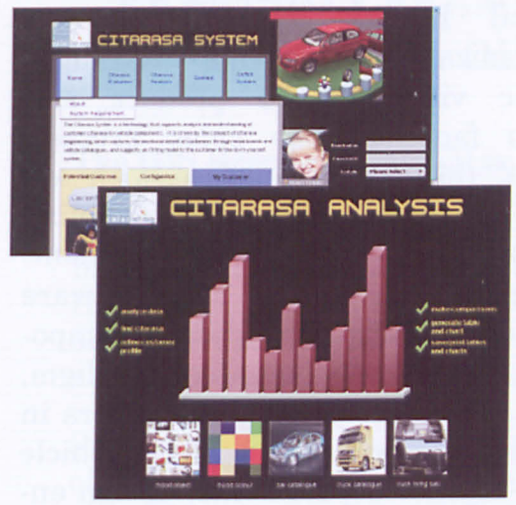
Labadin, J. and Walton, A. G. (2006), "*Modeling of axial flow between eccentric cylinders*". Proc. of the 2nd IMT-GT 2006 Regional Conference on Mathematics, Statistics and Applications. June 13th – 15th , Penang.

MODELLING SYSTEM BEHAVIOUR USING PARSING TECHNIQUE

Software documentations are essential in software development process to provide better comprehension and references to the system particularly during the software maintenance process. Without a proper documentation, software maintenance tasks can become very complex and expensive to perform as the system evolves during the repetitive software development, especially where the design documents have not been updated to reflect the actual code changes. Thus, software maintainers devote most of their efforts trying to understand the flows and the architecture design of the system that they are working on during the maintenance process. In order to solve this problem, reverse engineering tools are created to facilitate maintenance process by reproducing the design model. The aim of reverse engineering is to reproduce the design model from the software itself to offer the programmers high-level presentation of the program, and to ensure consistency in the actual implementation (Systä, 1999). This enables the software maintainer to have a clearer comprehension of the software behaviours and the architecture of the system, especially through the graphical representation models. Sequence diagram is one of the essential UML artefacts that depict the objects interaction in the system and a self-documented communication medium among the software project team members, especially the software developer and designer. Such diagrams capture important aspects of the object interactions, and can be naturally used to define the testing goals that must be achieved during software testing (Rountev et al.2005).

To regenerate a sequence diagram, data extraction is one of the important components of reverse engineering in order to draw out the relevant information of the system behaviour. This research proposes the use of parsing technique approach for data extraction and analysis in an attempt to map the program behaviours that reflect the actual program design and present it vividly via graphical presentation model; namely the sequence diagram. The data extracted from static java source code is converted into a data structure in a tree form before it is analysed to achieve the goal. This work only concentrates on reversing the Java Programming source code into parsed graphical representation and is done on the static source code.

Researchers:
Wee Bui Lin (Leader), Lau Sei Ping, Nurfauza bt Jali



COMPUTERISED AUTOMOTIVE TECHNOLOGY RECONFIGURATION SYSTEM FOR MASS CUSTOMIZATION (CATER)

Although automotive enterprises are becoming more customer-centric to meet today's challenging market demands, only few vehicle manufacturers have set-up mass customization systems that would enable them to better address customer needs and therefore improve their competitive advantage and business. In addition, the automotive industry has become highly networked but is impaired by a lack of improved communication mechanism on products and components in its B2B relationships. The use of ICT is expected to leverage both business and design activities without changing the fundamental goals of the organization. CATER introduces systems and methodologies that go beyond the traditional approaches of automotive OEMs and in which design is driven by cross-cultural and emotional aspects of customer needs. This is enabled through integration of innovative ideas from diverse expertise of both Europe and Asia. Tools that will be develop to reach the objective of enhancing mass customization of vehicles:

i. A semantic notation system, which will be used by the concurrent engineering team to address customers' needs and wants.
ii. A novel engineering methodology, called *citarasa*, which involves elicitation of customer expertise and feeling in vehicle purchase, and mapping these to vehicle design by concurrent engineering team.
iii. A Do-it-Yourself Design (DIYD) system for vehicle design, which will include a customization database structure and functionality with exemplary product data for vehicle configuration and a web user interface for mass customization, to support the customer in vehicle configuration tasks, taking

iv. into account emotional and functional criteria.
iv. A low-cost Virtual Reality interface for ve hicle mass customization, allowing a high-quality stereoscopic view of the product and its components, to facilitate the sales process.
v. A retrieval "module" (MArk) to interface with automotive existing teardown database, enabling
vi. better product benchmark and development.
An inter-linked database structure and software architecture based on the above mentioned components, which will support the N-business paradigm, taking into account the needs of all stakeholders in automotive N-business processes, namely vehicle buyers, sales point, market departments, design engineers, manufacturers, logistic chain, part suppliers.

Researchers:
Wang Yin Chai, Alvin Yeo, Narayanan Kulathuramaiyer, Noor Alamshah Bolhassan, Tan Chong Eng, Johari Abdullah, Edwin Mit, Mohd. Johan Ahmad Khiri, Cheah Wai Shiang, Chiew Kang Leng, Lau Sei Ping, Dayang Nur Fatimah.

Supporting grant:

European Commission Research Grant (About RM17 millions with 13 consortium members)

Related publications:
Lim, P.C., Wang, Y.C. and Narayanan, K. (2007). Middleware Platform for Customizable Vehicle Reconfiguration. IEEE International Conference on Industrial Engineering and Engineering Management, December 2007, Singapore.

THE GIS IMAGE PROCESSING (GIP) METHOD FOR PRECISION FARMING AND DECISION SUPPORT FOR OIL PALM INDUSTRY

The GIS Based Oil Palm Management System aims to assist the management of oil palm plantation via the use of satellite images as well as image content retrieval from the satellite image itself. This mechanisation is able to reduce reliance on manpower in the estate. With the GIS database, this system is able to determine the actual size of the estates and their layout. For example, we can determine whether the hills, rivers or estate roads are within the estate boundaries. Identifying the types of trees grown in a given area is the most crucial information required by the plantation management.

Site survey for planted and unplanted areas is hard to detect on ground hence the use of satellite images and GIS techniques together with award winning tree detection algorithms is a good match for this purpose. Thus, identification of oil palm plantation will be done using satellite images and integrate it into the image processing techniques. In additional, essential GIS information can be made available with just a click of a mouse because of the current development of GIS system. The ease of access will benefit the estates with greater efficiency and effectiveness in oil palm estate management.

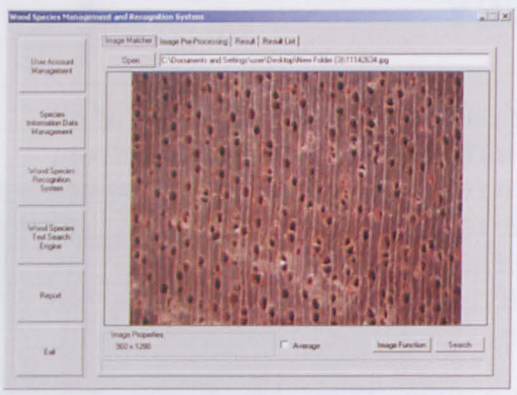
In the current estate development, all the planted areas rely on manpower to survey and investigate the actual size, which are time consuming and costly. This is because the actual planted areas for the participating land are difficult to verify due to the lack of proper and efficient measuring methods of equipments. Furthermore, the lack of qualification manpower is another constraint to provide accurate and efficient data acquisition. Different data acquisition teams may result in repeated work if the surveying works are not planned carefully. The issues mentioned earlier will result in difficulties especially during profit or dividend distribution among & buffering of oil palm tree using the GIS system, the actual planted and unplanted areas for overall estate can be done more accurately and solved the problem of knowing which participating land deserve to get the dividend.

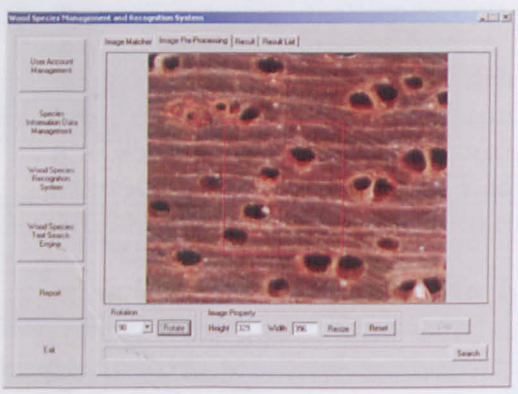
Thus, the GIS based management system is developed in order to provide more efficiency and accuracy in cost budgeting for the upcoming years. Apart from that, it is also to overcome the inaccurate hectare measurement of planted areas and the measurement of the estate size. Such inaccuracy in budgeting estimation will cause a higher loss in overall productivity and future maintenance planning will require a larger resources allocation.

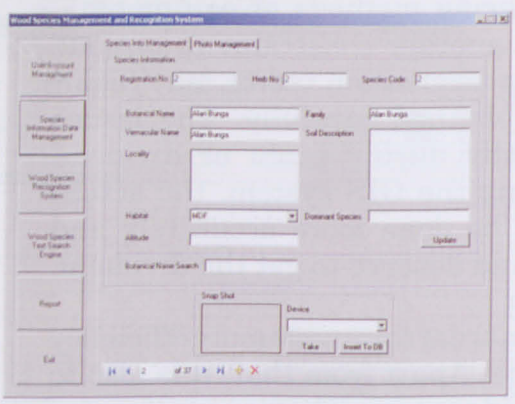
Through GIS based management system, the overall productivity measurement of an estate can be done more accurately. This is because the productivity measurement is related to the ratio of the actual production output according to the size of the estate. Using this inaccurate figure will further affect the result in inaccurate planning. The palm oil density for the planted areas need to be detected and calculated more accurately. ambiguity in confirming the planted areas and total oil palm tree within participating land will result inaccurately oil palm density figure.

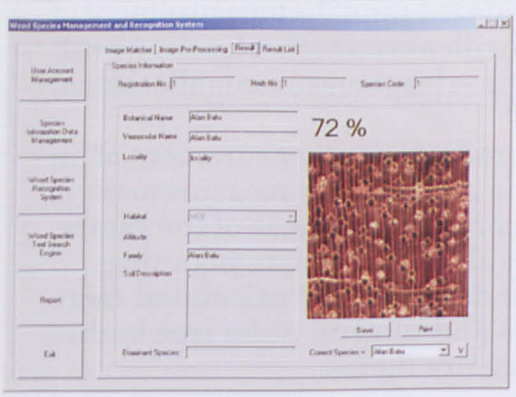
Researchers:
Wang Yin Chai (Leader), Chai Soo See and Tan Chong Eng

WOOD SPECIES MANAGEMENT AND RECOGNITION SYSTEM









Currently, wood species identification process is done manually through a series of analysis in the laboratory and supported by human expertise. Digital microscope and camera are setup in the laboratory as part of the image acquisition process to assist the expert in the identification processes. These processes are time consuming and heavily dependent on the expert proficiency, hence, subject to mistake. Therefore, a system was developed to automate the wood species identification process that aim to improve the overall efficiency by providing mechanism to assist the expert in the identification process and minimize time spend in performing laboratory analysis. The system makes use of low-level features extracted from wood images for indexing, matching and the populating of wood species knowledge base. The Wood Species Management and Recognition System are formed by the following components:

i. Image Feature Extraction and Indexing Module
ii. Data Entry and Text Search Module
iii. Wood Species Recognition Module
iv. Wood Species Knowledge Base
v. Report and Document Generation Module

Researchers:
Wang Yin Chai

Supporting grant:
UNIMAS Fundamental Grant:
2(58)492/2004(229)

Related publications:

Masli, A.B. and Ibrahim, H. (2005). Designing A General Framework of Decision Support System for Knowledge Management in Knowledge World Modeling. International Conference on Knowledge Management 2005, 7-9th July 2005, Kuala Lumpur.

Narayanan, K. and Ibrahim, H. (2004). Knowledge-world modeling for knowledge society. This paper is presented at the International Conference on ICT Businesses 2004.

SECURING EAVESDROPPING VULNERABILITY IN WIRELESS SENSOR NETWORKS

Descriptions

Wireless Sensor Networks (WSN) has been a trend for the past few years, and they involved deploying a large number of small nodes. The nodes then sense environmental changes and report them to other nodes over flexible network architecture. Sensor nodes are great for deployment in hostile environments or over large geographical areas. [1]

Furthermore, WSN is an emerging technology that shows great promise for various futuristic applications namely environmental observation, military monitoring, building monitoring and in healthcare field. The sensing technology combined with processing power and wireless communication makes it lucrative for further exploitation in future. [2]

Due to the inclusion of wireless communication technology incurs various types of security threats on WSN. Currently, there are a few examples of possible attacks on WSNs, such as the attack on availability, where an attacker can easily perform denial of service attacks (DOS attack) on the routing protocol that prevents communication and services; and attack on integrity, where the attacker injects malicious routing information into the network, resulting in routing inconsistencies and attack on authentication when attackers replay of legitimate routing messages to the receiving nodes. When the defender has the liabilities of insecure wireless communication, limited node capabilities, and possible inside threats, the attackers can use powerful laptops with high energy and long range communication to attack the network. Hence, designing a secure routing protocol or architecture is a great challenge in sensor network field.

The area that we are focusing on is the vulnerability of sensor network to eavesdropping threat. It is imperative to secure the transmission of data between nodes within WSN. This is to ensure that the data or messages that are being sent cannot be intercepted, copied, stored or analyzed, and to prevent the eavesdropper form learning the network operation and thus make the data visible to them. By securing the transmission in wireless sensor network we can prevent the information leakage to eavesdropper in order to preserve the confidentiality and integrity of the data.

Our objective is to develop a fundamental security framework that provides security features that are deem crucial to applications in WSNs. The propose framework will provide security in transmitting the data between nodes in order to avoid data interception. Therefore the propose prototype would provide a secure WSN environment that is able to ensure confidentiality, availability, integrity, authentication, authorisation and non repudiation of the data transferring between the communicating nodes. Also, the objective of this research is to investigate the security related issues and challenges in WSN.

Researchers

Noralifah Annuar, Ahmad Hadinata Fauzi, Dr. Tan Chong Eng (Associate Professor), Lau Sei Ping,Mohamad Imran Bandan, Muhammad Asyraf Khairuddin, Nor Surayati Mohd Usop and Rajan Thangaveloo

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