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Management of Hospital Information System through GIS: A Review

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Abstract: ***A computerized hospital information system (HIS) used to support clinical and administrative processes perceptions of the HIS is known to be one important factor in influencing successful implementation of hospital information systems. HIS is complex activity which required the tool that aid in an effective decision-making to come to terms with the better economic demand for sustainable development. Geographic Information System (GIS) is one of such tools for HIS. Geographic information system (GIS) will help to improve the decision making process in this area for better use of the available restricted funds. Using GIS we can get the whole information of any geographical area. The GIS techniques are used with spatial database. The analysis was. Carried out with Arc View GIS for GIS analysis. Now a day there's tremendous increase in the use of GIS applications in various fields. In this paper to solve the problem by making a GIS-based data analyses and system so patients can find out the information about necessary treatment in a hospital based on specialist services provided within the specific area.***

Keywords: Hospital information system (HIS), GPS, GIS

1. Introduction

1.1Geographical Information System (GIS)

Geographical information system (GIS) is a computer system for capturing, storing, quering, analyzing geospatial data also called as geographically referenced data, geospatial data that describe both the location and characteristics of the spatial features such as road land parcels, and vegetation stand on the earth's surface. Spatial data describe the location of spatial features, which may be discrete or continuous. Locations of spatial features on the earth's surface are based on a geographic coordinate system with longitude and latitude values. Attribute data describe the characteristics of spatial features. E.g. the attribute data of road are (length, name, speed limit, direction).

1.2 Hospital Information System (HIS)

Hospitals are complex organizations with intensive information needs. Effective management of data at intervals hospitals is crucial for higher service effectiveness and efficiency levels. It is a necessary component of modern hospital infrastructure. A HIS is a comprehensive and integrated information system designed to store, manipulate, retrieve and use information concerned with the administrative and clinical aspects of a hospital [2].The major goals of spatial database integrated with GIS are to improve the decision-making process. HIS is a computer-based information system that supports organizational decision-making activities [3].

Currently, the location of Hospitals in the city is based on addresses and the position of the health center. Without providing the knowledge regarding the facilities provided by the hospitals, expertise available, numerous treatments allotted within the hospitals, along with the various departments present just in case of multispecialty hospitals during a single system This goal can be achieved with the help of GIS. The GIS has been used in several areas such as retail site analysis, transportation, emergency services, fire, petrol station mapping, and health care planning for the measurement of physical accessibility [4]. Among neighboring areas are explicit on a map that permits for the visual image of spatial patterns [5]. In the case of the traditional GIS, the spatial information is generally maintained by an organization or group of organization for a specific purpose. Spatial databases is a very important part of the Web-GIS architecture and it allows the storage and querying of data that is related to objects in space, represented in vector form as points, lines, and polygons[6].

2. Methodology

Decision support system the author sonam pal has used the spatial database. In decision support system has four major components: Data Management System, Model Management System, Knowledge-based system, User Interface system. The data management system works as a spatial database, which includes POSTGIS queries to create and manipulate the database objects. The model management is used to generate new models in a geographical area, as buildings, malls, etc. they are searching the type of organization suitable for the specified geographical area. The knowledge-based sub-system is the core part of any decision support system. It contains the logical part for supporting to require a choice. The knowledge database is connected with spatial database, model management system and user interface. The user interface provides the result to the user. The spatial database contains overall surrounding of that particular geographical area as a boundary, railway track, roads, drainage system, ground water level, slope, villages, geomorphology, and lithology. The knowledge database is the important part of our system which makes a decision.

In the paper of GIS-based health information system uses the base map of the study area is collected while the coordinates of the health care centers obtained in the field using Global Positioning System (GPS).These data incorporated into GIS environment and analyzed using ArcGIS 10.0 software. This study shows how GPS and

ArcGIS software can be combined to locate hospitals and other infrastructure in a city.

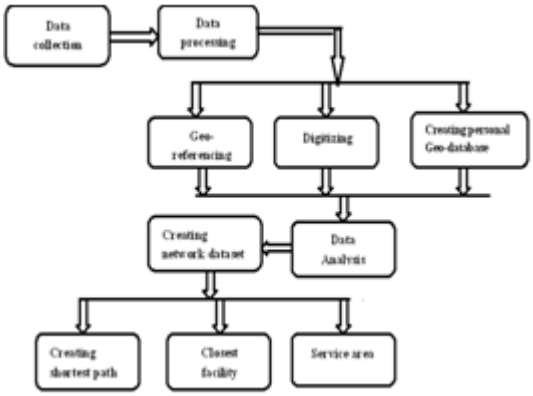

Figure 1: Methodology used

In data processing, the spatial data and the attribute data are merged together and form new GIS database. Georeferencing can be done by selecting the four controls. Points on the corners of the scanned map and placing that point by giving appropriate latitude and longitude values. Digitizing converts paper map features into digital format. The digitizing process creates spatial data. It allows the attribute data to be stored in together shape file creation is used for the appropriate name of the hospital edit to see the coordinate system of the file.

Geo-database stores all the information about the projection of maps, spatial data and attributes data. After the creation of geodatabase, the external personal database is joined together by database connection. Data analysis is used for creating network dataset and the shortest path. Network datasets area unit collections of feature categories that possess a connectivity relationship. It is used to find out the closest facility available from the location of the user [7].

Subhas Barman has used spatial oracle for implementing the smart map in this paper; he presents an approach to design and implement of a map using spatial data types. The layers of interest are identified and then each layer is implemented separately. The data is taken from a hard copy of a map and the locations or reference points are extracted from the hard copy of the map and entered to the corresponding relation or table assigned to a specific layer. With map viewer, map builder and oracle database can represent any region graphically on a map [8].

3. Important Tools needed

3.1 ArcGIS

A GIS (Geographic Information System) is a powerful tool used for computerized mapping and spatial analysis. A GIS provides functionality to capture, store, query, analyze, display and output geographic information. In this using ArcGIS Desktop 10, the newest version of popular GIS software produced by ESRI. Some fundamental GIS operations using ArcGIS [9].

a) In ArcGIS Frequently used File Formats.

b) Feature data are usually organized as points, lines, and polygons in vector format.
   1) Shape file: The most commonly used geospatial data format. Although it appears to be one file in ArcMap, a shapefile includes multiple files with the same filename, but different extensions. *.shp, *.dbf, and *.shx are necessary components of the shape file.
   2) Personal Geodatabase: These files are based on Microsoft Access (*.mdb). From a user perspective, the personal geodatabase is essentially a database structure but contains geospatial information as well as rows and columns.
   3) File Geodatabase: A file geodatabase is much like a personal geodatabase except that it has more capacity and greater processing capabilities than a personal geodatabase. File geodatabase enable users to create datasets, which are like subfolders within the geodatabase. These can be used to organize datasets that participate in various kinds of spatial networks.

c) Raster Data: Raster data uses the grid to represent a region with values as a “field”. Images explicitly have the parameter of resolution. Typical raster data is.
   1) GeoTIFF they have the file extension of *.tif. The key.
   2) GeoJPEG**:** Similar to GeoTIFF, but they have *.jpg extension
   3) Usage**:** Raster data can be air photos, satellite images, elevation data (DEM). But raster data tends to be huge and slow to load.

d) External Data: ESRI also supports some file formats produced by other vendors due to their popularity. Typical ones are:
   1) AutoCAD: *.dwg files can be added, imported and converted into ArcMap .
   2) Google Earth: *.kml files are supported by ArcGIS as well. However, conversion from KML into Shape file is required, which can be done using Arc Toolbox or some online services.

3.2. PostGIS

PostGIS is an open source, freely available, and fairly OGC compliant spatial database extender for the PostgreSQL Database Management System. In a nutshell, it adds spatial functions such as distance, area, union, intersection, and specialty geometry data types to the database. PostGIS is very similar in functionality to SQL Server Spatial support, ESRI ArcSDE, Oracle Spatial, and DB2 spatial extender except it have more functionality and generally better performance than all of those. PostGIS is a spatial database extender for PostgreSQL object-relational database. It adds support for geographic objects allowing location queries to be run in SQL. In addition to basic location awareness, PostGIS offers many features rarely found in other competing for spatial databases such as Oracle Locator/Spatial and SQL Server.

Features:

a) Geometry types for Points, LineStrings, Polygons, Multipoint, Multiline Strings, Multiple Polygons and Geometry Collections.

b) Spatial predicates for determining the interactions of geometries using the 3x3 DE-9IM (provided by the GEOS software library).
c) Spatial operators for determining geospatial measurements like area, distance, length, and perimeter.
d) Spatial operators for determining geospatial set operations, like a union, difference, symmetric difference and buffers (provided by GEOS).
e) R-tree-over-GiST (Generalized Search Tree) spatial indexes for high-speed spatial querying.
f) Index selectivity support, to provide high-performance query plans for mixed spatial/non-spatial queries.[10].

3.3 Oracle Database

An Oracle database is a collection of data treated as a unit. The purpose of a database is to store and retrieve related information. A database server is a key to solving the problems of information management. In general, a server reliably manages a large amount of data in a multiuser environment so that many users can concurrently access the same data. All this is accomplished while delivering high performance. A database server also prevents unauthorized access and provides efficient solutions for failure recovery.

Oracle Database is the first database designed for enterprise grid computing, the most flexible and cost effective way to manage information and applications. Enterprise grid computing creates large pools of industry-standard, modular storage, and servers. With this architecture, each new system can be rapidly provisioned from the pool of components. There is no need for peak workloads because capacity can be easily added or reallocated from the resource pools as needed. The database has logical structures and physical structures. Because the physical and logical structures are separate, the physical storage of data can be managed without affecting the access to logical storage structures.

Features

a) Oracle will manage the complete information spectrum from documents to multimedia, to XML, to map knowledge, and a lot of to assist increase user productivity, contour business processes.
b) It provides a flexible infrastructure that meets a wide variety of information sharing needs. Oracle Streams allows the propagation of information, transactions, and events during a information stream either within a database or from one database to a different.
c) It allowing application users to experience the extreme performance gains provided by the integrated combination of application, database, hardware, and storage.

4. Case Study

4.1 Kano Metropolis

Part of Kano metropolis was selected as a case study to point out however GIS can help native health planners and support their decision.GIS and Health care facility is the geographical study in medicine, maps the progress of diseases, famines, toxic spills and disasters. The aim and objective of this analysis is to evaluate the spacial distribution of Primary health centers using GIS and to form information and analyze the kind, location and spatial distribution of public primary health care facilities within the study area [5].

4.2 Iran city

The project GIS Applications in Public Health as a Decision Making Support System has been done in Iran city. In this project it is tried to study and evaluate the experiences on applying GIS in public health. The main goal of this project involves environment health, control of diseases, health education them and prevention, medical and nursing actions for early diagnosis, control and management of diseases [11]. In this project GIS can be used as a decision support system in order to help the mangers of public health. GIS can combine different data and generate information required for decision making.

4.3 Aurangabad City

The project GIS based health Care Information System has been done in Aurangabad city. The main objective of this study is to integrate data on the particular position of health centers in Aurangabad city with the services and facilities provided. In this project the base map of the study area is collected whereas the coordinates of the health care centers obtained in the field using global Positioning System (GPS)[8].These data incorporated into GIS environment and analyzed using ArcGI10.0 software.

5. Strength and Weakness

(a) Strength

(1)Identifying Health Trends:
The software system offers healthcare professional's the ability to identify health related trends and a lot of thoroughly target healing efforts based upon those results that utilizes geographic information systems in many of its different initiatives. The programs assess the demographic data and data collected from wearable health tech of all patients entered into the system. Data is then georeferenced and mapped. Healthcare professionals can visualize the locations of patients.

(2)Tracking the Spread of Infectious Disease:
The role of GIS systems should not be restricted simply to tracking occurrences of diseases although. One of its most powerful aspects is its ability to use geography and other inputs to identify the diseases are most likely to spread next Maps such as these are beginning to play a major role in the management of disease outbreaks like Ebola and measles.

(3)Utilizing Personal Tech
The collection of large quantities of accurate personal data is expected to reveal a great deal about personalized healthcare, but it can also greatly impact broad regional treatment plans. Personal health care technologies represent a powerful tool for data input into GIS due to their ability to inform statistical studies. It has the potential to uncover long-term geographic trends in the health of certain demographics of people or of individuals living within

certain regions of the United States. The technology is capable of collecting very broad amount of healthcare data such as average pulse, sleeping patterns, and exposure to the sun. The GIS will help to determine the average pulse or sleeping patterns of individuals varies over geographic areas.

(4)Incorporating Social Media

Technology that can used in social media. During the 2012-2013 flu season indicating sickness. They used terms such as 'flu,' 'influenza,' and 'medication' and geographically located where the tweet was sent from By adding this data to a GIS map, researchers were able to visualize the status of the contagious disease within the North American country for that year. Data collection to predict where the flu will have the greatest effect into the future.

(5)Improving Services

The use of GIS technology will change community leaders and developers to work more closely with hospitals to take larger steps in addressing national healthcare needs. system will identify that neighborhoods are in larger need of specific health services such as more rehab centers or senior care facilities.

(b)Weakness

1) In many governmental organizations, the role of location in gathering data is not recognized properly In other words, the data are collected either completely without recording the location, or only mentioning the geographic name of the place. In both cases, huge amount of extra work is required to collect and add the location element to the data.
2) Usually, a variety of data from different organizations are needed for managing any of the above-described aspects of public health. Often, the lack of cooperation between those organizations and limited access to their data makes the developed disease and health models unrealistic and unreliable
3) The data about the disease occurrences are limited to the death accounts reported by hospitals; i.e. the cured patients are not recorded. As a result, the according records of death caused by a disease are not a good representative of the real happenings of that disease.
4) Often, the location wherever patients live and get ill is different and even away from the place of the hospital, where their death is reported**.** This decreases the positional accuracy and general acceptability of the geo-statistical models representing the relation between the diseases and spatially distributed factors.
5) One of the parameters affecting disease occurrences in individuals is their consumption habit and life stile. Unfortunately, rarely, data about these area units registered with acceptable spatial unit. The available data in national scale include sample-based data on family spending habits in cities and villages.

6. Concluding Remarks and Future Direction

In the paper of An Intelligent call support system for establishment of recent Organization on Any geographic area exploitation GIS is to determine a organization, the entire information of that location must be better-known. Sometimes it becomes very difficult. An intelligent system is required to focus on all the affecting factors for the establishment of an origination on any geographical area.

The work is helpful in following ways:

1) It includes that factor that really affects an organization.
2) It uses both the knowledge database and the spatial database, one provides the knowledge about the location and another provides the situation of the particular geographical area.
3) The decision support system has all the logical choices for every kind of organizations as colleges, hospitals, etc.

GIS Based Health Care Information System observed that finding the desired hospital needed for the desired patients is the difficult task. The main objective of this study is to search out the health care facility close to from location of the user. It also calculates the shortest distance to be reached from user's location. The GIS application for health care facility can be used as a new technology for providing the information for the people. It can be beneficial not only to the user or patients but also to the organization. The future diction of work is to calculate the closest path from the desired location to nearer hospital. It can also locate the service area around the hospitals to find the all available accessible streets for that hospital.

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