

## GIS based Decision Support System for Crime Mapping, Analysis and identify Hotspot in Ahmedabad City

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**ABSTRACT:** *The rate of crime incidents is increasing in all developing countries due to change of technology and materialistic way of life and also due to poor socio, political, economic and environmental conditions. The distribution of incidents across the landscape is not geographically random since incidents are human phenomena. For incidents to occur, offenders and their targets - the victims and/or property - be required to exist at the same location for a period of time. Several factors, including the lure of potential targets and simple geographic convenience for an offender, influence where people choose to break the law.*

*GIS based Decision Support System (DSS) uses geography and analysis as an interface for integrating and accessing massive amounts of location-based information. GIS based DSS allows police personnel to plan effectively for emergency response, determine mitigation priorities, analyze historical events, and predict future events. GIS based DSS 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.*

### I. INTRODUCTION

Naturally crime does not disappear on its own. Police departments are on the duty of protecting the citizen's safety and taking precautions to minimize the risk of crime. It has long been common practice for the police to identify locations and times that are more prone to criminal activity. To reduce or completely eliminate the crime, some actions, such as crime prevention methods, should be taken. Crime prevention can be signified as a set of ideas for combating incident and includes the activities taken by individuals and groups, both public and private.

The first step of crime prevention is to analyze the current status of incidents such as determining the density or pattern of the incidents. To identify highest incident concentration areas as hotspots which are useful for prompt analysis to uncover what factors make a location a good spot for crime. Normally, three criteria that affect the occurrence of the incident are; a suitable target, a motivated offender and an absence of guardians. Besides these criteria the suitable land use and appropriate time could be added into the reasons of incidents. There is a strong relationship between land use, time and incidents. Particular areas may be devoted to different types of land use (residential development, retailing, industry, leisure, open space) and based on its land use type the activities and population profile of an area may vary considerably according to the day of the week or time of day. Social and geographic factors, such as location of schools or neighborhoods with different socioeconomic status within an area, can influence the patterns and rate of crime incidents in that area.

### II. RATIONALE OF THE MODEL

A **geographic information system (GIS)** integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts. A GIS helps you answer questions and solve problems by looking at your data in a way that is quickly understood and easily shared. The usage of Geographic Information Systems (GIS) in data storage, manipulation and display makes incident prevention process more manageable, more realistic and case specific. The results of GIS give an idea about the current status of incident pattern. Due to its spatial operation capability, GIS helps police and also other people who are interested in incidents, to visualize and analyze the spatial relationships between different data layers such as incidents and land use, to forecast and take precautions for future incidents. Crime analysis and crime maps, achieved by GIS, have a major role in reducing crime and improving the effective police activities.

With GIS, police department is able to produce more versatile electronic maps by combining their databases of reported incident locations with digitized maps of the areas they serve. GIS opens new opportunities for the use of digital mapping in incident control and prevention programs. GIS allows police personnel to make plans effectively for emergency response, determine mitigation priorities, analyze historical events, and predict future events; it helps crime officers to determine potential incident sites and facilitates to explore the relationship between incident and land use.

### **III. OBJECTIVES**

Main objective of this project is to apply spatial data analysis integrated with GIS and analyze what land uses are prone to incident and why incident is higher in one area than another. Following analysis may be generated in order to identify the incident pattern.

- **Identify** areas that may likely be targeted by an offender.
- **Determine** whether common attributes exists among a group of reported cases.
- **Explore** relationships between incident and other geographic features such as land use and the built environment.
- **Study** the movement of offenders to predict the location of future targets to establish interdiction locations along escape routes
- **Detect** whether the incident locations are clustered.
- **Determine** if incidents tend to be located close to a specific location such as taverns or gang territories or the periphery of a county or in the center.

### **IV. METHODOLOGIES**



1. **To get** Operational Knowledge/Skill of GIS Software.
  2. **To collect** Crime Data from part of Ahmedabad City.
  3. **To use** collected data in the GIS software as pilot run.
  4. **To Develop and implement** different analysis methods to achieve valuable information for crime prevention and provide to police department.
  5. **To see and analyze** the effect of Process no. 4.
  6. **To repeat** the process 2 to 4 for whole Ahmedabad city.
- To provide/conduct** training to officers of police department

### **V. APPLICATION**

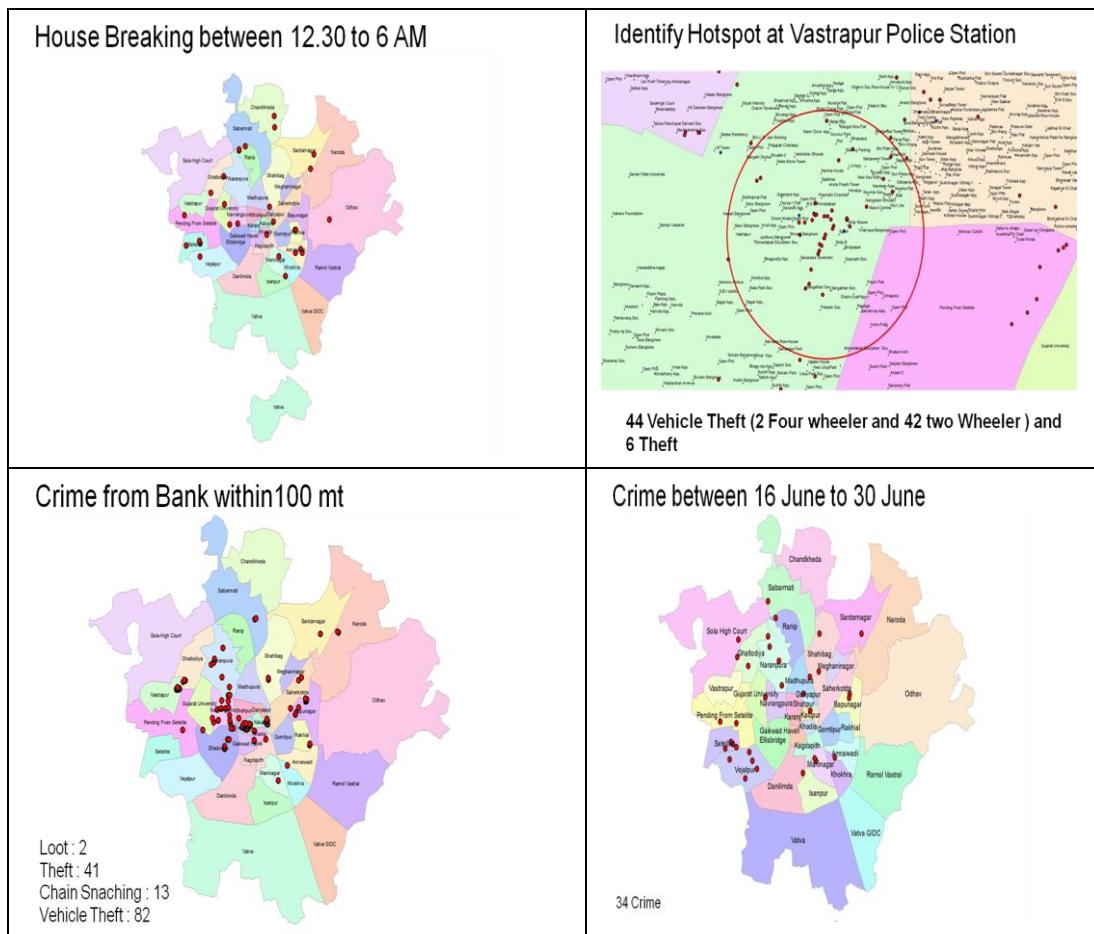
Crime data of property offenses for the period 1<sup>st</sup> July, 2011 to 31<sup>st</sup> December, 2011 were considered in the project and the same was received in the specified format. The following parameters were considered for the crime map.

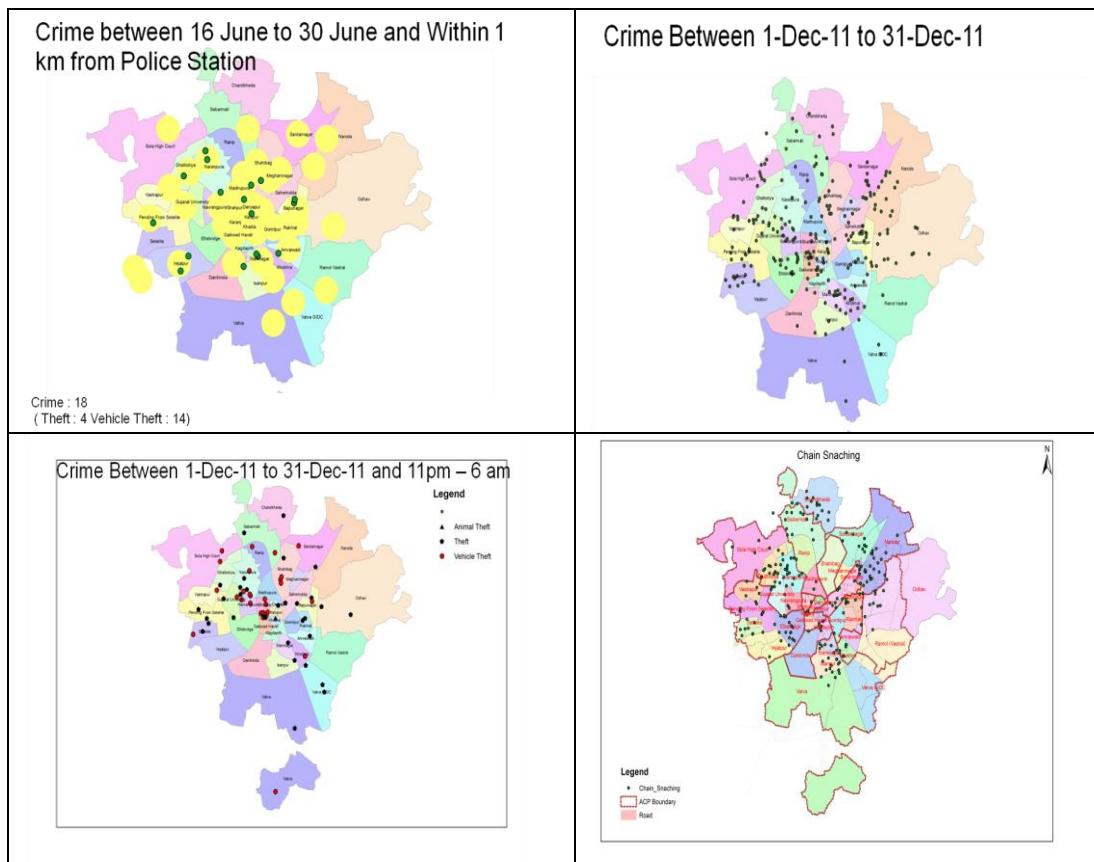
<b>1.</b>	Name of Complainant	<b>10.</b>	Name of accused
<b>2.</b>	Address of Complainant	<b>11.</b>	Address of accused
<b>3.</b>	Date of Crime Occurrence	<b>12.</b>	Number of Sector
<b>4.</b>	Time of Crime Occurrence	<b>13.</b>	Name of Police Station
<b>5.</b>	Date of Declaration	<b>14.</b>	Name of Police Choki
<b>6.</b>	Time of Declaration	<b>15.</b>	M.O.
<b>7.</b>	Place of Crime	<b>16.</b>	Type of Vehicle
<b>8.</b>	Type of Crime	<b>17.</b>	Make of Vehicle
<b>9.</b>	IPC Used	<b>18.</b>	Amount in theft

Crime data received from various police stations were not with latitude and longitude information of crime place without which crime mapping in GIS platform is not possible. To get latitude and longitude information of all crime places was very challenging and this was done with the help of detection staff of police department. In this project following all police station of Ahmedabad city were taken.

GIS based crime mapping for any objective needs the mapping of related information also which is useful always for making conclusion. All above maps include the related information for crime mapping such as sectors, zones and police station boundaries.

Following are few maps showing the results of Vejalpur Police Station crime mapping. Depending upon requirements, maps can be generated for study and analysis. Project is based on property offences only, and accordingly maps are designed. Figures show total crime map, maps with only particular IPC, map with only vehicle theft, map with type of vehicle and map with vehicle theft of particular company make etc., It also shows the theft with particular amount or more than particular amount and crimes in area centered particular point such as police station, school, temple, railway station etc.,,





## VI. CONCLUSIONS

The proposed solution is scalable to enterprise level. GIS based DSS is crucial for Public Safety and financial growth of any nation. Geo spatial technology can not only be useful for better planning but also useful for better management of assets in industries. Convergence of MIS and GIS technologies can provide near real time information resulting in efficient and effective decision support system (DSS) to help multiple areas like Health, Defense, and Disaster etc.