Safety and Security of people in Cities

Final Report

Team 17

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Overview

Mission Objective:

Safety and security is among the main concerns in any city. Citizen well being requires that security measures are adequate and law enforcement is well prepared and trained to effectively combat the breach of law and apprehend the miscreants.

In our technologically interconnected world and in smart communities of the future, the scope of the term security is quite broad and is not limited to only physical security of gated communities. With the increasing risk of cyber-crimes and data theft, smart cities would have to be prepared to tackle them adroitly. The risk of identity theft or stealing data would intensify in smart cities if they do not have a strong security framework.

In order to avert this risk, a systematic approach is required along with getting the priorities in order, changes in cyber laws, and recognizing data safety as a fundamental right.

In our cities, the economic disparities are quite high and also the police personnel to people ratio is low. In this context, how to make our cities and communities feel secure and safe. So in one sentence, the objective is to make the people living in the cities feel they are more secure and safe than before. Our system aims at making the citizens feel safer by aiming at the crime rate in the region and increasing the responsivity of the system personnel for the citizens thus making them feel more safer that before.Our system doesn't make the crime rate go down by a drastic amount at a time instead it is a system designed to gradually improve and grow its functionality which survives for a long time learning from its past.

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Operational Objective:

The field of safety seems to be underrated in many studied works. But even back up from Maslow's hierarchy of needs we can see, that safety is a crucial component of life quality in every city. Therefore we can say that every Smart City must be a Safe City as well.

Safe City system should include following features:

1. Healthcare
2. Smart traffic systems and routes
3. Smart safety systems for surveillance, search, detection and identification

Smart systems of crisis management to support decision making, early warning, monitoring and forecasting emergencies and environmental situation,

1. Centrally operated units of police and Integrated Rescue System (IRS)
2. Safe internet connection and data protection,
3. Centres of data processing

and others.

We have defined a safe city as one in which people living in it fell they are safe. Here, safe being it is assured that help would be provided at the earliest when it is required. For this, two things are necessary: 1. One is that there should be a proper communication channel between the police and the people. 2. Two, there should be automated surveillance in parts of the city which are are prone to theft and assaults. So the operational objectives would be to establish this communication channel and to have a proper surveillance system in the city.

System Design Requirements:

Safe City design should follow these principles:

1. Avoid urban sprawl
2. Slow down road traffic
3. Ensure main streets are safe for everyone, not just cars.
4. Create dedicated spaces for pedestrians.
5. Provide a safe, connected network for cyclists.
6. Ensure safe access to high-quality public transport.

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7. Use data to detect problem areas.

The system is used to provide security in cities to the general public. The system would be deployed in public areas such as roads, parks, etc. The overall requirements include sensors placed strategically so as to cover the entire area of the city, a centralized data analysis center and well-distributed decentralized first response teams. This first response team includes not only the general police but also other specialized units like the bomb squad. The system also contains an communication unit which will contain personal who can communicate with the general public for information. Finally the evaluation team is an internal team whose goals is to make sure that all other systems are functioning optimally and they don't need any external requirements.

Design Characteristics:

The chosen subsystems are – Surveillance, Public Transport, First(Emergency) Response, Natural Disaster and Terrorism Management sub-system. The subsystems were chosen in a way that they are interdependent of each other. The output of the surveillance system goes to the Data Analysis system for analysis. The data after being analysed is sent to the First Response System to take action. The Evaluation system, evaluates the performance of all the other subsystems which can be used for betterment of the system as a whole. System Use Cases: In this we try to point out some use cases which enable better understanding of the system's design:

1. One use case which covers most of the subsystems: Say the surveillance cameras are hacked (standstill), only the communication subsystem can detect and convey to the data analysis -> first response. The evaluation system will then figure out that the surveillance subsystem was at fault as it couldn't detect the crime and the maintenance by surveillance subsystem would be done.
2. If there is an area at a point of time which neither the surveillance objects nor the patrolling people are present, the case is registered with the communication system and the flow just carries on.
3. Now, if the surveillance has detected it, it goes on to the data analysis which gathers info and checks for legitimacy. This is sent to the first response and the troops are deployed. After all this the evaluation team comes up with better strategies for improving performance.

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4. Same goes with the patrolling team reporting to the data analysis team.

System Organization:

There are five subsystems of this system which are as follows:

1. Surveillance System
2. Public Transport System
3. Natural Disaster Management System
4. Terrorism Management System
5. Emergency Response System

The first sub system is the surveillance system which helps in monitoring the whole city by gathering information on public assets, government buildings etc through cameras all over the city.
It monitors the growing threat of crimes of terrorists which helps in ensuring public safety.
The network of cameras which is spread all over the city gathers the required data for monitoring by clicking pictures or shooting videos that are required to detect the threats. Next is transport system, The intelligent transport management system provides a sophisticated system for collecting and analyzing real-time transportation data in order to improve system efficiency and provide insights for generating services that cater to the requirements of the citizens and develop a more sustainable transportation system that integrates land use, economic development, and transportation planning.

Natural Disaster Management sub system helps us to protect and preserve a maximum number of lives and property during a natural disaster. These are multi-layered and are aimed to address such issues afloods, hurricanes, , fire and even mass failure of utilities or the rapid spread of the disease. . Due to unique geo-climatic conditions in India, , the land of India was vulnerable the natural disasters . Droughts , Floods , Cyclones , earthquakes and landslides would have been a recurrent phenomena . After that we have terrorism management system, which provides a logical and systematic framework for identifying and dealing with potential terrorism threat. This system helps in design and planning of cities based on the factors that impact on security.

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1. Public Transport System

Subsystem Goals:

- Introduction of technology into the public transport system helps passenger travel with an ease.
- This system covers the aspects regarding to Intelligent public transport for smart cities such as Bus Rapid Transport , smart ticketing , smart GPS based buses and bus stops , automatic fare collection.
- The final call would be on the necessity of Smart public transport for smart cities and the basic solutions a public transport requires.

Subsystem requirements:

- The present condition of Public transport in India and the distribution of the Urban transport.
- Having the statistics of the people travelling by the public transport especially in the most populated cities in India such as Delhi , Mumbai and Calcutta and the following metropolitan cities.(Chennai , Hyderabad , Bangalore)
- Present number of Bus Stations and auto stands to get an overview of connectivity for a certain radius of distance.
- A maintenance team who could handle all the physical and technical areas behind this smart public transport system.

Subsystem Boundary:

- This subsystem is not constrained only to the tech behind it but also looks after the safety of the passengers.
- And extending this type of transport system even to the most remote places of the region.

Subsystem Characteristics:

Below are some of the characteristics of this subsystem:

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- System Efficiency
    - Making a transport system intelligent for smart city needs , involving smart solutions and also it should be implemented into the existing transport system.
    - So the efficiency of this sub system depends upon how well the technology has been distributed at various places , its ease of usability by the people , Hassle-free operations.
    - Coming to the maintenance part it can depend on the tech developers team who are indulged in providing user-friendly service to the public and on the warehouse part , the servicemen who can take the charge of maintaining the buses by regular check-ups.
- System Risk:
    - Vehicle security is high priority because the combination of the basic physics of a moving object and a hacker with malicious intent is a dangerous one.
    - With the implementation of technology and also vehicle-to-infrastructure communications , there is some chance that an infrastructure attack may cause injuries or fatalities , though probably less chance than a direct vehicle attack.
- System Suitability:
    - This sub system understands you , your needs and always steps up to provide them.
    - With millions of people choosing to commute via different public transportation options , having a system that is smooth , hassle-free and quick is crucial.This balance not only helps the commuters but also ensures overall efficiency in the city.
    - The technology that we use here can be availed to the people living in rural areas to help in improving their lifestyle.

How this subsystem contributes towards the system's goal : Equipped with advanced computing, wireless communication, and navigation satellite system , smart buses can be monitored and co-ordinated meticulously to ensure bus services whether they are performing within standards or not. In addition, real-time live surveillance and video analytics of bus fleets can be implemented to respond to

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emergency events and ensure security and safety of drivers and passengers. Furthermore, smart buses can monitor and collect data such as driving behavior and passenger flows, giving bus operators insights into its fleet operation and allowing them to make service improvements or timetable rearrangements when necessary.

Subsystem Inputs and Outputs

- Inputs
    - Strategic planning needs precise , extensive and prompt data collection with real-time observation. Data should be collected via varied hardware devices that lay the base of further Information and Technical Services functions.
    - It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc.,
    - These can be extracted through the servers generally located at data collection centres which stores large amounts of data for further analysis.

      This subsystem also helps for the other subsystems which are used based on the collection of Data.

- Outputs
    - People love to feel special. Personalized information will make passengers of public transport feel as if they are being taken care of.
    - Technology will enable transit agencies to easily send out personalized travel information to passengers .

Subsystem Interfaces

- Intelligent autonomous objects interact in such a manner so as to make our life easier in many ways.
- As the proposed system consists of number of modules , integrating them properly is a big challenge.Therefore before the implementation at city level a number of case studies could be conducted for getting clear ideas between the interfaces.

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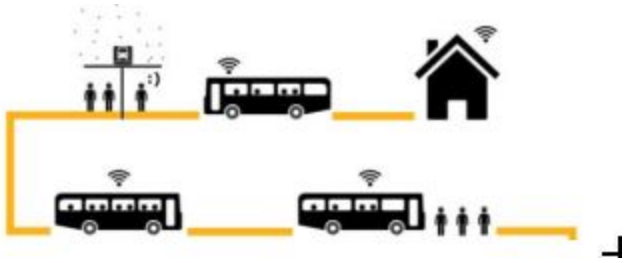
- Security Interface : Security of the data , mainly passenger details need to be very high.Privacy of passengers needs to be maintained with proper authentication and encryption techniques.

TYPES	MODES
Road Transport	Bus, Mini-bus, Taxis, Human-powered Rickshaws, Motorcycles
Rail Transport	Heavy rail transport, Light rail transport, Street tramway
Rapid Transit	Guided bus, Trolleybus , Metrobus
Water Transport	Ferry, Automobile Ferry, Fast-Ferry, Sea Taxi
Air Transport	Airplane, Helicopters, Gyroplane
Cable Transport	Funicular, Cable Car, Cable Ferry

INTELLIGENT PASSENGER INFORMATION SYSTEM:



LEVELS OF THE SUBSYSTEM:

Technical side:

- The main aim of this part of the subsystem would mainly focus on to provide data to the person who will be operating these systems.
- This subsystem will also be equipped with storage facilities as of data storage with respect to the passengers who use the transport system.
- Data needs to be secured as this information is related to the user and his personal travelling details.
- **LEVEL 1**
    - Since there is smart public transport , passengers need to carry some form of ID with them to travel.
    - By this form , there will be automatic tracking of person from the start

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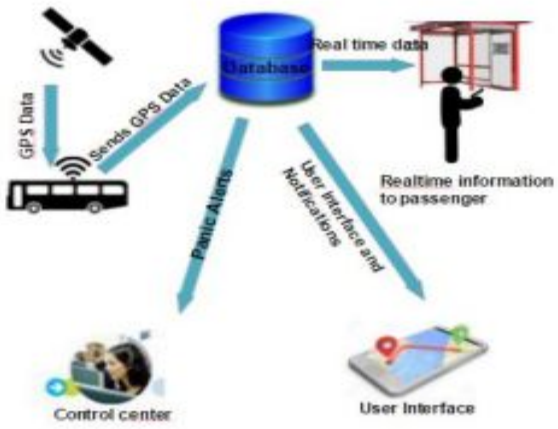
point of his travel to the end point .

- In case, if a person found violating the rules he can be tracked easily and be handed to the cops in a very short span of time.



Manual side:

- The main aim would be here providing best in class service to the vehicles used in the public transport.
- For this we will need workforces who will be engaged in tuning the mechanical parts of the automobile.
- Cleaning Staff , to maintain the cabin of the transport neat and clean.
- **LEVEL 1**
  - Workforces need to be very accurate here in the garages. Since it is the very crucial part of the system. This ensures that the passenger has a comfort mode of travel in his travel line which also encourages passengers to use this transport system on daily basis.
  - Cleaning staff who provide with the utmost neat and clean services which is in turn beneficial to the passenger travelling in this system. The passenger also would like the service and would love to travel again and again.

Challenges:

- The major challenge is to prevent hacking of the data.
- It is also a bit difficult to provide continuous power supply.

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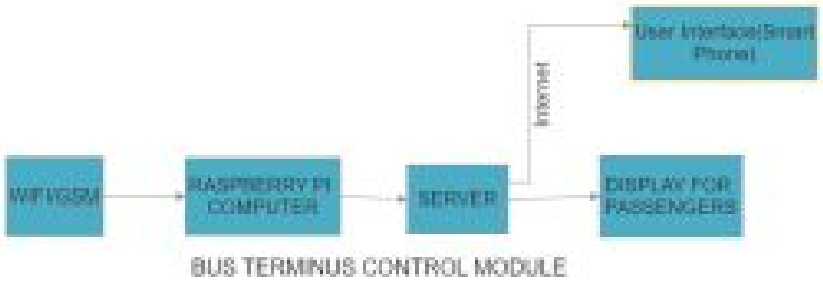
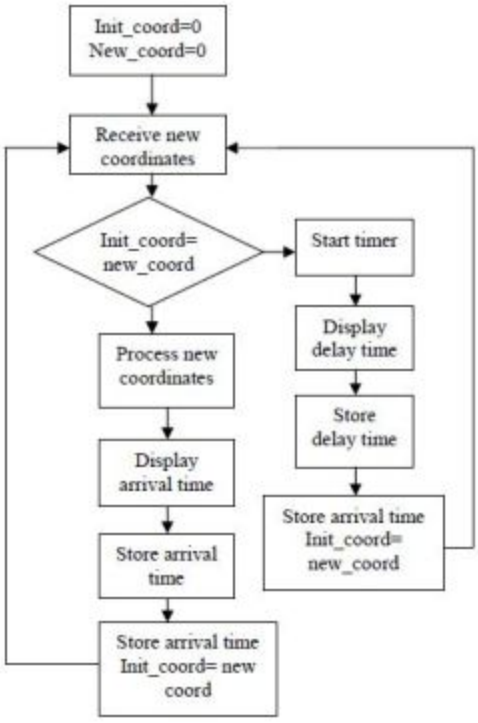
SYSTEM ARCHITECTURE:

- **Block diagram of the smart Public transport system**



- **Algorithm Flowchart**



- **Most Advanced Public Transport System(Hyperloop)**

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When you are thinking about how to solve what's wrong today in transportation it takes more as in just 1% to company it literally takes a movement what engineers do. The most advanced transportation system in the world , manufactured its first full scale passenger hyperloop capsule. The working was the best in class and also the company which manufactured hyperloop had its contribution in many sectors such as aviation sector , rail sector and even in the space sector. These are the most modern , the most futuristic form of transport. For this they developed a new material called Vibranium and is claimed to be the most safest material on planet Earth. It's intelligent and the metal itself senses integrity and monitoring impact.

They manufacturing the capsule was double layered so if one skin is damaged you still have the other one that contains a capsule out of circulation. The Hyperloop is an idea of an aircraft without wings. With the cutting-edge technology they are transforming mobility into a totally new segment of transportation. Giving hyperloop the lead in the race to deliver the high speed tubular transportation system.

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2. Surveillance System

SubSystem Goals:

- To ensure that the whole city is under surveillance and being monitored.
- To make sure that the crime rate and terrorism in the city is under control.
- To gather useful data from various parts of the city which are deemed to be vulnerable in the form of video footage.
- The objective finally is to gather data in two ways:
    - Technological
    - Manual

Subsystem requirements:

- A control room which a team to keep monitoring the whole city.
- The past police records which help in detecting the sensitive areas with high crime rate.
- The precise locations of each CCTV camera present in the city so as to arrange them in such a way so that they provide maximum view of the entire city.
- The past records of the surveillance subsystem.
- IP cameras, a patrolling team and a maintenance team to take care of the maintenance issues of the cameras etc.

Subsystem Boundary:

- The surveillance subsystem has to gather all the data and transmit it onto the link.
- It also needs to ensure that all the data has been transmitted successfully to the destination.
- It also needs to make sure that the cable lines are working properly and other such hardware issues.

Subsystem Characteristics:

These are some of the characteristics of this subsystem:

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- System Efficiency
    - The system efficiency of this subsystem highly depends on the positioning of the cameras around the city and how large their view is.
    - It also depends on how well the sensitive areas in the city are covered by the cameras.
    - On the other hand, it also depends on the coverage of the patrolling team and their attentivity when we talk about manual surveillance.
- System Risk:
    - The major system risk for this subsystem would be hacking.
    - The cameras can be hacked if proper care is not taken which results in the data received being fake.
    - This is not only a threat to this subsystem, but is also for the entire system as a whole.
- System Suitability:
    - This subsystem is more suitable in the urban areas or cities rather than the rural areas or villages.
    - This is because the rural areas do not even traffic signals and are hence not technically equipped to support this kind of surveillance which used CCTV cameras.
    - So, this subsystem has better chances of working as per needs in a city over a village.

How this subsystem contributes towards the system's goal :

This system helps in increasing the safety and security of people living in cities and improving the response time of the police and keeping the entire city under vigilance. This also means that we are trying to find out a crime even before it is reported. It also helps in tracing the accused in the cases and thus minimizing the number of thefts and assaults etc. This subsystem significantly contributes to improvement of the response time.

Subsystem Inputs

The inputs to the subsystem are more external to the system as such. The subsystem is basically an information gathering system.

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- The past police records which help in determining the sensitive areas and areas with relatively high crime rate.
- The old records of the surveillance subsystem.
- The precise locations of the CCTV cameras located around the city

Subsystem Outputs

- The live streaming is sent to the data analysis team and the control room by the several CCTV cameras located across the city.
- The other kind of output is the information that is gathered by the patrolling team which is sent to the data analysis team

Subsystem Interfaces

- There are two interfaces, one with the evaluation team and the other with the data analysis.
- The data analysis directly takes the output from the system and the evaluation systems indicates the malfunctioning of the subsystem.
- The format in which the output is given out to the data analysis team is the live streaming from the cameras and human input from the patrolling team.

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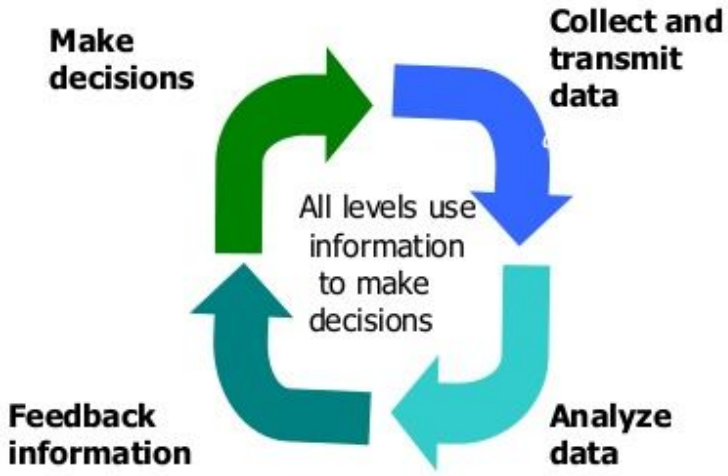
A dynamic vision of surveillance



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LEVELS OF THE SUBSYSTEM:

Technical surveillance:

- The main aim of this part of the subsystem is to provide continuous video footage from the CCTV cameras to the control room.
- The subsystem has to be able to store large amounts of data in the form of the video footage.
- It has to take care of the maintenance of the cameras.
- **Level 1**
    - Detecting the sensitive areas with relatively high crime rate.
    - This is done by observing the past police records and analysing them
    - A team can be formed to analyse the data.
    - The estimation of cost is also done based on the number of cameras that might be needed and the areas in which they have to be installed.

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    - The number of records obtained would be very huge. So we decided to have a time frame(ex: an year) and study the records in that particular time frame.
    - We believe that this would be effective because the data obtained would be practical data.
    - The data has to be gathered again once the time frame expires.
- **Level 2**
    - The aim of this is to give continuous footage to data analysis CCTV is the most cost effective solution for this process.
    - The IP cameras are used for wireless transmission of the video where the data system can directly take the data.
    - The maintenance involves guaranteeing good networking conditions andhaving foolproof methods to tackle the threat of hacking.
    - There are several types of cameras like motion detecting cameras ,day and night cameras ,weather compatible cameras .We need to figure out where to set the locations of various cameras in order to achieve better surveillance.
    - Rationale behind having such a system: If there is just one type surveillance object, the type of input we get is narrowed down and the system's goal might be compromised. For this to not happen, it is essential to have different types of surveillance objects.
- **Level 3**
    - (i)The maintenance of various devices involves various methods .
    - (ii) We took a reference from the honeywell case study which is one of the case studies discussed in the class in which there are some indicators even before the complete damage of the equipment.
    - This would not only be cost effective, but also improves the system availability as the entire system doesn't need to go down at a time.

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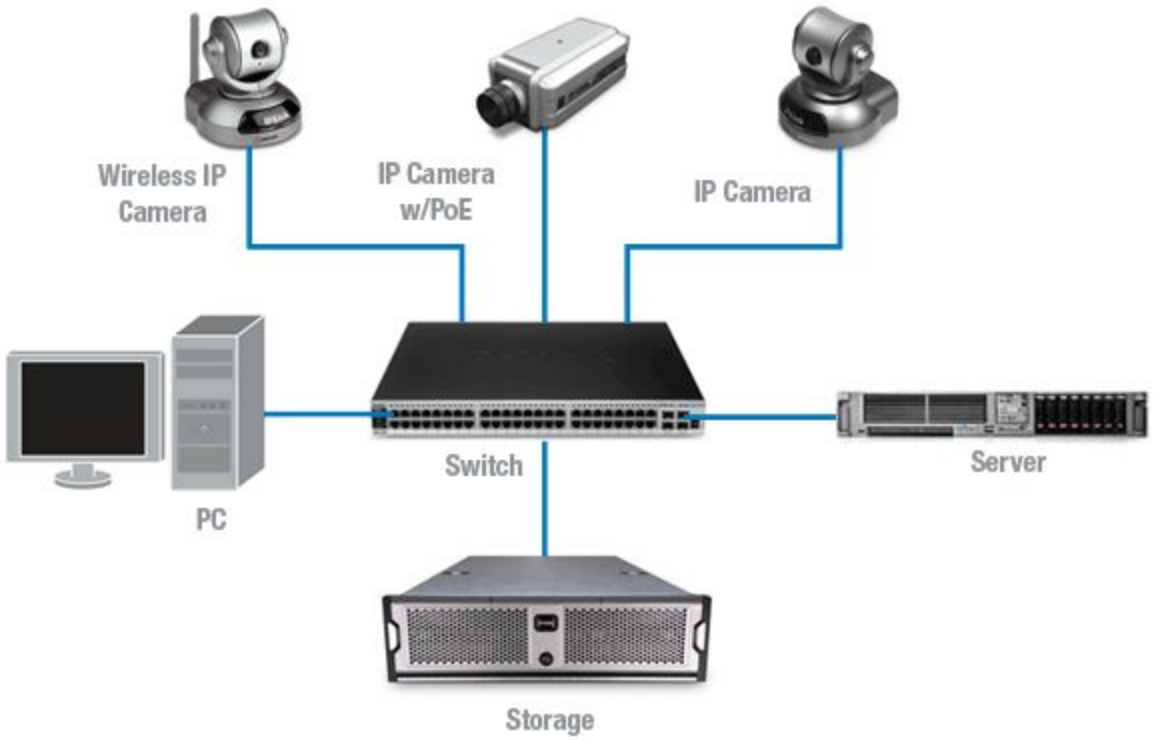

Manual surveillance:

- **Level 1**
  - Aim is to provide the surveillance where there is no possibility of installation of cctv.
  - Also in some areas, the surveillance objects might fail due to some reason or the other. So to tackle such a scenario, we thought of also having a manual patrolling team which keeps the city under check.
  - Maintenance of she shuttles and she teams.
  - For the further manpower they contact the data analysis team which in turn does a call forwarding kind of stuff to reach out to the first response system. This ensures that the patrolling team is also supported properly.
- **Level 2**
  - Improving the training infrastructure. The better we train the team, more is our system's efficiency.
  - Extending manpower where there is no cctv surveillance and in the

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theft prone areas.
    - Providing facilities to the police or to the security personnel if they are allotted in the remote areas.
    - Also the maintenance team needs to take care that the cable lines work properly. That is the output lines to the data analysis and the evaluation have to be functional. This would ensure that there is no data loss anywhere in the channel line.

Subsystem maintenance: A few simple checks and maintenance steps have to be taken in order to make sure that the subsystem and thus the whole system does not breakdown. If these steps are ignored, the system is more likely to be vulnerable and the cost of replacement in case of any breakdowns will be higher.

- **Cameras:** The motion detecting sensors of the camera and whether the camera lens is focused or not have to be checked frequently. We need to check whether the camera is properly attached to the wall or a signal and is adjusted so that it covers all the perimeter it is supposed to cover. The cameras which are damaged due to the weather conditions etc. has to be replaced or repaired.
- **Wiring:** Distortion or disturbance in the sound and picture received would generally be because of the wire faults. We need to check for the wear and tear of the wires and if there are any loose wires and replace them with newer ones.
- **Recording equipment:** We need to check if each and every switch and individual equipment is functioning properly. We need to check if all the connections are proper and there are no weak connections. We need to make sure that the correct timestamp is set on the footage that is transmitted.

Challenges:

- The major challenge is to prevent hacking of the cameras.
- It is also a bit difficult to provide continuous power supply.
- The installation of the cameras is not feasible everywhere in the city.

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Challenges table

Challenge	Solvable/ Not solvable	Reason
Hacking	Partially solvable	Absolute protection cannot be guaranteed but the risks can be reduced.
Power supply	Partially solvable	Continuous undisrupted power supply cannot be guaranteed at all times. We could rather depend on solar energy but that also depends on the weather conditions
Installation of cameras	Not solvable	It is not easy to install CCTV cameras wherever we want. But, we could rather rely on the manual surveillance in such areas.

Solutions:

Hacking:

- Secure the internet network.
- Keep updating the cameras with the latest firmware.
- Password protect the ip cameras.
- Change the default password of the routers.

CCTV installation: Installation of ip cameras is not feasible everywhere as well as costly. As mentioned earlier, this problem cannot be solved completely the manual patrolling takes care of such areas where installing cameras is not feasible.

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System use cases and border cases:

- In a normal scenario, if there is something wrong happening in the city and the cameras around the area are able to capture it, the data will be sent to the control room and the response team will be alerted and deployed after the data is processed by the data analysis team.
- If the cameras fail to capture the scene, the patrolling team will be able to sense that something is wrong and take action or could just forward it to the response team.
- In a case where both the cameras and the patrolling team fail, the situation can no longer be handled by the subsystem. However, the system does not fail. This can be handled by other subsystems.

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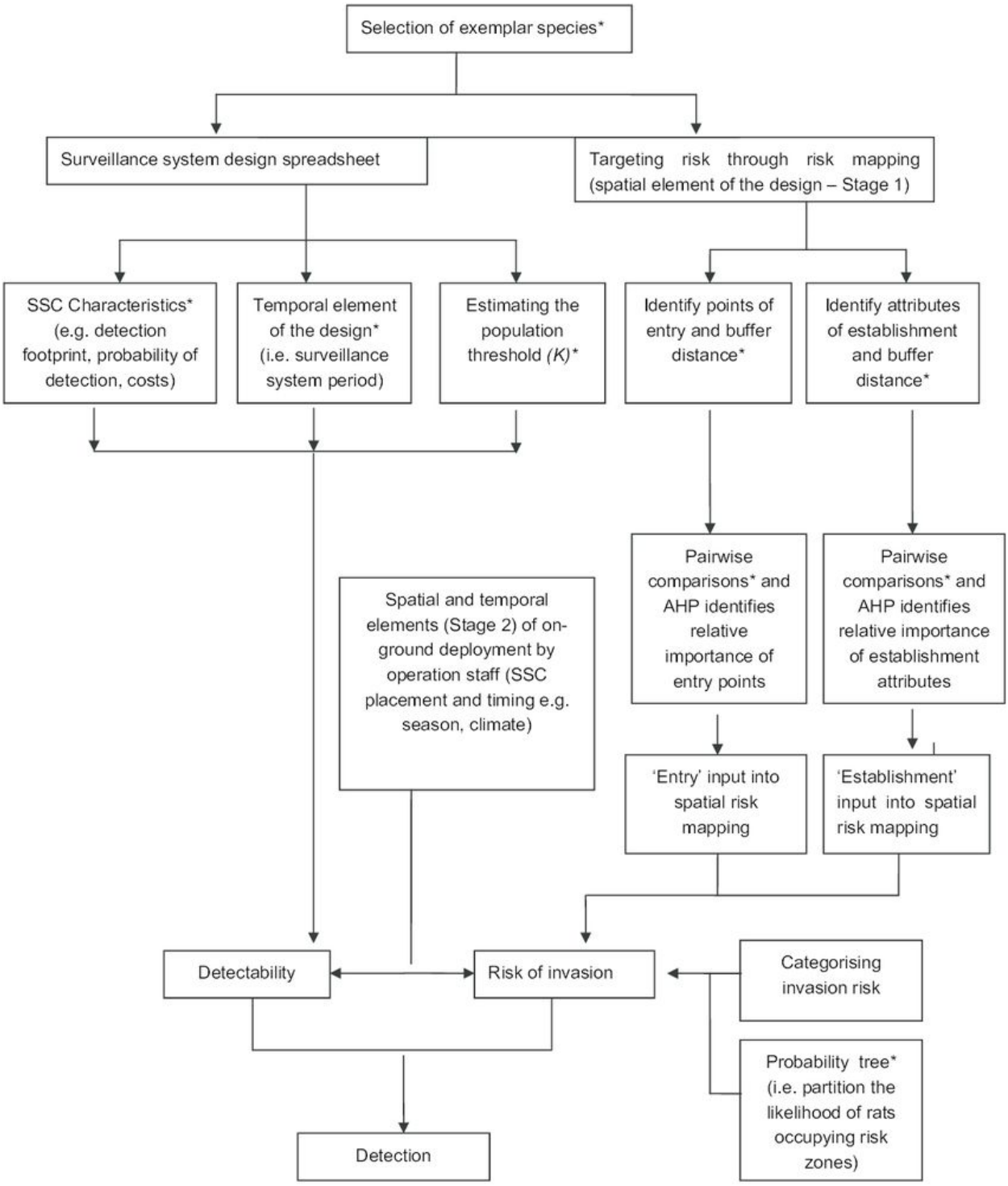

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3. Natural Disaster Management

SubSystem Goals:

- To protect and preserve a maximum number of lives and property during a natural disaster.
- Reduce, or avoid, losses from hazards.
- Assure prompt assistance to victims.
- Evacuation management is considered as one of the critical processes during a disaster which can be modelled as dynamic flow problems.
- Achieve rapid and effective recovery.
- This system should be efficient.
- Public awareness during disasters.

Subsystem requirements:

- Communication Services
    - We need a efficient and uninterrupted communication service for communicating between subsystems in case of natural disaster.
- Medical services
    - We need quick ambulance services and basic medical requirements.
- Well trained team
    - We need to different Disaster Response Force which would save people in different types of disasters.
- Maintenance Team
    - A maintenance team is required to check the maintenance of this subsystem.
- Natural disaster prediction Team
    - A team that would alter the people of city about the incoming disaster.

It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc., It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc.,

Subsystem Boundary:

- This system starts at a point where the Natural disaster prediction team alters about the disaster.
- This subsystem looks after the safety of people and minimization of socio-economical losses.
- The system ends at the point where it ensures that everyone is safe after the disaster occurs(in case it happens).

Subsystem Characteristics:

Below are some of the characteristics of this subsystem:

- System availability:
    - Based on the requirement, the team sends different teams based on their skills to support the location of the emergency.
- System Efficiency
    - Make disaster prediction as accurate and efficient as possible for needs of smart cities.
    - So the efficiency of this sub system depends upon how well the technology has been distributed at various places , its ease of usability by the people , Hassle-free operations.
    - Maintenance part of it depend on the tech developers team who are indulged in providing user-friendly service to the public and physically , the training team who is incharge in case of natural disasters.
- System Risk:
    - People's security is high priority in case of natural disaster. The trained team should be ready to take risk and ensure safety of people.
- System Suitability:
    - This sub system understands the needs of people and will always steps ensure safety of people.
    - The technology that we use here can be availed to the people living in rural areas to help in case of danger.

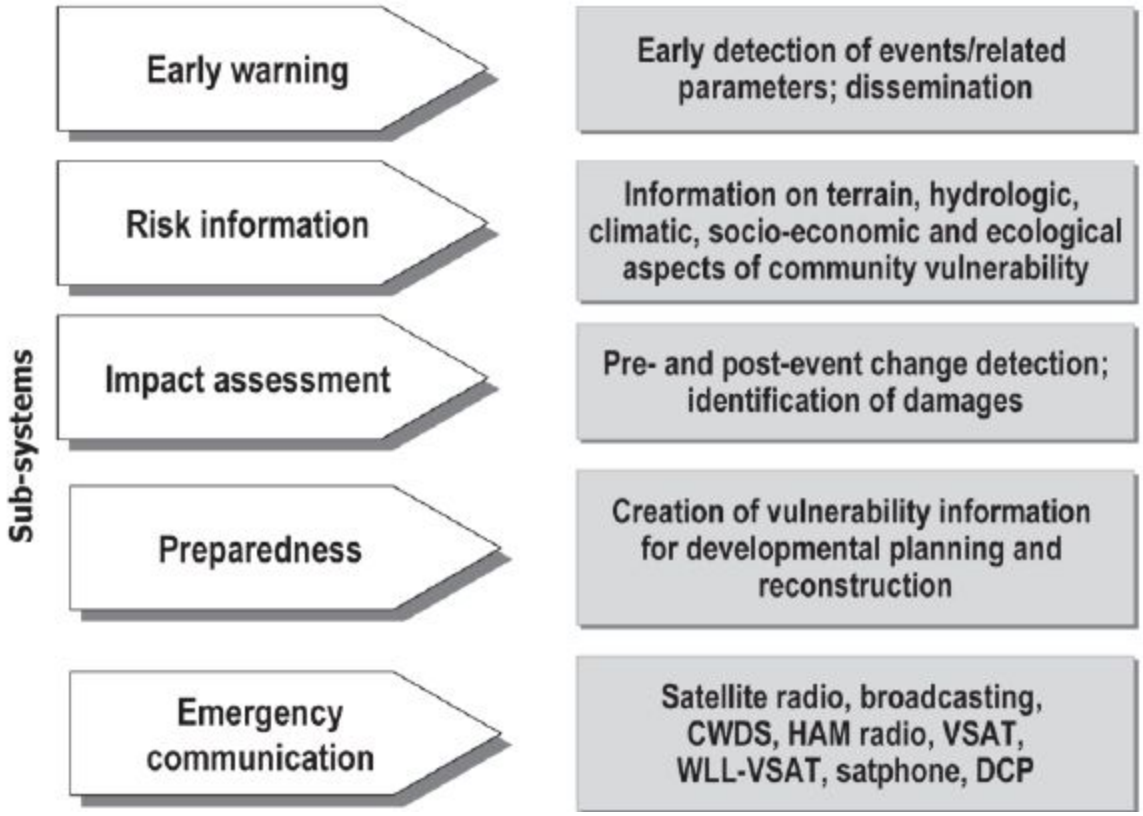
How this subsystem contributes towards the system's goal :

Natural disasters are massive threats to safety of people living in cities. Preventing

It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc., It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc.,

them, or minimising their impact is of utmost importance for any system dealing with safety and security of people in cities. The effects of natural disasters can last days or even weeks after the event. So, a subsystem dealing with natural disasters is very important towards the system's goal.

Further levels of Sub System:



<u>Technical side</u>:

- The main aim of this part of the subsystem is to collect and store weather and disaster related data and inform the concerned subsystem.
- Communicate with other subsystems and inform them about the disaster(if any).

Manual side:

- Workforce would be required to gather information about the weather/disaster.
- Disaster Response Force need to be informed and sent to the required

It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc., It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc.,

location.

Subsystem Inputs and Outputs:

- **Inputs**
  - Data obtained from previous natural disasters.
  - Data obtained from predictions made from already available data by analysing trends.

- **Outputs**
  - Designing a plan dynamically and continuously for natural disaster management and informing or sending message to disaster prone areas.

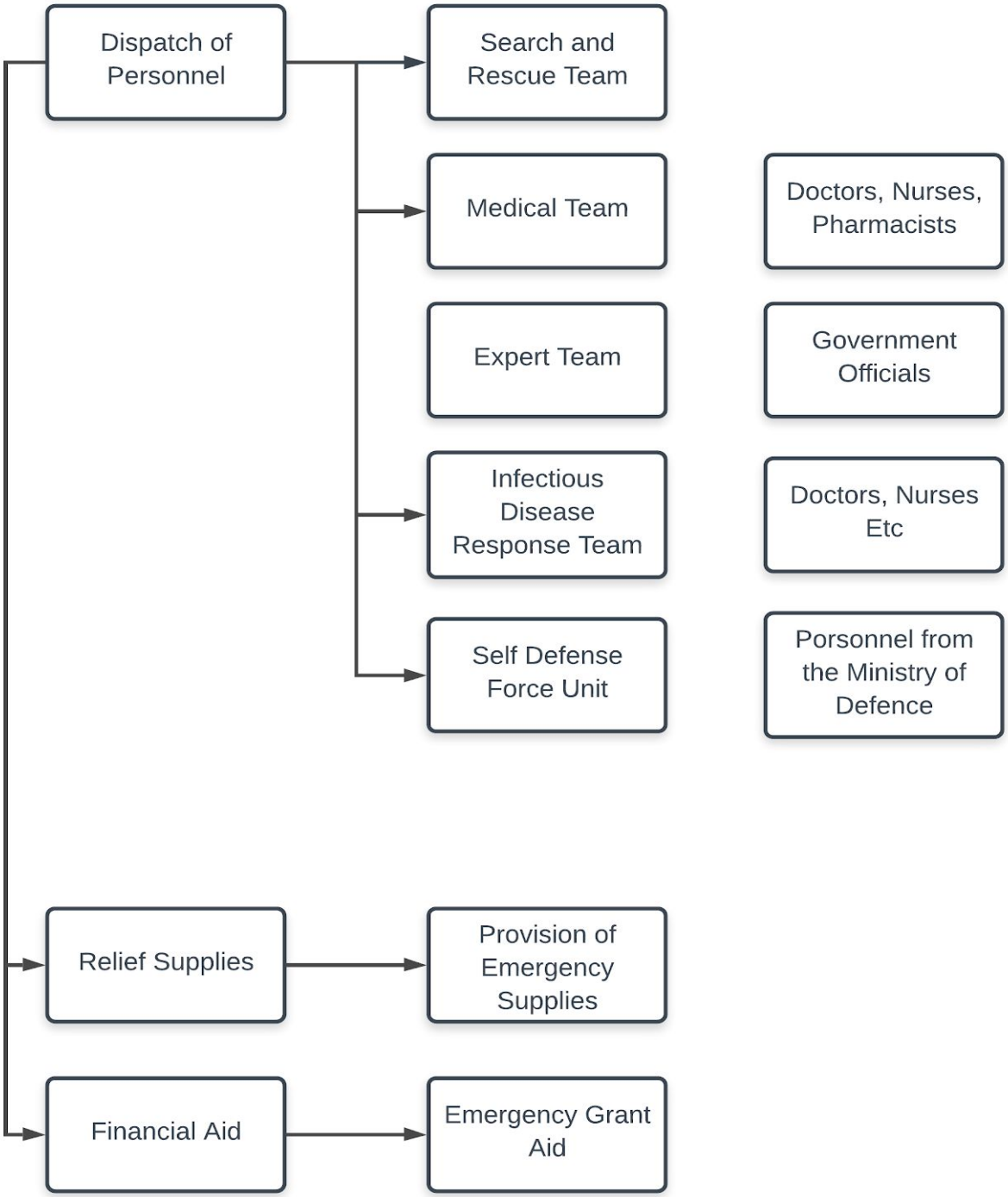
Subsystem Interfaces:

- It has two interfaces - one with data collection team and one with early warning systems for disaster prone areas.
- The data collection team collects data about previous natural disasters.
- Monitoring team will ensure the following of protocol and necessary installation of equipment for hazard mitigation.

Subsystem Maintenance:

- A few simple checks and maintenance tasks have to be done to keep the subsystem in good condition.
- We can maintain a tracking system that tracks the position of Disaster Response Force throughout the day.
- Regular checks on data storage and creating enough backup to ensure no data loss of previous instances of disasters.

It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc., It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc.,



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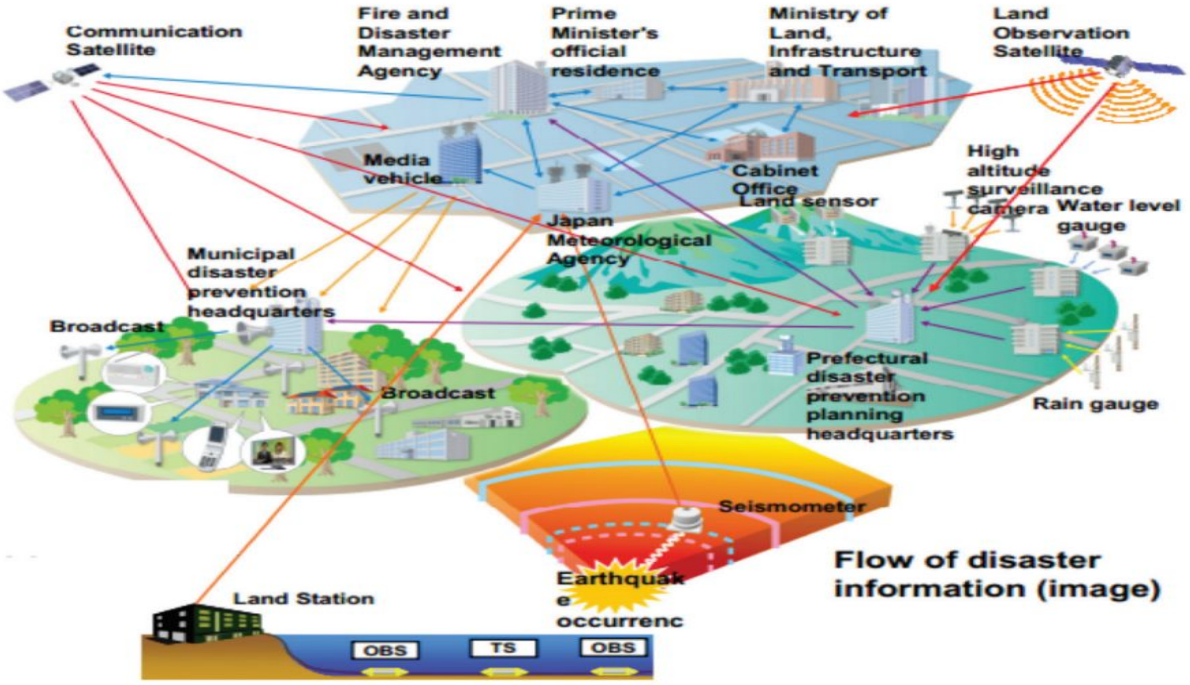

Source: NEC

Type of Disaster	Estimated Loss (in Cr. INR)
Earthquakes	118
Cyclones	2,771
Storm Surge	4,507
Tsunami	7,192
Flood	46,326
Total	60,915

Source: UN Global Assessment Report, 2015

It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc., It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc.,

Challenges Table

Challenge	Solvable / Not Solvable	Reason
Medical resources	Manageable upto some extent	Requires more hospitals that are sufficiently equipped and have skilled staff.
Communication	Somehow Manageable In Natural disaster	With the on growing technology development, it is possible to have uninterrupted communication during natural disaster.
Protection of citizens	Partially Solvable	It requires a expert team in ensure safety of people in different type of disasters

It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc., It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc.,

4.Terrorism and External Threat Management System

Subsystem goals:

- ❏ The main goal of the system is to deal with all contingencies and tactics that terrorists aim and perform.
- ❏ Help reduce crime rates and promoting law and order.
- ❏ Design and planning of cities based on the factors that impact on security.
- ❏ This system not only uses manual power but also for guessing and detecting crimes before they happen by analysing the information obtained from surveillance subsystem.
- ❏ Conduction of massive awareness drives and educate vulnerable groups.

Subsystem requirements:

- ❏ Well trained and well-equipped Quick Reaction Teams (QRT's) and teams like Special Weapons and Tactics Team(SWAT) within every city.
- ❏ Data from surveillance system to monitor especially terrorist prone areas.
- ❏ Gathering information about the type of places where threat has occurred and knowing potential of threat.
- ❏ Tracking of suspicious people and knowing their information like location, and whether they are meeting any suspicious people ,etc.

Subsystem boundary:

- ❏ This subsystem considers various inputs obtained from surveillance system.
- ❏ It analyses the information obtained and designs a plan accordingly for maintaining better security in the urban cities and may send the message to emergency response system if needed.

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Subsystem Characteristics:

Some of the characteristics of this subsystem:

- System Efficiency
  - This system comprises both automated and manual stuff.
  - Efficiency of this subsystem is strongly dependent on the efficiency of the surveillance system because it uses this data to analyse the situations.
  - Also efficiency of this planning system depends on how well and fast the manual force implements it after informing.

- System Risk
  - It will entirely fail if the data obtained for it is wrong and the it is very much prone to hacking because they can not only hack the surveillance system but also the data can be hacked during the communication.
  - If confidential Information related to strategies of counter-terrorism are leaked then it is a severe risk and it is difficult to take immediate responses.

- System suitability
  - This is suitable for almost every urban city as they are technologically well equipped for internet connection ,power throughout the day and also will be well equipped with manual force etc.
  - Might not be suitable where there are frequent power cuts etc.

- System Acceptability
  - While designing and maintaining this system is important ,we should also ensure that it does not disturb the public.
  - As most of this system deals with data obtained from devices we are not disturbing the people.Hence,it will be acceptable to most of the people.

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How this subsystem contributes towards the system's goal :

Improving security and reducing number of threats is the goal of the system and this subsystem is very important because without this you cannot prevent this external threats when you don't know that there is some chance of happening of this event like bomb blasts etc which have very high impact on the people of city and cause so much loss.

Subsystem Inputs and Outputs

- **Inputs**
    - Data obtained from surveillance system.
    - Data physically obtained from police forces.
    - Data obtained from common public when they suspect.

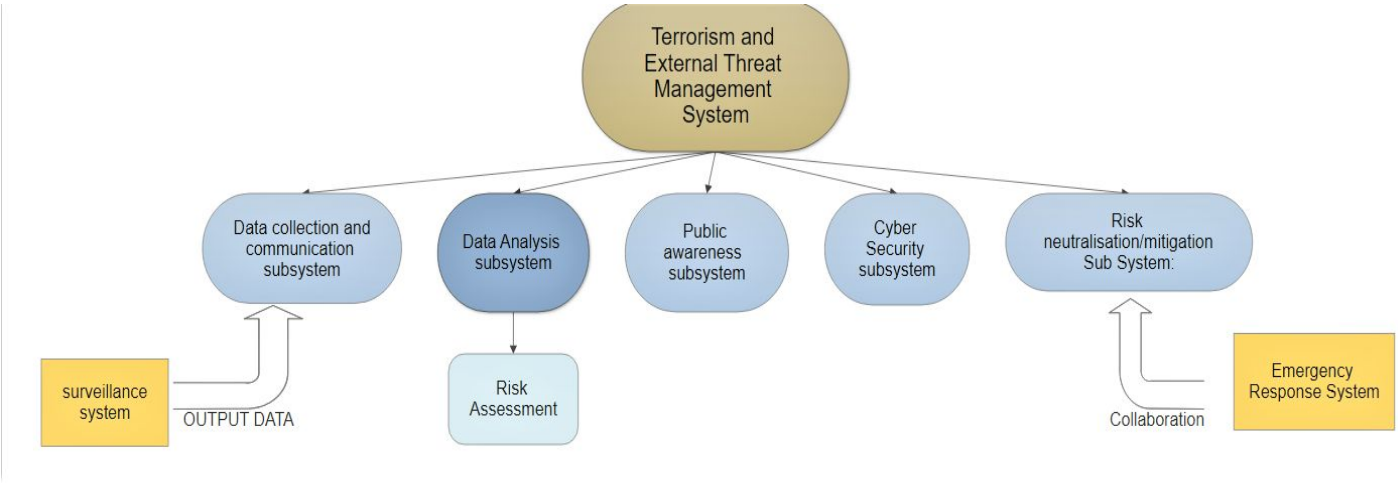
- **Outputs**
    - Designing a plan dynamically and continuously for threat management and informing or sending message.

Subsystem Interfaces

- ❏ It has one interface with the surveillance system to collect the data.
- ❏ It has one more interface with the emergency response system to send important messages.

It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc., It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc.,

Further levels of Sub System:



❖ Data collection and communication subsystem

- ❏ Storing the statistical data from previous incidents of attacks which includes potential of threats, types of places where threat had happened and measures taken to handle threat and limitations with response to threat.
- ❏ Further division:
  - ➔ communicating dynamically with surveillance system.
  - ➔ An app or cellular service from public to communicate and send information.

❖ Data Analysis subsystem

- ❏ The data obtained is analysed and this analysis is used to handle the present threat by overcoming limitations and to properly manage the forces available within resources.
- ❏ This sub-system is controlled by a team of people who are technically strong.

➔ Risk assessment :

- ❏ Counter terrorism protective measures should be proportional to the level of threat. Because threats vary, it is necessary to assess the likelihood of the threat, the vulnerability of the target and the impact such an attack would have if it were to occur.
- ❏ This system basically categorizes the threat level and gives responses

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according to that level. The levels are

1. CRITICAL: attack is imminent
2. SEVERE: attack is highly likely
3. SUBSTANTIAL: attack is strongly possible
4. MODERATE: attack is possible but not likely
5. LOW: attack is unlikely

- ❏ For low level risks, contingency plans are usually sufficient and they can be managed by local police officers.
- ❏ For high level risks, high police strength and collaboration with military is necessary.

❖ Public awareness subsystem

- ❏ This subsystem contains manual staff to make the public aware about our system.
- ❏ Conducting sessions for making them aware about our interface(i.e,app or cellular service) and teaching them how to use it.
- ❏ It can be further divided into subsystems based on how the awareness is being created(Ex:through newspapers or public meetings etc)

❖ Cyber Security and maintenance subsystem

- ❏ There will be many issues in for communicating data ,how much ever secure the channel is ,how much ever difficult the encryption scheme may be,hackers are coming up with novel ideas to overcome those and steal the data.
- ❏ Hence a group of people are required to identify if the system is hacked etc,to change the scheme where a loophole is used by the hacker etc.
- ❏ Also some people would be required for maintaining all the systems and servers.

Risk neutralisation/mitigation Sub System:

- ❏ This sub system works on three principles *"Deter Detect Delay".*

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1. **Deter**: by physical and electronic security measures coupled with good management practices
2. **Detect**: by providing alarms and visual-detection systems along with verification.
3. **Delay**: for a sufficient period of time to ensure that quick response teams can react effectively by putting in place physical security measures.

Challenges that still remain:

- ❏ Protection of citizens : If a huge attack is happened then protecting victims remains a challenge
- ❏ Engineering analysis of data : Analysis of huge data requires a lot of computation and time which is a challenge.
- ❏ Training an accurate identification system : Accuracy of data will be low due to limited amount of data which is a important challenge to be taken care of.
- ❏ Identification of sleeper cells.
- ❏ Identification of militant base camps.

Challenges Table:

Challenge	Solvable/Not solvable	Reason
Protection of citizens	Partially Solvable	It requires a lot of police force depending upon the potential of threat and can be solved by collaborating with other state police force and if necessary communicating with Indian Military Services.
Engineering analysis of huge data	Solvable	Using supercomputing resources and latest deep learning and artificial intelligence algorithms this can be solved . But there is a cost-capability trade off here.
Training an accurate	Solvable	Initially the accuracy will be pretty low, due to limited amount of training data. However, over time

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identification system		after the model is trained more and more, it will lead to more accurate identification. Hence, here there is a time-capability Tradeoff. This is because simulation takes a lot of time here.
Identification of sleeper cells.	Not solvable	These people behave normally and live like local residents. Identification of them is very difficult and it is possible only when we track every move of total citizens in a city which is highly impossible.
Identification of terrorist base camps	Solvable	These require high technology equipment like drones with wide range and other satellites information to track them . There is a cost tradeoff here.

System Use Cases and Border Cases :

- ❏ The whole city is under surveillance and being monitored.
- ❏ To make sure that the crime rate and terrorism in the city is under control.
- ❏ To gather useful data from various parts of the city which are deemed to be vulnerable in the form of video footage.

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5. Emergency Response System

Subsystem goals

- The primary goal of this subsystem is to provide immediate response in case of emergency.
- This system should be efficient and well-grounded.

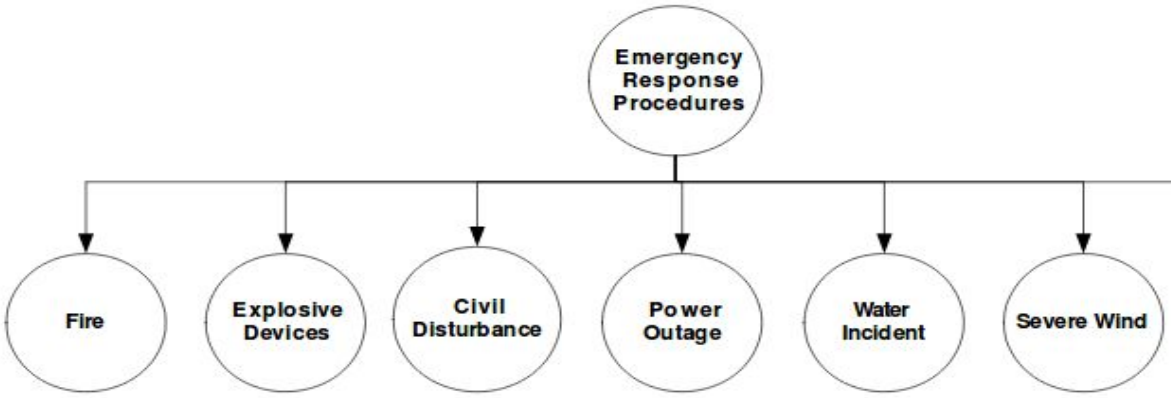
Subsystem requirements

- medical services
  - We need quick ambulance services and basic medical requirements.
- Police Taskforce
  - We need a special task force which is to be deployed according to our needs
- Communication Services
  - We need a efficient and uninterrupted communication service for communicating between subsystems.
- Basic training team
  - We need to employ few training teams that provide basic training in how to react and tackle an emergency situation.
- Maintenance Team
  - A maintenance team is required to check the maintenance of this subsystem.

Subsystem Boundary

- This system starts at a point where the input is received from any subsystem regarding the emergency situation.
- The system ends at the point where it ensures that the data is sent to the data team which is done by the maintenance team.

It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc., It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc.,



Subsystem Characteristics

- System availability:
  - Based on the requirement, the team sends different teams like the police or medical support or both to the location of the emergency.
- System efficiency:
  - Typically the efficiency of the system is measured in terms of the low response time.
  - In addition to the response time, other factors like sending the required support team for a particular emergency situation also affect the efficiency.
- System sustainability:
  - This subsystem is sustainable in almost all cases as the situations we get are very small like thefts, assaults.

Subsystem Inputs and Outputs

- Inputs
  - System would be getting input from surveillance team about a situation.
  - Inputs from surveillance team include
    - Location of emergency
    - Description
    - Severity of the situation

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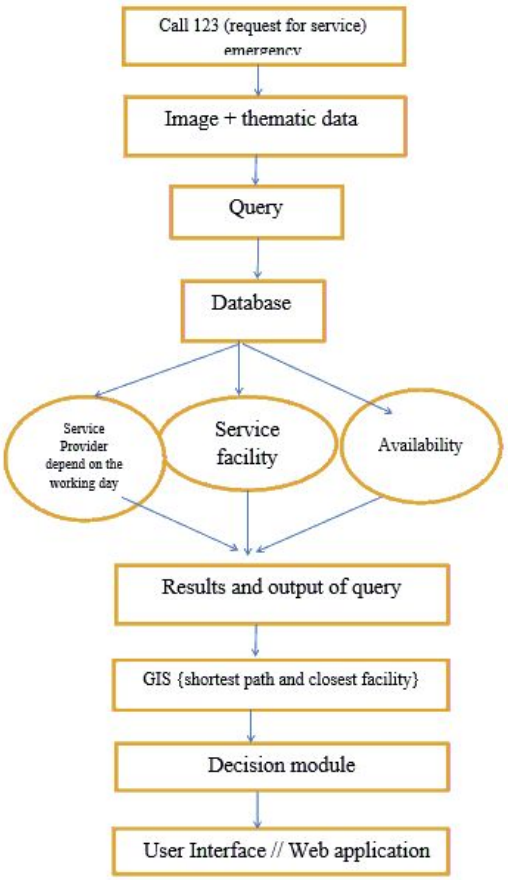
- ➢ Outputs
  - Based on the input from the surveillance team the emergency response team should deploy required kind of support like police task force, medical support etc.
  - Output format from emergency response team
    - Required number of police personal
    - Medical Services
    - Fire extinguishers (in case of a fire accident).



Further levels of Sub System

It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc., It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc.,

Emergency Response System

- CONTROL SYSTEM
  - It consists of a team which overlooks the various inputs and sends the necessary actions to be taken to the Response System .
  - Takes the input from surveillance team and then processes the information and gives necessary conditions to deploy the Response System.
  - The effective use of this system can be seen in the cases where large no of troops are deployed and are guided using this control system.

- RESPONSE SYSTEM
  - Executes the necessary actions like deploying police taskforce or the basic medical response team to the location of emergency according to the data sent by the control system.
  - Response system is the important component of emergency response system.
  - It is the job of Response system to bring the situation under control.

Subsystem Maintenance

- The maintenance of the subsystem is ensured by doing the following:
  - Maintaining the control system such that it processes the inout data in a efficient manner.
  - Deploying enough number of police task required for the given situation.
  - Evaluating whether the deployed support forces are reaching the emergency spot in time.
  - Continuously staying in touch with the other subsystems.

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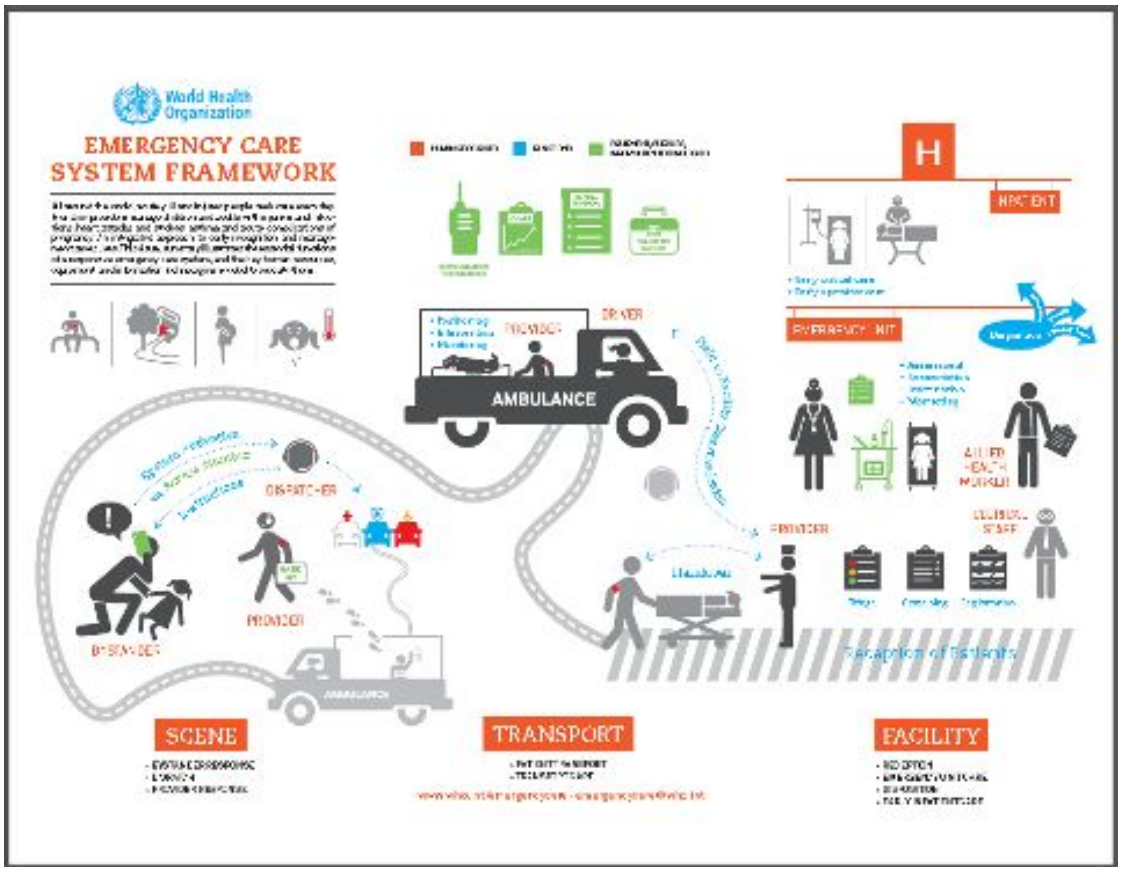
Challenges that still remain

- Limited police force
- Medical resources
- Response time
- Communication

Challenges Table

Challenge	Solvable / Not Solvable	Reason
Limited police force	Manageable upto some extent	Requires the approval of higher authorities from the police department.
Medical resources	Manageable upto some extent	Requires more hospitals that are sufficiently equipped and have skilled staff.
Response time	Manageable upto some extent	Depends upon the situation.
Communication	manageable	With the on growing technology development, it is possible to have uninterrupted communication during a emergency situation.

It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc., It should also have the records of the data like traffic count , surveillance , travel speed and travel time , location , vehicle weight , delays ,etc.,



ROADMAP FOR SAFE CITY:

Implementation of a safe city project is an inclusive and collaborative process that involves aspects such as governance, planning, technology, resources and awareness. It requires participation, inputs as well as ideas from a wide range of stakeholders. Considering this, we have cited a potential roadmap that provides insights that will help states as well as cities in launching an initiative aimed at fundamentally transforming their security .

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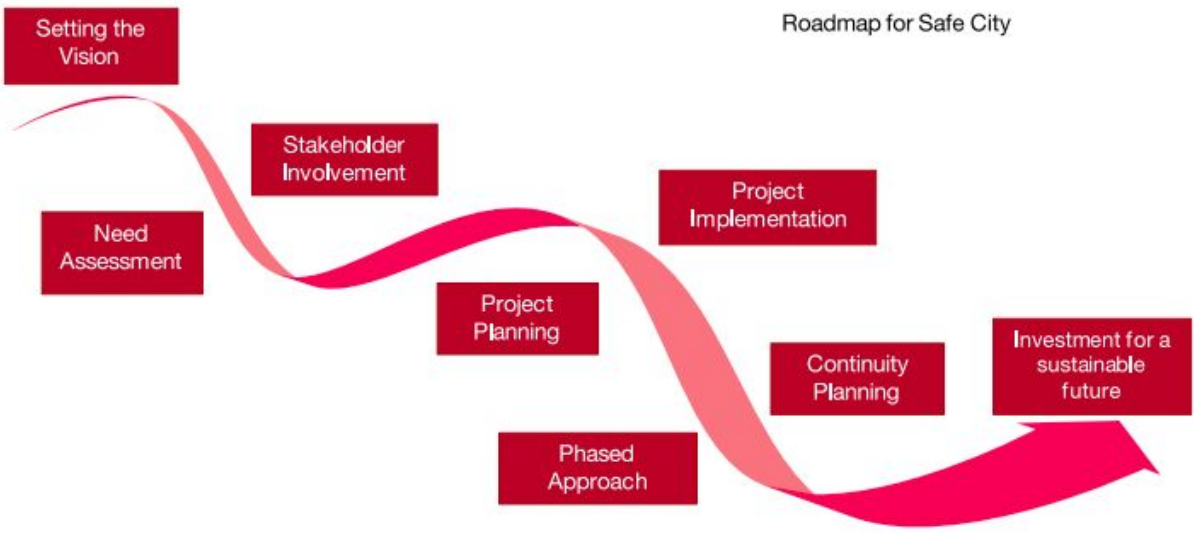

Critical steps within the roadmap

Setting the vision:

It is important to have in place a clear vision of the end result that is to be achieved, even before an approach of transformation is framed. A clear picture of the desired security scenario needs to be in place in order to take appropriate measures to reach to the desired goal.

Analysis-based need assessment: An effective assessment of the current scenario is one of the most important activities to be undertaken for such a project. A survey of various parameters affecting crime incidence, and the mapping of geographic areas with high perceptions of crime instances provide critical snapshots and help prioritise focus issues as well as resources.

Encourage stakeholder involvement: Different government agencies as well as working groups often operate in near isolation from one another, which results in a major barrier of facilitating various tasks and activities. It is imperative that the implementing authority engages with other stakeholders, since they can provide valuable insights into the most effective ways to improve security measures. Also, the earlier we get all the stakeholders involved, the better.

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Address challenges: During the course of implementation complex problems such as policy, funding gaps, technology adoption and awareness issues are bound to occur. However, it is important to view a particular hurdle well in advance and come up with a coordinated set of solutions. It may also be advisable to seek professional help in order to leverage best practices being implemented in other avenues.

Project planning: Thoughtful planning of technology and its use is critical while implementing such an initiative. While there are plenty of differences between geographies, they still have a lot in common. We need to look for global safe city implementations, and try to adopt those solutions which have already been successfully implemented for similar problems.

Phased approach to start small and scale big: The secret of rolling-out an initiative is breaking complex, overwhelming tasks into small manageable tasks, and then taking up the first task. Segment the project goals and activities into immediate, short-term and long-term based timelines. For instance, immediate measures can involve setting up of required surveillance infrastructure, Short-term measures can include use of analytics, while long-term measures can include collaboration with other agencies or establishments and sharing of data.

Long-term sustainability: It is critical that sustainability plans for the project are well-laid out. Future plans for the continuity of the project need to be defined from the outset, and issues such as budget for maintenance, appropriate staffing, provisions for technology upgrades, etc. need to be deliberated well in advance.

Invest for the future: It is important that the concerned authorities as well as leaders understand that the security initiatives they are investing in will take some time to deliver its desired results, and they must be prepared to invest upfront for long-term benefits. Such programmes take time to change the people's perception about the security scenario, and will lead to a significant reduction in crime rates in the due course of time.

India must look at rolling-out a proactive approach so as to provide a safe and secure environment, coupled with an enhanced approach towards robust response mechanisms in case of incidents of terrorism, crime or a natural calamities.

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