

Maturity Assessment Framework and Toolkit

Integrated Command and Control Center (ICCC)

Part B- Case Studies, Use Cases

Ministry of Housing & Urban Affairs (MoHUA)

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Maturity Assessment Framework and Toolkit to unlock the potential of Integrated Command and Control Centers (ICCCs)

Maturity Assessment Framework guidance document is a toolkit to assess the maturity of ICCC as an infrastructure. It aims to help Smart Cities self-assess their ICCC capabilities and effectiveness.

Disclaimer: This is confidential working paper and hence represents a work in progress concept framework. It is not meant to represent the position or opinion of Ministry of Housing and Urban Affairs, nor the official position of any staff members. Document is circulated only to seek feedback and industry suggestions over the draft concept framework.

Draft for consultation

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Annexure I: Case Studies

Case Study 1: Surat Smart City Center, Surat, India



City Information

City	Surat
Size and population development	1991: 1,498,817 2001: 2,433,835 2011: 4,467,797 Change: +6.26%/year [2001 → 2011]

Population composition	An ethnic mix of people speaking Gujarati, Sindhi, Hindi, Marwari, Marathi, Telugu, and Odia; also has a sizeable Parsi and Jewish population
Main functions	The second-largest commercial hub of western India after Mumbai
Main industries/business	Surat is known for diamonds, textiles, and for diamond-studded gold jewels manufacturing; Three-quarters of the world's diamonds are cut and polished in Surat
Political structure	The Surat Municipal Corporation is responsible for maintaining city's civic infrastructure as well as carrying out associated administrative duties. The powers have been vested in three Distinct Statutory Authorities: The General Board, the Standing Committee, and the Municipal Commissioner.
Administrative structure	1 Municipality, 29 wards
Website	www.suratmunicipal.gov.in

Background and Objectives

Surat is one of the first 20 cities selected under the Smart City Program initiated by the Indian Government. Surat, a port city, is the eighth largest city and ninth largest urban agglomeration in India. It is the second largest city in the state of Gujarat, after Ahmedabad. Surat is the 34th-largest city by area and the 4th-fastest developing cities in a study conducted by the City Mayors Foundation, an international think tank on urban affairs.

Considering the fast growth of the city and increasing demands and expectations of citizens from the city-government, Surat Municipal Corporation (SMC) has envisaged a Smart City Plan to serve citizens in an effective manner.

For the Corporation to monitor different services, like night brushing, cleaning of roads, garbage collection and disposal, road repairing, health services and illegal construction,

SMC has implemented a Smart City Center. In times of exigencies, the center is to double up as an emergency operations center that will coordinate and execute tasks with different agencies in the city.

Implementation

The SMART City Center (SMAC Center) is an initiative of the Surat Municipal Corporation under the Smart Cities Mission of the Government of India. The Surat Smart City Development Ltd (SSCDL), a Special Purpose Vehicle (SPV), is responsible for the execution of all Smart City Projects in Surat.

Inaugurated in June 2016, SMAC center uses an ICCC platform integrated with 12-13 layers for the project. This center is linked with the CCTV Project of Surat City Police Department that has over 650 CCTV cameras at different locations. An additional 1,000 CCTVs, proposed to be set up by the SMC soon will also be linked to this center.

This center collects functional information of all the departments and public on a real-time basis. Automated sensors and systems send various data sets to the SMAC, which are analyzed to avail important information to make decisions. All the online applications and mobile applications of SMC for people-centric services would be monitored from one place at the Smart City Centre. Birth and death certificates, relevant information on development plans and essential services, including water supply, are being integrated at Smart City Centre. During the time of natural calamities like floods, officials of different departments can remain in contact through the center.

Results and impact

With the implementation of this pilot project, SSCDL is able to monitor traffic movement, control the smart street lighting system and maintain a bird's eye surveillance of the city from the SMAC. This center collects functional information of all the departments and from public on a real-time basis and helps all the Corporation departments in maintaining civic service delivery standards on a day-to-day basis.

Case Study 2: Rio Operations Center, Rio De Janeiro, Brazil

The Rio Operations Center controls the city's daily operations, integrating several departments involved in Rio's day to day management; and for controlling crisis and emergency situations.



Rio de Janeiro has been hit hard by repeated Atlantic storms imperiling the city. This especially affects the low-income settlements that are located on the high slopes surrounding the metropolis, which are prone to devastating landslides. Following a vicious storm in 2010, Rio de Janeiro decided to create a center that operates 24 hours a day, staffed by officials from 30 city departments. This center has become a global model, showing the benefits that can be derived from collaboration, alignment and data sharing across city divisions.

The model has had many other benefits for the day-to-day management of the city. Traffic emergency time response has been reduced significantly with citizens alerted about traffic congestion points and accidents and redirected to the best routes. Data gathered for the center also enables the identification of neighborhoods with higher dengue fever infection rates. In planning the facility, Rio officials visited alert centers in Madrid, Seoul and New

York, and have since forged cooperation with the city of Johannesburg that established a similar entity which is called the Joint Operations Committee.

City Information

City	Rio De Janeiro
Size and population development	1990: 9,595,000 2011: 11,960,000 2010-2015: +0.85% / year 2025: 13,621,000
Population composition	Ethnic diversity with many different communities; 25% of the population is aged under 18
Main functions	Second industrial, service and financial center in the country after Sao Paulo. tourism hub
Main industries/business	trade, tourism, services, industries (chemicals, pharmaceuticals, petroleum products, metal products, textiles)
Political structure	Prefect who has municipal executive power and is directly elected by a two-round majority system and the Rio de Janeiro Municipal Chamber which has legislative power
Administrative structure	1 Municipality (Prefeitura), 19 Sub-prefectures (subprefeituras), 34 Administrative Regions
Website	http://www.rio.rj.gov.br/

Background and Objectives

In April 2010, the city endured heavy rains (over 304mm in 24h) and 68 people died due to landslides. Moreover, 22.72% of the city's population (around 1.47 million) lives in vulnerable low-income communities that are located on slopes surrounding the City. A 2010 study conducted by GEO-Rio (Rio Institute of Geotechnical Foundation) identified 20,000 households on high geological risk areas – 2,000 of them have already been relocated through public housing programs.

The Rio Operations Center was officially created by a Municipal Decree on December 23, 2010, with the goal of increasing the city's resilience. The Decree determines its responsibility to control the city's daily operations, integrating several departments involved in Rio's routine; and to manage crisis and emergency situations. The Decree also establishes that the Rio Operations Center should interact with the media in

disseminating and receiving information related to crises and process information from the 1746 Hot Line.

Inaugurated in December 2010, the Rio Operations Center was created primarily for risk management and prevention though it soon became clear that it was also a strategic tool for administrating urban mobility and coordinating large scale events.

The promotion of greater integration – internal and external – of the municipal administration has been established as one of the city’s guidelines in the city's strategic plan. The Rio Operations Center was designed to improve the cooperation and the communication between government entities, and to deliver relevant information for public departments and the population. It increased the capability of municipal departments and their reach. Its goal is to monitor and optimize the city's operations, as well as anticipate solutions and minimize errors.

Implementation

The Rio Operations Center is a Rio de Janeiro City Hall Initiative. Its technological platform development was done by the Municipal Company of Information Technology (Iplan) and the Pereira Passos Municipal Institute of Urbanism (IPP). The Rio Operations Center was designed based on the technological expertise of partners such as: IBM, Bilfinger, Cisco, Samsung and Google. Using Google Earth technology, it was possible for Iplan to create an integrated system of georeferenced data from all municipal assets involved in Rio's daily operational routine – the Geoportal software. The Operations Center collaborated with Oi and TIM (telecom companies), which implemented the links for data transmission.

The Control Room – the heart of the project – where 200 controllers, in three 24/7 shifts, monitor the city in real time, receiving images from over 900 cameras, through 30 km of fiber optic cable. The 60m² videowall in the control room is composed of 80 46-inch monitors, which rely on Bilfinger and Samsung technologies. Cisco provided the telepresence system, and Itautec provided the computer network used by employees of the Operations Center.

The Crisis Room is used for emergency meetings with different departments, connected to two other small crisis rooms, one at the mayor's official residence, and the other at the Civil Defense Service.

The Press Room is where media representatives are constantly releasing alerts to the population. The communication with all media outlets is a two-way exchange of information that amplifies the communication of the municipal authorities' messages, thus increasing its capillarity, and recommendations to the population. The media also warns the Rio Operations Center whenever there is an atypical event notified by their audiences. The creation of a channel of communication improves the quality of enabling frameworks, and guarantees transparency, accountability and public trust.

The 1746 Hot Line is a communication channel with City Hall, whereby citizens can report problems, requests and complaints about city services, get information about debts, fines and permits, and even tourist information. Along with and improved communication strategy, transparency and the digital engagement of citizens are fostered.

The Rio Operations Center has three key areas of operation: risk prevention and management; city's operations; and coordination for major public events.

1. **Risk prevention and management** aims to save lives and includes the weather forecast, rainfall volume monitoring, and general security measures. This integration of data makes the Operations Center a focal point for crisis situations and for disaster management in a city historically suffering from heavy rains and flooding.
2. In **routine operations**, through tools of intelligent monitoring and direct contact with field teams, the Operations Center is tuned into any occurrences which may impact the city's routine. It responds with the necessary steps and guides the public on procedures to circumvent possible problems.
3. The daily learning process of how to conduct the city's dynamics with the Rio Operations Center as a new operational management focal point has contributed **to improve planning for major events** such as the 2013 World Youth Day and the 2014 Football World Cup.

To process all data generated in the Rio Operations Center, City Hall created the Big Data Department "PENSA – Ideas Room" in June 2013. This new department aims to search, analyze and evaluate correlations and define impacts by crossing different databases, in order to improve service delivery to citizens. "PENSA" possesses access to all municipal databases. Big data management enables research to look for patterns and analysis that could not be achieved otherwise. It is possible, consequently, to plan policies based on accurate information. Now, for instance, data generated by the daily management of traffic operations are now also used for city-level public transportation policy and traffic planning.

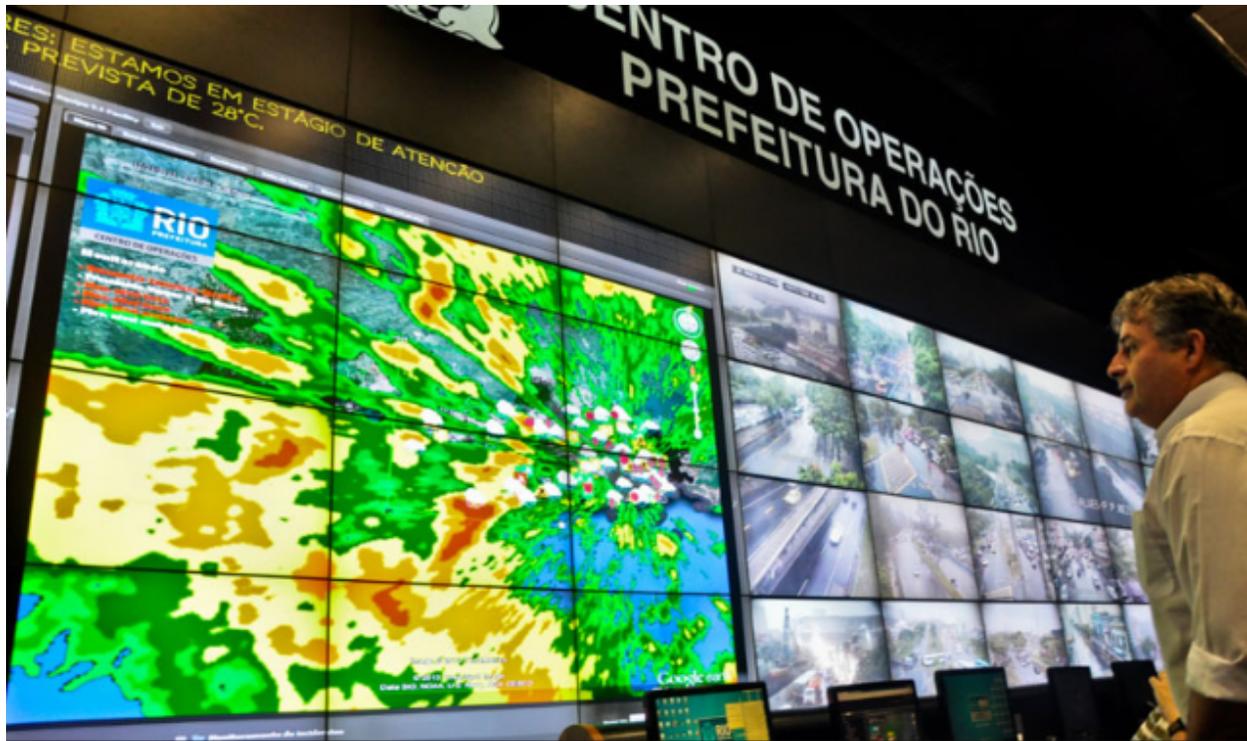
Financing and resources

City Hall constructed a three-story building at a total cost, of R\$ 20 million (approximately US\$ 8.9 million) including equipment. The Rio Operations Center gathers almost 30 city departments, public agencies and utility companies, as well as State Government's representatives.

Results and impact

The Rio Operations Center enables a new administration model that provides communication and coordination between public entities, facilitates information sharing and enables prompt and efficient decision-making processes.

The center has improved the city's management efficiency in many different areas – public transportation is one of them. Transportation is a major challenge in megacities like Rio de Janeiro and increased efficiency and use of public transportation are key to a sustainable urban development. Representatives of Bus, BRTs, Train, Ferry and Subway companies are present at the Rio Operations Center. The emergency response time was reduced by 30%. When any traffic incident is identified, traffic teams are rapidly sent to the location to solve it. The city's map, with over 80 digital layers, shows data such as the present location of all municipal vehicles and equipment.



In the case of street maintenance, the center coordinates with the municipal or concessionaries' teams responsible for the repair and traffic control. Another example was the work on dengue fever, a mosquito-transmitted disease with a high incidence level in summer. The geographical analysis of cases enabled the identification of the neighborhoods with the highest infection rates. City Hall used the information to implement preventive actions.

Barriers and challenges

Each department has its own organizational background. Through the years, each developed its standard procedures. The decision-making process used to be fractionated. In most cases, communication was done bilaterally. Departmental rivalries and information withholding had to be overcome. By integrating all stakeholders in the same room, all departments receive information simultaneously and in contact with other agencies. This collaboration constitutes a daily learning process. The Rio Operations Center is not vertically structured thus these interactions are constantly improved. Protocols for coordinating actions in over 150 types of occurrences were established.

To respond the challenge in terms of qualified human resources, the 400 employees go through continuous training and simulation exercises.

Lessons learnt and Transferability

In an increasingly urbanized world, with local governments facing several challenges such as traffic, and climate change an operations center is a strategic tool for smart megacities.

During the Rio Operations Center's conception, city officials visited similar centers in Madrid, Seoul and New York. The Rio Operations Center has been visited by dozens of delegations, including government officials, private companies and university students.

The effort to increase the city's resilience involved a comprehensive set of measures. The Rio Operations Center has a team composed of four meteorologists and seven technicians that work 24/7 monitoring the weather conditions with a variety of online information mechanisms. The whole weather technological system is linked to the National Space Research Institute (INPE) computers.

The communication strategy is key to alert the population about incidents and redirect them to the best alternative. Waze is one of the tools used . Three daily bulletins report the main occurrences through the Rio Operations Center's website, or through SMS, Twitter and Facebook accounts as well as radio and TV stations which are present 24/7 in the Rio Operations Center.

In an effort to educate the dwellers on how to prepare for risky situations, the Civil Defense created the Community Protection Program focusing on three subjects:

1. Training of Community Agents,
2. Community Alarm and Alert System, and
3. Simulation Exercises at Public Schools.

Similar centers in the world, such as CISEM in Madrid coordinate with police, fire and ambulance services. The Rio Operations Center is unique due to the quantity of public services and concessionaries integrated. The enormous quantity of data collected by the Rio Operations Center and the 1746 Hot Line is also being used in other initiatives.

Case Study 3: Integrated Centre for Security & Emergency in Madrid

(El Centro Integrado de Seguridad y Emergencias. (CISEM), Madrid, Spain)



City Information

City	Madrid
Size and population development	2001: 2,938,723 2011: 3,198,645 2015: 3,141,991 -.56%/year [2011 → 2015]
Population composition	In 2015, about 89.8% of the inhabitants were Spaniards, while people of other origins, including immigrants from Latin America, Europe, Asia, North Africa and West Africa, represented 11.2% of the population. The ten largest immigrant groups include: Ecuadorian: 104,184, Romanian: 52,875, Bolivian: 44,044, Colombian: 35,971, Peruvian: 35,083, Chinese: 34,666, Moroccan: 32,498, Dominican:

	19,602, Brazilian: 14,583, and Paraguayan: 14,308. There are also important communities of Japanese, Filipinos, Equatorial Guineans, Uruguayans, Bulgarians, Greeks, Indians, Italians, Argentines, Senegalese and Poles
Main functions	The capital city of Spain, seat of government, and residence of the Spanish monarch, Madrid is also the political, economic and cultural center of Spain. Madrid is considered the major financial center of Southern Europe and the Iberian Peninsula
Main industries/business	Madrid is the 5th most important leading Center of Commerce in Europe (after London, Paris, Frankfurt and Amsterdam) and ranks 11th in the world. The headquarters of a number of leading companies are located in Madrid. The leading industries are: paper, printing & publishing, energy & mining, vehicles & transport equipment, electrical and electronic, foodstuffs, clothing, footwear & textiles, chemical, industrial machinery.
Political structure	The City Council consists of 57 members, one of them being the mayor. The mayor presides over the RKO.
Administrative structure	Madrid is administratively divided into 21 districts, which are further subdivided into 128 wards (barrios)
Website	emergenciasmadrid.com

Background and Objectives

On March 11, 2004, Madrid suffered a major terrorist attack when several commuter trains were bombed. As with the 9/11 attacks in the United States, this tragic incident highlighted the need for greater coordination among first responders. “The different emergency entities- the police, the fire department, the ambulance service and the mobile police had to intervene independently, with disparate communication systems and technologies,” says Fernando Garcia Ruiz, Head of Innovation and Development,

Department of Security for the City of Madrid. There was no way to organize a unified response to incidents, and there was a lack of centralized command and control.

A key lesson was that more than one major incident can happen simultaneously, and emergency assets may be needed in more than one place. Different incidents may be related, or have nothing to do with one another---without a clear overall picture, it may be impossible to tell if there is an important pattern emerging. This potential for complexity poses a significant challenge for emergency managers. They not only need to coordinate activity but also need to have a thorough understanding of everything happening in the metropolitan area so as to properly allocate limited resources to provide the best response to each incident. In addition, proactive measures such as limiting access to impacted areas, or crowd and traffic control for public events, has to be. The need, therefore, was not only for top-down coordination, but also for the ability to capture and integrate information to give managers the understanding and insight required to quickly make the right decisions.

Implementation

This complex project began in 2005 and concluded at the end of 2007 with the physical and technological integration of the Command and Control Centers supporting the Security and Emergency Services in the capital of Spain. Over time, the project was consolidated and further updates of the innovative technology platform were added. After the guarantee period, maintenance tasks for all the systems have been undertaken year 2009 onwards.

IBM provided the software needed to create a service-oriented architecture (SOA) which allowed for the seamless coordination and integration of all first responder agencies and emergency services involved. Indre, a global technology company, designed and developed the command and control center, which combines information from many sources including video feeds, field reports and mobile computers. They also designed the operation room, crisis room, auxiliary offices, data center and mobile control centers.

Because each of the first responder agencies had its own communication technology, a common mobile infrastructure was deployed. Most vehicles, from police cars to ambulances and fire engines, are equipped with mobile wireless computers or PDAs that

are connected to CISEM. The mobile infrastructure is critical in providing interoperability among the various agencies and to enable a two-way exchange of information----which gives managers vital, on-the-scene input that helps them develop a better understanding of what is happening on ground.

A multilayered, redundant communications infrastructure links to existing telephone systems, VoIP, satellite communications, a private radio network and 3G wireless networks to ensure continuous communication. IBM WebSphere® Everyplace® Connection Manager provides seamless, reliable, secure access to CISEM resources by automatically selecting the best available network and encrypting all communications. IBM Tivoli® Directory Integrator adds an additional layer of access security.

Financing and resources: Approx. 20 million Euros.

Results and Impact

The combination of forward-looking system design and end-to-end integration gives emergency managers in Madrid the tools needed to not only deal with today's threats but also handle rapidly evolving situations. Any sensor input (video, data or voice) can be readily incorporated into the data stream and accessed by anyone who needs it.

Not only do commanders at CISEM understand the full situation, but those in the field are also made aware of the status of other teams and resources. This single, unified view reduces confusion and enables faster and more effective decision making. Managers are now better able to deploy the right assets at once , reducing response time by 25 percent. Commanders are able to understand how complex and/or multiple incidents affect the entire region, and can allocate and deploy emergency resources in a truly coordinated and effective manner that takes into account all of Madrid's needs, not just those of a single incident.

Barriers and Challenges

The key to CISEM is integration----of information, systems, data sources and people but it was a challenge. The city also has to integrate all the applications currently used by the different entities, and integrate other external organizations, like Madrid 112, the video surveillance center, and the M30 highway control center.

Annexure II: ICCC Functional Use Case: Street Light Management

Illustrative



Domain: Street Light

Category: Civic Utilities

Expected Outcomes:

- a) Cost and Energy Savings
- b) Operational Efficiency
- c) Safe Streets and Localities
- d) Reduction in Crime
- e) Citizen

UC-1	How can we manage city streetlights to optimize energy consumption and ensuring better safety of citizens in locality?	
S.no.	Parameter (Qualifier: facility on min 70 % of the deployed infrastructure)	Category (Visualization (V) / Analytics (A)/ Communication (C) / Command & Control (C&C)
1	View streetlights, controller and feeder on the city map	V
2	Receive Ambient light alert (fog/rain/smoke/Thunder)	V
3	View KPIs on the dashboard	V
4	View real time meta data from street poles	V
5	View designated unsafe streets on city map (Marked by police/ city administration/ citizens)	V
6	View heat-map based on streetlight complaints from different areas	V
7	Real time monitoring of streetlights – energy consumption status	V

8	Trigger Event as per configuration (Detect, inform, track, analyze)	C
9	Communication capability over VMD, PAS, social Media, over movement of the vehicles in the designated zone as well as option for re-routing of the traffic	C
10	Two-way communication with field response team	C
11	Light on/off control at individual light level	C&C
12	Brightness control	C&C
13	Light on/off control at group light level	C&C
14	Auto dimming schedule based on geo location	C&C
15	Light On/off as per pre-set ambient condition	C&C
16	Light On/off motion based	C&C
17	Light Intensity /Luminosity - auto increase/ dimming as per ambient conditions	C&C
18	Power saving mode - When there is no changes in environment and during night time, dimming the lights (reduce luminosity) and switch off alternate lights.	C&C
19	Traffic based light control	C&C
20	Availability of manual overrides	C&C
21	Analyze pattern of alert originating from emergency kiosks	A
22	Analyze trends over dashboard for Street Light Maintenance Dashboard.	A
23	Lighting policies (time stamp, GPS data, and observed value) for different street conditions (Accident prone, isolated area, slippery roads/ people density).	A
24	Prediction of optimum Light Intensity based on Ambient Light and Sensor Data	A
25	Asset tracking and replacement SLA	A

26	Street light complaint management thru citizen mobile app	A
27	Auto Learn the existing occupancy pattern and predict occupancy patterns for future planning	A
28	Report based on :	
(a)	Total burn hours calculation of streetlights	A
(b)	Correlation between Environmental Sensor & Smart Light	A
(c)	Predictive maintenance alerts	A
(d)	Fault detection and alerts on map	A
(e)	Automatic SMS/ Email alerts to the maintenance team	A
(f)	Trend analysis on energy pattern consumption	A
(g)	Auto ticket generation for faulty lights	A
(h)	Report of Actual v/s prescribed Burn hour	A
29	Ability to use camera/ sensor based streetlight to detect distress call/noise/ gun shots etc., Help in traffic rerouting, emergency trigger etc.	A
30	Ability to create useful analytical data sets	A
31	Visible impact thru streetlight- provide evidence- like Parking enforcement/Traffic Jam mgmt.	A
32	Correlation between natural lux levels and that generated by street lights to plan proper power to the light.	A
33	Light working and non-working trends last week, last month etc.	A

Annexure III: Use Cases Repository

#	Category
A	Safety and Surveillance
	Make citizens feel safe in the City?
	How to ensure safety of citizens during emergency/disaster situations?
	How to predict crime in a City using Data Analytics, Artificial intelligence?
B	Solid Waste Management
	How to improve cleanliness at public places?
	How to improve public toilet facility monitoring and servicing?
	How to manage on demand Waste Collection in City?
	How to manage Solid Waste Management Operations effectively?
C	Water Supply
	How to ensure reliable and quality water supply in city?
	Reduction of potable water wastage in the city?
D	Emergency and Disaster Management
	How to reduce the damage to property/life in case of fire event in a busy area of city?
	How to reduce the damage to property/life in case of Disaster/Emergency event in a busy area of city?
E	Service Delivery
	How to monitor and manage civic complaints effectively?
	How to gauge Citizen Satisfaction to citizens to improve service delivery?
F	Civic Health Use Cases
	How to reduce victim transit time from accident location to Hospital?
	How to effectively tackle mosquito borne diseases in city?
	How to strengthen Civic Health Care delivery in the City using Data Analytics?
	How to predict Stray Dog menace in the City?
G	Street Light
	How to monitor and maintain street lighting networks remotely
H	Transit and Mobility Use Cases
	How to effectively manage City Bus Operations?
	How to do City Traffic Planning using Data Analytics?
	How to identify open parking spots in City?
	How to monitor entry of vehicles to restricted Zones?
I	Roads Management
	How to reduce citizen inconvenience during road maintenance?
	How to effectively tackle potholes problems in City?
J	Waste Water Management
	How to control affluent disposal into city river water?

	How to ensure the storm water network readiness before rains?
K	Environment
	How to increase the green cover of the City?
	How to address air and noise pollution in city using environmental Sensors?
L	Data Monetization of City Assets
	How to monetize city assets for revenue generation/maximization to bring more sustainability to the cities?
M	Geo Spatial Analytics & Artificial Intelligence
	How to create geo analytics around mapping of all assets and various properties of Smart City?

A. Safety and Surveillance

Safety

Linked Indicators: Ease of Living Index Framework

- Number of CCTV cameras installed in the city per unit of road length
- Number of recorded crimes per lakh population
- Extent of crimes recorded against women, children and elderly per year
- Transport-related fatality per lakh population

Use Case 1: How to make city a safer place to live?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
Make citizens feel safe in the society?	Location of all CCTV cameras, police stations, Beat Marshals and Rapid action teams visible on the city map with feeds from CCTV	Location wise analysis of crimes in the city. Extent of crimes recorded against women, children and elderly per year	Trigger events for the utilities/ acting parties as per defined rules	CCTV Network across the city providing regular video feeds
	Marking few areas as 'Critical' for safety and security and putting up VMS for data display	Analysis and dashboard for classification of	Automated Messages to the Rapid Action Teams during the Law and order situations	Instantaneous event reporting to respective

		Crimes as per their types		authorities e.g. Police, Fire brigade
	Keep an eye on the entire city by collaboration with schools and housing societies to gather video feeds from private CCTV camera networks	Sentiment analysis by analysing citizen feedback about various safety issues in the city by ensuring anonymity of contributor	Automated messaging to citizens for providing regular updates during an emergency situation	On field warning systems e.g. Sirens, Public address systems to discourage defaulter in case an event is being viewed at the control centre
	Ability to view the dashboard/ intelligent word cloud from the data collected from internet, mobile app and social media	Integration of GPS for optimized route tracking with Emergency Response teams.	Awareness campaigns by authorities with citizens at large to remove the fear against the command control system	Creation of Green and Emergency corridors/ passages by traffic signal management for quick response
	Ability to map and view all accident and theft related data on the city map	Integration of face detection with CCTNS system. Transport-related fatality per lakh population	Anonymous complaint logging mechanism to ensure safety and privacy of complainant (removal of fear from the mind of citizens while raising voice against unlawful situations)	Drones for video surveillance

Use Case 2: How to ensure safety of citizens during emergency/disaster situations?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
Ensuring Safety of citizens in case of emergency/disaster situation (Fire, Riots, Epidemic, Protests, Forest fire, Chemical Hazard etc.) in city?	Location of all CCTV cameras, police stations, Beat Marshals and Rapid action teams visible on the city map with feeds from CCTV	Location wise analysis of crimes/ fires/ riots/ epidemics in the city	Better use of Public Address System to communicate messages	EWS & Disaster management
	Marking few areas as 'Critical' for safety and security and putting up VMS for data display	Analysis and dashboard for classification of crimes/ fires/ riots/ epidemics as per their types	Incident & Complaint management	Traffic diversions & signal mgt.
	Monitor the entire city by collaboration with schools and housing societies to gather video feeds from private CCTV camera networks	Analyse citizen feedback about various safety issues in the city by	Feedback/ awareness - Civic Services	GIS plot with Safe zones indicators

		ensuring anonymity of contributor		
	View the dashboard/ intelligent word cloud from the data collected from internet, mobile app and social media	Integration of GPS for optimized route tracking with Emergency Response teams	Two way Communication with Ambulatory services for effective deployment	Street lighting management
	View the heat maps of fire prone areas on the city map based on past incidences and patterns	Integration of face detection with CCTNS system	Information to Women safety, Patrol Services for quick response	Crowd management and Security Breach handling

Use Case 3: How to predict crime in a City using Data Analytics?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to predict crime in a given areas?	View designated unsafe streets on city map (Marked by police/ city administration/ citizens)	Generate Heat-map of common crimes from different areas	Notifications to the citizens about crime in sensitive areas	Ability to use camera/ sensor-based streetlights to detect distress call/noise/ gun shots etc, Help in traffic rerouting, emergency trigger etc.
	View Real time video streaming of camera feed	Trigger Event as per configuration (Detect, inform, track, analyze)	Deployment of Protection and Surveillance team in sensitive areas	Two-way communication with field response team to assist them in rescue or mitigation operation.
	View heat-map based on street light complaints from different areas	Apply Predictive Analytics over crime date over different dimensions.	Send alerts to various dept.'s. (like Police, Fire, Hospitals)Standard Operating Procedure to be invoked	On Field Resource Mobilisation in real time
	Specific gestures include Distress , violation of traffic rules ,detection of crowd gathering	Map High potential areas of crime : Crime Type, Crime Severity, Crime Location	Educating citizens to contact nearest support ecosystem at the time of distress	Coordination with Community Volunteers in event of a crime
	View objects for tracking and monitoring :Missing	Analyzeata generated on social media about crime patterns etc.		

	Car, Missing Person etc			
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B. Solid Waste Management

Linked Indicators: Ease of Living Index Framework

- Household level coverage of municipal solid waste collection
- Efficiency of collection of municipal solid waste
- Extent of municipal solid waste recovered through reuse

Use Case 4: How to improve cleanliness at public places?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to improve cleanliness	View the cleanliness, dead animal complaints on city map	Designing shortest route for garbage collection vehicle to aggregation point	Trigger Event as per configured SoPs	Asset and access Control

at public places?	View designated areas and places with high foot falls	Traffic simulation and congestion management for allocating appropriate vehicle	Communication over VMD, PAS and social media for educating citizens	PTZ Camera Control at Transfer stations. Sweeping machines, road sweepers
	View and locate hawkers in non-designated areas especially pan shops and food stalls.	Co-relate the data from Bin Sensors and other data like seasonal patterns, crowd movement, vehicle breakdown etc.	Two-way communication with field force: Sanitation Inspectors, Health Department Officers, and Vehicle drivers.	On Field Resource Mobilisation in real time.
	View dashboard/trend over compliant status for overflowing bin/litter around bins.	Areas wise analysis of waste or garbage on timelines	Bulk SMS/Notifications to the citizen in locality	Proper routing of vehicles in real times and assistance during vehicle breakdown
	View Attendance compliance report: Area wise	Sentiment Analytics and response wrt to event	Event Summary report using Knowledge Base	

Use Case 5: How to improve Public Toilet facility?

Use Case	Data Acquisition and Visualisation	Data Aggregation and Analytics	Communication	Command and Control
How to improve public toilet facility monitoring and servicing?	View all public toilets on city map along with meta data (toilet type, water supply, cleanliness etc.)	View the trend of public toilets usage	Communicate complaints and feedback with contractors, area officer and department heads responsible for maintenance of public toilet.	Allocate the complaint to specific contractor, area officer etc.
	View the cleanliness schedule of public toilets with meta data (contractor details, time etc.)	Predict the complaints related to public toilets	Provide information to citizens about public toilet through app, SMS and QR code	Send alert on receiving poor feedback or complaint wrt to public toilets.
	View the citizen feedback of public toilets	Track the area-wise issues pattern (Water leakage, unclean toilets etc.) wrt to public toilets.	Collect feedback from citizens using QR code mechanism	Control the CCTV Camera deployed at public toilet entrance
	View the complaints of citizens related to public toilets	Conduct trend analysis of citizen satisfaction rating wrt to public toilets (using mobile app or feedback capture machine)	Use VMD to update citizens about public toilets in given locality and its rating	

	Track and monitor SLA status of complaints related public toilets	Optional: Conduct usage/revenue analysis (if chargeable) of public toilets	Send complaint status to citizens wrt to public toilets	
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Use Case 6: How to manage Solid Waste Management Operations effectively?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to manage Solid Waste Management Operations effectively	View the bin sensor data	View the garbage collection trends from areas across the city	Real time reports to officers, contractors and departments on garbage pickup schedule and compliance	Ability to control the cameras at transfer station, processing plant.
	View the garbage pick-up vehicle schedule and transfer station real time feeds	Ability to predict the chronic garbage spots and assess the patterns	Communication to citizens and NGOs over garbage processed (Wet, Dry , Medical and e-Waste)	Ability to assign Solid Waste pick up vehicle in real time as per requirements
	View the processing plant real time data feed	Ability to assign shortest pick up route to vehicle and predict garbage vehicle breakdown	Ability to communicate with Vehicle driver, sanitation officer and processing plant manager real time	Ability to control the operations of Transfer station and Processing plant in real time.

	View and track the sanitation officers attendance and movement	Ability to predict the garbage operation compliance through SLA scorecard and dashboard	Educate citizens through website, mobile app, SMS to reduce garbage generation	Control Household level coverage of municipal solid waste collection
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Use Case 7: How to manage on demand waste collection in city?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to manage on-demand waste collection in City?	Ability to receive the complaint of on demand garbage collection through various channels	View the shortest route to respond the on demand request	Ability to communicate with on field staff/contractor/vehicle driver and citizen	Ability to allocate the request to an officer/contractor/processing plant etc.
	Ability to schedule the waste collection as per waste type (medical Waste, Hazardous Waste or e-Waste)	Ability to predict the waste complaints based on past trends of on demand waste collection requests	View and update the status of on demand request through call, SMS and WhatsApp	Ability to track the status of vehicle allocated to serve the request.
	View area wise request and pick up schedule	Ability to predict the cost and effort to calculate the cost wrt to size of request as per business rules.	Ability to communicate the real time status of vehicle to gauge the ETA etc.	View the SLA compliance and levy penalty on contractor etc.

	View the request allocation to specific officer and vehicle as per request.	Ability to predict ETA etc.	Ability to increase awareness through bulk SMS, VMD , Website and Mobile app.	
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C. Water Supply

Linked Indicators: Ease of Living Index Framework

- Household level coverage of direct water supply connections
- Per capita supply of water
- Quality of water supplied
- Level of Non-Revenue Water (NRW)
- Percentage of water connections covered through meters
- Percentage of plots with rainwater harvesting facility

Use Case 8: How to monitor pressure of water supplied in city?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
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How to monitor pressure of water supplied in city?	View waste water pressure levels and sump levels and across pumping stations and treatment facility with drilldown facility up to a locality	Correlate the complaints and the pressure level data	Communicate with water department to address specific leaks / seepage scenarios	Identify the city areas on GIS map that would require planning of sewer lines and the pumping station
	Identify and view the blockage in the drainage system till the treatment plant	Analyse the consumption data and the patterns in a given locality	Communicate using display devices/bulk sms to inform about traffic	Alert if a specific type of complaint is lodged several times from a particular area through citizens charter
	View complaints reported for sewerage across the city with drilldown facility up to a locality			Alert and shoot message to the concerned personnel in case of threshold breach (water surpasses the threshold.)
	View the status of the complaints/projects with real time monitoring of engineers and work done			Identify the city areas on GIS map that would require planning of sewer lines and the pumping station

Use Case 9: Reduction of potable water wastage in the city?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
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Reduction of potable water wastage in the city?

View the level of storages in reservoirs, dams and water tanks in the city	Level monitoring sensors at Dams, reservoirs, pumping stations/ distribution centres	Trigger event in case of visible pipeline burst	Communication to Response teams based on created alert
Record and view the trips made by water tankers in various parts of the city	Data collection from Mobile apps given to field officers to monitor wastages and from Citizens in the form of complaints	Automated messaging to citizens in case of water rationing and shortages	Monitoring of discharges through industries in the water sources
View the pipeline network and various nodes across the network	Analysis of water consumption per capita for regions in the city along with analysis of reported water wastage data	Regular messages to citizens to create awareness and display of per capita water consumption on VMS everyday	Controlling and monitoring of supply from pumping stations in case of wastage
Ability to record and view the volume distribution data at a central location	Analysis of water consumption patterns throughout the day and rationing of quantities based on that	Communication Water Ambulance in the vicinity for fixing the wastage by changing taps and monitoring quality of water	Alerts in case of water theft through pipeline and change in pressure
Ability to record and view the water quality reports	Analysis of water quality at source	Communication/ alert to authorities in case of inadequate volumes at specific nodes	-

D. Emergency and Disaster Management

Use Case 10: Reduction in losses during events of fire break-out?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to reduce human and capital losses in event of Fire break-out?	View the location of all fire hydrants and tenders across the city	Analysis of unstable, dangerous and fire prone structures in the city	Bulk messaging system for communicating citizens in the vicinity	Creation of emergency corridor/ passage for passing of fire response teams
	View the heat maps of fire prone areas on the city map based on past incidences and patterns	Correlation with the Environmental, Fire and Temperature sensors	Two way communication between field fire response team and command centre staff	Alerts and communication to Police agencies with appropriate messaging to ensure law and order
	View the location of hospitals and route with traffic condition in the city on the map	Analysis of number of establishments with appropriate fire safety audits and equipment	Communicating information of current status on VMS and PAS for controlling footfalls in the area	Detection of number of people/ crowd detection in the affected area and communication to nearest Hospital teams for backup
	View the real time video streaming of the location using the CCTV feed	Analysis of fire events in the industrial and commercial areas for better preparedness	Trigger the event in case of fire incidence for action teams	Auto SOP triggering to utilities such as Piped gas, electricity and telecom for discontinuation of services as necessary
	View the details of fire safety audits performed in the critical areas in the city	Sentiment analysis of the data collected from social media, complaints app and other physical media	Communication for safe exits via PAS for the citizens trapped in affected area	Drones for video surveillance

Use Case 11: How to reduce the damage to property/life in case of Disaster/Emergency event in a busy area of city?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to reduce the damage to property/life in case of Disaster/Emergency event in a busy area of city	Ability to track Fire Tenders on city map	Designing shortest route for Fire tender and hospitals/fire tender	Trigger Event as per configured SoPs	Asset and access Control
	View traffic congestion on city map	Traffic simulation and congestion management	Communication over VMD, PAS and social media for regular updates and advisory	PTZ Camera Control
	View on route camera feeds ,building exit plan	Co-relate the data from (Environment, Fire) Sensors	Two way communication with field force : Police , Traffic Police, Hospitals and City officers	Traffic Signal Control
	Ability to locate fire hydrants en-route and in premise	Simulation using 3D Maps of building to support field force	Bulk SMS to citizen in locality	On Field Resource Mobilisation ; Disaster Management Team

	View nearby Hospitals, Police Stations, Fuel stations, Buildings, public places	Sentiment Analytics and response wrt to event	Event Summary report using Knowledge Base	
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E. Service Delivery

Linked Indicators: Ease of Living Index Framework

- Percentage of citizen services available online
- Percentage of services integrated through Command Centre
- Percentage of citizens using online services
- Average delay in grievance redressal
- Tax collected as percentage of tax billed
- Extent of cost recovery (O&M) in water supply services
- Capital spending as percentage of total expenditure
- Percentage of population covered under Ward Committees/Area Sabhas

Use Case 12: How to monitor and manage civic complaints effectively?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to monitor	Ability to source civic complaints in real time through various channels : SMS, WhatsApp, Website,	Sentiment analysis for data collected from various citizen centric channels such as Social media handles, internet	Communicate with field staff from the requisite department while addressing complaints	Alerts to department officers and citizens if higher number of

<p style="text-align: center;">and manage civic complaints effectively</p>	<p>Mobile App, Facebook, Twitter, Call Center</p>	<p>media/ blogs, mobile applications, complaints mail box etc.</p>	<p>(ticket related information). Also Seek feedback from your employees wrt to complainant and problem type .</p>	<p>complaints are logged in given time interval.</p>
	<p>Ability to track complaint status and ability to provide update to citizens/officers</p>	<p>Predictive analysis of specific complaint type : Noise, Stench, Stray Dogs, Potholes, Water Quality etc.</p>	<p>Communicate with the complainant through SMS, Social Media , WhatsApp etc to update the Expected time of Allocation and Expected time of Resolution status of the work</p>	<p>Daily alerts for pending grievances along with details of responsible authorities</p>
	<p>View the SLA compliance status of complaints : Department wise , Officer Wise, Location Wise</p>	<p>Area/ location wise analysis of grievances/ comments for deriving patterns</p>	<p>Communicate using display devices to spread awareness</p>	<p>Alerts in case of non-adherence to SLAs by officers/employees with satisfaction score of each department.</p>
	<p>View the citizen feedback over the closed complaints through various channels.</p>	<p>Ability to analyse department wise/officer wise SLA compliance and the customer satisfaction on different dimensions</p>	<p>Use digital displays and PIS to spread awareness and taking precautionary measures to reduce the occurrence of civic complaints.</p>	<p>Daily alerts showcasing defaulters with pending tickets.</p>
	<p>Ability to assess the sentiment and key trending issues related to civic issues through online, news and social media platforms.</p>	<p>Root cause analysis of complaints, identify top complaints area wise, department wise etc.</p>	<p>Send SLA details for each process to a citizen / Send alerts to citizens for compliance/ Send reminders to defaulter employees for necessary compliance</p>	<p>Displaying the satisfaction index on VMS and best employees.</p>

Use Case 13: How to gauge Citizen Satisfaction to citizens to improve service delivery?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
Provide sense of satisfaction to citizens while availing services	CCTV at service delivery locations, facilitation centres, offices to get the live feeds of the operations	Sentiment analysis for data collected from various citizen centric channels such as Social media handles, internet media/ blogs, mobile applications, complaints mail box etc.	Communicate with field staff from the requisite department while addressing complaints (ticket related information)	Alerts to response teams in case of any unsettling activities at service delivery locations, facilitation centres, offices
	View the dashboard of various city administration services and their performance	Predictive analysis while launching / providing any service to the citizens at large	Communicate with the complainant through SMS on the status of the work	Daily alerts for pending grievances along with details of responsible authorities
	View civic infrastructure assets on map based on their classification and maintenance schedule updates	Area/ location wise analysis of grievances/ comments for deriving patterns	Communicate using display devices to spread awareness on using the citizens charters	Alerts in case of non-adherence to SLAs by service providers

	View grievance redressal information on the city map with outstanding grievances (utility wise and type wise)	Ability to analyze SLA compliance and the customer satisfaction on different dimensions	In case of an epidemic, use digital displays and PIS to spread awareness and taking precautionary measures	Daily alerts showcasing defaulters with pending revenue
	View the status of revenue generated through various services along with number of contributors for each revenue source	Analysis of grievance management mechanism for improvement	Send SLA details for each process to a citizen / Send alerts to citizens for compliance/ Send reminders to defaulters for necessary compliance	Displaying the satisfaction index on VMS

F.Civic Health Use Cases

Linked Indicators: Ease of Living Index Framework

- Number of in-patient hospital beds per 10,000 population
- Healthcare professionals per 10,000 population
- Average response time in case of health emergencies
- Period prevalence of water borne diseases
- Period prevalence of vector borne diseases

Use Case 14: How to effectively tackle mosquito borne diseases in city?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to effectively tackle mosquito borne diseases in city	View patients footfall in real time	Trend analytics of patients footfalls on timeline dimensions	Trigger Event as per configured SoPs	On Field Resource Mobilisation : Sanitation Inspectors allocation and tracking
	View hospitals and staff/beds/medicine availability in real time.	City wide Hot-Spot Analysis based on lab reports.	Communication over VMD, PAS and social media for regular updates and advisory through city health department	On Field Resource Mobilisation : Fumigation plan based on evidences
	View fumigation plan and schedule in real time	Co-relate the data from seasonal changes, fumigation activity and impact on disease	Two way communication with field force : Hospitals and City Health and Sanitation officers	
	Ability to locate water logging/potential mosquito breeding cases across cities	Sentiment Analytics and response wrt to event	Bulk SMS to citizen in locality to educate and control vector borne diseases. Event Summary report using Knowledge Base	Trigger alert to Hospitals Emergency room

Use Case 15: How to strengthen Civic Health Care delivery in the City using Data Analytics ?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to strengthen Civic Health Care delivery in the City using Data Analytics?	View the data of Vaccination Drive on city map	Ability to correlate cause like the impact of water quality, air quality, stress on diseases reported at primary, secondary and tertiary care.	Ability to communicate with patients about medicine /vaccination drive or camps	Ability to coordinate with Hospitals, Labs and on-field staff in real time using handheld devices etc.
	Ability to map in patients at all levels of public hospitals on city map	Ability to do the predictive analytics over the past data to predict the outbreak of disease in community	Ability to communicate targeted intervention with on field/ mobile healthcare staff in real time.	Ability to coordinate with Hospitals and lab to act in case of food poisoning, communicable diseases, industrial accident as per standard protocols
	Ability to map footfalls of citizens at primary, secondary and tertiary care centre for IPD/OPD , major and minor treatment etc.	View heat-map of different diseases on different dimensions over city maps	Ability to communicate health updates with Health officers, hospitals and labs.	
	Ability to collect data from various health care survey agencies in the city	Ability to identify common diseases based on patient data etc. on daily, weekly and monthly basis to	Awareness drive for citizens in targeted areas through email, SMS, WhatsApp , VMD etc as	Ability to coordinate with Sanitation Department and other line department to take corrective action.

gauge the impact of preventive care program

per preventive healthcare SoPs

Use Case 16: How to predict Stray Dog menace in the City?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to contain stray dog menace in the City?	View the dog bites incidents on the city map	Generate Heat-map on city map using the dog bites cases over various dimensions	Ability to inform stray dog team on receiving dog bite complaints	Review the thresholds of dog bites incidents every monthly against reported cases
	Ability to map the data from sterilization drive of stray dogs by department in different parts of the city	Predictive Analytics for over trends of stray dog menace incidents over various dimensions.	To increase awareness among citizens about dog bites and its treatment using SMS, WhatsApp, Website and mobile app	Coordination with Hospitals emergency staff for medical treatment
	Ability to mark sensitive zones where dogs menace is reported by citizens		Encourage citizens to report potential cases of dog menace in locality	

Use Case 17: How to reduce victim transit time from accident location to Hospital?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to reduce victim transit time from accident location to Hospitals?	View the data from mobile healthcare units	Trend analysis of accident zones based on heat map and ensuring readiness	Ability to send targeted alert notifications to officers, on field staff, hospitals and labs in case of emergency.	Ability to design shortest route for Ambulances/medical vehicles
	View availability of beds, doctors and paramedics in real time across public and private hospitals	Sentiment Analytics and response wrt to event		Ability to deploy assets and manpower as per dynamic requirements
	View availability of medicine and medical stock in real time		Traffic simulation and congestion management	Voice Communication to provide personal assistance to stakeholders
	View patient footfalls at primary dispensaries /secondary and specialized hospitals in real time	Ability to disseminate information/content to patients, citizens about bed availability, availability of doctors/medicines etc.		

G. Street Light

Linked Indicators: Ease of Living Index Framework

- Percentage of households with authorized electrical service
- Percentage of electrical connections covered through smart meters
- Average number of electrical interruptions per year
- Average length of electrical interruptions per year
- Percentage of total energy derived from renewable sources
- Energy consumption per unit - water supply and sewerage
- Energy consumption per unit - street lighting
- Percentage of new and redeveloped buildings following green building norms
- Total energy consumption per capita

Use Case 18: How to monitor and maintain street lighting networks remotely

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to monitor and maintain street lighting networks remotely	Light On/off as per pre-set ambient condition	Analyze trends over dashboard for Street Light Maintenance Dashboard.	Notifications to the citizens	View street lights, controller and feeder on the city map
	Light Intensity /Luminosity - auto increase/ dimming as per ambient conditions	Prediction of Optimum Light Intensity based on Ambient Light and Sensor Data		
	Power saving mode - When there is no changes in environment and during night time, dimming the lights (reduce luminosity) and switch off alternate lights.	Predictive maintenance alerts		
	Light On/off as per pre-set ambient condition			

H. Transit and Mobility Use Cases

Linked Indicators: Ease of Living Index Framework

- Geographical coverage of public transport
- Availability of public transport
- Mode share of public transport
- Percentage of road network with dedicated bicycle tracks
- Percentage of interchanges with bicycle parking facilities
- Mode share of non-motorized transport
- Availability of Passenger Information System
- Extent of signal synchronization
- Availability of paid parking spaces
- Percentage coverage of footpaths – wider than 1.2 m
- Percentage of traffic intersections with pedestrian crossing facilities
- Extent to which universal accessibility is incorporated in public rights-of-way

Use Case 19: How to manage the City Bus Operations effectively?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
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How to manage the City Bus Operations effectively?	View real time information about buses location, traffic flow, congestion of buses, peak and non-peak time information	Analyze the buses density on a particular route and updating the same on real time basis on traffic flows and utilization of buses	Sharing the information with the passengers about the route delay through Mobile app notifications and PIS Display	Suggest alternate routes to the drivers through 2 way communications. Also make decision to perform route scheduling
	Calculating the Run Km and Dead Km through GPS for the payment of Bus Operator	Analyzing the Km cloaked by the Buses in respect with the trip scheduled and operated	Sent alert to the operators about the Km cloaked by the buses in respect with no of trips operated	Comparing the GPS Run Km and Dead Km data with the audited data and clearing out the discrepancies
	Monitoring the incidents occurred such as route violation, skip stops, harsh driving, sharp cornering	Analyze the trends in the incidents occurred through Incident Management System	Automatic alerts to the operators and the agency regarding the generated incident and TAT for resolving the same	Calculating the penalty for the incidents and imposing it on the operators

Use Case 20: How to do City Traffic Planning using Data Analytics?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to do City Traffic Planning	View Traffic Volumes, Peak time, Flows and Vehicle Type across different cross roads/ Junctions of the city through ANPR system	Analyze the traffic volume and peak time data to identify the Cross roads/Junctions for zero tolerance for traffic violations, Infrastructure	Share real-time traffic congestion route through VMD's radio Services etc.	Suggest alternate routes to commuters, take corrective/repair activities for road infrastructure and

using Data Analytics?		health (Roads, Traffic signal etc.)		make decisions to widen the roads for smoother traffic flow
	View Traffic Signal controls and health status	Analyze the trend of the faults in the Traffic signals for identifying the root cause of the repeat failure and also plan a preventive maintenance schedule	Sent alerts through SMS and Whats app to the concerned staff and office	Monitor the Health and take corrective/preventive maintenance of the Traffic infrastructure
	View the Traffic Trend on city map for different time zones of the day	Analyze and co relate the Traffic flow and trend on city map for assisting the emergency services like fire tender's , ambulances etc.	Assist the driver of the vehicle through mobile application/ phone line	Identify the shortest and less crowded route for Ambulances/Fire/ Police vehicles
	View Traffic violations and accidents patterns on city map though camera system	Analyze the cases of traffic violations (types and no.) and accidents on city map to take serious action against offenders and control the accident rate	Send SMS based warnings and alerts to the repeat violators	Improve enforcement and vigil at such locations to reduce the accident and violation rate

Use Case 21: How to identify open parking spots in City?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
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How to identify open parking spots in City?	Identify location, number, functional/nonfunctional Parking Slots on city map	Total exceptions in the day/week/month and possible cause	Notifications to the citizens Delivery of vital information to users using Push Notification on app	View Hotlisted/ watch listed vehicle list
		Mapping of the city traffic , footfall with parking data for future planning		View real time meta data from cameras, sensors
	Identify location and number of Parking Slots on mobile app with payment gateway option	Analyze traffic patterns and parking at key locations for planning and operations purposes.	Auto ticket generation for faulty camera / other assets	Show Revenue Collections by each Parking Facility
		Public parking slot-space availability prediction		
		Expected waiting time for next parking availability		
		Parking space availability predictions based on traffic conditions and events happening in that area		
		Show average turnaround time (TAT) for a car bay in each lot		
		Show average occupancy for each parking lot at different hours		

Use Case 22: How to monitor entry of vehicles to restricted Zones?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to monitor entry of vehicles to restricted Zones?	View real time meta data from cameras	Trend analysis based on heat map	Action taken/ resolution report in coordination with RTO	On Field Resource Mobilization in real time
	View real time traffic movement in designated areas	Suspect person/ Proclaimed offenders/absconders (Offender's Pattern Matching - real time)		
	View Hot listed/ watch listed vehicle list	Planning/ forecasting man power required for surveillance in high risk area.		
	Complaint management thru citizen mobile app	Traffic flow optimization through major intersections and adjacent area		

Use Case 23: How to effectively manage Multi modal transit/Transport of the Cities?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
Manage Multi modal transit/Transport	Aggregate mobility based data : Identify all real time nodal points like Bus Transport, Metro Transport, Taxi, Parking nearer to Metro/Bus Depo etc.	Integrate the APIs with platform	Last mile mobility app for Citizen	View the transport movement and interaction with citizens
		Visualize the flow of transport/transit	Mobility App must allow bookings of other transit/transport	Track the multi modal transit taken and analyse the effectiveness in mobility ratio
			Mobility app must allow payments	Track revenue collections due to mobility initiative
			***Incentivise citizen to adopt this	

Use Case 24: How to optimize the usage of Adaptive Traffic Control System to improve the city traffic situation using Artificial Intelligence (AI)/Machine learning (ML)/emerging technologies?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
<p>Adaptive Traffic Control System</p>	<p>Read data from a wide variety of traffic sensors. Standard traffic detectors, video based detectors, 3D/4D radars, RFID readers, ANPR cameras and Bluetooth/WiFi sensors</p>	<p>ICCC should either have an integrated or third party rule-engine that can be configured to automatically make traffic control intervention actions based on real-time traffic sensor data and change signal timing plans. It should be able to run all the algorithms provided as a part of the ATCS solution.</p>	<p>It should communicate with any standards compliant traffic signal controllers using the standard protocol.</p>	

I. Roads Management

Use Case 25: How to reduce citizen inconvenience during road maintenance?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to reduce citizen inconvenience during road maintenance	View status of on-going roads projects across the city with drilldown facility up to a locality	Ability to do the prescriptive analysis for road engineers to show the priority of road /road asset maintenance in allocated budget	Communicate with field staff from roads (engineering) department while addressing complaints (ticket related information)	Alert if a specific type of complaint is lodged several times from a particular area through citizens charter
	View the status of the complaints/projects with real time monitoring of engineers and work done	View the road potholes in different areas using area wise past trends	Communicate with field staff from other utility departments (water, sewerage, telecom,gas) for permissions to dig roads and co-ordinating re-surfacing activities	Identify the city areas on GIS map that would require planning of roads, road widening and footpaths in the future
	View the underground utility network on the map for installations and maintenance work	Ability to correlate the potholes complaints with road maintenance schedule and defect liability period.	Communicate about roads reparation through display devices to divert traffic	
	View the ongoing work for maintenance with meta data (Contractor, duration, material, responsible officer)			

Use Case 26: How to effectively tackle potholes problems in City?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to effectively tackle potholes problems in City?	View potholes (with photos and videos) complaints logged by citizens	Trend analysis of Potholes complaints	Trigger Event as per configured SoPs.	On Field Resource Mobilisation : Sanitation Inspectors allocation and tracking
	View the dashboard of potholes based on status.	City wide Hot-Spot Analysis based on potholes	Allocation of potholes through Mobile app to contractors and Road Engineers.	Trigger alert to concerned Engineer
	View and track roads on city map	Co-relate the data from seasonal changes and budget spent on maintenance	Two way communication with field force to assist in field operations	Manage Traffic Diversions in real time
	View the road meta data like contractor data, maintenance data, materials etc.	Sentiment Analytics and response wrt to event	Communicate to citizens/community in locality etc. share the closure	NoC to be obtained for Road Maintenance
	View road maintenance schedule/plan of roads department	Aging Report of potholes and road construction and maintenance	Event Summary report using Knowledge Base	

J. Waste Water Treatment

Linked Indicators: Ease of Living Index Framework

- Coverage of toilets
- Coverage of sewerage network
- Collection efficiency of sewerage network
- Extent of reuse and recycling of waste water
- Coverage of storm water drains

Use Case 27: How to control affluent disposal into city water bodies?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to control affluent	View complaints reported from citizens	Identify the distribution of industrial areas across the city and their proximity to river areas	Communicate with water department to address issues	Control parameters and set thresholds for alerts at various location across the river
	Monitor the levels of pH and other chemical composition of water	View area wise water composition patters and derive insights	Communicate using display devices to inform about specific water conditions (shortage, purity levels, special instructions) or awareness messages about water conservancy to citizens at large	Alert and shoot message to the concerned personnel in case of threshold breach (water surpasses the threshold.)

**disposal
into water
bodies?**

View water level at reservoirs across the city with drilldown facility up to a reservoir

Ability to analyze waste dispense and identify patterns in given area in given season.

Communicate with field staff from fire department to provide overhead tank status while addressing exigencies

View the underground utility network on the map.

Analyze the diseases reported due to water contamination

View if flooding of waste into water bodies through CCTV

Use Case 28: How to ensure the storm water network readiness before rains?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to ensure the storm water network readiness before rains?	View the storm water network (along with meta data like capacity, maintenance due etc.) on city Map /GIS	Ability to simulate the water flow in different scenarios across storm water network	Communicate with Drainage department officers and contractors regarding overflowing drainage	Monitor the SLA compliance of contractor and officers wrt of maintenance of drainage network
	View Storm water drainage network cleanliness schedule and progress of cleanliness plan along with details of concerned officers and contractors.	Predictive analytics based on complaints and cleanliness schedule.	Communication to citizens through website, mobile app, SMS, WhatsApp to update them about maintenance drive	Ability to control the Cameras and sensors of water treatment plant and vehicles
	View the area wise budgetary provision of each area for cleanliness of storm water	What-If analysis to check the readiness of water network to manage the flow over GIS.	Communicate the lab reports of water treatment plant outputs	

K. Environment

Linked Indicators: Ease of Living Index Framework

- Concentration of SO₂ - air pollution
- Concentration of NO₂ - air pollution
- Concentration of PM₁₀ - air pollution
- Level of noise pollution, temp, humidity etc.
- Quality of water in public surface water bodies

Use Case 29: How to address air and noise pollution in city using environmental Sensors?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
How to address air and noise pollution in	View Air Quality Index across city, levels of various constituents (CO, CO ₂ ,SO ₂ ,NO ₂ , PM ₁₀) etc.	Ability to correlate the data emanating from various Environmental sensors in different areas of city wrt to city mobility/traffic	Ability to communicate the levels of AQI and Noise in locality to citizens, businesses and industry on daily basis	Monitoring the AQI in real time and coordinating with Traffic Police and Environment Department.

city using Environmental Sensors?	View the hotspots across various areas in city where high noise cases are reported by citizens	Ability to predict the poor quality of air and water with complaints received through various channels	Ability to send the aggregated data of AQI and Noise to concerned authority to address the problems through policy.	Ability to address the noise issue by issuing advisory to local businesses, marriage gardens etc.
	View visibility in different part of city	Ability to predict the poor quality of air and water on various dimensions like timelines, seasons where there is high density of markets, industry or shops.	Ability to spread awareness at chronic location/spots identified over VMD, website, mobile app, WhatsApp etc.	Allocating and monitoring noise complaint to the on-field squad to take intervention as per defined SoPs.
	Ability to Permissible limits of Noise levels in various areas across the city	View the heat-map of noise pollution over different dimensions	Ability to educate the masses using bulk SMS, email and messages about best practices	

Use Case 30: How to increase the green cover of the City?

Use Case	Data Acquisition and Visualisation	Data Collection and Analytics	Communication	Command and Control
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**How to
increase the
green cover of
the City?**

View the green cover on city map along with meta data (tree type, tree health, tree location, age)	Ability to assess the quality of green cover across the city	Ability to communicate the schedule for Tree trimming/cutting in real time to residents	Ability to coordinate with tree trimming/cutting team in real time.
Ability to view the request of tree cutting/trimming in real time	Generate area wise insights about flora and fauna of each area and it health	Increase awareness through bulk SMS, Bulk Email about the flora and fauna of the city.	Ability to respond to illegal tree cutting as pre SoPs
Ability to mark the areas with low/medium/high density tree cover	View the tree cover on interactive GIS map.	Increase Awareness about various tree plantation initiatives to preserve flora and fauna in locality.	Ability to review the SLAs as per citizen charter of contractors/officers for managing
View the locations and schedule of tree trimming/cutting squad in real time.		Ability to coordinate with key NGOs and environment activist group over the activities like tree plantation and trimming/cutting exercise.	

Annexure IV: Securing the ICCC Ecosystem-Cyber Security

Why is security of ICCC important?

ICCCs can act as the “nerve center” of a smart city and can aggregate information through smart-enabled integrated technologies. The ICCC is expected to provide a holistic view of all city operations allowing monitoring, control, and automation of various functionalities at an individual system level along with cross-system analytics.

The smart-enabled integrated technologies and devices also bring in their inherent security risks. These technologies and devices connect to ICCC, which makes them vulnerable. Hence, significant increase in the number of interconnected technologies and devices also results in the increase of the security attack surface.

The increase in the security attack surface provides an opportunity to cybercriminals, cyber activists, and nation states to exploit the attack surface to compromise the security of ICCC and, subsequently, of Smart City. Hackers and malicious actors now do not need to get direct access to ICCC or data center to compromise systems / applications but can plan attacks through the technologies and devices spread across the Smart City. Therefore, as the Smart City makes use of the advanced and integrated technology to deliver services to the citizens in an efficient manner, the integrated technology expands the cyber threat landscape. Hence, it becomes imperative to consider the cybersecurity requirements for a Smart City, and particularly of ICCC, in a comprehensive manner.

What can happen?

Overlooking the security of ICCCs can turn out to be very expensive for an efficient and secure service delivery, and protection of human life. Some of the serious concerns regarding security of the Smart City services include:

- The compromise of integrated traffic management system hosted in ICCC could lead to kidnappers / malicious actors monitoring live location of the buses, and other parameters and plan their attack accordingly
- Hacker can add/ remove/ modify/ delete sensitive information from the ICCC database, including residents' personal information, health information and sell the data (personal and health data) in illegal markets
- State actors from foreign nations can shut down the services (e.g., traffic signals across the city) offered to the citizens and create panic / havoc in the city
- State actors can also use access to post content to spread propaganda & disinformation campaigns
- Organized crimes can be committed by viewing CCTV live feed and then turn off the camera at the time of a heist
- GPS systems can be hacked to redirect vehicles – such as ambulances, police vans, and school buses leading to chaos in the city.
- Aggregation and unauthorized statistical analysis of data collected by ICCCs can be done by miscreants leading to privacy risks and in worst case scenario, loss of human life.

What should be done?

Security and privacy should be considered across all phases of an ICCC development – design, implementation, operations – along with preparation for long-term assurance.

a. Cybersecurity framework and security by design

- i. A Cybersecurity framework should be developed aimed at building a secure and resilient ICCC for citizens and stakeholders of a Smart City. The framework comprising of policy, procedures, and guidelines should be designed to

protect ICCC and information; build capabilities to prevent and respond to cyber-attacks; and minimize damages through cyber-attacks. The framework should align to the following:

- MoHUA guidelines vide circular K- 15016/61/2016-SC-1 dated 20th May 2016
 - Government of India guidelines on Data Security
 - IT Act and Amendment 2008
 - CERT-IN guidelines
 - CMP guidelines on countering cyber-attacks
 - International standards including ISO 27001, NIST Cyber Security Framework
- ii. A secure network architecture should be designed following a layered security approach. Security solutions as detailed out in MoHUA guidelines should be considered, as appropriate, to protect the ICCC.
- iii. Cyber security awareness trainings should be provided to different focus groups responsible for the security of ICCC.

b. Security while implementation

A governance mechanism should be setup to ensure that ICCC implementation conforms to secure requirements. Security assessment should be performed for all the ICCC associated applications, systems and devices before Go-Live.

c. Security during operations

Secure procedures should be followed during the ICCC operations. All the changes, operations, and monitoring of ICCC applications and systems should be performed in a controlled manner following a well-defined process.

A security operations center should be setup comprising of a threat analytics solution to give a reasonable security assurance for ICCC from emerging cyber threats. An incident response mechanism should be setup to respond in a coordinated manner to any security attack.

d. Security Assurance

A regular process should be setup to assess the ICCC compliance to security and Regulatory requirements on a regular basis. The gaps identified during the assessment should be actioned for mitigation depending upon the criticality.

e. Other important factors

It is suggested that cities should also periodically assess the cyber security of Integrated Command and Control Centres. This will ensure that the data, applications, and systems associated with ICCC are secure. The City will be served effectively if a cybersecurity and privacy policy is developed. This policy document needs to be supported by detailed security procedures and minimum baseline security guidelines for edge devices (e.g., IoT, sensors, CCTV, servers, applications, network devices), and comply to cybersecurity guidelines and Regulations (e.g., MoHUA guidelines, IT Act and Amendment, Data Protection Regulation etc.)

A cybersecurity organization structure with clearly defined security roles and responsibilities is required be put in place both at Smart City management level, and MIS level with skilled personnel and resources.

A risk assessment needs to be performed to identify security risks applicable to ICCC. A detailed mitigation plan to be developed to protect against the security risks.

A governing body comprising of cyber experts need to be set up to ensure cyber security is considered during design and implementation of ICCC.

All smart city applications need to undergo security assessment and source code review before the applications Go-Live for operations.

Security related procedures including, but not limited to, asset management, change management, User access management, Privilege access management, Patch management, Backup management, Incident management, Physical and environmental security, Business continuity and disaster recovery etc. need to be prepared for ensuring secure functioning of ICCC.

The best practices for the protection of ICCC from Cyber-attacks are tabulated below:

Phase	Sample Use Cases
Design	Use Case 1: Cybersecurity policy, and procedures covering ICCC security documented Use Case 2: Minimum baseline security guidelines for applicable edge devices (e.g., sensors, IoT, CCTV), applications and systems documented
Implement	Use Case 1: Security requirements clearly identified during implementation of ICCC Use Case 2: Security assessment is performed for ICCC applications and systems before Go-Live

Operate

Use Case 1: ICCC operations are performed in line with security procedures (e.g., change management, incident management, backup management)

Use Case 2: Security operations center generate security alerts for potential cybersecurity incidents. Dedicated team is responsible to monitor, detect and respond to security alerts.

Assurance

Use Case 1: Regular security assessment to assess the security maturity for ICCC



Appendix V: Other Indicative Use Cases

* The cities can identify any relevant use cases as per the details mentioned in this section and carry out self-assessment as per methodology given in this document.

#	Use Case	Source Department	Collaborating Department	Services	Action/Response	Infrastructure & Business Logic required
1	Hazardous chemical gas leakage	Meteorological	Meteorological	Dashboard for Air Quality	Daily/Weekly/Monthly trend report to appropriate authorities	<ol style="list-style-type: none"> 1. List of high-risk areas which require monitoring 2. Pollution sensors in all those areas 3. Deciding what information which needs to be shown on the dashboard 4. Deciding how to represent each of those information 5. Trend analysis to predict disasters
2	Hazardous chemical gas leakage	Meteorological	Health	Preparedness for a possible medical emergency	<ol style="list-style-type: none"> 1. Emails/SMS to medical institutions in the relevant areas 2. Medical institutions get the required time to make necessary arrangements such as - extra beds, antidote, etc. 	<ol style="list-style-type: none"> 1. List of high-risk areas which require monitoring 2. Pollution sensors in all those areas 3. Algorithms to detect when a component or a combination has crossed danger level 4. Affected areas 5. How will it spread
3		Meteorological	Traffic Police	Diverting traffic from affected areas	1. Emails/SMS to relevant authorities	1. List of high-risk areas which require monitoring

	Hazardous chemical gas leakage				2. Alert to police and ERT	2. Pollution sensors in all those areas
					3. Message display on variable message signboards of currently affected areas and areas where it can spread	3. Algorithms to detect when a component or a combination has crossed danger level
					4. Notification on social media	4. Affected areas
						5. How will it spread
4	Fire Outbreak	Fire Department	Health	Preparedness for a possible medical emergency	1. Emails/SMS to medical institutions in the relevant areas	1. Citizen helpline such as - Dial 100 or Dial 112
					2. Medical institutions get the required time to make necessary arrangements such as - extra beds, etc.	2. List of high-risk areas which require monitoring
						3. CCTV cameras in all those areas
5	Fire Outbreak	Fire Department	Traffic Police	Diverting traffic from affected areas	1. Emails/SMS to relevant authorities	1. Citizen helpline such as - Dial 100 or Dial 112
					2. Alert to police and ERT	2. List of high-risk areas which require monitoring
					3. Message display on variable message signboards of currently affected areas and areas where it can spread	3. CCTV cameras in all those areas
					4. Notification on social media	
6	Fire Outbreak	Fire Department	Utilities	Pre-emptive steps to minimize disaster	1. Emails/SMS to nearby petrol bunks to evacuate	1. Citizen helpline such as - Dial 100 or Dial 112
					2. Emails/SMS to schools, hospitals and other important institutions which are in the zone where fire can spread to evacuate	2. List of high-risk areas which require monitoring
						3. CCTV cameras in all those areas
7	Larva formation level at designated high-risk areas	Health Department	Health Department	Early detection of Larva formation level to predict outbreak of	1. Daily/Weekly/Monthly trend report to appropriate authorities	1. List of high-risk areas which require monitoring
					2. Preparedness of medical institutions if there is a possibility of disease outbreak	2. Data on larva formation level. This may be gathered manually

				dengue, malaria, etc.		3. Metadata to predict trend and declare epidemic
8	Water Supply and preventing water wastage	Water Department	Water Department	Water pressure measurement at regular intervals to detect leakage	Taking action to stop/prevent leakage	1. Sensors to measure the water pressure in water pipeline
9	Water supply to critical institutions such as schools, hospitals, etc.	Water Department	Education Department	Appropriate action for low or no water supply	1. Water supply trend to critical institutions	1. List of institutions which require monitoring for water supply
			Health Department		2. Providing water tankers to affected institutions	2. Sensors to measure the water level in water storage
			etc.			
10	Water quality measurement	Water Department	Water Department	Detecting pollution of water due to mixing of sewage or other pollutants	1. Early detection of contamination of drinking water 2. Locating the point in water pipeline where water is getting polluted	1. Sensors to measure the water pH value of water in water pipeline at regular intervals
11	School bus broken down	Traffic Department	Traffic Department	Traffic Management	1. Traffic department sends riders to clear traffic jams if any	1. GPS in school buses
					2. Alternate arrangement for sending school children back home are made	2. Route map and travel time for each school bus carved out on the GIS map
						3. CCTV cameras to monitor traffic
12	School bus broken down	Traffic Department	Education Department	Parents kept informed of their school children	1. Education Department informs school and school informs the concerned parents about the bus break down	1. GPS in school buses
					2. Alternate arrangement for sending school children back home are made	2. Route map and travel time for each school bus carved out on the GIS map
						3. CCTV cameras to monitor traffic
13	Green Corridor	Traffic Department	Traffic Department, Police Department	Providing a clear and safe passage for VVIP movement	1. Clear and Safe passage to VVIP movement	1. CCTV cameras on the green corridor passage 2. GPS enabled police vehicles on the GIS map to handle any obstruction to the green corridor

14	Green Corridor	Traffic Department	Health Department	Providing a clear and safe passage to ambulance for selected medical emergencies	1. Clear passage to ambulance for medical emergencies	1. CCTV cameras on the green corridor passage 2. GPS enabled police vehicles on the GIS map to handle any obstruction to the green corridor
15	Ambulance stuck in traffic	Traffic Department	Health Department and Traffic Department	Enabling patients get required medical help on time	1. Traffic department sends riders to clear traffic jams if any	1. GPS in ambulances
					2. Additional medical help sent if required	2. Intelligent Traffic Management to automatically adjust traffic signals using ambulance location to enable quick movement of ambulance
						3. CCTV cameras to monitor traffic
16	Tsunami, Cyclone warning	Meteorological	Meteorological	Predicting and warning about cyclone and tsunami	1. Trend analysis and predicting cyclone/tsunami	1. High decibel public warning placed throughout the city at regular intervals
					2. Issuing warnings using high decibel public warning sirens	2. The warning systems should be connected through wireless to continue operations during calamity
						3. Simulations to find out the areas where the calamity may spread
17	Tsunami, Cyclone warning	Meteorological	Health	Preparedness for a possible medical emergency, epidemic outbreak	1. Emails/SMS to medical institutions in the relevant or adjoining areas	1. List of medical institutions in areas adjoining to tsunami/cyclone prone areas which require this preparedness
					2. Medical institutions in adjoining areas get the required time to make necessary arrangements such as - extra beds, etc., so that people from affected areas can be treated there	2. Citizen helpline such as - Dial 100 or Dial 112

						3. CCTV cameras in all those areas
18	Tsunami, Cyclone warning	Meteorological	Traffic Police	Diverting traffic from affected areas	1. Emails/SMS to relevant authorities	1. High decibel public warning placed throughout the city at regular intervals
					2. Alert to police and ERT	2. The warning systems should be connected through wireless to continue operations during calamity
					3. Message display on variable message signboards of currently affected areas and areas where it can spread	3. Simulations to find out the areas where the calamity may spread
					4. Notification on social media	
19	Handling Mobs/Riots or terrorist/bomb threats	Police Department	Traffic Police	Diverting traffic from affected areas	1. Emails/SMS to relevant authorities	1. List of high-risk areas which require monitoring
					2. Alert to police and ERT	2. CCTV cameras those areas
					3. Message display on variable message signboards of currently affected areas and areas where it can spread	
					4. Notification on social media	
					5. Coordinate vacating institutions such as schools/hospitals in affected areas	
20	Handling Mobs/Riots or terrorist/bomb threats	Police Department	Health	Preparedness for a possible medical emergency	1. Emails/SMS to medical institutions in the relevant areas	1. List of high-risk areas which require monitoring
					2. Medical institutions get the required time to make necessary arrangements such as - extra beds, antidote, etc.	2. CCTV cameras those areas
21	Handling Mobs/Riots or	Police Department	Education	Vacate or alert schools/colleges in suspected areas	1. Inform schools/colleges in affected areas to send students back home	1. List of high-risk areas which require monitoring

	terrorist/bomb threats				2. Inform parents to pick up their children and help in vacating schools	2. CCTV cameras those areas
					4. Notification on social media	
22	Vulnerable perimeter security at school owned public parks	Education department	Municipal	Secure perimeters at school owned public parks ensuring security to school children when they are using these parks	1. Inform municipal to ensure proper perimeter security of these parks	1. CCTV cameras in these parks
					2. Provide	2. Perimeter security measures
23	Vulnerable perimeter security at school owned public parks	Education department	Police	Secure perimeters at school owned public parks ensuring security to school children when they are using these parks	1. Provide police security when children are using the park till proper security measures are in place	1. CCTV cameras in these parks
						2. Perimeter security measures
24	Flood water drainage system overflow	Municipal	Traffic	Diverting traffic from affected areas	1. Emails/SMS to relevant authorities	1. Sensors in flood water drainage system at regular intervals to detect and locate overflow
					2. Alert to police and ERT	
					3. Message display on variable message signboards of currently affected areas and areas where it can spread	
					4. Notification on social media	
25	Flood water drainage system overflow	Municipal	Water Department	Ensuring drinking water is not getting polluted with overflow	1. Check pH level of drinking water in pipeline near affected areas	1. Sensors in flood water drainage system at regular intervals to detect and locate overflow
					2. Notification on social media and variable message display for precautionary steps if required	2. Sensors in drinking water pipeline at regular intervals to detect pH value
26	Flood water drainage system overflow	Municipal	Health	Preparedness for a possible medical emergency	1. Emails/SMS to medical institutions in the relevant areas	1. Sensors in flood water drainage system at regular intervals to detect and locate overflow

					2. Medical institutions get the required time to make necessary arrangements such as - extra beds, antidote, etc.	2. Sensors in drinking water pipeline at regular intervals to detect pH value
27	High water pressure level in Sewage pipelines due to overflow	Municipal	Traffic	Diverting traffic from affected areas	1. Emails/SMS to relevant authorities	1. Sensors in flood sewage pipeline system at regular intervals to detect and locate overflow
					2. Alert to police and ERT	
	Low water pressure level in Sewage pipelines due to blockage				3. Message display on variable message signboards of currently affected areas and areas where it can spread	
					4. Notification on social media	
28	High water pressure level in Sewage pipelines due to overflow	Municipal	Water Department	Ensuring drinking water is not getting polluted with overflow	1. Check pH level of drinking water in pipeline near affected areas	1. Sensors in flood sewage pipeline system at regular intervals to detect and locate overflow
					2. Notification on social media and variable message display for precautionary steps if required	2. Sensors in drinking water pipeline at regular intervals to detect pH value
	Low water pressure level in Sewage pipelines due to blockage					
29	High water pressure level in Sewage pipelines due to overflow	Municipal	Health	Preparedness for a possible medical emergency	1. Emails/SMS to medical institutions in the relevant areas	1. Sensors in flood sewage pipeline system at regular intervals to detect and locate overflow
					2. Medical institutions get the required time to make necessary arrangements such as - extra beds, antidote, etc.	2. Sensors in drinking water pipeline at regular intervals to detect pH value

	Low water pressure level in Sewage pipelines due to blockage					
30	Handling noise pollution	Municipal or Traffic	Traffic department	Controlling area specific noise pollution	1. Messages on Variable message display in the affected areas	1. Noise pollution sensors
					2. Notification on social media	2. Variable message display
						3. Social media integration
31	Intelligent Traffic Management System	Traffic Department	Traffic Department	Traffic management based on current traffic situation at the group of junctions	1. Duration of red and green signals adjusted accordingly	Intelligent Traffic Management System
					2. Traffic riders dispatched if required	
32	Dispensary and primary health centers	Health Department	Health Department	Ensuring inventory supply at dispensary and primary health centers	1. Alert sent to appropriate authorities when inventory falls below threshold	1. Digitization of dispensaries and health centers inventory
					2. In case of emergency information on availability of medicine in nearby dispensaries or health centers communicated to the concerned health officer/patient	
33	Dispensary and primary health centers	Health Department	Health Department	Ensuring manpower availability at dispensary and primary health centers	1. In case of emergency nearby dispensaries and health centers alerted	1. Centralized management of staff and their attendance of dispensaries and health centers
					2. Either patient is transported or facilities are sent to the patient	
34	Traffic simulation to prepare for events in future	Traffic Department	Traffic Department	Ensuring preparedness for major events or calamities		
35	Police accepting complaints from multiple	Police Department	Police	Easy way to register complaints with police		

	sources such as Twitter, SMS, Phone Call, etc.					
36	GCC Revenue Database	Municipal	Municipal	MIS Dashboard		
37	GCC Revenue Database	Municipal	Municipal	Preventive Revenue Protection		
38	Citizen Grievances	Municipal	Municipal	Resolution rate		
39	Citizen Grievances	Municipal	Municipal	Major problem areas		
40	EMS for Street Lighting	Electricity Department	Electricity Department	Streetlight status (On/Off)	1. Alert sent to appropriate authorities when lights higher than the decided threshold are off	1. Sensors to detect if light is on or off
41	EMS for Street Lighting	Electricity Department	Traffic department	Traffic management in poorly lit areas	1. Alerts sent to traffic department and police department	1. Sensors to detect if light is on or off
					2. Traffic department dispatches additional riders if required to handle the traffic at night	2. IR illuminated CCTV cameras at strategic locations
42	EMS for Street Lighting	Electricity Department	Police Department	Crime prevention in poorly lit areas	1. Police department increases security if the dark areas are prone to crime	1. Sensors to detect if light is on or off
						2. IR illuminated CCTV cameras at strategic locations
43	City waste management	Municipal	Municipal	Ensuring city waste is disposed on time	1. Alerts sent to appropriate authorities if any bin is not cleaned on time	1. Sensors to detect if the bin has been cleaned
						2. CCTV cameras to capture bin cleaning wherever possible
44	City waste management	Municipal	Municipal	Ensuring city waste is disposed on time in case a waste management truck has broken down	1. Detecting if a truck has broken down using VTS, GPS, GIS, etc. 2. Assigning the bins that were supposed to be cleaned by the broken truck to another set of trucks	1. VTS, GPS and GIS maps to detect if the vehicle broken down
						2. A timed route map created for every cleaning truck and linked to the system so that major

						deviation from the expected time to clean the bin raises an automated alert
45	Beach Safety	Meteorological	Municipal council	Issuing warnings if going to sea is expected to be dangerous such as high tide or bad weather	1. Issuing warning messages on Variable message signboard	
					2. Making announcements on PA systems fixed for beach security	
46	Beach Safety	Municipal council	Health	Preparedness for a possible medical emergency	1. Emails/SMS to medical institutions in the relevant areas	
					2. Medical institutions get ready to handle calamity	
47	Surveillance	Municipal council	Police	CCTV monitoring of the city with features such as Video Analytics, ANPR, RLVD, Speed detection	1. Dispatch police, traffic, medical and fire facilities in response to events noticed through surveillance	
			Traffic			
			Disaster Management			
48	Public Transport - Handling bus break down	Transport Department	Transport Department	Helping passengers in case of a bus break down	1. Dispatching another bus of the same route if the bus breaks down	1. GPS enabled public transport
						2. A timed route map created for every public transport and linked to the system so that major deviation from the expected time to reach a stop raises an automated alert
49	Public Transport - Handling bus break down	Transport Department	Traffic Department	Diverting traffic from affected areas	1. Traffic department sends riders to handle a possible traffic jam because of broken bus	1. GPS enabled public transport
					3. Message display on variable message signboards of currently affected areas	2. A timed route map created for every public transport and linked to the system so that major deviation from the expected time to reach a

						particular stop raises an automated alert
					4. Notification on social media	
50	Smart parking	Municipal	Traffic Department	Smart parking near crowded locations to reduce traffic congestion	1. Inform people on mobile app of available parking slots. This will reduce traffic by preventing people to drive around looking for parking	1. Sensors to detect empty slots in parking 2. Parkings connected to a centralized system 3. Smart parking app on mobiles

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