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Gis System For Aircraft To Approach Mandalay Airfield

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Abstract:

GIS is an important technology because "Everything Happens Somewhere". Geographical information system captures, stores, analyzes, manages, and presents data that is linked to location. The presented system intends to supply the need for to approach Mandalay airfield. GIS helps as a tool with great power to know latitude, longitude and real distance to approach airfield. To find latitude and longitude, Latitude and Longitude algorithm is used. Cartesian Coordinate system is also applied to evaluate the distance between source and destination of locations. The presented system supports to approach Mandalay airfield easily. The system will help to save time and safety.

Keywords

Latitude, Longitude, Cartesian Coordinate System, Mandalay airfield.

1. Introduction

Today, GIS is a popular system in providing real world geographical information. GIS can apply for many areas such as transit, financial service, medical, disaster, forestry, etc. GIS also can provide coordinate system (latitude and longitude) of a location. Therefore, the system will focus on finding the right pattern, route to approach and land successfully in case of emergency condition while flying near Mandalay region. By using this system, many aircraft which flying near the Mandalay airfield. It may also be the guide for pilots. If they have no the geographical information, they encounter difficulties in deciding how to approach nearest airfield. The system intends to help to save time and safety.

The system presents geographical information system of Mandalay airfield based on Latitude, Longitude and Cartesian Coordinate System. The rest of the paper is described as follows: section 2 presents the related works of the system. In Section 3, Geographical Information System, history, components and data model: raster and vector. In section 4, Latitude, Longitude and Cartesian Coordinate System. Section 5 is implementation of the system. The conclusion of this system will be combines at the last section 6.

2. Related Works

Elisabeth T. DeGironimo [2] proposed that geodatabase based on the Arc Hydro data model to get the computational advantages over the coverage or shape file data types.

Chengda Lin, Lingkui Meng, Heping Pan present the concepts and technology of GMN and its application in developing real estate management software. GMN abbreviating GIS + MIS + Network, is a new technology integrating Geographic Information System (GIS) and Management System (MIS) in the internet environment [3].

The author [1] presented that it is necessary to distinguish between the conceptual level (where the abstract entities are defined) and the implementation level (where the graphical representations are constructed) in order to derive an object-oriented model for GIS data. Nanthan Watermeier proposed Computerized Software and Mapping Technologies for Crop Management. The author showed that farm recordkeeping software and digital mapping technologies helps take out the guess work in managing and planning your operation. Combining the use of computerized mapping and geographic information systems (GIS) software, imagery, GPS collected data, and other geo-data sources allows any manager to gain confidence in their management strategies [4].

3. BACKGROUND THEORY

3.1. Geographical Information System

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A GIS is a computer-based tool for mapping and analyzing geographic phenomenon that exist, and events that occur, on earth. GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. These abilities distinguish GIS from other information systems and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies. Map making and geographic analysis are not new, but a GIS performs these tasks faster and with more sophistication than do traditional manual methods [2].

3.2. Data Representation

GIS data represents real world objects (roads, land use, elevation) with digital data. Real world objects can be divided into two abstractions: discrete objects (a house) and continuous fields (rain fall amount or elevation). There are two broad methods used to store data in a GIS for both abstractions: Rector and Vector.

3.3. GIS Data Types

The basic data type in a GIS reflects traditional data that found on a map. GIS technology utilizes three basic types of data. They are

- Attribute data
- Spatial data
- Map data

3.4. Spatial Data Model

Traditionally spatial data has been stored and presented in the form of a map. Three basic types of spatial data models have evolved for storing geographic data digitally [5]. These are referred to as

- Raster
- Vector

3.4.1. Raster Model

Raster is a method for the storage, processing and display of spatial data. Each area is divided into rows and columns, which form a regular grid structure. Each cell must be rectangular in shape, but not necessarily square. Each cell within this matrix contains location co-ordinates as well as an attribute value. The spatial location of each cell is implicitly contained within the ordering of the matrix, unlike a vector structure which stores topology explicitly. Areas containing the same attribute are recognized as such, however, raster structures cannot identify the boundaries of such areas as polygons [8].

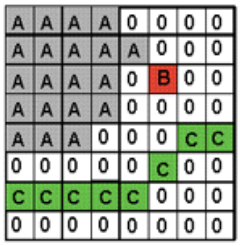

Figure 1 . Simple Raster Data Set

3.4.2. Advantages of Raster Model

The advantages of Raster model are as follows:

(1) The geographic location of each cell is implied by its position in the cell matrix. Accordingly, other than an origin point, e.g. bottom left corner, no geographic coordinates are stored.
(2) Due to the nature of the data storage technique data analysis is usually easy to program and quick to perform.
(3) The inherent nature of raster maps, e.g. one attribute maps, is ideally suited for mathematical modelling and quantitative analysis.
(4) Discrete data is accommodated equally well as continuous data and facilities the integrating of the two data types.
(5) It is a simple data structure.
(6) Overlay operations are easily and efficiently implemented.
(7) High spatial variability is efficiently represented in raster format.
(8) The raster format is more or less required for efficient manipulation and enhancement of digital images.

3.4.3. Vector Model

Vector is a data structure, used to store spatial data. Vector data is comprised of lines or arcs, defined by beginning and end points, which meet at nodes. In the vector base model, geospatial data is represented in the form of co-ordinates. In vector data, the basic units of spatial information are points, lines (arcs) and polygons. Each of these units is composed simply as a series of one or more co-ordinate points, for example, a line is a collection of related points, and a polygon is a collection of related lines [8].

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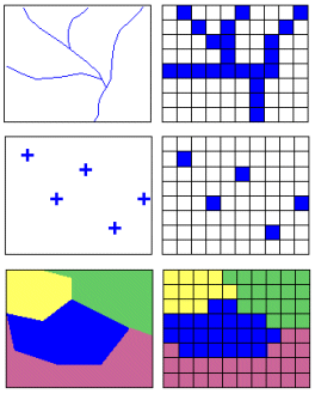

Figure 2 . Simple Vactor Data Set.

3.4.4. Advantages of Vector Model

Advantages of vector model are as follows:

(1) Data can be represented at its original resolution without generalization.
(2) Graphic output is usually more aesthetically pleasing.
(3) Since most data, e.g. hard copy maps are in vector form, no conversion is required.
(4) Accurate geographic location of data is maintained.
(5) Allows for efficient encoding of topology, and as a result of more efficient operations that require topological information, e.g. proximity, network analysis.
(6) It provides a more compact data structure than the raster model.
(7) It provides efficiently encoding of topology and as result more efficiently implementation of operations that require topological information, such as network analysis.
(8) The vector model is better suited to supporting graphics that closely approximate hand-drawn maps.

3.5. GIS Components

An operational GIS also has a series of components that combine to make the system work.
There are five components, critical for a successful GIS.

- People
- Data
- Methods
- Software
- Hardware

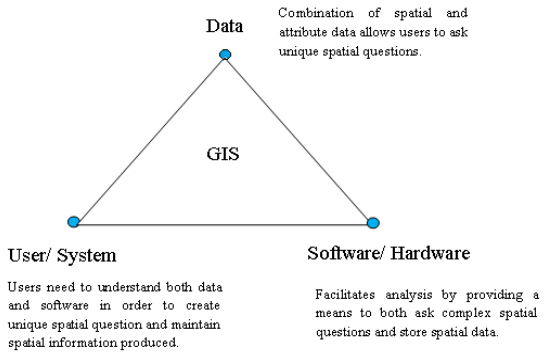

Figure 3. Component of GIS.

4. Geography of Mandalay Airfield

Mandalay international airport is the third international airfield of Myanmar. Many international airline and local airline use this airfield daily. Mandalay airfield is located in the latitude: 21° 42' 4.79'' N and longitude: 95° 58' 24.59'' E. The dimension of runway is 4268 m long and 61 m wide.

4.1. Method for Mandalay Airfield

To evaluate the geographical information of Mandalay Airfield, the system uses Latitude-Longitude formula and Cartesian Coordinate System.

4.1.1. Latitude and Longitude

Latitude and Longitude are spherical coordinates on the surface of the earth. These lines serve as an imaginary grid that geographers use to pinpoint locations on earth. To determine the latitude and longitude of a particular location, geographers measure distance in degrees, minutes and seconds [9].

Latitude is measured North or South of the Equator, resulting in a range of -90 (S pole) to +90 (N pole) degrees. Any point on the globe below the equator has a negative value for latitude, while points above the equator have positive latitude values.

Longitude is measured East or West of Greenwich, and can be expressed in different ways. For example, 120 degrees West Longitude is also 240 degrees East Longitude, since the earth is round, and 360 degrees make a circle. The choice of sign for longitude is also somewhat arbitrary. Some uses require (+) for West, others use (+) for East.

4.1.2. How to calculate Latitude & Longitude

Long = (x* Diflong / map resolution (W)) + startlong
Lat = (Diflong * (map resolution (H) - y) / H + startlat
Diflong = endlongitude – startlongitude
Diflat = endlatitude – startlatitude

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where,
start latitude=given map's latitude
end latitude=given map's latitude
start longitude=given map's longitude
end longitude=given map's longitude
H=Height of map resolution
x=coordinate of a given point
y=coordinate of a given point
W=Width of map resolution

4.2. Distance Measuring

Distance is the important thing for this system. In this system, the distance between two points is measured by using Cartesian distance. This formula produced total pixel value by the actual scale of the map. Thus, the user gets the actual distance of real world.

4.2.1. Cartesian Coordinate System

With a Cartesian system in place, any point in the plane is associated with an ordered pair of real numbers. To obtain these number, we draw to lines through the point parallel (and hence perpendicular) to the axes. We are interested in the coordinates of the points of intersection of the two lines with the axes. There are two coordinates: x-coordinate on the x-axis and y-coordinate on the y-axis [5]. The distance between two points (x_1, y_1) and (x2, y2 defined as

$$\text{dist}((x_1, y_1), (x_2, y_2)) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

4.3. System Implementation

The pilots have opportunity to choose whether he or she wants to see the overall information of Mandalay airfield in GIS as shown in figure 4.

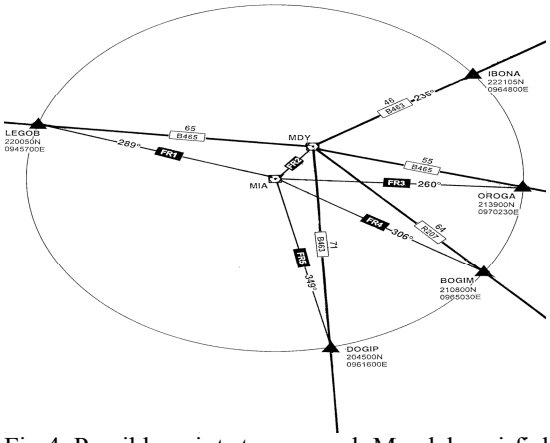

Fig 4. Possible points to approach Mandalay airfield

The pilots can land easily by using information of figure 5. The figure 5 shows the pattern and route to land runway.

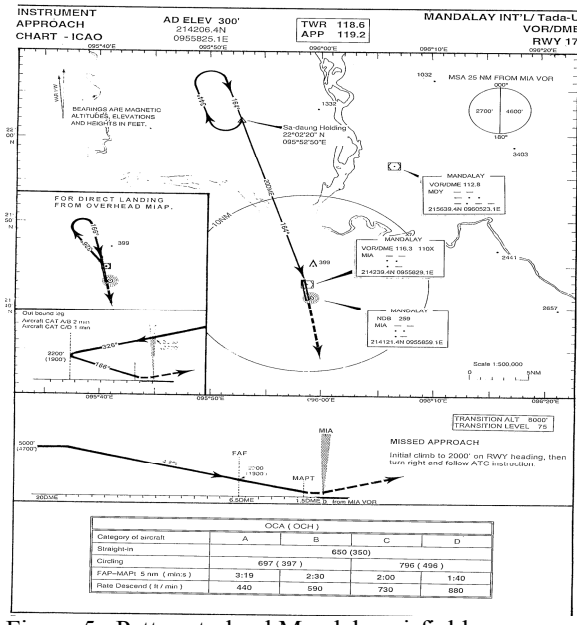

Figure 5. Pattern to land Mandalay airfield

5. CONCLUSION

This system is constructed to retrieve distance and pattern information associated with Mandalay Airfield, spatial data from the complex types of database and visualization of desire route on the GIS application and SQL. This system also provides the geographic distance by using Cartesian coordinate method.

In this system, the details of the map can be easily viewed by zooming in or out. The x, y coordinates system is used for the storage points, lines and areas. The pilots can use the latitude and longitude formula to approach airfield where they are flying.

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