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FOREWORD

ICT has been universally acknowledged as the key tool that can bring about efficient, scalable, affordable and pervasive delivery of goods, services and information flows between people, governments and industries. It is on these grounds that the United Nations established a special ICT Task Force, to address ICT as one of the requisites for accomplishing the Millennium Development Goals.

Increasingly, the deployment and prioritization of ICT as an enabler of economic and social development is becoming part of an integrated development approach within government, business and civil society. Thus, the very first thrust of The National Mission (2006-2020), as unveiled by our Prime Minister on 31 March 2006, focuses on “increasing the value-add of existing economic sectors as well as generating new knowledge-intensive activities and employment in ICT, biotechnology and services”.

In order for ICT to effectively contribute to development goals, infrastructural support, competent human resource and R&D endeavors are imperative. And in the context of National Missions, the role of Malaysian universities in building the human resource capability and generating new knowledge in ICT sector will need to be reemphasized, strengthened and intensified. As for UNIMAS, the capacity and prominence of its ICT education and research will be capitalized to the fullest. Consolidation of strategies will include increasing the student intake (with a higher proportion of post-graduates), expanding partnerships (technology platform) with private-public sectors and through international cooperation, as well as exploring and seizing new opportunities emerging from “ICT-rich” applications and synergies between ICT and other S & T fields.

This volume of Research Update focuses on ICT R&D at UNIMAS. Apart from show-casing the UNIMAS R&D niche in this field, it is hoped that some of the projects presented herein would invite interests for exchange of ideas, transfer of technology, partnership for further studies, or even ventures for product development and commercialization.

Prof Dr Murtedza Mohamed
Deputy Vice Chancellor
(Research & Innovation)

Content

- User authentication in bluetooth using Secure Socket Layer (SSL) ...3
- Customer-centered Design Approach (CCDA) for improving e-commerce website usability ...4
- Building software for Malaysians:
An application of Global-Software Development Lifecycle ...5
- Feature selection for automaed text categorization ...6
- Usability evaluation of e-recruitment website ...7
- Low computational complexity peak reduction scheme for OFDM Based Broadband systems ...8
- Challenges to community informatics to bridging the digital divide ...9
- Development of a Plagiarism System: Finding similarities within document collection ...10
- Application of ICT in tourism to improve livelihood of a rural community ...11
- Modeling of axial flow between eccentric cylinders with particular application to thread injection ...12
- Using grid computing to speed up string-matching algorithm ...13
- Latent Semantic Analysis (LSA) for automated marking computer programs assignment ...14
- When BDI meets argumentation: The Conceptual Ideal ...15
- Decision support System Knowledge World Modeling (By Applying K-World Sarawak) ...16
- Applying Knowledge Management in an academic context:
A case study at the Faculty of IT ...17
- Fourier Transform Method for measurement of nickel plated polished substrate surface texture...18
- Design and fabrication of a solar chimney...19
- Finite Element Analysis on single lap joint...20
- An Intelligent Augmented Reality System: Finger as pointing devices...21
- Factors influencing the use of e-learning as supplementary learning resource ...22
- Analyzing knowledge construction among adult students in a blended e-learning environment ...23
- Developing digital visualization of virtual heritage for Sarawak's Malay Traditional House ...24
- Unmanned underwater search craft ...25
- Video surveillance and monitoring: Tracking participants in laboratories ...26
- A Hybrid Intelligent System for density-based clustering and data mining ...27
- Virtual Reality (VR) for novice car drivers ...28
- Extricating the *web of learning*:
Identifying the characteristics of effective learning environments ...29
- The negotiated intervention strategy: A case study on online lecturer development ...29
- New wine or new bottles – What's new about online teaching? ...30

USER AUTHENTICATION IN BLUETOOTH USING SECURE SOCKET LAYER (SSL)



Bluetooth is a specification for a low-cost, low-power, short-range wireless communication technology that provides wireless connectivity between mobile devices such as cellphones, personal digital assistants (PDA) and portable computers. Not only can it be used as a cable replacement on point-to-point bases but can also form ad-hoc networks in a master-slave formation called Piconets, which allow users to create Personal Area Networks (PAN) between devices. Bluetooth network system is relatively secure, but there are still a number of weaknesses in the standard.

Bluetooth can only authenticate devices and not users. Normally the user does not have to authenticate himself to the device. When devices go missing, unauthorised third parties will thus normally be able to use them immediately.

User authentication is the means by which the device determines the identity of a user. It allows the device to verify that the user is entitled to use the service. In wired application, Secure Socket Layer (SSL) protocol is mostly used to authenticate user especially web servers and browser based applications. It provides a reliable end-to-end service. As an added security measure, SSL can be employed at the application level in Bluetooth protocol.

SSL provides communications privacy through symmetric encryption and integrity through Message Authentication Code (MAC). The successful use of the SSL protocol in the wired Internet has proved its usability and effectiveness. A Bluetooth device that supports SSL protocol can be used for various applications, like electronic transactions, including those which require the exchange of private information like passwords, PINs, or credit card numbers. It can ensure their secure transport through the network, and providing the user with the essential level of confidence and certainty.

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Supporting grant:

UNIMAS Short Term Grant No 493/2004

CUSTOMER-CENTERED DESIGN APPROACH (CCDA) FOR IMPROVING E-COMMERCE WEBSITE USABILITY

The e-commerce website usability also involved online store appearance. Online store product catalogs are the gateway to a company through which customers can obtain product information. This project managed to find key usability factors to improve e-commerce product display. Results of this research are expected to provide a basis for a better design and display of products at the online store. The results recommend improved guidelines for product display on e-commerce website. This study demonstrates that these three factors are vital in the design of e-commerce web sites. It provides an opportunity to maximize customer's satisfaction and may increase customer's retention. We argue that from the user experience point of view the critical success factors of highly usable e-catalogs are not so well understood. Our framework consists of the usability factors such as simplicity, attractiveness, effectiveness, product image, website information, interactivity, navigation, categorization and product details.

The study results indicate that these factors are found to have noticeable impact on the appearance of the online product catalog effectiveness. We developed an evaluation model and applied it in our testing. We found that while there are large potential benefits of this framework, there are also crucial issues that need to be addressed such as the suitability of the framework on different product type. We believe that the proposed model satisfies the requirements and challenges related to assessment of online store catalogs effectiveness.

The results suggest that e-commerce website can use our findings in the process of designing product display to achieve their goal to persuade customers to buy online. This study also offers contributions to existing research, particularly regarding aesthetics, attractiveness and interactivity, in several ways. It offers an empirical assessment on the relationship between aesthetics, attractiveness and interactivity of product display design. This study highlighted areas that will improve site quality through those feature, thus improving usability of the e-commerce website. Users are looking forward to see the most realistic view of the product and to attract user to browse the online catalog.

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Supporting Grant:

UNIMAS Fundamental Research Grant 357/2002(94).

BUILDING SOFTWARE FOR MALAYSIANS: AN APPLICATION OF GLOBAL-SOFTWARE DEVELOPMENT LIFECYCLE



Software system is developed and evolves according to certain phases known as the Software Development Life Cycle (SDLC). However, most of the software available today is developed by Western countries and is tailored to their needs and may not be suitable for adoption by other countries. With the diversity of ethnic groups, each with their own culture and language, Asian countries or specifically Malaysia must be able to either develop or customize aspects of software system to utilize the software and to reap the benefits that come with adopting such Information and Communication Technologies (ICTs).

The Global-SDLC provides the basis for customizing software system to suit the needs of the local community, culturally. Customizing software system by incorporating local language helps local people in learning, using and utilizing software system that play an important role in the adoption of ICTs. This also reduces the digital divide between urban and rural communities, in that the rural communities are able to access and use ICTs similar to those available to their urban counterparts.

The global-SDLC has been applied successfully in garnering software in two languages, Kelabit and Kayan. In the customizing/development phase of the word processor (AbiWord), numerous lessons were learnt. However, the key to success of providing software to rural communities again will depend on the availability of trained personnel. The Kayan software, which was tested by native Kayan speakers, showed that localization of software to minority language could be accomplished. Results indicate that the users have similar problems as per users of software which were previously not available in their language of choice.

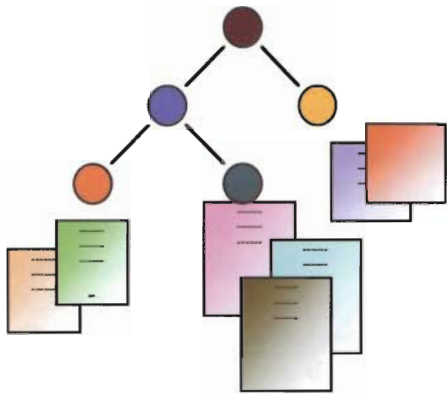
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Supporting grant:

UNIMAS Fundamental Grant: 02(01)/277/2002(15)

FEATURE SELECTION FOR AUTOMATED TEXT CATEGORIZATION



As the growth of the information technology, the booming production of the electronic documents has indicated the important of documents understanding. Text categorization have largely focused on filtering and routing content, which is the next wave of solutions aims to help users find what's relevant by classifying or categorizing content. The most prominent application of this area example can be discerned through spam filtering in any email agents. In it, there are basically three tasks: preprocessing, feature selection and classification. The purpose of feature selection is used for the purposes of dimensionality reduction by selecting significant and meaningful terms or feature from text, in order to supply to machine learning scheme to build classification models. Hence the objectives of the study include:

- (1) applying probabilistic reasoning techniques using Naïve Bayes and Support Vector Machine, or other pattern-matching technologies to extract ideas with in the text
- (2) extracting the significant feature with less computational intensive approaches to construct the document category structure

The expected output of the project would include a good working prototype for classifying text to predefined categories with acceptable accuracy.

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Supporting Grant:

UNIMAS Fundamental Research Grant 02(24)/355/2002/(92)

USABILITY EVALUATION OF E-RECRUITMENT WEBSITE

Evaluation Criteria	Usability Indicators	Description
Navigation	Use of hyperlinks	All hyperlink are working
	Length of pages	Keep the contents short
	Search Engine	No guideline for searching
	Indication of user's location	Use of Breadcrumbs (Bowler, 2001)
Page Layout	Use of colours	Use not more than four colours per page
	Use of images	Use not more than 3 images per page
	Consistency	Location of information, menu and hyperlink in the same area each time a new page is accessed
	Attractiveness	The appearance of the images should match with the user's needs and design feature that they expect

Table-1: Criteria of Usability Indicators

E-Recruitment is defined as “the utilisation of the Internet for candidate sourcing, selection, communication and management throughout the recruitment process” (Olivier, 2001). A tremendous growth of internet users has led to an adoption of e-recruitment from small to large organizations across the world. The research by Bussler & Davis (2001-2002) has found that a good e-recruiting system can reduce the hiring time by two-thirds and lower costs by 90%. This finding is significant due to the fact that e-recruitment is more cost effective than traditional recruitment. In this research we will focus on “The Sarawak Government Online Job Application System” (www.e-recruitment.gov.my), to create a guideline for usable e-recruitment website. The usability factors such as navigation and page layout are the major focus in this paper shown in the table-1. As mentioned by Nielsen, Jakob, navigation facilitates the movement from one page to another. The navigation involves a variety of features such as the operation and position of hyperlinks, the length pages, and the effectiveness of the search engine.

Research has shown that people resist to read a lot of text from computer screen (Nielsen., Jakob., 2000). To improve user movement on the website, it is better if they can facilitate users by adding breadcrumb trails instead of using a menu or button such as back button. For further improvement, we suggest that for the page layout criteria, they should reconsider the colours, images, and attractiveness of the website. By referring to table-1, use of colour must be four or less and images should not be more than three images. Too many colours will cause confusion for the web user and use of appropriate images will lead to website attractiveness.

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Supporting grant:

UNIMAS Fundamental Research Grant 2(62)/496/2004(233)

LOW COMPUTATIONAL COMPLEXITY PEAK REDUCTION SCHEME FOR OFDM BASED BROADBAND SYSTEMS

The rapid growth in Internet access and multimedia applications have created a demand for high speed networks particularly wireless networks that give the freedom of mobility. The throughput of the wireless LANs has been increased from the initial 1 or 2 Mega bit per second (Mbps) to 11 Mbps (IEEE 802.11b) and now a 54Mbps of transfer rate has been achieved (IEEE 802.11a/g) using the multi-carrier broadband technology. High speed wireless access comes with a price where more sophisticated algorithms are required to combat the impairment of the wireless channel and a higher speed of digital signal processor (DSP) is also required to execute these algorithms effectively. In recent years, many researches have been conducted in proposing more efficient and less computational complexity algorithms to reduce the overall cost of wireless system implementations.

We proposed to use a Genetic Algorithm (GA) to reduce the computational complexity incurred by using the Peak Reduction Carriers (PRCs) which has been proven to be effective. The major drive for research for this project will be to tailor a more efficient algorithm to further ease the high PAPR problem in OFDM based broadband systems. Owing to the mentioned problems, there is a need to tailor a more efficient algorithm specifically for PRCs to meet the requirements of future higher throughput OFDM based systems. Note that higher throughput requires more carriers which incur higher computational complexity in PAPR reduction. The challenge is now focused on how to further optimize and improve the peak reduction algorithm based on many of the other NP-hard solutions such as Simulated Annealing, Tabu Search, Queen-Bee approach to GA and etc. in adapting the amount of data to be sent to the wireless links available to the transmitting wireless terminal. Simulated Annealing and Queen-Bee approach to GA will be the main focus of this research.

Researchers:

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Supporting Grant:

Unimas Fundamental Research Grant 02(64)/502/2005(01)

CHALLENGES TO COMMUNITY INFORMATICS TO BRIDGING THE DIGITAL DIVIDE



Community informatics refers to the use of information and communication technologies (ICTs) for community practice, encompassing concepts of community development, community service delivery and community action. It is the application of ICTs to overcome the “digital divide” both within and among communities. This research investigates how community informatics can help to overcome the digital divide between rural and urban communities in developing countries, such as, Malaysia. The eBario Project, a research initiative undertaken by a group of researchers from Universiti Malaysia Sarawak (UNIMAS) provides a context to demonstrate how ICTs can provide opportunities for remote and rural communities to develop socially, culturally, and economically. The results of the initiative show the many ways in which ICTs can be used to improve the lives of the marginalized groups. However, other than the opportunities that the initiative provides, there are also many challenges that are encountered along the way. These challenges, based on the eBario experience are the major focus of this research.



Researchers:

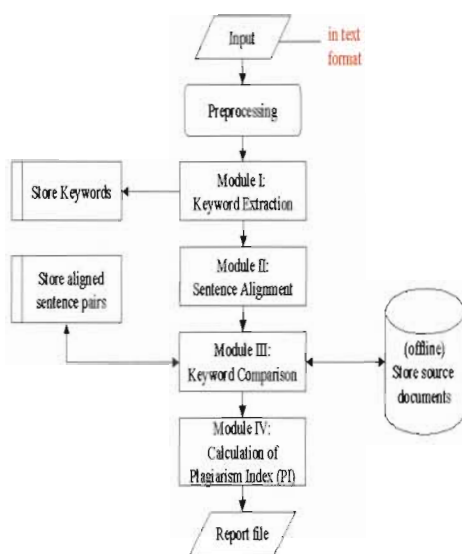
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Supporting Grant:

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DEVELOPMENT OF A PLAGIARISM SYSTEM: FINDING SIMILARITIES WITHIN DOCUMENT COLLECTION



Students in institutions of higher learning refer to various sources of information medium in doing their assignments. More often than not, these sources are copied directly or paraphrase without proper citation. According to the Writing Tutorial Services, Indiana University, this act is considered plagiarism and no credit will be given to the writer. This research comes to light due to the growth of plagiarism among students in higher learning institutions.

There are many techniques we can utilize to detect plagiarism. One of them is text analysis which has been an area of interest in research for the past decade. Paraphrasing in particular, has been singled out as a link between two documents that may appear similar in content yet different in expression. The problem lies in the ability to distinguish how similar these two documents may be.

Although there existing methods to detect paraphrases, most methods are complex in nature and use advanced technology like Artificial Neural Network (ANNs). Thus, this research is proposed to generate a simple yet effective method using common programming concept to detect similar sentence structure within a document collection. We are also proposed semantic similarity model to detect plagiarized document. Semantic similarity model is a kind of relatedness between two words that define resemblance. WordNet is used as a basis to measure semantic similarity between any two documents in the corpus. Word similarities derived from WordNet are evaluated and used to calculate plagiarism index (PI).

Researchers:

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Supporting grant:

UNIMAS Short Term Grant No 02(29)/360/2002(97)

APPLICATION OF ICT IN TOURISM TO IMPROVE LIVELIHOOD OF A RURAL COMMUNITY



A tourism website, as a part of eBario project, is developed to promote Bario as a culture, adventure and nature tourist destination for local and international visitors. It is believed that the residents of Bario will benefit from eTourism. Tourists coming to Bario will mean income for those involved in the tourist industry such as lodge owners, tour guides, food stall operators, and shop owners. With more tourists arriving, it is hoped that the livelihood of the community would be improved. To draw more tourists to Bario, from all over the world, the website would provide information about the people, its history, culture, fascinating tourist spots and other attractions. There is also information on how to reach Bario, as well as the flight schedules and travel tips. In addition, maps of Bario and surrounding villages are also included. The map features will distinguish itself from other tourism website. Tourist will be able to locate the place or landmark from the map. Tourist can also determine the availability of accommodation by contacting the lodge owners directly via email. Thus, the lodge owners will be more prepared for the correct number of tourists staying with them. Interactive maps of eBario website, built in Scalable Vector Graphics (SVG), a new language for Web graphics from the World Wide Web Consortium (W3C), the images are stored in a format that results in very small file sizes, about 3 to 4 kb. These small files translate to faster download times for the users. A user-centred approach was employed in the development of the website. This participatory approach, involving the community, is in line with the Participatory Action Research model adopted by the eBario project. The web based system development life cycle is employed, which encompasses issues such as web page design, framework and content development. The web-based system development lifecycle consists of seven major phases; definition, requirements gathering, requirements specification, design, development, testing and evaluation. Functional testing, usability testing and user satisfaction test were also carried out for evaluation. Requirements gathering and requirements analysis are done using the introspection and interview technique. Interviews were carried out, in collaboration with the Bario community to comprehend the features and functions provided by the tourism website.

Researchers:

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Supporting Grant:

UNIMAS Fundamental Research Grant 21/32/381/2003(118)

MODELING OF AXIAL FLOW BETWEEN ECCENTRIC CYLINDERS WITH PARTICULAR APPLICATION TO THREAD INJECTION

The injection of fluid into a body by using a needle or syringe is an application of fluid dynamics. As most of the fluid flow is transparent and the actual fluid motion is not readily apparent to the human eye, thus the modeling of injection of the fluid into the body is important. Through modeling the problem, a better understanding of the fluid flow characteristics in a syringe can be obtained by looking at the actual flow patterns. The design of the syringe can then be optimized in order to ensure that the injection can be carried out more efficiently and the pain caused to the patient can be minimized. Surgeons do not only inject fluid into the body but also chemical thread. The applications of chemical thread injection are in lip augmentation found in most plastic surgery procedures. Thread injection is a surgical technique that allows the injection of porous medical implants into the body in a minimally invasive way. This project presents a mathematical modeling of the problem.

The problem was modeled using the three-dimensional steady state Navier-Stokes equations in cylindrical form. The work has been compared to that of Walton (2003) where the difference between his work and ours is that, instead of considering the axial flow between concentric cylinders, we consider the thread to be in the eccentric position, then we supposed that the center of the thread is now at position $y = 0, z = \varepsilon$ where y and z are coordinates of the cross-section of the pipe. Then the boundary of the thread is described by $r = \delta + \varepsilon \cos \theta$ and $\varepsilon \ll \delta$ where δ is the radius of the thread and ε controls the eccentricity of the thread position. We will consider a parallel basic flow which means that the streamwise velocity u is independent of x so that the vertical and spanwise velocities can be taken to be zero i.e. $v=w=0$. This means that the streamwise velocity can now be written as

$$U = u_0(r) + \varepsilon \cos \theta u_1(r) + \dots$$

The velocity expansion is substituted into the Navier-Stokes equations which is then reduced to two ordinary differential equations for $u_0(r)$ and $u_1(r)$. These unknown functions are easily solved by applying the boundary conditions, which are $U=0$ on $r=1$ and $U=V$ on $r = \delta + \varepsilon \cos \theta$. After the manipulation of the algebra, the equation of the modified basic flow is obtained. It was found that the expression for the mean velocity becomes complicated when the effect of eccentricity is included. The basic flow obtained shows significant difference with that of the concentric case.

Researchers:

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Supporting Grant:

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USING GRID COMPUTING TO SPEED UP STRING-MATCHING ALGORITHM

The grid is a flexible, secure, coordinated resource sharing among dynamic collections of individuals, institutions, and resources which can be referred to as “virtual organizations”. The “Grid” is an emerging platform to support coordinated resource sharing and problem solving on a global scale for data-intensive and compute-intensive applications.

Looking at the emerging fields of biotechnology and life sciences in Malaysia, most of the time one of the requirement is to have sufficient computing power to perform calculations, run simulations as well as store, analyze and search for data. Grid computing presented itself as one of the solution to this requirement.

This research concentrate on investigating how grid computing system can improve the processing time of string matching algorithm which has many applications in wide area of research such as life sciences and data mining. This research also looks at the problem of partitioning the data (how to break the data into smaller chunks) and also the effect of grid computing to different string matching algorithm.

A small scale setup of one master node and two slave node has been successfully setup using Globus Grid Management software and testing has been conducted using brute force string matching algorithm. Initial finding shows that there is a minimal increase in time improvement with regards to performing string matching algorithm using Reuters dataset consisting of 20,000 articles (which has been pre-processed). It is suspected that more nodes needs to be added and fine tuning of data partitioning also need to be done before expected improvement can be achieved.

One of the main hurdles is to get sufficient machine (computers) to be set up as client/slave since the faculty is facing shortage of computers available for this purpose. Current plan is to add more clients and fine tune the data partitioning. This will be done during semester break where the computers will be available without affecting the teaching and learning activities in the faculty.

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Supporting grant:

UNIMAS Short Term Grant: 02(44)/432/2004(169)

LATENT SEMANTIC ANALYSIS (LSA) FOR AUTOMATED MARKING COMPUTER PROGRAMS ASSIGNMENT

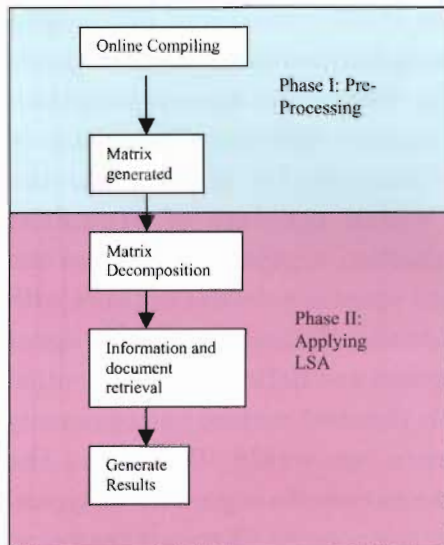


Figure 1: Proposed design of automated marking computer program assignments using Latent Semantic Analysis (LSA).

The aim of this study is to propose a design of automated marking computer program assignments using Latent Semantic Analysis (LSA). For many years researchers have done in-depth study in accessing the quality of free text questions especially essays. There are many approaches suggested by researchers regarding essay assessment since assessing students' writing is extremely labour intensive and time consuming. Some of the approaches are Project Essay Grade (PEG), E-rater, Intelligent Essay Assessor and LSA-based measurement.

LSA is chosen over the other approaches because of its ability to make absolute relative comparisons, where set of documents can be compared to each other, or to an answer schema by expert domains. This is a good criterion in building the model for assessing the computer program. Another strong reason to choose LSA is the computer programs written in high-level language producing programs in a subset of English like words, quite similar to an essay. However, the structure and logic in computer programs are different from an essay. Therefore, there is a need to design an approach using LSA to assess computer programs.

Latent Semantic Analysis (LSA) is a statistical corpus-based natural language processing technique that infers meaning from documents. It supports semantic similarity measurement between texts. By giving a set of documents in a domain, LSA uses the frequency of occurrence of each word in each document to construct a word-document co-occurrence matrix.

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Supporting grant:

UNIMAS Short Term Grant No 461/2004

WHEN BDI MEETS ARGUMENTATION: THE CONCEPTUAL IDEAL

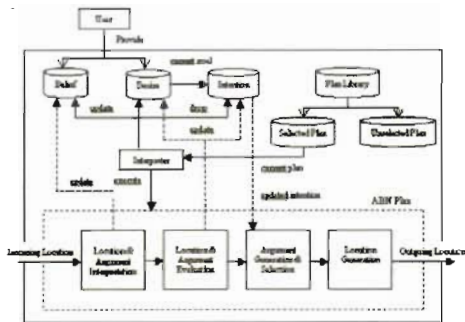


Figure 1: The logical view of integration framework

```

*****
ABN Plan(
  loc_IN = receive(incoming location);
  content = interpret(loc);
  argument = interpret(loc);
  B = update(content, argument);

  evaluate(content, argument);
  D = reconsider(B, I);
  I = change(B, D);

  generate(counter-arguments);
  select(counter-argument);
  loc_OUT = generates(counter-argument);
}

```

Figure 2: Partial Algorithm of the Integration

Argument-based negotiation (ABN) consists of meaningful expression, with more reasoning features and flexibility. Agents in this case are aware of the information surrounding them and attempt to analyze, influence and understand its opponents. The agents must behave intelligently to facilitate the argumentation process, which consists of argument interpretation, argument evaluation, argument generation and argument selection. Intelligent agent is a piece of software with the capability to think rationally. Various intelligent agent architectures have been proposed and Belief, Desire, Intention (BDI) architecture is probably the most mature and commonly adapted architecture. Hence, we would like to see the relationship between these two models. We argued that a typical intelligent model involves two components. There are reasoning and communication components. However, the integration between these components is still unclear. This project involves activities like integration among the ABN and BDI model into plan library. It includes the designing model and algorithm of the integration. Other than that, it had involved the implementation based on the integration framework. The logical view of the integration framework and the algorithm of the integration is shown in Figure 1 and Figure 2. The project involved the implementation of a prototype system that captures the scenario for a group of agents that hosted the sell and purchase activities over the Internet. The prototype system was implemented using the Java Agent Development Framework (JADE) software agent toolkit.

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Supporting Grant:

UNIMAS Fundamental Research Grant 2(57)/491/2004(228)

DECISION SUPPORT SYSTEM KNOWLEDGE WORLD MODELING (BY APPLYING K-WORLD SARAWAK)

Malaysia is scheduled to develop into a knowledge society. The knowledge society would mean that communities living throughout the country would have a broad and open global mindset with access to the latest information and living harmoniously with other communities worldwide and at the same time the ethical values are still upheld. Knowledge society or knowledge world has many potential benefits and becomes instrumental for nations that aspire to become a developed nation. Recognising the critical need to become a knowledge society, many programs and activities have been organised to move the country towards the direction. In order to do so, the capability to assess on where we are or how ready we are to become a knowledge society is a vital starting point. Therefore, the process to access how far we are towards knowledge society needs much effort to be put in. Many factors need to be considered, involving many indicators and there is also a need for collaboration of knowledge from multiple sources. The aim of this project is to provide a generic knowledge world, which provides an environment and a set tool for rapid prototyping of the knowledge world. Hence, the objectives of the project include:

1. To discover the concept mapping that will be mapped to the indicators of knowledge world
2. To design the DSS which incorporating some functionalities of knowledge management system for managing the diverse knowledge
3. To develop the database model, which will integrate heterogeneous sources of data
4. To develop a prototype using automated and semi-automated knowledge acquisition tools, that allows the rapid development of a customized knowledge-world model for a particular domain/entity

A decision support system knowledge world modeling will be developed where users can customize according to their preferences or needs. The system helps to determine whether a society is doing well, catching up or far behind the others.

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Supporting grant:

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

APPLYING KNOWLEDGE MANAGEMENT IN AN ACADEMIC CONTEXT: A CASE STUDY AT THE FACULTY OF IT



Knowledge Management (KM) is a systematic process of finding, selecting, organizing and presenting information in a way that enables an organisation manage and use its knowledge effectively. There are numerous benefits associated with KM such as better communication effectiveness, better sharing of knowledge to improve operational performance and which in turn improves its decision-making and productivity. In addition, it allows organisations to be flexible and responsive towards changing market conditions. In general, most of the KM practices have been applied in most business organisations. As Kidwell et al. (2000) noted, the applications of KM in colleges and universities are still few and far between. Therefore, Kidwell et al. (2000) believes that there is a need to apply KM in academic institutions, and they suggest ways of “applying corporate KM practices in institutions of higher learning”. The project applies KM approaches to an academic setting and determines if these approaches can be employed in such a setting. A KM framework or model for the academic context, in particular in the context of a Malaysian Public University, is sought. This KM approach was employed at the Faculty of Computer Science and Information Technology (FCSIT), UNIMAS, an example of an academic faculty. In this context, KM can benefit FCSIT in five areas: research, curriculum development, administrative services, teaching and staff development (as per identified in Kidwell et.al. (2000)). In order to determine whether KM practices can be applied in the academic context, KM practices were applied using the Intranet as the vehicle of change. The research has five phases; Phase I (Initiation), Phase II (Requirement Analysis), Phase III (Design), Phase IV (Implementation) and Phase V (Post-Implementation). A survey had been carried out to identify information needs of the faculty, the availability and accessibility of information and how effective the Intranet is accepted by the faculty members.

Researchers:

Alvin Yeo Wee, Dayang Hanani binti Abang Ibrahim, Eaquerzilla Phang, Inson Din (UNIMAS)

Supporting grant:

UNIMAS Fundamental Grant: 02(19)350/2002(87)

FOURIER TRANSFORM METHOD FOR MEASUREMENT OF NICKEL PLATED POLISHED SUBSTRATE SURFACE TEXTURE

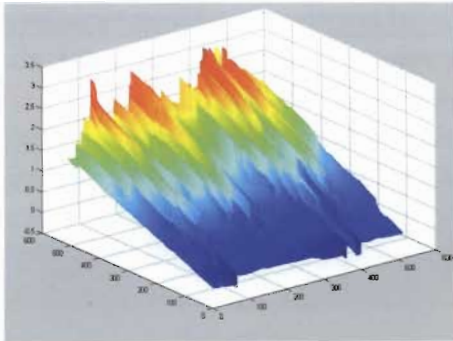


Figure 1: Wrapped phase map showing the 2π phase jump

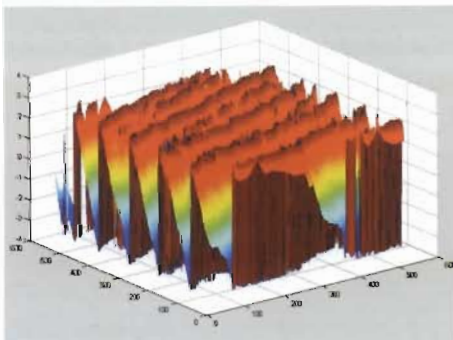


Figure 2: Unwrapped phase map showing the actual surface texture of the sample

Optical technique for measuring surface texture is widely used. This is due to the advantages which are non-contacting and non-intrusive. The most common measurement methods are the interferometry techniques. This method enables physical parameters such as deformation, strain, refractive index, vibration and surface profile to be measured. M Takeda et al, proposed a method in extracting the wrapped phase, the Fast Fourier Transform (FFT) method. The general equation of fringe a pattern can be written in the form of:

$$g(x,y) = a(x,y) + b(x,y) \cos[2\pi f_{0x} _ (x,y)] \quad (1)$$

The phase, i.e. the information containing the optical path difference is given by $_ (x,y)$, $a(x,y)$ and $b(x,y)$ are the additive and multiplicative noise respectively. Using Fourier Transform, this can be re-written as:

$$g(x,y) = a(x,y) + c(x,y)^{(2\pi i f_{0x})} + c^*(x,y)^{(-2\pi i f_{0x})} \quad (2)$$

with the complex conjugate of c^* is given as:

$$c(x,y) = _ b(x,y)^{(i\phi(x,y))} \quad (3)$$

This would filter out the zero-average (0th term) and the imaginary value (-1th term). The passing signal is then inverse transform to space domain. To remove the phase ambiguity, the value can then be calculated as:

$$\text{Phase, } _ = \arctan \left(\frac{\text{RE}}{\text{Im}} \right) \quad (4)$$

This will then give the direct value of the phase which can be unwrapped to correct the 2π phase jump. To illustrate this method, Figure 1 shows in two-dimensional, the measurements from the sample of the wrapped phase map showing the 2π phase jump. By simply unwrapping the phase map, this would yield Figure 2, the unwrapped phase map. The sample shows the unevenness of the sample depicting the roughness of the surface in the order of micrometers. The work described here shows that for high noise surface measurement, FFT method has successfully re-constructed the sample surface. This technique can be further improved to nano-level measurement depending on the optical bench set-up.

Researchers:

Mohd Shahril Osman, Alexon Jong (Unimas) and Sinin Hamdan.

DESIGN AND FABRICATION OF A SOLAR CHIMNEY

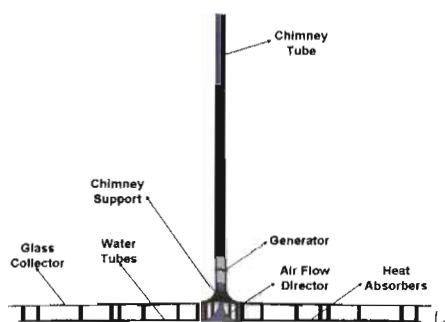


Figure 1: Solar chimney cross section

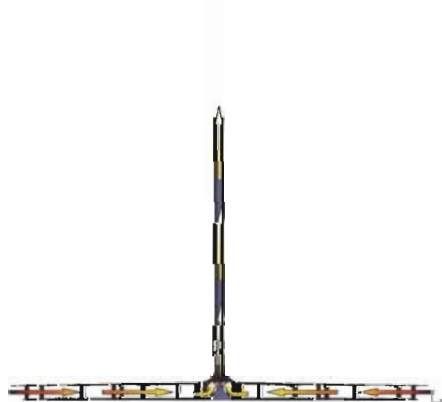


Figure 2: Air flow through the solar chimney



Figure 3: Air flow director of the solar chimney.

Non renewable energy resources will soon be exhausted, consequently leading to a global energy crisis. These resources are gradually replaced by renewable energy resources in Malaysia. This work presents the design, fabrication and performance analysis of a solar chimney power generator. Solar Chimney power generator utilise hot air rise concept to generate power. The design consists of a chimney tube built on top of a circular glass collector. These two structures are connected via a curved cave called the chimney support. Below the glass collector lies the heat absorber plates and water tubes for heat storage which is used for night operation. An air flow director is placed below the chimney to direct the air upward which then turns the electric generator in the chimney. Figure 1 shows the cross section design of a solar chimney. The solar chimney is designed to generate electric power 24 hours a day based on the upward movement of hot air. The overall performance of the solar chimney is measured and analysed in this project. Figure 2 shows the air flow through the cross sectional view of the air flow director, generator and chimney tube. Figure 3 shows the design of a certain part of the solar chimney which is the airflow director using rapid prototyping method. The performance of a solar chimney is dependent on the sun radiation, solar collector's size, collector glass's transparency and ground type. The night operation performance is influenced by the ground properties and water tube size. In this initial part of the project, the fabrication of solar chimney involves manufacturing a structure of 4.2m in diameter and 3m in height. The solar chimney will be tested and measurements will then be carried out. Measurement in terms of air flow, temperature rise and energy output determine the efficiency of the solar chimney.

Researchers:

Mohd Shahril Osman (Unimas) and Yong Weng Kheong (Unimas)

FINITE ELEMENT ANALYSIS ON SINGLE LAP JOINT

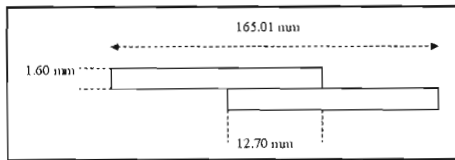


Figure 1: Overall dimensions of the single lap joint.

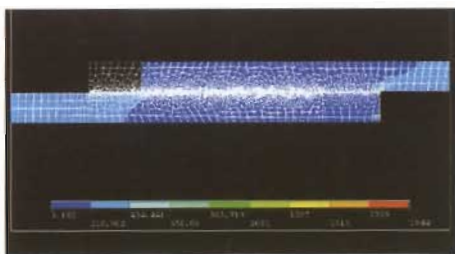


Figure 2: Single lap joint. Force is applied at each end revealing the simulations results. The thickness for this experiment is 0.1 mm.

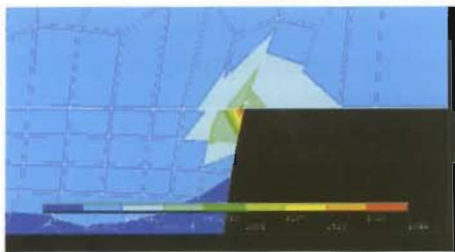


Figure 3: Stress contour at the interface of the bonded joint. High stress is revealed at the edge of the lap joint.

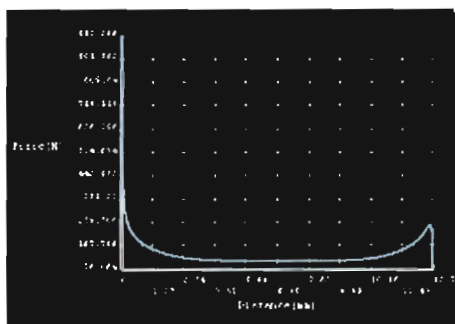


Figure 4: Graph of force versus distance from the one end to the other end of the lap.

Joining method such as welding, lap joints, riveting and etc is one of the important aspects in engineering. The joining of the materials would require care as engineering failure can occur. One of the most common applications of joints are in the marine as well as in the aircraft fabrication. Therefore it is then important to investigate and understand the engineering of the joining methods. This work concentrates on a single lap joint. The analysis employed is by Finite Element Analysis (FEA) method. The simulation results are compared with experimental results as for verification. FEA is a technique to obtain approximate solutions given the material properties and appropriate boundary conditions. In this work ANSYS, a window based FEA software is employed to do the simulations. The dimensions of the single lap joints are based on ASTM D3165 standard dimensions with thickness of 1.60 mm, overall length of 165.10 mm. The overlap region is 12.70 mm. The bonded thickness for the lap joint varies from 0.1 mm, 0.2 mm, 0.5 mm 0.7 mm and 1.0 mm. The material employed in this work is mild steel as this material is common within engineering work. Figure 1 shows the overall dimensions of the lap joint. Figure 2 shows the results for 0.1 mm bonded thickness with a 250 N force is applied. Figure 3 shows an exploded view revealing the stress contour at the interface. The results clearly show a displacement after a load is applied. A graphical plot of the result is shown in Figure 4. The results from the work look promising as the simulation shows an 8% difference from the experimental work. Therefore, this work can be extended to include other types of joints.

Researchers:

Mohd Shahril Osman (Unimas) and Mohd Rafiq Untong

AN INTELLIGENT AUGMENTED REALITY SYSTEM: FINGER AS POINTING DEVICES



Figure 1: Finger control web browser

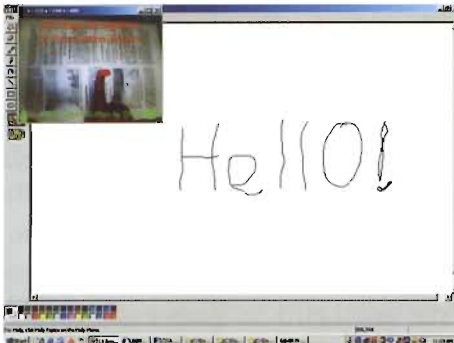


Figure 2: Finger control painting



Figure 3: Hand posture for next slide



Figure 4: Hand posture for previous slide

Augmented Reality (AR) has the goal of enhancing a person's perception of the surrounding world, unlike Virtual Reality (VR) that aims at replacing the perception of the world with an artificial one. Being partly virtual and real, the new interface technology of AR offers many potential applications. These applications include aiding in education, training, repair or maintenance, manufacturing, medicine, battlefield, etc. Most of these potential applications stem from the fact that the interface can display relevant information, at the appropriate time and location. Vision, sound and speech recognition could lead to a richer, multi-model interaction between human and machine. AR with finger tracking feature provides a natural alternative to traditional computer interfaces. User could now use their hands to select and manipulate data instead of a mouse. Intelligent Augmented Reality (AR) System is an object-oriented knowledge-based system, which incorporates with figure tracking, template matching, feature recognition, data handling structures and techniques, provide integration with real environment for data management and dissemination, and handle the needs of the students with diverse focus areas. This system is purposely designed by considering human factor where students can explore the system and they can visualise the 3D contents and objects, practice, increase and enhance their performance in the most practical way using bare hand as input device. The scopes of the research are finger tracking and hand posture recognition. The software framework that has been developed enables digitised video sequences to be captured from a lightweight webcam. This Intelligent AR system used an AR software tool (Ng, 2005), which is implemented in Microsoft Visual C++, OpenGL libraries, and DirectX Software Development Kit (SDK). Two applications have been developed, (i) FingerToMouse allows bare-hand control of mouse pointer of the windows by using only the user's fingertip, and (ii) HandPresentation uses the users' hand posture to control the flow of a Microsoft PowerPoint presentation slides. Both of them are aimed to improve the interaction between human and computer for a specific scenario and demonstrate different capabilities of the finger finding and hand posture recognition system using AR.

Researchers:

Ng Giap Weng, Shahren Ahmad Zaidi Adruce & Lim Yar Fen

FACTORS INFLUENCING THE USE OF E-LEARNING AS SUPPLEMENTARY LEARNING RESOURCE



An example of an e-learning course using Quickplace

Universiti Malaysia Sarawak has been actively promoting the use of e-learning for supplementary learning in its on-campus courses. Computer Supported Collaborative Learning (CSCL) Theories also suggest that students actively and intentionally seek and construct knowledge within a meaningful context such as threaded online discussion. However, the benefits of e-learning system will not be maximized if students do not use the system. Thus a study was conducted with 26 postgraduate students at a faculty in Universiti Malaysia Sarawak taking an on-campus course supplemented with an e-learning system. The purpose of the study was to determine which factors were related to intention to use an e-learning system as a supplementary learning tool. The factors investigated were system characteristics such as functionality, interactivity and response rates; user characteristics incorporating computer self-efficacy and Internet experience; perceived usefulness and perceived ease of use. This study also investigated the types of discussion-oriented and non-discussion-oriented threads that afforded knowledge construction.

The findings of the study showed that the participants viewed the e-learning system characteristics positively especially in terms of functionality and interactiveness. However, the response rate for the e-learning system was not up to expectations. Most of the participants believed that they were capable of using the e-learning system to accomplish their learning tasks and have adequate Internet use experience. Intention to use the e-learning system for supplementary learning was positively related to the participants' computer self-efficacy. Computer self-efficacy was also positively related to perceive usefulness of e-learning system and perceived ease of use. All three systems characteristics of functionality, interactivity and response rate were related to perceived usefulness. Students were active in constructing knowledge by sharing opinions with their peers and providing explanations with examples.

Researchers:

Hong Kian Sam (Unimas) and Julia Lee Ai Cheng (Unimas)

Supporting Grant:

UNIMAS Fundamental Research Grant 03(27)/394/2003(131)

ANALYZING KNOWLEDGE CONSTRUCTION AMONG ADULT STUDENTS IN A BLENDED E-LEARNING ENVIRONMENT



Threaded discussion using Quickplace

The emerging Computer Supported Collaborative Learning (CSCL) theories suggest that individuals are active agents who intentionally seek and construct knowledge within a meaningful context. In this case study, we captured a 6-week threaded discussion where an e-Learning tool was deployed to play a complementary role to the face-to-face classroom instruction. The aim of this study is to document as well as to understand the kinds of discussion-oriented and non-discussion oriented threads that affords knowledge construction. The tool for analysis is an adaptation of the model by Veerman and Veldhuis-Diermanse (2001). Data were collected from Quickplace, the e-Learning system at Universiti Malaysia Sarawak, where 23 adult students of Masters of Science in Human Resource Development were attending a 14-week course on Cognition and Learning. The results show that the students were active in constructing knowledge by asking for the opinion of their peers, giving explanations with examples, and giving opinions. The “knowledge telling” threads were substantial, pointing to the need for the facilitator to push the students to go beyond regurgitating facts of what they have learned. More guidance should be given to the students to refrain from merely knowledge telling. These results suggest that there are educational benefits of incorporating threaded discussions in the teaching-learning process of adult students since they are given the opportunity to learn beyond the walls of the classroom.

Researchers:

Hong Kian Sam (Unimas) and Julia Lee Ai Cheng (Unimas)

Supporting Grant:

UNIMAS Fundamental Research Grant 03(27)/394/2003(131)

DEVELOPING DIGITAL VISUALIZATION OF VIRTUAL HERITAGE FOR SARAWAK'S MALAY TRADITIONAL HOUSE



A snap shot from Virtual Reality Program interface for Traditional Sarawak Malay House. The image is displayed on a conventional computer monitor. Commercial software (Cult3D) is used instead of the Virtual Reality Modelling Language. The advantage of using Cult3D software lies in the Graphical User Interface (GUI) which is user-friendly and requires less programming skills.

Digital visualization is a process of creating a visible presentation of numerical data and revolutionizing the way we interact and communicate with each other. The digital visualization process provides an opportunity for us to collect, manipulate and transform data into graphic form, to make use of the raw source and modify it to produce new creative media. The tools and technology available for gathering data and making a virtual heritage presentation are not adequate at this time without human intervention. For this project, I have chosen the Sarawak Traditional Malay House as a subject because it is a fine example of indigenous tropical architecture located in Borneo and a valuable piece of evidence of Sarawak culture and civilization. To visualize virtual heritage project, I have chosen Virtual Reality System (Window on a World) and Immersive Photo stitching techniques as a mode of visualization. Window on a World system being applied because of low cost system where the creator works only with a computer system without using any special hardware. Meanwhile Immersive Photo Stitching mode is a multiple row of overlapping photos taken from a fixed viewing point using digital cameras and stitched together to form a 360° x 360° spherical panoramic or cylindrical panoramic view. Stitching together photos has always been a fun way to share the spectacular vistas we have seen with others. In the age of scanners and digital photography, photo stitching has also become much more accurate and easy. The ability to create and explore three-dimensional environments on a digital platform such as Virtual Reality System and others provide many interesting opportunities for exploration in the arts, culture, and design, especially in the disciplines of architecture, interior design, landscape design, visualization and 3D. These subjects involve the communication of ideas about structures and space.

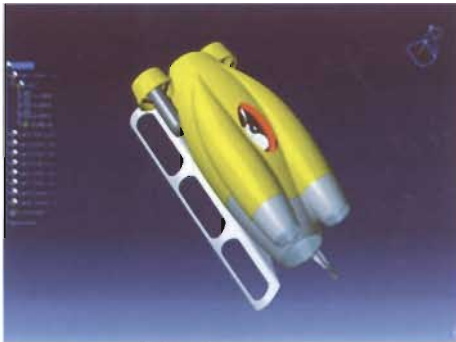
Researcher:

Musdi Bin Haji Shanat (Unimas)

Supporting grant:

UNIMAS Fundamental Research Grant 03(13)/364/2002(101)

UNMANNED UNDERWATER SEARCH CRAFT



Computer modeling image 1



Computer modeling image 2

This research looks into designing and producing the first Malaysian unmanned underwater search craft that utilizes existing unmanned underwater vehicle (UUV) and remotely operated vehicle (ROV) technology as a platform to develop an advance system for specialized application. The equipment is initially targeted for underwater search and rescue (SAR) operation in Malaysia. This is significant in supporting the country's SAR teams, which currently rely heavily on imported machineries and equipment. The unmanned underwater search craft (UUSC) will be one of the most important equipment in their inventory for underwater search of drowned victims. The equipment is also essential in supporting police units to recover crime evidence disposed off underwater. Apart from that, other specialized task by other authorities such as the fisheries department for inspecting and monitoring of our local coral reefs and fish habitats may require this special equipment. Relevant to this, the use of the equipment is crucial in executing and completing the task effectively with minimum cost and risks. The equipment is capable of eliminating human error in performing crucial operation as it is fully remote controlled, thus enhancing the efficiency and effectiveness of the operation especially in dangerous waters. The result of the project will be used to recommend further development of advanced UUV with the possibilities of incorporating additional gadgets. This technology has established its usage and functionality in underwater applications throughout the world, and the urgency is for us to develop our own specialized system to keep up with the rest. The success of producing a local UUSC will be an achievement for the university and the country as a whole and it is hoped that the research will enhance the UUV/ROV technology capability of our country.

Researcher:

Muhammad Firdaus Abong Abdullah, Andrew Ragai Henry Rigit, Mastika Lamat and Abdul Riezal Dim.

Supporting grant:

Unimas Research Grant – 03(70)543/2005(42).

VIDEO SURVEILLANCE AND MONITORING: TRACKING PARTICIPANTS IN LABORATORIES

Motion detection has been actively studied to assist in surveillance monitoring. 2D motion analysis has been dealt with using various algorithms that permit data extraction from analog video frames. This research has been motivated by the need at the Faculty of Computer Science and Information Technology to monitor the computer laboratory. In an instance where an equipment has been tampered with, either vandalized or stolen, the capture of the suspects and even to determine the time of crime is a major problem. Hence, the main objective of this research is to analyse the abnormality or undesirable motions/movements within an area by employing motion analysis techniques and 2D analysis methods:

- i) to detect intruders,
- ii) to detect a human trespassing into the prohibited area and
- iii) to support direct viewing of CCTV tapes when crime has been committed by using the report of suspected time of crimes (produced by the system).

Although most of the major features in the main module have been successfully accomplished and fulfilled all the requirements or specifications agreed upon, there are some limitations due to certain constraints. The limitations are as follows:

- When using the surveillance system, the video camera used is in static position
- The surveillance system fails to detect objects that moves slowly (one to two pixel differences)

Researchers:

Jacey-Lynn Minoi (UNIMAS), Sylvester Arnab Lucas
Sadin (UNIMAS), Eaquerzilla Phang (UNIMAS)

Supporting Grant:

UNIMAS Fundamental Research Grant 02(28)/359/2002(96)

A HYBRID INTELLIGENT SYSTEM FOR DENSITY-BASED CLUSTERING AND DATA MINING

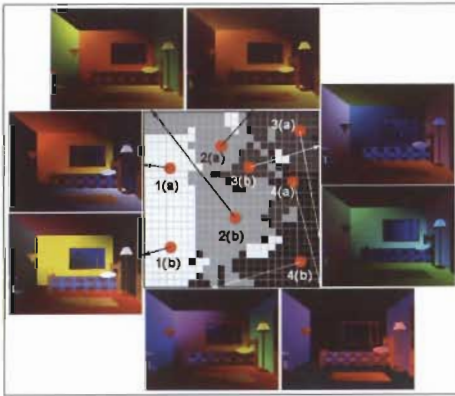


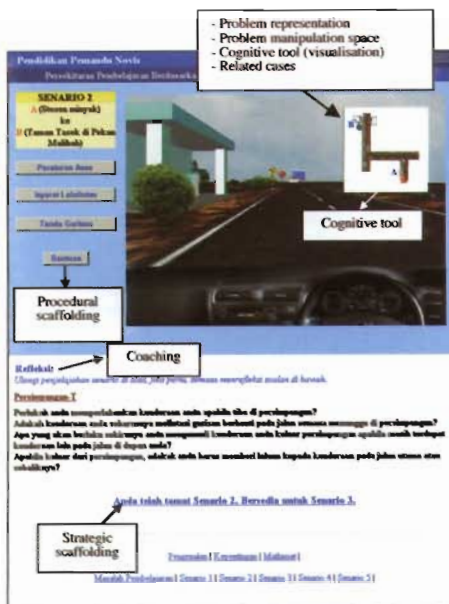
Figure: Visualisation of cluster regions and boundaries using grey scale representation and some samples of prototype vector (bedroom design) extracted from each cluster. Group 1-Active, Warm, Elegant, Hard-looking; Group 2-Relaxing, Comfortable, Soft-looking, Simple; Group 3 Artistic, High Class, Bright, Modern; Group 4-Romantic, Calm, Cool, Clean.

This research project proposes a novel hybrid intelligent system based on the integration of the SOM (Self-Organizing Map) neural network and the kMER (kernel-based Maximum Entropy learning Rule) approach for density based clustering and data mining. A case study, i.e., bedroom colour scheme design using Kansei Engineering (KE), is selected to perform data clustering. The cluster regions formed are then evaluated based on visualisation of clustering information on the 2D map. From visual inspection of the map, one can see the number of clusters as well as their spatial relationships. Besides, the characteristics and the features of the input samples are extracted by selecting various locations on the map, and the cluster (or density) structure of the data are obtained. This approach is particularly useful in exploratory cluster analysis and data mining. In this project, a KE application for designing the bedroom colour scheme was developed. The samples of the bedroom design were first fed into SOM-kMER model to form a topology-preserving map, and subsequently the density-based clustering method is used to obtain the Kansei clusters (groups) on the map (as shown in the figure). In this case, the designer was able to capture the preferred colour schemes for all the variables of each Kansei clusters by analysing and extracting the cluster information. Such visualisation and clustering provide opportunities for human to use their prominent perceptive and associative abilities to perceive clusters and correlation in data mining.

Researcher:

Teh Chee Siong

VIRTUAL REALITY (VR) FOR NOVICE CAR DRIVERS



This project introduces the innovative use of VR technology as a learning tool for novice car drivers of this country. This VR-based learning environment has recently been awarded the 'Winner of the MSC-Asia Pacific ICT Awards (MSC-APICTA) 2005 for the Best of Education and Training' category. It utilises conventional personal computer setting to generate interactive three-dimensional virtual environments that allow learners to actively construct knowledge on traffic rules of various road scenarios. Generally, this learning environment aims to impart cognitive skills, such as the understanding of the various traffic rules, traffic signs, and line markings for both ordinary roads and different types of junctions, to the novice car drivers. An instructional design model that combines the principles from different learning theories, guides the design of the learning environment. This instructional design model combines the concept of integrative goals with the constructivist learning environment design model as these two strategies are interrelated and in accordance with the new paradigm of instructional design theory. They serve as the macro-strategy that concerns with the selection, sequence, and organisation of the contents that are to be presented. The figure below shows a screenshot of the learning environment that depicts several of the components that are incorporated to support this macro-strategy. Additionally, the cognitive theory of multimedia learning, from which a number of principles for the design of multimedia messages are derived, is used as the micro-strategy that guides the presentation strategies of the learning environment. A study has also been conducted to evaluate the effectiveness of the VR-based learning environment. The significant positive effects of this learning tool on learning when compared with the conventional method of instruction, provides another evidence of the potentials of VR technology for instructional use. Indeed, such learning environment provides new learning experience and makes visible concepts that the existing methods have limited means to present.

Researcher:

Chen Chwen Jen

EXTRICATING THE WEB OF LEARNING: IDENTIFYING THE CHARACTERISTICS OF EFFECTIVE LEARNING ENVIRONMENTS

Web-based Learning (WBL) offers a new and exciting platform for teaching and learning by giving learners the convenience of a learning environment that is independent of time and place. While many are enthusiastic about the promises this accords, others are cautious and concerned with the quality of teaching and learning rendered in such environments. This research is interested in examining university lecturers' understanding and perceptions of effective WBL practices and aims at understanding the pedagogical, design, and implementation issues of WBL that promote effective and high quality learning outcomes. Findings highlight as essential the need for lecturers to establish a safe social-emotional climate appropriate for adult distance learners which lays the foundations for a shared sense of learning community and the effects of using collaborative technologies to support web-based learning. These have implications for the design of effective WBL for tertiary adult teaching and learning.

Researchers:

Elaine Khoo (Unimas), Michael Forret and Bronwen Cowie (University of Waikato, New Zealand)

THE NEGOTIATED INTERVENTION STRATEGY: A CASE STUDY ON ONLINE LECTURER DEVELOPMENT

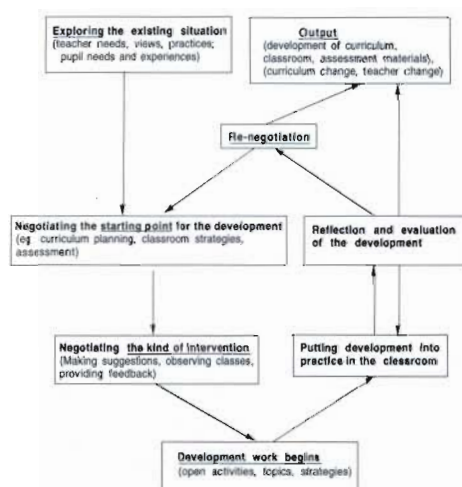
It is common for lecturer development for online teaching to take the form of one-off workshops and technical training sessions. Although short-term, generic training sessions can be quite successful in increasing lecturers' content knowledge and technical skills, they often fail to help lecturers integrate this knowledge and skill into successful, online, pedagogical practice. These sessions should derive their character and purpose from the lecturer's underlying beliefs about learning and its associated intentions. This research reports on a qualitative case study on a particular strategy for online lecturer development in asynchronous, online teaching in a tertiary institution. A negotiated intervention strategy was used to assist an experienced, face-to-face lecturer re-develop and teach his existing masters paper as an asynchronous, online course. Reflective conversations with the lecturer revealed the complexities of working with a lecturer to develop his online pedagogical practice. These highlight the potential as well as address the implications for utilising the negotiated intervention strategy as a tool for online lecturer development.

Researchers:

Elaine Khoo (Unimas), Michael Forret and Bronwen Cowie (University of Waikato, New Zealand)

NEW WINE OR NEW BOTTLES – WHAT'S NEW ABOUT ONLINE TEACHING?

The process of negotiated intervention



This research presents findings into the nature of successful, online tertiary teaching-and-learning. The project is part of a larger study aimed at establishing guidelines for the ongoing design and development of online courses within the authors' institution. The research findings from interviews with tertiary online lecturers, identify key characteristics of successful online teaching-and-learning that are consistent with a sociocultural view of learning. The researchers recognise that online teaching-and-learning contexts present challenges for both lecturers and learners but argue that quality pedagogy is founded on a well considered view of learning and that the guiding pedagogical principles provided by such a view apply equally well in online and face-to-face contexts. Thus, they caution against confusing the need to respond flexibly to changing environments with the need for a new philosophy of learning.

Researchers:

Michael Forret (University of Waikato, New Zealand), Elaine Khoo (Unimas), and Bronwen Cowie (University of Waikato, New Zealand)



