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GIS Based Emergency Response Information System for Sivakasi Town by using C# and .NET Platform

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Abstract : Emergencies occur anywhere, at any situation, at any place, at any time, and in different ways, will make one at risk. Emergency situations require a speedy response. Thus, it is undoubted to establish direct, fast and efficient software without delay. Hence, the development of emergency response information system has its own value and necessity. The ERIS is known as software that supports the responders for quick and efficient emergency care during the accidental emergency situation. GIS based Emergency Response Information System is proposed for trouble free routing of ambulances and fire vehicles during emergencies. C# AND .NET provides a versatile platform, enabling programmers to use object-oriented methodologies. ERIS was developed under the platform of C# AND .NET. This software was used to locate the nearest emergency responder, and also it provides all the available information regarding emergency care situation through ERIS.
Key words : ERIS, Arc GIS, .NET, C#, Arc View.

Introduction

The precious time after an accident which is golden hour serves as a measure of effectiveness of any emergency response service provider system. Accident recovery actions should be taken in that time to reduce the loss of life and property. In spite of the reason that the service providers are well equipped, routing problems and traffic congestions breaks their speedy recovery action in real time (1-4).

AERARS is a response and routing software which is used for accident emergency requirement. An efficient method has been proposed in this project for using a genetic algorithm to find the optimal route between a source and aaccident destination. The numbers of accident spots are collected and plotted in ArcGIS software environment and the major accident spots are identified and analyzed. The software package is designed with closest facility estimation and shortest route generation along with other basic software facilities in Visual Basic Environment (5).

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A GIS based fire emergency recovery services where GNFS can identify the shortest route from its location to any fire accident. Since access to a fire incident and timely intervention plays animportant role in managing all types of fire, the optimal route was modeled based on the distance of travel, time of travel, the elevations of the roads and the delays in travel times. Besides using this analysis to timely respond to urban fire emergency services, GNFS could perform analysis on the number and spatial distribution of fire water hydrants (6-9).Emergency situations require a speedy response. Thus, it is undoubted to generate direct, fast and good efficient software without delay. Hence, the development of emergency response information system has its own value and necessity.

Result and Discussion

Development of GIS Database

This Section discusses the study area (Sivakasi), data input methods, analysis (i.e. to find the optimal route and data output and it involves management of activities associated with road accidents, fire accidents, and shortest route of emergency systems like police stations, hospitals, fire stations, schools, etc. It is used to find the largest accident zones and route of emergency systems.

Study Area

The study area, we have chosen for our project is Sivakasi taluk is situated in the southern portion of the Tamilnadu state. The total geographical area of the Sivakasi taluk is 6.89 sq.km. The administrative headquarters located at Virudhunagar town. The Sivakasitaluk lies between 9.45◦ north latitude and 77.82◦ east longitude. The general geographical information of the taluk is simple and flatted area.

The Sivakasi taluk have large number of fire and match works industries. So more chances are there for occurring fire accidents and congestions are very high in this area and chances for road accidents are very prone on high. In this case study, we came to know about there is 8000 industries are there and it has only one fire station to meet the requirements in break of any accidents.

Data Capture and Processing

The sivakasitaluk map and city map was collected from municipality office sivakasi. This thematic map was very much helpful in analyzing in Arc GIS. The road accident details & fire accident details were collected from the SP office; it was very useful to find the density of accidents happened in the city from the past. From this density map we have decided where to concentrate on the places where large accidents would occur in future. The district police station numbers collected had been displayed in ERIS would be of very much help during the accident times.

GIS analysis

Time and month based data analysis were carried out to and to find which time period and month has more number of accident history. In time based analysis the whole day was divided into six sections with four hours gap. The month based analysis dealt with month wise occurrence of accidents data. From this network may be get aware of accident prone time period or month. Similarly different types of SQL queries were applied on accident related attributes to obtain the results on the various topics(10-12). Spatial Analyst of ArcGIS was used to analyze density patterns using simple or kernel calculations. Specifically, Kernel density type of calculation is applied to prepare accident density maps (**fig1**).

Roads in the study area are categorized as NH, major roads and minor roads and it is identified by giving a separate key element to each category in the database. Roads which are having names are identified and that data are stored in this database. Data base for road segment length, speed limit and drive time was created. Road network (**fig2**) was generated by using Network Analyst Extension of ArcView GIS.

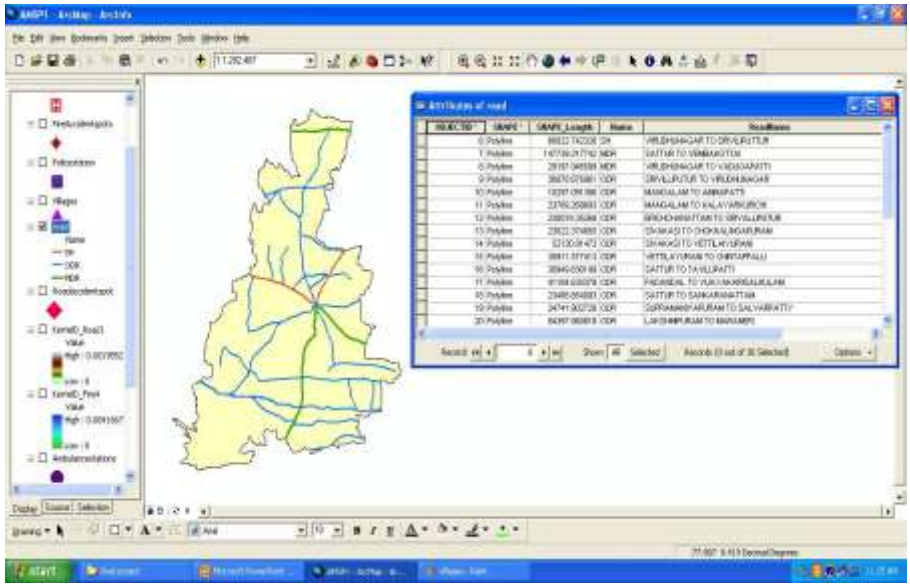

Fig 1. Road network map of sivakasi

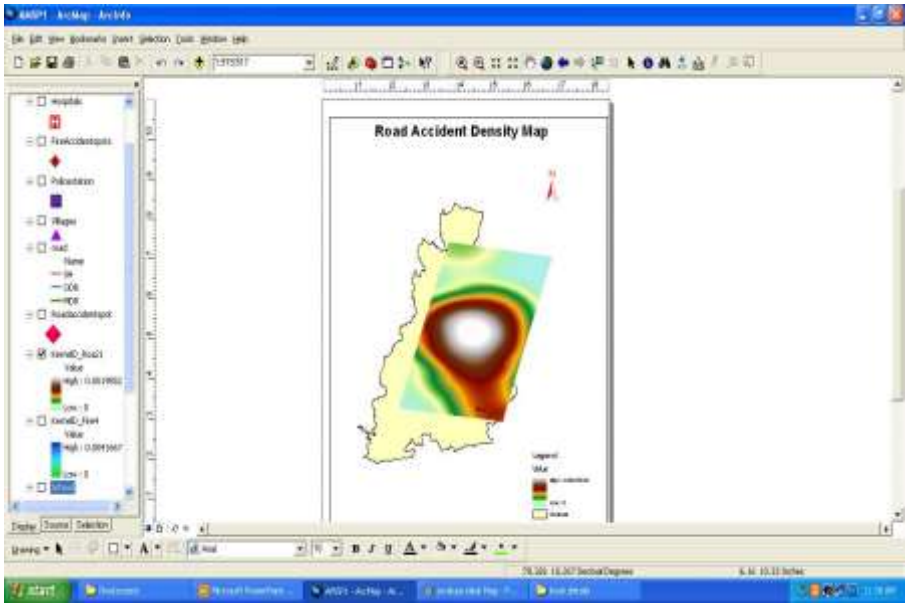

Fig 2. Road accident density map of sivakasi

Development of ERIS Software

The ERIS software acts as a local database that supports the responders /seekers at a particular area for quick and efficient emergency situation .This software holds the all the information's about hospitals,police stations,ambulances,fire station etc., which are nearby and their numbers ,which are ultimately needed at the time of emergency.It also holds the accident density maps of the study area. This is included for the purpose of finding the shortest route so as to provide service at a much lesser time. Individual maps about each and every route in that particulars area is embedded within the software.

ERIS does not require the user to be proficient in GIS techniques. It creates the displayed message of the spatial data and allows these data elements to be combined without a user having knowledge of the ArcGIS software. C#.NET provides a versatile platform, enabling programmers to use object oriented methodologies. Map Objects 2.4 is the mapping component software created by ESRI, to allow mapping functions to be included in applications developed in a variety of programming environments (13-14).

ERIS was developed under the platform of C#.NET with MO2.4. ERIS is designed as GUI which can handle by a user easily to obtain routing or ground truth information of an emergency site. The main window has three parts 1.Menu bar, 2.Standard Tool bar, 3. Map tool bar. The ERIS software preview and working view of ERIS software are shown in fig(1,2).

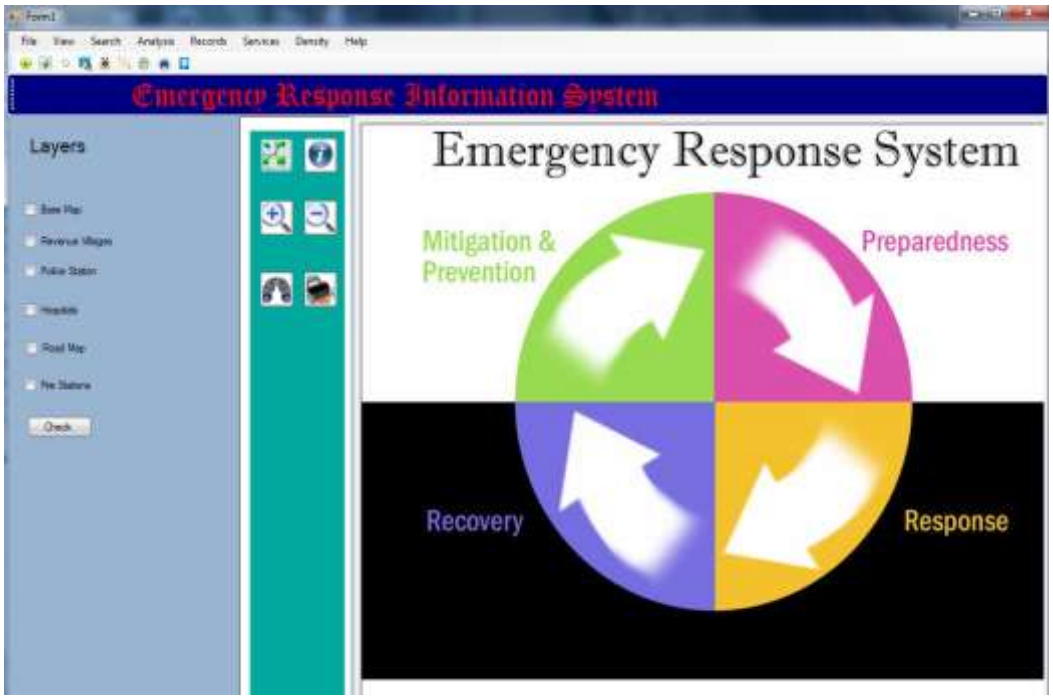

Fig.1. ERIS frontend Preview

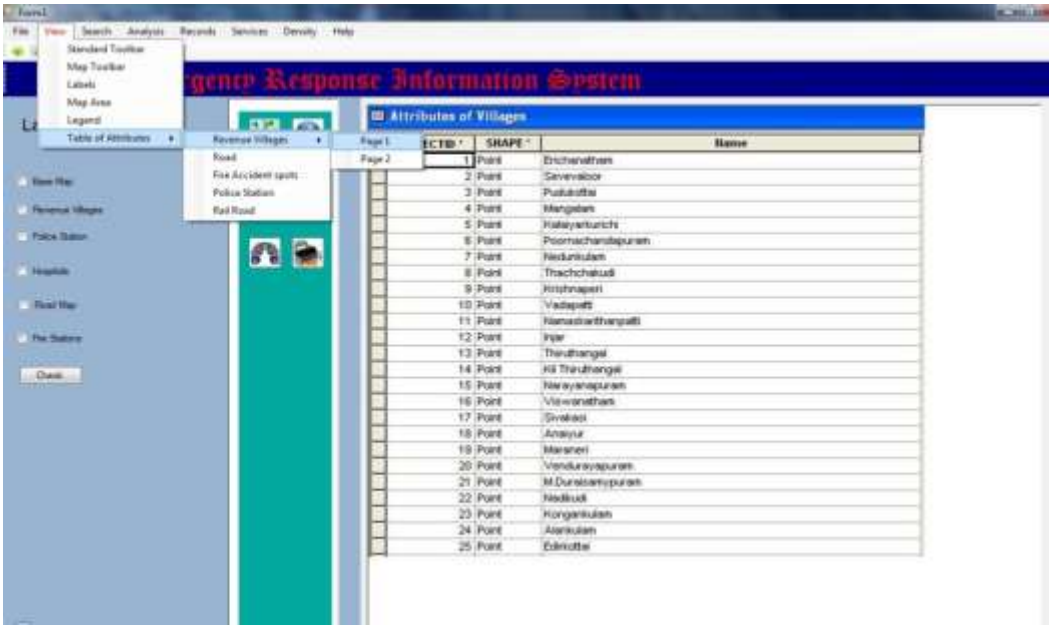

Fig2. Working view of ERIS

Menu bar & tool bars

To make the ERIS more user friendly, menu bars are added to user interface. Menu bar contains different menus with common commands to perform different functionalities on spatial data (15-16). ERIS has two types of toolbars. The Standard toolbar has 13 buttons including five control buttons and ten application buttons. Map toolbar has six buttons including seven visual map interaction controls, two querying controls and an output control. Table (1,2) shows the functionality of standard tool bar and menu bar .

Table no 1.standard tool bar

Tool Id	Functionality	Tool Id	Functionality
1	Add Layer	7	Emergency Services
2	Remove Layer	8	Fire And Rescue Service
3	Print Map	9	Police Stations
4	Accident Analysis	10	Find
5	Road Accidents Records	11	Help
6	Fire Accidents Records	12	Exit

Table no2.Menu bar

Menu	Sub Menu	Action
File	Add Layer	To add a new map layer in ERIS
	Remove Layer	To Remove a layer from user input
	Export Map	To export current map view as bmp file
	Exit	To close ERIS
View	Standard tool bar	User can select visibility ON/OFF
	Map tool bar	User can select visibility ON/OFF
	Legend	User can select visibility ON/OFF
	Table of attribute	User can view attributes of theme
Search	Ambulance Services	Search to locate specific ambulance
	Fire & rescue station	Search to locate a fire & rescue station
	Police stations	Search to locate a police station
	Roads	Search to locate a specified road
Analysis	Fire accidents	Separate window to show the FA results
	Road accidents	Separate window to show the RA Results
Records	Fire accidents	Previous years FA records
	Road accidents	Previous years RA records
Services	Ambulance services	Details of ambulance services
	Fire & Rescue stations	Details of fire & rescue stations
	Police stations	Details of police stations
Help	Help topics	To help user to understand functionality
	About us	Version history of ERIS

Applications

ERIS was designed to supply information to the user to make proper decisions at the time of emergencies. Applications part of ERIS can be broadly classified into two sections. One is to provide ground truth of locality; other is to determine a shortest efficient route within city transportation netw ork. ERIS database has designed to carry wide range of information including record of accidents and details of existing emergency services of the cit y. In ERIS the accidents results can be viewed through the Analysis Menu through following submenus Time Based Analysis of Fire and Road Accidents, Month Based Analysis of Fire Accidents & Road accidents, type of accident Statistics and economical impact of fire accidents, accident density spots identification, road accidents based on vehicle type, accidents based on road type, fatal and nonfatal Statistics, densit y maps **.**The**Services Menu** gives the details of existing emergency responding facilitators of the city. The use r can able to selective a specific or an alternatie service provider depending upon the situation. Services menu consistsofour emergency services (ie)., Ambulance services, hospitals, Fire & Rescue Stations a nd Police Stations.Hospitals submenu carries all the essential information concerning the particular hospital. L

ocation reference, contact numbers, existing medical facilities, specialties and trauma care facility details will make the user to prefer a precise choice.

Conclusion

Emergency Response Information System (ERIS) was designed inthe work by analyzing the ground situation of Sivakasitaluk. ERIS is aimed to solve routingproblems effectively and it also provides shortest as well as efficient route for speedytransportation of a patient when an accident or emergency occurs in Sivakasitaluk. Route mapand its directions output supply a substantial assistance to enable service providers to giving theiremergencies at least time. ERIS also analyzes emergency situations and emergency prone zones ofthe city from the past years accident history. ERIS is capable of handling multi accidentsituation and it is analyzed with the results obtained that how well the developed Route Finderworking with the efficient accuracy as much as the Network Analyst of ArcView software.All the accident records database can be updated by the user side itself with in the software. The wholesystem was designed to with an easy updating functionality due to the requirements in future.Traffic control authorities, emergency service providers, policemen and any common man cause the system without any prior GIS software proficiency. We hope that this project was **"savethe golden time of our life at atype of accident".**

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