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MINISTRY OF
HOME AFFAIRS



Project Report

On

Predictive Policing For Women Safety

(Project No.10/MM:03)

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1. Introduction

Predictive policing is a new concept for Indian Police. Though the police in various states are already using multiple tools for data analysis, the tool suggested in the report is on the dynamically updating database with live monitoring.

Many police units are already using MySQL and Oracle databases. Some use big data storage platforms, e.g., Hadoop, to manage the vast databases and unstructured data from various streams. Therefore, there is a need for a predictive analysis tool that integrates the GIS with extensive data analysis for city/district level policing.

For the ground-level implementation of predictive policing, a need arises to either take preventive action against the probable accused or take the formal statement of the person in the police station. This can often be challenging in the democratic society of our country. Therefore, the result of the software-based model should be judiciously used with the actual field level perception of the officer on the ground; otherwise, the usage of the model can be criticized. Standard Operating Procedures (SOPs) based on the local/area-based situations should be made to prevent probable misuse of the tool.

In the past, an increasing number of police forces worldwide have adopted software that uses statistical data to guide their decision-making: predictive policing. Such information can be used by law enforcers to efficiently deploy their resources to prevent criminal behavior (Ratcliffe, 2004). However, predictive policing does not replace conventional policing methods (e.g., problem-oriented policing, intelligence-led policing, or Hotspot policing) but enhances the efficiency of these traditional practices by applying advanced statistical models and algorithms (NIJ, 2014).

Some cases in the United States indicate a reduction in crime rate through the use of predictive policing software was used, the crime rate decreases. For instance, with historical data, Richmond's police department tried to forecast where gun firing would occur on New Year's Eve in 2003 and adapted their surveillance routes to these predictions. It was deemed a success: the random gunfire decreased on this night with 47%, 246% more weapons were seized, while the police force became more efficient as \$15.000 was saved (Pearsall, 2010, p. 17).

There are, however, also indications that predictive policing may have essential drawbacks. When predictive models are enforced, crime-forecasting is not dependent on theory anymore but takes a large amount of available data as a starting point (Kitchin, 2014; Vlahos, 2012). These models might result in possibly skewed depictions of society and criminal behavior as they tend to remove context (Innes, Fielding, & Cope, 2005). The risk here is that predictive policing could result in less effective and maybe even discriminatory policy interventions.

Predictive policing applies data analytical techniques— mainly quantitative techniques—to identify likely targets for police intervention, thus preventing crime or solving past crimes through predictions through the use of statistical models and algorithms. There is a substantial body of evidence to support the theory that crime is predictable in the statistical sense, mainly because criminals tend to operate in their comfort zone. They tend to commit the type of crimes they have committed successfully in the past and have a set pattern in time and location.

For sighting the effectiveness of predictive policing and this project, an approach to implement it for women's safety, specifically in urban areas, is made. The project can

improve policing and related preparedness for future challenges. The project can help in effective man management and deployment of police resources.

2. Objectives

This project focuses on the analysis output of dynamically updating the database with live monitoring of various crime-related inputs. The objective of this project is to

- Develop a comprehensive mechanism and tool based on an integrated engine to take the data from multiple sources in multiple formats and processes and provide the desired output in a geospatial, tabular, and document format.

- To show the crime Hotspots and give automated tasks/routines to the field police vehicles.

3. Project – Purpose and Finance

3.1 Purpose

Cities must be made safer and more inclusive for women and everyone. Women and girls are victims of violent crimes and abuse on the street, public transportation, and other public places, e.g., chain snatching, eve-teasing, molestation and bag lifting, etc. A large number of crimes remains unreported due to various reasons like:

- Burking at Police Station level.
- Inhibition to visit Police Station due to perception-related issues.
- Fear of losing support from family members.

3.2 Finance

For implementing this project, computer hardware and software are needed at the police control room and the offices of supervisory officers. It is suggested that the project may first be implemented on a pilot basis in all police stations of two districts, each in six different States located in other geographical regions. Ideally, the pilot project should be implemented in States where this system of predictive policing is not functional currently.

The exact budget requirements cannot be suggested as police stations in various sub-divisions vary. However, after implementing the pilot project, the

independent agency/committee conducting the assessment of the program can work out a realistic figure to be spent for the implementation of the program.

Proposed budgetary requirements are given below to estimate the overall approximate cost of the project.

Human resources (A)

Sr. No	Designation/Post	Duties	Desirable Qualifications	Number of Resources	Number of Man Months	Cost for Each Man-Month	Total Cost (in Lakh)
1.	Senior Software Developer	Solution Designing Architecture development, Tool development	Masters is mobile applications and Expertise in Web Application and Mobile application development	01	24	1,00,000/-	24
Total (A) In Lakhs							24

Hardware/Software (B)

S.No.	Details	Cost in lakhs (approx.)
High-End Computers (Quantity-2)	10Gen, intel core i7 processor, 32GB RAM, 500GB SSD, 4GB Graphics Card, etc.	4
Open Source Data Analytics Software, e.g., Pentaho	advanced analytics, business intelligence, data management, and predictive analytics.	-
Python	Matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages	-
Big data database (e.g., MongoDB)	Provides the different ways to perform aggregation operations on the data like aggregation pipeline, map-reduce, or single objective aggregation commands	-
App Testing	Verification and validation of apps functionality	-
Open-source GIS software and hardware tools	For GIS operations, collection, analysis, and data interpretation	-
LED Smart TV 75inch	Ultra HD (4K) LED Smart TV, Purpose Monitoring, Visual Display, Real-Time Activity Dashboard	1.6
Total (B)		5.6

	In Lakhs	
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Miscellaneous (C)

S.No.	Details	Cost in lakhs (approx.)
Other Budgeted Costs	Training programs, visiting faculty charges, workshops, seminars, events hosting and participating, lodging-boarding, traveling costs, Consultancy, third party evaluation, validation, specialist experts' charges, etc.	15

Total (A) + (B) + (C) = 24 + 5.6 + 15

So, the overall cost of the project will be around Rs. 44.6 Lakh Rs.

The Central Government may spend the budget required to develop the core analytical software and customization for various states.

4. Situational assessment and Problem statement

Crime does not erratically distribute, suggesting target selection by rational means. However, routine activities create opportunities that emerge as hot spots. Hence focusing upon targets provides promising methods for prevention. Situational factors and the geography of targets analyzed for predictive policing techniques. This prediction is probabilistic and involves statistical errors, which are unavoidable.

Predictive policing models use the big data and real-time information fed into the system. It also takes care of the feedback from the human interaction and verification from the ground. Some part of these models uses standard statistical methods.

5. Predictive Policing for Women Safety

Predictive policing for women safety project as software and part of control room will provide the output of the analysis of dynamically updating the database and living monitoring of various crime against women related inputs. This output will guide the field police personnel by displaying the dynamic crime hotspots. This software will help them provide meaningful patrolling points/routines to the field police vehicles. This bundle of software will include various modules.

- GIS Ecosystem: This involves all three segments, i.e., Input, Processing, and Output. Input includes digital maps, satellite imageries, and other demographic/socio-economic/crime data. The processing refers to GIS software capable of processing big data on the fly. The output will be in dynamic crime thematic maps and vigorous routes of vulnerability/patrolling.

- Core AI engine: An AI-based integrated engine to take the data from multiple sources in multiple formats, process, and provide the desired output in geospatial, tabular, and document format.
- Mobile Applications: Input and output
 - Input: A dedicated application functional in an open domain to collect the threat score of various areas and individuals, apart from reliable application crowdsourcing data from social media platforms.
 - Output: to intimate police personnel for necessary action - As described in one example: App for scheduling daily patrolling route.
- CAD (Computer Aided Dispatch): This software will be required to schedule vehicles for action and take feedback/reports from the field.

Apart from the software part, there will be regular surveys of women residing in vulnerable areas in the field. This survey will help design the questions through which the threat score/ predictive assessment of locations and individuals will be generated. It becomes important because women, especially domestic violence and physical abuse, do not want to express/report their problems. In that case, rather than asking direct questions, some indicators for assessing domestic violence and physical abuse need to be included, which need to be figured out via a detailed survey.

6. Critical Assumptions and constraints

6.1 Assumptions

The predictive policing models are based on the data and the heuristics. The analytic element typically involves an off-the-shelf or adapted software tool that analyses historical crime data and sometimes other data such as social media, environmental conditions, etc., to predict most commonly where, but sometimes, by whom or to whom, crime will take place. This project has many assumptions, including that the data used accurately reflects reality and the future outcome is similar to the past. It also assumes that the algorithms are neutral and without any bias. The omitted variables are believed to be ineffective in the analysis. This also considers that deploying police patrolling will reduce crime, and the place/location is more important than the person.

6.2 Constraints

For the actual ground-level implementation of predictive policing, one needs to either take preventive action against the probable accused or take the formal statement of the person in the police station. This can often be challenging in the democratic society of our country. Therefore, the result of the software-based model should be judiciously used with the actual field level perception of the officers and local leaders on the ground; otherwise, the usage of the model can be criticized. SOPs based on the local/area-based situations should be made to prevent any misuse of police action.

7. Implementation strategy

To implement predictive policing, a computer data center with a command-and-control room needs to be set up. Training policemen and women on this software will be required, and convergence of various databases will be required. Many databases, including FIR data, criminal crime record data, social media inputs, online/offline application data, CCTNS databases, and news databases, will have to be added to the master database of the predictive analysis tool. These types of convergence of databases are already implemented in many police units/branches to detect already occurred crimes. Now for the next generation of policing, we need to equip our policemen and women on the field with the latest information.

Predictive policing can be very useful due to the pervasiveness of the computers in the police department. These models can be efficiently and effectively implemented. In addition, police departments have big data, which can strengthen these models during day-to-day use. Using these models will help our police to become more proactive than reactive.

Phase – 1 Crowd Sourcing of Data

There is a need for a tool that enables cities to become safer by collecting data through crowdsourcing and other methods. We need a tool to assess different parameters linked to safer and more inclusive public spaces. Many

models of crime mapping work on the three parameters obtained from the registered crimes. Input must be obtained from other sources to make the predictive model better. In many areas where women and girls cannot give information via the internet, trust points should take their data and send it. For this purpose, GIS maps can help locate the place with precise GIS coordinates. National Geoportal developed and hosted by ISRO comprising of Geo-Spatial Data, Services, and Tools for Analysis has many versatile features, for Example (1) Visualization of Satellite Imagery and Maps (2) Analysis (3) Free Data Download and (4) Download Reports to name a few.

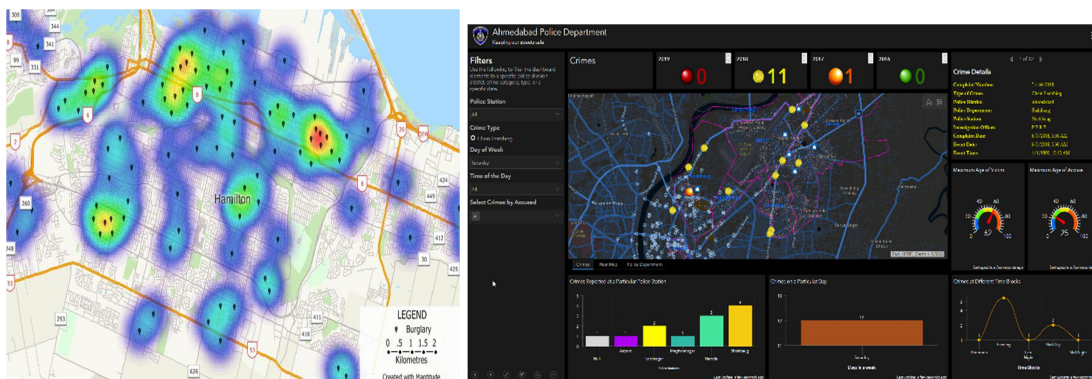
Girls/Women will not be required to come to the police station to give any less severe information but enough to discomfort them. Therefore, we need a technical framework to confide online/offline. She should be able to give her feedback with confidentiality. Inputs may come via social media, e.g., Facebook, Twitter, or a dedicated portal for receiving information. There is a need to treat every person as a sensor and provide valuable inputs.

FIR data from CCTNS will be added to this software to map crime based on the location. In addition to the CCTNS database, data sources will also be added to the database.

- a. Criminal incidents reported on ERSS 112/100 Dial System
- b. Traffic Offences Data of Online Challan Systems
- c. Face Analytics, ANPR outputs from CCTV Video Feeds
- d. Social Media Posts related to crime
- e. Crime Reported in Online Newspapers

Phase – 2 Identification of Hot Spots and Cold Spots through data inputs

These are the places where street harassment, stalking, harassment, and bullying complaints. These places can be secluded, but mostly, these are crowded places. The location of these Hot spots changes dynamically. Criminals work in limited space, and crime does not shift dynamically. The arrest of the molester reduces Hot Spot to Coldspot. Cold Spot may also become a Hot spot.



Phase – 3 Establish Physical Trust Points

Accurate information gathered in one-to-one interaction by women volunteers at the grassroots level in lower-income areas is very important. The role of NGOs and Social workers is essential in this way of data collection. These girls/women

have a sense of responsibility and can give clues of precursor to crime. Moreover, accurate information will strengthen the prediction model.

Phase – 4 Automation of Patrolling Planning

Resource planning generates prediction and crime mapping reports before every duty shift. Automation in patrolling by receiving daily route of patrolling. Visit Hotspot and read the signs of trouble. Give feedback in the mobile App. Seek input from the trust point if Hotspot turned into Coldspot. Then visit the new Hotspot or keep on patrolling regularly.

Phase – 5 Development of Mobile Application

1. Input: A dedicated application functional in the open domain to collect the threat score of various areas and individuals, apart from dedicated application crowdsourcing of data from social media platforms, must be implemented.
2. Output: to intimate police personnel for required action - As described in one example: App for scheduling daily patrolling route

Phase – 6 CAD (Computer Aided Dispatch) to schedule vehicles for action

A survey of women residing in vulnerable areas will help design the questions through which the threat score/ predictive assessment of areas and individuals

will be generated. It becomes important because women, especially victims of domestic violence and physical abuse, do not want to express/report their problems. In that case, rather than asking direct questions, some indicators for assessing domestic violence and physical abuse need to be included, which need to be figured out via a detailed survey.

7.1 Deliverables

Date	Deliverables
Zero-day	Problem definitions presentation
One month	Project proposals for identified problems
One year	Complete procurement of required hardware, software, services and hire a qualified team
Six months	A monthly presentation about the progress of the project
Six months	Presentation on product and integration
Three months	Final Handover

7.2 Stakeholders

1. Government – State Government, more specifically the state's home department, is directly involved in the project's functionality and the implementation of findings.
2. Police – Data collection from various sources, analysis, and implementation in the predictive policing model. Police will be the end-user of the tools and apps developed from this project.
3. NGO – Non-government organizations working for women's safety can also be intricate for implementing the project.

7.3 Related Projects

In Delhi, Police are using CMAPS (Crime Mapping Analytics and Predictive System) software using the data from the 112 helplines under ERSS (Emergency Response Support System). The police use data from the thousands of daily calls made to emergency helpline numbers to map crimes and generate insights from the process. Predictive policing starts with collecting large amounts of data on past crimes and co-relating them with present crimes. CMAPS, Delhi police's crime mapping, and predictive software are integrated with Delhi Police's new software and allow the information generated through Dial 112 to be plotted on a geospatial map of Delhi, and the gathered data is analyzed. The software looks for patterns and correlations in past crime data.

The algorithm predicts where and when a crime will likely happen in the future, and Predictive Maps are built. Based on the possibility of the crime, police add or redeploy resources during a specific period to prevent crime. In the area, overall surveillance is increased. In one instance, 200 calls were received within 10 minutes about rumors of violence in one district. This prompted the control room and local police to mobilize their force in big numbers and controlled situations in an hour. In Telangana, Hyderabad Police is using Geospatial Technology for crime prevention. It uses Periodic Geospatial and Temporal analysis on multi-dimension factors to derive crime patterns and trends. The study helps as a Decision Support Tool to fine-tune the Proactive / Predictive / Visible policing strategies. Police Vehicles (2 & 4-wheeler) patrol on a 24x7 basis based on the crime patterns and trend analysis in each police station jurisdiction. They are also using Traffic Data analysis with Periodic Geospatial and Temporal analysis on multi-dimension factors to derive traffic & accidents patterns and trends through co-relation analysis.

7.4 Workplan

- Issue of advisory by GOI to State/UT governments
- Issue of GO by the state government.
- Sanction of budget GOI/State Government
- Issue of Standing Orders and appointment of Nodal Officers by DGPs
- Meeting of Nodal Officers

- Organizing training of police station staff
- The actual implementation of the project
- Gathering of data from various databases.
- Statistical validation to analyze big data.
- Plotting of crime patterns on GIS-based map
- Creation of an automated schedule of patrolling vehicles
- Continuous monitoring and review by the state's Nodal Officer
- Laying down judging criteria for internal and independent evaluation
- Annual evaluation and audit by an external agency/committee constituted by the State/MHA/BPR&D

Conclusion

As a famous quote goes, prevention is better than cure. In the present scenario, one cannot deny the need for a GIS-based business intelligence tool to predict crime. Hotspot and predictive policing strategies make it possible to distribute limited policing resources efficiently and help police departments to achieve crime rate reductions. Data analysis will lead to prediction, which allows the Decision Support System to improve work efficiency. There will also be a Mobile App for data collection from citizens and a Mobile App for the special teams consisting of policewomen working in the field. Once the police vehicle starts intensive patrolling based on the input of the predictive policing tool, the Hotspot may turn into the Coldspot. It may happen due to the actual arrest of the offender

or the change of the offender's location due to the increased police presence. When the field officers give feedback into the software, they provide the next task to visit another Hotspot in their jurisdiction. Predictive policing is the future of policing all over the world. Police have access to various databases, but they remain in their silos. These big data need to be used productively by analyzing and generating business intelligence.

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