WEB AND SMS BASED GEOGRAPHIC INFORMATION SYSTEM TO MONITOR BURGLARY IN A SAMPLE URBAN CENTRE IN TAMIL NADU, INDIA

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Abstract: Burglary becomes a day-to-day affair in majority of urban centers, particularly in the metropolitan areas, in India. Main reason for this continued crime against society is socio-economic inequality. With increasing population in the urban areas due to in-migration in search of jobs and less man power in the police department is one of the reasons for this kind of activity. This could be managed with the friendly police concept. For a sample work, a Web-based GIS, a method of disseminating information, organized using Geographic Information Systems (GIS) for Kumbakonam 45 wards have been taken up for the study: (a) To digitally map the entire urban centre of Kumbakonam by transferring all the individual household locational details using Global Positioning System (GPS) to manage them for burglary information base in GIS, (b) To devise a GIS based WEB solution for all the wards in the study area and gather individual household information including their contact telephone, mobile numbers to connect and keep them with the police department in a common platform, to exchange details, when they are away. GIS has been used as a common platform to connect the Household and Police department on a WEB solution with a software designed using .NET: Household is the information provider and the Police department is the end user/ decision maker. In the present study, all the wards (spatial units) have been selected for the study. They were further converted into various digital maps and all the household details were attached with attribute tables. Global Positioning System (GPS) has also been used to re-register the individual households approximately 30,000 in the study area. The street-wise maps were digitally converted into images and they were re-registered using GPS control points. Once the data (house locked and the date in which they would return back) is entered using any gateways, then the end user, the police department would list the details at their end to view the locked houses on that day and they can keep an additional watch on the locked houses during their night petrol. Though there are 358 households in this sample ward only the houses locked and entered on the web site only BLINKS and the use of mouse pointer would give the details of the household to mark the police personal for monitoring. For those who do not have access to internet based WEB solution an alternate method of entering their house lock-in period has also been devised using Short Message System (SMS). This type of system would reduce the day-to-day burglary event in near future.

1. Introduction

Web-based GIS is an exciting new method of disseminating information organized using Geographic Information Systems (GIS). It became possible and popular due to the fast growing Internet technology and became a good source of providing better decision support in land use and environmental protection since mid 1990s (Barr,R. and K. Pease,1990). Many research activities and commercial efforts have been put into this field. The traditional and age-old system of intelligence and criminal record maintenance has failed to live up to the requirements of the existing crime scenario. Manual processes neither provide accurate, reliable and comprehensive data round the clock nor does it help in trend prediction and decision support. It also results in lower productivity and ineffective utilisation of manpower. The solution to this ever-increasing problem lies in the effective use of Information Technology (Brantingham, P.L and

Brantingham, P.J, 1995). Geographic Information System (GIS) uses geography and computer-generated maps as an interface for integrating and accessing massive amounts of location-based information. GIS allows police personnel to plan effectively for emergency response, determine mitigation priorities, analyse historical events, and predict future events. GIS can also be used to get critical information to emergency responders upon dispatch or while en route to an incident to assist in tactical planning and response. GIS helps identify potential suspects to increase investigators suspect base when no leads are evident (Brown, S.D et al, 1998).

1.1 GIS to Measure Crime in Public Housing

The incidence of crime in public housing has yet to be routinely and systematically measured. In the vast majority of jurisdictions with public housing, official police statistics on crimes specific to those areas are just not available. The majority of law enforcement organizations base their statistics on relatively large geographic areas often called precincts or districts. Police rarely publish official crime statistics for small parcels of land such as public housing developments. Few of the biggest public housing developments (i.e., 1000+ units) come close to even qualifying for consideration as distinct crime reporting zones. In any event, these 1000+ unit developments are exceedingly rare, appearing in less than one-half of one percent of the Nation's 3300+ public housing authorities. Furthermore, these very large developments constitute less than one-half of one percent of the roughly 14,700 public housing developments in the United States (Geggie, P.F, 1998). While a handful of criminologists have attempted to gauge the levels of some crimes in public housing, even the most rigorous attempts have been unable to generate comparisons between ostensibly high-crime public housing developments and their adjacent neighborhoods or even adjacent blocks. That being the case, it is possible that many inner-city public housing developments—by comparison—may prove to be calm islands in the midst of neighborhoods beset by crime and disorder (Harris, R.C et al, 1998).

1.2 Converting Address Data into Map Locations

Police crime reports include the physical address of the crime location. Important tasks here are to locate these address data on a map in order to display the map locations and to determine their locations relative to public housing—for instance, whether a crime fell within the boundaries of a public housing development or within a specified distance of a public housing development boundary. Fortunately, the GIS provide the tools necessary to convert the physical address to a map coordinate location (Lee, Y and F.J.Egan, 1972). The process of converting address data to coordinate data is called geocoding or address matching. It relies on the GIS's ability to compare the elements of each address to the attributes associated with each line segment until the elements match (or in the case of the street number, until the number falls within the range of addresses associated with a particular line segment). The exact location is determined by interpolating the available range of addresses to determine where the specific street number lies along the line segment. The output of the geocoding process is a point layer showing the location of each address in the same coordinate system as the street centerline layer. In other words, the output can be used to create a map showing the crime locations and the streets. The map will show each crime as a point on or near the actual street address of the crime. In addition, each point is linked to any other attribute data contained in the original database—that is, all the other information extracted from the written crime reports. Geocoding normally requires some amount of data preprocessing to achieve acceptable results. The address given on the police report commonly does not match an address available within the street centerline layer (Olligschlaeger, A.M 1997). Reasons may include that the street name does not exist, the name was spelled incorrectly on the report, the street number does not fall within a valid address range, the street type is incorrect, or the street's locational designation (e.g., North Main Street) is omitted or does not exist. Also, police reports often give the location as a name (e.g., county jail) or a street intersection rather than an address. Finally, the report may contain a valid address that is missing from the street centerline layer, e.g., an address within a new subdivision that has not yet been included in the street centerline layer or the street centerline attributes may be incomplete (Sorensen, S.L 1997).

1.3 Burglary a Major Problem in Metropolitan cities

House-break-theft (Burglary) is a day-to-day affair in the majority of urban centers, particularly in the metropolitan areas. The main reason for this continued theft is socio-economic inequality and the recent reports indicate that the unemployed youths are involved in such type of activities. With ever increasing population in the urban areas due to immigration in search of jobs and less man power in the police department to monitor is one of the reasons for this criminal activity. This can be managed with the friendly police concept. Basic initiative in the project is to pass confidential information to the Police department as and when a house is locked for quiet some time / unattended for longer time periods / which may likely instigate an intruder to break the house. Police department, which, if a house is unattended for longer time interval, the period of absence may be intimated to the nearest police station, is informing the Public and they in turn keep additional watch during night patrols to curtail and reduce the burglary in urban areas. Keeping in view of the above, the investigation is focused upon: To map the existing urban crime pattern in Kumbakonam using GIS Technology for the data, to available time periods and select the highest burglary incidence ward for sample analysis, To devise a GIS based WEB solution to the sample ward of 23 in the study area and gather all the household location/ information using GPS and connect the household and police department in a common platform, to exchange details when they are away.

2. Methodological issues in design of a WEB host

Geographical Information System developed by ESRI, has been used as a common platform to connect the Household and Police department on a WEB solution with a software designed using .NET: Household is the information provider and the Police department is the end user/ decision maker. In the present study, based on the highest house-break theft data available in the Kumbakonam Police jurisdiction, ward No. 23 have been selected for a sample study. The entire ward has been converted into digital maps and all the household details were attached with attribute tables. Global Positioning System (GPS) has also been used to re-register the individual household with satellite tracking mechanism. The street-wise maps (9 street) were digitally converted into images (using scanner) and they were re-registered using GPS control points. There are 358 households in this ward has been re-surveyed using GPS to exactly demarcate the locations of individual households. Then a WEB based GIS software has been devised using .NET. It works simple and the household information provider and the end user are connected on a common network. If a household is to enter the information on the web site (specifically designed) they have to clear the entry by given user name and password. Then they have to enter the date in which they intend to leave the house locked and the date in which they would return back home. Once the data is entered using any gateways, then the end user, the police department would list the details on their end to view the locked houses on that day. They can keep an additional watch on the locked houses during their night petrol. Though there are 358 households in this sample wards only the houses locked and entered on the web site only BLINKS and the use of mouse pointer would give the details of the household to mark the police personal for monitoring. This type of system would reduce the day to day burglary event in near future.

2.1 Sample Location

Kumbakonam, one of the special grade Municipal Towns of Tamil Nadu, is the second bigger town in Thanjavur District. It is situated 10° 57" north latitude and 79° 28' Longitude. It is located about 313 kms away from Chennai (the state capital) on the south, about 90 kms from Tiruchirapalli on the east and about 40 kms from Thanjavur on the North East. The town is surrounded by two rivers namely River Cauvery on the north and River Arasalar on the south. It has a gentle slope towards south from North. Kumbakonam is located at 10.97° N 79.38° E. It has an average elevation of 24 metres (78 feet). Kumbakonam is located 273 km south of Chennai, 96 km east of Tiruchirappalli, and about 40 km north-east of Thanjavur. Two rivers bound the town, the Kaveri River on the north and Arasalar River on the south. There is a gentle slope from north of the town to south.

2.2 GIS based WEB solution for Burglary

2.2.1 Home Page

The Home Page provides with user login and Admin login facilities to navigate through the details about the inhabitants of the town.

Fig-1

Fig-2

2.2.2. User Login

The User, by clicking on the link "people Use this link for security Registration" **(Fig-1)**, will be shown the slot to enter in his Id, password, and the information regarding his absence so as to suggest from which date up until which date he will be absent, as has been shown below.

User_Id : 1w100

Password: Raja

From Date: dd/mm/yyyy

To Date : dd/mm/yyyy

The User Id is a conglomeration of the user's ward no and Id no and his name is given as password. The Police department uses Admin login to get the details of the inhabitants of the town, whereas the public (the common man who is in need of security) uses "people Use this link for security Registration".

Note: Common man (public) has nothing to do with Admin log in.

2.2.3 Admin Login

The Admin login **(Fig-2)** is used by the Cop crew (police) to get to know of the user's (common man) territory to provide Security with.

This reads like,

User Name   : admin

Password   : admin

Clicking the log in button will eventually take the User to the full map view of the town Kumbakonam , used as a specimen town to try this new strategy out.

Fig-3

Fig-4

2.2.4 Full Map

Full map shows the full view of the town Kumbakonam **(Fig-3)**, with the wards well marked. Every ward has got a button indicator showing blue color. Once the User (Police) clicks on the ward he wants to have a close look at, the color blue turns blinking red, taking him to the zone he wants to peer through.

2.2.5 Ward Map

Ward Map helps the police to view all the features of every ward of the town (Fig-4). To let the User decipher directional confusions, a direction indicator is placed on the right side of the map. The moment the User (police) enters into the ward he wants to check about, by moving the cursor on, he will be let known of the details about the inhabitants of that particular ward.

Fig-5

Fig-6

2.2.6 Direction Map

Direction map enables the User to be well aware of directions (Fig-5). The moment one moves on the cursor to click on the button indicators, individually (one by one), he will be shown the details about the inhabitants of every ward.

2.2.7 Report (For the common man's purpose)

Clicking on the option "**Report**" on the right side of the full map page (Fig-6), makes it possible for the police to know from which date up until which date a person is going outstation leaving his residence locked. This Web based system also encourages the common man to be optional in selecting the via-media to inform the police of his absence. This means, one can let the police know of his absence through two different sources. One is through web, another through mobile.

Fig-7

Fig-8

The option **Report** (Fig-7), once clicked, shows an entablature rolling out, giving information about the user_id, Hname, id no, ward no, from_date and to_date. Then the police can move on to click on the option "GOTO" , to get to the full map view of the town, and from there go to review the ward in which, the above given details fix correctly up (Fig-8). The ward details are given by the common person, it is very easy for the police to get into his territory without any problem.

Clicking the relevant ward will show the ward page.

Clicking the id_no will take the User to the direction page, then clicking the same will get the User back to ward page.
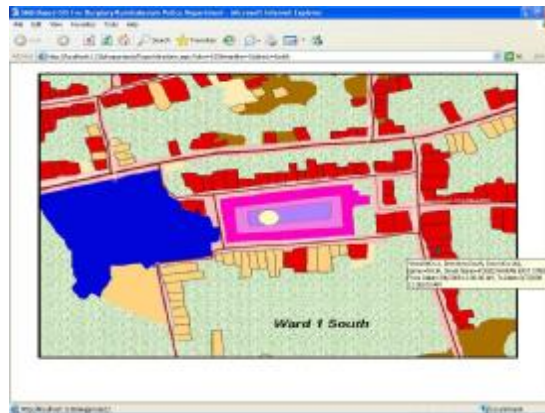

Fig-9

2.3 SMS Based Solution

2.3.1 How to connect Server

Running the setup project, giving the Port no (for example 5),clicking the Connect button, gets a e response from the server coming in in the form of a message that reads "successfully connected" .

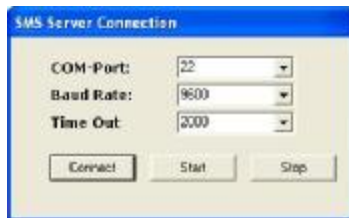Fig-10

Fig-11

A new window will open
*click the message menu
   send button will appear
* Click the Send button
   three options will be viewed.

a. Individual
b.Multiple
c.Ward Wise.
Individual:

*Click the Individual check box
     a box will appear
 *enter the ward no, idno (of that particular ward which has been dealt with) then click the send button.
The below format will be sendtto the End User.

Userid: 1w100 Password: Raja Fdate: dd.mm.yyyy Tdate: dd.mm.yyyy.

Fig-12

Multiple:
*Click the Multiple check box
   a box will appeared
 * select the ward no, idno (of that particular
   ward which has been dealt with)
  *click the send button
   The information shown below will be sent to the End User.

Userid: 1w100 Password: Raja Fdate: dd.mm.yyyy Tdate: dd.mm.yyyy.

Fig-13

 Ward Wise:

 *Click the Ward wise check box
    a box will appear
 * select the ward no
   click the send button
The information shown below will be sent to the End User.

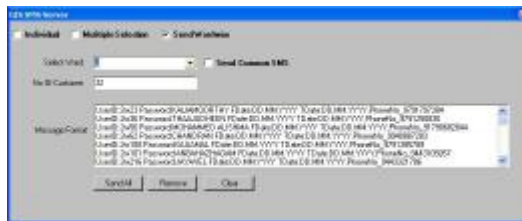Userid: 1w100 Password: Raja Fdate: dd.mm.yyyy Tdate: dd.mm.yyyy.

Fig-14

Login:
End Users edit the format (only Fdate & Tdate) and send it as an sms to admin.

Admin No: 9791220355

The Server receives the SMS and replies to the End User which reads "**Logged Successfully**" only If the End User has sent in the information in the apt format otherwise the reply will read "**Invalid Format**" otherwise they send the SMS thro' some other mobile, the SMS will come "Access Denied".

2.4 Update

To update one's change of address, must intimate the police department for modification, so that they will update the details about that person on their web based system which, of course, contains all the facilities to edit any information of the inhabitants with. Particularly, the option "update" on the right side of the Full map view page, makes this editing possible.

Fig-15

The software has been devised using .NET. Basic idea behind this software is that: the police personal inform the general public that if a house is locked for a specific period, they should inform the police so that they can keep a watch on the locked houses. In larger towns/ cities it is difficult to identify the locked houses and if the person informs the police through this WEB site the houses that blink on a particular day shall be monitored and this would also reduce the burglary in due course of time.

3. Concluding remarks

Burglary is becoming common in urban centers and every day there are reported cases in Tamil Nadu. It is difficult to manage this crime with the handsome police personal. People's participatory approach is the need of the hour and based on the friendly police concept, being in existence in most of the urban centers in this state, this can be controlled. This WEB-GIS solution has been developed using .NET transmits day to day information about the information provider (about their absence period) to the police department for on-line monitor and they will be able to at least locate the houses to be locked for some time

and access to overall list on that particular day and post their personal for additional monitoring during night patrols. This software has been implied for a specific ward as a sample, and this can be applied to other towns and cities for better monitoring and management, to curtail the burglary in near future.

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