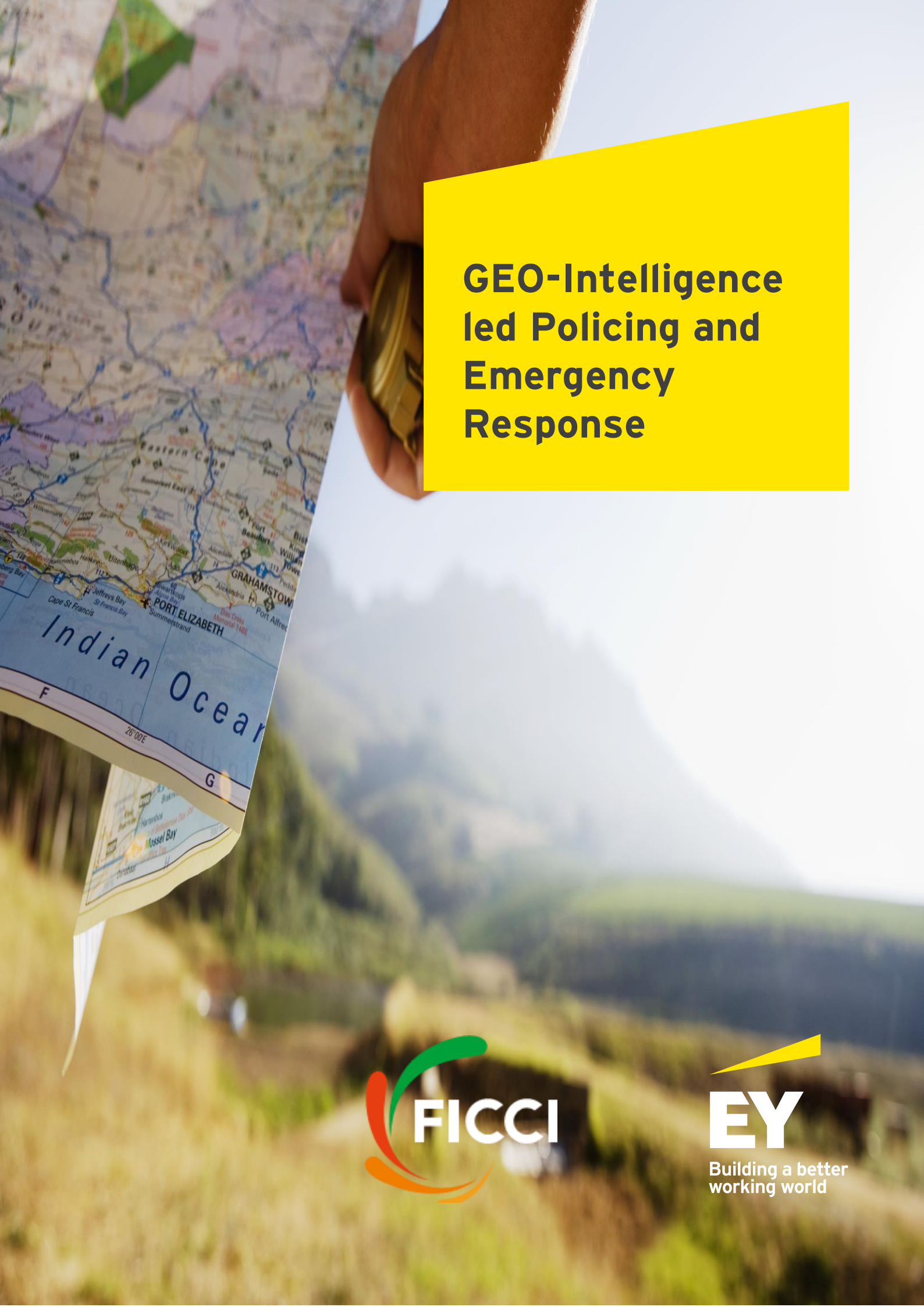


GEO-Intelligence led Policing and Emergency Response

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Executive summary



1 Executive summary

Geospatial technologies primarily refer to the wide range of modern systems that contribute to the geographic information mapping and analysis of the information for various purposes. With the development of technology, these systems have evolved into tools for national security, scientific research, and are complemented by commercially operated satellites and powerful desktop GIS.

Today with help of technology - that includes state of the art Digital Mapping solutions, analytics tools and complex processing algorithms; it is possible to add context, timing and location data to raw data thus creating rich and interactive maps that can provide actionable insights to the law enforcement agencies. These maps can be designed to hold multi layered data and can show changes over time along with the location details. The fast paced advancements in GIS technologies and the proliferation associated applications that can essentially combine the large variety of geo-spatial data have made it really suitable for police and law enforcement departments to leverage the GIS capabilities effectively. GIS enabled tools can also help agencies to share and take advantage of satellite images, building floor plans, street network plans, census and utility data. Additional benefits from live data feeds such as video cameras and weather department can also be analysed in an integrated manner for effective security management and law enforcement.

This paper identifies certain key areas where geo-spatial technologies can make significant difference to the way policing and law enforcement happens in the country. These areas include Crime analysis, Predictive Policing, Emergency Response and Public safety, Workforce management and Prison & Parole management

Crime mapping and spatial analysis using GIS tools such as hot spot generation, zonation, navigation, and mobile location identification are already well recognized techniques and can be scientifically applied for enhancing the safety and security scenario for citizens.

Geo Intelligence led solutions can also be effectively used for prediction and control of crime. Crime analysts have employed a variety of statistical modelling techniques to help detect patterns, trends, and interpret hot spot map data. These techniques range in sophistication from simple to complex and in their potential for being applied across crime categories and regions e.g. Geospatial analysis, regression analysis, time-series analysis, risk terrain modelling etc. Instead of simply following a reactive approach towards handling crime and criminals, law enforcement agencies are now able to be more proactive in their crime analysis. With the forecasting capabilities of predictive policing software, agencies may be able to deploy personnel more effectively, expand their range of crime prevention strategies, and change the environmental conditions that give rise to crime. Predictive policing combines law enforcement expertise with a specialized policing strategy/tactic that develops and uses information and advanced analytics to enable forward-thinking crime prevention. The final goal of predictive policing is to reduce crime and enhance public safety.

Geospatial technologies such as GIS can play a vital role in workforce management as well. Using this capability, heads of respective Police Departments can ensure more effective resource planning and deployment of adequate manpower at crime hot spots by analysing systems and resources on visual maps with integrated data pertaining to different relevant aspects.

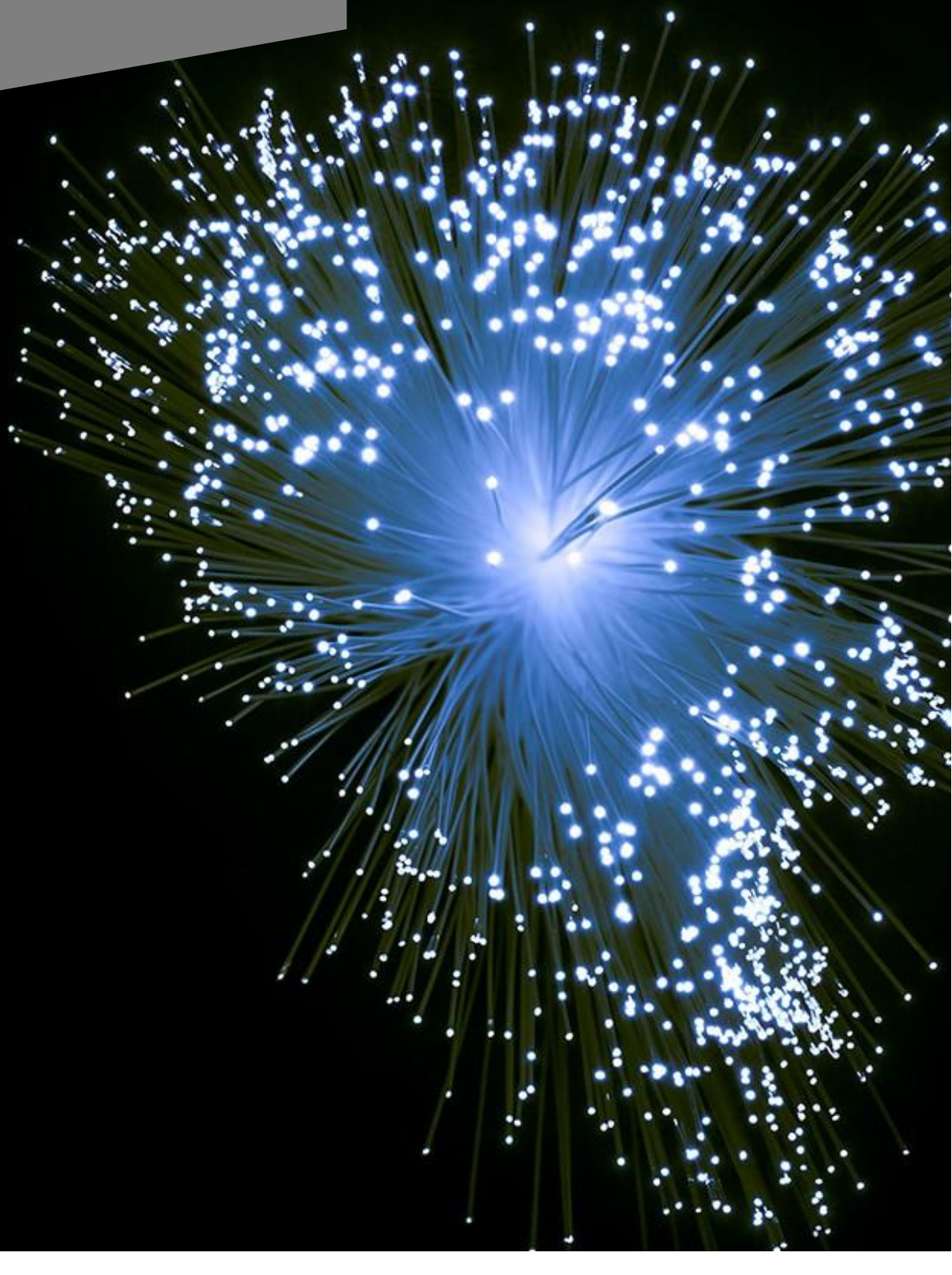
Geospatial data has great potential for being a valuable analysis and investigation mechanism for Prison authorities. Such data can help the Prison officers to gain an understanding of the dynamics of prisoner population and also ascertain potential security threats even before they actually happen. The Prison authorities can effectively use a map of the prison complex as the base map that can have address locations pin-pointed as housing units, individual cells and other discrete locations in the complex

Emergency response personnel often need details to analyse and interpret actionable insights from various sources. By embedding data from different departments onto GIS maps, the data can be more readily processed by the emergency response and public safety personnel else the emergency workers have to access multiple systems which will require multiple accesses across various departments, for their unique map and data, thus slowing down the response time. This is equally important during the incidents of mass terrorist attacks, public unrest etc. Using GIS tools, officials can pinpoint hazards and begin to evaluate the consequences of potential emergencies or disasters. GIS tools can also help agencies to efficiently plan, mitigate, prepare, respond and recover with alacrity.

Government guidelines also play an important role in ensuring that the GIS and Telematics solutions are effectively used for providing safe and secure transit for the citizens e.g. the draft standard AIS-140 is basically an Intelligent Transport System that is a new addition in automotive industry standards and guidelines for vehicle tracking system, camera surveillance system and emergency request button. In order to be compliant to the AIS 140 guidelines, each passenger carrying bus will need to have GPS tracking system, cameras along with an emergency button.

This is meant to ensure that the concerned authorities are able to track the public transport in case of an emergency. This shall also allow the passengers to inform the control room of any kind of catastrophe or other emergency. It also specifies that emergency buttons can be placed anywhere in the vehicle and can be easily accessed by a passenger. Both the existing as well as future vehicles would need to have GPS and emergency buttons. Along with this, the vehicle health monitoring systems in future would also need to be configured and integrated with these systems to ensure a safe transit experience for citizens.

Introduction



2 Introduction

Geo-spatial technologies are primarily referred to the range of tools that are used for geographic mapping and analysis in a wide variety of application areas like Emergency Response, Health, Crime Mapping, Crime prevention, weather alerts etc. Systems with large computing and processing abilities led to the storage and transfer of images from satellites to user systems. Also, the concomitant development of corresponding software for analytics, development of subsidiary maps and collation of complex data sets on geographic, demographic, socio-economic and environmental phenomena have collectively helped development of the Geographic Information Systems (GIS).

One of the most important features of GIS is its capability towards assembling a large range of geospatial data into a layered set of maps that allows complex themes to be analysed and then communicated to wider audiences. This layering is facilitated due to the presence of data that includes details on an entity's precise location/coordinates on the surface of the Earth, thus leading to the term 'Geo-Spatial'. There are now a variety of types of geospatial technologies which have application across wide range of domains, including the following:

- Remote Sensing: capturing of image and collection of data from space or airborne camera and sensor platforms
- Geographic Information Systems (GIS): It is a system designed to capture, store, manipulate, manage, analyse, and provide all types of geographical data in a visual format usually on a map. The key term to this technology is Geography – meaning a portion of data is spatial in nature i.e. data is some way referenced to places / locations on the earth
- Global Positioning System (GPS): is a satellite navigation system used to determine the object or human position on the ground
- Internet Mapping Technologies: Software tools with Internet mapping technologies have the potential of changing the approach through which geospatial data can be viewed and shared. The intuitive user interface design is making these technologies available to a bigger audience.
- Satellite Imagery: Satellite imagery allows the analysts to assess the atmospheric changes as they give an accurate description of the events unfolding at a fast pace
- Telematics: Telematics is a general term that refers to any device that encompasses telecommunications and informatics. Telematics includes anything from GPS systems to navigation systems. Telematics enables wireless data communication to control the distant objects and opens up a huge range of possibilities

With the development of technology, these Geo-spatial systems have evolved into tools for national security. In addition, aerial remote sensing platforms, including unmanned aerial vehicles are also contributing to geospatial technologies that can be leveraged for security and policing applications.

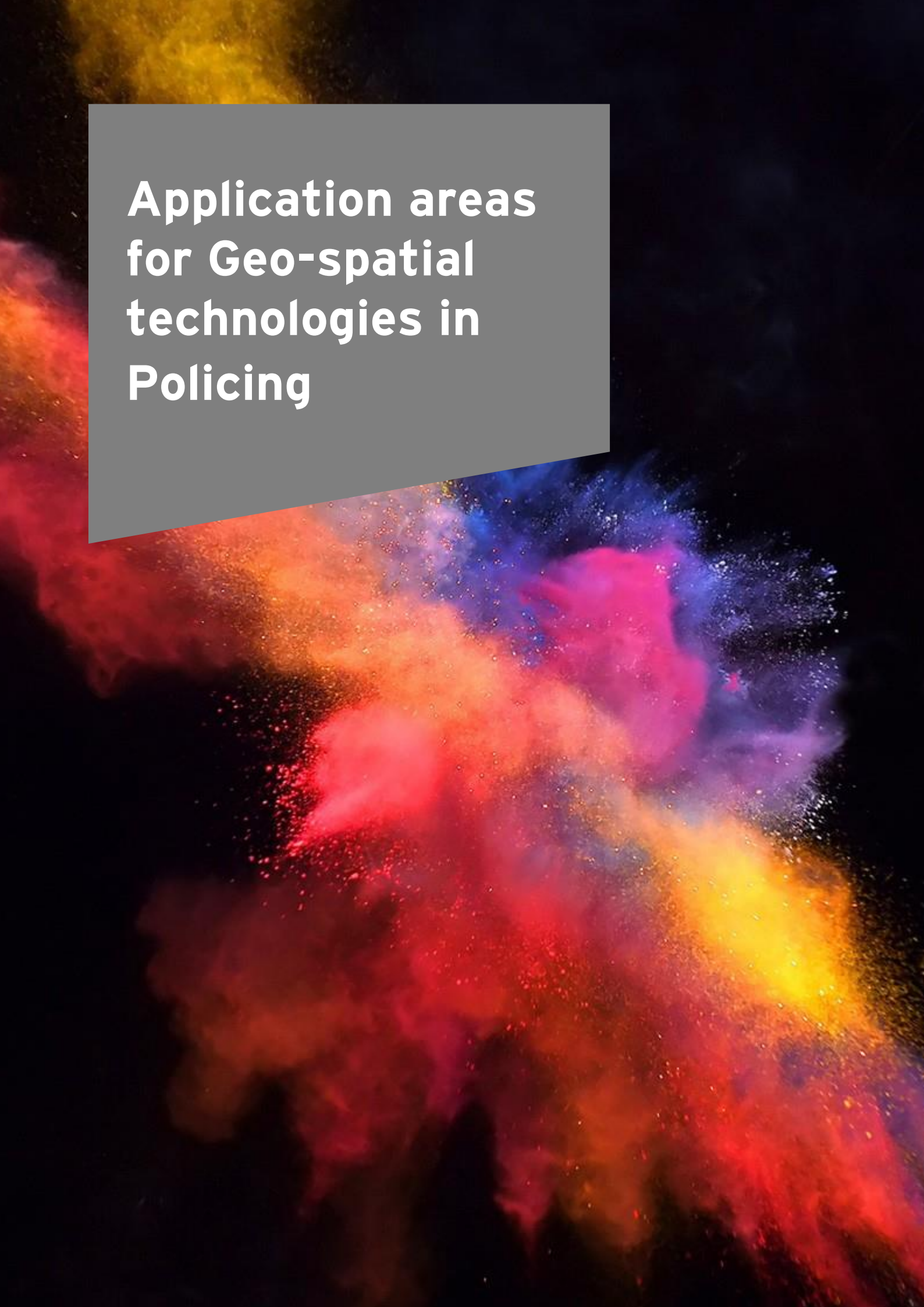
The security and Law Enforcement Agencies in any country have almost analogous requirements from a GIS solution:

- Planning and Analysis
- Logistics management
- Command and Control
- Operational Support including Workforce management
- Outreach to the citizens

This paper aims at exploring the various application areas for Geo-Spatial technologies in the safety and security domain in the country. The key application areas where Geo-spatial techniques are being effectively utilized by the law enforcement agencies around the world are:

1. Crime analysis
2. Predictive Policing and reduction in cost of crime
3. Emergency Response & Public Safety
4. Workforce management
5. Prison and Parole management

Each of the above application areas has been explored in terms of the key solutions, how they have been able to assist the law enforcement agencies in addressing the challenges with erstwhile traditional methods of policing and how they can be further enhanced to ensure efficient and effective management of their resources.



Application areas for Geo-spatial technologies in Policing

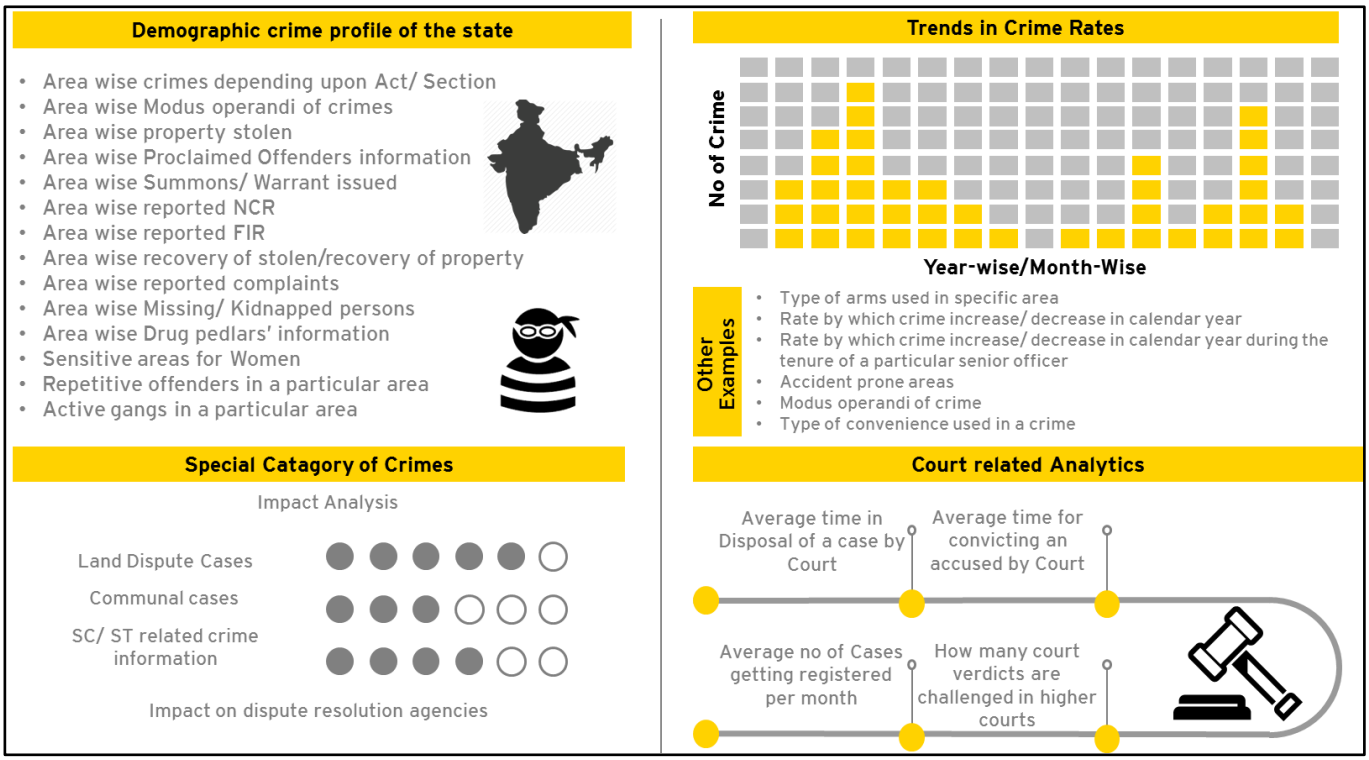
3 Geo-spatial technologies : Application areas in the Policing domain

3.1 Crime Analysis

The collection of crime-related information/data to identify patterns with the goal of understanding, predicting and empirically explaining crime and criminality is crime analysis. Creating tactical and strategic deployment for criminal justice personnel is an important outcome of such an analysis. Although crime analysis is being regularly used by law enforcement agencies, its development and utility can also be found among the works of social scientists particularly in the field of criminology. Over the years they have been constantly using multiple crime analytic approaches to study crime and to assist law & order agencies to take an informed decision.

Locating and collecting information to be analysed is an essential and often time-consuming process for crime analysis. Crime analysis involves identifying patterns from large amounts of seemingly disparate pieces of information. Computerized and automated forms of data can be a convenient and abundant source of data for this purpose. The most commonly used forms of computerized information collected for the purposes of analysing crime are police calls for service, computerized records of written police reports, and computerized records of arrest. These three sources are most widely used by police analysts and criminologists when attempting to formulate crime patterns, predict criminality, or develop crime prevention schemes.

But over the years crime agencies across the nations have realized that this analysis still remains traditional and many facets of the analysis are being ignored to this date. Below is the sample analysis done using NCRB reports:



Challenges being faced by law enforcement agencies

Over the years law enforcement agencies have faced severe challenges in churning out valuable information from the data collected. Few challenges are mentioned below:

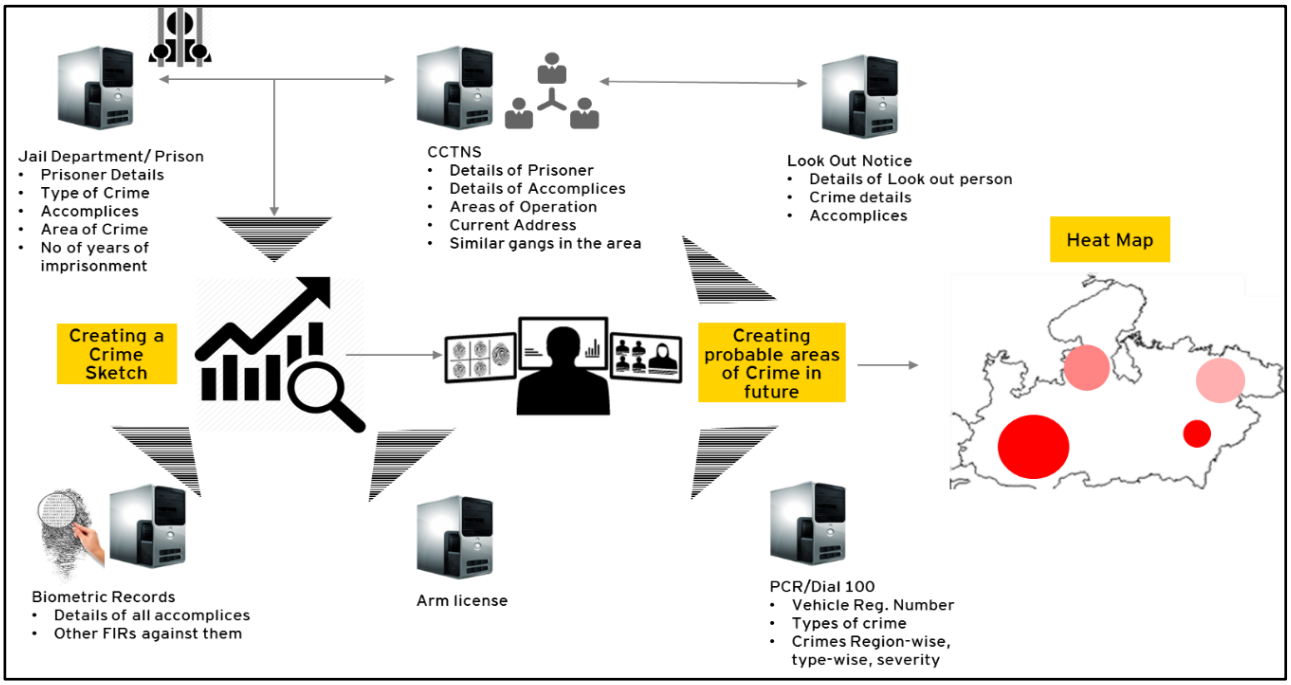
- Validity of the information getting collected
- Getting information on organized crime that is empirical in nature and comes only from the law enforcement units/ agencies
- Analysing the unstructured data creates huge problems. This type of data makes it impossible to understand the context of incidents or crimes which is vital to investigations
- Data sharing among various departments
- Authenticity of the data being shared
- Non-availability of information required
- Integration issues among databases of various law enforcement agencies

Role GIS can play in improving Crime analysis

Using GIS helps in breaking down the data barriers and integrates multiple systems to present a complete picture—using geography. Analysts/ Law enforcement agencies and criminologists can derive meaning from data, using location as the foundation for sophisticated analysis. GIS provides analysis beyond the traditional tools by providing the analyst a means to deliver data, maps, and analytical products as online maps and apps that can then be shared with all departments for meaningful action. GIS can be typically used for the following analysis:

- Predict crime through story mapping and trail identification
- Create incident maps and heat maps with incident recurrence
- Analyse cell phone data patterns and linking with geo-locations
- Identify risk factors including businesses, buildings, or other locations that draw crime
- Resource deployment after analysing crime trends over time
- Assign crime abatement teams to address regional or seasonal hot spot locations.

A typical GIS heatmapping of crime in a given state that also assists in forecasting and preventing future crimes is as given below:



3.2 Predictive Policing

As the law enforcement agencies globally understood the benefits of utilizing Geo-Spatial technologies, a new scientific approach known as "Predictive Policing" was developed. Predictive policing is primarily the usage of analytical techniques, specifically the quantitative techniques to identify the most probable areas for urgent police intervention and to prevent crimes or help solve crimes using the statistical prediction and processing capabilities. Predictive policing focuses on harnessing the power of geospatial technologies with a combination of information processing capabilities and evidence based police response models to do crime analysis, detection and prevention. As per Andrew Ferguson, an American Journalist and author, patterns of crime are a "function of environmental factors that create vulnerabilities for victims and spaces at certain times". The basic premise of predictive policing is that crime is not necessarily distributed randomly across places and people but has a set pattern. Thus, instead of simply relying on an investigation officers approximations, this method relies on actionable intelligence derived through the power of analytics.

Predictive policing doesn't intend to change the traditional police investigation and analysis methods but puts a focus on usage of advanced analytics on huge and diverse sets of data from multiple sources in conjunction with the existing response models to help forecast and prevent crime.

Currently there are four methods to forecast crimes:

1. Predicting the time and place with increased risk of crime
2. Predicting potential future offenders
3. Predicting individual or demographics most likely to become victim
4. Creation of profile for past crimes

Benefits of predictive policing:

Predictive policing method significantly changes the response mechanism from reacting to crime to predicting the likelihood of crime and deploying resources to mitigate crime. This approach to policing leverages the existing traditional approach by enhancing their capabilities in intelligence led policing, community led policing and hot spot policing.

This capability has enabled practitioners to perform more sophisticated analysis, gain a better understanding of the factors underlying criminal behaviour, and provide better forecasts of where and when crimes may occur. It harnesses the analytical models and modern computing power to anticipate crime events and provides with actionable intelligence. Predictive analytics can focus on variables such as places, people, groups or incidents. Furthermore it can also assist in analyzing demographic trends, parole populations and economic conditions that may affect crime rates in particular areas. Using models supported by prior crime and environmental data, can help police reduce the number of crime incidents.

Crime anywhere in the world creates huge costs for the society at national, community and individual levels1. It is extremely important to estimate the cost to society of different crimes as it also helps in economic evaluation of many social programs. GIS has great potential in reducing the cost of crime. For instance, in the US2, property crimes against citizens are fewer and lower in value than automobile crimes that traditionally include stealing a mobile, wallet or bicycle worth few hundred dollars as compared to typical automobile crime involving vandalism or theft costing a few thousand dollars. These crime costs can be significantly reduced through an effective usage of GIS solutions e.g. predicting the crime hot-spots and increasing police patrols in those areas, swift and accurate response to acts of vandalism and thefts

[1] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2835847/
[2] https://www.planetizen.com/node/65857

Role GIS can play in future:

- **Better Allocation of Resources:** With police force constantly being overburdened with work, it reduces the overall efficiency of workforce utilization. Through analytical models like hot spot analysis, risk terrain analysis and near repeat theories, predictive policing would enable law enforcement agencies to identify individuals, location and workforce required for targeted policing.
- **Preventive Policing through holistic analysis:** Predictive Policing offers the opportunity to the law enforcement agencies to pre-emptively act against predicted crimes by focussing on crime-prone areas and individuals at the risk of engaging in crime or being targeted. If crimes can be forecasted and prevented before they are committed, it will help in sustaining the social and economic value of not only those who can be a probable victim of the crime but also for the offenders.

Case studies[3]

Arlington, Texas

Criminal Activity: Burglary

Analysis: Residential burglary data was used to map crime hot spots in the city and then compared the hot spots to locations and infrastructure with reported code violations, which included broken windows, abandoned cars, and even graffiti. It helped the department establish a positive co-relation between residential burglary and code violations; The Department was thus able to initiate a collaborative crime prevention exercise amongst themselves and other agencies to efficiently utilize their resources.

With the help of specialized analysis tools, the data so gathered from various sources helped the Department to examine the relationship amongst neighbourhood physical deterioration and crime. As we are aware that a large number of code violations are generally associated with a deep rooted social disorganization, Police Department, Arlington devised a formula for identifying traits of a "fragile neighbourhood." Thus, the police department of Arlington and other nearby city law enforcement agencies are now able to apply resources efficiently to these fragile neighbourhoods, ultimately preventing crime.

Santa Cruz, California

Criminal Activity: Auto Theft

Analysis: Historical crime data was used in conjunction with a predictive policing solution with a statistical algorithm that was then used to map auto theft hot spots. This exercise helped identify the likely time frames and high-risk locations for auto thefts in future that included a downtown area that even consisted of a parking structure. As a result, officers were directed to the area, where they arrested suspects who were suspiciously loitering around cars in the parking structure.

The Santa Cruz Police Department enhanced the predictive policing solution sets that were initially in an experimental stage into full scale operations 2012. Thus, in addition to handling the cases of Auto theft and property theft, the system can now be utilized for gang fights/activities prediction and street crimes for enabling quick response by the department.

Additionally, the predictive policing system has now been automated. During initial deployment, only 10 maps were manually generated with the predictive algorithm's crime hot spot findings on a daily basis. As on today more than 15 maps are generated, while supervisors can now log in to the system before the briefings with a list of predicted crime locations. This information is accessible online by any officer while refresh of data is done hourly thus providing users statistical views in real-time.

[3] https://www.dhs.gov/sites/default/files/publications/GIS-Predictive-Policing-AppN_0813-508_0.pdf

3.3 Emergency Response

The various phases of emergency management involve data gathering from numerous sources which sometime becomes very difficult to collate and interpret at the time of emergency. During the time of emergency it becomes essential to have the right data, at the right time, displayed logically, in a unified format, to respond and take necessary actions on the basis of criticality. Emergency response personnel often need details to analyse and interpret the actionable insights that needs to be implemented.

Challenges in traditional methods of providing emergency response to citizens:

- Lack of availability of data at one place to provide emergency response
- Lacks efficiency and routes optimization in the existing system
- Loss of valuable time in reaching emergency response
- No historical data pertaining to geolocation to ascertain or predict the nature of risk
- Lack of co-ordination between multiple departments to quickly send a response team
- No real-real time monitoring tool

Emergency response management using GIS across various stages

1. **Planning**
   Effective emergency management programs begin with identifying, locating and prioritizing the potential emergency problems. Using GIS will assist in defining and evaluating the consequences of potential emergencies and crisis situations. GIS helps in formulating the efforts required across the emergency stages by providing appropriate combinations of spatial data through computer-generated maps.

2. **Mitigation**
   During the time of emergency, it is of a high priority to identify the mitigation needs and deploy necessary actions to prevent and control the situation. GIS helps in prioritizing the risk on the basis of its criticality, so that highly critical situations can be quickly identified and targeted for protective action.

3. **Preparedness**
   Preparedness involves activities that trigger emergency preparation and deployment during crisis situation. GIS can display real-time monitoring for emergency early warning. This further helps in forecasting the resources requirement that may arise on the basis of level of emergency. E.g. GIS solutions now assist the NDMA (National Disaster Management Authority, Government of India) to be better equipped in responding to Disasters with effective planning, mobilization and monitoring of relief teams.

4. **Response**
   During an emergency, GIS will display the real time location of forces deployed in the situation along with the task assigned. This will allow the emergency response team to navigate and coordinate flexibly in the situation which will reduce the overall crisis response time and improve efficiency

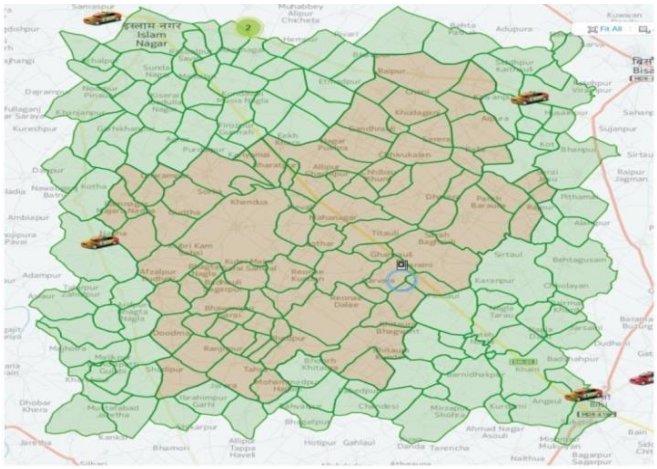
Solutions/strategies for Emergency response worldwide consume geospatial tools/ technologies & systems. Not only GIS but mapping solutions contribute to emergency response significantly. GIS helps in bringing different nature of information available with various Govt. depts. (and also in public domain in select cases) to a common platform (without sharing the data physically) which is essential for authorities to take appropriate decisions and for field forces to implement the strategy in real time.

Case study: Uttar Pradesh (UP 100)

For UP 100, Digital map of all village boundaries were collected. Each village was mapped onto the correct police station jurisdiction and integrated in GIS applications. The GIS application was able to identify police jurisdiction at any point of time with accuracy. With participation of more than 11,000 users from more than 1500 police stations, 1.5 million point of interest have been integrated with digital map of UP100. As and when the emergency alert is received, nearest police department would take action at the quickest possible time. Thus ensuring the safety of citizens.

यूपी 100 UP

आपकी सेवा में सदैव तत्पर







- Digital maps of jurisdictions of all police stations in the state
- State-wide massive exercise conducted
- Digital map of all village boundaries collected: 1.07 lakh approx. from NIC. Then mapped each village onto the correct police station jurisdiction
- Boundaries of urban police stations were mapped with the help of GIS application.
- Capability to identify police jurisdictions of any location on the ground with accuracy
- An Android app for GIS data collection was developed.
- Between August and October, 2016, with participation of more than 11,000 users from more than 1500 police stations, approximately 2.8 million points of police interest were captured. After screening, about 1.5 million POIs have been integrated with the digital map of UP100.

GIS in conjunction with Telematics can further improve the effectiveness of Emergency Response Systems. Telematics assists in controlling vehicle operations while relaying information about its' location and status. These systems function in tandem with each other to exchange information between vehicles on the road (Police vehicles, Ambulances and Fire Engines) and a central command and control center. Telematics together with GIS solutions enables the personnel at the Command Center to dispatch right resources at the right time at the right place. Since Telematics empowers them to have a clear visibility of resources on the field, the dispatchers can quickly dispatch the best asset to the incident.

AIS-140: Draft Standards on Intelligent Transportation Systems (ITS) - Requirements for Public Transport Vehicle Operation

Based on the directions given by Government of India, the AISC Panel on Intelligent Transportation Systems prepared the draft standard AIS-140 titled, "Intelligent Transportation Systems (ITS) - Requirements for Public Transport Vehicle Operation. The Communication Protocol and Backend Control Centre requirements for tracking and handling the alerts ensure that the vehicle location is seamlessly transmitted to the control centres. AIS-140 is basically an Intelligent Transport System that is a new addition for automotive industry standards.

The intelligent transport system (ITS) is a much needed requirement of the world of vehicles. The vehicles on the road are increasing daily and therefore there is a need of a government guidelines which specify the emergency and safety standards that need to be implied in all kind of public transport systems. These include all kinds of rail, road, air and water transportation modules to be fitted with AIS-140 GPS devices.

There are two kinds of AIS-140 requirements in a GPS device – emergency button and vehicle location tracking.[4] The AIS-140 guidelines specify that emergency buttons can be placed anywhere in the vehicle but should be easily accessible to the passenger The devices equipped with AIS-140 GPS devices would transmit data to the Backend Control Centre using 2G/3G/4G wireless connectivity (with SMS fall back) as per the protocol defined in the draft standards

- The data from the devices would travel over the wireless telecom service provider network and finally get delivered at the Backend Control Centre
- Each vehicle is also expected to have provision for video surveillance (two or four cameras), search and retrieval system.

Location information using the GNSS with due support from GPS-aided GEO augmented navigation (GAGAN) is also required to be installed in the vehicle with the internal antenna.

3.4 Workforce management

Workforce management includes all the activities needed to maintain a productive workforce and is needed by all law & order agencies for effective resource deployment. Activities include scheduling, deployment of personnel, performance management, time and attendance. It is about assigning the right security (police) personal with right skills to right geolocation at the right time to render the service to citizen.

Geospatial technologies such as geographic information system (GIS) can play a vital role in police (security) workforce management.

GIS technologies can play a major role in decision making for the deployment of forces at a particular location. The Geospatial solutions enable capturing real time status information, allowing dispatchers and technicians to communicate in real time.

The use of Geographic Information System (GIS) for crime mapping facilitates visualizing, and analyzing crime heat maps, along with other trends and patterns. GIS uses geography and computer-generated maps as a boundary for integrating and accessing large amounts of location-based information. Key activities of workforce management using GIS include:

- Field visit for general supervision
- Crime Investigation visit
- Route optimizing
- Route tracking of the concerned officers
- Work scheduling/ Time schedule
- Police vehicle tracking
- Real-time tracking of location of the force
- Attendance management
- Human Resource management
- Asset Management
- Reporting etc.

Key areas and challenges of Workforce Management in Security:

- **Time & Attendance Tracking**
  Typically time tracking & attendance is paper based, with employees manually signing in and out, thus making it open to errors and inaccuracies.
- **Scheduling**
  Within workforce, there are different shift patterns requiring police personnel to be scheduled for different parts of the day and at different locations. Paper based scheduling is becoming increasingly inefficient in the modern workplace.
- **Deployment of police personnel**
  Police force comprises of many sub-divisions or wings and the need to deploy the police personnel to respective police wings is important. Paper based mapping of personnel to wings or sub-divisions is time consuming and also inefficient in the modern workplace.
- **Tracking of police personnel**
  Without any monitoring device, it is very difficult for the police organisation to monitor or track the movement of the police personnel on field. This is major concern in providing satisfactory police services to citizen as it allows the personnel to evade his/her accountability.
- **Patrol Management**
  Monitoring of patrol force and route optimization is a difficult task without an integrated platform. Also, managing or reassigning of the patrol services for unforeseen assignments without a live monitoring leads to loss of valuable time to reach the location.
- **Managing Absences**
  Unplanned absences can place unnecessary strain on police workforce to deploy in field and handle work at stations. Planned absences are simpler to deal with but still present obstacles for an organization.

GIS can enable workforce management in following ways:

- **Live Dashboard**
  Provides an instant view of all the police assets deployed on the job and also aids in centralized decision-making about the resource allocation and deployment.
- **Dynamic Tracking**
  Provides an aerial view of police force operations in real time to give up-to-date location information. Further, system would allow to backtrack in time for post-incident analysis. Dynamic tracking helps in monitoring the movement and increases the accountability of the police force.
- **Time and Attendance**
  Police personnel can mark their attendance in the system from mobile place using the GIS system. As the system allows for dynamic tracking, it reduces any unethical behaviour.
- **Reporting**
  As all the systems and processes are integrated, it provides an instant access to data that which needed for decision making. With the presence of Geo-spatial data, the MIS-dashboard can assist decision makers in taking swift decisions based on verified data.
- **Patrol**
  Provides a live view to monitor the patrol and also helps to reassign patrol party to nearest place where an unforeseen incident is raised. System helps in route optimization and in reducing response cycle time based on location.

[4] http://transync.in/who-needs-ais-140-gps-devices/

Case studies - Use of GIS technology for effective workforce management

Case Study: Northgate police department[5]

Northgate Public Services uses vehicle and dynamic resource management for UK Police forces to improve operational efficiency, accountability and visibility of policing to deliver on the commitments made by PCCs to improve services and control costs. The geographical information systems (GIS) provided to police forces across the UK are integrated with command and control applications. The solution helps in real-time monitoring of security related events, GPS based tracking of resource location real-time reporting of incidents, real-time feedback and telemetry directly from police vehicles to command and control center.

3.5 Prison and Parole management

Challenges being faced in parole and prison management:

- Time consuming manual processes
- Manual errors in administrative records management and registers of prison inmates
- Lack of centralised data to analyse and make decision
- Information inaccuracy
- Ensuring personal security of both inmates and staff
- Monitoring health of prisoners
- Facilitating timely release of inmates back into the community
- Lack of efficient record management, leading to delay in parole

GIS in prison and parole management helps in the following ways:

- Identifying areas prone to inmate violence in institutional settings
- Assigning probation and parole officers by geographic location
- Directing probationers and parolees to services and treatment centres
- Making site selection decisions for the placement of new facilities within a community

Use of GIS in effective Prison management

Agencies can share and take advantage of satellite images, building floor plans and maps of street networks, census data, infrastructure data, and utility data. Live data feeds from video cameras and weather departments can augment the surveillance capabilities of the prison complex and surrounding areas.

The GIS enabled information as collected and analyzed by prison authorities has great potential for being an extremely valuable analysis and investigation mechanism for authorities, that can accurately ascertain the coordinates of persons released from prison who have been convicted of different types of crime in the past.

A GIS map of a prison residential quarters would typically comprise of a base layer with locations and mapping of event layers. This is equally applicable for detention areas. The Prison authorities can effectively use a map of the prison complex as the base map that can have address locations pin-pointed as housing units, individual cells and other discrete locations in the complex.

The GIS Datasets may receive multi-level hits and it needs to quickly map and present the results e.g. GIS practitioners can accurately pinpoint the location of criminals in a particular age-range that are on parole for violent and cognizable crimes like firearms and drugs, who are currently not employed and who live west of one lane and south of another.

GIS can also help with processing other inmate information such as photos at the time of registration, IPC code under which incarceration has been done, demographics, association with other gang members and prison history available at just a mouse click.

[5] https://thorcom.uk/solutions/police-dynamic-resource-management

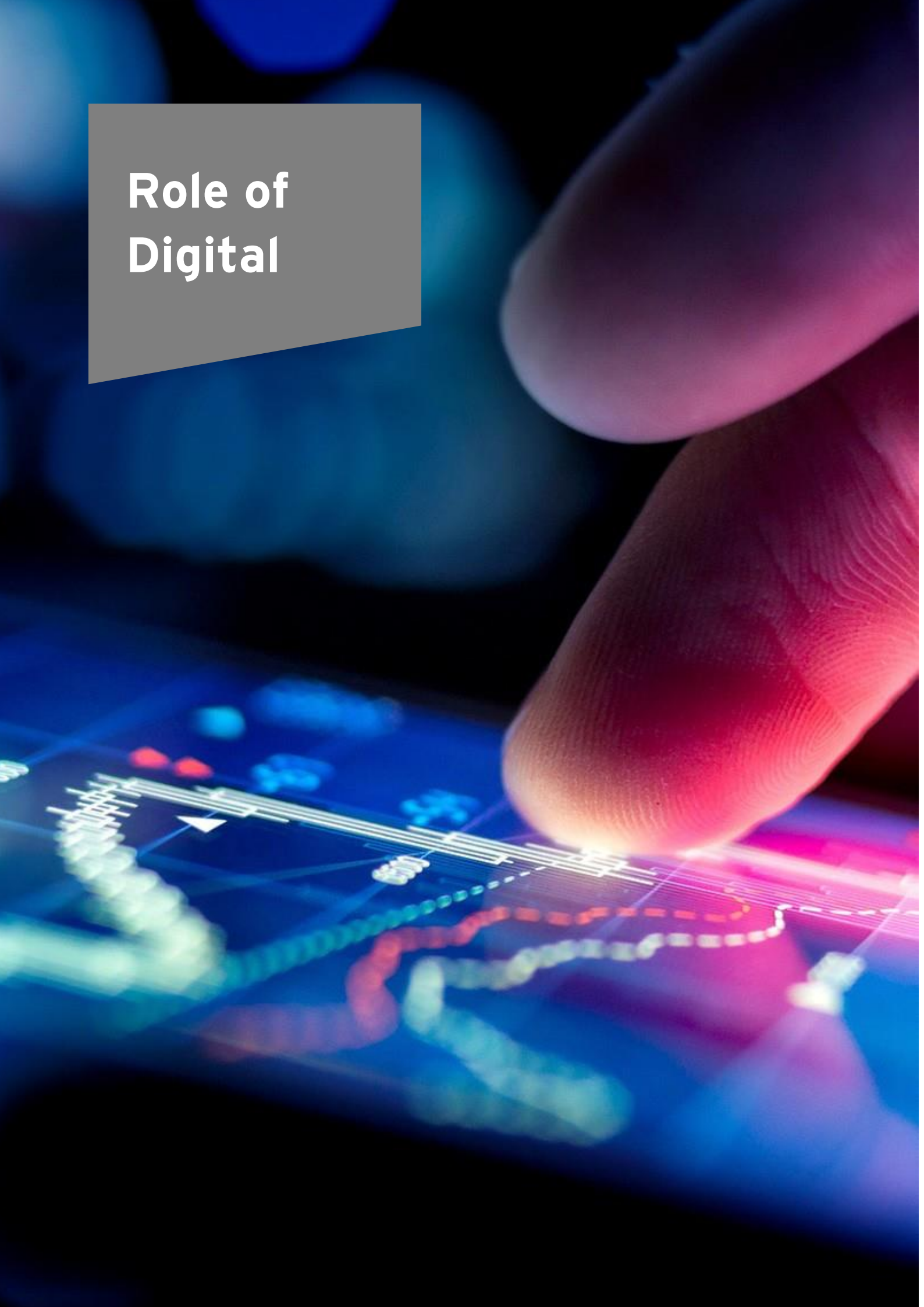
Such data can help the Prison officers to gain an understanding of the dynamics of prisoner population and also to ascertain potential security threats even before they actually happen. At any particular instant, a prison authority can view gang fights, gauge suicide or escape risks, and also to decide which of the prison inmates may be facing precaution hazards. The GIS tools can help in swift head counts by displaying the exact locations of each prisoner.

Case Study: Correction Centres management system - California[6]

U.S. correctional institutions have always been in the forefront in devising ways on usage of GIS in the prisons' daily operations. California has already created GIS datasets as part of the core GIS database for corrections and is a sub-system of the California Environmental Information Catalog that can be accessed over the Web through a dedicated database of environmental data and information resources for California. It contains information about the California prison location and youth correctional facilities locations, including addresses, name of the city and the number of prisoners. California adult correctional facilities were mapped using GIS to aid local planning departments, by providing the data on prisons and prisoners.

[6] http://www.iaca.net/Resources/Articles/drjaishankarmaparticle.pdf

Role of Digital



4 Role of digital

As we observed in the preceding section, the role of Geographic Information System (GIS) has increased manifold during the recent times to maintain safety and security. GIS acts as data integrator of complex data sets which further assist in interpreting and creating actionable intelligence. Given below is an analysis that emphasises on the role of digital in using GIS for improving the safety and security scenario in the country:

Data aggregation

Data stored in silos across various sources in the police departments makes it difficult to extract, transfer and load the data across various platforms. This makes it difficult to gather actionable intelligence and further delays the process during an emergency. GIS helps enable organizations to eliminate the data inconsistency and duplicity by integrating the data in to a single standardized integrated framework.

Data Mapping

Digital mapping and complex analytics engines have now enabled agencies to work with large numbers of layers of data. The authorities now no longer need to sift through huge volumes of tables, spread sheets or pages of data to take critical decisions concerning national security, they can now simply visualize the data sets layer by layer on a map that is capable of displaying vivid relationships among complex data sets. This significantly reduces the time taken to estimate and find relationship in various criminal activities thus supporting the police in crime prevention

Actionable Intelligence

Digital data will be redundant and obsolete unless actionable intelligence is derived from the same. GIS helps in interpretation of varied data sources with insights which help in enhancing crime analysis, trend analysis, and predictive forecasting. This is achieved through advanced analytics capabilities coupled with spatial analysis tools. These tools are capable of processing large complex data sets in order to understand the behaviour, identify hotspots and even to forecast future crime outcomes.

Through a thorough examination of crime and non-crime data, analysts can obtain a comprehensive view of crime and criminal activities in their respective jurisdictions, make efficient and reliable forecasts, and even assist in crime prevention. It is understood that predictive policing solutions per se cannot eliminate crime, yet they provide promising new solutions for law enforcement agencies to operate efficiently, effectively within their limited resources and budgets.

With the advent of technologies that enable a city to be safe and smart like sensors, cameras, surveillance and billions of other connected devices that generate Zettabytes of data every year, it has become even more important to ensure the security of such data from cyber threats. GIS in conjunction with big data analytics tools, helps the experts in Cybersecurity to analyse the visual representations of cyber networks, how they are connected, communication mechanisms and thus help recognise vulnerabilities in cyber networks. GIS can also assist in locating infected devices for remediation and in spatially monitoring rea-time data streams on system security, software versions, network traffic etc. across the variety of cyber assets owned by an organization. GIS has the ability to do a geospatial profiling of IP addresses and thus can help in identifying patterns and trends.[7]

Another important aspect that is affecting the way Geospatial data is being used by agencies for identifying crime patterns is the usage of Artificial Intelligence. Deep learning that is actually one of the branches of machine learning uses algorithm sets that are able to model abstractions in Geospatial data. It helps analysts with a near human level analysis capabilities while integrating into the core GIS workflows, essentially automating the entire process of gaining visual actionable insights from large sets of data.

7 https://gis.usc.edu/blog/gis-and-cybersecurity/

Share intelligence

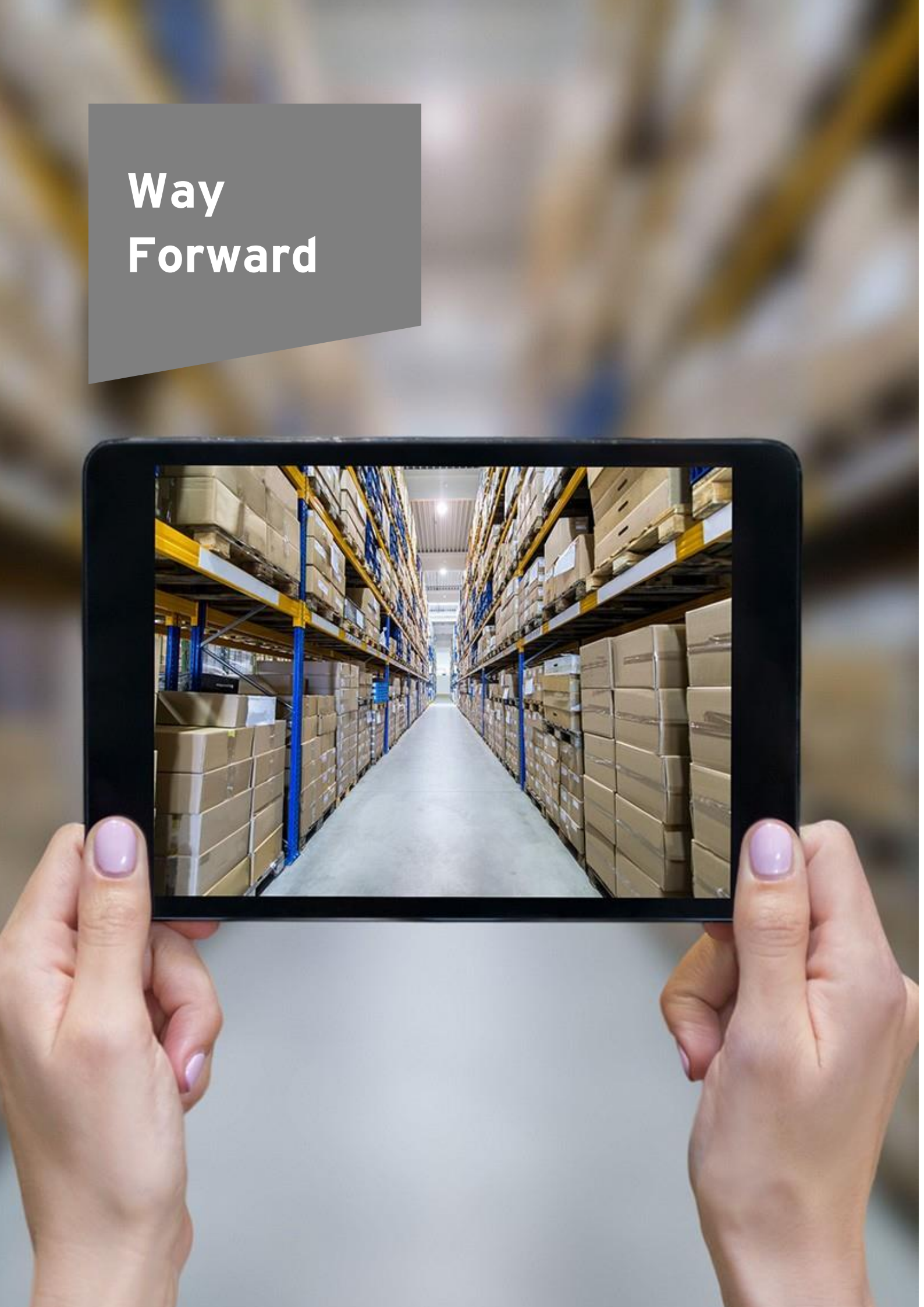
Visualizing and sharing intelligence derived from the available data helps in improving the overall efficiency of the law enforcement agencies. In case of emergency response, the information and intelligence that is swiftly shared with multiple agencies has the ability to significantly improve the response rate to assist the team deployed in the field. Digital tools can also help share the critical GIS information like location of the calamity (Earthquake, Tsunami, Flooding etc.) and also the location of citizen in distress with external relief organizations to improve collaboration or even with public at large to share information through a web portal or on social media in highly interactive formats.

Mobility

Mobile GIS allows easy accessibility of data to the police officials on ground with high level of accuracy. This can improve the real time decision making and will play a greater role in understanding the effectiveness of data insights and intelligence. A number of law enforcement agencies have already started harnessing the power of Mobile GIS apps to capture the points of interests for enriching their base maps and help in quick response to citizens whenever required. The capability of apps to make real time updates while on the go helps improve productivity of field officials and also saves a lot of time by eliminating the need to do the same activity by returning to their respective base locations.

GIS can also help enhance the efficiency and security of Intelligent Traffic Management Systems by integrating real time traffic data with GIS data sets. It can help in improving various functions of ITMS in terms of graphic analysis capabilities through temporal visualization of traffic conditions in an urban area. GIS database has the ability to integrate historical and current traffic status and such data can be overlaid on maps for geographic reference. This data from the Traffic Departments can then be used by the law enforcement agencies in crime investigation, crime prevention.

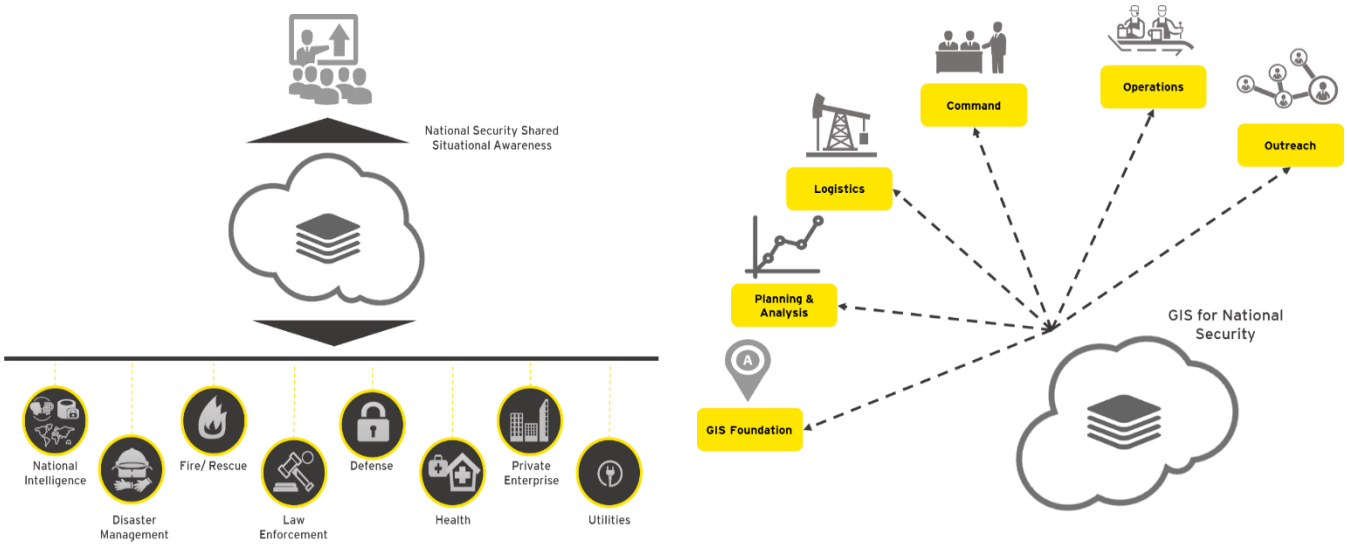
Way Forward



5 Way forward

Law Enforcement agencies have an established history of using innovative technologies to assist in controlling and preventing crime. A majority of security agencies use location of crime and the geographic space to track the offenders as they are the most important components of the any criminal event. Thus it is, necessary that the information collected for analysing and identifying crime patterns and trends should include mapped crime locations. GIS maps are now designed to integrate and view descriptive information about phenomenon such as a crime in a spatial context. The ability of a GIS to map criminal incidents will enable analysts across the country to effectively identify areas experiencing high-crime activity. Once high-crime areas are identified, computer mapping will further assist in the development and evaluation of interdiction strategies.

Analysts can further help enforcement agencies develop a better understanding of the relationships among crime, target, and offender patterns by relating incidents to geographic criteria. The ability to associate criminal incidents to other spatial information will allow analysts/ criminologists to explore a variety of factors influencing crime. In this regard below is the framework of common enterprise platform for using GIS for various domains:



Providing a common platform for GIS for all law enforcement agencies include developing capabilities to prevent, protect from, respond to, and recover from catastrophic incidents. Maintaining continuous situational awareness is now generally accepted as the foundation for successfully maintaining peace & security. The customized framework of enterprise platform for using GIS in security domain is as illustrated above.

Geospatial technologies have already proven its potential in helping organizations to take critical decisions. However, the need now is to graduate from treating geospatial as a standalone solution or using it on case to case basis to use it as an essential component or backbone of entire planning, execution, monitoring and decision making process. This can be achieved using the national GIS platform as mentioned above. In a nutshell, Geo-spatial technologies promise to be a game-changer for the way present day internal and external security, law enforcement, crime detection and prevention and prosecution events are handled by the various law enforcement and security agencies in the country.

Thus, it is imperative that a comprehensive digitally enabled security strategy be framed with a structured plan and framework to identify, analyze and operationalize the digital tools for increasing the efficiency and effectiveness of agencies responsible for ensuring the security of our nation. This strategy shall be instrumental in providing

Questions

1. Are you or your organisation using GIS? What are the challenges being faced?

Questions

2. In view of the significance of geospatial information, how would you define an enabling policy environment?

Questions

3. What do you think has been the impact of proliferation of GIS technologies in India?

Questions

4. What measures do you think need to be taken by the Industry as well as Government to enable seamless operations of GIS enabled solutions?

Questions

5. What in your opinion can be the other futuristic applications of Geospatial solutions in law enforcement domain? What are your expectations from geospatial and related technologies?

Notes

FICCI Geospatial Technologies Department

Vision

Making geospatial technologies more pervasive in India

Mission

- To make a collaborative ecosystem with help of all possible stakeholders to ensure that geospatial is embedded into all systems and processes/ governance related functions.
- To help the Government through advisory & advocacy on following fronts –
  - Policy framework
  - Geo-enablement of large projects
  - Skill development
  - Thought leadership

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