VCCGIS: An Application of Geographic Information System in Urban Planning

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Chapter 1
Introduction

About two decades ago, some geographers conceived a system for storing and organizing spatial information in a computer. In the past 10 years, this growing technology has come to be known as "Geographic Information System" (GIS). In addition, many advancements in the technology have lead to the growth of applications.

The development of both computer technology and mathematical tools for spatial analysis have made many things possible, among them are the abilities to store, to retrive, singly or in combination, and to display data about all aspects of the earth's surface. As well as being able to handle existing data, GIS can easily handle fictional data and the results of simulation models, permitting scenarios of possible past or future situations to be modeled and explored. These abilities have created a revolution in the mapping sciences and in the uses in the practical day-to-day inventory, understanding, and management of our environment. (ESRI, 1990)

Today, computerized spatial information systems are used in many branches of pure and applied science, in business and commerce, and in local, national and international governmental agencies. The applications range from the completely utilitarion, such as mapping the networks for telephones, electricity, and sewers, to the esoteric and futuristic, such as modeling the possible future effects of climatic change.

More and more organizations now spend large amounts of money on GIS and on geographic databases. Predictions suggest billions of dollars will be spent on these items over the next decade. There are two reasons which caused GIS to become so popular and important. First, the costs of computer hardware needed for the task are dropping rapidly and are affordable to an increasingly wider audience, like PC version GIS software. Secondly, geography and the data describing it is part of our everyday world; almost every decision we make is influenced or dictated by some fact of geography. The fact that information is a resource to our economy just as people, money, and equipment are

resources for manufacturing goods, has led many large organizations to manage their information better. That is, many organizations have began to realize that they have invested an enormous amount of money in the data that is stored in their computers and have implemented new standards, policies, and procedures to help control the costs associated with computerized information systems. By improving both efficiency and effectiveness, computer processing technology added value to the information that was computerized. This value was associated not only with the efficiency of the workers but also with the effectiveness of their efforts and of the efforts of the managers and policy-makers of the organization. (Jeffrey Star, 1990)

Since the cost of computer hardware and software have been sharply reduced in recent years, it has become easier for a local government or planning agency to create a GIS in analyzing spatial data. This report, as well as introduction to GIS and its applications in urban planning, includes a case study of Valley Court Community Geographic Information System (VCCGIS) to describe a GIS application in local government.

The Valley Court community is a small community in East Lansing Michigan. The social, economic and geographic changes in this community area, have bad negative impacts on the area. The main problem is this area is technically transitional area between the downtown and it's surrounding western neighborhoods. Therefore, the users of the commercial district stumble upon a "dead end" feeling of shops, and the residents or homeowners are neighbored by a parking lot. In the meanwhile, the residents also complain couple problems like rental properties need to be cleaned up, Valley Court Park needs to be maintained better than it is now, more lighting is needed, speeding by motorists should be reviewed on the side streets of East Lansing and the high vacancy rate of the rental housing. The goals and objectives are to reverse them and make them positive. So in this area, we need to create some particular maps to help us analyze the problems we encounter we conflicts happened in this area. If we can create a database

including traffic, housing, population, historic districts, etc., it will be easy to figure out and solve the problems in this area. This is the great merit of GIS to assist planners for dealing with the problems of urban planning.

Before creating a GIS, first of all, we have to design the goals and objectives for the system. According to the mater plan of Valley Court Community, ten specified and quantitative objectives were designed for VCCGIS. The next step is to select the hardware and software for the system, since GISs are strongly depend on computer facilities. Basically VCCGIS is based on the popular software and hardware, like micro computers (IBM compatible), MS-Windows, MS-Excell, ARC/Info, etc. By this way, we need not to spend more expense in purchasing new facilities and software. On the other side, planners can be familiar with the system shortly without long-term learning.

Data collection is the other important issue. We must decide what kinds data we need and what kinds format of the data for the analyses. Analysis is the main function of a GIS since it can handle many data and display by varied ways which people almost can not do it by hand. But there is no GIS can create every information and makes the analysis, planners have to link their knowledge and the functions of GIS to do the final decisions. VCCGIS illustrates varied analyses and presentation for dealing with the problems in Valley Court Community.

The VCCGIS can provide all GIS functions like data input, edit, analyze and presentation by a few computer facilities. It shows that it is feasible to build a professional GIS with limited cost. In addition, this case study demenstration to that GIS is not a heavy burden or hard job and can easily be successful.

Chapter 2
What is GIS?
Definition

The use of Geographic Information System (GIS) has grown quickly in the 1980s in business, universities and governments. They use GIS for many diverse applications. However, many people are still unclear on what exactly GIS is. There are many definitions of GIS. A general one is "An organized collection of computer hardware, software, geographic data, and personal designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information". In figure 2-1 shows the real meaning of GIS:

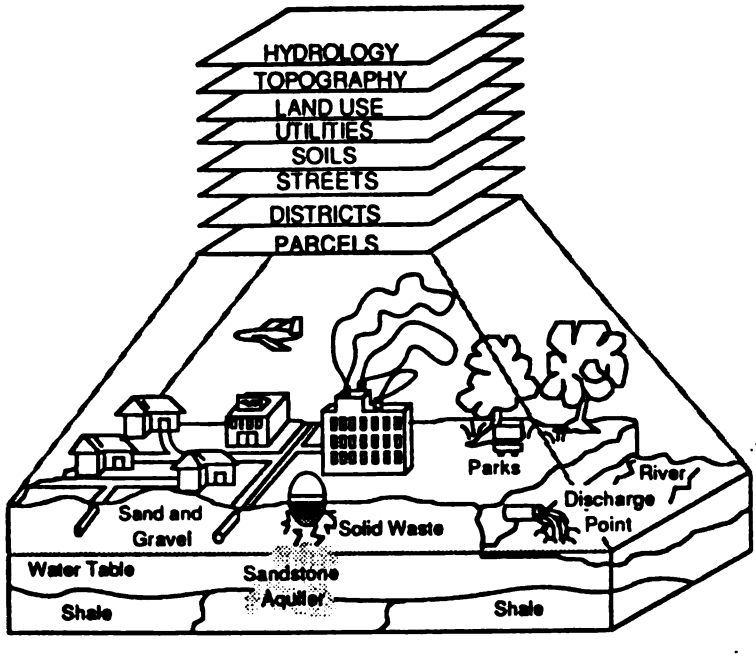

Figure 2-1 : The real world consists of many geographies which can be represented as a number of related data layers.

Data Linkage

A lot of computer programs, such as spreadsheets (e.g. excel, lotus), statistics programs (e.g., SPSS, SYSTATIC) or computer designing packages (e.g., AutoCAD) can handle simple geographic or spatial data. These packages are similar to GIS or they could be called parts of GIS. Why? According to the functions of GIS, it can capture, store, update, manipulate, analyze and display all forms of geographically referenced information. Like Excel or SPSS, they can store, update and analyze the attribute data, but they can not link those data to the spatial data. On the contrary, AutoCAD can capture, store, display the geographical data, but it can not link this data to the attribute data. So we know, a key point of the difference between GIS and those package is "data linkage".

A GIS typically links different data sets. For example, if we want to know the population density in each state, we should have a file containing the population in each state and a file containing the area. Then, we have to combine or link the two data files. Once this is accomplished , we divide the population data by the area to get the density.

State	Population
California	29279015
Colorado	3272460
Florida	12774603
Iowa	2766658
Illinois	11325247
Indiana	5498725
Kansas	2467845
Kentucky	3665220
Maryland	4732934
Michigan	9179661
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.	.

State	Area
California	158706.1
Colorado	104090.9
Florida	58663.7
Iowa	56275.3
Illinois	56345.1
Indiana	36185.4
Kansas	82277.3
Kentucky	40409.5
Maryland	10460.1
Michigan	58527.2
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.	.
.	.

State	Population	Area	Density
California	29279015	158706.1	184.49
Colorado	3272460	104090.9	31.44
Florida	12774603	58663.7	217.76
Iowa	2766658	56275.3	49.16
Illinois	11325247	56345.1	201.00
Indiana	5498725	36185.4	151.96
Kansas	2467845	82277.3	29.99
Kentucky	3665220	40409.5	90.7
Maryland	4732934	10460.1	452.48
Michigan	9179661	58527.2	156.84
. . .	. . .	. . .	. . .

Besides the attribute data linkage, we also have to link attribute data and spatial data. Spatial data is the information about the location, shape, and relationships among geographic features, which is stored as coordinates and topology. In the example of population density, if we want to display the population density by shading method in each state. We have to link the attribute data and spatial data. First, we have to classify the population density data into several groups. Each group has its own shading pattern. Then put the shading pattern into each state according to their attribute data. This procedure is called spatial and attribute data linkage. In figure 2-2, we divide the population densities into five classifications. It is clearly useful to figure out the distribution of population density in America.

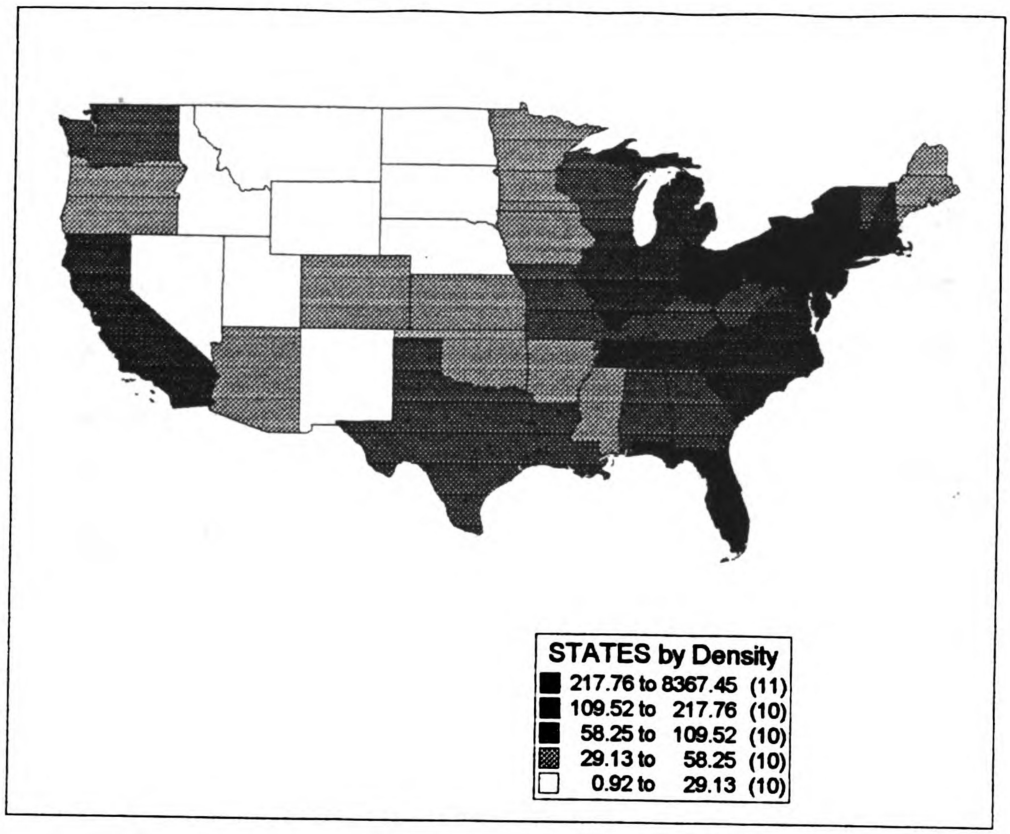


Figure 2-2 : Population Densities of America by state

Establishing a GIS

Generally, a GIS project can be organized into a series of logical steps, each of which builds upon the previous one. Many GIS will follow a similar sequence.

Step 1. Build the database

This is the most critical and often the most time - consuming part of the project. The completeness and accuracy of the database determines the quality of the analysis and final producs.

(1) Design the database - determine the study area boundaries, what coordinate system will be used, which data layers are needed, what features are in each layer, what attributes are needed for each feature type, and how the attributes are to be coded and organized.

(2) Automate the data: Get the spatial data into the database, make the spatial data usable and get the attribute data into the database.

(3) Manage the database - putting the spatial data into real world coordinates, jointing adjacent coverage, and maintaining the database.

Step 2. Analyze the data

This is the most important part of GIS and it is the true value of GIS. Analytical tasks which are otherwise extremely time-consuming or even impossible if done manually, can be performed very efficiently using a GIS. The GIS can be used in conjunction with specified knowledge of the project objectives and the database you have developed.

Step 3. Present the results of the analysis

A GIS offers many options for creating customized maps and reports. The final products should relate directly to the objectives of the project and the intended audience, both of which are determined at the beginning of the project. The presentation should consist of both the analysis of graphic and tabular data. It will help in the decision-making process. (Worrall Les, 1990)

Benefits of GIS

A number of benefits are generally attributed to a GIS. They include:

1. Improved productivity in providing public information.
2. Improved efficiency in updating maps.
3. The ability to track and monitor growth and development over time.
4. Improved ability to aggregate data for specific subareas.
5. The ability to perform displays of different types of professional analyses that are too cumbersome or time consuming using manual methods.
6. Improved policy formulation.

Most GISs tend to be focused on automating routine tasks and monitoring growth trends. While these activities are useful, the real payoffs from such systems come from their ability to enhance analysis and to support more creative policy formulation.

The benefits associated with some of these applications are more easily quantified than other applications. For example, automating routine map updating. But it is difficult to know the value of improvements in analysis and policy formulation. At least we can not use cost-benefit to analyze the values since they are hard to quantify. (Boyce, 1989)

Chapter 3
GIS Applications in Urban Planning

To an urban planner, we know that "one plot is worth 1000 pages of printout". Since many planning decisions relate to geographically dispersed phenomenon, local governments or planning agencies have had a long interest in the development and implementation of a GIS. They have created and maintained maps for essential functions such as defining parcel boundaries, tax assessment, and identifying and maintaining the public rights of way. The amount of data created and collected, have greatly added to policy makers' information requirements. Today, the demands of GIS are greater and wider than before because GIS had been really applied in every field of urban planning. In this chapter, three main urban GIS applications including land use, socio-economic and transportation are described separately.

Land Use

In urban planning, we usually need to create a lot of maps related to property lines, land use and zoning etc. A deed contains a description of a parcel of land that accurately and precisely locates the parcel. Land surveyors utilize these descriptions to prepare land subdivision plats, assessor's plats, cemetery plats and certified survey maps. These graphic representations of the legal property descriptions are used by local government for a number of purposes, including the assessment of properties for taxing their owners.

To local government, an important problem is how to record these huge number of maps and data. The more serious problem is that we have to change or update the maps and data frequently.

Changes to maps occur when:

1. A new subdivision is created in preparation for new development.
2. A new survey of an existing subdivision is conducted to change lot boundaries or correct errors in a previous survey.
3. A change is made in the size or location of the public right-of-way.

4. A street or alley is vacated.

5. A street name is changed.

6. Property outside the jurisdiction is annexed.

7. Errors of any kind are detected and corrected.

Only GIS can solve these problems since we can alter and redraw these maps in computer. If the data is too huge or complex, sometimes it is not only time consuming but also impossible to do by hand.

Land use maps usually record how the land in a jurisdiction is used by the citizens: whether it is residential, commercial, industrial, public, open space, etc. Besides land uses maps, the local governments have to record and maintain plat maps and quarter-section maps. Generally, the Local Planning Department of the agency creates and maintains these maps. Usually the descriptions of the three maps, much of the map information recorded on them is redundant (street names, parcel boundaries, right-of-way). Since they are maintained in three separate functional units, this redundant information must also be maintained redundantly by the separate units. Thus, one change can cause three separate update actions to take place. Depending upon their own local needs, local governments maintain many more map series than these three, causing an even greater degree of redundant map updating.

A geographic information system eliminates most of this redundancy by storing all map information in one data base where only one change need be made to common data. The change is then reflected on all maps containing that information. (William E. Huxhold, 1991)

Social-Economic -- TIGER

In order to realize the activities of people, the US. Bureau of the Census created the Topologically Integrated Geographic Encoding and Referencing system (TIGER). The TIGER system consists of the TIGER database, plus the data specifications, computer

programs, and other materials required to prepare, maintain and use the database. The TIGER database contains digital data for all 1990 census map features (e.g., roads, railroads, and rivers); census geographic units (e.g., tracts and blocks); political units (e.g., cities and townships); feature names; and 1980 and 1990 census geographic area codes for the entire United States.

These development of the Census Bureau's TIGER system coincides with the emergence of low-cost and easy-to-use geographic information systems (GISs) that are becoming increasingly important for city and regional planning in the United States. Together, the TIGER national geographically referenced database and these powerful GIS tools provide the means to conduct a variety of planning and management tasks that were impossible or extremely difficult to do until recently.

In TIGER, it provides a thematic mapping function. Thematic or "choroplethic" maps use a system of colors, shades of gray, or hatching to display the regions shown on a map. For example, a thematic map can use lighter and darker shades of gray to display the median family income for different census tracts in a city. Tracts may be displayed in white to indicate median family income below $10,000; light gray can be used for tracts with median family incomes between $10,000 and $15,000, and so on. Other variables that can be displayed in a thematic map include the area's total population, minority population, education levels, or any other variable that is available for different subareas of a city or region.

Attractive and informative thematic maps can now be prepared easily and quickly with a number of low-cost microcomputer-based mapping packages. TIGER/Line data can be incorporated into one of these packages to provide the boundaries for census reporting areas(e.g., tracts and blocks) and political jurisdictions (e.g., cities and MCDs) that are to be mapped. The area boundaries can be associated with the attribute values to be mapped by relating the code in the TIGER/Line file to a corresponding code in an attribute data file. For example, data from the Census Bureau's summary tape files for

census tracts can easily be related to the corresponding tract boundaries generated from the TIGER/Line files by using the tract number that is included in both files.

The TIGER data can also be used with population information from the decenial census to help locate new public facilities, such as schools and police and fire stations. The location of such facilities is dependent largely on distance standards (e.g., a community may establish a standard that there must be a fire station within five miles of any resident). In this case, the TIGER street network map can be located into a GIS to draw circles with a five-mile radius around the existing facilities to identify areas that are not being served adequately. Similar analyses can be used to identify suitable sites for new industrial and retail facilities.

The location of other facilities, like libraries, may be defined in terms of the maximum client population (e.g., a neighborhood library should serve no more than 50,000 residents). In this case, a GIS can be used to determine the location of existing neighborhood libraries along with the census block boundaries and the populations they contain. The GIS can then be used to draw service areas around each facility that contain populations that are approximately equal to 50,000. The municipality can assume that areas outside these boundaries are inadequately served, indicating where new facilities should be provided.

The TIGER/Line road and street network information can also be used to estimate the noise and air pollution impacts of existing and proposed highways and major aterials. The TIGER/Line files can be located into a GIS to locate the highway under consider consideration and the residential population in neighboring blocks or tracts. GIS buffer operations can then be used to identify the proportion of each block that lies within a specified distance of the highway and estimate the residential population that will be affected within the corridor. (Wimkowitz, 1991)

Transportation -- GIS-T

Transportation agencies are currently faced with ever-increasing demands for information to support more effective decision making throughout their organizations - from engineering at the individual project level to statewide planning and management. Further, the broad environmental and economic development problems that confront all of society today require data sharing and cooperation among multiple government agencies at all levels.

The application of GIS to transportation problems is relatively new. Very few large-scale implementation efforts have been undertaken. However, a number of successful pilot projects and a few broadly introduced applications have effectively demonstrated many potential benefits of GIS for transportation (GIS-T). Main inhibitors of large-scale implementation include a lack of awareness of the revolutionary nature of this technology, institutional barriers, and the significant costs of implementation.

An effective design and implementation plan for GIS-T must have both a technological and an institutional context. Information technology in general is changing rapidly and will continue to do so. GIS is one of a number of information technologies that must be planned for in concert. Principal aspects of the institutional context include determining the most critical initial applications, sharing costs of developing and maintaining the required spatial databases across applications, gaining and retaining support of high-level management, coordinating with external organizations, and utilizing standards developments.

There are several capabilities required for GIS applications to transportation that go beyond those developed for applications in other areas. In the ideal - at some cost in efficiency - these should be realizable by acquiring modules that provide them and can be used in association with other modules that provide core GIS capabilities. In a server net, the different modules might well be supported by different servers. The current state of technology is such that products providing the capabilities are unlikely to be so neatly

decomposable into modules. In some cases, the pioneer DOTs (Department of Transportation) that have made these capabilities available to themselves have done so by extending commercially available products with internal development efforts. (Transportation Research Board, 1993)

Chapter 4

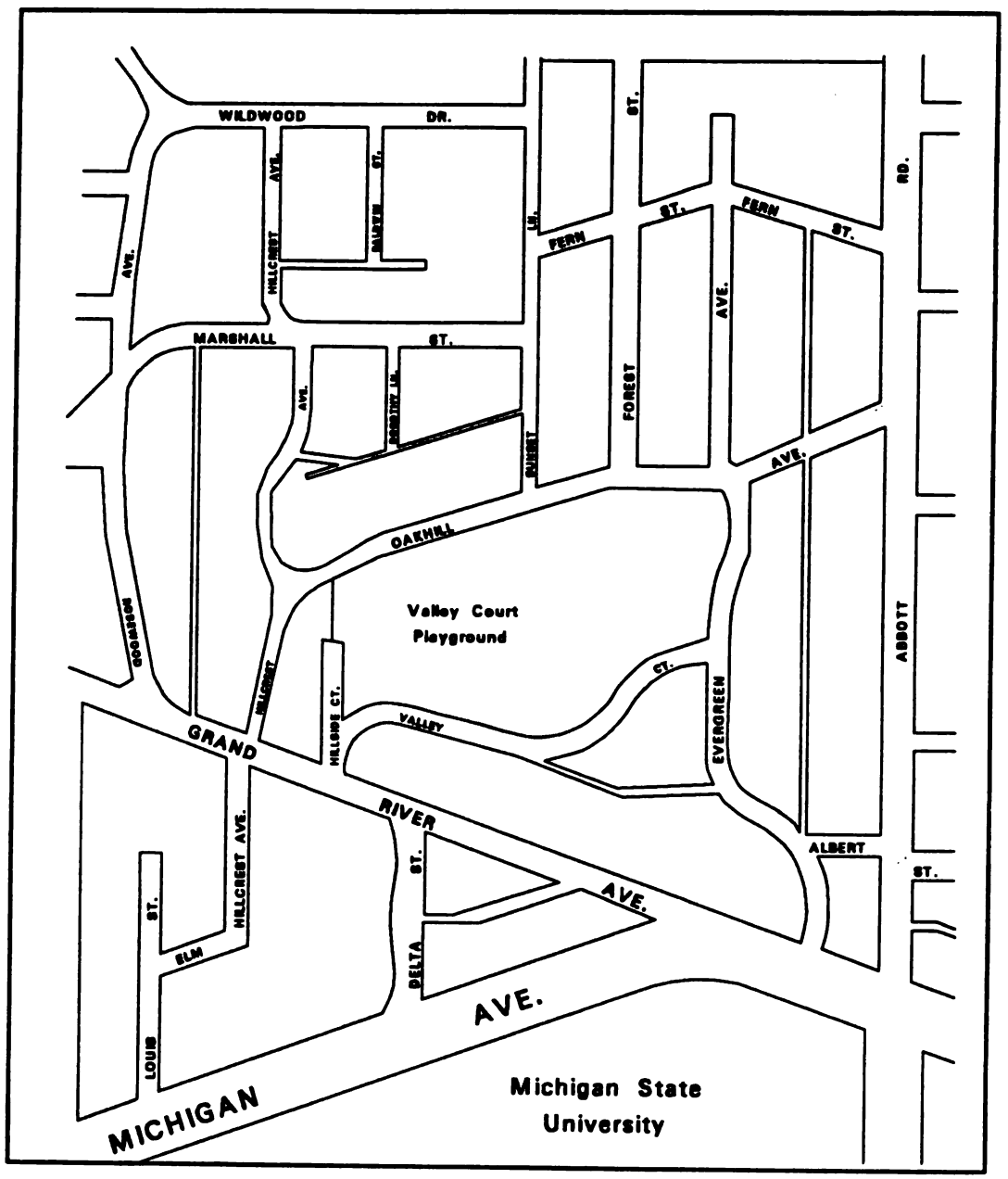
Valley Court Community Comprehensive Plan

A central component of this report is a case desciption of the Valley Court Community project which displays how a GIS can work in urban planning. The project is compiled for the East Lansing Planning Commission and the Downtown Development Authority. The purpose of this study is to collect data on issues that affect the study and interpret the data to provide a plan of action.

The Valley Court area is located three miles east of downtown Lansing (figure 4-1). The Valley Court Community boundaries are Louis Street on the west, Abbott Road on the east, and Wildwood Avenue and Michigan Avenue on the north and south. The Valley Court Community consists of pre-50's and 60's styles of development. This explains why a majority of the housing area is zoned as a historic district. Michigan State University, originally known as Michigan Agricultural College, officially opened in 1847, with all its faculty and students living on campus. The main circulation of traffic funneled through Michigan Avenue and Grand River Avenue. Also, a street trolley system serviced users from downtown Lansing along Michigan Avenue to Grand River Avenue, up MAC Avenue to Burcham Street and then back downtown. This route system lasted until approximately 1930. In 1950, as the university population had grown to 14,996, housing outside the university evolved similarly. By 1970, the population of Michigan State University jumped to 44,092 and in 1975 university numbers peaked at 48,488. During this time, the city of East Lansing recognized many major social changes.

Within the study area there are two neighborhood groups, the Central Neighborhood, and the Glencairn Neighborhood. The Central Neighborhood extends westward to the city limits from Michigan Avenue and Grand River Avenue intersection. It contains an area called the Delta Triangle (en-framed by Michigan Avenue, Grand River Avenue, and Harrison Avenue) and the Chesterfield and Kensington subdivisions. The

Valley Court Community Block Groups



Glencairn neighborhood extends north of Grand River Avenue and to Wildwood Street. It is sandwiched between Abbott Road and Rosewood Street.

In the center of our study area lies the last of East Lansing's green space -- Valley Court Park. Within the park is the Valley Court Community Center which is used as an elderly day care and doubles as a public meeting facility for the different community groups in the East Lansing area in the evenings.

Before discussing the application of GIS in this area, there are six topics , Transportation, Land use, Housing, Neighborhood preservation, Business as well as Crime , are introduced in this chapter.

Transportation: Within the Valley Court Community, people utilize various forms of transport. The majority of the working population (71%) travel by car; of that seventy-one percent, eighty-eighty percent drive alone. This causes the serious problem of parking in this area. The next highest percentage of people walk to work. This implies that the work is close in terms of time and distance. The average trip time for job related trips is almost fourteen minutes is taken to get to work. The reason for this is that students within the study area typically work in downtown East Lansing, while older residents work in downtown Lansing. The average number of people making Lansing their destination was twelve hundred, while twenty two hundred were going to East Lansing. It is readily evident that the car is over utilized as a mode of transport when a thousand more people are using it to access the core of the city only a couple of blocks away.

Land Use : The Valley Court Area is made up of two type of soil: UpA - Urban Land - Capac - Colwood, and UtB - Urban Land Marlette Complex. UpA has a zero to four percent slope and is classified as nearly level to undulating. It is found in the northeast corner of the study area where the Hannah School is located, in Valley Court Park itself,

and along the Michigan Avenue border of the Delta Triangle. UtB maintains a two to twelve percent slope and is classified as undulating to rolling, well drained soil. It is the predominant soil across the rest of the site.

Currently there is a diverse spectrum of use in this area. The different housing uses including: single family, double family (duplex), multiple family (apartment), and group (fraternity, sorority, cooperative). The commercial uses include: offices, restaurants, retail, and highway service uses. Other uses include churches, schools, government, and public facilities.

The Delta Triangle area between Grand River Avenue and Michigan Avenue is predominately multiple family and group housing with a small amount of commercial interspersed. On the north side of Grand River Avenue there is a small commercial strip containing a church, four restaurants, a bus station, and several empty lots. Behind this commercial strip is the Valley Court Park and Community Center. North and west of the park is all residential. The periphery of the park area is multiple and group housing, transiting into single family housing. A large proportion of the single family units close to Grand River Avenue and the university exist as student rental homes. The single family units on the northern and western borders of the study area are predominantly owner occupied single family homes.

Housing: Physically, housing is one of the most important elements in our lives. Population and households are important factors in dealing with over crowding, parking, and garbage disposal. In the rental areas, the higher the concentration of people appears in the R-2 zoned areas. These areas are mostly student housing rentals, fraternity and sororities. The highest concentration of people, according to the maximum occupancy load for rental houses, is the area north of Valley Court along Oakhill Road, the area to the east of Valley Court between Evergreen and Abbott, and along Louis St. off of Michigan Ave.

If Valley Court was a central focus then this area could be compared to Burgess' Concentric Zone Model, where the lower income dwellings surround the central focus and the higher income housing is another concentric zone surrounding the lower income rental housing. This kind of model shows the buffer between the owner occupancy and the rental housing. The effect that this had on the Valley Court park is that most of the owner occupancy buildings are buffered from the park.

Neighborhood Preservation: Neighborhood preservation is an important ingredient concerning the conservation of any community. Historic preservation is only a small part of maintaining the integrity of an area or neighborhood. Deterioration and loss of historic, architectural and cultural resources are the main reasons for a community's decline as a vital economic, social and cultural center. Neighborhood preservation and its programs help to rebuild and revitalize various areas.

In East Lansing, a Historic Preservation Code was adopted in 1989. The code addresses the physical stabilization, maintenance and improvement of historic resources and structures within designated Historic Districts. Considering the quality of homes, it was important to study rental homes vs. residential homes, their location and their structural condition. In East Lansing, to study the structural quality, Michigan State University students need to be taken into account, since they are the renters and change from year to year.

Neighborhood preservation is always important to the image of a community. With this in mind, historic preservation, the historic preservation code and the structural quality of homes are extremely important issues.

Business: The students of Michigan State University are an enormous economic resource to the city of East Lansing, however, the students alone are not enough to support such a diverse market.

East Lansing is currently a very pedestrian oriented town. This is often true of college towns. Consumers much bike or walk to reach their destinations. Or they must park in one of the many pay lots, and then walk. Based on this point alone, a valid alternative would be to make our service area more user friendly -- beautify the stereoscope, provide more visual links and improve safety.

Another problem that was verbally expressed by business owners was that East Lansing did not cater to their needs. A simple achievable short term goal would be to initiciate a system in which the work force of East Lansing or at least the business owners would be allowed free parking during business hours. This seems minor, but in actuality many owners are so angered by the parking that they considered moving.

Parking is an extremely pressing problem, but it need not be one that detracts from East Lansing business. Another serious problem in East Lansing is "awareness". How can East Lansing make local businesses aware of issues that could affect them? They need to be made aware of positive things being done for them as well as things that may temporarily negatively affect them.

Crime: East Lansing is not a crime infested city, but some crime does occur on and off Michigan State University's campus. Noise citations have increased over the past three years, while the number of tickets to people driving under the influence has decreased over the last three years. Crime statistics for the Valley Court community were not made available, but a general crime data sheet for the city of East Lansing from 1984-1992 showed that violent crimes do take place in this area.

Chapter 5
Objectives and Goals

Before the planning and implementation of social programs, the planners usually have to predict and design the objectives and goals. VCCGIS, since it is a tool for research the data of Valley Court Community, the explicit goal of this system is "To can efficiently capture, store, update, manipulate, analyze and display the data related our study area, Valley Court Community". Of course, this general and abstract statement only briefly describes what we have to do in this system. Like chapter 3, the application of GIS in public policy, we have to transfer the general policy statement into quantification. It is also necessary to set the specific objectives including the quantification and locations for each problem in Valley Court Community because computer systems can not work according to a general statement. The following are ten objectives from six main topics (they are briefly mentioned in chapter 4), Transportation, Land use and Zoning, Housing, Neighborhood preservation, Business as well as Crime issue.

Transportation

There are two main issues related to transportation. One is the average daily traffic volume and the other is the public transportation system.

a. Average daily traffic volumes

Because Valley Court Community is close to the DDA (Downtown Development Authority) of East Lansing, to identify the traffic volumes is significantly important. According to the investigation, the average daily traffic volumes of selected streets in the study area are as table 5-1: (on the following page).

Can we display and analyze the above data through GIS? The answer is absolutely "yes". Since the daily traffic volumes combine two important factors, the attribute and

spatial data. They are qualified to fit the basic requirements of GIS, so we can design the objective for the average traffic volumes.

Street Name	Average Daily Traffic	Majority % & its direction
Abbott N. of Grand River	14,733	52% heading South
Abbott N. of Burcham	13,252	53% heading South
Delta S of Grand River	804	51% heading North
Delta N of Michigan	900	51% heading North
Evergreen N of Grand River	1,455	51% heading South
Grand River E of Abbott	39,102	54% heading N.W.
Grand River W of Abbott	42,295	51% heading N.W.
Grand River W of Rosewood	24,587	51% heading S.E.
Michigan SW of Grand River	33,844	53% heading S.W.
Michigan SW of Beal	36,360	53% heading S.W.

TABLE 5 - 1 : Average Daily Traffic Volumes of Valley Court Community

Objective 1:

VCCGIS should have the ability to display two different base maps, one is Valley Court Community and the Greater Lansing area (including East Lansing and Lansing area). When we research a community, not only try to identify the activities within the area but also try to understand the relationship between this community and the adjacent areas. Therefore system is expected to exhibit the two base maps with this information.

Besides the base maps, GIS can also display the volumes of daily traffic by each street. The demonstration should include the directions of traffic flow and the amount, so we can distinguish which street has a heavy volume or hsa a light volume.

b. Public Transportation System

There is only a public transportation system, Capital Area Transportation Authority (CATA), in great Lansing area. The bus system represents the most common means of urban transit. It has universal application and it is both reliable and economical. Because a lot of students live in the Valley Court community area, it is doubtless that CATA plays an important role for the area's transportation considering that many students do not have vehicles. Five routes of CATA cross this area and the data as following:

Route 1: Travels along Michigan Ave. from downtown Lansing all the way to Meridian Mall
Route 17: From downtown East Lansing along Abbott to Carriage Hills Shopping Center
Route 19: Follows Grand River Avenue from downtown East Lansing to the Lake Lansing Road Meijer via North Harrison Road.
Route 20: Follows Michigan Avenue from downtown East Lansing to Spartan Village down South Harrison Road.
Route 1X: From Meridian Mall to Williamston express.

TABLE 5 - 2 : CATA Bus Routes

Objective 2:

The VCCGIS can display the paths of each routes and bus stops, and use the analysis of the GIS to examine the service area of each bus stop and check the number of stops is too much or little.

Land Use and Zoning

a. Land Use

A land use plan is an expression of a community's intent as to what its future pattern of land uses should be. It identifies areas that are to be devoted to various types, densities, and intensities of use categories, such as residential, commercial, industrial and various public uses. A land use plan is an important component of a comprehensive plan, we have to understand the land use in this area when we deal with the master plan of Valley Court Community.

The land use planning process should begin with an understanding of what is already there. This is achieved by conducting an existing land use survey, which normally consists of (1) a map with colors or patterns denoting various land use categories, (2) a quantitative analysis of how much land exists in each category, further subdivision by geographic subareas, and (3) a text that analyzes the findings.

b. Zoning

Besides the land use map, the other significant map of the master plan is the zoning map. A traditional zoning ordinance consists of a map and a text. The map divides the community into districts, and the text lists the types of uses permitted in each district and sets forth regulations governing the way in which these may occur. Since zoning ordinances are the basic rules for a community development, we can not study Valley Court Community without the zoning map. (John M. Levy, 1991)

Objective 3 and 4:

Display and query the land use and zoning of the whole or part of the study area. The GIS can use different colors to show the different categories, meanwhile, it can provide the quantitative analysis of each category.

Housing

Housing in its most basic sense is shelter, but in fact it serves more needs than only protecting people from the elements. It provides space for a range of activities - cooking, eating, working, recreation, and sleeping. It also provides relative access to schools, jobs, parks and so on. In the housing, there are various people activities. In this topic, we will try to analyze the social/economic activities in the housing.

a. The value of housing

The primary housing concern today is the proportion of income that households must spend in order to procedure adequate housing. If the GIS can display the value of each housing in this area, we can not only distinguish the distribution of housing values but also realize the relationship between area and income.

Objective 5:

Demonstrate the value of each housing by a different color and calculate the statistical significance.

b. Value of housing, total housing units, mean contract rent and population

In the 1990 Census of population and housing in the Valley Court Area, to help define the study area more accurately, it has been broken down into its respective tracts, 40 and 41, and further more, into block groups and blocks. Tract 40 includes block group 2 (or BG2) and tract 41 includes BG3 and BG4.

The major emphasis of the research will be on the housing and population characteristics in terms of total number of housing units, mean contract rent and population.

Objective 6:

Census data displays the pattern of this data block by block and the GIS can capture and update the new census data.

Neighborhood Preservation

The Historic Districts in East Lansing were created to protect the importance historic, architectural and cultural resource that the East Lansing community has to offer. Six geographically defined historic districts exist within the city: Hillcrest Village, Chesterfield Hills, Collegeville, Oakwood, College Grove and Bailey. There are also exists a Landmark District and a Cast Iron Street Light District.

a. Historic Districts and Land marks

The study area is located in part within three geographically defined districts: Collegeville, Oakwood and College Grove. Besides the three historic districts, the landmark district is also a part of this project area. The landmark district is a non contiguous district comprised of 27 individual structures which the Historic District Committee felt had outstanding historical and architectural merit. There are 10 landmarks in this area.

Objective 7:

Display the three historic districts in this area with the 10 landmarks by using a layer overlaying function. The system should record the basic information of each landmark and we can check the information and the picture of each landmark in the computer.

b. Structural Quality

The structural quality of homes is always important for the preservation of a neighborhood. The project area, in East Lansing , being primarily residential, contains mainly sound structures. When reviewing the homes, the following criteria was used:

1 - Excellent : Structurally sound and in excellent condition.

2 - Good: Structurally sound.

3 - Fair: Dilapidated. (problems that are fixable)

4 - Poor: Deteriorated (will not be around in 20 years)

Objective 8:

Display the structural quality of each lot. We can analyze the relationship between the housing quality and historic districts as well as housing value.

Business

In the Valley Court Community, the commercial area is a small part of this study area. Since some residents suggested extending the DDA (Downtown Development Authority) and connecting with Frandor Plaza commercial area, consideration of the the commercial development of this area is an important issue. There are 35 business stores in our study area and most of their activities relate to students of Michigan State University. DDA extension will attract more students for shopping and dining in this area.

Objective 9: First to create a query system for checking the basic data of each business, like address, store name, area, type of their consumers and business categories. Second, to decide the locations of new stores with some conditions such as if we want to develop some retail stores.

Crime issues

To keep a safe community is a substantial issue for the living quality of a community. Although East Lansing is not a crime infested city, some crime does occur on and off Michigan State University. The associations of this area suggest that adding more street lights for detering the criminals.

Each of the three associations in this area, East Glencairn, Oakwood Historic, and the Central Neighborhood Association, stated that more lighting is needed. In addition, they also suggested the ordinance on street lights in historic districts should be re-evaluated.

Objective 10:

To determine if the existing lighting facilities are enough? If it is found that more lighting is needed, then how to decide the locations of new street lights by VCCGIS.

Chapter 6
The Process of Establishing VCCGIS

Generally, there are a series of logical steps used to create a GIS project. Establishing VCCGIS also follows the similar sequence. In the previous chapter, the ten objectives of six issues had been disscussed. They provide the information about what the functions and database of VCCGIS should be. We have to build the database and analytic functions according to these objectives.

Sometimes, it is necessary to organize the non-quantitative data and calculate the quantitative data for getting more information. On the other side, if we get the graphic data from the other existing system with different format, we have to convert the coordinates to fit our system. Therefore besides building a database and a system, some basic principles about database management and graphic transformation will be discussed in this chapter.

VCCGIS Components and Structure

In the computer software market, many computer programs run under MS-DOS and call themselves Geographic Information Systems (GISs). What is a true GIS? and what is "Desktop GIS" ? Actually, a computer program can begin to call itself a GIS if it will give users information geographically. Specifically, if we can point to a geographic feature on a map display and be shown a data record for it, the program begins to be a GIS. About the desktop GIS, it is a personal GIS, not that runs an enterprise and runs on a personal computer, though it may be connected to an enterprise GIS over a local area network. It has more functionality than a thematic mapping program. (C. Peter Keller, 1988) When we choose a GIS software, several factors which should be considered :

1. Cost: since most people or bureaus have limited budgets, the cost is an important factor.

2. Functions: choose the GIS which fits our need. Usually different GISs focus on different fields, like transportation, natural resources, urban planning etc., and we have to decide which software to use according to what needs we have.
3. Performance: a good computer program can be designed to do things fast, such as by using indexs to go right to data in a large file, rather than search each record for matches, or by organizing the map data so that geographic features in a small area can be quickly found and drawn.
4. Ease of learning and use: the more "natural" a program is in its approach to doing work for you, the better you will like it. Whatever the functions a GIS provides, it is not a good program if it is hard to use and learn. (Wiggins, 1990)

Basically, the whole VCCGIS combines some PC version software including AutoCAD, Arc/Info, Arc/View, DbaseIII, MS Excel and Wingif. Why does VCCGIS comprises these programs but not an independant software? Actually, it can not be expected that there is a perfect GIS software which can fit all your needs. It is a new trend in computer applications of urban planning to use varied programs for dealing with different problems of a project. For example, Arc/Info is the main component of VCCGIS, but we use the digitizing function of AutoCAD instead of Arc/Info because AutoCAD is the most popular Computer Aided Design program and easy to use and edit. The other reason that we consider the combination of programs is that we can use our existing programs to match the needs without buying new ones. Figure 6 - 1 is the structure of VCCGIS.

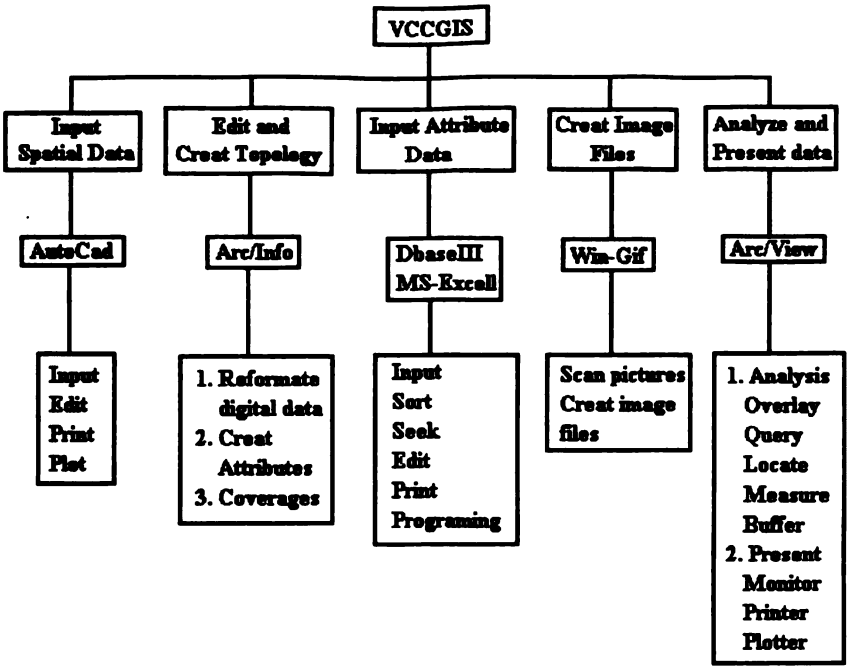


Figure 6 -1: The structure of VCCGIS

The followings are the brief descriptions of the function of each software.

AutoCAD:

It is a Computer Aided Design program and is famous for its friendly use and powerful functions. In VCCGIS, we input the spatial data by digitizing through AutoCAD. Besides inputing the features like points, lines, arcs, circles or polygons, we also can add the texts on the graphic. After drawing the base map, we need to transform the AutoCAD graphic format into "DXF" (Drawing Exchange Format) because it is a bridge format between AutoCAD and Arc/Info. (R. Gesner, 1991)

Arc/Info:

PC Arc/Info is developed by ESRI (Environmental System Research Institute) and includes lmost of the abilities of GIS. A whole Arc/Info are divided into six parts, Starter Kit, ArcEdit, ArcPlot, Overlay, Network, Data conversion and PC Info. In VCCGIS, we only use Starter Kit and Data conversion to transform the DXF files from AutoCAD and create the topology and coverages. A coverage can have point, arc (line) and polygon (area) features, but node points are part of arcs and a polygon is defined by the group of arcs that bounds it. Coverages can be used together in any combination when doing analysis.

3. DbaseIII and Excell:

Both of them are the software for Data base management. DbaseIII provides a programmimg function working in MS-DOS and Excell provides Macro language working in MS-Windows. Why does VCCGIS need two database systems? Since users can design the program to input, delete, edit, calculate and print the data according to their need and format by DbaseIII. But it does not work in Windows system. Excell has statistic and geographic function like bar, pie and charts. Most importantly is that it can work in Windows system , so we can execute Arc/View to analyze the graphics and in the meanwhile edit the Database by Excell. (PC Learning Labs, 1994)

4. Arc/View :

ESRI produces Arc/View in Windows system because Arc/Info is a huge program and difficult to learn and use. In order to improve the problems, Arc/View is designed in Windows system and users can easily operated by a mouse for choosing the database and analyzing tools. It provides the most graphic analyzing functions of Arc/Info like thematic map, overlay and service area coverage.

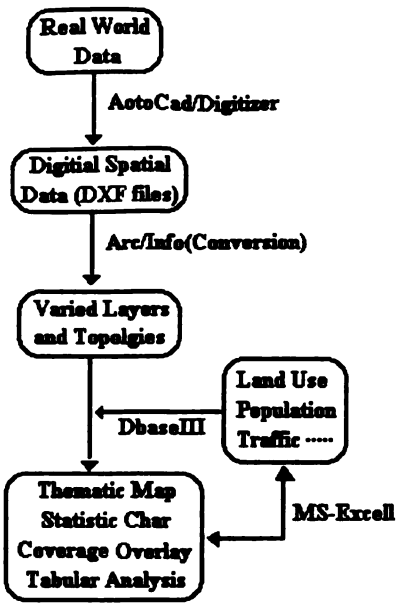


Figure 6 - 2: The flow of VCCGIS Database.

Creating Database

Before creating the database of VCCGIS, we have to determine what kinds data we have to prepare. A GIS combines two main kinds of data, spatial and attribute data. Spatial data means the information about the location, shape, and relationships among geographic features, in this project like the locations of street, lot or bus stops. In Arc/Info, the different spatial data is stored in different layer called coverage. Attribute data is directly associated to the spatial data and contains both spatial data characteristics and attributes. In VCCGIS, the land use, value of each lot, housing units and the population of each parcel are attribute data.

Besides the two kinds data, a image file is the other format data in GIS. It is a two-dimensional data representation which can be transformed from a photograph by a scanner. Table 6-1 shows the spatial, attribute and image data in each objective.

Objective	Spatial data	Attribute data	Image Data
1.Traffic Volumes	Great Lansing area Block map* Traffic voulmes	the number of traffic volumes	
2.Public Transit system	Bus stop Lot map** Bus routes Great Lansing area	Land use	
3.Land Use	Lot map**	Land use	
4.Zoning	Lot map**	Zoning	
5.Housing	Lot map**	Housing value	
6.Census Data	Block map*	Housing value Housing units Contract rent Population	
7.Historic District	Lot map**	Historic districts	Land marks
8.Structural Quality	Lot map**	Structural quality	
9.Business Stores	Lot map**	Business data	
10.Street lightings	Lot map** street lightings		

Block map*: Valley Court Community Map by each block.

Lot map**: Valley Court Community Map by each lot.

Table 6-1 : The spatial, attribute and image data in each objective.

According to the table, it is evident that most objectives use the same spatial data such as a lot map. It is a main character of GIS which can create much information only by a limited database. The following are the steps in creating the whole database.

- **Get the spatial data into the database**

This step is the most time consuming in creating a database. Inputing the spatial data means the convert on of features on a map to a digitial format on the computer. In Arc/Info, a digital map is called a coverage and the process of capturing spatial data manually is called digitizing.

Data on a map can be captured by digitizing each feature, one by one, or by using an electronic scanner to capture an entire sheet of features. Image files can only be created

by a scanner but not by digitizing. Digitizing is the process of converting the spatial features on a map into a digitial format. Point, line and area features that form a map are converted into X,Y coordinates. A point is represented by a single coordinate, a line by a string of coordinates and when combined, one or more lines with a label point inside , outline and identify an area.

To ensure the maps are digitized most efficiently and accurately, we usually have to prepare good base maps since the accuracy of the digitial data is directly affected by the quality of the map manuscripts from which we digitize. Before starting to digitize, we have to define the coordinates. In VCCGIS, the block map is the first coordinate to be digitized. So the other maps should follow this identical coordinate.

• Converting data from other system

If the spatial data is already in a digital format, we need not to digitize from manuscript maps. Digital data can sometimes be obtained from government agencies or commercial firms. In VCCGIS, the Greater Lansing map is converted from the data base of Integraph Workstation of Michigan Department of Transportation. We need to convert the spatial data of workstation to our Arc/Info system by DXF files. The largest problem in converting data is transforming the new coordinat to fit the existing one. There are three procedures to transform the two different coordinates.

1. Movement

Movement means shifting the original point (0,0) of the new coordinate to the orginal point of the existing coordinate. In our case, the block map is the first map and the Greater Lansing map has to match its coordinate . The formula for movement is

$X' = X + a$

$Y' = Y + b$

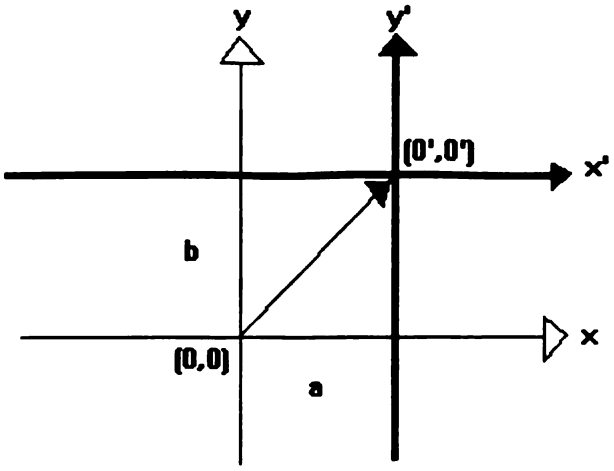


Figure 6 - 3: The shift of two coordinates

(X', Y') is the existing coordinate and (X,Y) is the new one. a and b are the shifts between two original points of the different coordinates in X and Y axis. (Figure 6 -3)

2. Scale

Since each map has its own scale like 1": 1000' or 1": 500', we have to change the new coordinate with the same scale as the existing one. The formula for scale is

X' = a * X

Y' = a * Y (a is the ratio of the two scales)

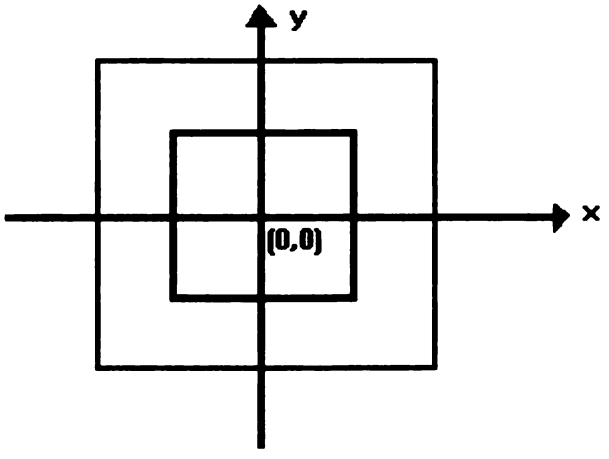


Figure 6 - 4: The scale of two coordinates

3. Rotation

Usually map creaters use the same orientation (set the north head to the top of map). If they do not, we have to rotate the new coordinate to match the existing one. The formula for rotation is

$X' = \cos\theta * X$

$Y' = \sin\theta * Y$ (θ is the degree difference of two coordinates)

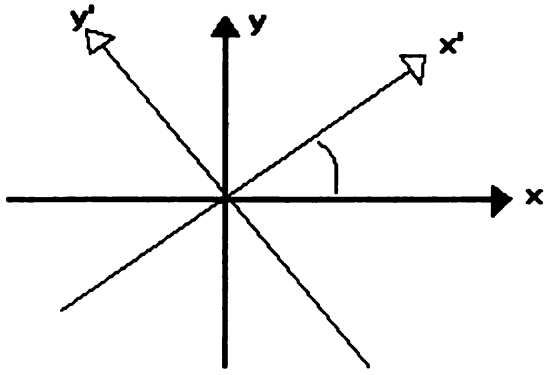


Figure 6 - 5 : The rotation of two coordinates

The three procedures are sequential in transforming the map, so the order can not be changed.

• Get the attribute data into the database

Before the analysis can be done, we need to specify additional data, for example, what type of land use each polygon represents. To do this, we have to add descriptive attribute to the land use coverage. The attribute includes a code indiciating the type of

AREA	PERIMETER	LOT_ID	ZONING	ST_NUME	ST_NAME	AV_1993	USAGE	CONDIT	HISTORI	LAND_USE	
	23086.740000	0				0	1	0	0		
2375.464000	222.257700	266	R2	656	SUNSET LN	35300	1	2	0	8	
831.238300	121.526000	272	R2	656	FOREST ST	19000	2	4	2	8	
922.013400	124.979500	276	RM32	655	EVERGREEN AVE	26000	2	4	0	8	
1931.615000	211.060500	279	RM32	635	ABBOTT DR	660000	1	1	0	9	
2055.953000	207.899500	283	RM32	635	ABBOTT DR	660000	1	1	0	9	
2025.937000	189.867900	216	R2			86300	1	1	0	8	
1930.499000	205.085800	217	R2			122500	1	1	0	8	
1440.645000	169.310200	241	R2	335	WILDWOOD DR	58300	1	1	0	8	
1629.298000	175.489300	242	R2	329	WILDWOOD DR	44800	1	1	0	8	
2680.963000	236.089900	247	R2	325	WILDWOOD DR	60000	1	1	0	8	
2909.821000	231.938700	248	R2	655	SUNSET LN	55300	1	1	2	8	
1474.350000	169.629400	237	R2	343	WILDWOOD DR	46500	1	1	0	8	
1457.644000	168.921700	236	R2	353	WILDWOOD DR	41300	1	1	0	8	
1725.653000	168.635300	235	R2	652	HILLCREST AVE	64300	1	1	0	8	
1665.732000	167.668300	223	R2	648	ROSEWOOD AVE	75700	1	1	0	8	
1839.979000	180.917600	224	R2	417	WILDWOOD DR	94800	1	1	0	8	
2751.810000	211.444400	225	R2	651	HILLCREST AVE	56700	1	1	0	8	
1848.967000	171.999500	288	RM32			0	1	1	0	9	
1005.611000	130.252800	273	R2	654	FOREST ST	32800	1	1	2	8	
1585.863000	170.713100	280	RM32	635	ABBOTT DR	660000	1	1	0	9	
1694.880000	183.288400	281	RM32	635	ABBOTT DR	660000	1	1	0	9	
1002.738000	129.161100	277	RM32	649	EVERGREEN AVE	26100	2	4	0	8	
2376.137000	222.274000	267	R2	648	SUNSET LN	44000	1	2	0	8	
966.780400	128.309400	274	R2	644	FOREST ST	35200	1	1	2	8	
1248.391000	143.979400	278	RM32	645	EVERGREEN AVE	31800	2	3	0	8	
1415.907000	156.081300	234	R2	644	HILLCREST AVE	67000	1	1	0	8	
2217.642000	214.471400	249	R2	647	SUNSET LN	51500	1	1	2	8	
1410.741000	158.133900	285	RM32	635	ABBOTT DR	660000	2	1	0	9	
2017.352000	213.549400	268	R2	644	SUNSET LN	40900	1	2	0	8	
2515.144000	201.248300	222	R2	640	ROSEWOOD AVE	86700	1	1	0	8	
1027.434000	133.654100	289	RM32			0	1	1	0	12	
1004.680000	132.372600	275	R2	638	FOREST ST	32800	2	1	2	8	
3756.495000	251.604200	226	R2	635	HILLCREST AVE	66900	1	1	0	8	
1056.402000	142.576000	243	R2	638	BALDWIN CT	38600	1	2	0	8	
1162.663000	145.034100	238	R2	639	BALDWIN CT	41200	1	2	0	8	

land use in each polygon and the cost so we can determine the land acquistion cost of each potential site. Table 6 - 2, it shows the attribute data linked to the lot map.

Area, perimeter and lot_ID are generated by Arc/Info automotively, but the other items are created by users. In the items of land use and condition (Structural Quality), attributes are stores as sets of numbers but not characters.

Land use : 1 -- General Office

2 -- General Retail Sales

3 -- City Center Community

4 -- Community Facilities

.

.

.

Condition : 1 -- Excellent

2 -- Good

3 -- Fair

4 -- Poor

Why do we use numbers to represent the types instead of characters? There are two reasons. First, it saves the space of the computer. Secondly is because the ease for operators to input data. This is especially ture because it will take too much time in typing when the database is enormous. But if the item is related to the individual or specified data, we still have to input the characters like addresses, names of owners.

Before we finish the database for the GIS project, the final step is to ensure its functionality. A functional project database should contain a number of associated coverage with the following characteristics.

1. Each coverage contains clean topology.
2. The accuracy of all feature locations has been verified.
3. Feature attribute tables are present.
4. The accuracy of the feature attribute values has been verified.

To a computer, since "Garbage in and garbage out" , insuring the accuracy of database is important to the result of analysis.

Chapter 7
Analysis and Presentation

Analysis, this is where the true value of a Geographic Information System shines through. Analytical tasks which are otherwise extremely time consuming or even impossible if done manually. It can be performed very efficiently using a GIS. But the most importantly is the conjunction of the knowledge of the project objectives and the database.

The other substantial benefit of a GIS is to present the results of analysis. Usually a GIS offers many options for creating customized maps and reports. The final products should relate direct to the objectives of the project and intended audience. Of course, we have to determine them at the beginning of the project. For example, the intended audience of Valley Court Community is East Lansing City Government and the residents of this area and the goal is to improve the living quality. So all the objectives we designed have to fit their need. We can get varied analytic results even though we are using the same database. The skill in summarizing and presenting understandable results of the analysis is the key to determining the effect of the analysis in the decision - making process.

The analysis and presentation will be according to the objectives designed in chapter five. There are several common methods of geographic analysis which will be used in VCCGIS to help in understanding and solving the problems in this area.

Transportation

Objective 1 . Average Daily Traffic Volumes

Figure 7-1, the study area, Valley Court Community , is in the red frame which two arterial roadways, Grand River Road and Michigan Avenue run through. On the west

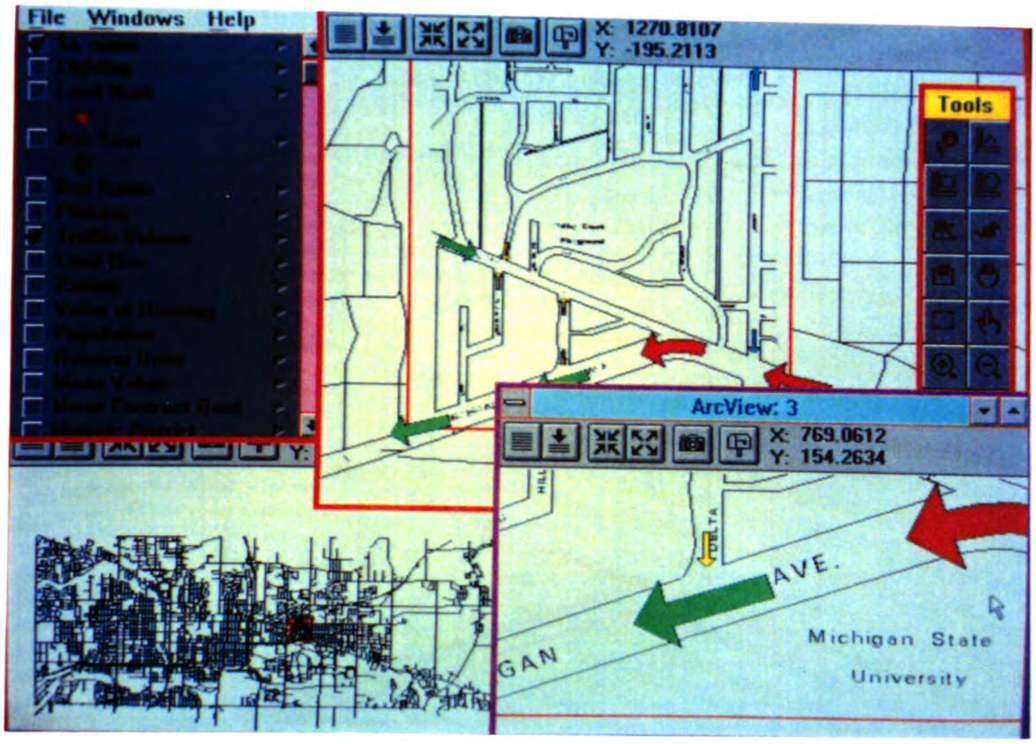


Figure 7-1 : The Greater Lansing Area and Average Daily Traffic Volumes.

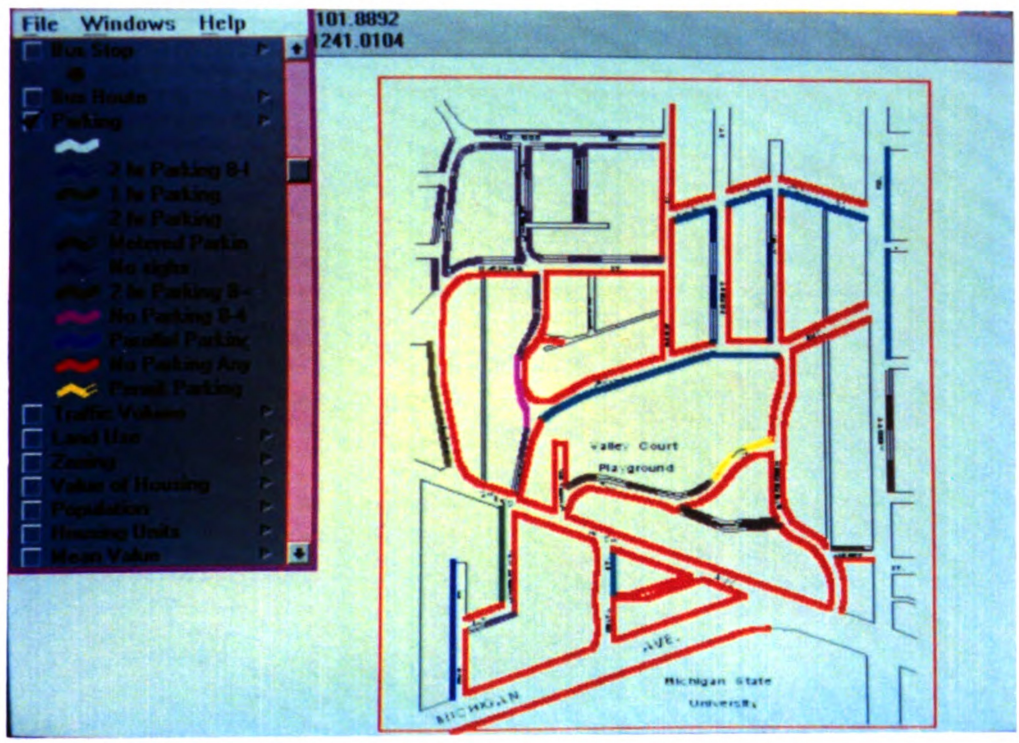


Figure 7-2: The parking status distribution

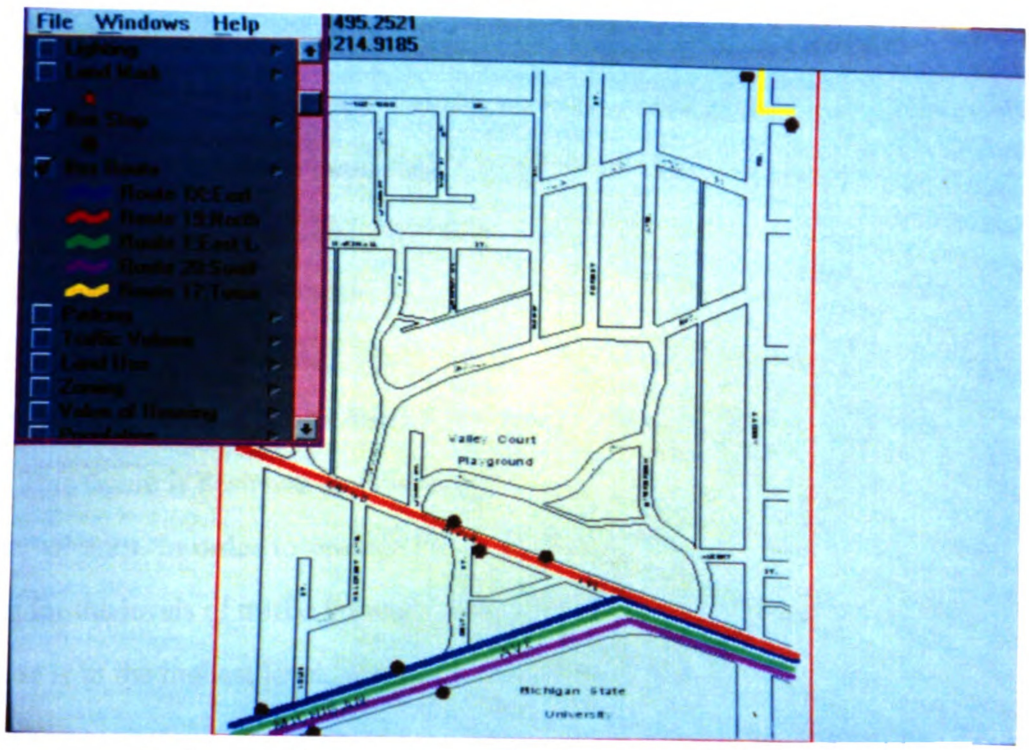


Figure 7-3: The bus routes and stops of CATA.

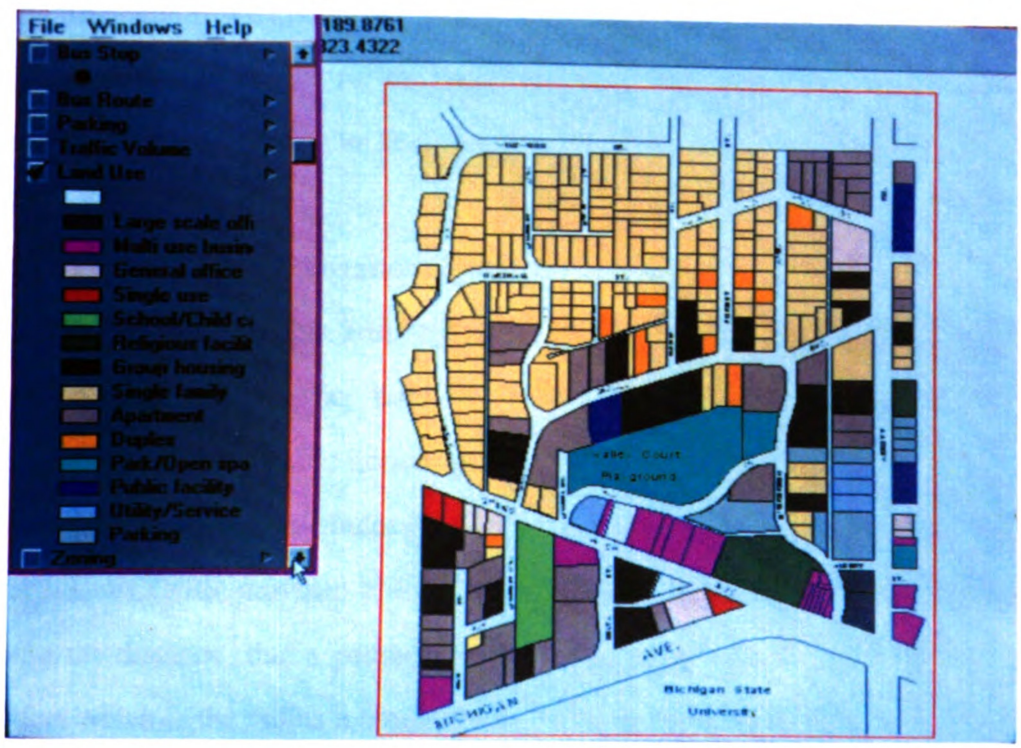


Figure 7-4: Land Use Map

side, Michigan Avenue crosses I-127 and heads to the State Capitol. In the east side, is the East Lansing downtown and Grand River Avenue is the main street. Basically, this map combines two base maps, one is Greater Lansing including East Lansing city and Lansing city and the other is the study area. The reason to show the both maps is because we can figure out the relationship between the study area and the adjacent area. If there is only one base map of Valley Court Community, in the database, it will be hard to understand where Grand River Road comes and where Michigan Avenue goes.

This figure is designed to use different arrow signs for presenting the directions and traffic volumes. In order to provide more detailed information, the system shows varied colors for the levels of traffic volumes. For example, since the traffic volume of Michigan Avenue is in the highest level, we know the drivers choose Michigan Avenue over Grand River Avenue as their route to access Lansing.

The other serious problem in this community is parking. Figure 7 - 2 shows the parking distribution. We know most streets are set to be "No Parking Anytime" and there is no large public parking lot for the residents in this area. We can consider the parking status or create a new parking lot according to the traffic volumes, population and zoning maps.

Objective 2. Public Transportation System

The residents of this area complain about the locations of the East Lansing commercial bus terminal. They think there are some negative effects on Valley Court Community, like noise, traffic impairment and inappropriate use in the area. First of all, we can understand these bus routes through the area and the locations of bus terminals by figure 7-3. VCCGIS provides a function to analyze the service area of a bus stop. Suppose the distance that a passenger walks from home to the bus terminal is within 1800 feet which is the radius a terminal can serve. We can draw a circle with 1800 feet radius and the bus terminal as the center to see the service area of each bus stop. It is obvious that

most of service areas are overlaid each other. We can immediately understand why the residents complain about the noise, traffic impairment and inappropriate use. So VCCGIS can provide the useful information for the planners to decide how many and the locations of bus terminals in this area.

Land Use and Zoning

Objective 3: Land Use and Objective 4: Zoning

Figure 7-4 and figure 7-5 show the existing land use and the zoning map according to the master plan of East Lansing. In the two figures, we select different colors to represent the attribute data which are called "Thematic Map". A thematic map means " A map that presents the distribution of attribute data (a theme) across a set of map features. Through the use of color, patterns, shading , or size, the relative value of feature characteristics and their geographic relationship can be displayed." (F. Stuard Chapin, 1985)

Usually planners use some specified color to show the varied land use. The following illustrative major urban land use categories for Generalized and Detailed Land Use Map Presentations.

Residence

Low density - Yellow. Medium density - Orange. High density - Brown

Retail business - Red

Transportation, Utilities, Communications - Ultramarine

Industry and related uses - Indigo blue

Whole sale and related uses - Purple

Public buildings and open spaces - Green

Institutional buildings and areas - Gray

Vacant or non urban use - uncolored

Figure 7-5: Zoning Map

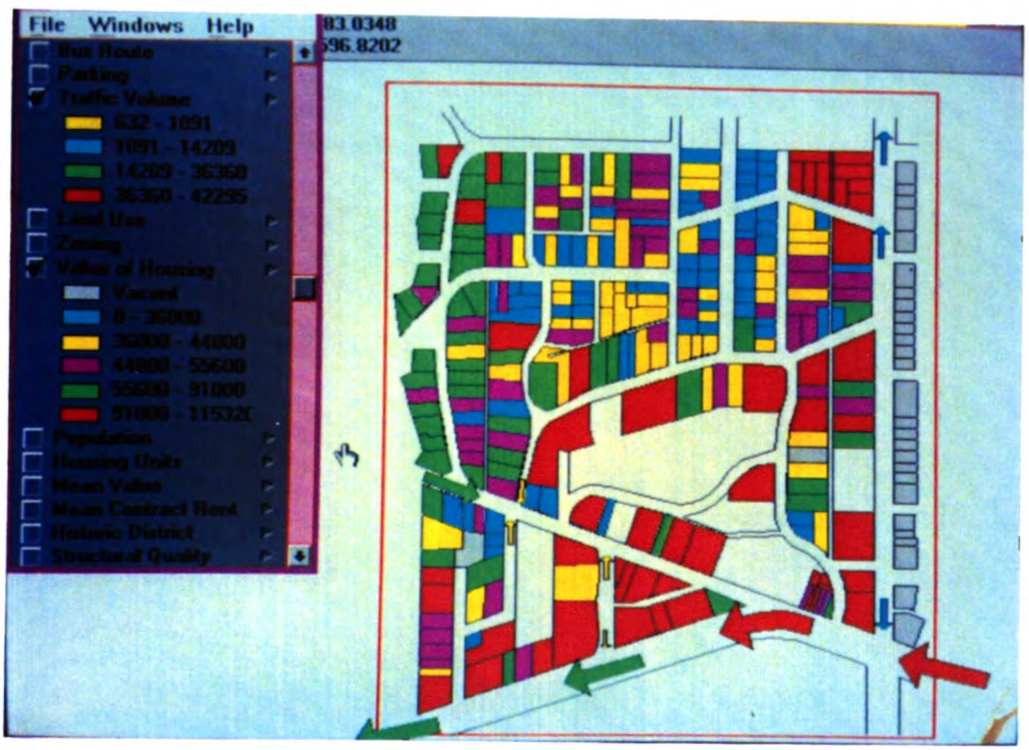


Figure 7-6: The 1992 Assessed Value of each lot.

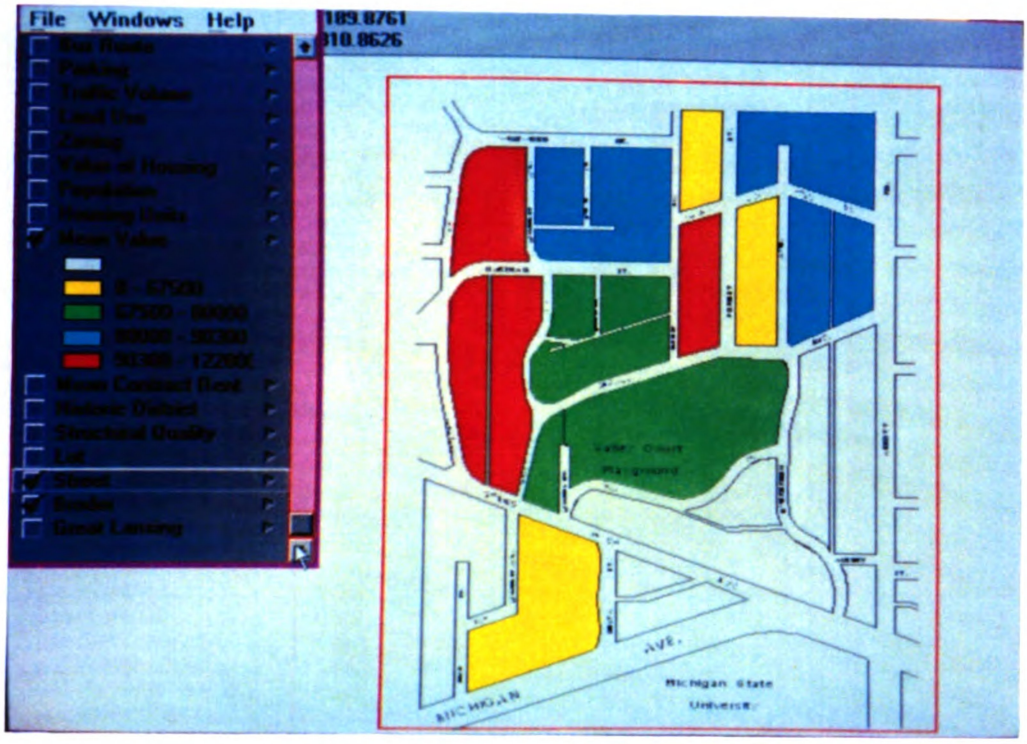


Figure 7 - 7: Mean Value of Owner Occupied Housing Units by Block

Figure 7 - 8: Total number of Housing units by Block

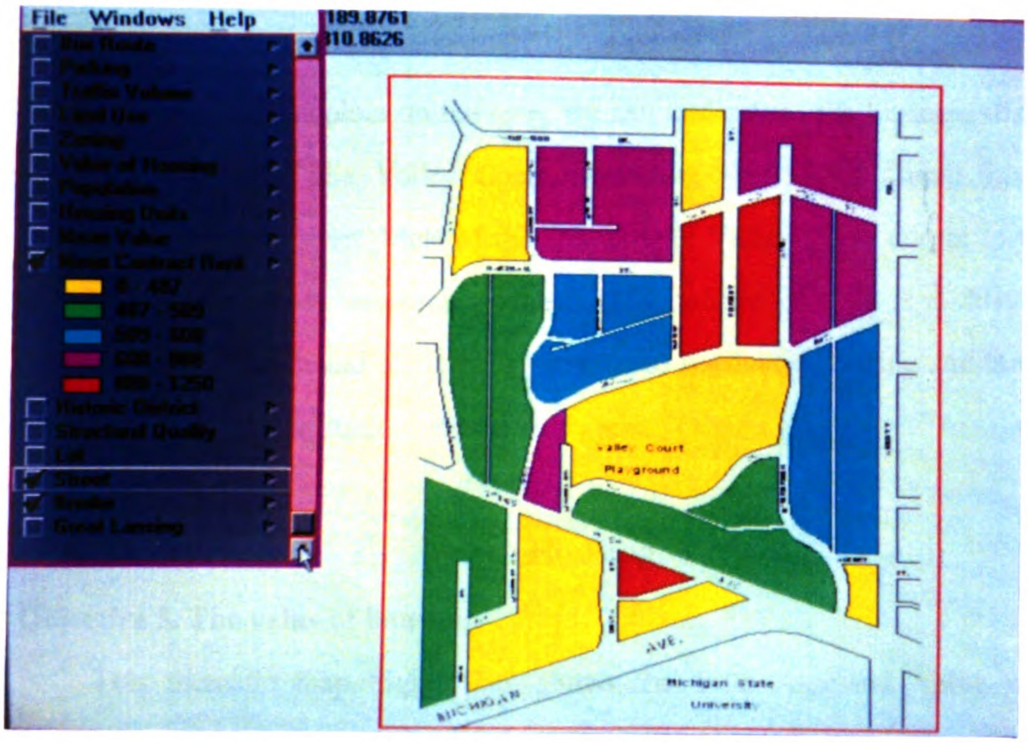


Figure 7 - 9: Mean Contract Rent by Block

Figure 7 - 10: Total population by Block

After filling the colors on the map, we can understand the business districts move along the bottom of the Valley Court expanding west along Grand River Avenue frocentral business district. Most of the area around Valley Court except to the south is zoned for multi-family housing, and the area outside of that is a historic district residential to the north and scattered zoning to the southwest. Zoning and land use maps are always the best way to describe the study area.

Housing

Objective 5. The value of housing

This thematic map, figure 7-6, shows the 1992 Assessed Value of each lot. According to the map, it is evidence to figure out the distribution of housing value. For example, the houses of the highest level, $91,000 - $15,320, are located at the Northeast area and the stores along Grand River Avenue and Michigan Avenue. This means the value of the housing is more expensive if it is near the main streets. Sometimes the result of analysis depends on the classifying method. In this area, the assessed value are divided into five levels by the same quantity method in which every level has the same number of lots. However, if we use same range method instead of same quantity method, some lots will be changed into the other levels. Analysts should be careful in designing the patterns of a thematic map when choose different classifying ways.

The other problem in this map shows only the value of each housing but not the average value of each square feet. In order to get the average value, we have to divide the assessed value by the area of each lot in the attribute database. Then reselect the new item, average value of square feet, to be the analytic data.

Objective 6. 1990 Census Data

Population and household size is an important factor in dealing with over crowding, parking, and garbage disposal. In the rental areas, the higher the occupancy the more evident these problems becomes. The higher concentration of people in R-2 zoned areas.

These areas are mostly student housing rentals, fraternity and sororities.Figure 7- 7 to 7- 10 show the census information about mean value of owner occupied housing units, total number of housing units, mean contract rent and total population by block. All of them are displayed by the same spatial data, the block map, but not the lot map since the basic unit of census data is a block. Because 1990 census data is public and easy to access and census bureau keeps this data for ten years, it is very useful for planners to analyze the social issue by GIS.

Neighborhood Preservation

Objective 7. Historic Districts and Land Marks

Historic preservation in the East Lansing area was officially begun in October of 1989, through a Historic Preservation Code that was adopted by the East Lansing City Council. In this study area, there are three historic districts which are represented by three colors.

Collegeville: Most of the structures in this area were built between 1890 and 1920 and show a variety of cottage and farm house designs popular to that period.

Oakwood: This area was home to many prominent local figures. Many of their homes still exist today with relatively few alterations.

College Grove: This district is demographically mixed, with boarding houses for students and homes for faculty intermingled. (East Lansing City Council, 1988)

Besides displaying the districts in figure 7 - 11, VCCGIS also shows the ten land marks with their pictures in this area. For example, figure 7-12 is the landmark map which contains the information on the "People Church" and the picture of the church. Using image files to store the pictures of every land mark is an advanced function of the

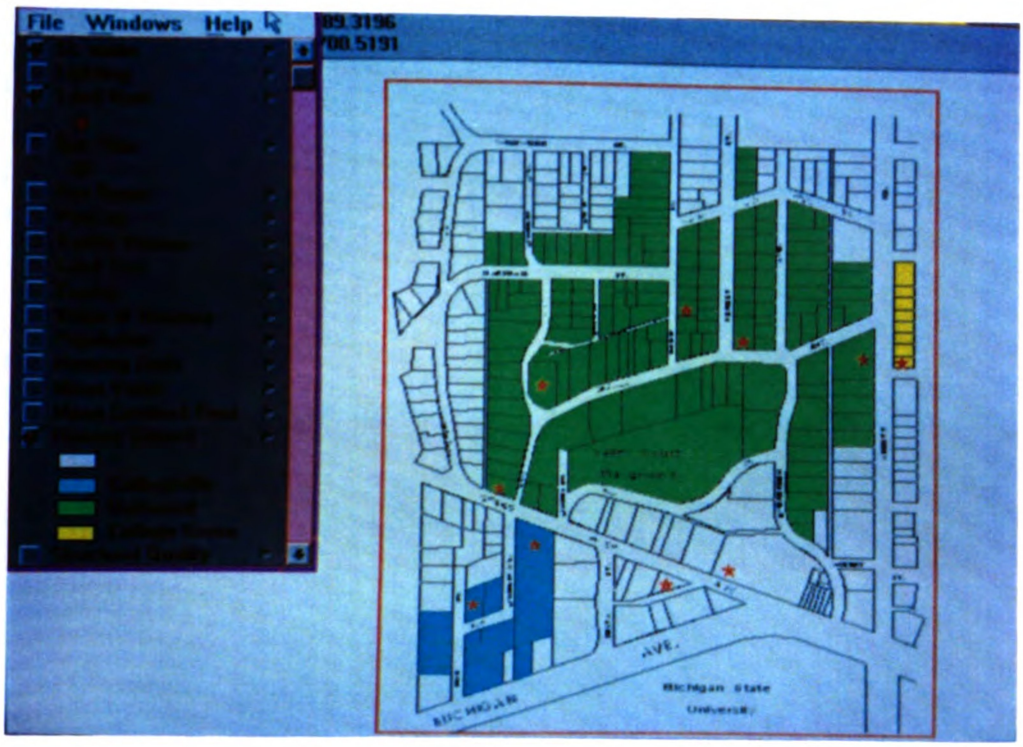


Figure 7 - 11: Historic Districts and Land Marks

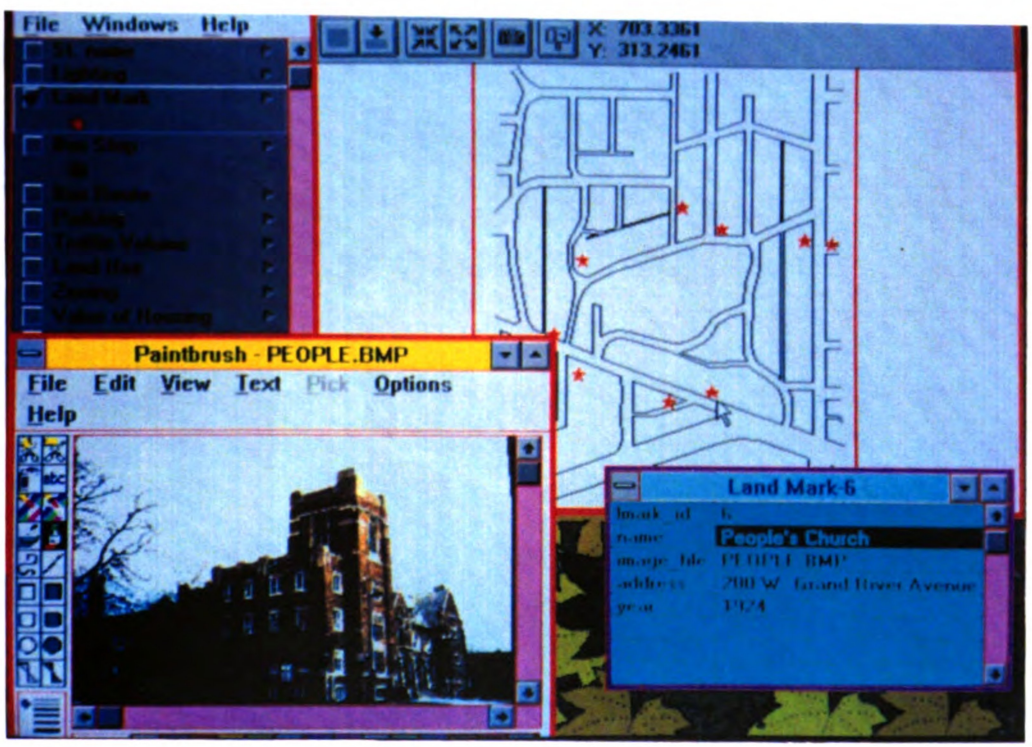


Figure 7-12: A land mark and its picture

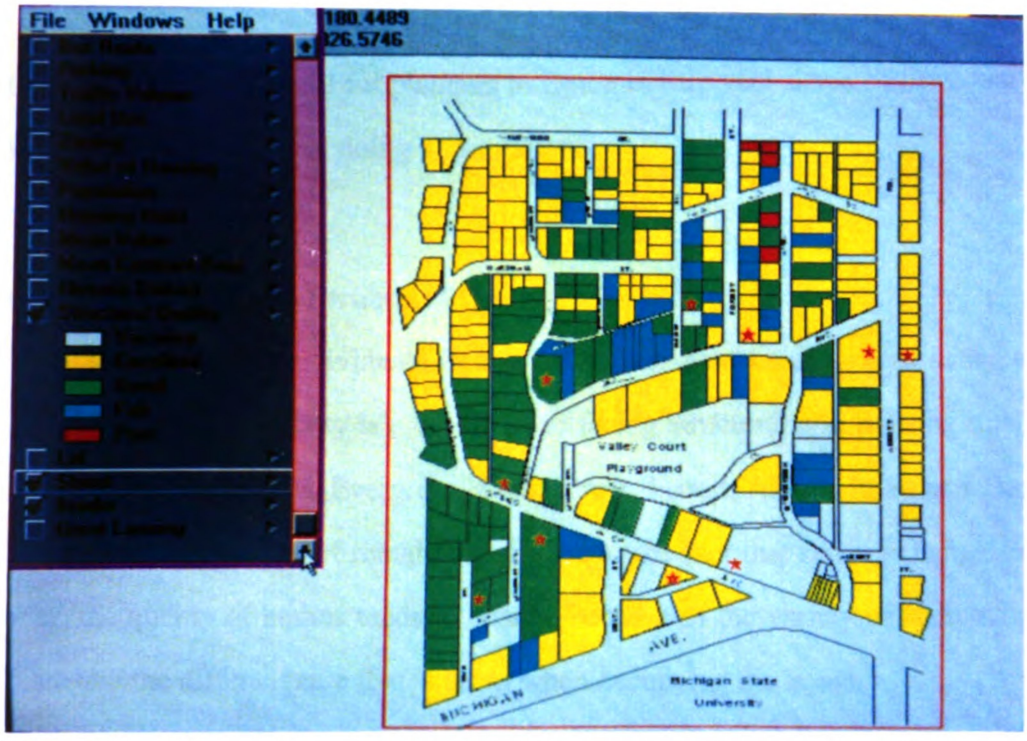


Figure 7- 13: Housing structural Quality

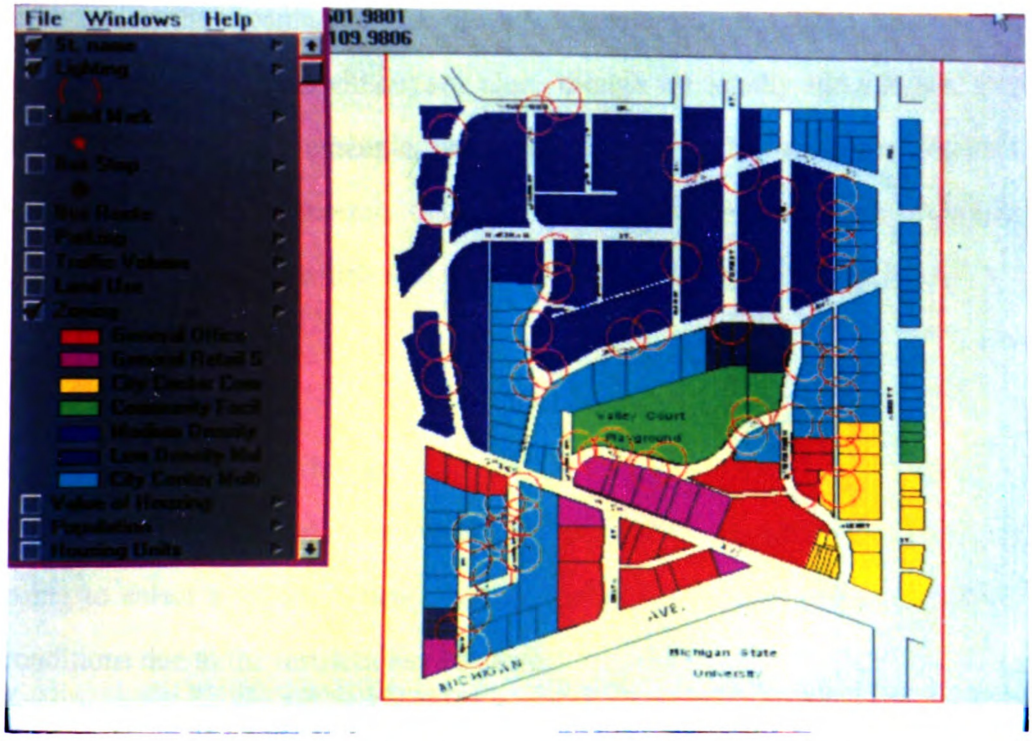


Figure 7-14: The distribution of street Lighting.

GIS. It is not only helpful for planners to figure out the real shape of the housing but also helpful for them to use in doing presentation.

Objective 8. Housing Structural Quality

The change of individuals in and out of the East Lansing area every year due to Michigan State University is a define issue facing structural and housing quality. Sunset Lane, Hillcrest, Oakhill, Evergreen, Louis street, Forest, Abbott Road and Dorothy Lane have a high percentage of rental homes. Due to the fact that renters change from year to year, the quality of homes tends to change because of the variety of students that live in them and the different care that is taken when occupying the home.

Figure 7-13, the housing with poor quality is displayed by red since we usually tend to use red for representing dangerous. The way to select the patterns or colors for representing the meaning of data is very important. A best map should be clearly and immediately understood without any clue, though we usually add a legend to provide the detail information. For example, people are familiar to recognize the density of dotes or the size of a circle to represent the population density or the number of population. They can easy to distinguish which area with high population density or low one.

Business

Objective 9. Business stores

There is a useful ability of analysis in GIS called site selection. For example, we are going to select a lot for a new store in Valley Court Community and there are some conditions due to the restrictions of a store.

1. The area of the store is more than 2300 square feet.
2. The land use of the lot is general retail sales.
3. The assessed value of the lot and housing is less than 100,000.

4. The structural quality is good or excellent.

After determining the conditions, we can input these statements (logical expressions) into VCCGIS one by one. The number of selected objectives will reduce when we add a new condition. Usually the planners will get several ideal lots for matching all the conditions. If the local results are too many or none, we can reset more restrictions or some loose conditions. This process is similar to "What - if" analysis which is frequently used in spreadsheets like MS-Excell or Lotus.

Crime issues

Objective 10. Adding more street lighting.

A main problem which the associations of this community mention is the lack of street lights caused the crime occurrences. There are two ways to improve the situation, one is to add more street lighting and the other is to increase the candlepower of the lighting. VCCGIS provides both the abilities to decide the new locations of street lighting and the degree of candlepower. In figure 7 - 14, it is evident that the street lighting are not enough at Hillcrest St.. We can either set more lighting in these streets or relocate some existing street lighting. Since it is easy to add or delete the symbols representing street lighting in computer , we can arrange and recognize the new street lighting distribution. The second ability of VCCGIS is to use the different size circle as a symbol for showing the coverage of a street lighting. The bigger size of the circle means the more degree of candlepower. We can immediately know the area where is covered or not by the street lighting.

Chapter 8
Conclusion

It is doubtless that the technology of GIS has demonstrated a remarkable maturity. This maturity is supported in the first instance by the rapid strides over the past few years in computer hardware, especially the hardware of personal computers and workstations. Even more important is the explosion in software offerings both of general nature and in the form of a variety of GIS systems. (Marble, 1988)

GIS is a most important tool in many kinds of development planning, for two principal reasons. First, it is oriented to the spatial component of development. This comprises the use of the land for human settlements. The use of land resources and the social and economic activities. Second, GIS is oriented not solely to the purely geographic aspects of planning, but its informational content. Thus, GIS goes for beyond mapping and purely spatial analysis, and deals with the attributes of the land, the residents and social content. A vitally important aspect of any GIS is its provision of means to store, access, and manipulate data and to utilize its informational content in a spatial context. (United Nations Center, 1989)

Basically, VCCGIS is a tool for the master plan of Valley Court Community As most GIS systems, VCCGIS not only provides the spatial demonstrations of the base maps and attribute data, but also has the abilities to analyze the data. The whole hardware structure of VCCGIS is based on microcomputer system (IBM compatible) since it is the most popular personal computer on the market. To some small bureaus or departments, it is hard for them to develop GIS systems on workstations because of the high expense. The other reason that VCCGIS is created by micro-computer is that most planers are familiar with the operations of micro-computer, so we need not to spend much time in training the users. To create a GIS based on a popular and low price micro-computer can be a first step for the bureaus or departments without any experience in GISs.

Since the VCCGIS deals with the master plan, it created a lot of attribute data and spatial data in its database. The six issues, transportation, land use and zoning, housing, neighborhood preservation, business as well as crime, are the most important topics usually mentioned in urban planning problems. Most of these problems or issues are displayed by the thematic maps with the lot or the parcel map and varied colors. Providing the information is the basic function of a GIS by the thematic maps. Planners can not only "look at" the maps but also "interpret" them and generate more information. For example, the thematic map of 1993 Assessed value shows the different value in each lot. Besides recognizing the distribution of assessed value, planners can also analyze the relationship between income and lot value or how traffic volumes or historic districts affect the values.

There are two common mistakes in using GIS applications. First, people think a GIS is a system to draw maps. In fact, this is only one basic function of a GIS . It is called computer Graphic Design if the system only provides the drawing function. Second, GIS systems can not provide the final decisions after creating databases and execute the analysis. Do not expect that there is a perfect system that can deal with every planning problem and solve it. Planners still have to use effort in analyzing therefare the role of a GIS system is to deliver the information generated by the database to assist the planner in their analysis.

The other main problem in GIS is that there is no single GIS software that can totally fit our needs. For example, TransCAD and GIS Plus are popular GIS software, but they focus on transportation issues. Therefore they are not suitable for natural resources or economic issues. The functions of VCCGIS are established on many softwares like Arc/View, Excell and Win-Gif. Since even software has its own merits and faults, we can combine all the merits of the software packages to match our needs. On the other side, if a GIS is created on existing or familiar software, planners or users need not to spend too much time in learning.

There are three points on which VCCGIS could be improved. First, we need more spatial and attribute data to create a functional and useful database. Because all the output information or results of analysis are gained through the database, only a good database can provide more and helpful information for planners. The second point is to improve the software and hardware. Due to the restriction of software and hardware, it is hard to deal with the data quickly, such as to display a graph or get the exact output by a plotter or a screen. After the rapid advances in new technology, we can improve these faults of GIS systems shortly. For example, VCCGIS provides image file function to show the pictures of each land marks. The new technology not only improves the qualities of the pictures, buts also use CD-ROM to record the voice and film of the life site. The final point of needed improvement is that the system should have more abilities to analyze the data. Since a GIS is not only a mapping system, more functions of analysis will improve the power of this system.

Although VCCGIS is not a perfect and professional system, it successfully demonstrates that it is possible to create a GIS for a local area or even like a small community. In the future, a comprehensive plan report will no longer be a thick report but a small CD-ROM which record all the contents, tables, maps, images as well as voices.

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