STUDENT INFORMATION RETRIEVAL USING GEOGRAPHICAL INFORMATION SYSTEM: KUKTEM HOSTEL

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ABSTRACT

An effective and faster data retrieval technique is important when dealing among systems with large database. The existing Hostel Management System in Students Affairs Department (HEP) of University College of Engineering and Technology Malaysia (KUKTEM) involves thousands of student data. As a result, the processing time of data retrieval becoming lengthy. This system also restricted the administrator to detect student's location visually. In order to solve these flaws, Student Information Retrieval using Geographical Information System (GIS) is developed. This system focused on discovering student information based on their student identification number and name by applying geographical location / map concept. This new system provide functions zoom in, zoom out, panning, identify and query builder in order to simplify the data manipulation by the administrator. By applying the data visualization technique using GIS, the administrator can retrieve data faster and in an interactive way.

ABSTRAK

Pencarian maklumat yang cepat dan efektif adalah penting bagi system yang melibatkan data yang besar. Sistem pegurusan asrama di Hal Ehwal Pelajar (HEP), Kolej Universiti Kejuruteraan dan Teknologi Malaysia (KUKTEM) melibatkan beribu data pelajar. Sistem ini mengambil masa yang lama bagi proses mendapatkan maklumat pelajar di sebabkan data yang terlalu banyak. Sistem ini juga tidak mambenarkan pihak pengurusan untuk mendapatkan lokasi pelajar secara visual. Bagi mengatasi masalah ini sistem Pencarian Maklumat Pelajar menggunakan Sistem Maklumat Geografi (GIS) telah di bangunkan. Sistem ini memfokuskan kepada pencarian maklumat pelajar menggunakan kedudukan geografi / peta berdasarkan nombor pelajar. Sistem baru ini juga menyediakan fungsi – fungsi membesarkan dan mengecilkan peta, *panning,* pengenalpastian data, *query builder* bagi memudahkan pihak pengurusan memanipulasikan data yang ada. Penggunaan pemaparan data secara Sistem Maklumat Geografi (GIS) dapat membantu pihak pengurusan mendapatkan data dengan cepat dan lebih interaktif.

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LIST OF ABBREVIATIONS

ArcSDE	Advanced Spatial Data Server
CAD	Computer Aided Design
CPU	Centre Processing Unit
DBMS	Database Management System
GIS	Geographical Information System
GUI	Graphical User Interface
HEA	Academic Affairs Department / Hal Ehwal Akademik
HEP	Student Affairs Department / Hal Ehwal Pelajar
HTML	Hyper-Text Markup Language
ICC	Information and Computer Centre
KUKTEM	University College of Engineering and Technology Malaysia
LAN	Local area Network
Map Object IMS	Map Object Internet Map Server
MNE	Ministry of Nature Environment
PC	Personal Computer
PSM	Undergraduate Project / Projek Sarjana Muda
SIR	Student Information Retrieval

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CHAPTER 1

INTRODUCTION

This chapter is focusing on introduction of the system, problem statement of the existing system, objectives and scope of the system.

1.1 Introduction

The management in hostel is very important because they have to manage lots of data such as the student data and information. So they should have to manage the data systematically. Therefore Student Affairs Department (HEP) has applied the computerized system to help them in hostel management. Without the computerized system, they have a lot of problem in manage the student data and also the data that related to the hostel management. Although the computerized system is known can reduce human energy, paperless and also help the staff in managing time more wisely, it still has the problem in providing the systematic management especially in getting the student information. To solve this problem, Student Information Retrieval using Geographical Information System (GIS) has been develop to improve the existing system further to assist users in finding student's room and to retrieve student's data by clicking on the map. Besides, user will know the number of students in the hostel and also the number of the student in the room. Therefore this system will not waste their time because they only need to click at the place that they want to know by click at the maps.

Student Information Retrieval helps the Student Affairs Department (HEP) to retrieve student's data easily and faster. This system focusing on how to improve the retrieving of student's data beside others additional function. So user can know the student data faster and easily such as to know the student's room, and others information about the student. Users also are allowed to search student's room by student id. This system eases to the user to get any information anytime when they needed.

1.2 Problem Statement

According to the existing system used by Student Affairs Department (HEP), it is found that the system does not really helps in retrieving student's information wisely. Sometimes human power still needed to configure it manually. Below are some of the problems faced by the current system.

The current system that used by Student Affairs Department (HEP) at KUKTEM has face the problem on getting the student information in short time. Based on the current system, the user should search the student by metric number before they can get the information about that student. The system does not provide searching by room. So that they do not know who's student there and also the number of the student in that room.

To solve these problems, the system provides a student information retrieval using Geographical Information System. This system based on University College of Engineering and Technology Malaysia (KUKTEM) hostel map. The user will get the student's information in KUKTEM hostel through the visualization of hostel map. They also can get the student information by searching the student id and name.

1.3 Objectives of the System

The main objectives of the system are:

i. To develop the Student Information Retrieval Using Geographical Information System.

ii. To search the student location.

iii. To manipulate the map by zooming and searching.

1.4 Scope

The scope of this system is to develop the Student Information Retrieval only for University College of engineering and Technology Malaysia (KUKTEM) hostel.

i. This system is using Geographical Information System (GIS).

ii. Searching based on the student identification number and name.

iii. This program is developed using Arc View 3.1 and Avenue scripting as an application language.

iv. This system uses the vector data type.

v. The information of the student for Student Information Retrieval involves students in blocks C1 and C2.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Literature review is the ways to increase knowledge and understanding about the topic that is proceed by finding out all information before developing the system. This chapter is finding out the researches that related to this system and make the specific analysis.

2.2 Geographical Information System (GIS)

GIS is acronym for Geographical Information System. Geographical is refers to a specific location in space. This term is used because GIS tend to deal primarily with geographic or spatial features. Information is refers to a large volumes of data which are usually handled within a GIS. Every object has their own particular set of characteristics or descriptive attributes. System is the term used to represent the system approach taken by GIS. Most of the information systems now are computers based. Geographical Information System (GIS) refers to a computer-based system for storing, analyzing, and reporting map and spatial database, providing environmental, social economic and geographic information. GIS is a collection of computer hardware, software, and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information [1].

Geographical Information System (GIS) is an integrating technology by linking a number of discrete technologies into a whole that is greater than the sum of its parts. GIS have emerged as very powerful technologies because they allow geographers to integrate their data and methods in ways that support traditional forms of geographical analysis as well as new types of analysis and modeling [2].

A regular map shows only spatial data such as cities, rivers, roads, and forests. A geographic information system contains further information by linking attribute data to spatial data. For example, population and unemployment rate can be linked to specific city areas. This link creates intelligent map features and provides the ability of retrieving the data for fact-finding, querying the data with criteria, spatial analysis and modeling, topological operating, and network analysis [2].

A Geographical Information System (GIS) is a tool that uses the power of the computer to pose and answer geographical question. The user guides the program to arrange and display data about places on the planet in a variety of ways including maps, charts, and tables. The hardware and software allows the users to see and interact with data in new ways by blending electronic maps and database to generate color coded display. User can zoom in and out of maps freely, add layers of new data, and study detail and relationships [3].

Actually GIS is differs from Computer Aided design (CAD) and other graphical computer applications. It is because all spatial data that using GIS is geographically referenced to a map projection in the earth coordinate system. A GIS supports several views for working with geographic information. Three views of GIS used for working with elements of geographic knowledge which is geodatabase, geovisualization and geoprocessing.

These three (3) elements are [4]:

i. Geodatabase View - A GIS is a unique kind of database of the world and known as a geographic database (geodatabase). It is an information system for geography. Basically, a GIS is based on a structured database that

describes the world in geographic terms. It is also containing data sets that represent geographic information in terms of a generic GIS data model (features, rasters, topologies, networks, and so forth).

ii. Geovisualization View - A GIS is a set of intelligent maps and other views that shows features and feature relationships on the earth's surface. Various map views of the underlying geographic information can be constructed and used to support queries, analysis, and editing of the information.

iii. Geoprocessing View - A GIS is a set of information transformation tools that derives new geographic data sets from existing data sets. These geoprocessing functions take information from existing data sets, apply analytic functions, and write results into new derived data sets.

These three (3) GIS views are represented in ArcGIS by the catalog (a GIS is a collection of geographic data sets), the map (a GIS is an intelligent map view), and the toolbox (a GIS is a set of geoprocessing tools). All three are critical parts of an intelligent GIS and are used at varying levels in all GIS applications.

2.2.1 Components of GIS

A working GIS integrates five (5) key components which is hardware, software, data, methods, and people [5]. All of these components need to be in balance for the system to be successful. Figure 2.1 shows the GIS components.

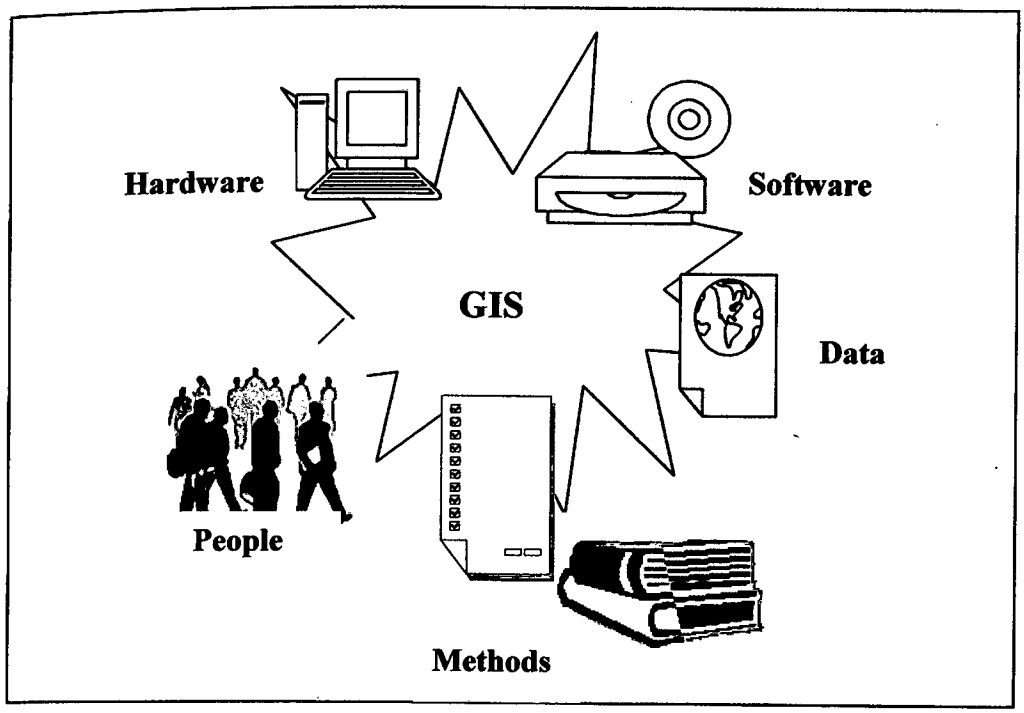

Figure 2.1 GIS Components

i. Hardware is a computer system on which a GIS operates. Today, GIS software runs on a wide range of hardware types, from centralized computer servers to desktop computers used in stand-alone or networked configurations. Hardware consists of the technical equipment needed to run a GIS including a computer system with enough power to run the software, enough memory to store large amounts of data, and input and output devices such as scanners, digitizers, GPS data loggers, media disks, and printers.

ii. Software is defined as the group of instructions which enable the execution of a certain procedure by a computer. GIS software provides the functions and tools needed to store, analyze, and display geographic information. Key software components are:

(a) A database management system (DBMS)

(b) Tools for the input and manipulation of geographic information

(c) Tools that support geographic query, analysis, and visualization

(d) A graphical user interface (GUI) for easy access to tools

ii. Data is the most important component of a GIS. Geographic data and related tabular data can be collected in-house or bought from a commercial data provider. Most GISs employ a DBMS to create and maintain a database to help organize and manage data.

iv. Method is a process in develop the GIS system. The successful of the GIS system is depend on the type of the methodology that applied, well-designed plan and business rules, which are the models and operating practices unique to each organization.

v. People is refers to system users who manage the system and develop plans for applying it. They are also need to be educated to make decisions on what type of system to use. People who associated with a GIS can be categorized into viewers, general users, and GIS specialists.

2.2.2 GIS Data Types

GIS organizes geographic data into series thematic layers and tables. It is because data in a GIS are referenced to geography. GIS links the location to each layer such as people to addresses, buildings to parcels, or streets within a network to give a better understanding of how the features interrelate.

In a GIS, collections of geographic features are organized into data sets, such as land parcels, fire locations, buildings, orthophoto imagery, and raster-based digital elevation models in particular defined geographic data sets are critical for useful geographic information systems, and the layer-based concept of thematic collections of information is critical for GIS data sets. There are two (2) basic of spatial data types used in GIS work which are raster and vector [6]. Figure 2.2 shows the differences between vector data and raster data.

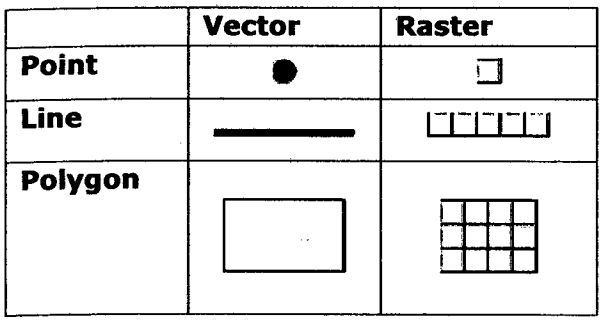

Figure 2.2 Vector data versus Raster data

2.2.2.1 Vector Data

The vector data model represents each feature as a row in a table, and feature shapes are defined by x,y locations in space. For examples lines on the road map, the points that indicate cities and the polygons that encloses a state which is based on points, lines and polygons. Much vector data is stored in GIS formats, such as those of ArcView SHP or MapInfo formats. Vector data is composed of discrete coordinates that can be used as points or connected to create lines and polygons.

Points is refers to discrete location on the surface of the planet, represented by an x-y coordinate pair. Each point on the map is created by latitude and longitude coordinates, and is stored as an individual record in the database.

Lines are formed by connecting two (2) data points. The computer reads this line as straight, and renders the line as a vector connecting two x-y coordinates (X = longitude, Y = latitude). The more points used to create the line, the greater the detail. For lines, this means that the system stores one end of the line as the starting point and the other as the end point, giving the line direction.

Polygons is refers to an area that fully encompassed by a series of connected lines. Because lines have direction, the system can determine the area that falls within the lines comprising the polygon. Polygons are often an irregular shape. Each polygon contains one type of data such as vegetation, streets, and dispatch locations would be different polygons. All of the data points that form the perimeter

of the polygon must connect to form an unbroken line [6]. Figure 2.3, 2.4 and 2.5 shows the examples of vector data.

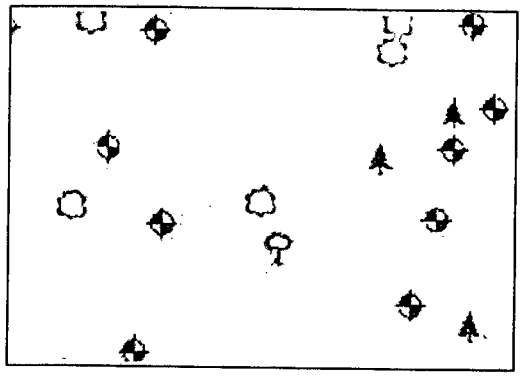

Figure 2.3 GIS Points

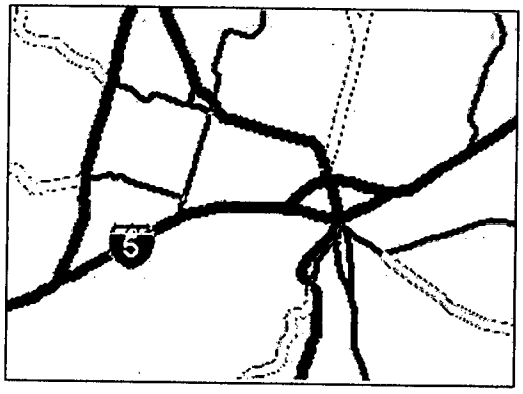

Figure 2.4 GIS Lines

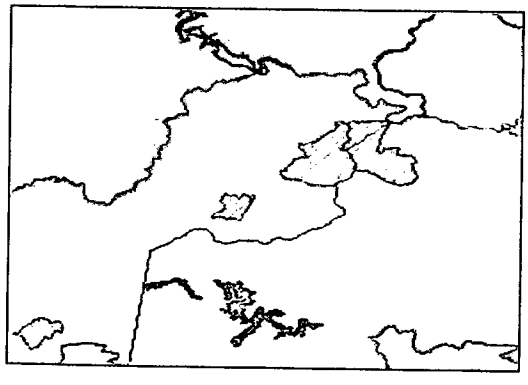

Figure 2.5 GIS Polygons

2.2.2.2 Raster Data

Raster data represent features as a matrix of cells within rows and columns in continuous space. These cells are formed by pixels of a specific dimension size, and can be described as either cell-based or image-based data.

An example of raster data is a scanned image or photograph. A line drawn in a raster format must be defined by a group of pixels along the length of the line. As a result the size of a raster file is larger than that required by a vector file [6].

i Cell - Based Data

Each raster data layer represents one attribute. Most analyses combine these layers to create new layers with new cell values, as either continuous or discrete data. Continuous data types have gradations, such as temperature or elevation. Discrete data types have clearly delineated boundaries, such as a city boundary or specific vegetation type.

The cell size used for a raster layer affects the results of the analysis and how the map looks. Using too large a cell size is causes some information to be lost. Using too small a cell size will significantly increase the storage space and processing time required, without adding precision to the map. To create an effective cell size, base the cells on map scale and on the minimum mapping unit of the other GIS data. Refer to Figure 2.6.

Figure 2.6 Cell – based raster data

ii Image - Based Data

Image data ranges from satellite images and aerial photographs, to scanned maps that have been converted from printed to digital format. Refer to Figure 2.7.

Figure 2.7 Image – based raster data