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AN OVERVIEW OF THE LOCATION OF AIRPORTS USING GEOGRAPHIC INFORMATION SYSTEM

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A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data. The acronym GIS is sometimes used for geographic information science (GIS science) to refer to the academic discipline that studies geographic information systems and is a large domain within the broader academic discipline of geoinformatics. GIS can provide the airport management staff with visual pavement information and powerful analysis tool. Meanwhile, the spatial information managed by GIS can ensure the accumulation of valid attribute data of airport. Based on the principle and general implementation process of GIS and the characteristics of airport pavement management, this paper describes the implementation process of GIS in Airport planning and design. To organize the spatial entities effectively, some layers are set according to the characteristics of spatial entities. The spatial database is established, and then the function design of the GIS software is presented including map exploring, map locating, spatial query, rendering style of map and output of map. Finally, in this paper, an overview of locating airports using GIS studied.

Keywords: Locating, Airport planning, GIS science, Suitability, Traffic control.

1 INTRODUCTION

There are two primary objectives in performing airport geomagnetic surveys. The first is to determine the suitability of the site for a compass calibration pad (compass rose), and the second is to determine magnetic declination at a suitable site. Suitability is assessed using the standards outlined in FAA (Federal Aviation Administration) and DOD (Department of Defense) documents. Magnetic declination is determined using procedures developed by the US Geological Survey (USGS). Surveyors must have an understanding of geomagnetism and be trained to use several sophisticated magnetometers to acquire magnetic measurements. Personnel from geomagnetic observatories are especially suited to perform compass rose surveys. In the United States, the USGS and private companies provide airport geomagnetic surveys.

Suau-Sanchez *et al*. (2014) studied on this paper presents a free available dataset, the CORINE land cover that helps dealing with the biases caused by pre-defined and heterogeneous census district boundaries in airport catchment area analysis in Europe. Using this dataset and conventional GIS software it is possible to measure the size of the population within catchment areas at the same spatial level for all EU airports, allowing for consistent comparisons among airports. To illustrate the potential of the CORINE/GIS approach, the size of the population in the catchment areas of all European airports was determined. The empirical exercise has an aggregate perspective, but this database presents many other possibilities of analysis to perform in

a case-by-case basis. The CORINE dataset and the GIS analysis have shown to be useful and contribute to consistent airport catchment area examination.

Anwer and Ibraheem (2014) investigated on Conceptual vision of airport geographic information system (AGIS). GIS can provide the airport management staff with visual pavement information and powerful analysis tool. Meanwhile, the spatial information managed by GIS can ensure the accumulation of valid attribute data of airport pavement. Based on the principle and general implementation process of GIS and the characteristics of airport pavement management.

Wang *et al.* (2012) studied on Airport detection in remote sensing images: a method based on saliency map. The detection of airport attracts lots of attention and becomes a hot topic recently because of its applications and importance in military and civil aviation fields. However, the complicated background around airports brings much difficulty into the detection. This paper presents a new method for airport detection in remote sensing images. Distinct from other methods which analyze images pixel by pixel, we introduce visual attention mechanism into detection of airport and improve the efficiency of detection greatly. Firstly, Hough transform is used to judge whether an airport exists in an image. Then an improved graph based visual saliency model is applied to compute the saliency map and extract regions of interest (ROIs). The airport target is finally detected according to the scale invariant feature transform features which are extracted from each ROI and classified by hierarchical discriminate regression tree. Experimental results show that the proposed method is faster and more accurate than existing methods, and has lower false alarm rate and better antinomies performance simultaneously.

Huang *et al.* (2012) investigated on Web-based GIS: the vector-borne disease airline importation risk (VBD-AIR) tool. Over the past century, the size and complexity of the air travel network has increased dramatically. Nowadays, there are 29.6 million scheduled flights per year and around 2.7 billion passengers are transported annually. The rapid expansion of the network increasingly connects regions of endemic vector-borne disease with the rest of the world, resulting in challenges to health systems worldwide in terms of vector-borne pathogen importation and disease vector invasion events. Here we describe the development of a user-friendly Web-based GIS tool: The Vector-Borne Disease Airline Importation Risk Tool (VBD-AIR), to help better define the roles of airports and airlines in the transmission and spread of vector-borne diseases.

2 DATA

The database is the version 4.1 of the "Population density disaggregated with the CORINE land-cover 2000" dataset from the European Environmental Agency (EEA 2009). This dataset provides information about estimated population density for the EU27, Croatia and Moldova at a pixel size of one hectare. This is a level of detail much higher than the NUTS 3 level used in previous analyses (Redondi *et al.* 2013, Scotti *et al.* 2012, Lieshout 2012, Papatheodorou and Arvanitis 2009, Grosche *et al.* 2007). Table 1 shows the substantial improvement in terms of data disaggregation that CORINE represents over the NUTS units. Considering the different data aggregation levels, in terms of area size, the average size of a NUTS 3 unit is 330,000 ha, while CORINE has a constant definition of 1 ha. The CORINE dataset solves the issue of heterogeneous census district boundaries. The NUTS unit size depends on different national administrative boundaries defined by each member state. For example, while the average size of the NUTS 3 unit in Sweden (Län) has 21,017 km^2, the average size of the NUTS 3 unit in Belgium (Arrondissementen/Arrondissements) has 694 km^2. The same holds true for local administrative boundaries at the municipal level. GIS analysis based on the CORINE database allows the researcher to choose the same boundary for each airport under consideration. Hence, it

allows for consistent comparisons, at any geographical scale, between European airports without the influence of administrative boundaries. Figure 1 shows the different population results using CORINE and NUTS 3 for the case of Amsterdam. The database uses the CORINE land-cover of the year 2000 as the Original source for the estimation of the population-density values, which are calculated for the year 2001. To weight the different land use types in terms of population, each CORINE land-use cover class is attached to a different weighting coefficient. See Gallego and Peedell (2001) and Gallego (2007) for a detailed explanation on the algorithm used to estimate weighting coefficients. The countries included in our analysis are the EU27 member states, Croatia, and Moldova. To determine whether an airport had scheduled traffic, we used data from the OAG (Official Airline Guide) for the year 2009, as it was the most recent data at our disposal.

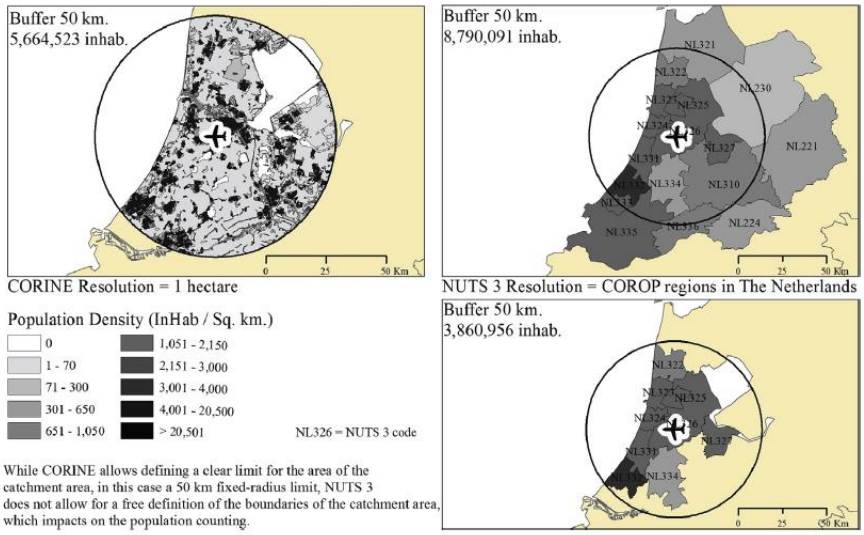

Figure 1. Population counting with NUTS 3 and CORINE using the case of Amsterdam Airport.

3 AIRPORT GEOGRAPHIC INFORMATION SYSTEM (AGIS)

Geographic Information Systems (GIS) are increasingly being implemented by airport operators. Airport operators today face unprecedented challenges to provide greater safety and security for passengers, while still efficiently managing their facilities. Modern airports are finding an integrated geographic information system (GIS) that can help in to better management both air and ground side operations. Some of the applications can be classified into two groups as follows (Airport Technology, Esri 2004):

3.1 In the Air

Flight Tracking: commercial airlines and air traffic control regulators use GIS for airspace planning and routing applications, integrated flight monitoring, and real time flight tracking. These applications facilitate greater airspace efficiencies, and support a number of security and public information programs, including noise monitoring and real time flight arrival information.

3.2 On the Ground

Modern airports are some of the most intensively used facilities, and must remain at a High level of performance at all times of the year, sometimes under trying circumstances. To meet these

challenges; airport managers are turning to GIS technology to support their efforts in planning, operation, maintenance, and security by adding spatial information and modeling Capabilities. GIS provides them with unique information and analytical power not available in other information systems. Above all, comprehensive GIS support a wide array of airport missions:

1) **Planning and Design**: Many engineering firms have adopted GIS as a tool for expansion studies and design reviews. Using mapping data from the local community, such as ground access, neighborhood constraints and environmental sensitivities, can significantly reduce the time spent analyzing significant land use issues, particularly for expansions of land locked facilities in large, densely populated urban areas. GIS software can now provide a greater level of interoperability with other key software tools such as Computer Aided Design (CAD) systems and relational database management systems, allowing airport managers to better integrate their information technology environment. Users can now bring information captured in digital aerial photographs, environmental and design data into the same environment for analysis and planning.

2) **Operations**: Significant growth in traffic has left many airport properties severely constrained for space. Airport managers must carefully balance security concerns with increasing revenue requirements. GIS can be integrated with property management applications, and used to effectively manage competing needs for revenue-generating facilities and readjust facilities for the ever-changing needs of their tenants.

3) **Maintenance**: The use of GIS in a modern maintenance management system for airports is valuable. From runway lighting systems, to terminal facilities, GIS can provide a powerful graphical component to the maintenance of an airport's critical infrastructure.

4) **Security**: The security needs of airports have been significantly revised in recent years. GIS provides a powerful analytic capability for understanding vulnerability in existing facilities, and a way to integrate disparate security information into a single command environment. Airports have discovered that GIS is an integral part of a well-designed security infrastructure, from perimeter control to terminal access control, and monitoring.

5 GIS SOLUTIONS FOR AIRPORTS AND AVIATION

Airports represent some of the most highly-used facilities on our planet. Given the sensitive nature of flights, especially takeoffs and landings, these facilities must remain at a high level of performance at all times of the year, sometimes under trying circumstances. Airport managers cannot afford lengthy downtimes or untimely lapses in performance. They must plan and maintain their facilities for peak performance and identify potential points of failure well before a critical failure can occur. For many years, airport managers have turned to GIS technology to support their efforts in planning, operations, maintenance, and security by adding spatial information and modeling. In the following, aerial photograph of Phoenix Sky Harbor Airport and ArcGIS™ provides are shown in Figures 2 and 3. GIS provides unique information and analytical capabilities not available in other information systems.

Commercial airlines and air traffic control regulators use GIS for airspace planning and routing applications as well as for facilities management applications. Recent enhancements to three-dimensional GIS allow more advanced airspace modeling applications to be combined with geographic information from local communities such as parcels, land use, building heights, new construction, and modified terrain around the airport. GIS software allows for a greater level of interoperability with other key software tools such as computer-aided drafting (CAD) systems and relational database management systems. Users can now take greater advantage of

information captured in digital aerial photographs, which can be registered geographically, providing excellent background layers for mapping applications. Significant growth in traffic has left many airport properties severely constrained for space. Airport managers must carefully manage competing needs for revenue-generating facilities and effectively readjust facilities for the ever-changing needs of their tenants. GIS can be integrated with property management applications, improving accuracy and timeliness in responding to property information requests.

Figure 2. Imagery of Phoenix Sky Harbor Airport, AZ.

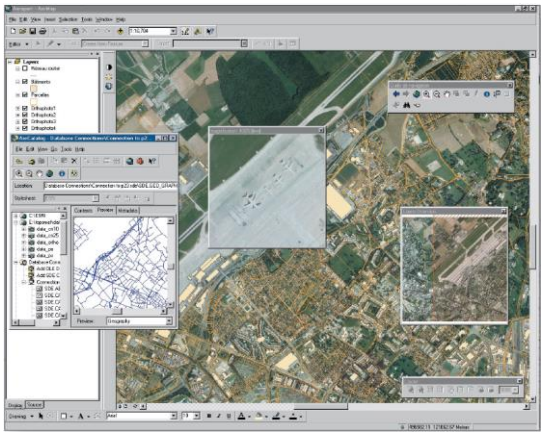

Figure 3. ArcGIS™ provides advanced geoprocessing and metadata tools to assist the user.

The security needs of airports have been significantly revised in recent years. GIS provides a powerful analytic capability for understanding vulnerability in existing facilities as well as in pinpointing trends in incidents and past security breaches. Tying incident log information directly to the exact location in the airport's facility maps can help in planning for improvements in security equipment and procedures. Many engineering firms have adopted GIS as a tool for expansion studies and design reviews. Using mapping data from the local community, such as current roadway or railway access to the airport grounds, neighborhood constraints, and environmental sensitivities, can significantly reduce the time spent in understanding the complexities involved, particularly for expansions of landlocked facilities in large, densely populated urban areas.

6 CONCLUSION

The CORINE dataset and the GIS analysis have shown to be useful and contribute to consistent airport catchment area examination. This methodology can be of the interest to the aviation sector since it introduces the use of a free available database to do extensive comparative analyses of the population component of airport catchment areas in Europe and helps achieving consistent comparisons among European airports and dealing with the biases caused by predefined heterogeneous administrative districts. The study has an aggregate perspective, but this database presents many other possibilities of analysis to perform in a case-by-case basis (e.g., market leakage analysis, catchment area overlap analysis, airport choice modeling, accessibility analysis, forecasting and route feasibility analysis). In this paper, visual attention mechanism has been introduced into the airport detection problem and a new method for airport detection has been presented. In this paper a review on locating of airport presented, which is mentioned below:

(i) For more than 30 years, ESRI has been helping people manage and analyze geographic information. ESRI offers a framework for implementing GIS technology in any organization with a seamless link from personal GIS on the desktop to enterprise wide GIS client/server and data management systems. ESRI GIS solutions are flexible and can be customized to meet the needs of our users. ESRI is a full-service GIS company, read to help you begin, grow, and build success with GIS.

(ii) The AGIS program provides access to the system solely to the airport sponsor and proponent. However, the AS/P may provide their access credentials to a Consultant on a temporary project specific basis, with responsibility for the accuracy and completeness of the data remaining the responsibility of the AS/P.

(iii) Airports represent some of the most highly used facilities on our planet. Given the sensitive nature of flights, especially takeoffs and landings, these facilities must remain at a high level of performance at all times of the year, sometimes under trying circumstances.

(iv) Geographic Information System (GIS) surveys are being conducted to provide detailed geospatial data about airports. The data will be used for new Localizer Performance with Vertical Guidance approaches, including obstruction analyses, as well as electronic Notices to Airmen and flight deck airport moving maps.

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