BULETIN GIS

JAWATANKUASA PEMETAAN DAN DATA SPATIAL NEGARA

BIL. 2 /2008 ISSN 1394 - 5505

PENDAHULUAN

Jemaah Menteri berasaskan Kertas Kabinet No.243/385/65 bertajuk *National Mapping Malaysia* telah meluluskan jawatan dan terma-terma rujukan *"Surveyor-General Malaya and Singapore"* sebagai Pengarah Pemetaan Negara Malaysia dan mengesahkan keanggotaan serta terma-terma rujukan Jawatankuasa Pemetaan Negara pada 31 Mac 1965.

Cabutan para-para 2(b), 2(c) dan 2(d) daripada kertas kabinet tersebut mengenai keanggotaan dan terma-terma rujukannya adalah seperti berikut:

"2(b) National Mapping Committee

That a National Mapping Committee be appointed to comprise the following:

i. Director of National Mapping;
ii. Director of Lands & Surveys, Sabah;
iii. Director of Lands & Surveys Sarawak;
iv. Representative of the Ministry of Defence;
v. Representative of the Ministry of Rural Development (now substituted by the Ministry of Natural Resources and Environment);
vi. Assistant Director of Survey, FARELF

2(c) The terms of reference of the National Mapping Committee to be as follows:

i. to advise the Director of National Mapping on matters relating to mapping policy;
ii. to advise the Director of National Mapping on mapping priorities.

2(d) That the Committee be empowered to appoint a Secretary and to co-opt persons who would be required to assist the Committee,"

Seterusnya pada 22 Januari 1997, Jemaah Menteri telah meluluskan pindaan terhadap nama, keanggotaan dan bidang-bidang rujukan Jawatankuasa Pemetaan Negara kepada Jawatankuasa Pemetaan dan Data Spatial Negara (JPDSN), bagi mencerminkan peranannya yang diperluaskan ke bidang data pemetaan berdigit. Keanggotaan JPDSN pada masa kini adalah terdiri daripada agensi-agensi seperti berikut:

1. Jabatan Ukur dan Pemetaan Malaysia
2. Jabatan Tanah dan Ukur Sabah
3. Jabatan Tanah dan Survei Sarawak
4. Wakil Kementerian Pertahanan
5. Jabatan Mineral dan Geosains Malaysia
6. Jabatan Perhutanan Semenanjung Malaysia
7. Jabatan Pertanian Semenanjung Malaysia
8. Jabatan Perhutanan Sabah
9. Pusat Infrastruktur Data Geospatial Negara (MaCGDI) *(co-opted)*
10. Jabatan Pertanian Sabah
11. Jabatan Pertanian Sarawak
12. Pusat Remote Sensing Negara (MACRES)
13. Universiti Teknologi Malaysia
14. Universiti Teknologi MARA *(co-opted)*
15. Universiti Sains Malaysia *(co-opted)*
16. Jabatan Laut Sarawak *(co-opted)*
17. Jabatan Perhutanan Sarawak
18. Jabatan Perancangan Bandar dan Desa Semenanjung Malaysia *(co-opted)*

Buletin GIS ini yang diterbitkan dua kali setahun adalah merupakan salah satu aktiviti oleh Jawatankuasa Pemetaan dan Data Spatial Negara, sebagai salah satu media pendidikan dan penyebaran maklumat dalam mendidik masyarakat memanfaatkan maklumat spatial dalam pembangunan negara. Walau bagaimanapun, sebarang kandungan artikel-artikel adalah tanggungjawab penulis sepenuhnya dan bukan melambangkan pandangan penerbit.

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Dari Meja Ketua Editor

Baru-baru ini, dalam isu tuntutan Pulau Batu Puteh, Batuan Tengah *(Middle Rocks)* dan Tubir Selatan, Mahkamah Keadilan Antarabangsa (ICJ) di Belanda telah memberi hak kedaulatan Pulau Batu Puteh kepada Singapura dengan kemenangan 12-4 dan Malaysia mempunyai hak kedaulatan terhadap Batuan Tengah dengan kemenangan 15-1. Sementara bagi Tubir Selatan pula, timbul masalah dalam menentukan hak kedaulatannya kerana kedudukan Tubir Selatan terletak di antara pertindihan perairan wilayah Malaysia, Pulau Batu Puteh dan Batuan Tengah. Dalam hal itu, panel hakim ICJ memutuskan bahawa hak kedaulatan Tubir Selatan akan ditentukan berdasarkan di perairan negara manakah entiti tersebut terletak.

Dalam pada itu, JUPEM telah menerbitkan Peta Baru Malaysia 1979 berskala 1:1,500,000. Peta ini memaparkan pulau-pulau dan entiti geografi yang terdapat di dalam keseluruhan perairan negara. Ia telah diwartakan di bawah Warta Kerajaan No. 575 bertarikh 21 Disember 1979 dan dengan itu merupakan dokumen yang sah dari segi perundangan bagi menunjukkan sempadan perairan negara serta pulau-pulau dan entiti geografi yang terdapat di dalamnya. Peta ini telah digunakan oleh agensi-agensi penguatkuasa di dalam menjalankan tugas-tugas penguatkuasaan undang-undang mereka di kawasan perairan negara.

Di samping itu, peta topografi terbitan JUPEM juga bukan sahaja menunjukkan kawasan daratan, malah turut meliputi pulau-pulau terutamanya yang berada di pesisiran pantai. Ia ditunjukkan bersekali dengan daratan yang berhampiran dan sekiranya kedudukan pulau itu berada jauh daripada pesisiran pantai, butiran berkenaan akan ditunjukkan sebagai inset pada lembar peta yang terdekat. Walaupun begitu, masih terdapat pulau-pulau dan entiti berkaitan yang jauh daripada pesisiran pantai dan tidak ditunjukkan dalam lembar-lembar peta topografi yang diterbitkan, terutamanya bagi sesetengah pulau dan entiti di sebelah utara negeri Sarawak dan barat laut negeri Sabah, seperti Terumbu Layang-Layang, Pulau Amboyna Cay dan lain lain lagi. Selain daripada itu, bagi memudahkan rujukan dibuat, JUPEM telah mengambil inisiatif untuk menerbitkan Buku Maklumat Keluasan dan Perimeter Negeri, Daerah dan Pulau di Malaysia. Buku ini diterbitkan pada tahun 2005 yang menyenaraikan pulau-pulau di Malaysia serta memaparkan lokasi pulau-pulau tersebut dengan rujukan koordinat geografi.

Memandangkan Peta Baru Malaysia 1979 diterbitkan pada skala yang kecil iaitu 1:1,500,000 dan dengan itu tidak kesemua pulau dan entiti geografi dapat ditunjukkan dalam peta tersebut, maka JUPEM kini sedang mengambil tindakan untuk menerbitkan peta khusus untuk pulau-pulau serta entiti geografi luar persisir pada skala yang lebih besar. Pasukan ukur JUPEM juga akan turut meninjau pulau-pulau yang akan dipetakan di sepanjang sempadan antarabangsa dan mengkaji kesesuaiannya untuk diletakkan monumen ukur. Untuk makluman, baru-baru ini pihak JUPEM telah berjaya menanam monumen *Global Navigation Sattelite System*

(GNSS) di Batuan Tengah yang terletak berhampiran Pulau Batu Puteh. Monumen sedemikian merupakan satu daripada stesen Jaringan Kawalan Geodetik yang akan membantu memberi bacaan koordinat yang tepat. Di samping itu, pihak JUPEM juga akan menjalankan kerja-kerja merekodkan bentuk topografi maritim serta keluasan pulau-pulau.

Sehubungan dengan itu, agensi-agensi di bawah JPDSN yang juga pembekal data spatial perlulah peka dengan kewujudan pulau-pulau serta entiti geografi, khususnya yang terletak bersempadan dengan negara-negara jiran. Dengan adanya teknologi GIS, pelbagai analisa mampu dilaksanakan dan melalui maklumat yang diperolehi, agensi berkenaan boleh memaklumkan kepada pihak berkuasa negeri tentang kewujudan entiti geografi tersebut yang mungkin kita tidak sedar akan kepentingannya pada masa hadapan. Dengan maklumat yang disalurkan kepada pihak berkuasa negeri, suatu pembangunan mungkin boleh dijalankan ke atas entiti geografi berkenaan agar ia tidak dituntut oleh pihak lain pada masa hadapan. Oleh yang demikian, sebagai agensi kerajaan yang komited dengan tugas-tugas yang diamanahkan, hak negara perlulah dipelihara kerana ia merupakan tanggungjawab kita bersama.

GEOGRAPHICAL INFORMATION SYSTEM (GIS) KNOWLEDGE AMONG UPM'S STUDENT: A CASE STUDY

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ABSTRACT

Today geographic information systems (GIS) have become central to the way thousands of government agencies, private companies and not for profit organization do business. GIS science is demanding to the way provide professional to perform research science and administration in numerous disciplines. The growing use of GIS at university level especially for teaching and research has created a demand for data, software, and technical support that is best accommodated by a central GIS service provider. The university is a natural candidate for this role. Some academic institutions only teach GIS as an embedded syllabus in their courses. Therefore, this article presents GIS knowledge among UPM's student in 15 faculties. The objectives of this paper are three folds: (i) to measure the awareness of university student about the knowledge of GIS, (ii) to expose the knowledge of GIS university students, and (iii) to increase the interest in using GIS among student for related applications. The questionnaires survey covers 4 sections were designed to meet the objectives of the study. Section 1 consist all data about the socio-demographics information. Section 2, a question about the activity that involve a GIS, Section 3 ask the information about experience expose towards GIS, and Section 4 ask about the interest and motivation that have been offered in the university. A total of 400 respondents involved in this survey. Then the data were analyzed using SPSS to determine its score where Likert's scale is used. Score analysis was selected because its operation will be simple and provides statistics analysis that suitable with the research. From the results, we can conclude that many student of UPM do not recognize about the GIS yet. This may due to the lack of exposure and attitude of the student which do not have enough courage to learn a new thing. University can encourages student by playing a strong and influential role in the use of GIS at university level by providing comprehensive internet-based resources facilities to access this information.

1. INTRODUCTION

Currently, technologies such as geographic information system (GIS), global positioning system (GPS), remote sensing tremendously changed the nature of work in the mapping sciences, as well as professional surveyors, industries and education and research institutions. In the other hand, GIS science is showed crucial needs to the thousand of researchers and users to carry out a task or study in numerous disciplines. GIS in brief can be defined as a set of computer tools that facilitate the storage, retrieval, analysis and display of spatial data (Burrough, 2001). Most data contain a geographical component. Using GIS, otherwise disparate data can be related on the basis of common geographic location, creating new information from existing data resources.

The supply of GIS professionals, however, has not kept pace with the demand generated by growing is one of the most pervasive of today's technologies and is recognized by the U.S. Department of Labor as a high-growth technology. High-capacity computers and networks, improved software, data collection using GPS and digital sensors it's the expansion of technologies such as these that's driven the evolution of GIS especially with the growth of the Internet and its ability to integrate information from multiple sources. The transition of geographic information from paper to digital maps has also been fundamental. Digital information is more widely available via personal computers and the Internet, which amounts to an array of uses that were once impossible with paper-based information only. This trend will certainly continue.

Technological developments are driving changes in every aspect of university. One arena of technology that has made a large impact on university is GIS. Education institutions are seeing growing user interest in GIS and in response are changing their staff, services provided, and collection development policies to accommodate this demand. Each university may choose a slightly different method or degree of responding to the students' interests, but unquestionably GIS is demanding some reaction from all. This GIS course is intended for undergraduate and graduate students who have the desire to understand the basic concepts underlying modern geographic information science and technology.

There are a few studies that have been done to know about the awareness of GIS technology towards the need of daily routine. Usually the researchers only study the GIS on scientific perspective field but this paper attempt to study on social science view. The paper also assesses education and research needs, including essential training and education, new curriculum changes and responses, quality assurance in education and training and organizational challenges. This is a call for geography and environmental educators to think critically about the value of GIS, to study its uses in geography and environmental education carefully, and to consider the most effective pedagogies to implement it.

New educational technology is seductive. Radio, television, computers, multimedia, and now hand-held computing devices have, in turn, been offered as solutions to educational problems. Claims were made that each would enhance learning and transform the educational system, yet, in some cases; the system absorbed each without the intended change (Cuban, 1986). In this case, it is argued that we must carefully evaluate the value of GIS to geography and environmental education and encourage only that which promotes and supports spatial thinking and environmental understanding (Salomon and Perkins, 1996).

The implications for geography and environmental educators are significant and focus on building a stronger justification for GIS as a support for spatial thinking and on developing the pedagogy to students. Geography and environmental educators need to be clear about the role of GIS in promoting the core tenets of our disciplines, including spatial thinking and reasoning, before proceeding to invest continued time and effort on its behalf. It has not been persuasive enough or sufficient for us to assume that GIS promotes and develops spatial skills. We need to know if it occurs and under what conditions in order to further expand its practice or to find better and simpler ways to achieve the same goals.

The value of working with GIS to explore the local environment needs to be placed within larger education objectives, and those should relate to subject-specific goals, not school-to-work transition issues exclusively. We do not need to join a technology driven workplace oriented crusade on behalf of GIS unless we are convinced that it is in the best interests of students and their personal, social, and spatial development. As in most geography (and environmental) education papers, there must be a knowledgeable for research. Geography and environmental educators need to conduct research on a wide variety of pedagogical issues. Once the justification case issue is resolved, then we can begin to devote the time and effort needed to prepare GIS-literate, spatially attuned teachers, GIS enabled classroom instructors, and the developmentally appropriate curricular needed to support spatial thinking and reasoning. In arguing the educative value of GIS, we can assert that students may be taught spatial thinking through GIS if certain instructional strategies are in place. These instructional strategies may include teaching in different contexts and teaching for understanding by explicitly emphasizing abstract representations, cognitive strategies, and spatial thinking and reasoning. We cannot afford to continue to assume that simply by doing GIS, students will recognize or learn cognitive mapping processes, spatial analysis, or spatial thinking. An examination of what students already know about spatial relations could help lecturer construct and develop learning opportunities and interest with GIS more closely related to human cognition. If GIS actually matched the cognitive processes used to develop cognitive maps more effectively, it could be hypothesized that it would have a greater effect on students' abilities to develop a more sophisticated and accurate understanding of geography (Raper, 2000).

2. METHODOLOGY

2.1 Data Collection

The primary data consist of questionnaires is collected during a period of 8 weeks on February and March 2008 and was conducted at Universiti Putra Malaysia. The aim was to evaluate the awareness of UPM's students from 15 faculties on geographic information system knowledge. The questionnaire was used to get the basic information about the student background and their interest levels towards the GIS knowledge. Basically, this questionnaire covers 4 sections. Section 1 consist all the data about the socio-demographics information. The data are about the respondent's general background information. Section 2, asks question about the activity that involve GIS (4 level Likert scale), section 3 ask the information about influence exposure towards GIS (5 level Likert scale) and section 4 ask about the interest and motivation that have been offered in the university (5 level Likert scale).

The gathered data then transferred to SPSS (Statistical Package for Social Science) program for analysis. The results from the analyses were produced statistically, then were described and interpreted. Score analysis was selected because its operation is simple and provides statistics analysis that suitable to the research. Descriptive analysis was applied to present the percentage and means as we cannot gain the statistic directly from raw data which is socio-demographic of the respondents and the evaluation of the interest of student toward GIS. Frequency distributions summarize the distribution of a variable by reporting the number of cases contained in each category of the variable. Percentages on the other hand show a frame of reference for reporting research results in the sense that they standardize the raw data. Chi-square test was used to determine the significant of the variable.

2.2 Sample Size

To determine sample size, a formula simplified by **Yamane (1985)** was applied. According to formula, to calculate the sample size the following equation can be used.

$$n = \frac{N}{1 + N(e)^2}$$

Where, n = sample size
N = population size
e = level of confidence / level of precision = 5%

$$\text{so,} \quad n = \frac{20\,852}{1 + 20\,852\,(0.05)^2}$$

$$= 392.4713, = \sim 400$$

From the calculation above, the total sample size taken is 400 respondents. There are 15 faculties in the UPM, so the n=400 have to be divide by 15 which will produce total 27 which mean 27 respondents for each of faculties.

3. RESULTS AND DISCUSSION

The respondent's demographic information among faculties is showing in **Table 1**. The Faculties of Agriculture, Food Science and Technology and Biotechnology and Bimolecular Science were dominated by female students more than 80%. This probably the ratio of male and female student in university or faculties is dominated by female or female students were more responsive to the survey compared to the male students. The age of the respondent was ranged from 18-22 or 23-27 years old and majority of them were Malay. Many of the respondents is in the field of science and only respondents from faculties modern language and communication and half from educational studies and are in the field of art.

Table 1: The Demographic Information of the Respondent

NO	FACULTY	GENDER		AGE				RACE				FIELD	
		M	F	18-22	23-27	28-32	33-37	M	C	I	O	SC	ART
1	Agriculture	4	23	8	19	0	0	25	1	0	1	27	0
2	Forestry	6	21	11	16	0	0	23	3	0	1	27	0
3	Veterinary Medicine	12	15	20	7	0	0	18	7	2	0	27	0
4	Economics and Management	8	19	20	7	0	0	15	8	2	2	27	0
5	Engineering	17	10	17	10	0	0	24	3	0	0	27	0
6	Educational Studies	6	21	9	18	0	0	24	2	1	0	13	14
7	Science	10	17	20	7	0	0	21	5	1	0	27	0
8	Food Science and Technology	4	23	14	13	0	0	21	3	1	2	27	0
9	Human Ecology	12	15	11	16	0	0	22	2	1	2	27	0
10	Modern Language and Communication	12	15	17	10	0	0	21	4	2	0	0	27
11	Design and Architecture	13	14	16	11	0	0	25	2	0	0	27	0
12	Medicine and Health Science	12	15	11	15	1	0	14	8	2	3	27	0
13	Computer Science and Information Technology	16	11	18	9	0	0	21	3	2	1	27	0
14	Biotechnology and Bimolecular Science	4	23	17	10	0	0	22	5	0	0	27	0
15	Environmental Studies	11	16	23	4	0	0	21	5	1	0	27	0
	TOTAL	**147**	**258**	**232**	**172**	**1**	**0**	**317**	**61**	**15**	**12**	**364**	**41**

Most of the faculties are never doing research in GIS except engineering students and students from faculty of design and architecture and educational studies. This is because most of the GIS courses have been offered in that faculties compare to others faculty. Meanwhile Faculty of Forestry and Faculty of Environmental studies showed a frequent research in GIS. **Figure 1** depicted that a faculty which does not offer GIS courses or doing research in this area was having the little knowledge about GIS. This is because different field required different system operation so it is not necessary to use or apply GIS. Therefore, this will influence the students on their interest towards GIS.

Overall, most of the students never take any GIS subject in university except engineering, design and architecture and forestry **(Figure 2)**. This is because only these faculties have offered the GIS courses or teach this subject as embedded syllabus in related courses. Majority students never have experience in GIS assignment except students from faculty engineering and design and architecture and forestry.

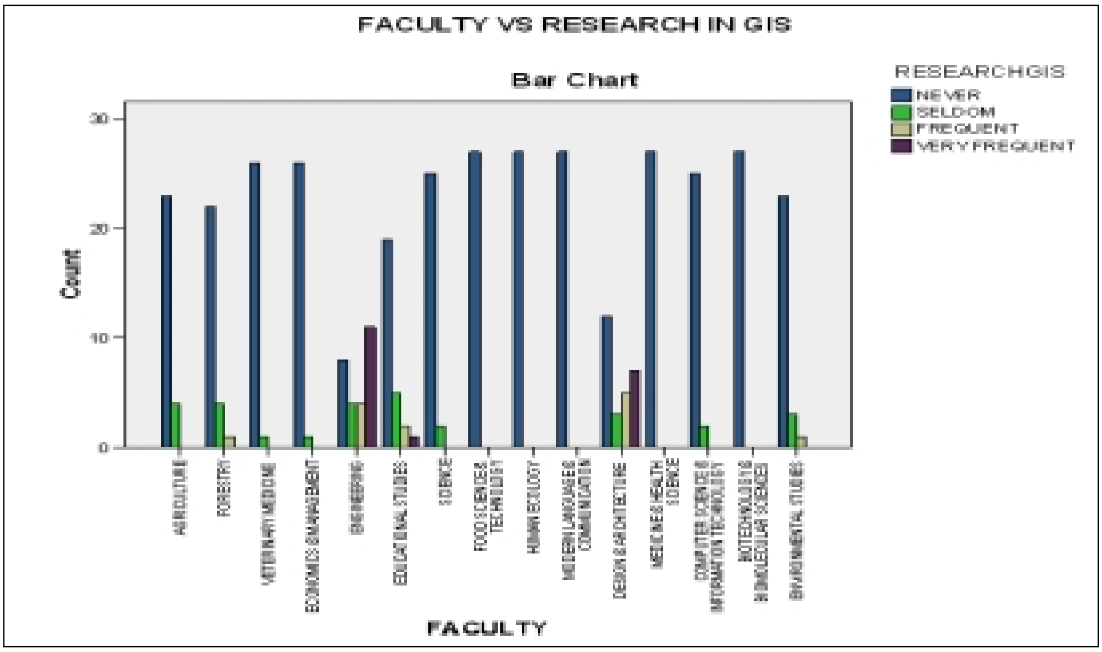

Figure 1: Frequency of research in GIS that have been done by the students among faculties

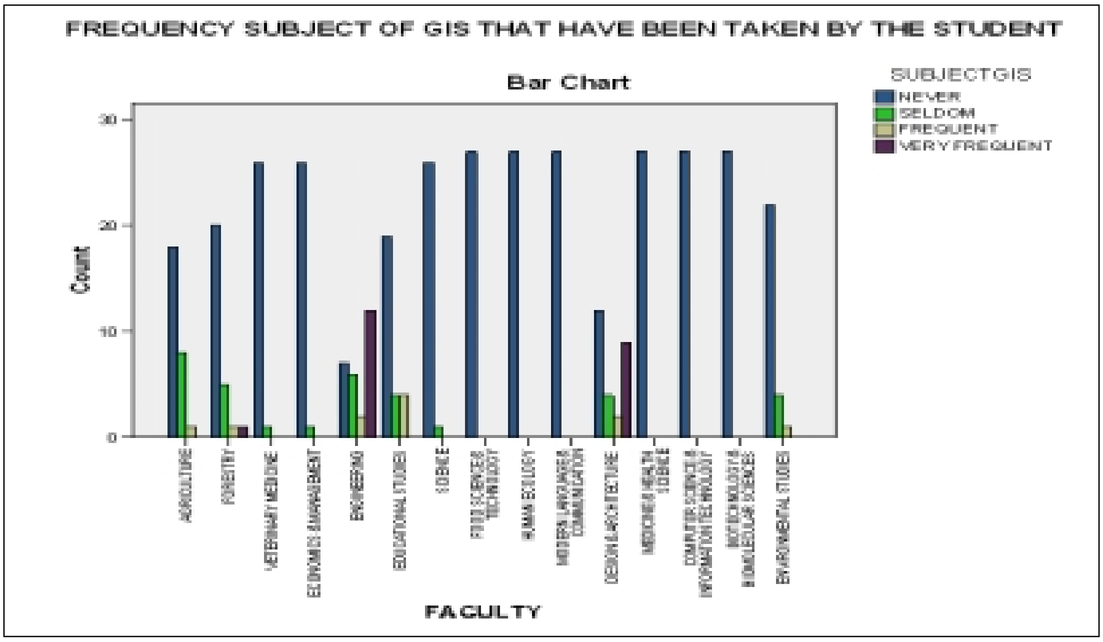

Figure 2: Frequency subject of GIS that have been taken by the students among faculties

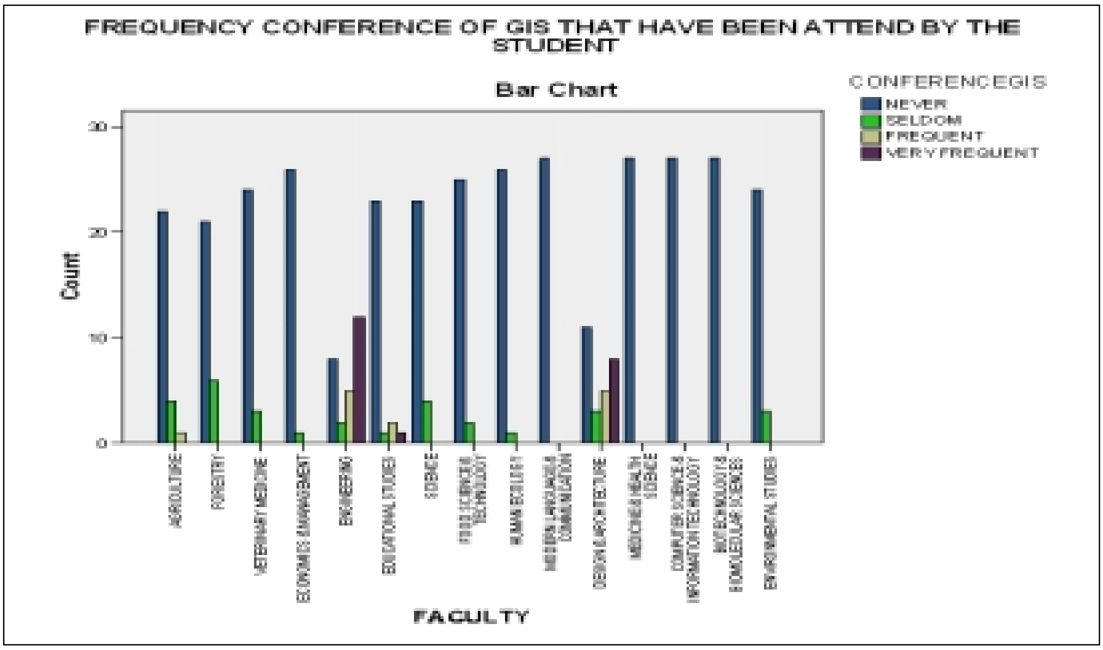

Figure 3: Frequency conference of GIS that have been attend by the students

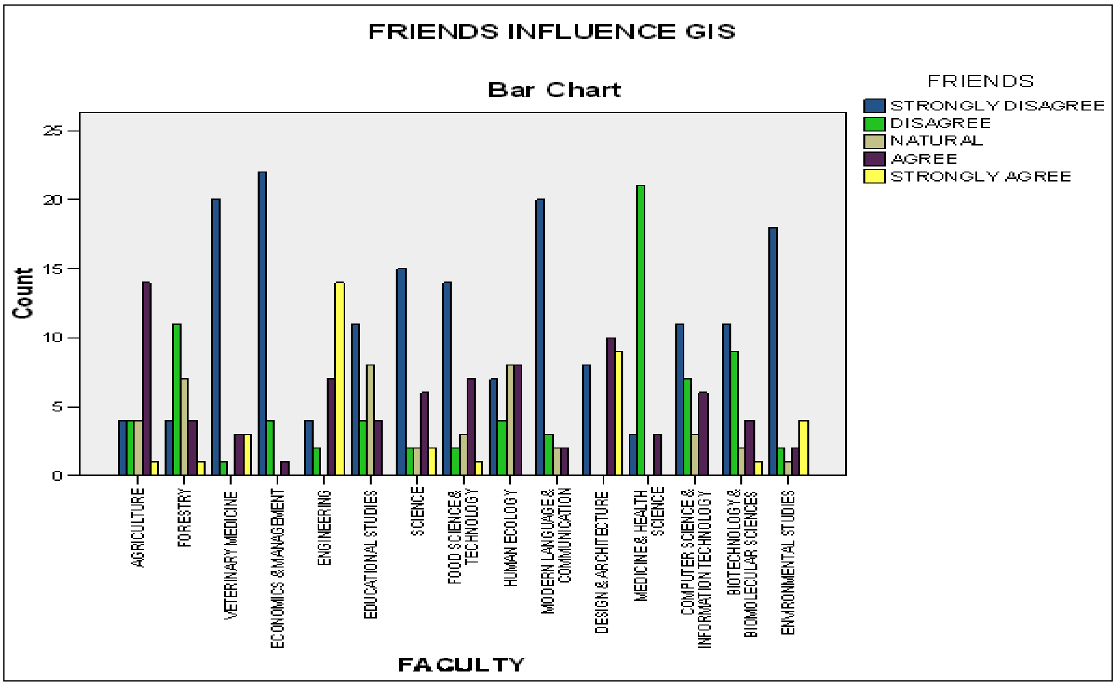

Figure 4: Students get information of GIS through friends

Promoting GIS and related technology through the series of seminar and conferences are important. However about 80% of the respondent from all faculties are never attend any GIS conferences **(Figure 3)**. The very frequent attending were from engineering, design and architecture and environmental studies. There were small respondent from agriculture attend at least 2 conferences. These due to only those faculties were offered the courses that related to GIS. On the other reason was the role of lecturers in encouraging and exposing the opportunity to their students to attend the seminar or conferences.

Figure 4 show the influence of peers or friend in gaining knowledge among student. 42% respondents strongly disagree with that way. They were agreed that usually the students get to know about GIS through the lecturer or courses that they were taken. Although their friends are come from same program, but didn't take GIS courses were lack in knowledge of GIS. The students also strongly disagree internet provide information of GIS and make them aware about the GIS system by 38%. Lecturer is the main factor influenced them and later on they will surf information about GIS through the internet. This is because until now not many people have background on the GIS and the GIS to them are still new especially in Malaysia. So awareness on the use of GIS is not spreading fast among respondents. Most of the students strongly disagree that they know about GIS through reading materials by 53%. This is because lack of publication on GIS topic.

Figure 5 show most of the students believe GIS have a high potential in today technologies with 34%. The GIS may be having a high potential in today technologies but majority of the students do not understand the GIS system this may blow down their interest to career opportunity related to GIS. Moreover they do not understand what are GIS can benefit to the development of the technologies.

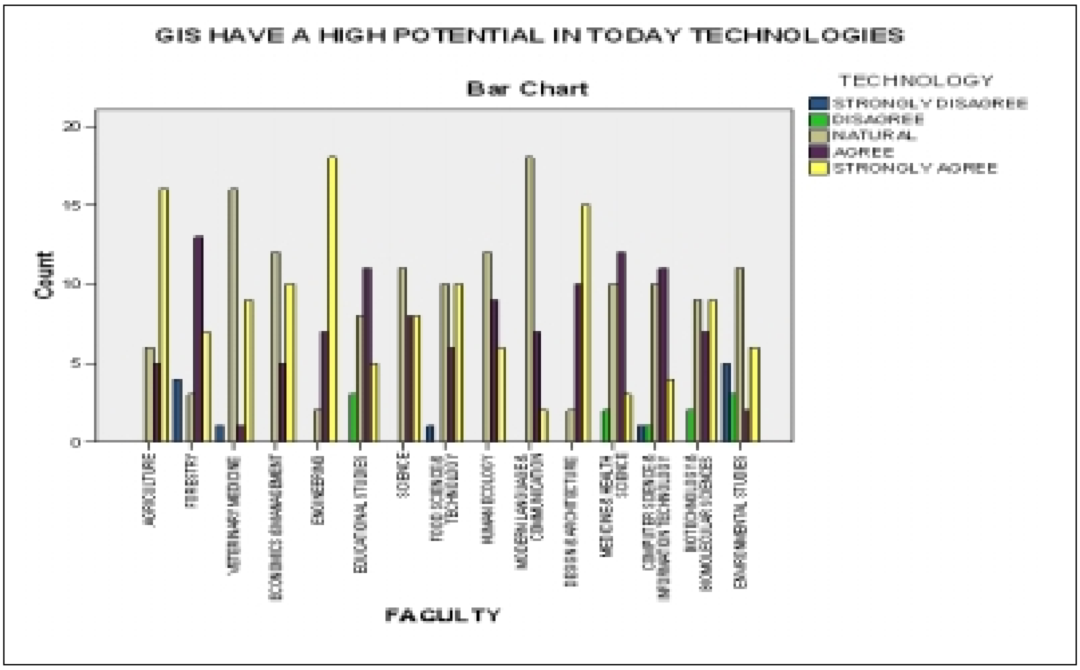

Figure 5: GIS have a high potential in today technologies

Figure 6 shows that 34% students strongly agree that by learning GIS will open their access to computer and ICT technologies. They also agreed curiosity is the major factor that encourages them to learn GIS. This is supported with 55% students shows strongly agree that their interest to assignment or work involve computer and ICT. Although GIS software requires high skill in computer and ICT, most respondents believe computer and ICT are very important for the development of the country and it is important skills in job requirements.

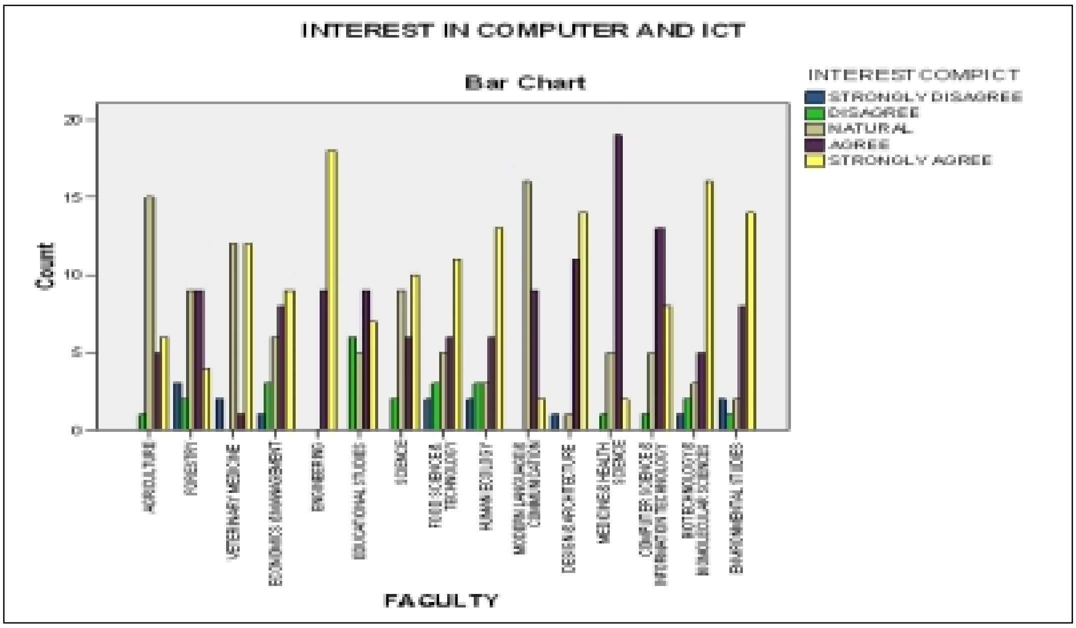

Figure 6: Students who interest in computer and ICT

5.0 CONCLUSION

Universities can and often play a strong and influential role in the use of GIS in Malaysia. By being a central point of higher education, contact for the acquisition of expertise, the university stays in touch with current research and the needs of the user supporting the Information needs by GIS users. Centralized, managed GIS facilities can support students as individual or research teams for a significant amount of time spend in gaining GIS knowledge and solving technical problems. Providing comprehensive Internet-based resources allows students to work independently in space and time. Therefore by making the software and data available online student are able to access the materials anytime when needed. GIS is exciting, growing fast and universities can play a vital role to encourage student interest in geographic information system courses or various programs.

This study showed that almost 80% of the students do not aware about the use of GIS and some of them only know the meaning of GIS but does not know what is the operation system of GIS and do not know how to implement it. This is due to lack of knowledge and information about GIS and they did not get any exposures by any resources. To overcome this problem, GIS courses should be open to all the students as an elective subject. By doing this interested student from any program can learn and gain more knowledge of GIS. Furthermore universities should produce many trained analysts of GIS operation that which will facilitate students to learn GIS software. On the other hand, there should be an alternative in getting in material such as software that is economical and affordable to the student. Learning materials should easily be to find, understand and applicable to the new learners.

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GIS EDUCATION AND POTENTIAL CAREER IN MALAYSIA

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ABSTRACT

Geographical Information Systems (GIS) are computer software programs written to allow creation of digital maps and to link data, or attributes to map objects. It is designed for efficient data management, analysis and display of geographically referenced data. GIS is related to a number of other fields and disciplines. It contains certain aspects of each of these fields and, thus, is closely related to each of them. It includes geology, urban planning, forestry, landscape architecture, agriculture, civil engineer and etc. As GIS become more widely used, many colleges and universities in Malaysia now offer certification degrees that are related to GIS. For example, Universiti Putra Malaysia offers GIS courses in its program such as forestry, agriculture, landscape, etc. In the future, GIS will become one of the most important systems used by either private or government organization. Many disciplines can benefit from GIS technology. An active GIS market has resulted in lower costs and continual improvements in the hardware and software components of GIS. These developments will, in turn, result in a much wider use of the technology throughout science, government, business, and industry, with applications including real estate, public health, crime mapping, national defense, sustainable development, natural resources, landscape architecture, archaeology, regional and community planning, transportation and logistics. Thus, the GIS in broad and specific range create opportunities to those people who have the ability to combine their passions or interests with GIS for a satisfying and successful career.

1.0 INTRODUCTION

A geographical information system or well known as GIS is a system for capturing, storing, analyzing and managing data and associated attributes which are spatially referenced to the earth or phenomenon. In the strictest sense, it is are computer technology which equipped with software system that provide various capabilities for capturing, managing, manipulating and analyzing as well as visualizing and displaying geographically-referenced information, and final information can be utilized for daily life.

In a more generic sense, GIS is a tool that allows users to create interactive queries (user created searches), analyze the spatial information, edit data, maps, and present the results of all these operations. Meanwhile, geographic information science is the science underlying the geographic concepts, applications and systems, taught in degree and GIS Certificate level at many universities.

Today and in the future many social, economic and environmental processes operate on different geographical space and scale. Therefore, geographic information is relevant to many human activities and decision making in complex environments. Thus it is not surprising that GIS technology can be used for scientific research, resource and asset management, environmental impact assessment, Urban and regional planning, cartography, criminology, history, sales, marketing, and logistics. For example, GIS with validated model might allow emergency planners to easily calculate emergency response times in the event of a natural disaster, GIS might be used to find fragile wetlands and highland that need protection from pollution and degradation, or GIS can be used by a company to site a new potential business site to take advantage of a previously underserved market.

As GIS become more widely used, many colleges and universities in Malaysia now offer undergraduate and graduate programs with certification diploma, degrees and Masters that are related to GIS. The aim is to enhance the skill of student in current scientific knowledge and in theory, method and uses of geographic information for various applications. Specifically the program has the following objectives:

i. Providing student with current scientific knowledge and skill on the theory, methods and uses of geographic information.
ii. Providing students capable of applying geographic information technologies in various disciplines such as planning, resources management, business and environment.
iii. Producing better qualified graduates in geographic information science who will be able to contribute and meet the market requirement, and challenges of the national development. As such this program emphasizes on the specific applications of acquired scientific knowledge through guided research in dissertation.

2.0 THE RELATIONSHIP AND APPLICATION OF GIS TO OTHER FIELDS

2.1 Uses of GIS

Data used in GIS are of many types; they were captured from many sources and are stored in different ways. GIS provides tools and methods for the integration of these data in formats that would allow it to be compared and analyzed. Data are captured mainly from manual digitizing/scanning of aerial photographs, paper maps, and existing digital data. Remote-sensing satellite imagery and GPS are also data input sources.

In data management, after the data is collected and integrated, GIS provides facilities to contain, maintain and update these data. Effective data management includes the following aspects: data security, data integrity, data storage and retrieval, and data maintenance. Spatial analysis is the most distinctive function of a GIS when compared to other systems such as computer-aided design (CAD). Spatial analysis includes such functions as spatial interpolation, buffering, and overly operations.

One of the most exciting aspects of a GIS is the presentation of the results in a variety of ways once information has been processed. Visual presentation is one of the most remarkable capabilities of a GIS, which allows for effective communication of result, which otherwise could not be done by traditional way. The strength of GIS is in its individual treatments of each sector particularly the forest sector in plantation system. This system makes it possible to analyze several different production factors at the same time.

Many organizations are interested in GIS technology because is that so much of the information that they need to conduct their business is spatially referenced. Utility, services companies and government agencies often have very large collections of paper maps that had been used to record the locations of their assets and to record maintenance work and transactions in property. Consulting and updating these large and often unwieldy collections of maps can be a very laborious process. Hence, GIS were use to help in planning and organizing the geographic data. GIS is not limited to federal use local and state government also use it to keep track of the properties, public works, roads and more within their jurisdiction.

The strength of GIS for spatial information handling is derived from several other disciplines, notably from the field of computer science, surveying and quantitative geography. From a computing view point, the early development of GIS maybe seen to be built largely upon a combination of database technology, for storing information, and of computer graphics for digitizing and display spatially referenced information. Some of the early GIS included map-overlay facilities with automated evaluation of spatial coincidence of environmental and socio-economic factors.

Recently we can see the importance of image processing in interpreting remotely sensed data and of artificial intelligence applied to several aspects of GIS, including image understanding, database design and query languages, planning and automated cartography. GIS has been widely used for decision support in applications such as urban and regional planning, agriculture and the utilities and the analytical tools of operational research will increasingly become integrated within existing GIS software. GIS may be seen as an adjunct to management science, and for some organizations the GIS-related functionality may become entirely integrated with a corporate or management information system.

Many of data used in GIS are derived from topographic, socio-economic and environmental surveys because there are large quantities of such data recorded in paper documents, there has been an enormous demand for digitizing such documents which are referred as secondary digital data acquisition. The largest primary source of digital data for use in GIS is undoubtedly the data created by remote-sensing technology on board satellites and other aircraft.

In future, a progressively higher proportion of acquired digital data will be from primary, ground-based or remote surveys. It is therefore essential for some applications that remote sensing and GIS be closely linked.

2.2 GIS and Internet

Through GIS, Internet users will be able to access GIS applications without purchasing GIS software by using only a web browser. Short, fundamentals of GIS remain, but it gets online and everybody can use or access it. There have been changes in map making and map usage through the convergence of GIS and WWW.

Now details maps can be generated from huge databases of spatial information and distributed all over the world. The web is a cost-effective way to share or provide public access to data worldwide on the internet.

2.3 GIS and Computing Skills

Technical GIS computing skills can be organized into several categories such as following;

i. Programming. This category covers a wide range of programming skills, from menu and toolbar customization to component software programming for GIS.
ii. File Handling and Databases Covers file types, database models, architecture of GIS and databases.
iii. Application Software focuses primarily on the use of GIS and CAD software.
iv. Computer Systems and Networking Covers a wide range of topics, from basic knowledge of computers systems concepts (e.g. numbering systems) to system administration tasks.

2.4 GIS for Landscape Architects

Landscape architecture is the design, planning and management of natural and built environments. It is a discipline grounded in spatial thinking. For progressive landscape architects, GIS technology is an increasingly important software tool for organizing digital spatial data in an accessible and logical manner. This allows landscape architects to consider more design options and to do so more quickly and efficiently than ever before. GIS for Landscape Architects shows that this technology is no longer the exclusive realm of geographers and scientists. Through actual examples, you'll learn how landscape architects, land planners and designers now rely on GIS to create visual frameworks within which spatial data and information are gathered, interpreted, manipulated, and shared.

Case studies drawn from the real world show how GIS was used to:

i. Prepare a comprehensive plan for a historic streetscape

ii. Create a site design for a major vacation resort
iii. Design and manage a recreation area
iv. Visualize a proposed landfill
v. Solicit public input and manage resources for a river restoration project

GIS for Landscape Architects should also includes a detailed chapter on the GIS Graphic Method to make GIS concepts accessible to landscape architects.

2.5 GIS for Health Organizations

GIS for Health Organizations gives detailed and compelling answers to the difficult questions health care providers ask every day: Where is the disease coming from? How will it spread? Where is the nearest hospital? What is the fastest route for the ambulance? Where should we allocate our funding?

Health professionals use GIS to visualize and analyze geographic elements in every branch of health management. Even if you've never seen a GIS, or used one, you see its effects all around you: GIS already helps patients check into hospitals faster, speeds ambulances around rush-hour traffic, and shows managers where to build new clinics so that they'll serve the most people. GIS for Health Organizations presents twelve case studies in which GIS is being used to:

i. Track the spread of infectious and environmentally caused diseases
ii. Site new hospitals and clinics based on demand and demographic factors
iii. Monitor toxic spills to protect the health of nearby residents
iv. Map demand for future nursing home facilities
v. Market pharmaceuticals.

Health management is a rapidly developing field, where even slight shifts in policy affect the health care we received Physicians, public health officials, insurance providers, hospitals, epidemiologists, researchers, and medical executives use GIS to focus resources to meet the needs of those in their care.

2.6 GIS in Telecommunications

Global competition is forcing telecommunication companies to stretch their boundaries as never before -requiring efficiency and innovation in every aspect of the enterprise if they are to survive, if they are to prosper, and especially if they are to come out on top. Even as the competition grows fiercer each day, these companies must simultaneously continue to offer the high levels of service their customers have come to expect, or risk losing them. With these kinds of challenges, telecommunications firms worldwide are turning to GIS to give them the edge they need.

GIS combines diverse kinds of geographic information, and that gives forward-thinking companies an indispensable new tool. In the hothouse telecommunications marketplace, GIS can help firms streamline network design, find the clearest paths for wireless operations, or solve difficult connectivity problems.

Companies like the ones profiled in GIS in telecommunications are also finding that GIS will solve marketing and customer service needs-combining up-to-date geographic information with such data as demographics, service call histories, and revenue.

Some of the most exciting new markets for telecommunications firms, location services, might not even exist without GIS-meaning that the technology helps companies offer new services where none existed before: giving customers real-time interactive mapping and routing services, or, when combined with 911 emergency services, even saving lives and property.

The telecommunications industry sometimes seems to have horizons that are limitless. Those firms that know this are finding that GIS can enhance virtually every aspect of what they are doing, and take them as far as they want to go.

2.7 GIS in forestry

The harvesting of rainforest requires inventory and monitoring of large areas at a fine scale. Increasingly, modeling is used as a research and management tool to examine spatial-temporal processes such as resource harvesting. The advancement of GIS and related technology provides an effective tool not just for monitoring the change of the forest environment but also very useful for planning, managing and developing of forest resources. For example, GIS tools allow harvest planners to dynamically assign timing of access and haul cost attributes to the existing inventory database for several road access alternatives. When combined with other standard features such as species composition and merchantable volume, it is possible to analyze the effect a road network design has on delivered wood costs.

A forest area suitability system was developed in order to determine the spatial distribution and extent of suitable area for forest harvesting in Pahang, Malaysia in 2005 by Mohd Hasmadi Ismail (2005). Using cartographical modeling and linear weighted combination (LWC) approaches in a GIS, harvest suitability zones were determined and mapped according to economic and environmental perspectives. The study revealed that by integrating remote sensing, GIS modelling and DEM, a suitable harvest zone and road network for harvesting operations could be determined. The proposed forest road density in the study area is to ensure the harvesting operation is carried out in line with the reduced impact logging and sustainable forestry concept. The approaches would not only assist in the forest harvest planning but could improve the overall effectiveness of the logging operation and forest management practices. The methodology may be used in remote sensing and GIS forestry applications and also by international organizations concerned with forest resource management and environmental sustainability. This can be a useful input for forest managers, forest engineers, environmentalists, and forestry departments as well as in national planning.

Other GIS applications in forestry include terrain and slope stability analysis, cut and fill estimates, visibility and watershed analysis, alignment and grade calculations, right-of-way corridor studies, environmental impact assessment, integration of survey data, and cost and flow analysis.

3.0 EDUCATION PROGRAM RELATED TO GIS IN MALAYSIA

Since GIS is widely used in this day, many fields require the knowledge and application of GIS. So, many courses in Malaysia tertiary school are related to GIS. This is to make sure that student is always exposed to what the society need and not lacking of the GIS skills. **Figure 1** showed some courses in several universities such as University Putra Malaysia (UPM), University Sains Malaysia (USM), University Teknologi Malaysia (UTM), University Malaysia Sabah (UMS).

Forestry is a science and for decision making, the scientific information must be readily available in a form that is easily understood. There are a number of environmental issues that are related to forest management. These include: biodiversity and ecosystem, forest fire, forest encroachments and water crisis. There are many issues regarding forestry discussed internationally where scientific information is critical for decision making. Even where problems are more social than scientific, the availability of information is also necessary for decision making. In this regard, IT has become a critical tool monitoring the development of any forestry project. The use of IT and computer technology is increasing speed and options in analysis, storage and distribution of information throughout the world. They can be very useful in all aspects of forestry activities from planning to implementation. To balance the competing resource conservation and resource use, activities must be accommodated. Accessing the feasibility of these multiple uses is greatly enhanced by the use of GIS techniques.

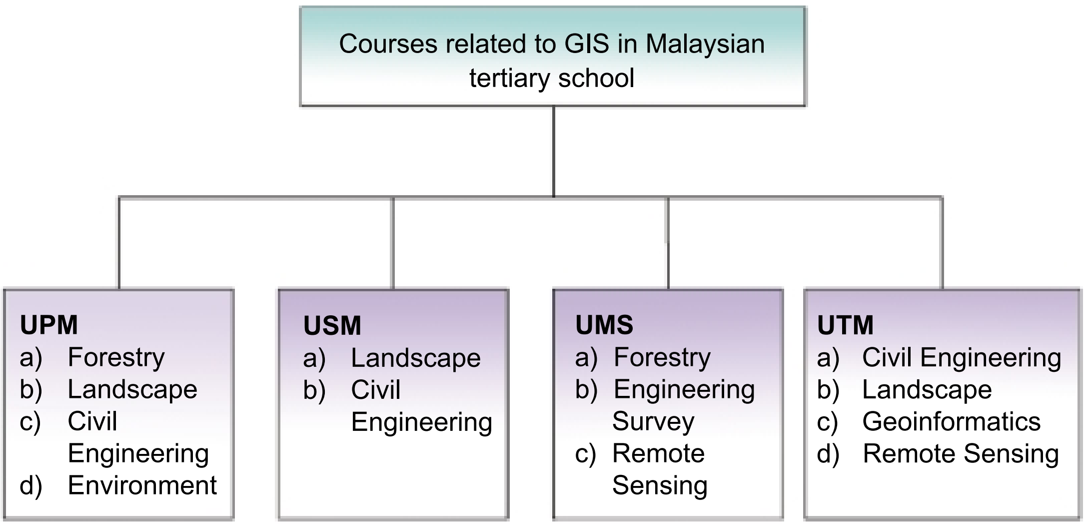

Figure 1: Diagram show the courses related to GIS in several Malaysian tertiary education

In Malaysia, UPM and UMS are universities that offer forestry course. Forestry has a close relationship with GIS as GIS technology frequently used in forestry management and production. Foresters have played central roles in the development of today's GIS. UPM offers an opportunity for advanced studies and career development in the field of forest management by adopting GIS in a multi-disciplinary approach to managing forest resources and services. The program is designed to prepare knowledgeable and competent managers in tropical forest management. Faculty of Forestry UPM for example offered a Master of Science (M.S) and Doctor of Philosophy (Ph.D) program in Applied Remote Sensing, GIS and Precision Forestry which are include a comprehensive research in GIS for natural resource management, survey and development.

Landscape Architecture is a discipline of art and science of materializing an outdoor environment comfortable for human habitation. With greater availability of digital spatial data and adoption of GIS, the potentials of using such metrics to support better urban planning and management are great. Meanwhile, landscape metrics is used in monitoring urban land and GIS is used for data input, management and analysis purposes. One of the examples in Malaysia is Butterworth, Penang Knowledge and expertise of various disciplines which are important to a landscape architect is provided for by the unique multi-disciplinary curriculum and academic. Some of the courses that are related to GIS is landscape construction, landscape horticulture, GIS for landscape design, environmental Impact Assessment, and hydrology & Watershed Management.

Civil engineering are most courses offered by universities in Malaysia. UTM offer Master of Engineering (Civil-Hydraulics and Hydrology). This program offers knowledge in hydraulics engineering, hydrology and water resources systems. The target groups for this programme include professionals and engineers responsible for the management, development, maintenance and design of hydraulic structures, storm water management facilities, and river and coastal developments. In this program, there is an elective subject on GIS in civil engineering.

Civil Engineering Department in UPM offers several program for post-graduate studies leading to the degrees of Master of Science (M.S.) and Doctor of Philosophy (PhD.) are closely related to GIS such as Remote Sensing, Water Engineering, Highway & Traffic Engineering, Water and Environmental Engineering, and Geomatic Engineering (Remote Sensing and GIS).

In USM, the Geomatic Engineering program at the School of Civil Engineering has offered and produced competent civil engineers, who are well trained in the field of geomatics. They have been exposed to the various aspects of engineering measurements related to civil engineering.

Besides the courses mentioned above, there are still many courses related to GIS, for example, agriculture, fisheries, oceanography, geography, and etc.

4.0 CAREER RELATED TO GIS

GIS careers exist in every imaginable discipline, from environmental science, mining urban planning, commercial businesses to defense and beyond. The broad range of GIS opportunities available gives people the ability to combine their passions or interests with GIS for a satisfying and successful career. GIS careers typically include positions such as:

1. Cartographic designer
2. Computer programmer
3. Database administrator
4. GIS Project manager
5. System administrator
6. Geographic Information System Specialist

GIS Professional

The Geographic Information Officer (GIO) is important personnel in the organization management and must be responsible for producing information that impacts both the decision making and the day-to-day operations of the organization. The changes in work flow resulting from this approach have been responsible for the significant reductions in cost, increases in efficiency, and major benefits to successful organizations.

GIS professionals use GIS to visualize, analyze, and model systems to help in the planning and decision-making processes of their organizations. They make geographic information accessible to scientists, planners, decision makers, and the public. They also encompass business development, managerial, and administrative roles. GIS is often associated with making maps, but GIS professionals do much more than that. GIS is used to manage human activities.

A GIS career can be exciting and have a tremendously positive impact on the world. At the level of basic science, GIS professionals are improving understanding of how the planet works at macro and micro scales. At the application level, GIS professionals are capable to analyze complex situations, visualizing problems, and creating geographic plans and suggest for solutions. They are also increasing efficiency, reducing costs, and helping people make faster and better decisions that consider all the geographic factors necessary to create a sustainable future. And GIS professionals are improving the processes of communication and collaboration, helping to better coordinate work across organizations. As a result, GIS professionals have an opportunity to make a real difference in the work.

Surveying Profession

The surveying profession originated from land surveying. The land surveyor profession has evolved in many ways with the much new technological advancement like GIS, Global Positioning System (GPS) and remote sensing. GIS is a more advanced form of land surveying in which topographical maps are produced through the use of aerial photographs and satellite images. GIS enables surveyors to produce digital maps stored as ‘layers’ within the system.

A surveyor involved in pre-construction, development planning and GIS. There is a lot of measuring and calculating to be done. A surveyor uses the science of measurement to collect and analyze land and geographic data. Unlike the traditional profession, the surveyor's analysis must also be in line with legal, economic, environmental and also social issues that may affect the project. The surveyor's analysis, especially important to building, construction and real estate industries, is used for planning and implementing solutions for projects like building construction and land development. Surveyors collates a data and coordinates an analysis with the help of engineers and architectural personnel, valuers and clients.

GIS Engineer

Normally, GIS engineer has to degree or diploma in GIS, Remote Sensing, or surveying. A GIS engineers involves in data entry, editing and compilation using CAD and GIS software. They have experience in project management and spatial data handling that are related to GIS, GPS data capture and land survey. Besides that, GIS engineer must be independent, systematic, outgoing and able to travel outstation or overseas periodically. This is because a leading GIS, GPS or RS services company normally has been trusted to carry out many quality works that related GIS by many government agencies, organization and large corporate both locally and oversea.

5.0 SUMMARY

GIS is widely used in these few years and it seems will become one of the most important technologies in the future. So, our government has offered many courses in this field to Malaysian undergraduate and graduate students. This is to make sure that the student is exposed to the latest technology and it will help in development of the nation.

Besides the courses discussed above, there are still many courses that related to GIS. The relationship of GIS to other field has provided many opportunities to graduate student to find a career that they want or interest. In the new millennium the adoption of GIS society nation wide and worldwide is inevitable and that GIS users will be advantaged in their work while nonusers will be relatively disadvantaged. The factors that will have the most impact on GIS development in the next millennium can be broadly grouped into the three categories of functionality, communications, and management.

Although many educational institutions offer coursework or a curriculum related to GIS, these programs can look quite different from one to the next. At most educational institutions, for example, GIS courses are located within the geography department and engineering. However, specialized GIS courses may be found within departments such as fisheries, oceanography, forestry, and rangeland resources. More than likely, GIS courses offered in departments other than geography will provide a different perspective on what is important to students pursuing natural resource degrees. If a university or college still does not offer courses related to GIS, students can still learn about the capabilities of GIS through Internet courses, self-study of GIS texts, and volunteer work with local agencies or government offices.

In this day we will see greatly improvement of GIS and GIS career. An essential foundation of GIS usage is the availability of trained people. The need is crucial to persons who are geographically literate, able to learn how to use the technology, and must be able to solve geographical problem. People with special skill in this field can expand their career path abroad since GIS is an international interest. The GIS managers have a potential to make a major contribution toward sustainability of social, economic and environment. The emphasis on GIS world is making GIS more easy and practical in the near future as the technology becomes increasingly supportive to organization and useful to use. The context or discipline is not too important, but the state of art and science lies behind the technology must be grabbed because its value to make our environment important and we aware of the space that we occupy in this world.

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INTEROPERABLE GEOSPATIAL DATASETS USING OPEN GEOSPATIAL STANDARDS, PROTOCOLS AND TECHNOLOGIES

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1.0 INTRODUCTION

In the information and communication age, the way digital data can be accessed and delivered has been acknowledged to be extensively and intensively researched and examined as they increase in volume and complexity (MacDonald, 2001). Successful data management depends on many issues affecting technology, resources, storage, networking and versatility. Geospatial data, the most common type of data, requires unique techniques and storage due to its format and heterogeneity. The need to present and distribute much heterogeneous geospatial data to a wide variety of users is a difficult challenge faced by many data providers. Government- oriented data providers especially are coping with the call to supply information and services to a wide range of data users (Wilmersdorf, 2003). One way to achieve this is by using a Web browser. The implementation of e-government has been a significant issue for a timely development of the economy and infrastructure. There are many benefits of geospatial objects being active in a repository for internal and external access. Geospatial data management and distribution using graphic and non-graphic interfaces enables the existence of intelligent data objects for variety of purposes.

Due to the vast amounts of data now in reality, the issues of data storage, management and access are crucial. Moreover, data collection and data conversion from hardcopy to digital form are costly. Issue of duplication of data has been significantly discussed and researched in the geospatial community. Geospatial data and information is actually one of the exclusive sources for many types of analysis, decision making, development and planning. However, such information is sometime located in various disparate sources and everywhere in a traditional file processing system. It would seem logical that there is a growing need for efficient and well-defined data management systems to store, manage and distribute tremendously large and multiple-located datasets, in a single view by multiple users. Handling and provision of geospatial data efficiently from data collection to its dissemination had caused many issues. One of them is that all the geospatial data and information that were captured and maintained are seen as islands of files and databases in a typical geospatial data collecting organisations. In many of the organisations, administration and management are carried out based on divisional departments or units that produce different kinds of geospatial data.

GIS is an important organisational and decision tool that should be most beneficial and fully utilised together with the Internet. The Internet has introduced World Wide Web (WWW, Web) as the road to transport the load, no matter what the backend systems are (Stoimenov and Djordjevic-Kajan, 2005). With the existence of geospatial interoperability standards, the movement and transfer of data within GIS and among geospatial datasets, especially when the geospatial data has to be transformed into fully GIS-ready information, can be achieved. Geospatial interoperability has been a matter of debate among many academics and provides influential issues among people of the government in particular (Jerome, 2005). The distribution of geospatial data through Internet services can benefit many enterprises and communities in the current information and communication age.

This paper underlines issues currently faced in the access, delivery and use of geospatial information (GI) via the Web. The research practically and particularly focused on the need for the recognition and application of existing geospatial interoperable standards in addressing some of these issues. Therefore a range of solutions have been developed around the provision of geospatial datasets within Kuala Lumpur, Malaysia. As widely as possible existing geospatial interoperable standards, protocols and technologies have been used to develop solutions to the problems discussed in this paper. The research also highlights some of the problems encountered in implementing current geospatial standards. Geographic Markup Language (GML) technology has been used to enable online data delivery, sharing and query. A prototype of GML feature schema was implemented to describe a simple feature used to represent the real world phenomena.

Specifically, the aim of this research is to use current interoperable standards among other common technologies to develop a solution for data interoperability and resolve the issues of data integration and access from and to multiple heterogeneous data sources. This research was part of the studies during the author’s duration of doctoral program in the University if Newcastle upon Tyne, United Kingdom.

2.0 GIS INTEROPERABILITY

GIS-ready information is not usable and complete in its real sense if it is unable to access online. Advances in technology concerning Internet particularly in multimedia and visualisation approaches generally pose great potential for the delivery of the GIS data in real time or near real time (Zhang et al., 2005). This potential brings with its both conceptual and operational issues that require consideration and collective, long-range planning in order to effectively implement the developing technologies. Delivery online provides the sharing of data among staff, organisation and the public. Interoperability in GIS is a must for GIS-ready information to be well informed and delivered to the community. Geospatial information is not only for internal but for the external part of the organisation and the public. The emergent WWW and GML allow cheap and vendor-independent Internet GIS system be developed.

Geospatial data and information interoperability emerges increasingly in the GIS community over the last decade. The move and transfer of data within GIS needs standards for interoperability especially when the geospatial data has been transformed to be fully GIS-ready. GIS interoperability revolves around the distribution of geospatial data through Internet services which benefits many communities in the spatial information and communication age. Interoperability has advantages to companies and government organisation in term of reduction in data duplication, definitive data and costs savings.

GIS interoperability is a new concept and is an on-going research, always sought by users as important but has been difficult for system developers (Laurini, 1998). This saying is a long term ambition to be achieved and federating geographic databases can be seen as a preliminary step towards full interoperability (Kraak, 2004). By geospatial data interoperability, inter-departmental benefits of sharing standardised information via the SDI website can be appreciated. The dynamic of the whole SDI concept is principally reflected by referring to all important issues regarding interoperability (Rajabifard et al., 2002).

Worboys and Duckham, 2004 refers GIS systems as interoperable when they have the ability to share data, information and processing. To share spatial data means to transfer them. Initiatives such as SDI are based on particular transfer format to ease data sharing. There are so many different standards for geospatial data that transferring and converting them pose barrier to interoperability (Bishr, 1998). Standards organisation such as Open GIS Consortium (OGC) is coordinating their efforts in an attempt to minimise such barrier. In OGC, specifications are tabled with core intention that all data model and features are to be defined and manipulated so that they could provide a reference point that will allow data exchange among heterogeneous systems. However standardization does not address the problem of how to convert existing data into standard format and how to integrate data from various sources. So, a software system needs to be developed to support data interoperability. This has been an existing research issue on Internet GIS.

Another approach of data interoperability is database integration. This has been a popular, most sophisticated approach in the late 20th century with much current research activity. Database integration is a process of merging existing data sources into a single, uniform, non-redundant data framework which serves a GIS application (Devogele, 1998). An initial part of database integration can be carried out by splitting new application into pieces which tailored to access one data store and to pass the local data for global application use. A simpler alternative way is to extract the data of interest from the local sources and copied into a new single database which is linked to a new application.

GML has become important in the open GIS concept and is used in major GIS systems. Geospatial information exchange is concentrated on the use the simple code XML-based encoding standard of GML. GML basically uses XML tags to describe geographic feature properties and the neutral format that is optimally suited for distribution over the Internet (Lake, 2001). Plain XML files or compressed one can be streamed and user is not troubled with downloading an entire file before opening. This greatly enhances usability in a networked or Internet environment.

3.0 GEOSPATIAL DATA DELIVERY BY OPEN SOURCE TECHNOLOGY (OST)

Using the open source technology as part of the research ideas promoted the use of OpenGIS Web Feature Server (WFS) protocol to disseminate and manage GIS-ready information in a heterogeneous networked environment. It is possible to design an Internet based geospatial information processing and updating environments which include disparate servers offering data layers and different client types (Brentjens et al., 2005). This research tries to investigate this assertion.

Open source technology is a trendy technology for GIS whereby software and application for spatial data delivery and management uses open source software that is available over the Internet. This technology has achieved a broad diffusion covering all application in the Earth environment and land management field (Diviacco, 2005). GIS based on open source software is nowadays common practice for public institutions and professionals because they are freeware and can be easily accessed and used. The open source software systems available to manage and deliver geographic information are (Neteler and Mitasova, 2002):

- GRASS (Geographic Resources Analysis Support System). It is a GIS that manages many types of geospatial data including 3D data and images;
- MapServer, an open source development environment for building spatially-enabled Internet application;
- GRASSLinks, a WWW interface to GIS application that offers public access to mapped data; and
- PostgreSQL, a modern object relational DBMS that supports almost all SQL constructs. It is the most advanced open source database available anywhere.

This research uses MapServer as the technology to show delivery of GIS-ready information because it can be easily downloaded and configured. It has a friendly user forum over the mailing list. MapServer as the interface application needs a program to be developed to enable the delivery of data. GML is used to transport the data. GML has been known to be a standard for transport and storage of geographic information including geometry and properties of geographic features using data encoded by Extensible Mark-up-Language (XML). In it's simplest terms, GML is a means of encoding geospatial information using XML for data description. Users can encode a description of the location or spatial extent of a limit of survey, road or land parcel which capture its geometry and other properties including surveyor, type of survey, road classes and survey monument and boundaries. There are clear distinctions between geographic data, which is encoded in GML and graphic interpretation of that data as appears on a map or any other form of visualisation. Geographic data in GML is concerned with a representation of the world in spatial terms that is free of any visualisation of the data.

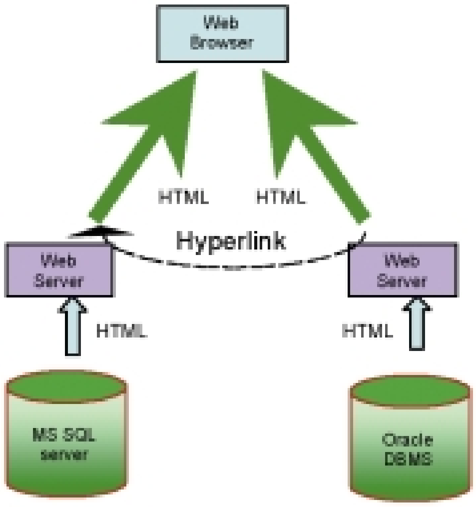

Figure 1: HTML version in internet development(after Peng and Zhang, 2004)

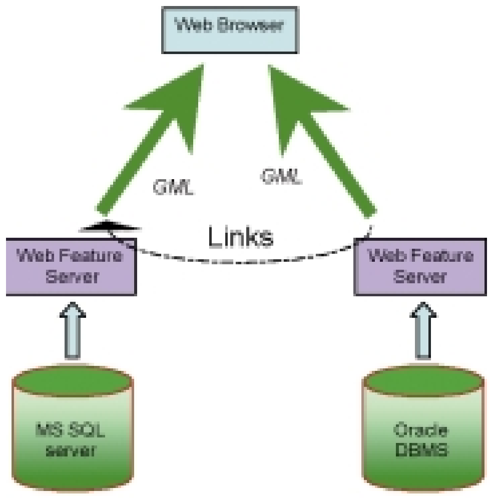

Figure 2: GML for geographic information links(after Peng and Zhang, 2004)

If the data representation is made on a map in which colours or line weights are used to describe the representation, it is very different when GML is concerned. As shown in **Figure 1** and **Figure 2**, for comparison just as XML helps the Web to clearly separate content from presentation, GML does the same in the world of geography (Lake, 2005). In the evolution of geospatial information infrastructure, GML is critical as HTML was to the development of the conventional Internet.

4.0 IMPLEMENTATION

This section concentrates on the use of open source technology comprising existing geospatial interoperable standards, protocols and technologies to disseminate geospatial data from multiple heterogeneous sources. OGC standards and specifications such as GML, Web Feature Server (WFS), Web Map Server (WMS), and HTTP, XML, Common Gateway Interface (CGI), Spatial Relational Database (SRDB), are some of the available freeware. The development and implementation of Internet GIS using open source technology emphasizes the access, delivery and use of geospatial data over the Web.

For this research a test area was chosen covering commercial, industrial, forested and residential portions in the Mukim of Damansara, one of the administrative regions of the state of Federal Territory of Kuala Lumpur. There are a selection of three types of geospatial dataset from Department of Survey and Mapping Malaysia (JUPEM) relating to spatial data of land administration (cadastral) and geographic map features (topographic digital map) as well as aerial ortho-photograph wrapping the tested area.The methodologies for the application use a 3-tier web service architecture, namely a client, middleware and server.

4.1 Server

The server was based on OGC's WFS and WMS specifications. These specifications allow the serving of raster (WMS) and vector (WFS) geospatial data from multiple sources via the Web. WMS produces the requested geospatial data in raster format (eg. GIF, JPEG, PNG), so is called the image server, whilst WFS produces vector data, typically in GML and so is called the GML server.

For the image server, a free map server called Minnesota MapServer was utilised to serve raster data. Minnesota MapServer is an open source development environment created by the University Of Minnesota, USA for constructing spatially enabled Internet applications (Neteler and Mitasova, 2002). MapServer server supports the ESRI Shapefile and image data format. **Figure 3** illustrates the use of the Shapefile format to serve image of Kuala Lumpur (KL), Malaysia on the Web. As shown CGI was used to request data, however it could be set to request in a manner compatible to OGC WMS specification.

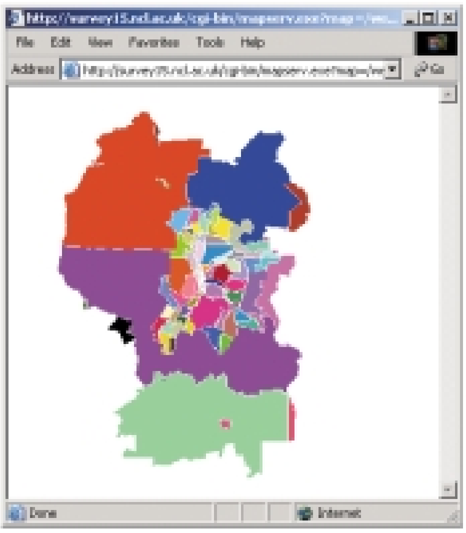

Figure 3: Kuala Lumpur administrative map usingthe Web Map Server

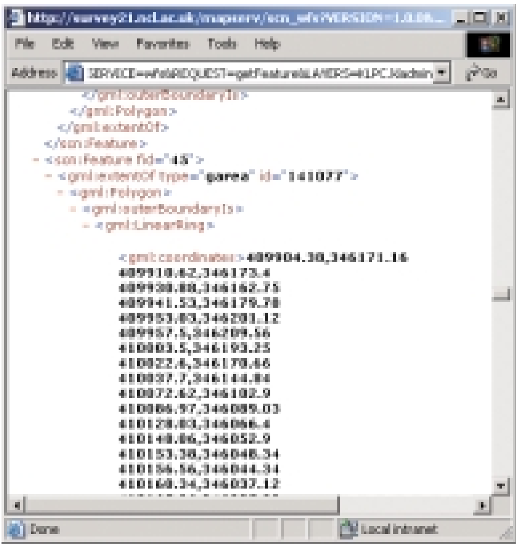

Figure 4: The KL administrative boundary feature in GML format

The GML server was developed to provide vector data in GML format. GML technology provides transport of geographic information by XML encoding. The use of GML thus enables one to facilitate geospatial data interoperability. The OGC WFS specification was implemented to develop the GML server. It was developed using Java servlet technology. The two main WFS operations utilised were *GetCapabilites* and *GetFeature.* The formats supported by the GML server include data stored in the Spatial Relational Database (SRDB) and Shapefile. **Figure 4** shows the created GML from the server which was an administrative boundary feature of Kuala Lumpur similar geographically to the image map in **Figure 3.**

4.2 Middleware

The development of middleware was intended to enable the application to retrieve geospatial data from different servers. Java servlet that supported CGI was utilised. This servlet was meant to provide communication between server and client via URL. The capabilities of this ‘connector’ that the servlet middleware performed include:

- getting the user request;
- connecting and retrieving data from map servers;
- combining the requested data;
- delivering the resultant data back to the client application

Data type requested by the middleware can be raster or vector. The procedure to retrieve data can be from HTTP protocol or FILE protocol. HTTP was used for datasets located on a different server and FILE protocol was used for dataset that are stored in the same server as the middleware connector. For data retrieving from different servers and combining that data by sending only one request, a project request was made. The project request encoded using XML and a sample is illustrated below.

```
<project xmlns=”http://geomatics.ncl.ac.uk/webgis/scn/”>

  <box minx="402250" miny=”345972.47" maxx=”408970.0" maxy=”352473.62"/
>
  <rwo_dataset>
      <dataset protocol=”http” type=”gml” name=”hospital_clinic” address=
       “http://survey1.org/wfs?VERSION=1.0.0&amp;SERVICE=wfs&amp;
       REQUEST=getFeature&amp;LAYERS=KL.hosp_clinic”/>
    <dataset protocol=”http” type=”gml” name=”gov_office” address=
       “http://survey2.org/data/gov_office.gml”/>
    <dataset protocol=”http” type=”gml” name=”education” address=
       “http://survey3.org/ducation.gml”/>
    <dataset protocol=”http” type=”image” name=”canal” address=
       “http://survey4.org/wms?VERSION=1.0.0&amp;SERVICE=wfs&amp;
       REQUEST=getFeature&amp;LAYERS=KL.canel”/>
   <dataset protocol=”file” type=”image” name=”river” address=”river.png”>
  </rwo_dataset>
</project>
```

The project consisted of information to be retrieved from the connector. The project request code can be written to bring up a list of datasets and the project dataset can be opened in one request via HTTP. GML format and image data (JPG, GIF, JPEG) are supported for the request.

4.3 Client

In the client side, a map viewer is required to render the data requested by the servlet. This application is mainly for the use of GIS tools such as rendering, querying, pan and zoom. An applet application, which should be able to run on a web browser, was developed using Java technology. It allows users to open data locally and from different sources remotely. **Figure 5** shows the application Graphic User Interface (GUI) with some functions of zoom, pan, rendering and query. **Figure 6** displays the dialog window to open data locally and remotely. Selections of data format are supported including image files, GML and Shapefile. As long as the project request code contains information about the list of datasets, they can be displayed with one request via HTTP.

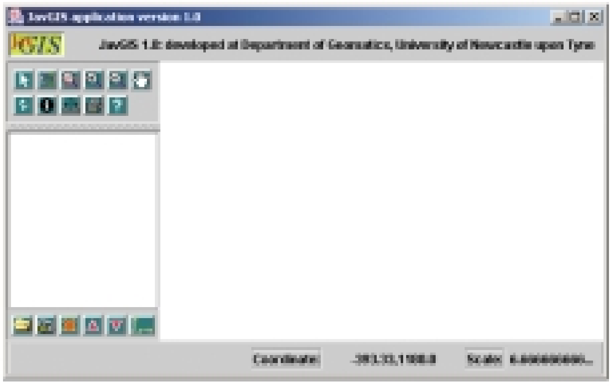

Figure 5: The interface for the client map viewer

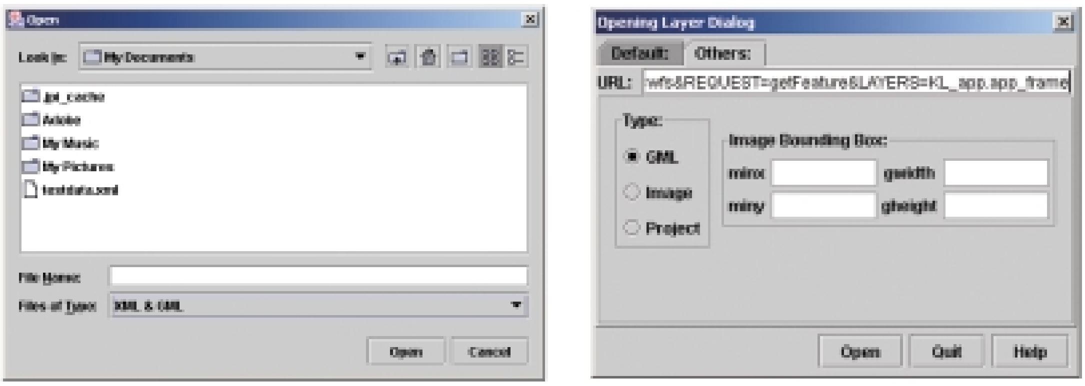

Figure 6: Local file and HTTP data open dialog

A sample of data that was classified as feature classes in the feature dataset *The_GIS-READY_Information* was listed (as in the code shown in 4.2) and opened using the application. **Figure 7** demonstrates the display of the sample project datasets in the application. **Figure 8** provides the zoom-in view of the area showing cadastral (lot parcel, lot boundary lines, lot boundary marks), topographic (buildings and roads) and image data in one single view. These datasets were stored in different servers and retrieved via the HTTP protocol.

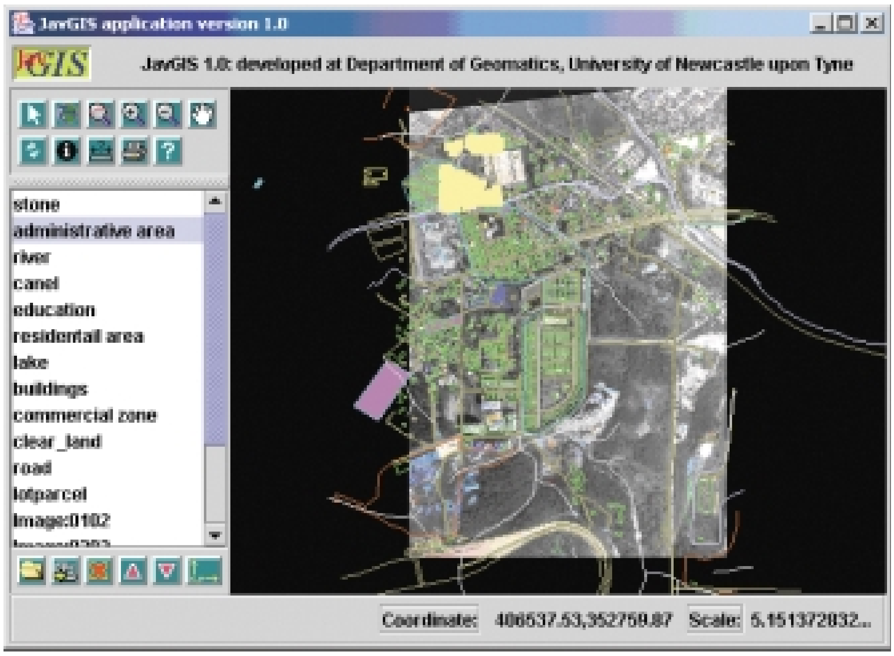

Figure 7: The sample of project covering Kuala Lumpur area

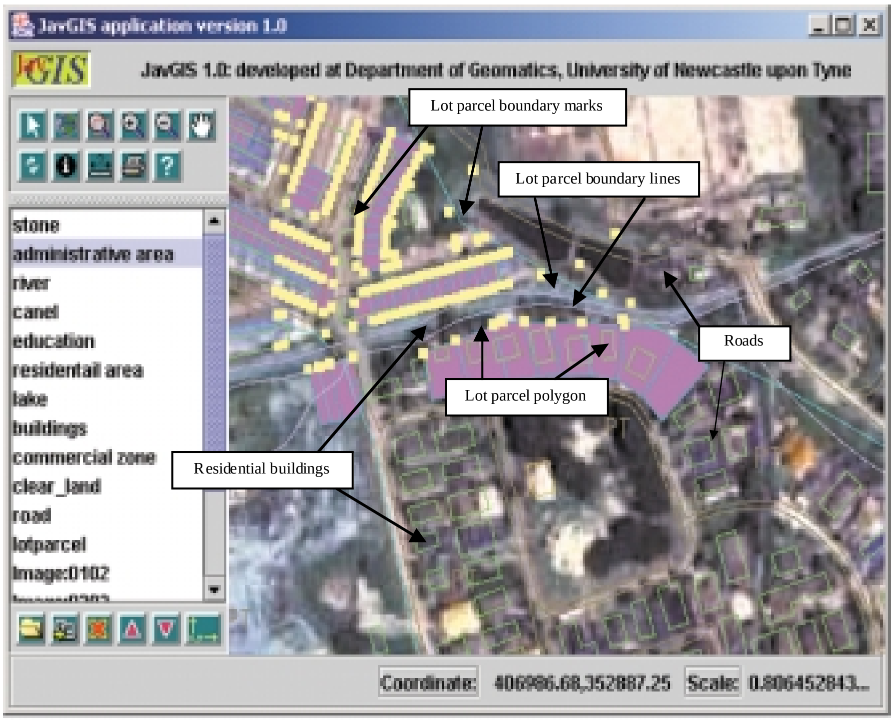

Figure 8: A close-up (zoom-in) of an area showing the data in single view

5.0 SUMMARY

This research has demonstrated the use of GI interoperable standards such GML and web service specification to facilitate data interoperability. Particularly in the test case of JUPEM geospatial datasets that requires data dissemination on the web from multiple different data sources, this clearly shows the possibility to retrieve and combine those data for visualisation and query over the web. As mentioned earlier that Brentjens et al. (2005) has reported that the retrieval, updating and combination of geospatial data were relatively easy primarily because, firstly WFS Specification clearly describes the requests and responses that WFS should support and secondly, because WFS uses standard Web technology such as GML and HTTP. Evidently, the success of the open source prototype dealt in this research has demonstrated this statement except there is no addressing of updating issue specifically. This research has fulfilled the aims of implementing and utilising existing geospatial standards and technologies, e.g. OGC standards and specification (GML, WFS, WMS), HTTP, CGI, XML and SRDB, to overcome the issue of data integration and dissemination from multiple heterogeneous systems.

6.0 CONCLUSION

The development of the open source application comprising of geospatial standards and protocol has clearly shown the successes of the concept of data combination on-the-fly from multiple heterogeneous GIS servers which supply the spatial web service. GML has provided a technology that can be optimally utilised for data dissemination over the Internet. The SRDB was implemented and utilised to enable the construction of an *ad hoc* database capable of providing a solution to some of the issues of proprietary format of GIS dataset. A move to use open source technology vigorously will enable the cooperation and collaboration of private sectors and government departments for the development of geospatial data sharing and interoperability because of its low cost, fully available user forum support and vendor independent application.

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LAND SUITABILITY STUDY USING GIS AND MCDA IN AGRICULTURE ACTIVITIES: A LAND SUITABILITY STUDY FOR HARUMANIS MANGO IN PERLIS USING GIS AND MCDA

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ABSTRACT

The demand for fruits is increasing since the public is now aware about their benefit. One of the popular fruits is mango, especially Harumanis clone which is grown in Perlis. Mango is rich in nutrient like vitamin, energy, fiber, calcium, carbohydrate, potassium and other nutritional values. To satisfy the Harumanis enthusiast, there is a need to extend the existing Harumanis cultivation area. This study identifies the suitable area for Harumanis in the state of Perlis. The land suitability analysis for Harumanis is based on factors such as agro-climatic, soil series and the location of land relative to the road networks, irrigation, terrain condition, and availability of the workers. Analysis was done through an integration of geo-spatial data and the preference criteria using Multi-Criteria Decision Analysis (MCDA) and Geographic Information System (GIS) approach. At the end of the study a map of suitable area for Harumanis is generated and it provides zones of Most Suitable, Suitable and Moderately Suitable land for cultivating Harumanis.

INTRODUCTION

Recently, our country has stressed the importance of the agricultural activities as an economic contribution for the nation. Government has introduced many incentives and new ideas to expand the existing agriculture sector as well as introduced new technology to increase the agricultural production. From the past years, Government already provided almost all the physical infrastructure for the agriculture: roads, irrigations, machineries, new seeds, supporting man power, new technologies etc. With the comprehensive physical infrastructure and non physical infrastructure which is more on information such as land information, the agricultural activities can be expanded and hopefully can produce the maximum yield. One of the issues always highlighted is regarding how to identify the suitable land to develop any agriculture project, such as fruits industry. However, with the recent technology such as GIS, this issue is become easier. GIS is applied in agricultural activities to effectively capture, store, analyze and display information that is geographically based. By using GIS technology, land use inventory can be created and variety of maps, analyses and statistics can be produced to monitor and to know where the best area for certain crop.

There are seventeen fruits identified as having market potential and commercial value for local and international market (Abd. Hadi, 1993). One of the fruits is mango. In Peninsular Malaysia, the area of mango is estimated at around 8000 hectare, mainly in Kedah, Perak, Perlis and Penang. Mango is also grown in smaller farms in Melaka, Negeri Sembilan, Pahang and Johor (MARDI, 2007). There are over 300 mango clones with fruits varying in size, shape, color, flavor and fiber content. The Department of Agriculture has registered about 200 clones. Common commercially planted clones and recommended by the Department of Agriculture are MA 128 (Harumanis), MA 162 (Golek), MA 217 Karutha Kolumban, MA 204 (Melele), MA 165 (MAHA 65), MA 204 Masmuda, MA 224 (Chok Anan), MA 125 Nam Dorkmai (Lim, T.K et al, 1985). Perlis is one of the states active in producing mango, especially Harumanis clone. Harumanis is only exist in Perlis and the main factor that influenced Harumanis cultivation in Perlis is climate factor. Harumanis needs at least two months of pronounced dry period during the year. Well defined drought will stimulate the flowering and fruiting. The existences of drought from January to April in Perlis suits Harumanis. Harumanis is very sensitive to climatic changes. Rain during the processes of flowering and fruiting will cause young fruits to drop before maturity and stimulate diseases that will damage the fruits.

OBJECTIVE

The objectives of the study discussed in this paper are as follows:

i. to apply Analytical Hierarchy Process (AHP) technique for determination of the criteria weight; and

ii. to identify the suitable areas for Harumanis mango in term of Most Suitability, *Suitability* and *Moderatly Suitabality* land for cultivating Harumanis.

STUDY AREA

State of Perlis was chosen as a study area which consists of twenty three *mukim* and covers an area of 795 square kilometers, located at the north of Peninsular Malaysia as shown in **Figure 1.**

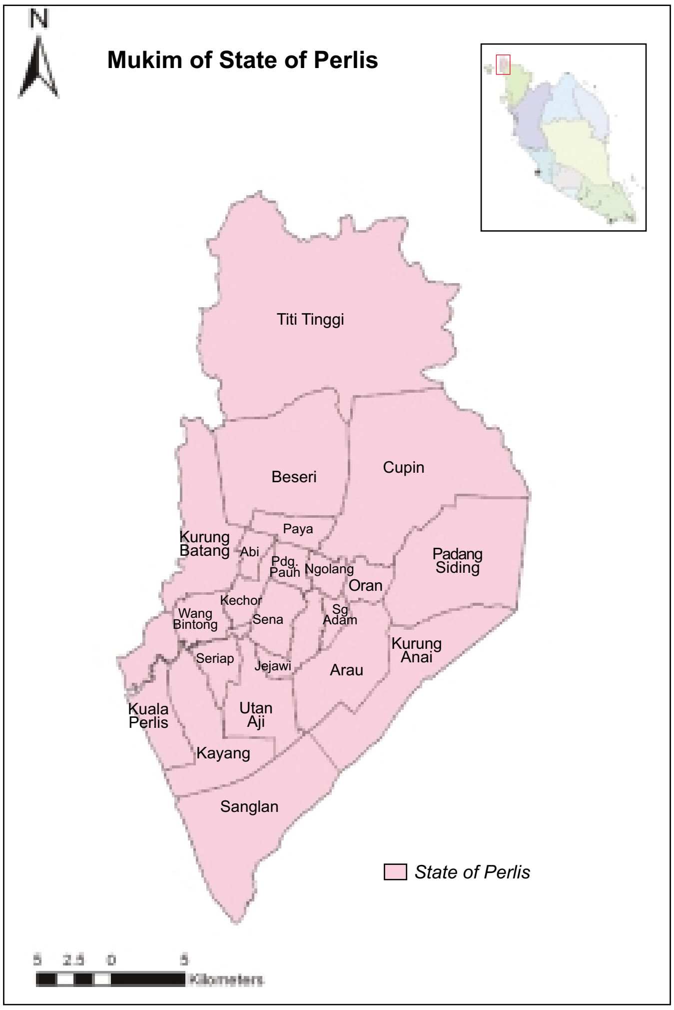

Figure1: Location of the study area

DATA COLLECTION

Data were obtained from several related departments as shown in **Table 1.**

Table 1: Catergory of data used in this research

Data Category	Data Owner	Description of Data
Agro-Climatic	Department of Agriculture (DOA)	Dry and wet distribution
Soil series	Department of Agriculture	Soil series distribution
Land use	Malaysia Centre for Geospatial Data Infrastructure (MaCGDI)	Land use distribution
Topography	Department of Survey and Mapping Malaysia (DSMM)	Rivers and canals, road networks, slope and villages distribution
Cadastral	Department of Survey and Mapping Malaysia	Land information such as lot number, area and *mukim* name

METHODS

Determination of Criteria

Criteria are the basis for evaluating decision alternatives. It is choose in order to evaluate how best to fulfill the requirement for planting Harumanis. There are six criteria used based on agronomy and physical requirements as follow:

i. agronomy requirement: agroclimatic and soil type; and

ii. physical requirement: irrigation, road, village and slope.

The first is used for identifying the available land, and the later is used for determining the suitable land for Harumanis. The criteria represent by data layers as follow:

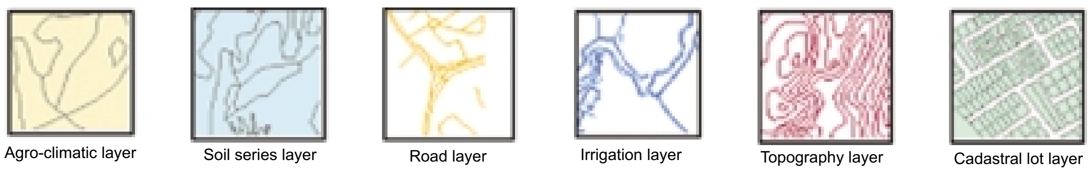

Figure 2: Data layers used in the study

All the criteria above are obtained after consulting the relevant departments regarding the relative importance among the criteria. The departments visited were Department of Agriculture of Perlis, Department of Agriculture of Kedah, Malaysia Agricultural Research and Development Institute and Head Quarters of Department of Agriculture.

Criteria scoring were assessed to know the relative importance between criteria. The score value is determined according to the scale introduced by Saaty (Saaty.1980) to represent score value of 9 to 1. The bigger score value the more importance rank of criteria. The results of the criteria scoring to assess the relative importance between two criteria are used to generate the cell values in a square matrix as shown in **Table 2.**

Table 2: Criteria Score

Criteria	Irrigation	Road	Village	Slope
Irrigation	1	2	3	3
Road	1/2	1	2	3
Village	1/3	1/2	1	3
Slope	1/3	1/3	1/3	1

Calculation Criteria weighting

The importance of each criterion relative to other criteria is shown by criteria weighting. The method used to calculate criteria weighting in this study uses AHP. AHP also called Pairwise Comparison Method is a quantitative method of ranking decision alternatives by developing a numerical score to rank decision alternative based on how well each alternative meets the decision maker's criteria (Saaty, 1980). This technique is the processes of taking pairs of criteria and evaluating them in term of their important rank (score).

Manipulation and Analysis

Manipulation and analysis of data in this study consists layers overlay process, buffering and generating criteria weight using GIS function. Finally, suitable area for Harumanis will be obtained according to the selected criteria. There are three steps of manipulation and analysis of data involves: determination of available land, generating criteria maps and determination o suitable land.

Available land means the potential land to be developed, and the land is free from any obstacle (such as built-up area, recreational area, lake, gazette area etc.) and fulfills the basics requirement for planting Harumanis. Determination of available land for this research is to identify the land that fulfill the factors needs by Harumanis mango such as agronomic requirement (climate and soil series) and physical limitation (i.e. not in township area, recreational area, lake etc.). There are three requirements used to determine the available land. The requirements are (in the form of map layers): agro climatic, soil series and land use. The determination of land availability was done through the processes of spatial overlay, with over-layering of two maps or more. The product of land available analysis is the available land layer. This layer will be used as the 'analysis mask' during the analysis process to get the suitable land for Harumanis mango. In other word, the suitable land should be located within the boundary of available land (potential area land for Harumanis).

Layers representing evaluation criteria will be referred as Criteria Maps (Malczewski, 1999). Criteria Maps were generated based on their selected criteria and sub-criteria accordingly as shown in **Table 3**. The process involves applying new break values to the each criterion layer. The new break values for each criterion were discussed and obtained during visits to the relevant departments as stated earlier. The Criteria Map for each criterion is represent the level of suitability either most suitable, suitable or moderately suitable.

Determination of suitable land is the final output of the manipulation and analysis of the data. Suitable land was obtained by integrating criteria weights from AHP into the criteria maps. The results will show the rank of highest and lowest suitability, i.e., indicate the most suitable and less suitable area for the Harumanis mango. The suitability classification is divided into three classes: most suitable, suitable and moderately suitable.

Table 3: Description of criteria

Criteria	Sub-Criteria	Description
Irrigation	0 - 0.25 km 0.25 - 0.5 km > 0.5 km	most suitable suitable moderately suitable
Road	0 - 1 km 1 - 2 km > 2 km	most suitable suitable moderately suitable
Village	0 - 1 km 1 - 2 km > 2 km	most suitable suitable moderately suitable
Slope	0 - 12 ° 2 -25 ° > 25°	most suitable marginal not suitable

RESULTS AND DISCUSSIONS

Available Land

Three criteria were considered to determine the land available: agro-climatic (dry and wet distribution), soil series and land use. Agro-climatic and soil series are the two basic agronomy requirements and land use is used to obtain the 'constraint area'. Constraint area means the land that cannot be planted Harumanis for example, lake, township area, recreational area. Available land is determined by overlaying the two basic agronomy requirements for Harumanis: agro-climatic and soil series. The result later is integrated with the constraint area. The final available land is shown in **Figure 3**. A total of 40,946 ha of potential land for Harumanis has been identified in this study. The size and shape of available land is depend on the criteria used. If we use the others factors for the criteria such as level of land salinity, pH and the soil type, the result will be differenced. This study is referred to the dry/wet factor and soil series as stated by DOA where by the series of *Chuping, Dampar, Gajah Mati,*

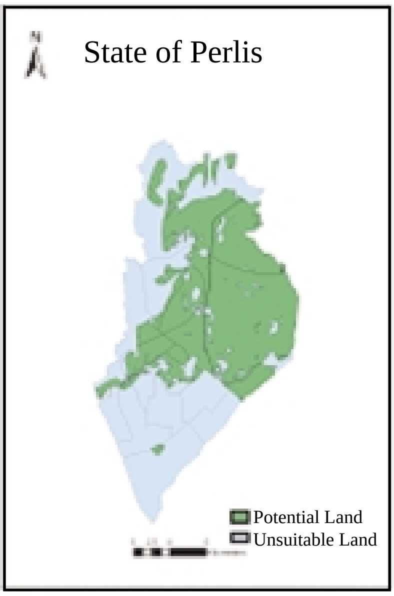

Figure 3: Potential land for Harumanis

Gong Chenak, Harimau, Hutan, Kaki Bukit, Kangar, Kodiang, Langkawi, Lunas, Nangka, Pedu, Penambang, Pokok Sena, Rasau, Sembrin, Tampoi and Telemong is suitable for Harumanis.

Criteria Map

Criteria Maps were generated based on their selected criteria and sub-criteria (as in **Table 3**) accordingly. The results are shown in **Figure 4** to **Figure 7** with three classifications: most suitable, suitable and moderately suitable.

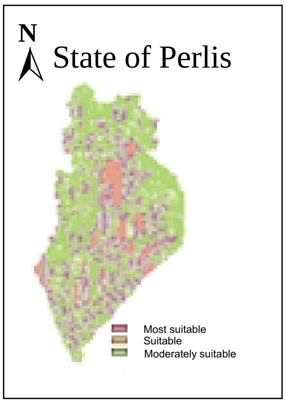

Figure 4: Irrigation proximity criteria map

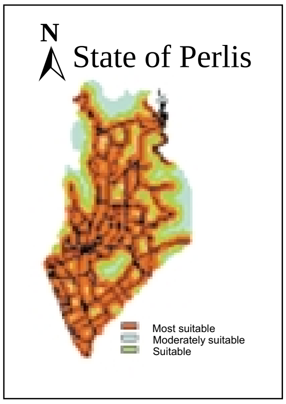

Figure 5: Road proximity criteria map

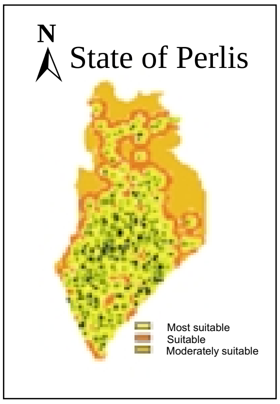

Figure 6: Village proximity criteria map

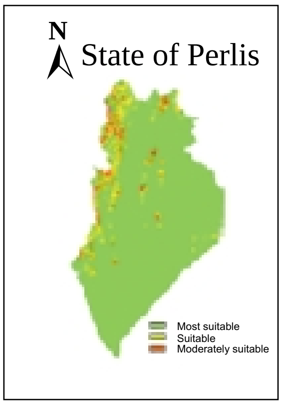

Figure 7: Slope criteria map

Criteria Weight and Consistency Ratio

Criteria weight is the important of each criterion relative to other criteria. The bigger the weight, the more important is the criterion in suitable land analysis. With the criteria scoring obtained as shown in **Table 2**, the criteria weight were computed as shown in **Table 4** to **Table 6**.

Table 4: Pairwise comparison matrix with sun column value

Criteria	Irrigation	Road	Village	Slope
Irrigation	1	2	3	3
Road	1/2	1	2	3
Village	1/3	1/2	1	3
Slope	1/3	1/3	1/3	1
Sum column	2.167	3.833	6.333	10.000

Table 5: Normalized pairwise comparison matrix

Criteria	Irrigation	Road	Village	Slope
Irrigation	0.462	0.522	0.474	0.300
Road	0.231	0.261	0.316	0.300
Village	0.154	0.130	0.158	0.300
Slope	0.154	0.087	0.053	0.100
Total	1	1	1	1

Table 6: Relative weights of the criteria

Criteria	Weight
Irrigation	(0.462 + 0.522 + 0.474 + 0.300)/4 = **0.439**
Road	(0.231 + 0.261 + 0.316 +0.300)/4 = **0.277**
Village	(0.154 + 0.130 + 0.158 + 0.300)/4 = **0.185**
Slope	(0.154 + 0.087 + 0.053 + 0.100)/4 = **0.099**
	Total = 1.000

To determine the comparisons are consistent Consistency Ratio (CR) is calculated by the formula:

CR= CI ÷ RI
Where CI= Consistency Index
= $(\lambda - n) \div (n-1)$
λ= average value of consistency vector
n= number of criteria
RI= random index, the consistency index of a randomly generated pairwise comparison matrix, simply obtained from the table of Random Inconsistency Indices

The CR is designed in such a way that if CR < 0.10, the ratio indicates a reasonable level of consistency in the pairwise comparisons. However, if CR > 0.10 the value of the ratio is indicate inconsistent judgments. This study shows that calculated CR is 0.05 indicates a reasonable level of consistency in the pairwise comparisons and we can accept the weights.

Suitable Land

The analysis of suitable land is done by an extension of ArcGis functionality. Raster Calculator under Spatial Analyst multiply the weight obtained from AHP with the Criteria Maps accordingly. The result of integration from both inputs to get the suitable land for Harumanis is shown in **Figure 8.**

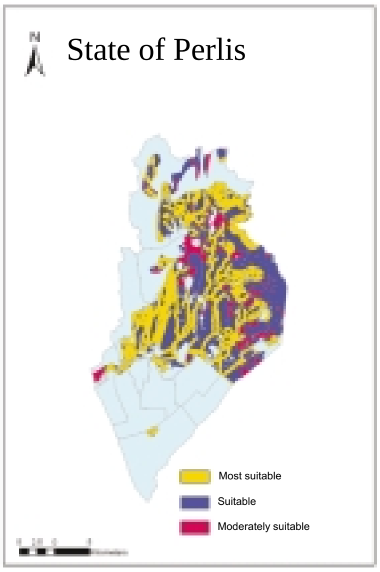

Figure 8: Suitable land for Harumanis using AHP technique

The map indicates a classification ranking in order of higher suitable and lesser suitable. The map was classified into *Most Suitable*, *Suitable* and *Moderately Suitable*. The total suitable land for Harumanis is summarized in the **Table 7.**

Table 7: Harumanis suitability area under different classes

Suitability Class	Area (in ha)	Area (in %)
Most suitable	18,598	45.44
Suitable	18,513	45.24
Moderately suitable	3,814	9.32
Total	40,925	100.00

In this technique, the most suitable area is 18,598 ha which covers 45.44% of the total area suitable land. The suitable area is 18,513 ha (45.24%) and moderately suitable area is 3,814 ha (9.32%). The highest acreage for the most suitable land is due to the effect of AHP approach where the highest weight is from the irrigation criterion. The explanation is due to the existence of rivers and canals in suitable land is the highest volume compare to the others as shown in **Figure 4** to **Figure 7**. Similarly, the map also shows that distance to the road, villages and the slope condition influence the determination of potential area for Harumanis. As a result, only a few areas (red areas in **Figure 8**) are fall under the *Moderately Suitable* because the existence of the criteria in the available land. Consequently, the *Most Suitable* and *Suitable* classification occupy a high percentage of the area covered. The result shown will differ depend on the criteria (and sub-criteria) selected as well as the scoring level. These two factors obtained the criteria weight values as 0.439, 0.277, 0.185 and 0.099 respectively for irrigation, road, village and slope. However, calculated weights will change if the score value given by the experts changed. Thus, inputs from experts are the important to this study. Beside the expert's inputs, source of data influences the analysis. For example, this study used irrigation data from DSMM's Topography Map Series which is the water features was recorded in detail until the smallest canals. As a result the Most Suitable areas were the largest area generated for the Harumanis suitable land.

Another aspect that will influence the result is the sub-criteria preference scale. As stated, sub-criteria scale is used as input in reclassify function in Spatial Analyst to create Criteria Maps. The Criteria Maps will be integrated with the criteria weights from AHP to produce the classified suitability land. The result will change if the sub-criteria values are different. For example if we change the most suitable preference from 0.25 km to 1.0 km for irrigation factor, the final result of *Most Suitable* land will be bigger. Similarly, if we change the break values for the road, village and slope criteria, the result of Criteria Maps also will change. Although it is very difficult to get perfect criteria and its weights, the important point here is, we have to refer to experts and experienced practitioner to gather the inputs before we start the analysis processes.

Harumanis suitable land enhanced with ancillary data

Combination of generated suitable land and ancillary data will enhance the results obtained. Ancillary data used in this study is cadastral lots data. The purpose of overlaying on cadastral lots is to know the location by *mukim* sector and lot's number. This analysis is done by cropping cadastral lot layer with the suitable land layer. **Table 8** shows the ten highest acreage of potential Harumanis areas based on *mukim* sector.

Table 8: The ten highest potential area for Harumanis based on *mukim*

Mukim	Most Suitable (ha)	Suitable (ha)	Moderately Suitable (ha)	Total Land (ha)
Chuping	4007.8	5232.4	720.6	9960.8
Titi Tinggi	4985.6	3657.4	894.7	9537.7
Padang Siding	1719.4	3439.9	912.4	6071.7
Beseri	1150.2	1401.5	807.1	3358.8
Kurung Anai	649.5	1190.9	239.9	2080.3
Sena	580.5	573.6	-	1154.1
Paya	605.9	328.3	-	934.2
Wang Bintong	710.0	139.2	-	849.2
Oran	267.6	548.6	-	816.2
Kurung Batang	659.3	151.6	-	810.9
Total	**15335.8**	**16663.4**	**3574.7**	**35573.9**

CONCLUSION

Suitable land map was generated from the criteria selected. The total of suitable area is 40,925 hectare whereby the *Most Suitable* area is 18,598 hectare (45.44%), *Suitable* area is 18,513 hectare (45.24%) and *Moderately Suitable* area is 3,814 hectare (9.32%). AHP method gave satisfactory results of the weight for each criterion where the CR is between the acceptance values. The weight and analysis of criteria is a guideline for identifying suitable land for Harumanis. The suitable areas will be different as the criteria ranking, sub-criteria and criteria scoring in pairwise comparison are changed depend on the experts/decision makers preference. However, the model can be used and modified to meet the certain requirement of the research.

ACKNOWLEDGEMENTS

Special thanks to JUPEM, MaCGDI, MARDI and DOA for their cooperation in getting the related information.

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PROJEK PEMETAAN FOTOGRAMETRI JARAK DEKAT BERDIGIT (FJDB)
[DIGITAL CLOSE-RANGE PHOTOGRAMMETRIC (DCRP) MAPPING]
MASJID LAMA KG KUALA DAL, PADANG RENGAS, KUALA KANGSAR, PERAK DARUL RIDZUAN.

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1.0 PENGENALAN

Masjid lama Kg Kuala Dal terletak di Padang Rengas, Kuala Kangsar, Perak Darul Ridzuan adalah merupakan sebuah masjid lama bercirikan peninggalan bersejarah. Memang sewajarnya masjid ini **(Rajah 1.0)** diberikan perhatian bagi maksud pemuliharaan dan pembaik-pulihan untuk dijadikan sebagai bahan warisan sejarah generasi akan datang dan juga sebagai sumber daya tarikan sektor pelancongan di Negeri Perak Darul Ridzuan.

Rajah 1.0: Masjid Lama Kg. Kuala Dal.

Fotogrametri adalah merupakan satu bidang yang dapat didefinasikan sebagai suatu seni, sains dan teknologi bagi maksud perolehan maklumat berkaitan fizikal sesuatu objek menerusi proses perakaman, pengukuran dan penafsiran terhadap (berasaskan) imej-imej fotograf." (American Society of Photogrammetry, 1980, m/s: 1).

Fotogrametri dapat dibahagikan kepada tiga pengkelasan utama iaitu:

i) Fotogrametri Udara (khas untuk pemetaan topografi muka bumi).
ii) Fotogrametri Terrestrial.
iii) Fotogrametri Jarak Dekat (FJD).

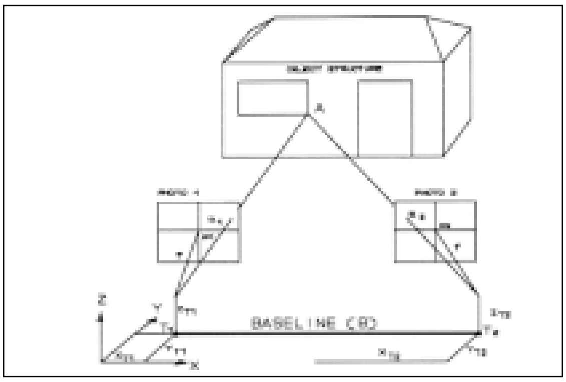
Fotogrametri Jarak Dekat (FJD) adalah juga dikenali sebagai "Fotogrametri Bukan Topografik" yang mana melibatkan pengukuran terhadap imej fotograf tetapi tidak berlandaskan hasilan pemetaan topografi. Pengertian "Jarak Dekat" adalah membawa maksud "*jarak dari objek ke kamera adalah terhad, pada jarak maksimum tidak melebihi 300 meter dan pada jarak minimum ke tahap pecahan kecil milimeter"*. (Atkinson, 1980, m/s: 2). Imej fotograf makroskopik (Moffit dan Mikhail, 1980) dan imej fotograf mikroskopik (Ghosh, 1979) adalah juga boleh digunakan dalam bidang amalan pengukuran fotogrametri, dan kedua-duanya adalah terletak dalam skop bidang Fotogrametri Jarak Dekat (FJD).

Fotogrametri Terrestrial pula adalah bagi kes-kes dimana jarak diantara objek dan kamera yang melebihi 300 meter (Karara, 1979, m/s: 75). Dalam kes disini kamera adalah difokaskan pada situasi optikal infiniti. Amalan ini tidak dilakukan bagi kes Fotogrametri Jarak Dekat (FJD). Walau bagaimana pun kebanyakan peralatan yang digunakan dalam kes Fotogrametri Jarak Dekat (FJD) adalah boleh juga digunakan untuk kes Fotogrametri Terrestrial. Bagi kes Fotogrametri Terrestrial adalah melibatkan pengambilan fotograf-fotograf terhadap sesuatu objek, dari kedudukan kamera di permukaan bumi dan berupaya menjana hasilan berupa maklumat/data 3-D (Tiga dimensa) bagi objek berkenaan. Dengan menggunakan pendekatan kaedah ini, maklumat/data 3-D objek berkenaan dapat dijana dan dikumpulkan dengan tepat, berkejituan tinggi, lebih efektif dan dalam banyak situasi adalah lebih menjimatkan berbanding kaedah pendekatan lain.

2.0 PRINSIP ASAS FOTOGRAMETRI JARAK DEKAT (FJD)

Pada dasarnya kamera yang digunakan dalam pengambilan fotograf terhadap sesuatu objek adalah menghasilkan suatu imej perspektif pusat (*central perspective image*). Sekiranya satah objek dan satah fokal kamera pada kedudukan selari antara satu sama lain maka imej ortografik *(orthographic image)* akan dapat dihasilkan. Secara umumnya ini tidak mungkin (sukar) dilaksanakan kerana keadaan permukaan objek itu sendiri yang tidak sekata *(object irregularity)* dan perubahan kedalaman *(depth changes)*, dan juga kerana satah fokal kamera tidak selari dengan satah unjuran ortografik.

Sekurang-kurangnya dua atau lebih fotograf bagi sesuatu objek hendaklah dirakamkan dari dua atau lebih kedudukan stesyen kamera. Keadaan ini akan membekalkan maklumat/imej dari dua arah berbeza yang mana akan bersilang di reruang, seterusnya membekalkan kedudukan reruang bagi objek berkenaan. Ini dapat dilihat seperti yang ditunjukkan dalam **Rajah 2.0.**



RAJAH 2.0: Prinsip Asas Fotogrametri Jarak Dekat (FJD).

Fotograf-fotograf yang bertindihan *(overlapping photographs)* digunakan untuk menubuhkan model steroskopik dengan menggunakan peralatan khas fotogrametri dan perisian yang bersesuaian. Operator fotogrametri kemudiannya akan berupaya mencerap secara visual kedalaman permukaan objek, seterusnya menjana maklumat-maklumat kedudukan reruang samada berbentuk 2-D atau 3-D secara kaedah pendekatan analog atau pun kaedah pendekatan analitikal.

3.0 PROSIDUR KERJA ‘FJD’ DAN KEPERLUAN PERKAKASAN.

Prosidur perlaksanaan kerja FJD dan keperluan perkakasan adalah terdiri daripada beberapa siri elemen. Bagi sebarang kerja yang melibatkan FJD hendaklah memenuhi faktor keseimbangan dari segi elemen-elemen ini, agar perlaksanaan FJD dapat berjalan dengan lancar. Siri elemen tersebut adalah:

a. **Objek / Struktur**

Objek/struktur adalah terdiri daripada permukaan bangunan *(building façade),* jambatan,empangan dan sebagainya, yang mana penjanaan data 3-D dan pengukuran jitu perlukan dilaksanakan.

b. **Perkakasan Penderia**

Perkakasan penderia adalah terdiri daripada sistem kamera (samada kamera berfilem atau kamera berdigit; kamera metrik atau bukan metrik), tiodolit atau*‘total station’*, pita ukuran atau pengukur jarak laser, tanda titik sasaran dan sebagainya untuk tujuan mendapatkan atau merakamkanmaklumat pengukuran.

c. **Persekitaran Pengukuran**

Persekitaran pengukuran merangkumi situasi/keadaan cuaca, keboleh-laluan atau halangan kepada objek/struktur. Ini akan mempengaruhi proses perlaksanaan bagi proses perolehan data di lapangan.

d. **Makmal dan perkakasan proses perolehan/pengkalibratan data**

Alat Pemplot Stereo, komparator mono atau komparator stereo, pendigit *(digitizer),* pengkod data *(data encoder),* komputer, perisian berprogram dan pencetak.

4.0 PENGUKURAN, PENAWANAN IMEJ DIGITAL, PENGKALIBRATAN IMEJ DAN PEMPROSESAN IMEJ DIGITAL

Prosidur cerapan dengan menggunakan teknologi pengukuran moden seperti cerapan menggunakan *“Reflector-less Laser Total Station”,* penawanan dan rakaman imej fotograf berdigit/CCD beresolusi tinggi, pemetaan dan pemaparan visual dengan berbantukan perisian komputer berprogram fotogrametri yang bersesuaian adalah dilaksanakan disini. Penjanaan imej fotograf terkalibrat bagi Masjid lama Kg Kuala Dal dengan kaedah Fotogrametri Jarak Dekat (FJD) dibangunkan berdasarkan langkah-langkah tertib seperti berikut:

i) Perolehan data dan cerapan di lapangan:
   a. Penubuhan titik kawalan bumi dan struktur objek.
   b. Cerapan data 3-D struktur objek di lapangan.
   c. Penawanan imej fotograf berdigit/CCD.

ii) Pemprosesan data (Makmal: Pengkalibratan dan pemprosesan).

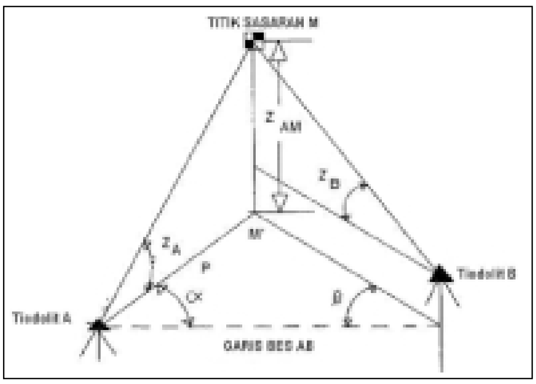
iii) Penjanaan imej fotograf terkalibrat.

iv) Pemplotan dan pemaparan sistem maklumat berukuran.

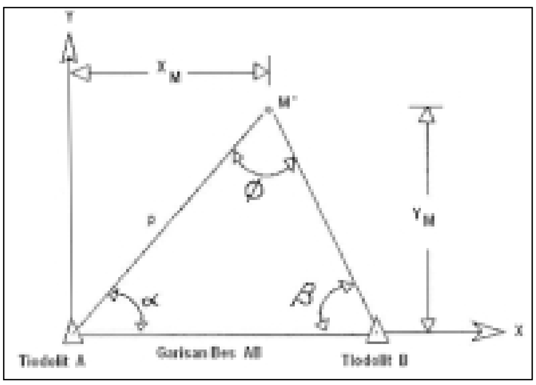
4.1 Kaedah Persilangan Sudutan untuk FJD

Cerapan sudutan horizontal dan vertikal dilaksanakan terhadap titik-titik sasaran kawalan dengan menggunakan alat ukur tiodolit atau “total station” **(Rajah 4.1(a))**. Kedudukan kedua-dua stesyen cerapan juga perlulah ditentukan terlebih dahulu. Dengan penentuan atau pun memberikan nilaian anggaran koordinat stesyen-stesyen tiodolit 1 dan tiodolit 2, maka koordinat 3-D titik-titik sasaran bolehlah dihitungkan.

Merujuk kepada **Rajah 4.1(a)** dan **Rajah 4.1(b)**, penentuan koordinat X, Y dan Z bagi titik sasaran kawalan M dapat dihitungkan. Hitungan ini adalah berasaskan kepada koordinat 3-D stesyen-stesyen cerapan (stesyen A dan stesyen B), jarak garisan bes AB, sudut cerapan horizontal (a dan b) dan sudut cerapan vertikal (Z_A dan Z_B) terhadap titik sasaran M.



Rajah 4.1(a): Cerapan persilangan sudutan tiodolit untuk FJD.



Rajah 4.1(b): Penentuan koordinat X dan Y titik sasaran M.

Berdasarkan kepada **Rajah 4.1(a)**, penentuan koordinat Z bagi titik sasaran M adalah seperti berikut:

$$p = AM' = \frac{B.Sin(\beta)}{Sin(\alpha+\beta)}$$

$$Tan(Z_A) = \frac{Z_M}{p} = \frac{(Z_{AM})/B.Sin(\beta)}{Sin(\alpha+\beta)}$$

Maka,

$$\Rightarrow \quad Z_{AM} = \frac{B.Sin(\beta).Tan(Z_A)}{Sin(\alpha+\beta)}$$

Berdasarkan **Rajah 4.2(b)** pula, koordinat X dan Y bagi titik sasaran M dapat ditentukan seperti berikut:

$$Cos(\alpha) = \frac{X_M}{p}$$

Dan,

$$Sin(\alpha) = \frac{Y_M}{p}$$

Tapi,

$$p = \frac{B.Sin(\beta)}{Sin(\alpha+\beta)}$$

Maka,

$$\Rightarrow \quad X_M = p.Cos(\alpha) = \frac{B.Sin(\beta).Cos(\alpha)}{Sin(\alpha+\beta)}$$

$$\Rightarrow \quad Y_M = p.Sin(\alpha) = \frac{B.Sin(\beta).Sin(\alpha)}{Sin(\alpha+\beta)}$$

Proses hitungan ini dilaksanakan terhadap setiap titik-titik sasaran yang telah dipilih untuk dijadikan sebagai titik-titik kawalan pada bangunan Masjid lama Kg Kuala Dal. Paparan **Jadual 4.1** menunjukkan sebahagian daripada senarai titik-titik kawalan yang telah dijana hasil cerapan sudutan tiodolit/*total station*.

Jadual 4.1: Senarai Sebahagian Titik-titik Kawalan Kampung Kuala Dal

CONTROL POINTS	GEO-TS / GPS OBS. COORD.			VECTOR DISTANCE			PHOTO COORD	
	N	E	H	LINE	X-Diff	Y-Diff	X	Y
							FACE 3-1	
P48	322005.875	528306.656	62.337				100.000	100.000
P51	322010.488	528303.277	62.428	P48-P51	5.718889	-0.091	105.719	100.091
P47	322005.432	528306.208	65.897		0.630042		100.630	103.560
P50	322010.565	528303.049	65.915	P47-P50	6.018699	-0.018	106.649	103.578
P46	322006.620	528306.105	69.493		0.214367		100.844	107.156
P49	322010.768	528302.998	69.662	P46-P49	6.013322	-0.159	106.858	107.315
							FACE 3-2	
P52	322010.246	528302.760	62.491		5.709669		100.000	100.000
P57	322010.973	528302.306	62.476	P52-P57	0.857776	0.015	100.858	99.986
P53	322010.376	528302.672	66.932		0.156984		100.157	103.441
P56	322011.073	528302.221	66.913	P53-P56	0.830404	0.019	100.987	103.422
P54	322010.568	528302.593	69.509		0.202617		100.365	107.018
P55	322011.249	528302.137	69.493	P54-P55	0.819727	0.016	101.184	107.002

4.2 Pengkalibratan Imej Digital Dengan Pendekatan FJD.

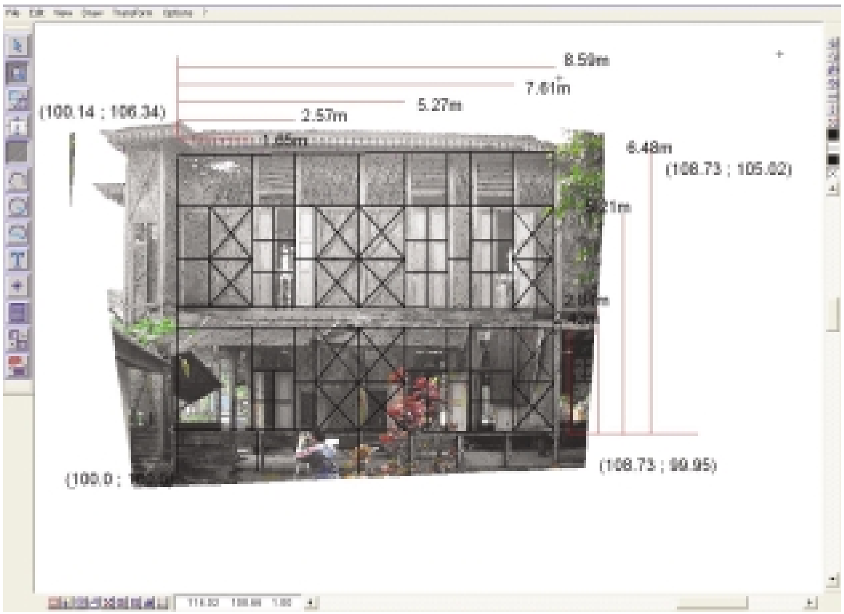
Rajah 4.2(a) memaparkankan imej fotograf digital bagi sebahagian permukaan bangunan Masjid lama Kg Kuala Dal yang belum dilakukan sebarang pemprosesan pengkalibratan. **Rajah 4.2(b)** pula memaparkan imej fotograf digital yang telah dilakukan pengkalibratan dengan pendekatan Fotogrametri Jarak Dekat (FJD). Ini bermakna pengukuran boleh dilakukan terhadap imej ini, setelah pengkalibratan terlaksana.

Rajah 4.2(a): Imej fotograf digital sebelum pengkalibratan FJD.

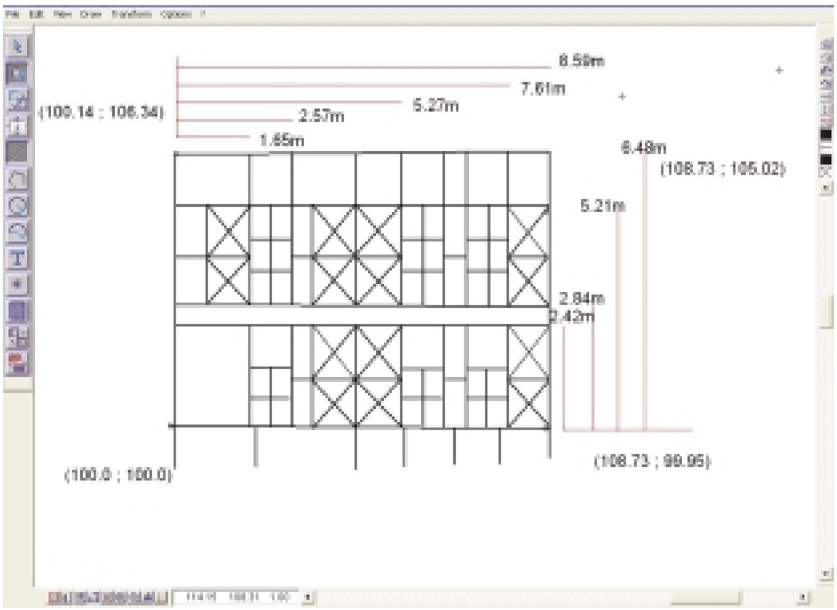
Rajah 4.2(b): Imej fotograf digital setelah pengkalibratan FJD.

4.3 Hasilan Pengkalibratan Imej Digital Dengan Pendekatan FJD.

Rajah 4.3(a) memaparkan hasilan dengan pendekatan Fotogrametri Jarak Dekat (FJD) yang mana turut memaparkan ukuran-ukuran dalam unit meter (lukisan terukur) di atas lapisan (layer) imej digital sebenar masjid Kg Kuala Dal yang telah terkalibrat. **Rajah 4.3(b)** pula hanya memaparkan hasilan lukisan terukur bagi sebahagian permukaan Masjid Kg Kuala Dal.



Rajah 4.3(a): Hasilan FJD berlapisan imej sebenar terkalibrat dan lukisan terukur.



Rajah 4.3(a): Hasilan FJD memaparkan lukisan terukur.

5.0 KESIMPULAN

Fotogrametri Jarak Dekat (FJD) berupaya melaksanakan dan menghasilkan lukisan terukur di atas lapisan imej digital yang telah dilakukan pengkalibratan. Maklumat/data ukuran bagi sesuatu objek dapat dijana dan dikumpulkan dengan tepat, berkejituan, lebih efektif dan dalam banyak situasi adalah lebih menjimatkan masa dan tenaga berbanding kaedah pendekatan lain.

6.0 RUJUKAN

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14TH MEETING OF PERMANENT COMMITTEE ON GIS INFRASTRUCTURE FOR ASIA AND THE PACIFIC

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Y.B. Datuk Douglas Uggah Embas, Menteri Sumber Asli dan Alam Sekitar menyampaikan ucapan pembukaan beliau

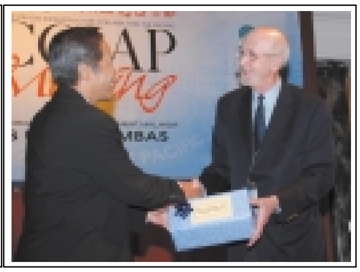
Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP) merupakan jawatankuasa peringkat antarabangsa yang ditubuhkan dengan objektif untuk membangunkan infrastruktur maklumat spatial bagi rantau Asia dan Pasifik di samping menyumbang kepada pembangunan infrastruktur tersebut di peringkat global. Pertubuhan ini telah diwujudkan semasa *13th United Nations Regional Cartographic Conference for Asia and the Pacific* yang telah diadakan di Beijing pada 1994. Pertubuhan ini dianggotai oleh 56 buah negara dari rantau Asia Pasifik dan beroperasi di bawah naungan Pertubuhan Bangsa-bangsa Bersatu (PBB) termasuklah Malaysia melalui Jabatan Ukur dan Pemetaan Malaysia (JUPEM) merupakan negara ahli bagi PCGIAP.

Semasa *"13th Executive Board Meeting of PCGIAP"* yang telah diadakan di Seoul, Korea pada 12 - 15 Jun 2007, persetujuan telah dicapai untuk mengadakan *"14th Meeting of PCGIAP"* pada tahun 2008 di Kuala Lumpur. Sehubungan dengan itu, Malaysia telah menyambut baik peluang dan penghormatan yang diberikan dengan menganjurkan *"14th Meeting of PCGIAP"* yang telah diadakan pada 19 -22 Ogos di Hotel Renaissance, Kuala Lumpur.

Mesyuarat tersebut telah dirasmikan oleh Y. Bhg. Datuk Douglas Uggah Embas, Menteri Sumber Asli dan Alam Sekitar pada 19 Ogos 2008. Seramai 156 peserta yang terdiri daripada pakar-pakar, wakil bagi 25 buah negara dan peserta jemputan dari dalam negara telah pun menghadiri mesyuarat ini. 78 daripadanya merupakan peserta antarabangsa sementara 78 lagi adalah peserta tempatan. Peserta-peserta dari dalam negara antara lainnya terdiri daripada pegawai-pegawai kanan dari JUPEM, institusi-institusi pengajian tinggi, pejabat-pejabat tanah dan galian negeri / persekutuan, agensi-agensi di bawah Kementerian Sumber Asli dan Alam Sekitar serta agensi-agensi kerajaan lain yang mempunyai kepentingan dalam bidang pentadbiran tanah, ukur dan pemetaan serta GIS.

Di bawah PCGIAP, empat (4) *Working Groups* telah ditubuhkan dan bertanggungjawab untuk merancang serta melaksanakan aktiviti mengikut skop kerja yang telah dikenal pasti bagi membantu PCGIAP mencapai matlamatnya*. Working Groups* tersebut adalah *Working Group on Regional Geodesy (WG1), Working Group on Fundamental Data (WG2), Working Group on Spatially Enabled Government (WG3) dan Working Group on Institutional Strengthening (WG4)*. Setiap *Working Group* telah melaporkan kemajuan projek dan aktiviti serta cadangan program kerja baru masing-masing. Pada masa yang sama kesemua *Working Group* tersebut telah mengadakan perbincangan mengenai isu-isu yang dihadapi serta merangka langkah-langkah bagi menangani isu-isu tersebut.

Y.Bhg. Datuk Hamid bin Ali, Pengarah Ukur dan Pemetaan turut menyampaikan ucapan aluan kepada tetamu yang hadir



Y.Bhg. Datuk Hamid bin Ali, menyampaikan cenderahati kepada Mr. Peter Holland, Presiden PCGIAP

Bersekali dengan penganjuran *"14th Meeting of PCGIAP"* ini, majlis lain yang turut diadakan ialah *"International Seminar on Land Administration Trends and Issues in Asia and the Pacific Region".* Seminar ini telah dikendalikan oleh WG3 sebagai salah satu aktiviti kerja mereka untuk mendalami sistem-sistem pentadbiran tanah negara-negara ahli serta mengenalpasti keperluan mereka. Berikut merupakan kertas kerja yang telah dibentangkan semasa seminar tersebut:

- Kertas 1 : *Land Tenure Services* (UNFAO)
- Kertas 2 : *The UNECE Working Party on Land Administration* (Mr. Peter Creuzer)
- Kertas 3 : *Challenges Facing Cadastral Survey in Malaysia* (Dr. Teng Chee Hua)
- Kertas 4 : *Land Privatization in Mongolia* (Mr. Chinzorig Batbileg)
- Kertas 5 : *Land Privatization in Cambodia* (Mr. Lor Davuth, Suon Sopha & Seng Thany)
- Kertas 6 : *Toward eLand Administration in Australia* (Mr. John. E Tulloch)
- Kertas 7 : *Land Information Trends and Issues in New Zealand* (Mr. Geoff O'Malley)
- Kertas 8 : *Korea Cadastre and Land Administration System* (Mr. Hyun Sook, Lee)
- Kertas 9 : *Thailand Land Administration* (Mr. Montri Petcha-em)
- Kertas 10: *Land Administration Issues in Philippines*
- Kertas 11: *Iranian Cadastre System* (Mr. Nasrollah Jahangard)
- Kertas 12: *Land Administration Trends and Issues in Fiji* (Mr. Kemueli Masikerei)
- Kertas 13: *Land Legislation Construction Issues in Developing and Transition Economy Countries With Practical Experience in Vietnam* (Prof.Dr.Sc.Dang Hung Vo)

Kertas 14: *Integration of Built and Natural Environmental Datasets within National SDI Initiatives* (Prof. Abbas Rajabifard)

Dalam pada itu juga, WG2 turut mengadakan *"International Workshop on ISO-PCGIAP Metadata Profile for Asia and the Pacific Region"*. Bengkel ini bertujuan untuk memberikan pendedahan secara menyeluruh kepada para peserta mengenai pembangunan dan status *ISO Metadata Profiles*. Berikut merupakan kertas kerja yang telah dibentangkan semasa bengkel tersebut:

Kertas 1 : *Geospatial Metadata Profiles, Catalogues and Interoperability* (Mr. Jeroen Ticheler)

Kertas 2 : *Regional ISO Metadata Profiles: Status* (Mr. Henry Tom)

Kertas 3 : *PCGIAP Metadata Profile Survey and Resulting Draft ISO Metadata Profile for Asia and the Pacific (Mr. Sang-Ki Hong)*

Kertas 4 : *ANZLIC ISO Metadata Profile: Experiences and Status* (Mr. John Hockaday)

Antara pembentang yang membentangkan kertas kerja masing-masing, sementara ahli mesyuarat yang lain mendengar dengan penuh minat serta mengajukan pertanyaan mengenai kertas kerja yang dibentangkan

Selain daripada itu, *International Steering Committee for Global Mapping (ISCGM)* telah turut mengambil kesempatan dengan kehadiran wakil-wakil negara dari rantau Asia Pasifik untuk mengadakan mesyuaratnya bersempena dengan penganjuran *"14th Meeting of PCGIAP".* Mesyuarat ISCGM ini diadakan bagi memaklumkan negara-negara anggota mengenai aktiviti-aktiviti yang telah dijalankan oleh ISCGM sejak mesyuaratnya yang lepas pada bulan Jun 2008 dan juga status penyediaan *global mapping* sehingga kini.

Sementara itu, JUPEM dan Lembaga Juruukur Tanah (LJT) telah bekerjasama mengadakan Majlis Makan Malam pada 19 Ogos 2008 di Hotel Renaissance, Kuala Lumpur bagi meraikan kehadiran ahli mesyuarat PCGIAP terutamanya delegasi antarabangsa serta juruukur-juruukur tanah berlesen dan juga sekaligus meraikan sambutan Ulang Tahun LJT Yang Ke-50.

Pada 21 Ogos 2008 iaitu hari ketiga mesyuarat tersebut berlangsung , ahli mesyurat telah berpeluang untuk meyertai salah satu daripada lawatan yang dianjurkan oleh JUPEM iaitu lawatan ke Pusat Insfrastruktur Data Geospatial Negara (MaCGDI) di Putrajaya dan *Kuala Lumpur City Center (KLCC) Twin Tower Skybridge.*

Sebahagian daripada *Executive Board* dan ahli mesyuarat PCGIAP

Hasil daripada mesyuarat PCGIAP, wakil-wakil negara telah dapat berkongsi pengalaman dan maklumat serta berbincang mengenai perkara-perkara berkepentingan bersama. Perkongsian maklumat di kalangan negara-negara ahli PCGIAP adalah sangat penting bagi menangani isu-isu serantau dan telah memberikan sumbangan dalam membantu usaha pembangunan lestari negara. Selain daripada itu, wakil-wakil negara telah dapat memperolehi manfaat kepakaran dan kemudahan ke arah pembangunan dan penggunaan teknologi moden. Penganjuran mesyuarat ini juga telah membuka jalan dan menyokong usaha JUPEM bagi menempatkan negara sebagai pusat kecemerlangan serantau dalam bidang ukur dan pemetaan serta GIS.

Sekitar Majlis Makan Malam yang turut dihadiri oleh
Y.B. Datuk Douglas Uggah Embas, Menteri Sumber Asli dan Alam Sekitar

Sekitar lawatan ahli mesyuarat PCGIAP ke
Pusat Infrastruktur dan Data Geospatial Negara (MaCGDI)
serta *Kuala Lumpur City Centre (KLCC) Twin Tower Skybridge.*

PERKAMPUNGAN SAINS, TEKNOLOGI DAN PENDIDIKAN PARLIMEN BALING 2008

Norazmel bin Abd Karim
Pusat Infrastruktur Data Geospatial Negara (MaCGDI)

Pada 15 hingga 17 Februari 2008 yang telah lalu, Perkampungan Sains, Teknologi dan Pendidikan Parlimen Baling 2008 yang dianjurkan oleh Jabatan Perdana Menteri dengan kerjasama oleh Kementerian Sains, Teknologi & Inovasi (MOSTI), Kerajaan Negeri Kedah dan juga Pejabat Daerah Baling telah diadakan di perkarangan Dewan Kenangan Tun Abdul Razak, Baling, Kedah Darul Aman. Perkampungan Sains ini telah dirasmikan oleh Y.B. Dato' Dr. Mashitah binti Ibrahim.

Tujuan utama program ini adalah untuk meningkatkan kesedaran, kefahaman dan pengetahuan sains dan teknologi di kalangan masyarakat terutamanya di kawasan luar bandar khususnya di Daerah Baling. Program seumpama ini dapat mendekatkan lagi penduduk sekitar Baling tentang perkembangan sains dan teknologi yang berubah dengan pantas. Hampir 50 agensi telah menyertai Perkampungan Sains ini yang meliputi agensi kerajaan, yang dibuka dari pukul 9.00 pagi hinggalah 10.00 malam. MaCGDI juga turut tidak ketinggalan di dalam memeriahkan lagi perkampungan Sains ini dengan menonjolkan



peranannya sebagai pusat perkongsian data geospatial negara yang mana rata-ratanya masih kabur tentang GIS ini. Di sinilah peranan MaCGDI di dalam mendedahkan kepada masyarakat setempat, pelajar-pelajar sekolah menengah dan rendah serta guru. Pelajar-pelajar ini telah diberi penerangan bagaimana peta geografi berbentuk kertas, boleh ditukarkan ke dalam bentuk digital. Begitu juga peranan GIS sebagai satu medium yang boleh membantu menyelesaikan masalah pengurusan alam sekitar dan pemantauan. Sebahagian besar masih kurang jelas tentang peranan GIS di dalam menyelesaikan setiap permasalahan, seperti mana yang boleh diperolehi pada peta geografi sedia ada. Untuk menambahkan pemahaman dan menceriakan suasana lot pameran MaCGDI, kuiz juga telah diadakan kepada pelajar. Pelbagai hadiah dan cenderahati telah diberikan kepada pemenang setiap kuiz. Risalah dan buku pekeliling MaCGDI juga telah diedarkan.

Secara keseluruhannya, sambutan adalah sungguh menggalakkan di lot booth pameran MaCGDI dengan pertanyaan yang menjadi keraguan kpeda pengunjung. MaCGDI telah menerima lawatan daripada Ahli Parlimen Baling iaitu Y.B. Dato' Dr. Mashitah binti Ibrahim dan seterusnya menyampaikan penghargaan kepada beliau.

Pelbagai acara menarik telah diaturkan sepanjang 3 hari berlangsungnya Perkampungan Sains, Teknologi dan Pendidikan 2008. Antaranya adalah ;

- Sesi Ramah Mesra dan motivasi bersama Angkasawan Negara Dr.Sheikh Muszaphar Shukor pada16 Februari 2008 jam 2.30 petang.
- Cerapan bintang dan planet pada sebelah malam yang memberi peluang kepada pengunjung untuk melihat keajaiban alam secara lebih dekat dan *'live'*.
- Ceramah ehwal islam dan diikuti oleh persembahan nasyid oleh Kumpulan Rabbani.


LAWATAN SAMBIL BELAJAR FAKULTI PERHUTANAN, UNIVERSITI PERTANIAN MALAYSIA (UPM) KE MaCGDI

Norazmel bin Abd. Karim &
Aziz bin Hasan
Pusat Infrastruktur Data Geospatial Negara (MaCGDI)

Lawatan sambil belajar oleh pelajar-pelajar Universiti Putra Malaysia (UPM) ke MaCGDI telah diadakan pada 22 Januari 2008 (Selasa). Seramai 29 orang pelajar yang terdiri daripada pelajar-pelajar peringkat Ijazah pertama, Sarjana dan Phd yang sebahagian besarnya pelajar-pelajar yang hadir daripada negara timur tengah seperti Iran, Yaman, Jordan, Iraq dan juga pelajar daripada Malaysia.

Wakil pensyarah dari Fakulti Perhutanan UPM ialah Dr Alias bin Mohd Sood yang mana beliau telah memberi ucapan kedatangan beliau dan hasrat pihak UPM agar pelajar Fakulti Perhutanan dapat menimba maklumat yang secukupnya untuk tujuan penyelidikan mereka. Wakil pelajar pula ialah Encik Amjad Ali Shah daripada Jordan.

Antara agenda yang terdapat pada sesi ini ialah memberi penerangan tentang perkembangan terkini peranan aplikasi MyGDI sebagai platform perkongsian data dan penggunaan GIS sebagai satu alat bantuan untuk menjayakan konsep dan peranan MaCGDI.

Dari segi aspek data pula, pengerusi memaklumkan senario data-data ini diperolehi dan dapat ditunjukkan melalui lapisan *(layer)* pada setiap *attribute* yang ada bersama data tersebut. Selain daripada itu, pengerusi juga telah memberi penerangan selanjutnya mengenai *Clearinghouse* di mana pangkalan data telah ditempatkan di setiap agensi berkenaan supaya ia boleh dan mudah dimuat turun kepada pangkalan data utama MaCGDI. Pihak agensi berkenaan akan mengutip data-data di lapangan dan disimpan pada pangkalan data pada agensi tersebut.

Pihak MaCGDI menerima berbagai format data dan melaksanakan semakan terhadap data tersebut sehingga ia di kemaskini ke dalam Pangkalan Data MaCGDI. Di masa yang sama data-data ini boleh dicapai, dilayari dan dimuat turun kepada Jabatan Kerajaan dan persendirian yang berdaftar sahaja.

Bagi pelajar yang hadir untuk lawatan ke MaCGDI ini, mereka telah diberi penerangan dan ditunjukkan secara demo ke atas aplikasi MyGeoportal secara *'online'.*

Di samping penerangan yang telah diberi, pihak MaCGDI juga telah memberi cenderahati berupa Corporate Profile, Buletin Geospatial Sektor Awam, Brosur MyGDI, buku nota dan Kalendar Meja Tahun 2008. Majlis lawatan telah selesai jam 4.25 petang di mana pihak MaCGDI telah mengucapkan terima kasih di atas kehadiran pelajar-pelajar daripada UPM dan berharap pihak pelajar UPM berpuas hati dengan layanan yang diberi sepanjang lawatan yang dijalankan. Di harap segala penerangan yang diperolehi dapat digunakan sepenuhnya semasa pembelajaran di UPM. Pihak MaCGDI berharap pelajar-pelajar UPM dapat melayari Portal MaCGDI untuk memperolehi maklumat yang lebih lanjut.

KALENDAR GIS 2008/2009

TARIKH	TAJUK	LOKASI	PENGANJUR	TALIAN PERTANYAAN
19 – 22 Ogos 2008	*14th Meeting of Permanent Committee on GIS Infrastructure for Asia and the Pasific*	Kuala Lumpur	JUPEM, University of Melbourne, Australia & United Nation Food and Agricultural Organisation	Encik Ahmad Fauzi bin Nordin Tel : +603 26170841 Fax : + 603 26933618 E-mail : fauzi@jupem.gov.my
26 – 28 Ogos 2008	*Map Asia 2008*	Kuala Lumpur	MaCGDI & GIS Development Sdn. Bhd.	Encik Sunil Ahuja Tel : +601 72929756 Fax : + 603 21447636 E-mail : info@mapasia.org
28 – 30 Oktober 2008	*ISG 2008*	PWTC, Kuala Lumpur	KLIUC	Encik Ranjit Signh Tel : +603 79551773 Fax : + 603 79550253 E-mail : glsdiv@ism.org.my bsdiv@ism.gov.my
4 – 5 November 2008	*MRSS 5th Malaysian Remote Sensing and GIS Conference and Exhibition*	Kuala Lumpur	UTM	Prof. Dr. Mazlan bin Hashim Tel : +607 5502873 Fax : + 607 5566163 E-mail : mazlan@fksg.utm.my
Mac 2009	Mesyuarat Jawatankuasa Pemetaan dan Data Spatial Negara (JPDSN) ke 60	Belum ditentukan	Bahagian Pemetaan, JUPEM	Encik Ng Eng Guan Tel : +603 26170831 Fax : + 603 26970140 E-mail : ng@jupem.gov.my
Mac 2009	Jawatakuasa Teknikal Nama Geografi (JTNG)	Belum ditentukan	Bahagian Pemetaan, JUPEM	Cik Nornisha binti Ishak Tel : +603 26170820 Fax : + 603 26970140 E-mail : nornisha@jupem.gov.my
Jun 2009	Jawatankuasa Kebangsaan Nama Geografi (JKNG)	Belum ditentukan	Bahagian Pemetaan, JUPEM	Encik Ng Eng Guan Tel : +603 26170831 Fax : + 603 26970140 E-mail : ng@jupem.gov.my
10 - 12 Ogos 2009	*ISG & SDSS/LBS 2009 (International Symposium and Exhibition on Geoinformation & ISPRS Symposium on Spatial Decision Support System LBS*	Belum ditentukan	UPM & MaCGDI	Prof. Dr. Shattri Mansor Tel : +603 89467543 Fax : + 603 85566061 E-mail : shattri@eng.upm.edu.my

SUMBANGAN ARTIKEL/ *CALL FOR PAPER*

Buletin GIS diterbitkan dua (2) kali setahun oleh Jawatankuasa Pemetaan dan Data Spatial Negara. Sidang Pengarang amat mengalu-alukan sumbangan sama ada berbentuk artikel atau laporan bergambar mengenai perkembangan Sistem Maklumat Geografi di Agensi Kerajaan, Badan Berkanun dan Institusi Pengajian Tinggi.

Panduan Untuk Penulis

1. Manuskrip boleh ditulis dalam Bahasa Malaysia atau Bahasa Inggeris

2. Setiap artikel yang mempunyai abstrak mestilah condong *(italic).*

3. Format manuskrip adalah seperti berikut:

Jenis huruf	: Arial
Saiz huruf bagi tajuk	: 12 (Huruf Besar)
Saiz huruf artikel	: 10
Saiz huruf rujukan/*references*	: 8
Langkau (isi kandungan)	: 1.5
Margin	: Atas, bawah, kiri dan kanan = 2.5cm
Justifikasi teks	: *Justify allignment*
Maklumat penulis	: Nama penuh, alamat lengkap jabatan/ institusi dan e-mel.

   Satu *'column'* setiap muka surat

4. Sumbangan hendaklah dikemukakan dalam bentuk *softcopy* dalam format Microsoft Word.Semua imej grafik hendaklah dibekalkan secara berasingan dalam format .tif atau .jpg dengan resolusi 150 dpi dan ke atas.

5. Segala pertanyaan dan sumbangan bolehlah dikemukakan kepada:

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