

King Fahd University of Petroleum and Minerals



COLLEGE OF ENVIRONMENTAL DESIGN

CITY AND REGIONAL PLANNING

CRP-507

COMPUTER AIDED PLANNING

TERM PROJECT

**REPRESENTATION OF KFUPM ACADEMIC CAMPUS
IN TO VARIOUS FORMS OF SERVICES USING [ArcView](#)**

Submitted to:

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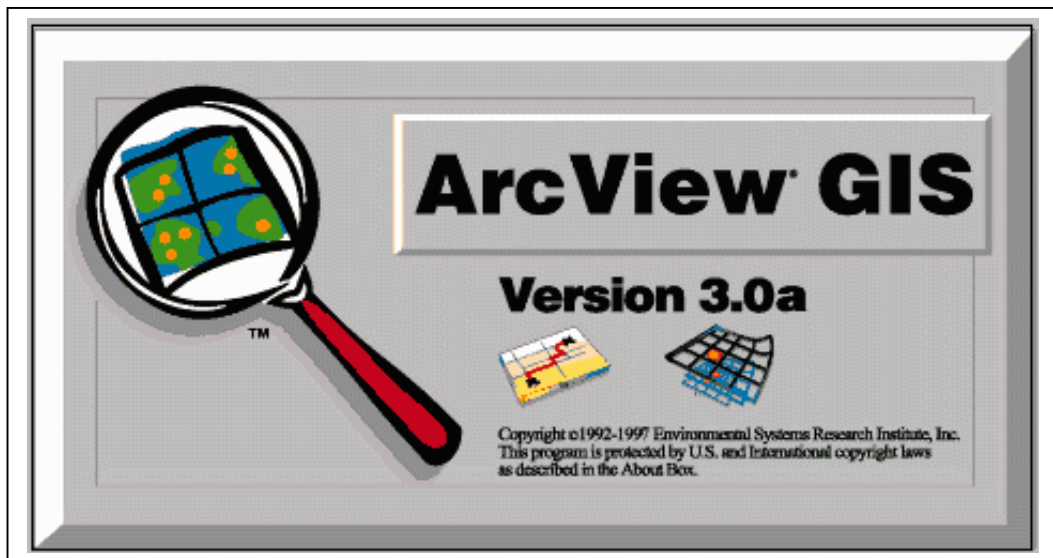


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1.0 Introduction

Planners have always shown interest to offer innovative and improved techniques of Planning. Since the time of existence man has shown immense interest in studying his surroundings. With the advent of science era he has explored the world using models such as maps and globes. From the last 4 decades it has become possible to put these models into computers along with the tools to analyze them in the form of Geography based Information systems. The twentieth century has witnessed great innovations in the field of communication one of which, most interesting to planners has been the development of Geographical information system popularly known as GIS.

In the strictest sense, a GIS is a computer system capable of assembling, storing, manipulating, and displaying geographically referenced information, i.e. data identified according to their locations. Practitioners also regard the total GIS as including operating personnel and the data that go into the system. It made entire world Represented with its attribute information, this paved way in solving several complicated tasks. A geographical information system lets u visualize information on new ways that reveal relationships, patterns, and trends not visible with other popular systems. GIS has developed so rapidly over the past 2 decades that it is now accepted as an essential tool for the effective use of geographical information. They represent a database that links information to location, allowing us to see and analyze data in new and useful ways. It lets you visualize information on new ways that reveal relationships, patterns and trends not visible with other popular systems. Its capability to link

descriptive information with maps makes it a natural solution. The features on the map are organized according to relative positions or locations and the relationships are called as spatial relationship. GIS combines multiple layers of information about a place to give you a better understanding of that place. Depending upon the requirement we can combine layers of information. It can produce information much more quickly, achieve higher mapping standards and keep data more current than was before.

A GIS, which can use information from many different sources, in many different forms can help with such analyses. The primary requirement for the source data is that the locations for the variables are known. Location may be annotated by x, y and z coordinates of longitude, latitude, and elevation, or by such systems as ZIP codes or highway mile markers. Any variable that can be located spatially can be fed into a GIS. Federal agencies and private firms are producing several computer databases that can be directly entered into a GIS. Different kinds of data in map form can be entered into a GIS.

This technology has provided an exciting potential for geographic information to be used more systematically and by a greater diversity of disciplines than ever before. Now more than 90% of urban affairs involve the use of geographical information systems.

2.0 Problem Statement

The Basic aim of this current project is representing King Fahd University of Petroleum and Minerals (KFUPM) in its various forms of available services and as well creating a database for various features attached in the attribute tables using Arc View GIS is for easy acquaintance with the campus. GIS enables one-to-one correspondence between the spatial features and their attributes. The advanced analyzing power of GIS will help the data representation in the form of easily understandable bar charts and pie-diagrams, which makes the data more readable. Our aim is to generate two maps. One representing the whole university, and another the academic campus. The purpose of studying the academic campus discretely is due to its existence as a separate entity in itself.

3.0 Literature Review:

In the strictest sense, a GIS is a computer system capable of assembling, storing, manipulating, and displaying geographically referenced information, i.e. data identified according to their locations. Practitioners also regard the total GIS as including operating personnel and the data that go into the system.

GIS can be described as the systematic introduction of numerous different disciplinary data, connected by their shared location on the planet, which can be used to record and inventory the environment, document observations of change and constituent processes. GIS also permit predictions based on current practices and management plans. **(Ian McHarg, Forward to the History of Geographic Information Systems, 1996)**

Geographical Information Systems work using the following features;-

1. Relating information from different sources
2. Data capture
3. Data integration
4. Projection and registration
5. Data structures
6. Data modeling

Relating Information from different sources:-

GIS, which can use information from many different sources, in many different forms can help in getting data like amount of rainfall and etc. The primary requirement for the source data is that the locations for the variables are known. Location may be annotated by x, y and z coordinates of longitude, latitude, and elevation, or by such systems as ZIP codes or highway mile markers. Any variable that can be located spatially can be fed into a GIS. Several computer data bases that can be directly entered into a GIS are being produced by Federal agencies and private firms. Different kinds of data in map form can be entered into a GIS (www.usgs.gov).

GIS can also convert existing digital information, which may not yet be in map form, into forms it can recognize and use. For example, digital satellite

images can be analyzed to produce a map like layer of digital information about vegetative covers.



Fig: 1. Raw Satellite Image Data

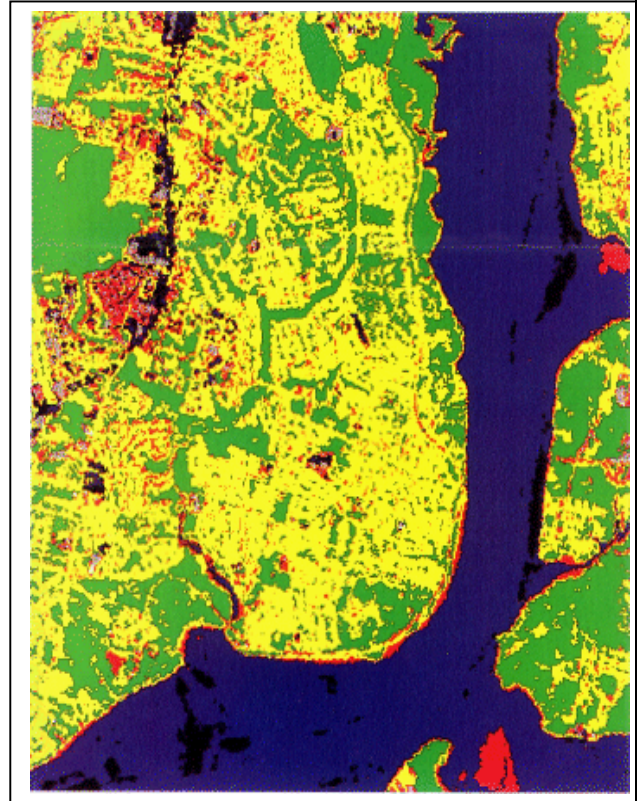


Fig: 2. Analyzed Satellite Data Showing Classes of Vegetation (www.usgs.gov).

Data Capture:

Data capture - putting the information into the system - is the time-consuming component of GIS work. Identities of the objects on the map must be specified, as well as their spatial relationships. Editing of information that is automatically captured can also be difficult. Electronic scanners record blemishes on a map just as faithfully as they record the map features. For example, a fleck of dirt might connect two lines that should not

be connected. Extraneous data must be edited, or removed from the digital data file.

Data Integration:

A GIS makes it possible to link, or integrate, information that is difficult to associate through any other means. Thus, a GIS can use combinations of mapped variables to build and analyze new variables.

Projection and Registration:

Since much of the information in a GIS comes from existing maps, a GIS uses the processing power of the computer to transform digital information, gathered from sources with different projections to a common projection.

Data Structures:

There are two major methods of storing mapped information. Geographic Information Systems stores map features in, Vector format store points, lines and polygons with high accuracy. They are preferred in urban applications where legal boundaries and the analysis of networks are important.

Raster Geographic Information Systems, which store map features in raster or grid format, generalize the location of features to a regular matrix of cells. Raster GIS data structures are preferred for digital elevation modeling, statistical analysis, remotely sensed data, simulation modeling and natural resource applications (www.usgs.gov).

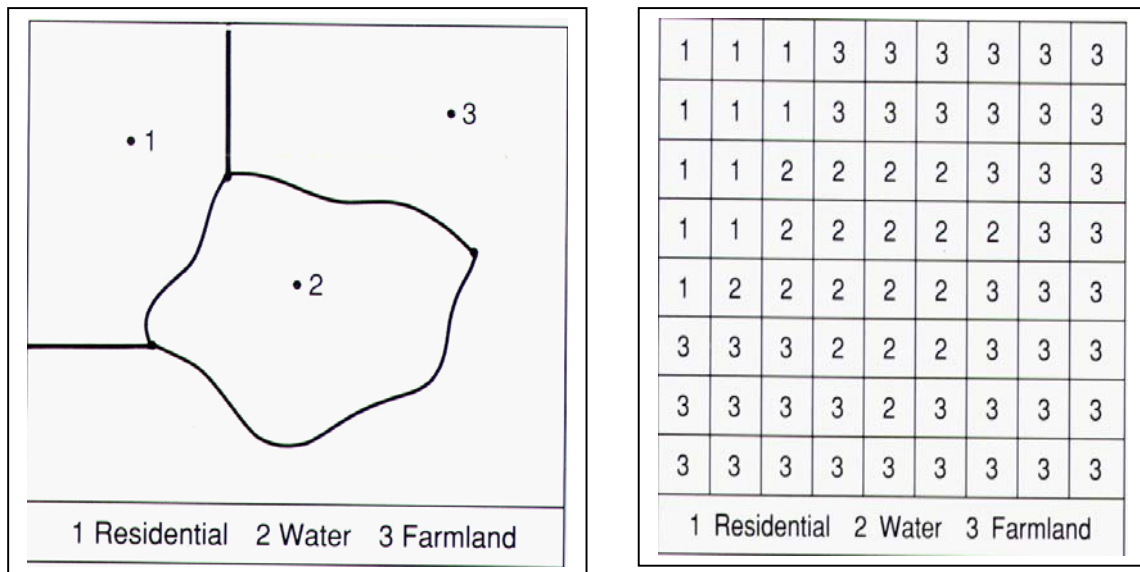


Fig. 3: Structure of Vector Data File Fig. 4: Structure of Raster Data File

Data Modeling:

Geographical Information Systems can be used to depict two- and three-dimensional characteristics of the Earth's surface, subsurface, and atmosphere from information points. Which is useful for generating rainfall contour map, etc.

Special Features of GIS:

The way maps and other data have been stored or filed as layers of information in a GIS makes it possible to perform complex analyses.

1. Information retrieval
2. Topological modeling
3. Networks

4. Overlay
5. Data output

Information Retrieval:

Geographic Information System can be used to "point" at a location, object, or area on the screen and retrieve recorded information about it from off-screen files.

Topological Modeling:

GIS can recognize and analyze the spatial relationships among mapped phenomena. Conditions of adjacency (what is next to what), containment (what is enclosed by what), and proximity (how close something is to something else) can be determined with a GIS.

Networks:

GIS can simulate the route of materials along a linear network. It is possible to assign values such as direction and speed to the digital stream and "move" the contaminants through the stream system.

Overlay:

Overlay is an special working tool of Geographic information system. Map overlay technique comprises of overlaying or superimposing the number of different maps with different specification over each other merging the data in to one. For example in fig below maps of customers, Buildings and streets are overlaid and GIS might produce a new map layer or overlay that gives the reality of that city.

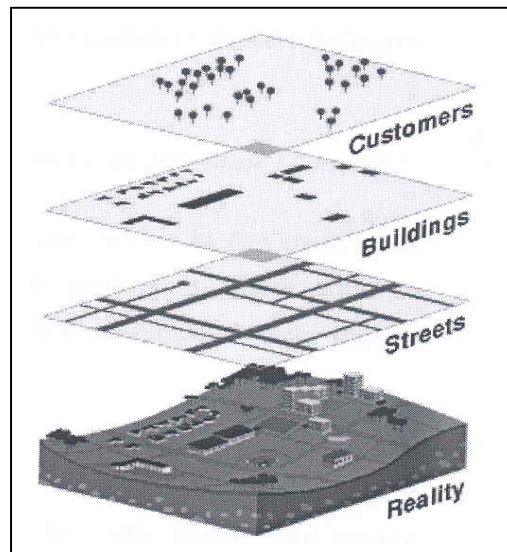


Fig. 5: Overlay of three Maps

Data output:

A critical component of a GIS is its ability to produce graphics on the screen or on paper that convey the results of analysis to the people who make decisions about resources. Wall maps and other graphics can be generated, allowing the viewer to visualize and thereby understand the results of analyses or simulations of potential events.

Applications of GIS

1. GIS through history

On the walls of caves near Lascaux, France, Cro-Magnon hunters drew pictures of the animals they hunted 35,000 years ago.

Pictures Associated with the animal drawings from thousands of years ago are track lines and tallies thought to depict migration routes. These early

records followed the two-element structure of modern geographic information systems: a graphic file linked to an attribute database.

Today, biologists use collar transmitters and satellite receivers to track the migration routes of caribou and polar bears to help design programs to protect the animals. In a GIS, the migration routes were indicated by different colors for each month for 21 months.

Researchers then used the GIS to superimpose the migration routes on maps of oil development plan to determine the potential for interference with the animals.

2. Uses GIS:

1. Mapmaking
2. Site selection
3. Emergency response planning
4. Simulating environmental effects

Map Making:

Researchers are working to incorporate the mapmaking experience of traditional cartographers into GIS technology for the automated production of maps.

Using a GIS and digital versions of the 1:100,000 - scale transportation network, political boundaries, and hydrographic features, cartographers produced a 1:500,000 - scale standard base map of New Jersey. This digital revision was done in three steps of map scale reduction: 1:100,000, 1:250,000, and 1:500,000.

Each scale reduction required edge matching, or paneling, of the larger scale maps to produce the next small-scale map. In addition, through the process known as generalization, the amount of information was reduced to make the smaller scale map readable.

Site Selection:

The U.S. Geological survey (USGS), in a cooperative project with the Connecticut Department of Natural Resources, digitized more than 40 map layers for the areas covered by the USGS Broad Brook and Ellington 7.5-minute topographic quadrangle maps.

GIS is most dependable source for site selection in any field. Geological survey departments can use GIS to digitize numerous numbers of maps and merge them in to one single map. This combined information can manipulate in a GIS to address planning and natural resource issues. GIS information was used to locate many such potential sites. Like for new water well within half a mile of the Somers Water Company service area, USA.

Emergency Response Planning:

A GIS can be used to combine road network and earth science information to analyze the effect of an earthquake on the response time of fire and rescue squads. This will help to plan for the safety measures of residents in any area at the time of any calamity or emergency situation.

The locations of fire stations can be plotted on the road network, and a GIS function called network analysis is used to calculate the time necessary for emergency vehicles to travel from the fire stations to different areas of the

city. The network analysis function considers two elements: distance from the fire station, and speed of travel based on road type. Based on this analysis the time required for providing any emergency service to any remote part of city can be known. .

Simulating Environmental Effects:

GIS has noticeable Simulating techniques, that can combine map types and display them in realistic three-dimensional perspective views that convey information more effectively and to wider audiences than traditional, two-dimensional maps.

Future of GIS:

Many disciplines can benefit from GIS techniques. 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 application of the technology throughout government, business, and industry.

GIS and related technology will help greatly in the management and analysis of large volumes of data, allowing for better understanding of terrestrial processes and better management of human activities to maintain world economic vitality and environmental quality.

4.0 Objective of the Project:

The objective of this project is to present the area of study (King Fahd University of Petroleum and Minerals) academic campus, classified comprehensively based on different services and areas and facilities. The objective of this classification is any visitor to the university can get acquainted with the entire campus with just a click on the ArcView GIS.

5.0 Area of Study:

Our area of study in the present context is the King Fahd University of Petroleum & Minerals is situated in Dhahran, Kingdom of Saudi Arabia. The university lies between the headquarters of the Saudi Arabian Oil Company (SAUDI ARAMCO) and the Dhahran Air Base (www.kfupm.edu.sa).



Fig.6: Portray the Arial view of KFUPM

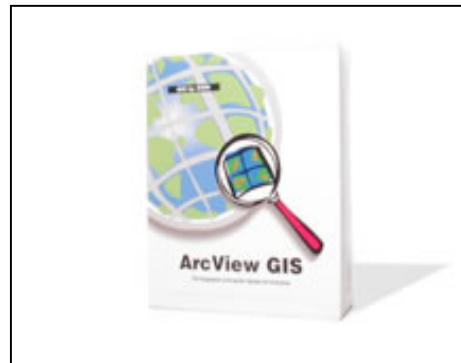
The campus is situated near the Arabian Gulf at a distance of about seven Km from the town of Al-Khobar. The port city of Dammam, capital of the Eastern Province, is only 20 kilometers away and the oil refinery at Ras Tanura is 70 kilometers from the campus. The academic buildings are located on a 100-foot mountain, which forms the main attraction. The 900 acres of the University are divided into three Sectors: North, Central, and South. The North Sector consists of the Preparatory Year Campus, the North Staff housing compound, and the student dormitories. The Central Sector contains all the academic facilities: classrooms, laboratories, faculty offices, the University administration, the Research Institute, the Library, the Information Technology Center, and many support facilities. The South Sector contains faculty and senior staff housing (www.kfupm.edu.sa).

6.0 Data:

The Digitized map for the current project was obtained from the GIS lab Coordinator. The further data about the various buildings, parking area's and Greenery sections of KFUPM academic campus was acquired by personal survey and enquiry and from the KFUPM website (www.kfupm.edu.sa). All the data entered in the attribute tables of the current project is real and authentic.

7.0 Tools of Study:

Environmental research system institute (ESRI) located in New York, USA as the vendor of products like ArcView, Arc Info and ArcGIS has created Sensation in the world of GIS. *In this current study ArcView GIS has been used.*



ArcView is a comprehensive, integrated, scalable system designed to meet the needs of a wide range of GIS users.

ArcView includes Arc Catalog and Arc Map, which allow you to browse, manage, analyze, edit, and document your data.

ArcView makes it easy to create maps and add your own data to them. Using ArcView software's powerful visualization tools, you can access records from existing databases and display them on maps. ArcView makes it easy to integrate data from all the organizations and work with the data geographically (www.esri.com).

ArcView has special features to present the results. user can make great-looking publication-quality maps and create interactive displays by linking charts, tables, drawings, photographs, and other files. You will find that communicating geographically is a powerful way to inform and motivate others (ArcView 3.x).

8.0 Methodology:

The Methodology adopted was as follows:

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- The Digitized map of the study area ie. KFUPM campus was obtained.
- Digitized maps were taken, as ArcView recognizes a Digitized map easily.
- The Entire Academic campus was divided in to four layers based on the functions and use.
- As my aim was to study on KFUPM academic campus, a specific map of KFUPM academic section was obtained. The existence of the academic section as a separate entity made it meaningful.
- Arc Catalog was used so as to create various shape files in the form of layers and then they were added to the AcrView GIS document and worked on with.

- The academic campus was worked in much detail way with layers shown for Academics, Services, Administration, Special item and Activities. Along with those, layers for Parking and pounds were added to add some aesthetic view to the representation.
- Due lack of easy access to data and also limited time, reluctantly the analysis was carried out with relatively small amount of data.
- Most of the data entered is genuine data. Data was entered in to **attribute tables** also approximate values for the areas of the buildings were calculated from an *.dxf file and entered in the table.
- The maps generated are shown along with the figures attached at the end.

WORKING:

The fig-8 below gives the overview of the Digitized map of KFUPM academic campus imported in to Arc View. The figure below represents the first of the four layers, which I have worked on with. On the left side of the drawing you can view that only the first layer is activated and the other are inactive.

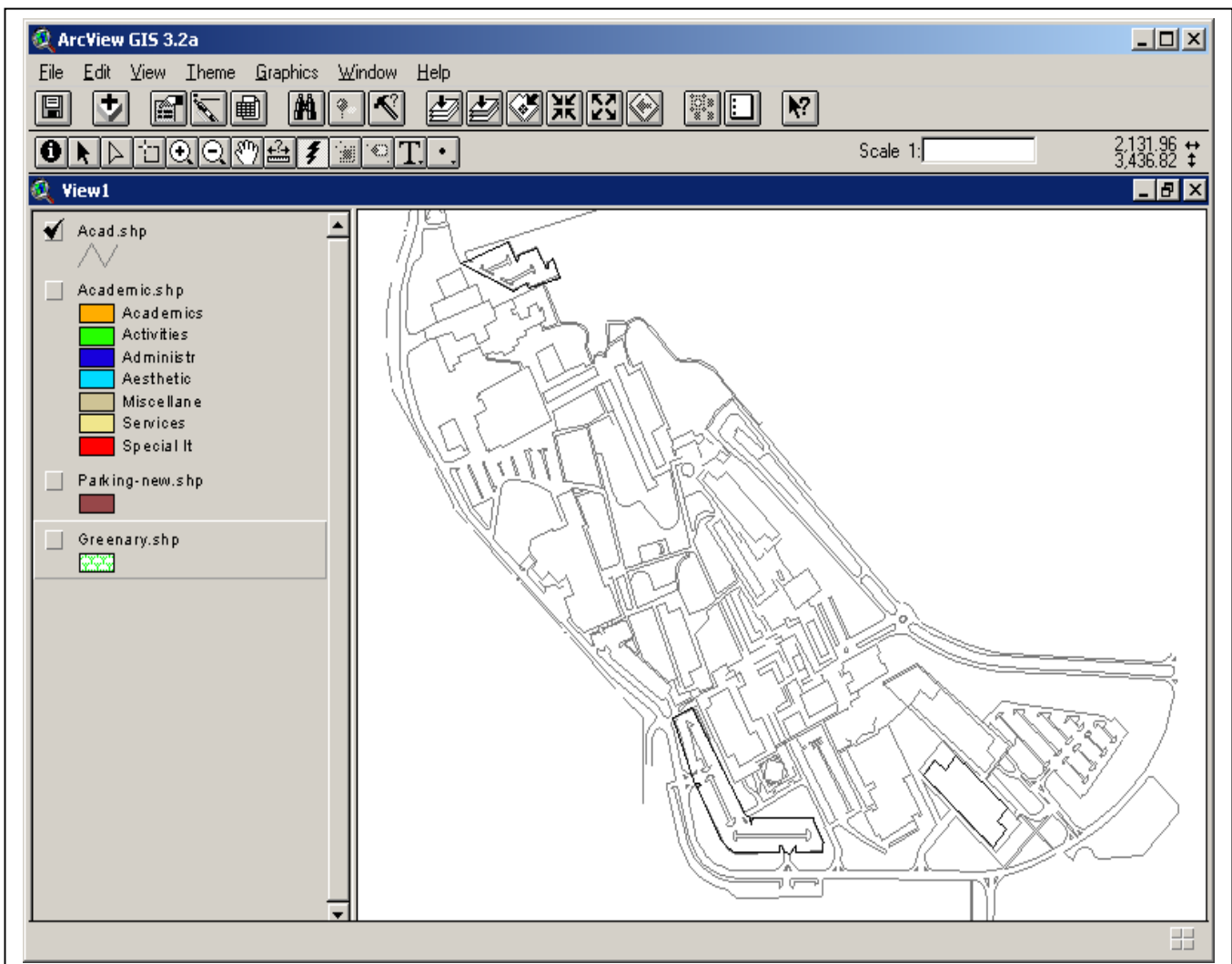


Figure- 8 : Representing the first layer

The Fig: 9 below, give the overview of the first two layers activated. This ArcView snap shows the different services buildings of KFUPM academic campus well classified based on different categories. We can see that the second layer has been classified in to Academics, Activities, Administrative, Aesthetic, Miscellaneous, Services and Special items.

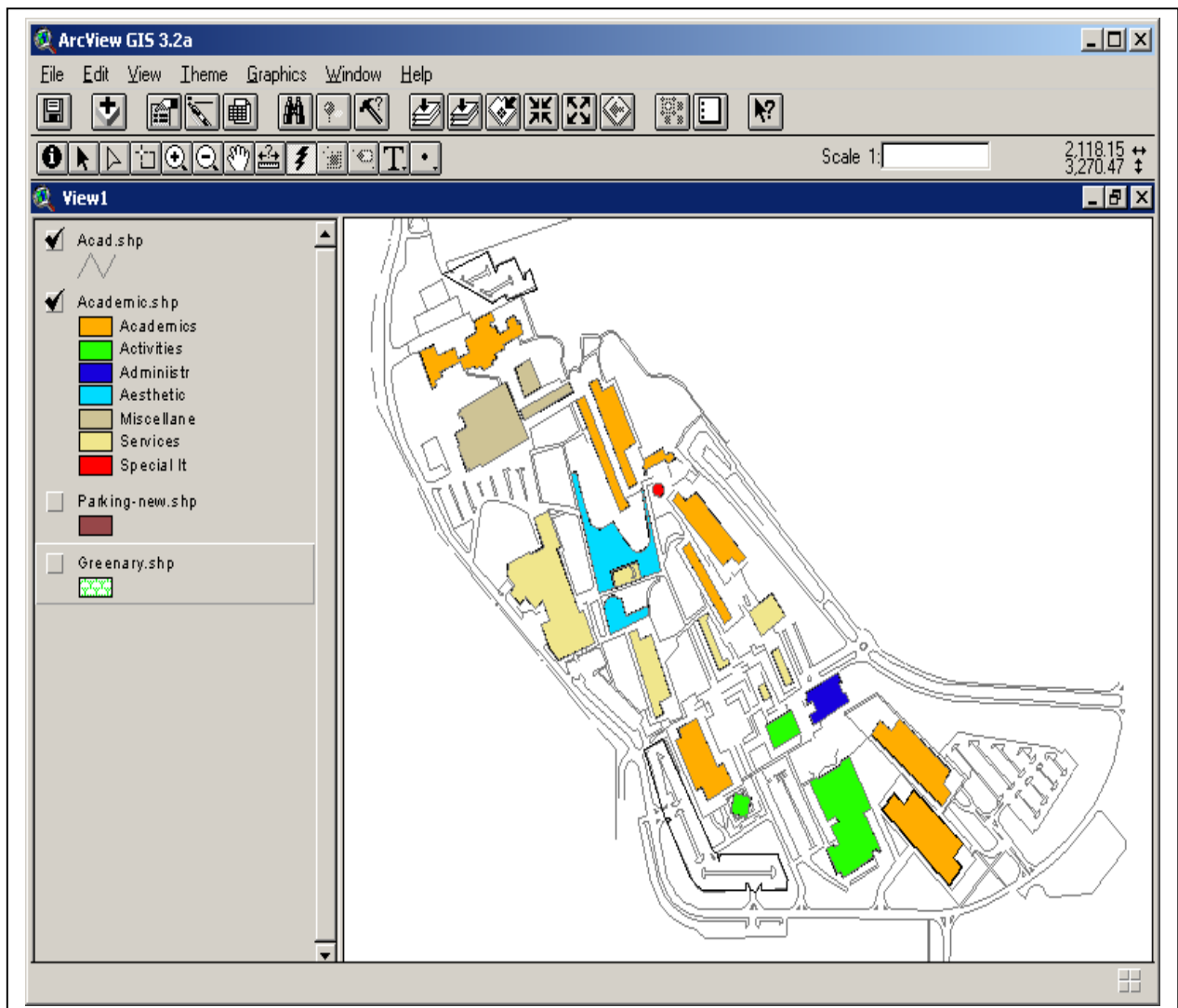


Figure –9: Representing the details of first two layers.

Figure: 10 Gives the over view of Attribute table of the Second layer. This is the beauty and one of the traits of the ArcView GIS, with a just single click one can view the attribute table. In the present context the attribute table give the following features of the Buildings:- The Shape, Area , Perimeter, Building number, Building Name, Category , Number of Floors, Number of Departments. If needed we can add many such attribute details.

Shape	Area	Perimeter	Building No.	Building Name	Category	Number of Floors	No. of DEPT
Polygon	4541	337	24-25	College of Ineus	Academics	4	0
Polygon	4854	345	22-23	CCSE Department	Academics	4	0
Polygon	7115	448	11	Gymnasium	Activities	1	0
Polygon	586	89	20	Conference Centre	Activities	2	0
Polygon	3637	279	19	CED Department	Academics	4	4
Polygon	2675	271	14	ITC Building	Services	1	0
Polygon	9021	537	15	Research Institu	Services	6	0
Polygon	6514	458	1	Building - 1	Miscellane	1	0
Polygon	4428	505	25	Heavy Equipment	Academics	3	0
Polygon	899	122	2	Building - 2	Miscellane	2	0
Polygon	958	177	3	Building - 3	Miscellane	2	0
Polygon	1742	312	16	Building - 16	Academics	3	0
Polygon	3102	328	4	Civil Engg Dept	Academics	4	0
Polygon	544	136	5	Building - 5	Academics	3	0
Polygon	196	51	Tower	KFUPM TOWER	Special It	10	0
Polygon	3087	295	6	Building - 7	Academics	4	0
Polygon	1354	236	7	Building - 7	Academics	3	0
Polygon	1315	145	8	Library	Services	4	0
Polygon	826	179	17	Student Affairs	Services	3	0
Polygon	549	114	9-8	Faculty and stud	Services	3	0
Polygon	1242	142	10	Auditorium	Activities	2	0
Polygon	1940	213	21	Administrative B	Administ	9	0
Polygon	500	139	12	Al Siddique Mosq	Services	1	0
Polygon	2500	462	Pound	Rt- Big-Pound	Aesthetic	0	0
Polygon	1138	220	Pound	Rt- Small-Pound	Aesthetic	0	0
Polygon	240	0	9-A	Registration	Services	2	0

Figure 10: Shows the Attribute table of the Second Layer

Figure 11: Gives the overview of the KFUPM academic Campus with three layers activated. The third layer specifically deals with the academic parking areas. Using this preview any guest to the university can easily reach the required Place and park his car in the authorized place. KFUPM parking areas are generally classified in to

- Faculty and staff parking
- Students parking
- Restricted Parking
- Unrestricted Parking

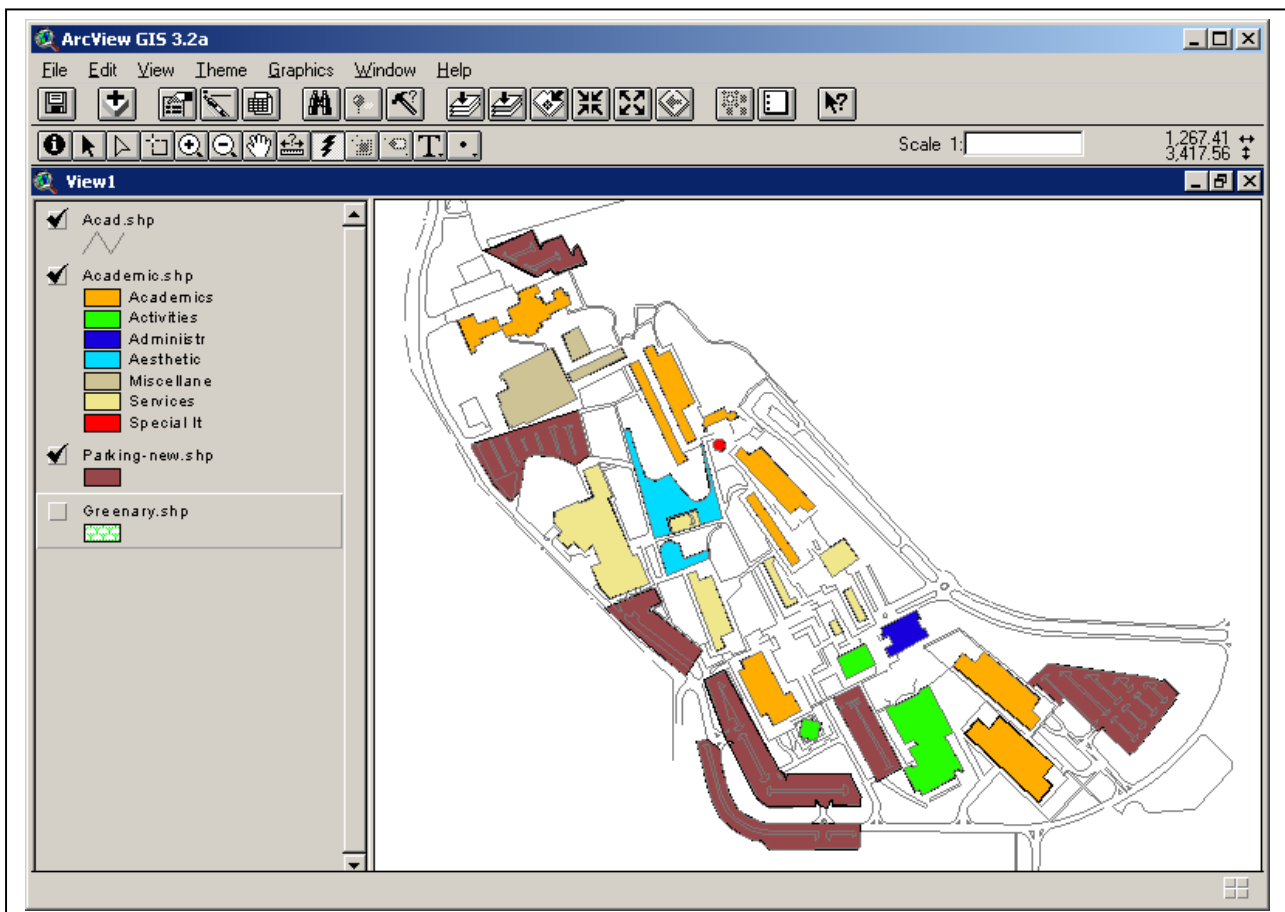
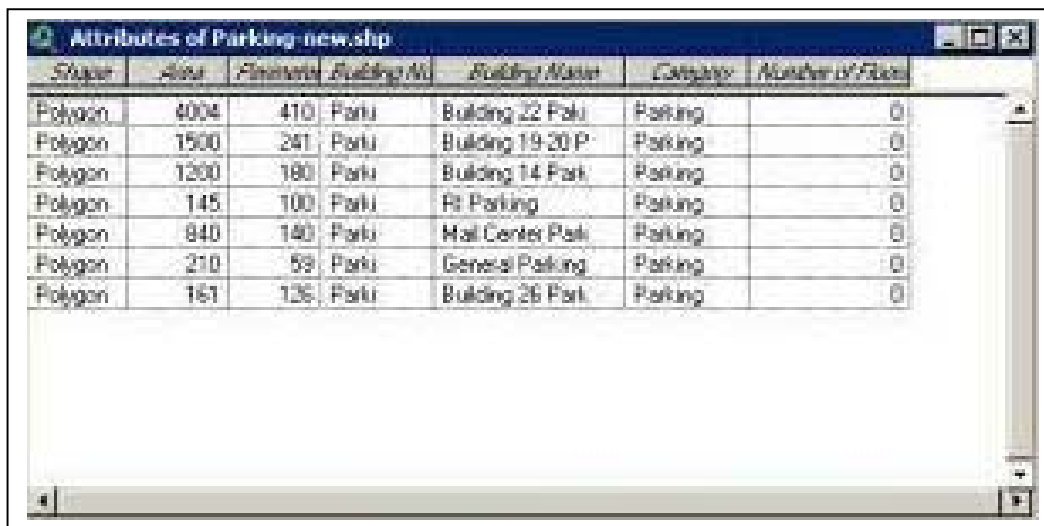


Figure 11: Gives the overview with three Layers Activated.

Table 12: Gives the over view of the Attribute table of Parking Area in King Fahd University of Petroleum and Minerals, Academic campus. The Attribute table give details the Following of Parking Area: Shape, Area, Perimeter, Building Number, Building name , Category of parking, Number of floors.



Shape	Area	Perimeter	Building No.	Building Name	Category	Number of Floors
Polygon	4004	410	Park	Building 22 Park	Parking	0
Polygon	1500	241	Park	Building 19-20 P	Parking	0
Polygon	1200	180	Park	Building 14 Park	Parking	0
Polygon	145	100	Park	Rt Parking	Parking	0
Polygon	840	140	Park	Hall Center Park	Parking	0
Polygon	210	59	Park	General Parking	Parking	0
Polygon	161	126	Park	Building 26 Park	Parking	0

Fig 12: Attributes of Parking

Figure 13: Gives the view of KFUPM academic campus with all the layers activated, it is the final view of this project it gives clear and in detail pictorial view of all the layers. The forth layer which is finally activated in fig 13: Deals with all the greenery details in KFUPM academic campus. It gives the aesthetic view to the academic campus. This combination of all the four layers is called as the composite layer. A

composite layer is the one which is formed on the overlay of all the maps or when they are superimposed over each other.

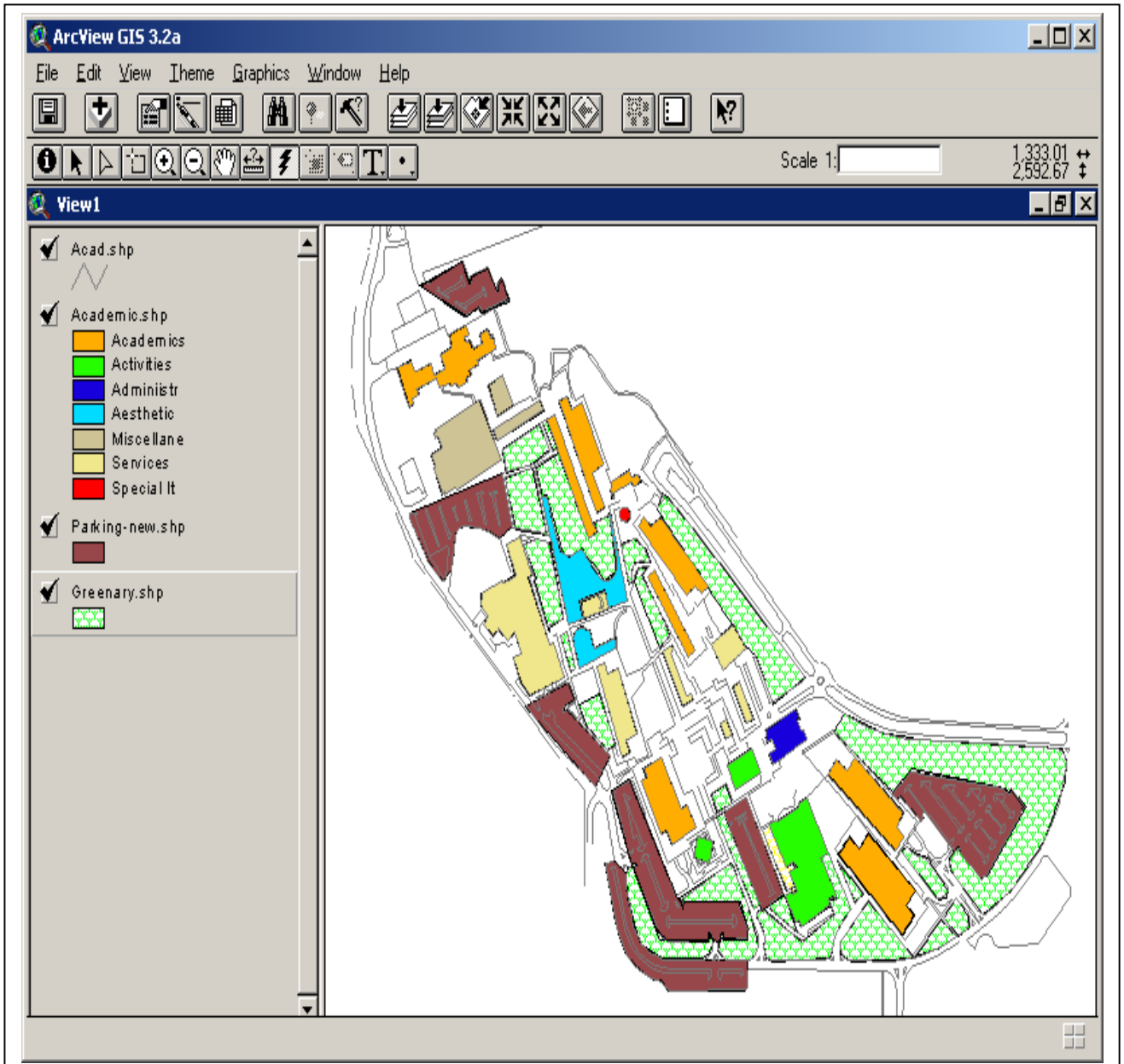


Fig 13: Gives the Over view of map with all the layers Activated

9.0 Analysis:

The absence of sufficient volume of data didn't allowed proper relations between the attributes. Hence very amount of analysis could be performed. But still with available data entered in the attribute tables, several bar charts and pie-diagrams were generated to show the complete work. These bar charts and Pie-diagrams help in automatically explaining the trend of data. The bar charts and pie-diagrams are attached at the end.

10.0 Summary and Recommendations:

With Geographical Information System, it is possible not only to create different features but also to maintain a database of those features in an attribute table so as to get the information of any of the features selected either on the map or in the table. This property of any GIS makes it a very powerful tool for any sort of spatial analysis, as just by a click it is possible to get most of the information of any feature anywhere in the world. Also the attributes can be used to create thematic maps i.e. Maps in which colors or other symbols are applied to features to indicate their attributes.

In the present project the attribute details of entire Academic campus of King Fahd University of Petroleum and Minerals were entered. Subsequently the ArcView GIS software made it straightforward for any person to know the details of any fraction of the campus on a single click.

The project was executed as a part of requirement for the course and I could not make justice with the innumerable functions of ArcView GIS. Mostly due to the non-availability of the relevant data and absolute shortage of time. The availability of both would have made difference to the project. During the course of study I felt the need of introducing ArcView GIS as a separate course in itself, which will offer the students more time to work on and understand this splendid software in detail.

On the whole I felt lucky to be working on ArcView GIS as one of the course of my Masters Degree. With this course and subsequently the project I got acquainted with the world of computer aided planning. The Immense help and guidance from Dr. Baqer Al- Ramadhan made the project more interesting and adventurous, importantly prompted me in completing this project within the speculated time. The help provided by CRP staff and colleagues is also appreciable.

11.0 Scope of Study:

In further to the present project, ArcView GIS concepts can be applied to each and every part and unit of the KFUPM campus, in fact they can be used to represent the each and every city and whole of Saudi Arabia and world.

In the present project many things couldn't be accomplished due to non-availability of data and shortage of time. ArcView have bundle of other features, which can also be incorporated along with the current project to create a comprehensive and detail project. The features like **HOT LINKS**

can be used to display the real Photographic of any feature. There are numerous other features that can also be employed.

12.0 References & Bibliography

Appendix and Attachment:

- ESRI.,1997. “**Getting to Know ArcView GIS**”, Environmental systems Research Institute, Inc. USA.
- Getting to Know Desktop ArcView GIS-Tutorial (7-28)
- Hand-outs on “**ArcView GIS**” provided by Dr. Baqer Al-Ramadhan
- GIS: “**A Management Perspective**” by Ston Aronoff
- www.esri.com
- <http://www.usgs.gov/research/gis/work1.html>
- www.kfupm.edu.sa
- <http://www.geog.mcgill.ca/heeslib/giS.html>
- <http://geography.uoregon.edu/infographics/projects.html>
- <http://www.digit.utah.edu/digitlab/projects.html>
- <http://www.library.arizona.edu/library/teams/set/sample.html>
- http://www.indiana.edu/~uao/html/campus_images.html

13.0 Acknowledgement:

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