



DEVELOPMENT OF UNIVERSITY CAMPUS WIDE  
INFORMATION SYSTEM (UOWIS) USING INTEGRATED  
GIS MAP & DATABASE DEVELOPMENT

ASSOC-PROF.DR. MOHD SANUSI S-AHAMAD

UNIVERSITI SAINS MALAYSIA  
KAMPUS KEJURUTERAAN

2008



# **Laporan Akhir Projek Penyelidikan Jangka Pendek**

## **Development of University Campus Wide Information System (UCWIS) using Integrated GIS Map and Database Development**

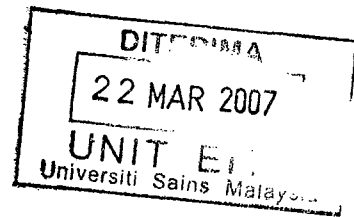
**by**

**Assoc. Prof. Dr. Mohd Sanusi S. Ahamad**

**Assoc. Prof. Dr. Wan Muhd Aminuddin**

**Wan Hussin**

**Dr. Shamshad Ahmad**



PEJABAT PENGURUSAN & KREATIVITI PENYELIDIKAN  
RESEARCH CREATIVITY AND MANAGEMENT OFFICE [RCMO]

**LAPORAN AKHIR PROJEK PENYELIDIKAN JANGKA PENDEK**  
**FINAL REPORT OF SHORT TERM RESEARCH PROJECTS**

1) **Nama Ketua Penyelidik :**  
*Name of Research Leader :*

Ketua Penyelidik <i>Research Leader</i>	PTJ <i>School/Centre</i>
PM Dr. Mohd Sanusi S. Ahamad	School of Civil Engineering

**Nama Penyelidik Bersama**  
*(Jika berkaitan) :*  
*Name/s of Co-Researcher/s*  
*(if applicable)*

Penyelidik Bersama <i>Co-Researcher</i>	PTJ <i>School/Centre</i>
PM Dr. Wan Muhd Aminuddin Wan Hussin	School of Civil Engineering
Dr. Shamshad Ahmad	School of Civil Engineering

2) **Tajuk Projek :**  
*Title of Project:* DEVELOPMENT OF UNIVERSITY CAMPUS WIDE INFORMATION SYSTEM [UCWIS]  
USING INTEGRATED GIS MAP AND DATABASE DEVELOPMENT.

3) **Abstrak untuk penyelidikan anda**

(Perlu disediakan di antara 100 – 200 perkataan di dalam Bahasa Malaysia dan Bahasa Inggeris. Ini kemudiannya akan dimuatkan ke dalam Laporan Tahunan Bahagian Penyelidikan & Inovasi sebagai satu cara untuk menyampaikan dapatan projek tuan/puan kepada pihak Universiti & luar).

*Abstract of Research*

*(Must be prepared in 100 – 200 words in Bahasa Malaysia as well as in English. This abstract will later be included in the Annual Report of the Research and Innovation Section as a means of presenting the project findings of the researcher/s to the university and the outside community)*

The research is a mapping project effort to create a campus base map that will serve as a common reference for all spatial data on USM main campus and the Engineering campus. The automated system is build on GIS for the capture, storage, update, retrieval, manipulation, analysis, management, and display of all forms of geographically referenced information on the USM campus. The system allows tabular data to be displayed on maps [spatial information]. These maps and databases represent valuable piece of comprehensive mapping system that provides the essential spatial information to the USM campus-wide information [UCWIS] relating to facility and utility infrastructure. The creation of UCWIS serve as a common reference for all spatial data on campus serving the students, faculty, and administrative departments.

Penyelidikan ini berbentuk projek pemetaan bertujuan menghasilkan peta asas untuk rujukan umum data ruangan Kampus Induk dan Kampus Kejuruteraan USM. Sistem pemetaan automasi dibina menggunakan GIS untuk perolehan, pengstoran, kemaskinian, analisis, pengurusan, dan pemaparan maklumat rujukan geografi terhadap kampus USM. Sistem ini membenarkan data atribut dipapar bersama peta lokasi untuk penghasilan data ruangan. Peta digital yang dihasilkan merupakan satu pelan komprehensif kepada penghasilan Sistem Maklumat Ruangan USM menyeluruh berhubung dengan maklumat kemudahan utiliti dan infrastruktur USM. Sistem ini dianggap sebagai data ruangan rujukan kampus yang boleh dilangani oleh pelajar, pusat pengajian dan pejabat pengurusan.

- 4) Sila sediakan Laporan teknikal lengkap yang menerangkan keseluruhan projek ini.  
 [Sila gunakan kertas berasingan]  
*Kindly prepare a comprehensive technical report explaining the project  
 (Prepare report separately as attachment)*

**-REFER TO ATTACHMENT REPORT-**

Senaraikan Kata Kunci yang boleh menggambarkan penyelidikan anda :  
*List a glossary that explains or reflects your research:*

<u>Bahasa Malaysia</u>	<u>Bahasa Inggeris</u>
Sistem Maklumat Geografi .....	Geographic Information System .....
Maklumat Ruangan .....	Spatial Information .....
Pemetaan Berdigit .....	Digital Mapping .....

- 5) **Output Dan Faedah Projek**  
*Output and Benefits of Project*

(a) \* Penerbitan (*termasuk laporan/kertas seminar*)  
*Publications (including reports/seminar papers)*  
*(Sila nyatakan jenis, tajuk, pengarang, tahun terbitan dan di mana telah diterbit/dibentangkan).*  
*(Kindly state each type, title, author/editor, publication year and journal/s containing publication)*

1. Mohd. Sanusi S.A., Shamshad A., Wan Hussin W.M.A.[2006] Layout Error Analysis By Comparing Architectural Plan With "As Built Map' Derived From Satellite Image. International Symposium & Exhibition on Geoinformation ISG06, Shah Alam, 19-21<sup>st</sup> Sept.  
**[Submitted with this report].**
2. Mohd Sanusi S. A and Ramlah A. (2005) GIS Smart Mapping Technique For Urban Spatial Pattern Analysis. International Symposium and Exhibition on Geoinformation 27-29 September, Batu Feringghi, Penang, Malaysia.  
**[Submitted in the 1<sup>st</sup> Report].**

(b) **Faedah-Faedah Lain Seperti Perkembangan Produk, Prospek Komersialisasi Dan Pendaftaran Paten atau impak kepada dasar dan masyarakat.**  
*Other benefits such as product development, product commercialisation/patent registration or impact on source and society*

1. **Improved records management**

Information that is currently stored in paper form are now efficiently stored electronically and allows easier distribution and accessibility of the information

2. **Better decisions**

More thorough, timely, and accurate information is available. Quicker and better analyses of higher quality of data

3. **Improved communications**

Facilitates the visualization of data, i.e. information that was previously viewed only as tables or charts will be displayed as easy-to-read maps.

- \* Sila berikan salinan
- \* *Kindly provide copies*

(c) **Latihan Gunatenaga Manusia**  
*Training in Human Resources*

i) Pelajar Siswazah : **Nil (Insufficient Research Fund)**  
*Postgraduate students:*  
*(perincikan nama, ijazah dan status)*  
*(Provide names, degrees and status)*

.....  
.....  
.....

ii) Pelajar Prasiswazah : **3 undergraduate students**  
*Undergraduate students:*  
*(Nyatakan bilangan)*  
*(Provide number)*

.....  
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iii) Lain-Lain : .....

*Others:*  
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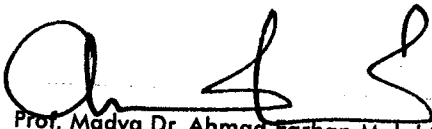
6. **Peralatan Yang Telah Dibeli :**  
*Equipment that has been purchased:*

**NO equipment under Vot 3500**

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7. Untuk Kegunaan Jawatankuasa Penyelidikan Universiti

- Kenajinan reemaskah
- Sotong untuk bayaran sekutusnya.



Prof. Madya Dr. Ahmad Farhan Mohd Sadullah

Dekan

Pusat Pengajian Kejuruteraan Awam

Kampus Kejuruteraan

T/TANGAN Pengerusi  
Universiti Sains Malaysia

J/K PENYELIDIKAN PUSAT PENGAJIAN

21/3/07



UNIT KUMPULAN WANG AMANAH  
UNIVERSITI SAINS MALAYSIA  
KAMPUS KEJURUTERAAN  
SERI AMPANGAN  
PENYATA KUMPULAN WANG

TEPOH BERAKHIR 31 JANUARI 2007

20 FEB 2007

DR MOHD SANUSI S AHAMAD

304.PAWAM.6035141

DEV IF UNIVERSITY CAMPUS WIDE INFORMATION SYSTEM (UCWIS) USING INTEGRATED GIS

JUMLAH GERAN :-

Tempoh Projek:15/04/2005 - 14/04/2007

NO PROJEK :-

PANEL :- JIPEDEK

PENAJA :-

<u>Vot</u>	Peruntukan (a)	Perbelanjaan sehingga 31/12/2006 (b)	Tanggung semasa 2007 (c)	Perbelanjaan Semasa 2007 (d)	Jumlah Perbelanjaan 2007 (c + d)	Jumlah Perbelanjaan Terkumpul (b+c+d)	Baki Peruntukan Semasa 2007 (a-(b+c+d))
11000: GAJI KAKITANGAN AWAM	2,100.00	0.00	0.00	0.00	0.00	0.00	2,100.00
21000: PERBELANJAAN PERJALANAN DAN SARAH	1,800.00	765.00	0.00	0.00	0.00	765.00	1,035.00
23000: PERHUBUNGAN DAN UTILITI	150.00	101.20	0.00	0.00	0.00	101.20	48.80
24000: SEWAAN	0.00	350.00	0.00	0.00	0.00	350.00	(350.00)
26000: BAHAN MENTAH & BAHAN UNTUK PENYELE	400.00	0.00	0.00	0.00	0.00	0.00	400.00
27000: BEKALAN DAN ALAT PAKAI HABIS	1,203.00	3,428.00	2,200.00	0.00	2,200.00	5,628.00	(4,425.00)
28000: PENYELENGGARAAN & PEMBAIKAN KECIL	500.00	0.00	0.00	0.00	0.00	0.00	500.00
29000: PERKHIDMATAN IKTISAS & HOSPITALITI	990.00	250.00	0.00	0.00	0.00	250.00	740.00
	<u>7,143.00</u>	<u>4,894.20</u>	<u>2,200.00</u>	<u>0.00</u>	<u>2,200.00</u>	<u>7,094.20</u>	<u>48.80</u>
Jumlah Besar	<u>7,143.00</u>	<u>4,894.20</u>	<u>2,200.00</u>	<u>0.00</u>	<u>2,200.00</u>	<u>7,094.20</u>	<u>48.80</u>



PEJABAT PENGURUSAN & KREATIVITI PENYELIDIKAN  
*Research Creativity & Management Office [RCMO]*

**LAPORAN KEMAJUAN PROJEK PENYELIDIKAN JANGKA PENDEK**  
**Progress Report for Short Term Research Project**

*(Laporan ini perlu melalui Pusat Pengajian)*  
*[to be submitted through Schools/Centres]*

6 bulan  
 6 months

12 bulan  
 12 months

18 bulan  
 18 months

**Nama Ketua Penyelidik :** PM Dr. Mohd Sanusi S. Ahamad  
*Name of Research Leader :*

**Pusat Pengajian :** School of Civil Engineering.  
*School/Centre :*

**Tajuk Projek Penyelidikan :**  
*Title of Research Project :*

DEVELOPMENT OF UNIVERSITY CAMPUS WIDE INFORMATION  
 SYSTEM [UCWIS] USING INTEGRATED GIS MAP AND  
 DATABASE DEVELOPMENT.

**Jumlah Geran Diluluskan :** RM7,143.00  
*Amount of Approved Grant :*

**Baki yang ada :** RM 48.80  
*(sila sertakan penyata kewangan terkini)*  
*Balance of Grant:*  
*[attach all relevant receipts /statements of accounts]*

**Tarikh mula :** 15<sup>th</sup> April 2005  
*Date of Commencement of Project:*

**Tarikh tamat asal :** 15<sup>th</sup> April 2007  
*Date of Completion of Project [original date]:*

**Lanjutan tempoh yang diluluskan (sekiranya berkaitan) :**  
*Approved Extension Period [if relevant] :*

Tarikh Permohonan <i>Date of Application</i>	Tarikh diluluskan <i>Date of Approval</i>	Tarikh tamat baru yang diluluskan <i>Date of Completion (following extension)</i>

**Laporan Kemajuan dari segi kerja-kerja yang telah dijalankan :**

*Progress Report for All Conducted Work*

*(Sila beri Laporan Kemajuan yang terperinci dan sebarang penerbitan yang telah dihasilkan)*

*(Kindly attach progress reports that are relevant as well as resulting publications)*

**-Please Refer to the Report Attached-**

**KOMEN JAWATANKUASA PENYELIDIKAN PUSAT PENGAJIAN  
(COMMENTS OF THE RESEARCH COMMITTEES OF SCHOOLS)**

- Kenapainya memusnahkan

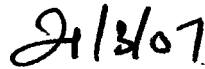
- Diselamatkan untuk  
bayaran setruanya.



Prof. Madya Dr. Ahmad Farhan Mohd Sadullah

Tandatangan Pengerusi  
Pusat Pengajian Kejuruteraan Awam

Chairman's Signature  
Kampus Kejuruteraan  
Jawatankuasa Penyelidikan Pusat Pengajian  
Universiti Sains Malaysia  
(Research Committee of School)



Tarikh  
Date

## Introduction

The development of university campus wide information system project was approved on 15 April 2005 for a duration of 2 years with completion in April 2007. The first progress report was submitted in March 2006 covering the initial working progress. This is the final report that will describe the final output and findings.

Managing wide campus information like Universiti Sains Malaysia (USM) incorporating two other major campuses is not a simple problem. To overcome the problem of database management, spatial data tool like Geographical Information System (GIS) is a very useful. Despite of having spatial data tool capability, it can also perform data analysis that can be very useful in managing information. The initial objective of the project is to develop a spatial and attribute data management tool that can:-

- Store data about University's map features in a database along with the associated map graphics.
- Create GIS Data Model for university's facilities and utilities: The data model will be used with GIS software to allow for specialized functions and analyses, such as the ability for map features to "know where they are" in relation to each other. This characteristic is essential for spatial analyses such as proximity analysis, buffering, spatial queries, etc.
- Geo-reference these data to an established coordinate system: This allows relations to be established between different maps and databases.

But with the minimal budget being approved [RM7,143.00] the project was completed on the main campus but half complete for the Engineering campus. However, the benefits to the University in terms of followings have been achieved:-

### 1. Improved records management

Information that is currently stored in paper form are now efficiently stored electronically and allows easier distribution and accessibility of the information

### 2. Better decisions

More thorough, timely, and accurate information is available. Quicker and better analyses of higher quality of data

### 3. Improved communications

Facilitates the visualization of data, i.e. information that was previously viewed only as tables or charts will be displayed as easy-to-read maps.

# The Final Product

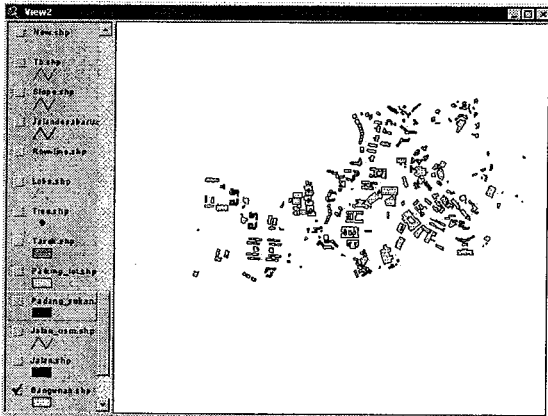
The objective of this project was to develop infrastructure database along with the associated map graphics. It was successfully carried out by merging existing vector data with satellite image to create as build map with spatial database. Even though the information in the database still basic information but for future development, it was a great platform to make an ideal spatial database.

For the second objective, managed information about the campus through user friendly specialized function and analysis were carried out but not fulfilled due to man power and budget constraint. The as build map was a great success and will help in the the analysis of USM infrastructure development accurately. The development in main campus was built accordingly to the engineer's plan with a slight difference in road construction. Also, the newly build Desasiswa Restu, Tekun and Saujana were built within USM border and almost exactly built as in the plan except the water tank and the road.

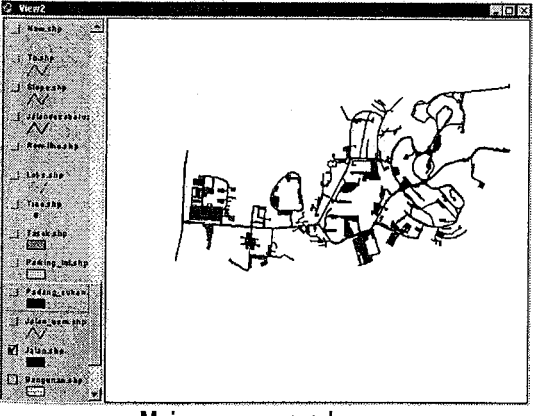
The user friendly specialized function was only a basic interface but not specialized function. This was because of time factor, limited source and work force to make a perfect interface for this project. Also when developing the project, much time and effort on database and creating the perfect as built map. However, the real success is to joint the different vector into one image file to make a perfect 'As Built Map' with spatial database for USM main campus.



The USM wide campus information system



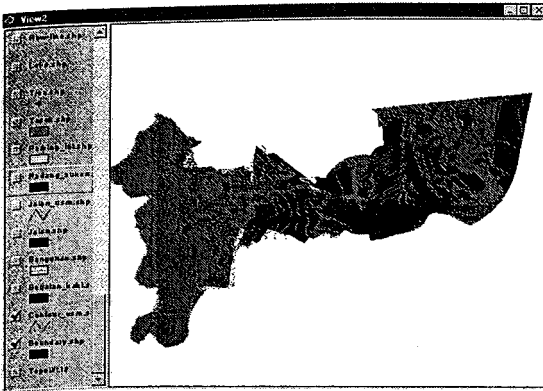
Main campus building map



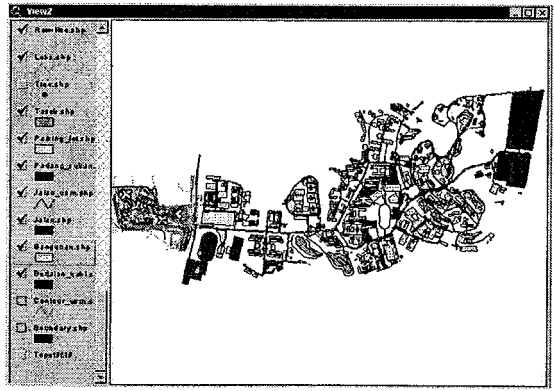
Main campus road map



Sport complex, lake and parking lot map



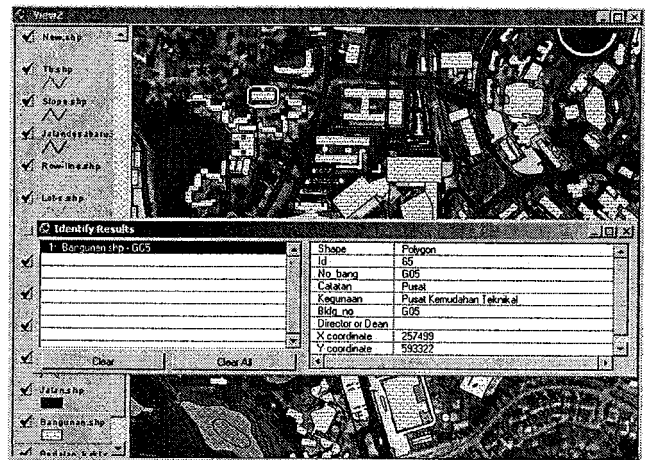
Boundary and contour map



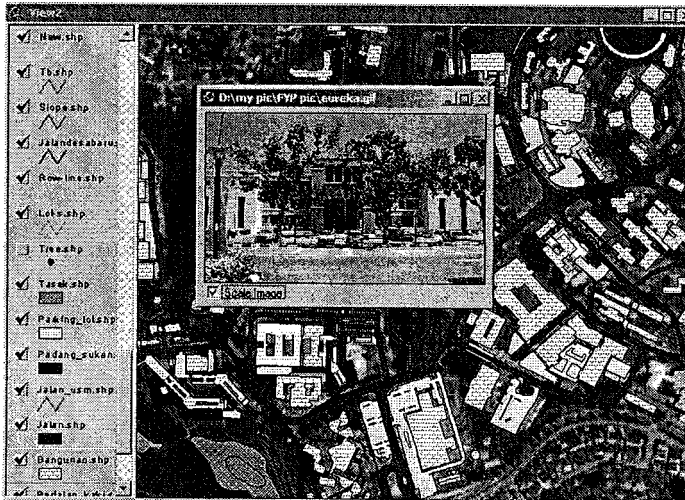
Combined Information on Main Campus



Whole campus on Satellite Image



The system database query



The hotlink system

## **Project Summary and Conclusion**

The development of spatial database for Universiti Sains Malaysia information centre was done through the integration of GIS software with AutoCAD tools. This project also practices a data analysis through the integration of satellite image and engineering drawing as known as 'As Built Map'. All the information and analysis are combined and assumed to be the basic tool for managing the campus development in the future.

Generally, the project objective was achieved. Even though some application does not function very well and area poorly developed, but for future development this project is the platform to create an ideal mapping system for USM main campus. Creating the perfect as build map was a huge success but still need corrections and need updating the database from time to time.

Special acknowledgement is given to the School of Civil Engineering for the software and instrumentation support and an outmost gratitude to the Research Creativity and Management Office USM for the research funding.

## **Publication from this Project**

1. Mohd. Sanusi S.A., Shamshad A., Wan Hussin W.M.A.[2006] Layout Error Analysis By Comparing Architectural Plan With "As Built Map' Derived From Satellite Image. International Symposium & Exhibition on Geoinformation ISG06, Shah Alam, 19-21<sup>st</sup> Sept. **[Submitted with this report].**
2. Mohd Sanusi S. A and Ramlah A. (2005) GIS Smart Mapping Technique For Urban Spatial Pattern Analysis. International Symposium and Exhibition on Geoinformation 27-29 September, Batu Feringghi, Penang, Malaysia. **[Submitted in the 1<sup>st</sup> Report].**