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Foreword

I am happy to note that the Ministry of Housing and Urban Affairs and the National Institute of Urban Affairs (NIUA) is releasing a set of best practices in the book 'SAAR: A compendium of 75 Smart Cities Projects'. It is pleasing to know that this compendium has been compiled by our partners in academia, with students and professors from 15 premier institutes contributing innovative studies on urban policies and reforms in 47 Indian cities.

Under the leadership of the Hon'ble Prime Minister Shri Narendra Modi ji, urban development has assumed central importance in India's growth story. It is seen as a means to accelerate economic growth even as it aims to provide urban dwellers with a better quality of life. Initiatives such as the Smart Cities Mission were launched with the purpose of unlocking the potential of urban areas through technology and citizen-friendly reforms.

R&D institutions, led by the enterprising zeal of their young researchers, are playing a crucial role in supporting urban development programmes. As India looks to become a developed nation by 2047, it is important to encourage research, and promote a scientific and technological bent-of-mind among the younger generations towards the field of urban development.

This compendium is a stellar example of the potential of the 'demographic dividend' that lies within India. More than 65% of the country's population is younger than 35 years of age today. It is imperative that we provide opportunities to our youth to engage with development processes and conceptualise solutions to India's emergent problems.

I congratulate the Smart Cities Mission, NIUA, and above all, the students and professors who prepared this compendium. It will surely be a useful addition to the growing discourse on urban development in India.

New Delhi
07 March 2023

(Hardeep S Puri)

A16

Overview of Integrated Command and Control Centre, Agra

Name of the project: *Integrated Command and Control Centre*
Location: *Agra Nagar Nigam Campus, near Sur Sadan, Civil Lines, Agra, Uttar Pradesh*
Year of Project Implementation: *On going (started in 2019)*
Sector: *Technology in Urban Management*
SDG: *SDG 3, SDG 10, SDG 11*
Project Cost: *Rs. 2980 Cr*

Institute: *IIT-Roorkee*
Advisors: *Faculty Coordinator: Dr. Arindam Biswas, Mentor: Ms. Nikita Ranjan*
Students: *Ms. Shipra Verma and Ms. Kritika Sharma*

Keywords: *Smart Information Management, Effective Collaboration, ICCC*

Abstract:

The major goal of the Integrated Command & Control Centre (ICCC) is to break down silos between departments and within departments, and to combine operations in order to better serve the public. It is proposed to construct a single shared operation centre as part of Agra Smart City. This centre will give an integrated picture of all smart component projects described in this document, with the primary aim of serving as a decision-making engine for municipal officials in day-to-day operations or during emergencies.

This centre will combine information from many departments to give a comprehensive reaction mechanism to the city's day-to-day concerns. The City Operation Centre will be fully integrated, providing client-server/web-enabled solutions for incident response management, collaborations, and geospatial display. Various ICT projects will be able to utilize data and intelligence obtained from other elements' operations, in order to supply municipal services more effectively and in a more informed manner.

This research assessed how the ICCC assists citizens and government officials in the proper functioning of a city, using a primary survey and physical observation of a limited set of places due to time constraints.

Case Study: **A16**

1. Introduction

Agra Smart City : Agra city, located in Uttar Pradesh state of India, is governed by Municipal Corporation which comes under Agra Metropolitan Region. . As per provisional reports of Census India, the population of Agra in 2011 was 1,585,704; of which male and female were 845,902 and 739,802 respectively. Although Agra city's population was 1,585,704; its urban / metropolitan population amounts to 1,760,285 of which 939,875 are males and 820,410 are females.

Agra was selected as a smart city in September 2016 in the third round of the Smart Cities Challenge.Following this, a special purpose vehicle (SPV), Agra Smart City Limited, was set up under the Companies Act to implement the development work at the city level. The SPV is headed by the Divisional Commissioner, who will plan, approve, implement, manage, monitor, and evaluate smart city-related projects.

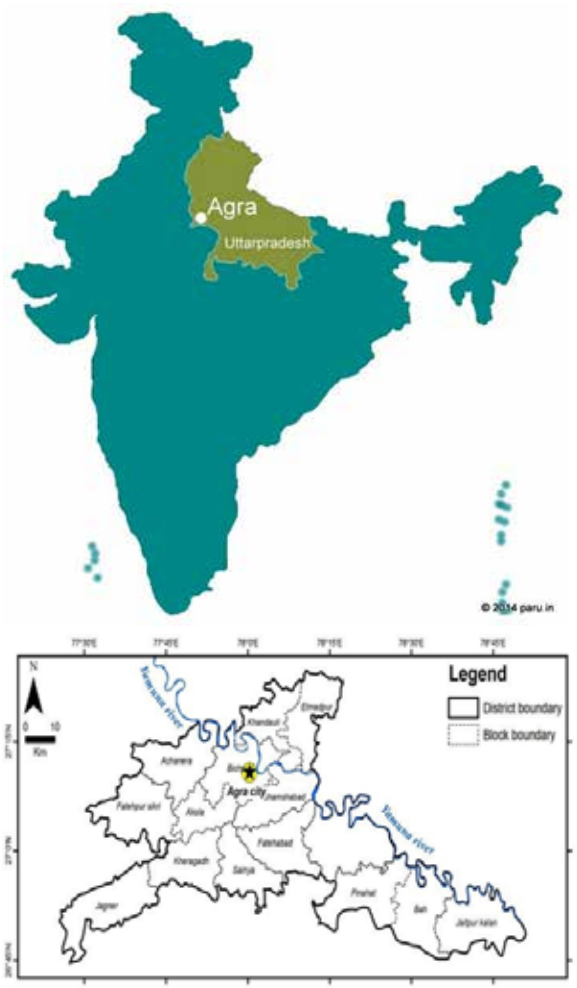

Figure 1. Location of Agra in India, Location of Map of Agra district showing various blocks, Source: (Singh et al., 2020)

The smart city proposal for Agra includes INR 2,133 core makeover plans. 2,250 acres of the area around Taj Mahal, Agra Fort, and other parts of the city will be covered under the project.

Smart Cities Mission is an urban renewal, retrofitting, and extension program of the Government of India, launched in 2015 with the aim of improving the infrastructure and quality of living offered by cities. It was envisioned that each smart city would create an Area Based Development plan to rejuvenate an existing location through either retrofitting, redevelopment or developing a greenfield location. The Pan-city plan would leverage smart solutions for city-wide infrastructure to improve the infrastructure and services available to all citizens.

Agra Smart City vision is based on the aspirations of its people and the analytical assessment of the strengths, weaknesses, opportunities, and threats for the city. The list of citizen suggestions included themes such as "tourist-friendly", "memorable", "livable", "culturally-vibrant", "economically-vibrant", "protect and celebrate heritage", "urban mobility", and "sustainable".

Figure 2. ABD Area and Regional connectivity map, Source: Agra Revised Detail Project Report Estimated 2019

Figure 3. Agra Nagar Nigam Office, Source: Author

The vision statement for Agra Smart City is:

"City of Taj – where history is preserved, the environment is pristine, infrastructure is world-class, and opportunities are plenty – a safe place to live, a great place to tour."

Flagship Projects under the Smart City Project:

- Integrated Command & Control Centre
- Micro-Skill Development Center
- Automated Self Cleaning Toilets
- Smart Health Centre
- Smart Classes

This research paper mainly involves the study of **Integrated Command & Control Centre.**

1.1 Topic and Context

Agra is the administrative capital of the Agra district and Uttar Pradesh's third most populous city. Apart from the Taj Mahal, the city is a prominent tourist destination with a number of UNESCO World Heritage sites, including Agra Fort and Fatehpur Sikri Fort. The Agra Development Authority (ADA) Area has witnessed the extraordinary geographical expansion and population growth in recent decades, growing from 61.80 sq km in 1971 to 520.20 sq km in 2008. The city's population increased from 5.91 lakhs in 1971 to more than 9.78 lakhs in 1991, and the city's population was found to be 12.75 lakhs in the 2001 census. It is now a million-plus city. Despite the significant geographical growth, disproportionate spatial development has resulted in regions of high density in terms of employment and population, putting strain on the city's infrastructure. Agra is rapidly urbanizing. This growing urbanization offers the city a unique opportunity to accelerate its development while also addressing long-standing urban issues. The urban infrastructure development has lagged behind population expansion, resulting in demand and supply shortages in sectors like water, waste management, energy, mobility, built environment, education, healthcare, and safety. A city generates a lot of data and the effective utilization of this data is crucial for the sustainable growth of any region. Therefore, the Agra Municipal Corporation wanted to foster the development of a robust ICT infrastructure(Technology in Urban Management) that supports digital applications and ensures seamless steady-state operations, transportation and traffic management, emergency response mechanisms, and real-time tracking of services and vital city metrics throughout the city and in government departments in order to achieve its goals.

1.2 Significance of the project

The floating population is a big issue in Agra. Tourists

and short-term migrants visit Agra for a variety of reasons and stay for varying lengths of time. The city government faces issues in terms of sanitary facilities, toilets, solid waste management, sewage, water supply, and transportation. Furthermore, Agra attracts roughly 19-22 percent of the entire population per day for employment and other official/business/personal purposes from adjacent villages and metropolitan areas. The floating population is estimated to be around 0.3 million people per day (AJS, 2015).

Cities are looking for ground-breaking technology interventions to manage the demand of an exponentially growing population in cities (also attributed to migration from rural areas for better economic opportunities) in order to bring in efficiency and optimization for providing a better living environment to its inhabitants. Compared to the conventional inefficient silo-ed departmental style of the city administration, the Integrated Command and Control Centre platform enables cities to achieve more with less by moving to real-time data-driven decision/ policy making with enhanced situational awareness.

The ICCC serves as the "nerve center" for operations management, day-to-day exception handling, and disaster management. It also delivers insights by aggregating complex data sets to derive insights. By integrating multiple systems/applications in different technologies using different platforms into a common platform, the Integrated Command Control Centre reduces the complexity of dealing with multiple systems/ applications in different technologies using different platforms to leverage intelligence for making informed decisions. Such successful Integrated Command and Control Centers would become an important component of Indian cities,by providing a long-term solution to the needs of 400 million urban people who are expected to become urbanized over the next 35 years. The ICCC is designed to collect data from a variety of apps and sensors installed across the city, then present actionable data with suitable visualization to decision-makers.

The Integrated Command and Control Centers are designed to be the brains behind municipal operations, exception handling, and catastrophe response. Water, waste management, energy, mobility, the built environment, education, healthcare, and safety will all be captured and generated in real-time by the sensors and edge devices. The ICCC platform, with its various layers and components, will operate as a decision support system (DSS) for city administration, allowing it to respond to real-time events by consuming data feeds from various data sources and processing information from the data sets.

1.3 Aim and Objectives

To analyze the impact of ICCC on promoting a better quality of life for residents and also on enhancing and improving the efficiency of municipal services in the city.

The objectives of the study are:

a. To analyze how ICCC has benefitted the residents of the city. (Citizens)
b. To analyze the role of ICCC in effective monitoring and management of service delivery within the city. (Administration)
c. To evaluate the impact of the ICCC to combat the COVID-19 pandemic in Agra.

2. Contextual Background

2.1 Conceptual framework / Research design

The evaluation framework adopted for the study aims to achieve the broader objectives through a unique set

Figure 4. Command and Control Centre, Source: Author

Figure 5. Command and Control Centre, Source: Author

Figure 6. Cameras installed in the junctions, Source: Author

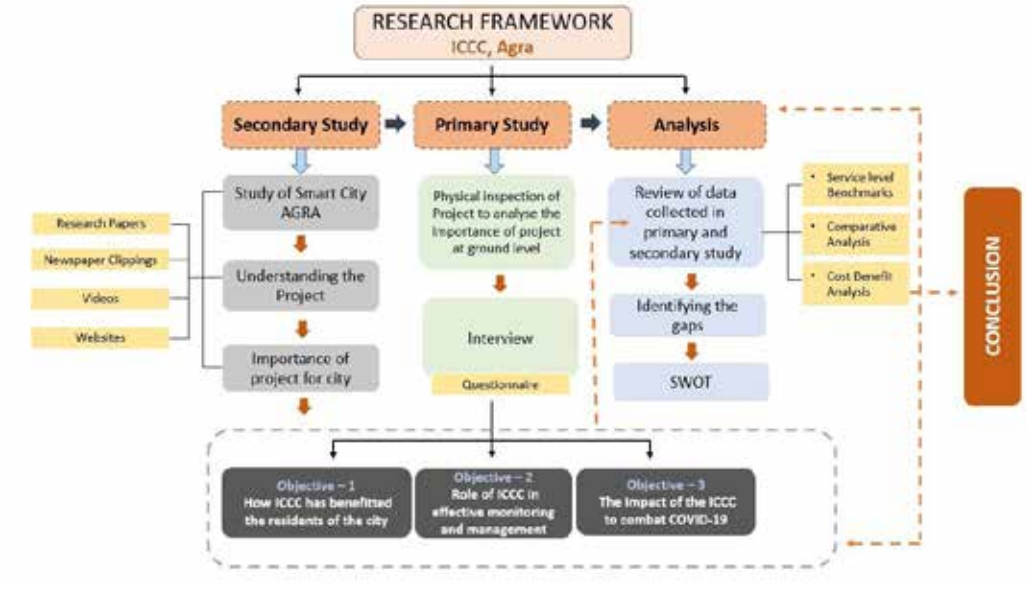

Figure 7. Research Framework, Source: Author

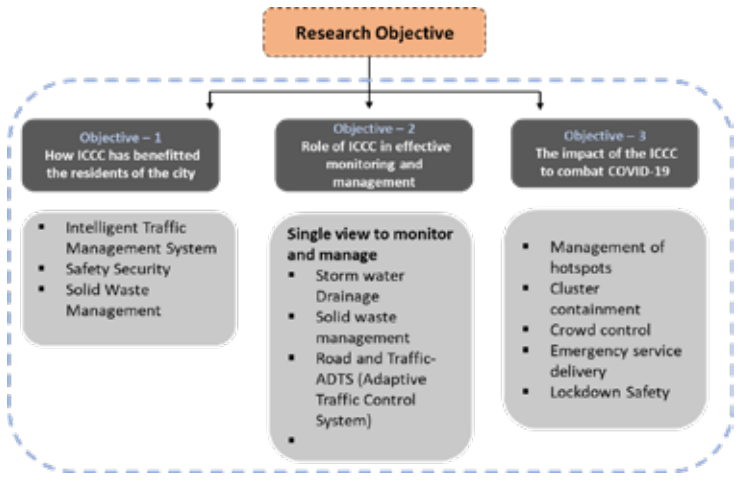

Figure 8. Objective assessments framework, Source: Author

of data analyses for each. The evaluation framework is shown in the table below.

S.No.	Objective	Evaluation Framework
1	To analyze how ICCC has benefitted the residents of the city.	By analyzing reduction in crime rate
		Ease of traffic movement
		Reduction in number of accidents
		Impact on public safety
2.	To analyze the role of ICCC in effective monitoring and management of service delivery within the city.	Number of services linked with ICCC and scalability to other departments
		Ease of service delivery within the city
		Impact on decision making
		Budget of the project
3.	To evaluate the impact of the ICCC to combat the COVID-19 pandemic in Agra.	Service delivery linkage with ICCC
		Lockdown management and monitoring
		Functioning of the 'Agra Model' of combating the COVID-19 pandemic

For conducting the mentioned research, a methodology was devised as shown in Figure 7. It includes analysis of secondary and primary data to achieve the desired objectives of the study.

Extensive analysis of the available secondary literature has been a significant part of the research to arrive at the primary aims and objectives of the study. The institute complemented this data by conducting the primary survey through field visits and interactions with the officials. The primary survey uses open questionnaires and on-site visits t

Command and Control Centre. The data/information obtained from the interview is used to analyse the impact of ICCC on various users.

2.2 Key features of the project

2.2.1 Challenges in the project

a. Different government agencies (local, regional, state) work in silos. Integrating the operations of all was a challenge.
b. Creating synergies between various urban systems like water supply, sewerage, solid waste management, transportation.
c. Covering all parts of the city and all households under the project.
d. Vandalism of the component infrastructure poses a major challenge in the effective implementation of the project.

2.2.2 Risks involved in the project

a. Theft of infrastructure components.
b. The risk involved with the OFC (Optical Fibre Cable) being cut because of any activity/incident, could lead to the entire camera system shutting down.
c. Third-party departments doing underground digging without informing the ICCC could create issues.
d. Since the entire system is cloud-based the risk of a cyber attack always exists.

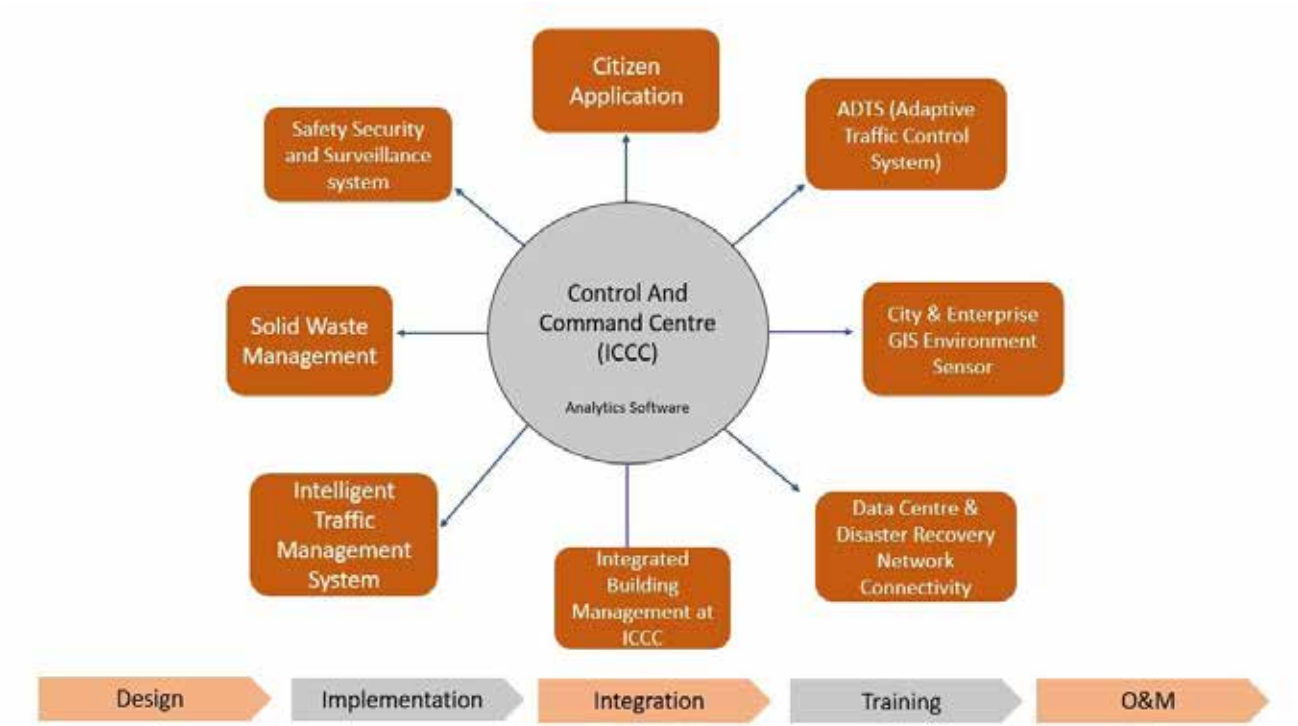

Figure 9. Key Components of ICCC, Source: Detailed Project Report for Information Communication and Technology (ICT) Components

2.2.3 Features and Benefits (social, technical, city administration level, impact on environment and economy) to the city (expected and observed)

a. The Agra Smart City ICCC is a vital convergent technology that allows all technological implementations in the city to be monitored, managed, and optimized in order to improve the service delivery quality.
b. It's a platform that connects all city services and allows the city to manage cross-functional service delivery.
c. Agra ICCC is integrated to manage the following systems:
    - Safe City Cameras Feed (CCTV): 1250 CCTV cameras have been located in around 240 locations for security and surveillance of the city. The cameras are also equipped with various analytics like facial recognition systems and alert generation.
    - Intelligent Transport Management System (ITMS): ITMS is installed in 43 traffic junctions of the city. ANPR(Automatic Number Plate Recognition) cameras are installed, which capture any traffic violation incident like red light violation detection and no helmet detection along with the number plate. The information is automatically received by the traffic police sitting in ICCC, which issues e-challans to the offenders. It is also linked with the Vahan and Saarthi database along with NIC.
    - Adaptive Traffic Control System(ATCS): ATCS is installed in 63 junctions in Agra. The entire traffic data is captured in ICCC. It works in three different modes. First is the VAC(Vehicle Actuator) mode, which is completely automatic, based on AI learning. The system learns the traffic pattern and flow, and based upon that, the duration of the signal lights is decided. The second is the fixed mode in which a cycle of 180 seconds is equally divided as per the need. The third is the manual mode, which is dependent on the traffic police.
    - Environment Sensors: In 39 locations, environment sensors have been installed in the city. The sensors measure 18/20 parameters on a real-time basis. Data on AQI(Air Quality Index) is stored in ICCC.
    - Emergency Response and Disaster Management: Emergency panic buttons have been located in 43 locations. The distress calls are attended by the ICCC. Fifteen dial-112 vehicles operate within the city and are installed with cameras. Miniature ICCC has also been created in the police control room.
    - ICT-based Solid Waste Management Services: RFID tags have been installed in 3,50,000 households to monitor the collection of solid waste. The information is recorded in the ICCC and also sent to the household. SWM collection vehicles are equipped with a GPS system to facilitate route mapping and

tracking of vehicles. Bin volume sensors have also been installed in some bins, wherein an alert is generated when the three-fourth bin capacity is reached, the nearest vehicle can empty the bins.

- City GIS Platform: The entire commercial and residential properties in Agra have been mapped. Agra Smart City has established an enterprise GIS system that is connected to 12 departments and systems for land, estate, disaster and emergency services, parks and gardens, water, sewerage, roads and traffic, stormwater drainage, streetlights, and capital project monitoring and control.

Replicability/Scalability:

a. ICCC can be seamlessly integrated with additional city-systems in future, including
   - Municipal Corporations Call Center
   - Municipal Corporations Services Portal`
   - Met Department
   - City Application
   - Water Management System
   - Fire Brigade Control System
   - Smart Parking
   - Public Bike Sharing

b. The platform is easily replicable in other regions and can be customized to include the unique input systems, features, analytics, and insights needed by those cities.

Key Benefits:

a. Social:
   - Ensuring public safety through CCTV-based video surveillance, which is helpful in deterring, detecting, and thus dealing with criminal activities.
   - Improved living standards, satisfaction, and urban quality of life through enhancedpublic safety, shortening daily commutes, boosting public health, and creating a cleaner, more sustainable surroundings.
   - Assists in minimizing occurrences, such as the spread of infectious illness, while assuring compliance. ICCC played a significant role in managing the pandemic in the city by monitoring lockdown safety, crowd control, and delivery of essential and emergency services.

b. Technical:
   - Use of cloud-based Data Center Disaster Recovery (DC-DR) to host the common command center and save data related to common command center applications.
   - Real-time field information is sent to ICCC. The data is also stored in the data centre, a copy of which is saved on the cloud.
   - Geo-tagging of the city infrastructure and GIS-based mapping to create a comprehensive system of geospatial maps.

c. City Administration:
   - ICCC uses city technology to assist the governance of city functions, services, vendors, and staff, as well as to effectively administer services for residents from all walks of life.
   - The data from all of these systems and devices provide municipal officials with real-time,comprehensive insights, allowing them to make judgments about current city operations and future growth plans.
   - With the use of advanced technologies, human resources could be put to better use. For instance, with the development of ATCS in city junctions, the traffic police have been assigned for handling crime within the city.

d. Economy:
   - Timely monitoring and effective management reduce loss to the public infrastructure.
   - The use of digital technology for effective management and improved operational efficiency of services within the city reduces the time overrun, thereby reducing the economic loss.
   - Reduction in maintenance loss, because of timely monitoring of systems.
   - Creation of skilled jobs within the ICCC.

e. Environment:
   - Proposed 39 Environment Sensors (6 sensors with special parameters around the Taj Mahal) across the city to monitor air pollution levels.
   - These sensors gather data, based on certain parameters like air pollutants, and ambient conditions (temperature, noise, humidity, pressure, light) on an hourly basis.
   - The data from the sensors can be utilised for dealing with the problem of air pollution

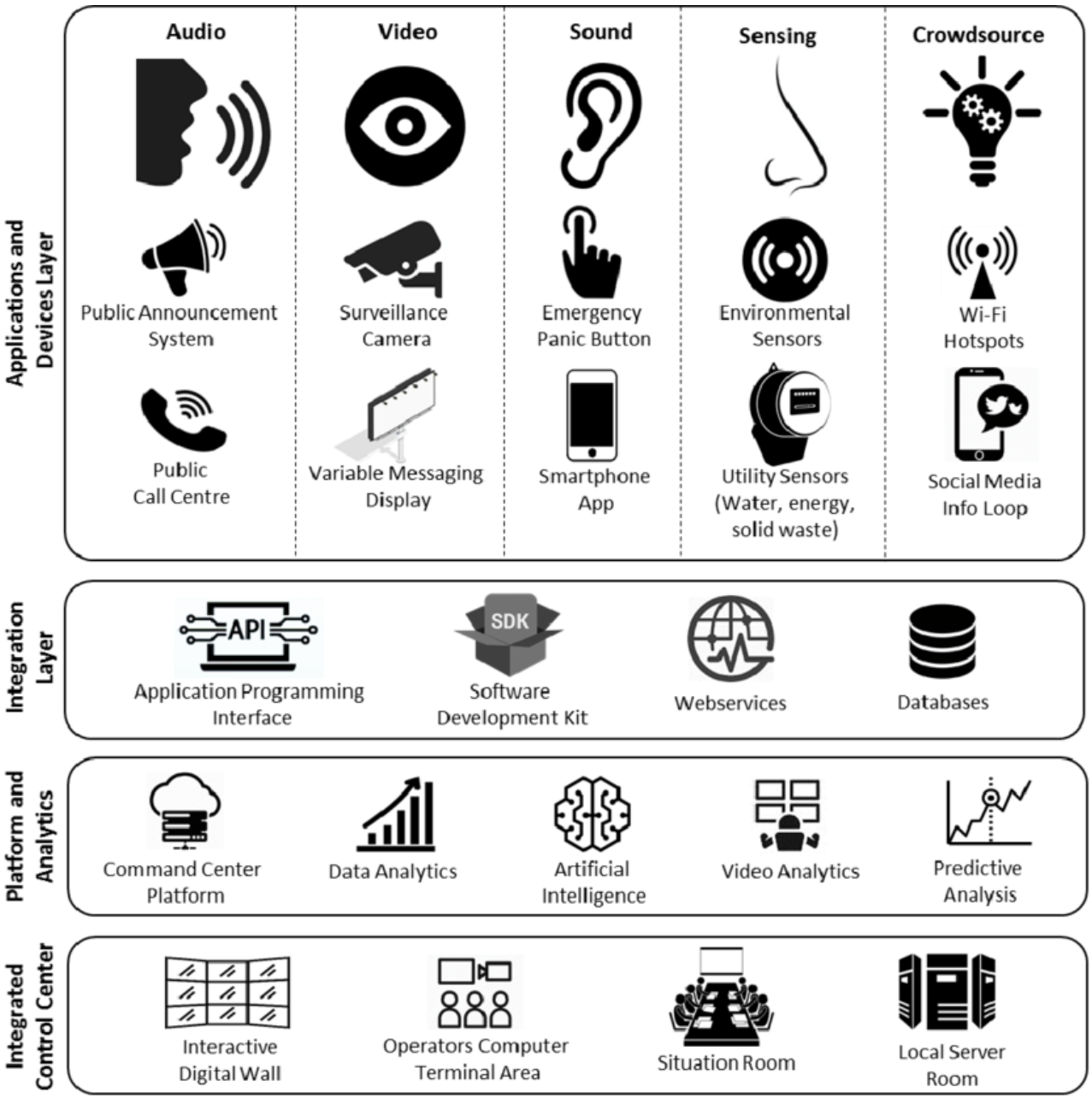

Figure 10. Typical architecture of the Integrated Command and Control Centre in Indian cities, Source: (Praharaj, 2020)

in sensitive locations. Adequate mitigation measures can be adopted by the government after analysing the information from the environment sensors.

2.3 Key findings from the interviews, surveys, and primary/secondary data collection

1. Smart City Integrated Command & Control Centre (ICCC) as 24/7 COVID-19 war room:
   The district control room, grocery helpline, security & surveillance functions, traffic monitoring, lockdown monitoring, live telecast of advisories through VMS systems and PA systems, and video conference facility with relief commissioner in Lucknow are all integrated here as part of the smart city mission's integrated command and control centre, which served as COVID -19 war room. In the ICCC, a 25-member team worked around the clock to combine diverse COVID-fighting activities.

   Smart Health Centre:
   The Smart Health Centre, which was built under the Smart City initiative, helps to raise awareness about the numerous Dos and Dont's of Corona. Each patient is given a 3-5 minute briefing on the Corona advice for both general consultation and dentistry clinic. In March 2022, 325 patients sought advice, compared to 675 in February 2022. The pharmacist at Smart Health Centre delivered 1015 hand sanitizers and 935 masks at subsidised rates, providing considerable relief to the people.

   Online Information Portal for Grocery at your Doorstep:
   The Agra District Administration and Agra Smart City collaborated to ensure doorstep delivery. The entire 100 wards of Agra City were surveyed, and specific kirana shops and fruit/vegetable vendors were identified ward by ward, and their mobile numbers were transmitted to various house owners who had provided their mobile numbers during the GIS property survey and SWM RFID tag installation. Bulk communications were sent out by wards regarding grocery stores and vegetable vendors who delivered the stuff to the consumers'houses within 24 hours, and the tariffs for various basic commodities were regulated to prevent stockpiling and price rises. Zomato and Big Bazar also partnered to bring groceries to their doorsteps.

   Agra Smart City Combats COVID 19 using Technology – Launches Agra Lock-Down Monitor App - A Secura (CSR Initiative):
   The Agra Administration, in collaboration with Agra Smart City and Agra Police Department, utilized the ICCC Control Room, which was created by the Agra Smart City Limited at Nagar Nigam Agra.

   In the presence of the IG, Agra Range; SSP Agra; Municipal Commissioner, SP Traffic; and other Agra Police and Agra Smart City officials, the Divisional Commissioner, Agra, launched the Agra Lockdown Monitoring App at the Command & Control Centre.

   This cutting-edge video surveillance system is used to properly monitor numerous sites throughout Agra in order to regulate crowds and combat COVID 19. The AI-based Analytics, the first of its kind, to battle COVID-19 in Agra, is the most recent example of these initiatives.

2. Due to ICCC's CCTV surveillance initiative, the crime rate has decreased by 4-5%.
3. Operation and maintenance issue: vandalism is seen in several places, which leads to inefficient working of ICCC.
4. There are a lot of facilities provided to the citizens by ICCC, but there is a lack of awareness, caused due to the lack of awareness programs.
5. Not functional in all locations: it is observed from the primary survey and the data from ICCC,about the equipment not working in all the locations, leads citizens to take traffic rules lightly.
6. A new app is under process by ICCC for citizens, known as ***'mera agra app'.*** This app will provide citizens with one single platform to tackle city-related problems. For example e-challan, water metering, filing complaints, what's near me, tourism and basic utilities, etc.

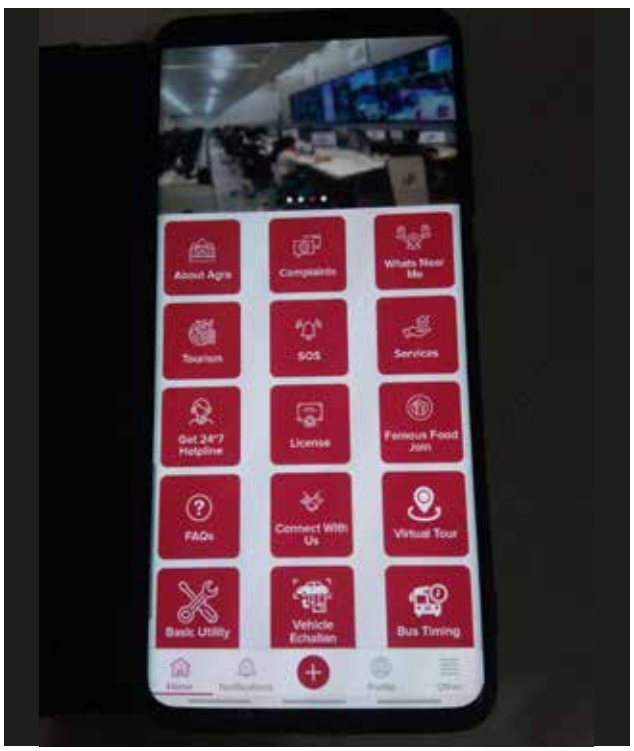

Figure 11. 'Mera Agra' App Interface, Source: Author

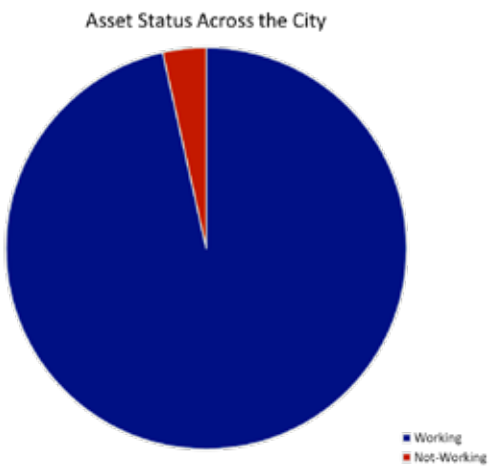

Figure 12. Working and non-working assets in the city, Source: Author

3. Discussion and Conclusion

One of the key goals of Agra's smart city mission is to improve the safety and security of Agra residents and the tourists who come to see the Taj Mahal, the city's heritage monument and a symbol of love, affection, and love. Another goal was to increase the law enforcement and public awareness among Agra inhabitants on different aspects such as traffic rules, safe driving, solid waste, and improved sanitation, all of which will improve residents' quality of life and municipal service efficiency. Therefore, as part of the 'Smart Solution' for the city, ICCC was developed to improve infrastructure and services through the use of technology, information, and data. Projects such as a city-wide video surveillance network, real-time monitoring of environmental quality, large-scale installation of smart energy and water meters, and the development of intelligent transportation and traffic solutions are among the typical smart solutions proposed in the approved proposals.

The first objective of the study was to analyze the benefits of ICCC for the residents of the city.

ICCC integrates the operations of various departments in the city. With the ability to accept, intelligently correlate, and share data with city operations and planning stakeholders, the goal is to improve safety, security, and public services in Agra. As a result of these smart applications and systems, there has been a considerable change in the behavior of the citizens. People are adhering to the traffic rules. However, it was found that this was the case only in those ITMS junctions where the ANPR cameras were functioning properly. The presence of CCTV surveillance across the city helps ensure public safety. The surveillance cameras have not only helped deter crime but also protect the city infrastructure from theft and vandalism. This is assisted by the panic buttons across 43 locations in the city. The awareness in the public about these facilities, like panic buttons, remains to be assessed. Also, the criteria for the selection of 43 locations should be analyzed to assess their functional viability. Public announcement systems also exist in key locations of the city. The ambient noise levels however, hampered their efficient functioning.

Services like transportation, solid waste management, city surveillance, GIS-based city mapping have been linked to the ICCC. The integrated functioning leads to efficient service delivery. However not all departments have been linked to the centre. The scalability to other sectors will further enhance the functioning. The use

of technology in service delivery has led to better decision-making on the part of the city officials. This was experienced during the COVID-19 pandemic. The Agra model of handling the situation was well appreciated. Another advantage of the use of smart technology is that the human resources could be put to better tasks. The huge amount of data generated in the ICCC is stored in its data centres and on cloud. This data could provide insights to the officials and lead to informed decision-making.

The district control room, grocery helpline, security & surveillance functions, traffic monitoring, lockdown monitoring, live telecast of advisories through VMS systems and PA systems, and video conference facility with relief commissioner in Lucknow are all integrated here as part of the smart city mission's integrated command and control centre, which serves as COVID -19 war room. In the ICCC, a 25-member team works around the clock to combine diverse COVID-fighting activities.

Technology alone is not capable of making a city smart. Smart cities are built by smart people. Informed and responsible citizens form the essence of any smart city. The use of cutting-edge technology is important for growth and development but so is the involvement of the people of the city. Only then can our cities be truly smart in all aspects.

3.1 Implications (the impact assessment framework to be included here)

Input: The Bharat Electronics Limited is a Navaratan PSU and it is one of the 9 PSU under the Ministry of Defense of India. The Bharat Electronics Limited (BEL) consortium has been granted Rs. 336 crore to Agra Smart City Project.

Synergy and Bookman are part of the BEL collaboration for Agra Smart City. BEL is the project's system integrator for smart waste, CCTV, video analytics, smart transportation, surveillance, Intelligent Traffic Management System (ITMS), and violation.

Measurable Outputs:
Agra city has installed the following:

a. 790 Fixed Box and 326 PTZ cameras
b. 43 Emergency Panic Buttons
c. 50 Body-Worn Police Cameras
d. 48 Upgraded UP Dial 100 vehicles
e. Automatic Number Plate Detection Cameras at 43 Junctions
f. Red Light Violation Detection Cameras at 31 Locations
g. Adaptive Traffic Control Systems at 62 Junctions
h. 39 Environmental Sensors

The Integrated Control and Command Center receives data from various systems for analytics, visualization, alerts, and event triggers.

Key Impacts:

a. Interconnected systems, data, and advanced analytics to address social, residential, commercial, and national threats
b. Use of technology for integrated and efficient control and management platform
c. Ability to adapt a structured approach to handling incidents effectively and efficiently
d. Effective replacement of legacy and manual systems with automated and hybrid processes
e. Ongoing business process reengineering, training of leaders, and capacity building in city staff in managing the command center
f. Focus on safeguarding personal data
g. Effective use of video wall via adequate training

3.2 Limitations of the research

The audience ICCC is catering to is huge, as it is a pan-city project. The primary survey is limited to the administration and officials only. This added a degree of subjectivity to the responses which could not be cross-verified with other sources.

As ICCC is a pan-city project, it was difficult to survey all the locations physically

3.3 Key lessons learned

Research work primarily involves the study of secondary and primary literature. Secondary data is essential when we think of doing any research work, particularly in times of COVID-19, when such uncertainty persists concerning the field visits and interviews. Also, careful analysis of the secondary literature is necessary to get a first-hand observation of the subject and arrive at a preliminary framework for the research. Well-documented literature enhances the overall experience.

The primary survey included discussions with the officials. Cooperation of the authorities is a crucial factor. The officials in Agra provided the best on-field support.

3.4 Recommendations

The project is working well overall, but there is a lack of citizen awareness about the benefits and opportunities that they receive from the ICCC. One example is the panic button, which is not very obvious where it is placed and should be displayed more prominently. The panic buttons are mostly found at traffic intersections, but not in shady areas, where they may drastically reduce the city's crime rate, if implemented.

The ICCC is a massive data repository, but it appears that the data is notbeing utilized to its full potential.

This information might be used in academia, such as planning and architecture schools, to improve cities; however, it is not widely available to students and researchers. If the information gathered is shared with students and other research institutes, it will aid in the establishment of similar projects in other cities.

Figure 13. Impact assessment framework, Source: Author

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