SUMMER TRAINING

ON

COMMAND CONTROL & COMMUNICATION CENTER

AT

RANCHI SMART CITY

Submitted in partial fulfilment of the requirements for the

Award of the Degree of

BACHELOR OF TECHNOLOGY

In

ELECTRONICS & COMMUNICATION ENGINEERING

BY

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(BTECH/15143/20)

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ENGINEERING

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Acknowledgement

I wish to express my sincere gratitude to General Manager Technical Mr Rakesh K. Nandkeolyar for allowing me to do my summer training at Ranchi Smart City. I am really fortunate that I had his kind association as well as Supervision. In my training, I was mentored by Mr. Atul Agrawal, he has provided me a huge amount of his precious time and effort in understanding the core concepts behind working of traffic management control system in Ranchi. I feel really grateful to be able to work under his guidance.

I would also like to thank all the in charges of different departments who took out some time from their schedule and showing me different working units of the RSC.

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SAHIL SHARAN

BTECH/15143/20

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CERTIFICATE OF COMPLETION

This is to certify that Mr. SAHIL SHARAN a student of BIRLA INSTITUTE OF TECHNOLOGY, PATNA has successfully completed his Internship with Ranchi Smart City Limited from 08-05-2023 to 08-07-2023. During the period of Internship, he worked and assisted the Ranchi Smart City Limited in research/design/fieldwork related to ICCC with due diligence and commitment.

Date :24/07/23

Amit Kumar
Chief Executive Officer

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1. ABSTRACT

This report provides an overview of the Smart City initiatives in Ranchi, focusing on the various technological components and systems that have been implemented to transform the city into a more efficient and interconnected urban centre. The report covers key aspects of the smart city infrastructure, including the Integrated Traffic Management System (ITMS), Automated Traffic Control System (ATCS), Data Centre, Field Equipment, Connectivity, Integration, Dashboard, Website, Cloud Storage, Security Audit, Violations Monitoring, Geographic Information System (GIS), Public Announcement (PA) System, and various types of cameras used for surveillance.

Furthermore, the report discusses the City App Ranchi, Video Wall, Cables, Software, License Plate Recognition (LPR) Technology, Vehicle Number Challan Generation, Optical Character Recognition (OCR), Flow Control, and Chartered App. It also examines the differentiation between the Control Room and overall applications, along with the utilization of MOTADATA for monitoring live data on working and dismantle processes.

The IT infrastructure, including WAN, VLAN, Routers, Subnets, MAC addresses, User Types, Tags, Service Level Agreements (SLA), Helpdesk, Switches, Ports, Static IPs, and ARP Table, is also analysed in the report. The report delves into Infrastructure Health and Monitoring, CIDR, Production Server Monitoring, Testing Server, Development Server, High Availability, Clustering, Load Balancing, Field Team Operations, Ticket Prioritization, and Network Management System (NMS).

Furthermore, the report discusses the use of satellite-based Google GIS for mapping, Live Traffic monitoring, Furniture, Security against attacks, and sensitive areas identification. Lastly, the report examines the Database Server and its role in managing the applications.

Through a comprehensive exploration of these components, the report highlights the efforts made by the Smart City Ranchi initiative in leveraging technology to enhance city operations, improve citizen services, and create a more sustainable and connected urban environment. The findings of this report shed light on the significance of technology-driven solutions in realizing the vision of a truly Smart City in Ranchi.

2. INTRODUCTION

2.1 Smart City Mission: -

The 100 Smart Cities Mission in India was launched by Prime Minister Narendra Modi on June 25, 2015. Smart Cities Mission is an urban renewal and retrofitting program launched by the Government of India to develop smart cities and make them citizen friendly and sustainable.

National Smart Cities Mission is an urban renewal and retrofitting program by the Government of India with the mission to develop smart cities across the country, making them citizen friendly and sustainable. The Union Ministry of Urban Development is responsible for implementing the mission in collaboration with the state governments of the respective cities. The mission initially included 100 cities, with the deadline for completion of the projects set between 2019 and 2023. The effective combined completion of all projects as of 2019 is at 11%. As of March 2022, 3577 projects out of total 6939 tendered projects have been completed, utilizing ₹60,073 crore out of total tendered amount of ₹191,294 crore.

2.1.1 Foundation of Smart City Mission

The objective of SCM is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment through the application of 'Smart' solutions.

2.1.2 Phases

Three phases of the development of smart cities defined as Smart City 1.0, Smart City 2.0, and Smart City 3.0. The proposed phases are of an open-ended nature, as there is currently the shaping of another phase—Smart City 4.0, inspired by economics.

2.1.3 Pillars

I. *Social Infrastructure.*
II. *Physical Infrastructure.*
III. *Institutional Infrastructure.*
IV. *Economic Infrastructure.*

2.1.4 Special Purpose Vehicle [SPV]

A Special Purpose Vehicle (SPV) is a separate legal entity created by an organization. The SPV is a distinct company with its own assets and liabilities, as well as its own legal status. They are

the companies created by the state and municipal bodies to expedite the process of development

2.2 Ranchi Smart City: -

Ranchi Smart City Corporation Limited is SPV (Special-Purpose Vehicle) incorporated on 30th Sep 2016 for the execution of smart city projects of Ranchi. Urban Development & Housing Department, Govt. of Jharkhand vide Memo no. 4552 dated 16.08.2016 acquainted the construction of Ranchi Smart City Corporation Ltd as the SPV to contrivance the Smart City Project. The aims and intents of the company are as follows: To plan, Strategies, develop, contrivance, manage, maintain, operate, and monitor the Smart City Development Projects for the city of Ranchi following Smart City Mission of the Government of India and State Government. Resource building in terms of financial and physical possessions for Smart City Project to acquire/purchase/buy land for Smart City Project and to transfer the same on the Build-Operate-Transfer (BOT) Model.

The state government divided the smart Development of Ranchi City into two primary projects:

1. Area Based Development (ABD)

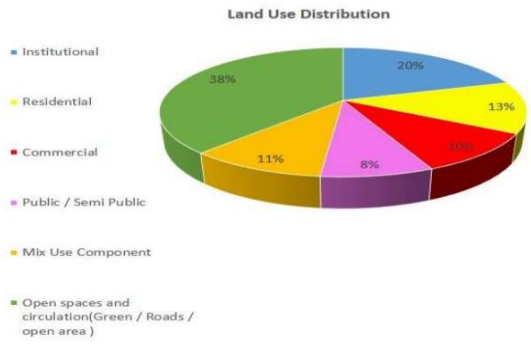
2. Pan City Development Projects

2.2.1 Area Based Development (ABD)

Area based development in Ranchi Smart City envisages development of a Greenfield encumbrance free land of 656 acre. This area is well within the municipal core within 5kms distance from the central business district (CBD) and close proximity to the Proposed Capital Complex, Airport and Hatia Railway Station. The Layout Plan for the ABD has been conceptualized in discussion with the different stakeholders and is being put up in Public Domain for public opinion. The Proposed land use breakup is as under

Land use break up of Area Based Development Site for Ranchi Smart City

Land Landuse break up of ABD proposal		
Land Use	**IN Acres**	**%**
Institutional	134.06	20%
Residential	86.51	13%
Commercial	67.07	10%
Public / Semi Public	54.60	8%
Mix Use Component	69.14	11%
Open spaces and circulation(Green / Roads / open area)	245.05	38%
Total Area	656.43	100%



2.2.2 Pan City Development Projects

The Integrated Traffic and Transport System (RITTS) is a comprehensive project planned for Pan City Ranchi. Its primary objective is to utilize Information Communication Technology (ICT) to integrate all existing and upcoming transport and traffic solutions under a single umbrella. By doing so, the RITTS aims to create a digital platform that effectively manages public transport, parking, corridor traffic, Intermediated Public Transport (IPT) services, and fare management. Additionally, the system will cater to the specific transport and traffic needs of ABD (Area-Based Development) in Ranchi.

Explanation:

- The RITTS project aims to integrate all transport and traffic solutions through the use of ICT in Pan City Ranchi.
- It will provide a digital platform to manage public transport, parking, corridor traffic, IPT services, and fare management.
- The system will address the specific transport and traffic needs of ABD in Ranchi.

Central Control and Command Centre:

- The RITTS will be managed from a Central Control and Command Centre.
- This center will act as the central hub for all traffic and transport-related decision making processes.
- It will focus on ensuring the safety and security of Ranchi city.
- The center has the potential for future scalability, allowing for the inclusion of other utilities like Solid Waste Management.

Bullet Points:

- Integrate all transport and traffic solutions using ICT in Pan City Ranchi.
- Manage public transport, parking, corridor traffic, IPT services, and fare management through a digital platform.
- Address specific transport and traffic needs of ABD in Ranchi.

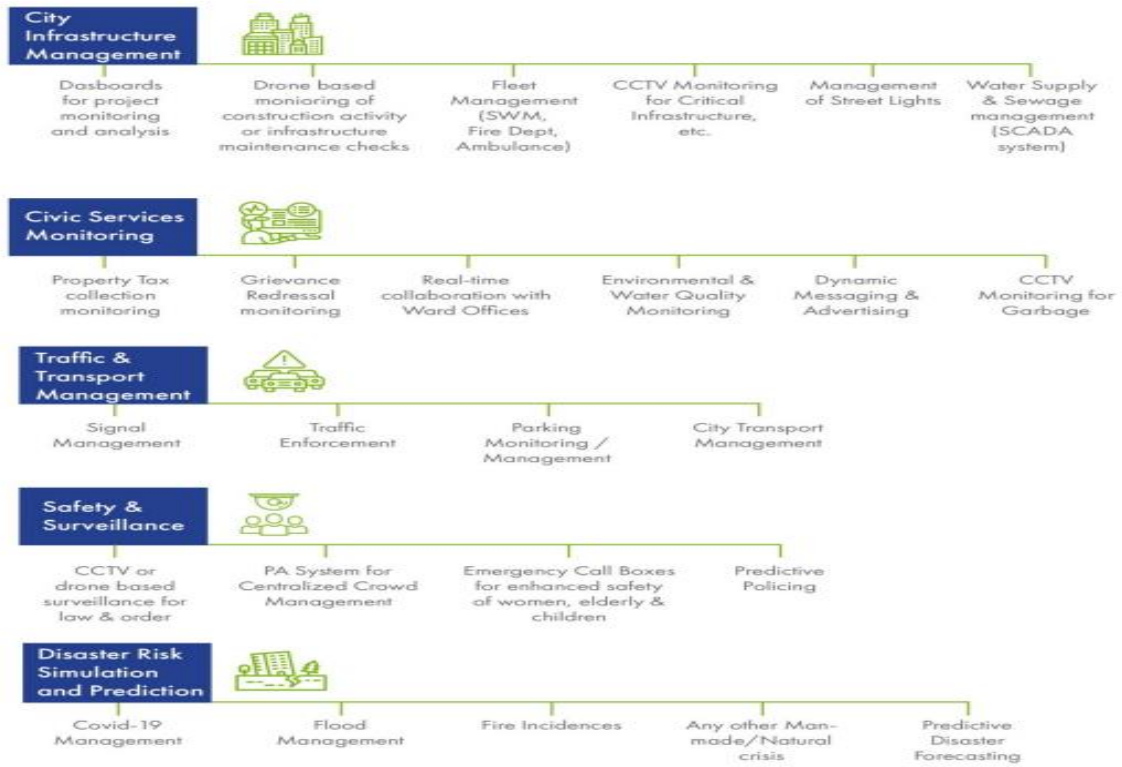
3. ICCC

3.1 Command Control & Communication Center: -

3.1.1 What is C4?

The Authority has envisaged implementation of an Integrated Command & Control Center (ICCC or C4) and Digital infrastructure in the city. Through this initiative, the Authority plans to utilize information technology to build a well-informed, connected, smart and intelligent system of systems to help in providing an efficient and effective citizen service. ICCC is envisaged as a nervous system of the city which shall enable collation of information and collaborative engagement among city stakeholders, thus helping in the analysis of data for quicker decision-making.

The key objective of this project is to establish a collaborative framework where input from different functional departments such as Transport, Water, Solid Waste Management, Fire, Police, Traffic, e-governance etc. can be assimilated and analyzed on a single platform for building an effective decision support system. Indicative municipal and non-municipal services that can be supported well by ICCC are depicted in the infographic as below.



3.1.2 Envisaged Benefits for the city

- **Increased Traffic Efficiency:** Reduction in stoppage time, optimized cycle times of intersection to regulate and maintain free flow of traffic to enhance the efficiency of the road & transport infrastructure. Traffic intersections designed for differently abled should help in improving the quality of life and convenience for people with disability.
- **Increased Travel Speed:** Optimized signal timings shall result in improved road network performance, enabling higher travel speed. It shall be possible to plan traffic diversions and traffic re-routing for a particular public event and avoid road congestion and minimize inconvenience to the citizens.
- **Increase Operational Efficiency:** City Authorities intend to spend more time on public facing functions. Thus, ICCC solutions should help in reducing repetitive paperwork/records & making the back-office as well as city operations management functions more efficient.
- **Safety Improvement:** The real-time safety management, traffic monitoring and intelligent traffic control can help prevent accidents and also respond to potentially dangerous situations in advance. f. Higher Productivity: Achieving improvement in the productivity, logistics and other economic activities by obtaining precise real-time information on transport due to the availability of data on traffic flow in key areas of the city.
- **Solid waste management:** Addressing the challenges through monitoring mechanisms, instant communication, data-based decisions and automation to bring efficiency and cost effectiveness across the SWM life cycle, convenience to the citizens and cleaner, healthier environment.
- **Real Time Information & Response:** The real-time information at the ICCC shall help in taking necessary actions and execute the required responses such as sending an emergency vehicle to the spot, arranging alternate routes to VIP convoys, diverting the traffic to different routes etc. It shall be possible to track a particular event using the cameras installed at the traffic junction.
- **Creating awareness and educating the public:** Through VMD boards, awareness of current traffic situations, road traffic rules and safe driving precautions shall be imparted to road users.
- **Enforcement:** Continued monitoring of traffic flow at junctions shall reduce the traffic related offences like- Red Light violation and Stop line violations, resulting in effective enforcement of traffic regulations.
- **Reduction in Pollution:** Optimized traffic flow shall lead to less congestion which shall

have a direct impact on the carbon emitted by the vehicles. This shall help improve the air quality of the city and help meet the sustainable goals.

3.2 Integration Of Police With C4: -

3.2.1 What is the need to integrate police with C4?

In a smart city ecosystem, policing faces various challenges that arise from the integration of technologies inherent to smart city processes and systems. While digitization, automation, and system convergence enhance efficiency, they also increase digital security vulnerabilities. Moreover, the interconnectedness of systems can lead to large-scale collapses due to minor breaches, while the data-driven nature of smart cities raises privacy concerns and necessitates responsible handling of individuals' information.

To effectively address these challenges, law enforcement agencies need to integrate with the Command, Control, Communications, and Computing (C4) framework. This integration will enable seamless coordination, data sharing, and real-time response capabilities.

3.2.2 What are the key components of this integration?

- **City-Wide Surveillance and Monitoring Setup:** Utilize CCTV cameras and field sensors (e.g., RFID, gunshot sensors) for extensive monitoring.
- **Enterprise-Level Intelligent Database Integration:** Establish a system that enables all smart city databases to share data and draw meaningful connections.
- **Database Analytics Engine:** Implement an analytics engine for real-time processing of multiple databases and live data, generating actionable insights.
- **Machine Learning, Deep Learning, and AI:** Incorporate machine learning and AI algorithms to continuously improve data analytics and decision-making processes.
- **Crowdsourcing and Community Policing:** Integrate data from open sources and crowd-sourced inputs, fostering community policing through social media and civic amenity apps.
- **Intelligent Traffic Management System:** Implement a dedicated traffic management system to handle vehicular traffic data and optimize response systems.
- **Central Command, Control, and Coordination Centre (C4 Centre):** Establish a centralized hub for seamless coordination and response management across all components.
- **Dedicated Data Network:** Create a secure and redundant data network to ensure the transmission of sensitive data while maintaining system robustness.
- **Information Security/Cybersecurity Setup:** Implement robust security measures to safeguard

databases, applications, and decision-making tools.

- **Incubation & Adaptation Centre:** Set up an R&D center to study and adapt new technologies for smart city policing requirements.

By integrating law enforcement with the C4 framework and deploying these components, the police force can leverage the potential of smart city technologies while ensuring public safety, privacy protection, and efficient response to emerging challenges. The integration will empower law enforcement to make data-driven decisions, optimize resource allocation, and enhance overall security and public safety within the smart city environment

3.3 ITMS(Intelligent Traffic Management System): -

3.3.1 What is ITMS?

One key feature of a ICCC is the integration of an Intelligent Traffic Management System (ITMS). Intelligent Traffic Management System is one of the advanced solution to the congested traffic conditions face by many cities. ITMS Solution is to utilize information technology to modernize key functions of traffic management, Traffic control, Traffic Law enforcement and traffic information dissemination in the city to build a safer city with smooth traffic flow, informed road users and improving the efficiency and effectiveness of Road Traffic Infrastructure. Which provide greater information to the authorities to proactively manage the ongoing traffic situation and allow citizens to make informed travel choices.

3.3.2 ITMS COMPONENTS

- **Traffic Monitoring:** ITMS employs a network of sensors, cameras, and other devices strategically placed across the city to monitor traffic conditions continuously. These sensors collect data on vehicle movement, speed, and congestion levels, generating valuable insights for traffic management.
- **Adaptive Traffic Control System (ATCS):** ATCS is a crucial component of ITMS that dynamically adjusts traffic signal timings based on real-time traffic data. By optimizing traffic signal phasing in response to varying traffic demands, ATCS can significantly reduce congestion and waiting times at intersections.
- **Incident Detection and Response:** ITMS includes incident detection systems that can identify traffic incidents such as accidents, road closures, or breakdowns in real-time. The CCR operators are immediately alerted to respond promptly and coordinate emergency services as needed.
- **Public Information and Communication:** An essential aspect of ITMS is the dissemination of real-time traffic information to the public through various communication channels. Dynamic Message Signs (DMS) on roads, mobile applications, websites, and social media platforms provide commuters with relevant traffic updates, enabling them to make informed travel decisions.

4. Role Of Electronics In RSC

The role of electronics in a Command, Control, and Communication Center(C4) is crucial for the effective functioning and management of a smart city in India. Electronics play a significant role in enabling seamless integration, real-time data analysis, and communication among various components of the smart city ecosystem.

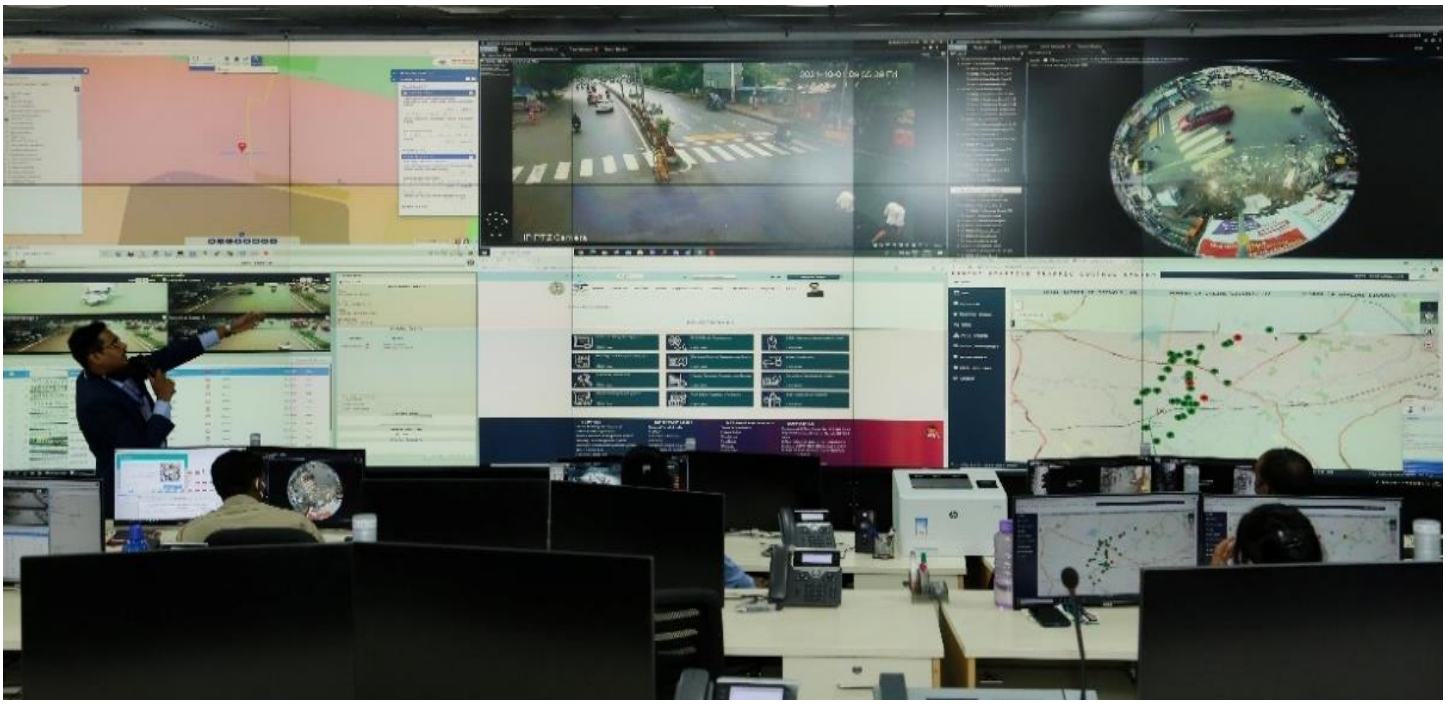
The Integrated Command Control Centre has few major components :

- Interactive Video Wall with intuitive GUI
- Adaptive Traffic Control System (ATCS)
- Automatic Number Plate Recognition (ANPR) System
- Red Light Violation Detection (RLVD) System
- Speed Violation Detection (SVD) System
- Traffic Accident Reporting System (TARS)
- Variable Message Sign Boards (VMSB)
- Public Address (PA)
- Emergency Call Box (ECB) System
- Camera

4.1 Video wall: -

4.1.1 What is a video wall?

A video wall is a display system comprising multiple computer monitors or television sets that are arranged contiguously and seamlessly to create one unified large screen. It is often referred to as a TV wall, display wall, data wall, or media wall. The main purpose of a video wall is to showcase visual content, data, or media on a larger scale, providing a more immersive and impactful viewing experience. By tiling the individual screens together, video walls offer a cohesive and continuous display, allowing users to present information, videos, graphics, or presentations on a grand scale. Video walls are commonly used in control rooms, command centers, public spaces, corporate offices, entertainment venues, and advertising displays, where a larger and attention-grabbing display is desired.



4.1.2 Why is a video wall required?

A video wall is essential for various reasons due to its numerous advantages, including:

High-Definition Display: Video walls offer high-definition displays, ensuring clear and detailed visuals.

Consistent Brightness: The screens in a video wall maintain consistent brightness levels across the entire display.

Increased Video Image Quantity: Video walls can show multiple video images simultaneously, enhancing information visibility.

Mixed Source Resolutions and Formats: Video walls can handle different resolutions and formats, allowing for versatile content presentation.

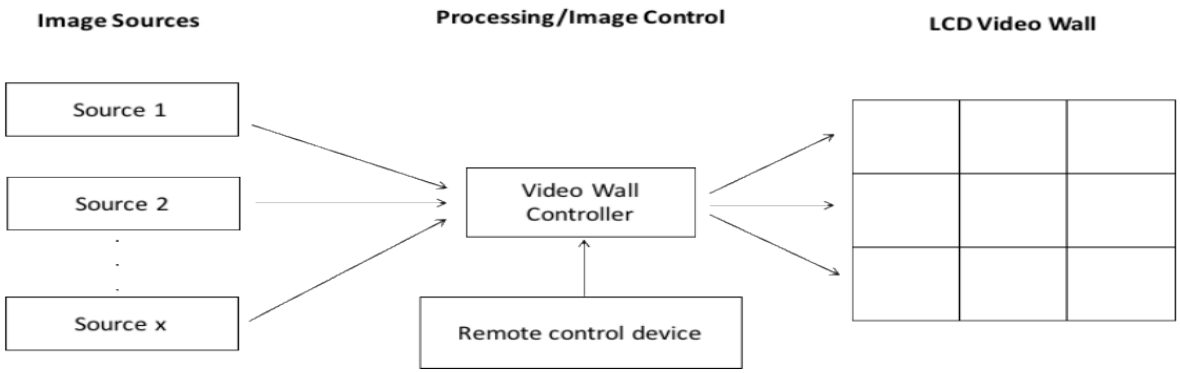
Customization Flexibility: Video walls offer the flexibility to customize tile layouts and arrangements as per specific needs.

Cost Efficiency: Video walls provide greater screen area and pixel density per unit cost compared to single large screens.

Video walls find applications in control rooms, command centers, NOCs, TOCs, data centers, call centers, surveillance facilities, stadiums, and large public venues. Their adaptability, cost-effectiveness, and ability to display vast amounts of information make them indispensable in various industries and settings.

4.1.3 What is a video wall controller?

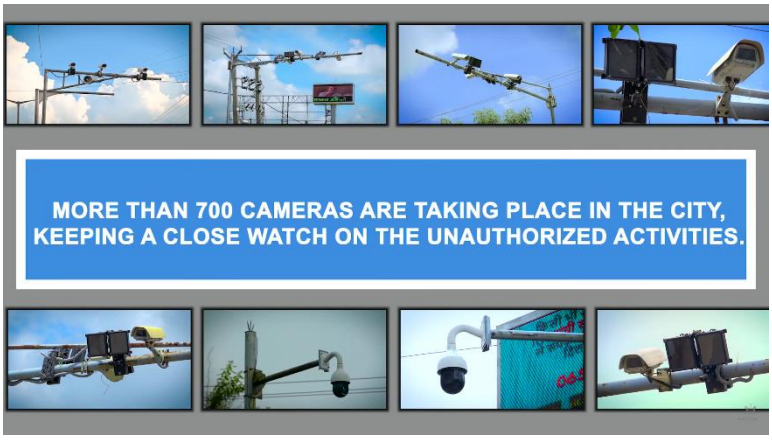
Simple video walls can be driven from multi-monitor video cards (computer graphic cards), however more complex arrangements may require specialized Video Wall Controllers or Processors, specifically designed to manage and drive large video walls. Software-based video wall technology that uses ordinary PCs, displays and networking equipment can also be used for small video walls (Typically no more than 16 displays, for example 4x4 video walls). To make large scale video walls (Typically up to 144 displays, or more), a Video Wall Controller is necessary.



4.2 Cameras: -

Cameras play a crucial role in the development and functioning of a smart city. They are a fundamental component of the smart city infrastructure, contributing to enhanced safety, security, and efficiency. The role of cameras in a smart city can be summarized as follows:

- **Surveillance and Security:** Cameras are deployed throughout the city to monitor public spaces, traffic intersections, and critical infrastructure. They act as a deterrent to crime and provide valuable footage for investigations, ensuring public safety and security.



- **Traffic Management:** Smart traffic cameras are used to monitor and manage vehicular movement in real-time. They help in identifying traffic congestions, monitoring road conditions, and optimizing traffic signals to improve overall traffic flow.
- **Public Safety and Emergency Response:** Cameras equipped with advanced analytics can detect incidents like accidents, fires, or other emergencies. They can trigger automatic alerts to emergency

services for quick response and assistance.

- **Environmental Monitoring:** Cameras can be utilized to monitor air quality, noise levels, and environmental conditions in various parts of the city. This data helps in implementing measures to address pollution and environmental concerns.
- **Waste Management:** Cameras can be integrated into waste collection systems to optimize waste management processes. They can help monitor fill levels in trash bins, enabling efficient collection routes and reducing unnecessary trips.
- **Parking Management:** Smart parking cameras assist in monitoring parking spaces, guiding drivers to available spots, and enforcing parking regulations to reduce congestion and enhance parking efficiency.
- **Public Health and Crowd Monitoring:** Cameras can be used to monitor public spaces for crowd density, adherence to social distancing norms, and the identification of potential public health risks.
- **Data Collection and Analysis:** Cameras contribute to a vast amount of data collection, which, when analyzed, provides valuable insights for urban planning, resource allocation, and overall city management.
- **Tourism and Promotion:** Cameras in iconic locations and tourist spots help promote the city's attractions, supporting tourism and branding initiatives.
- **Community Engagement:** Cameras in public spaces can be used for interactive displays, showcasing real-time city information, events, and engaging with the community

4.2.1 Different Types Of Camera Used

- 360° camera
- PTZ camera
- Fixed camera

360° camera: -

A 360-degree camera is a specialized device capable of capturing a complete spherical view of its surroundings in a single shot. It employs multiple fisheye lenses to record in all directions, including above and below. The images from each lens are stitched together using software to create seamless panoramic photos and videos. These cameras are popular for creating

immersive VR and AR experiences, providing virtual tours for real estate and tourism, capturing dynamic views of events and sports, and enhancing security and surveillance monitoring.

PTZ camera: -

A PTZ camera, short for Pan-Tilt-Zoom camera, is a type of surveillance camera with motorized capabilities that allow it to pan (rotate horizontally), tilt (tilt vertically), and zoom in or out on its target. It can be remotely controlled, enabling operators to adjust the camera's position and focal length as needed.

In the context of C3 (Command, Control, and Communication) systems, PTZ cameras play a crucial role in enhancing situational awareness and security. They provide real-time monitoring of critical areas, offering a dynamic and flexible approach to surveillance. Operators can quickly respond to incidents, track moving objects, and focus on specific points of interest within a scene. The zoom function allows for detailed close-ups even at a distance, aiding in identification and assessment of potential threats. PTZ cameras are integral components of modern surveillance setups, facilitating effective decision-making and response coordination in various sectors, such as public safety, transportation, and industrial security.

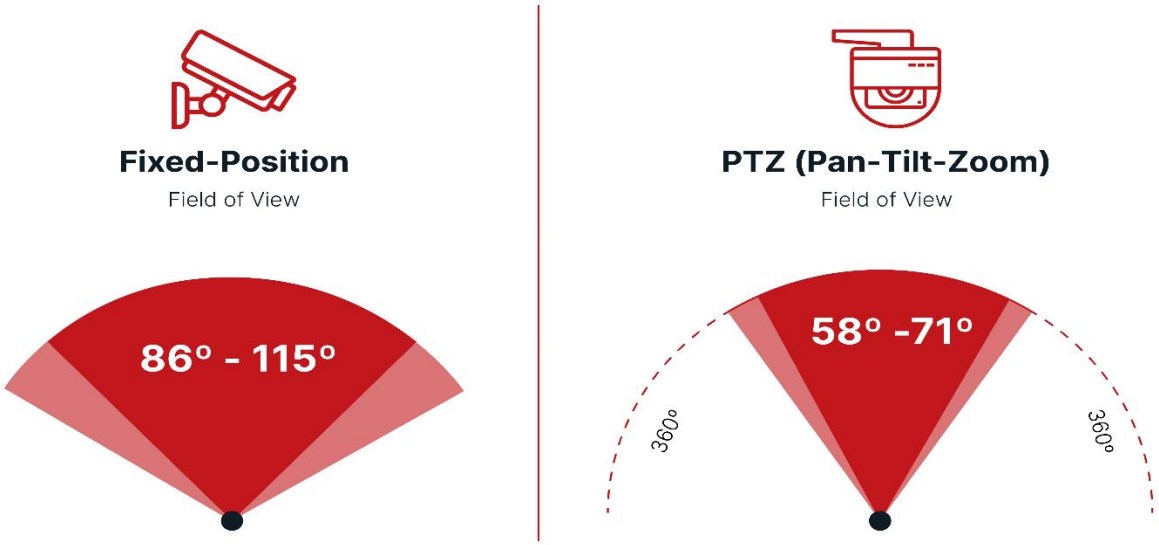
Fixed Camera: -

A fixed camera is a stationary surveillance camera that remains in a fixed position and does not have motorized pan, tilt, or zoom capabilities. It captures a static view of its designated area and cannot be remotely controlled to change its orientation.

In the context of C3 (Command, Control, and Communication) systems, fixed cameras play a significant role in providing continuous monitoring and coverage of specific locations. They are ideal for monitoring areas that

require constant surveillance, such as entrances, exits, hallways, and critical infrastructure points.

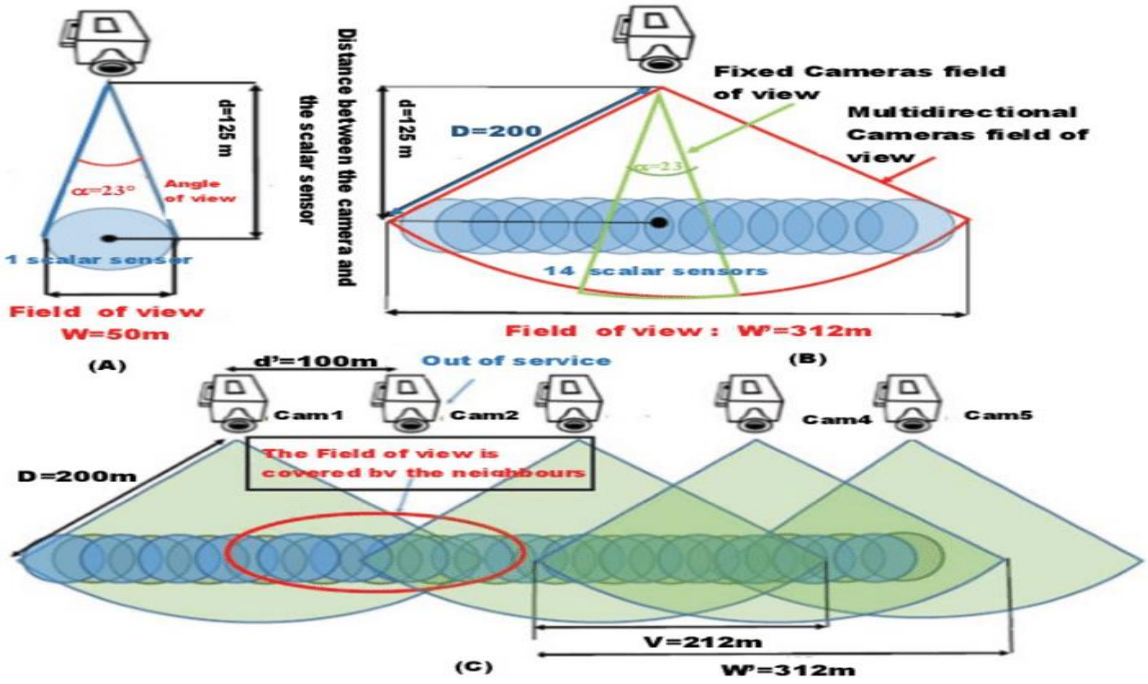
Fixed cameras are often deployed in combination with PTZ cameras and other sensors to create a comprehensive surveillance network. While PTZ cameras offer flexibility in tracking moving objects, fixed cameras provide stable and consistent views, ensuring that crucial areas are continuously monitored. Together, these cameras enhance situational awareness, facilitate real-time decision-making, and contribute to overall security and safety management in various sectors, including public spaces, commercial establishments, and industrial facilities.



4.2.2 Camera Positioning and Installation Precautions

When placing cameras for traffic control, several precautions should be taken to ensure their effectiveness and compliance with regulations. Here are some essential considerations:

- Optimal Placement: Select strategic locations for cameras to capture critical areas such as intersections, pedestrian crossings, high-traffic junctions, and accident-prone zones. The placement should provide a clear view of the traffic flow and potential hazards.



Every blind spot is covered

- Visibility and Lighting: Make sure cameras are positioned to avoid obstruction and have sufficient lighting during both day and night. Poor visibility can compromise the effectiveness of the surveillance system.

- Camera Type and Specifications: Choose cameras with appropriate features such as high-resolution, wide dynamic range (WDR) for varying light conditions, and support for night vision to capture clear images at all times.

Night Vision Camera used to recognize Number at night

- Integration with Traffic Management Systems: Integrate the cameras into a centralized traffic management system for effective monitoring and control. This allows traffic operators to respond promptly to incidents.

- Data Security and Privacy: Prioritize data security and privacy to safeguard sensitive information collected by the cameras. Implement encryption, access controls, and secure data storage practices. Comply with relevant data protection laws and regulations to protect the privacy of citizens.

- Interoperability and Integration: Ensure that the cameras can seamlessly integrate with other smart city systems and platforms, such as traffic management systems, emergency response networks, and data analytics platforms. Interoperability allows for data exchange and better decision-making.

- Scalability and Future-Proofing: Plan for future expansion and scalability of the camera network to accommodate the growing needs of the smart city. Choose cameras and infrastructure that can adapt to technological advancements and changing requirements.

- Redundancy and Resilience: Create redundant camera placements and backup power sources to ensure continuous operation even in the event of a power outage or system failure.

- Real-Time Analytics: Consider cameras with built-in or integrated analytics capabilities to process and analyze traffic data in real-time. This enables the city to respond quickly to traffic congestions, accidents, or emergencies.

- Public Engagement and Transparency: Engage with the public and stakeholders to communicate the benefits of the traffic control cameras in enhancing road safety and traffic management. Transparency fosters trust and acceptance among citizens

4.3 Adaptive Traffic Control System (ATCS): -

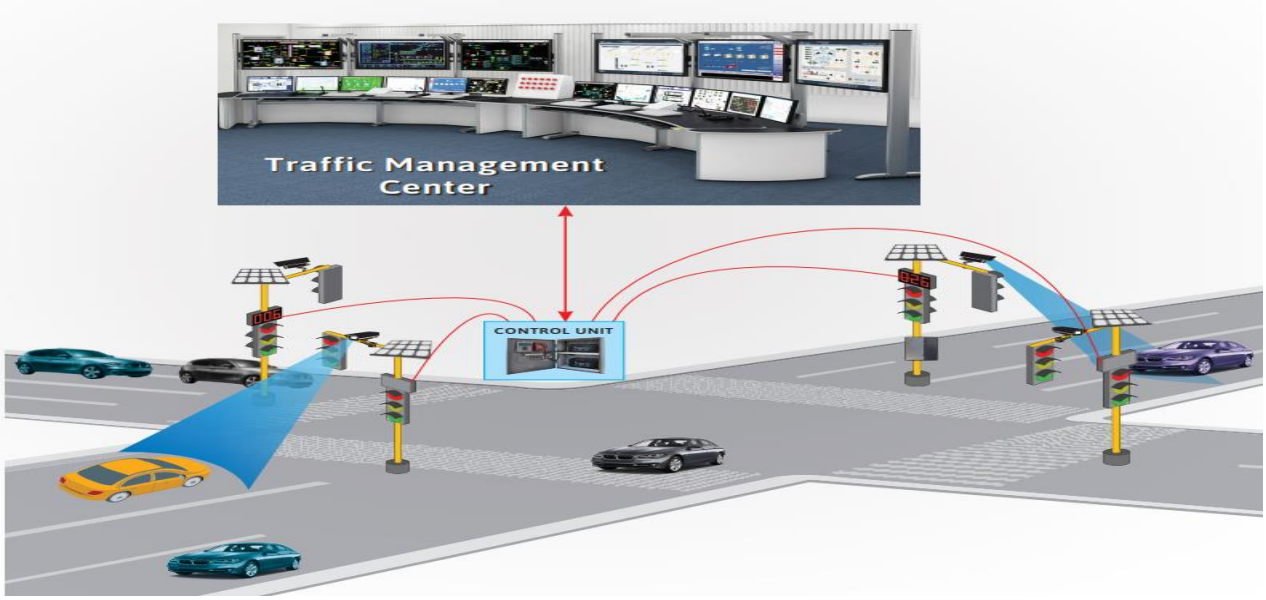
ATCS, or Advanced Traffic Control System, is an intelligent transportation system designed to optimize traffic flow, enhance safety, and improve overall efficiency on roadways. This sophisticated system employs various technologies, such as sensors, cameras, and traffic signals, integrated with advanced

software and communication networks.

The primary goal of ATCS is to manage traffic dynamically based on real-time data. It can detect traffic conditions, monitor vehicle movements, and adjust traffic signal timings accordingly. By analyzing traffic patterns and congestion levels, ATCS can optimize signal phasing, reduce waiting times, and minimize traffic delays.

ATCS also plays a crucial role in promoting sustainable transportation by coordinating traffic flow and encouraging the use of public transit, carpooling, and cycling. Additionally, it contributes to reducing carbon emissions and fuel consumption by reducing unnecessary idling and stop-and-go traffic.

With its ability to respond quickly to changing traffic conditions, ATCS improves the overall traffic management, enhances safety for both drivers and pedestrians, and provides a more efficient and eco-friendly transportation system for modern cities and road networks.



4.3.1 Working Principle

The Advanced Traffic Control System (ATCS) is an intelligent transportation system designed to enhance traffic management and safety on roadways. It operates through a combination of data collection, processing, and analysis. Sensors, cameras, and other devices are strategically placed to gather real-time data on traffic volume, vehicle speeds, and other relevant parameters. This data is then processed by advanced algorithms and software to identify traffic patterns and congestion points. Based

on this analysis, the ATCS formulates an optimized traffic control strategy, adjusting traffic signal timings and coordinating signal phasing to improve traffic flow. The system is adaptive, allowing it to respond in real-time to changing traffic conditions, incidents, and road closures. By promoting efficient traffic management and reducing congestion, the ATCS aims to create safer and more sustainable transportation networks for modern cities.

4.3.2 Adaptive Traffic Control Algorithm

An adaptive traffic control algorithm is designed to dynamically adjust traffic signal timings based on real-time traffic conditions. It continuously collects data from various sensors, such as cameras, loop detectors, and radar, to analyze traffic flow, congestion, and other parameters. The algorithm then uses this data to optimize traffic signal timings and improve overall traffic efficiency.

4.3.2.1 Components of an Adaptive Traffic Control Algorithm:

- ***Data Collection:*** *Sensors placed at intersections and along roadways collect data on vehicle counts, speeds, and occupancy. This data is continuously fed into the adaptive traffic control system.*

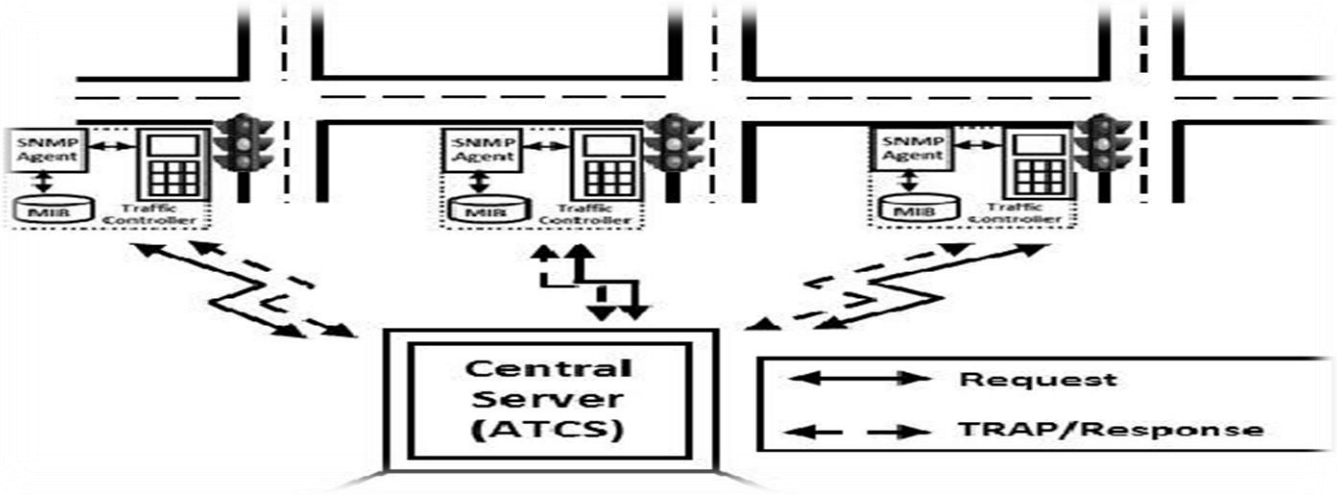
- ***Data Processing and Analysis:*** *The collected data is processed and analyzed by advanced algorithms. Traffic engineers use historical data and real-time information to understand traffic patterns and identify congestion points.*

- ***Traffic Control Strategy:*** *Based on the data analysis, the adaptive algorithm formulates an optimal traffic control strategy. It adjusts the timing and coordination of traffic signals to accommodate changing traffic demands.*

- ***Adaptation Mechanism:*** *The adaptive traffic control algorithm is dynamic and responds to changes in traffic conditions in real-time. It automatically adapts signal timings to minimize delays, reduce congestion, and optimize traffic flow.*

- ***Coordinated Traffic Signal Control:*** *In many systems, the adaptive algorithm coordinates traffic signals along major corridors to create green waves, allowing a continuous flow of*

traffic with minimal stops.



4.3.3 Benefits of Adaptive Traffic Control

- ***Reduced Congestion:*** *The adaptive algorithm optimizes traffic signal timings, reducing congestion and improving traffic flow.*

- ***Improved Safety:*** *Smoother traffic flow can lead to fewer abrupt stops and starts, potentially reducing the risk of accidents.*

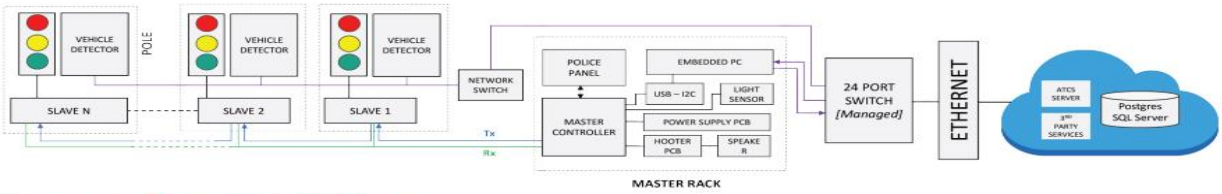
- ***Energy Efficiency:*** *By reducing unnecessary idling and stop-and-go traffic, adaptive traffic control can lead to fuel savings and lower carbon emissions.*

- ***Real-Time Responsiveness:*** *The adaptive system can respond to incidents, accidents, and changing traffic conditions promptly, adapting signal timings as needed.*

- ***Increased Capacity:*** *Optimized signal timings can increase the capacity of roadways, accommodating higher traffic volumes during peak hours.*

It's important to note that specific adaptive traffic control algorithms may vary depending on the manufacturer or jurisdiction implementing the system. Each system is tailored to the unique traffic conditions and requirements of the particular road network.

Architecture

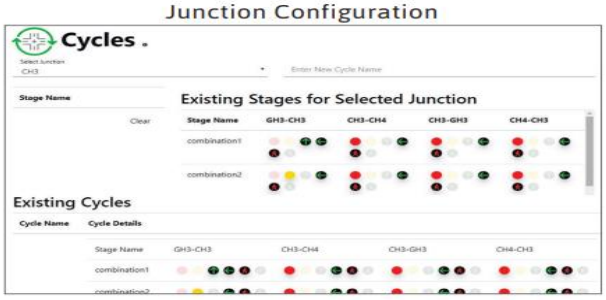


Command Control Software

Network Screen

Junction Live View

Junction Configuration

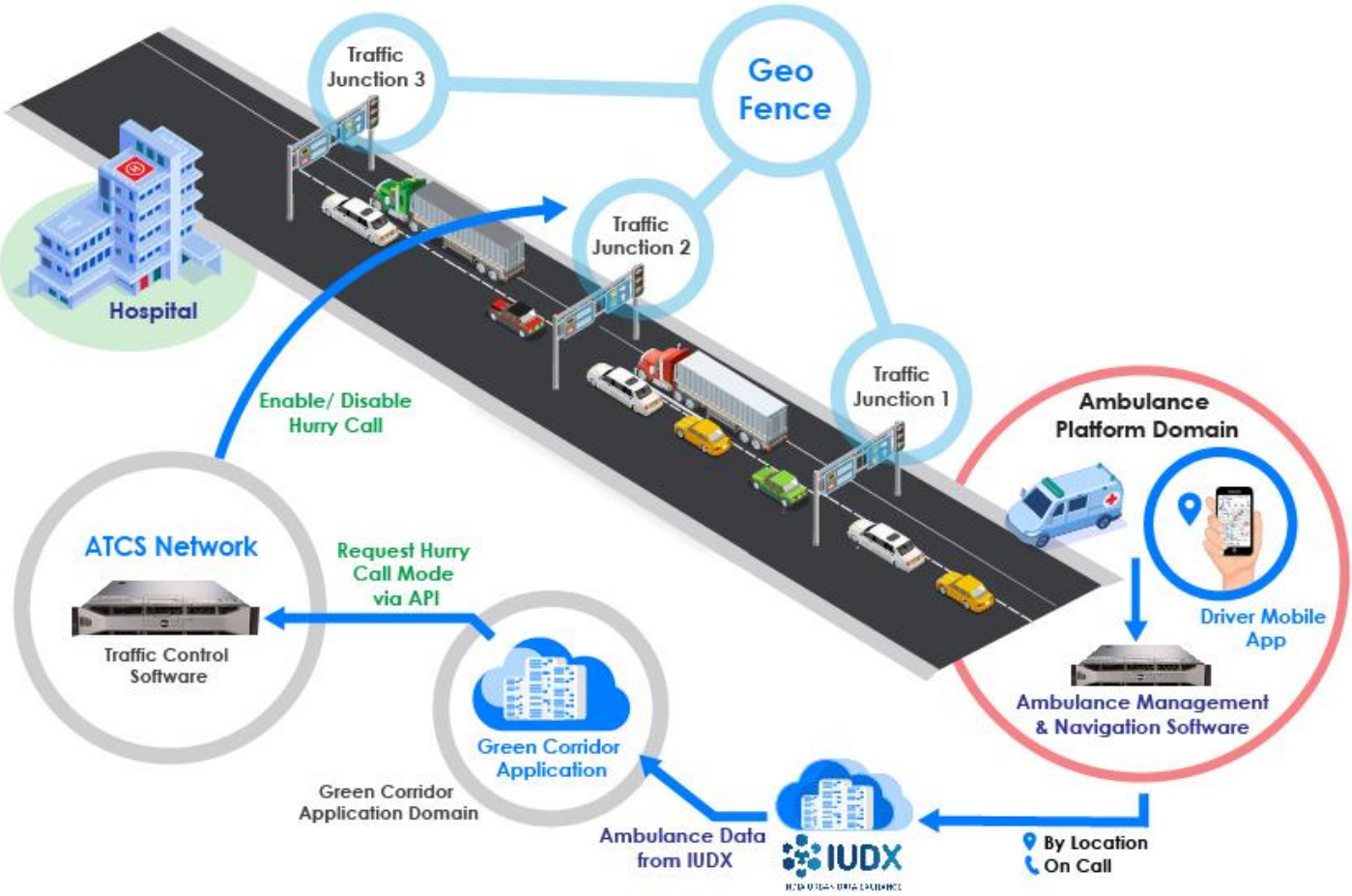


KPI Reports

4.3.5 Green Corridor Formation

The integration of ATCS with the Command Control Room enhances the city's emergency response capabilities, allowing for the formation of "Green Corridors" during critical situations. A Green Corridor refers to a designated route that is cleared of traffic congestion to facilitate the swift movement of emergency vehicles, such as ambulances transporting critically ill patients or organs for transplantation. In emergencies, every minute counts, and reducing travel time for emergency vehicles can be life-saving.

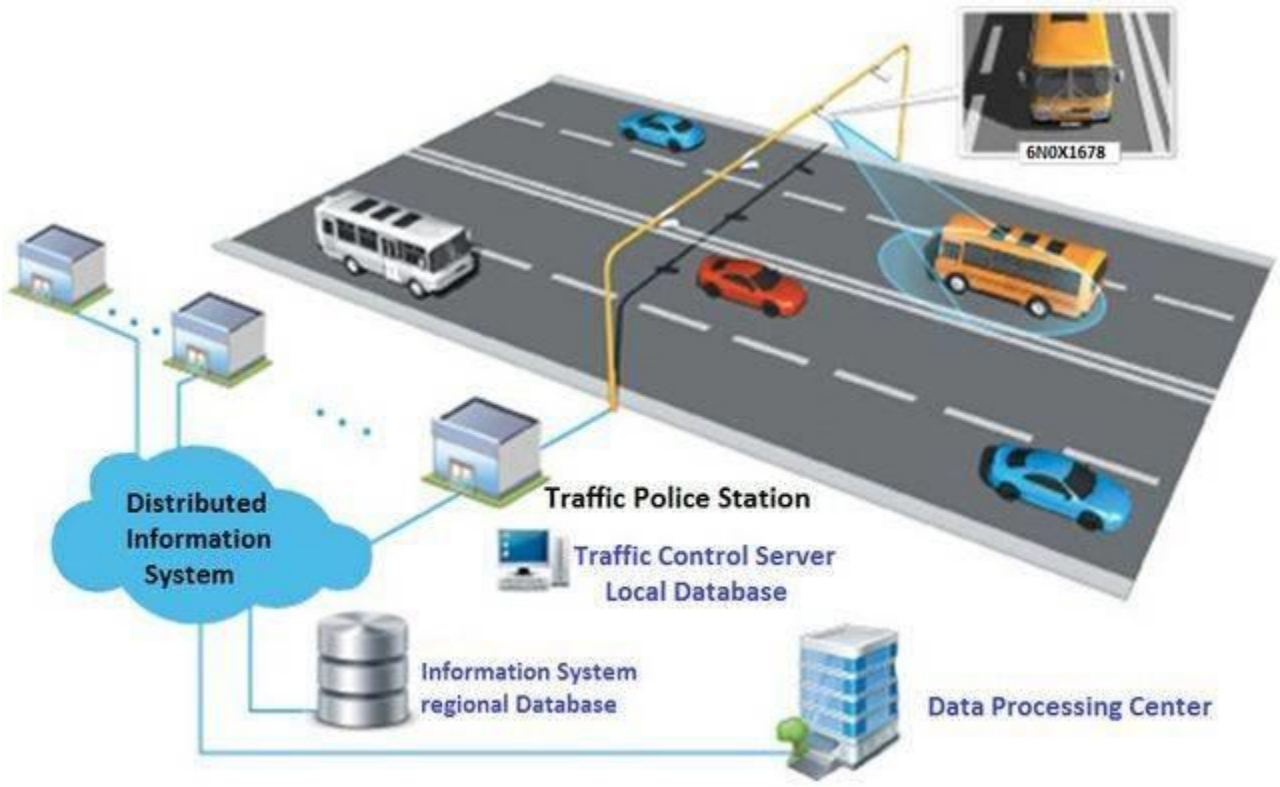
With ATCS's real-time traffic data and control capabilities available in the Command Control Room, authorities can identify the most optimal route for the Green Corridor and activate it instantly. The traffic signals along the designated route can be adjusted automatically to give priority to the passage of emergency vehicles, ensuring they encounter minimal obstacles or delays.



4.4 Automatic Number Plate Recognition(ANPR) System: -

4.4.1 What Is ANPR?

It is a technology that uses optical character recognition (OCR) and image processing techniques to automatically read and interpret vehicle license plate numbers from images or videos captured by cameras. ANPR systems are commonly used in various applications, including law enforcement, toll collection, parking management, traffic monitoring, and security surveillance.



4.4.2 How does ANPR work?

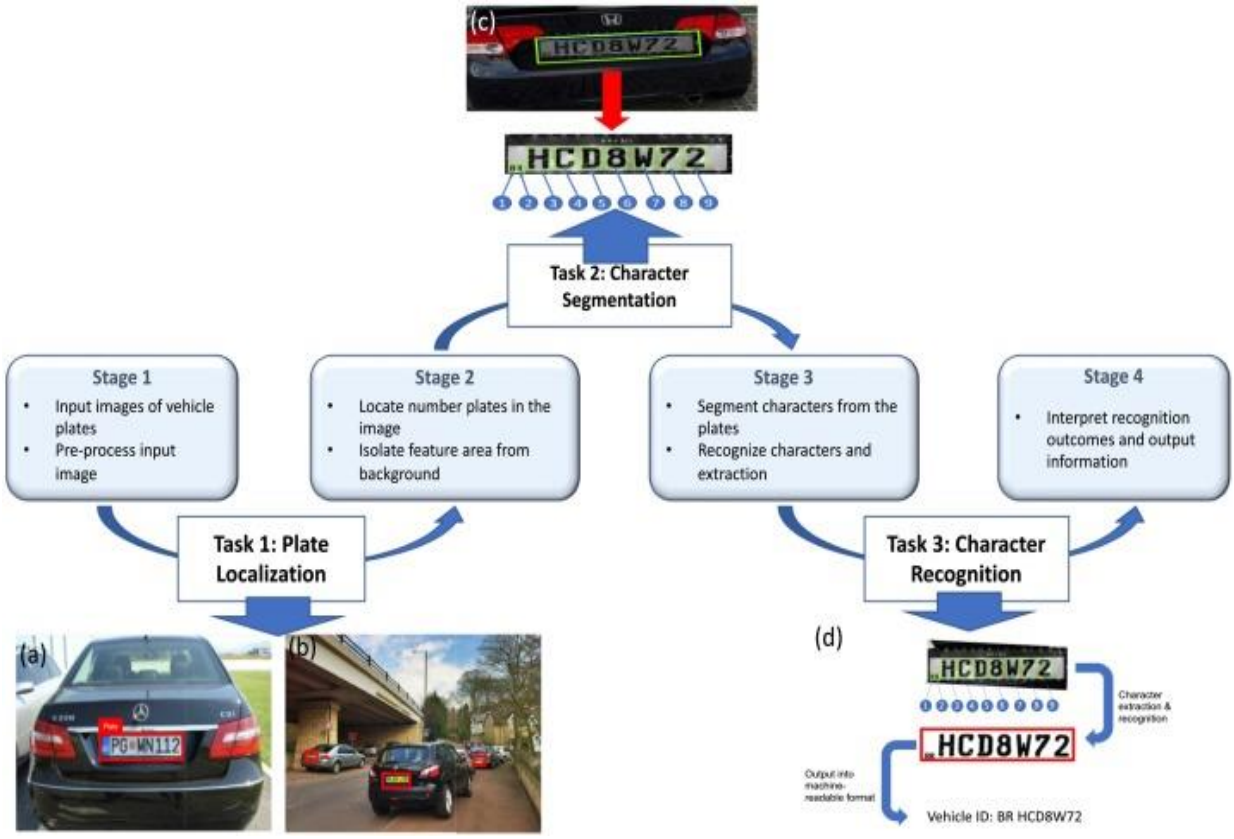
- **Image Capture:** ANPR cameras are strategically positioned to capture images of vehicles as they pass by. These cameras can be stationary, mounted on police vehicles, toll gantries, or other infrastructure.

- **Image Processing:** The captured images are processed through specialized software that identifies and isolates the license plate region in each image.

- **Optical Character Recognition (OCR):** The software uses OCR algorithms to convert the characters on the license plate into machine-readable text. This process involves recognizing the alphanumeric characters and extracting the license plate number.

- **Database Comparison:** The extracted license plate number is then sent to C4 to be compared against a database of known license plates or against a list of wanted vehicles. This comparison can be used for various purposes, such as identifying stolen vehicles, tracking traffic violations, or managing access to restricted areas.

- **Alerts and Actions:** If a match is found in the database, the ANPR system can trigger various actions, such as issuing a traffic violation notice, raising an alarm for a suspicious vehicle, or allowing access to authorized vehicles in controlled areas.



4.4.3 What is Optical Character Recognition (OCR)?

OCR stands for Optical Character Recognition. It is a technology that converts different types of documents, such as scanned paper documents, PDF files, or images captured by a digital camera, into editable and searchable data. The primary goal of OCR is to recognize printed or handwritten text characters and convert them into machine-readable text.

4.4.4 How does Optical Character Recognition work?

A simple OCR algorithm typically consists of the following steps:

- **Image Preprocessing**: The input image is preprocessed to improve its quality and make it suitable for character recognition. Common preprocessing techniques include resizing, noise reduction, and binarization (converting the image into a binary black-and-white format).
- **Text Region Detection (Optional):** In some cases, OCR algorithms might include a step to detect and locate regions of interest in the image that likely contain text. This step helps to isolate text areas from other parts of the image, such as images, logos, or background clutter.
- **Character Segmentation:** Once the text regions are identified (or if this step is skipped), the image is divided into individual characters or character blocks. Character segmentation is a crucial step because it allows the algorithm to recognize each character separately.
- **Feature Extraction:** In this step, relevant features of each individual character are extracted to represent them in a numerical format. Common features could include pixel patterns, strokes, angles, or any other distinguishing characteristics.
- **Character Recognition:** The extracted features are then compared to a pre-trained set of character patterns or templates stored in a database. The algorithm matches the features with the closest matching characters to determine the character's identity.
- **Post-processing:** After character recognition, post-processing techniques may be applied to improve the overall accuracy of the OCR results. These techniques can include context-based correction, dictionary lookup, or language modeling.

It's important to note that OCR algorithms can vary significantly in complexity and accuracy, depending on factors such as the quality of the input image, the language and font used, and the specific purpose of the OCR application. Modern OCR systems often utilize machine learning and deep learning techniques, such as Convolutional Neural Networks (CNNs), to achieve higher accuracy in character recognition tasks. These advanced algorithms can handle more complex scenarios and are capable of recognizing a wide range of fonts, handwriting styles, and languages.

4.5 Red Light Violation Detection (RLVD) System: -

Violating the red-light rule is one of the most serious and dangerous violations in the everyday traffic system. Most people get away with it due to either the traffic light not being equipped with an overview camera or absence of visible deterrent measures such as police or automated enforcement equipment. Red Light Violation Detection (RLVD) system aims to provide a safer driving experience, improve compliance with road traffic rules, and smoothen the movement of vehicles along the stop line while reducing accidents and fatalities at intersections. India's Red Light Violation Detection (RLVD) system is fully automated mass surveillance system identifying vehicles jumping the red light, stopping after the red-light mark, and over the zebra-crossing.

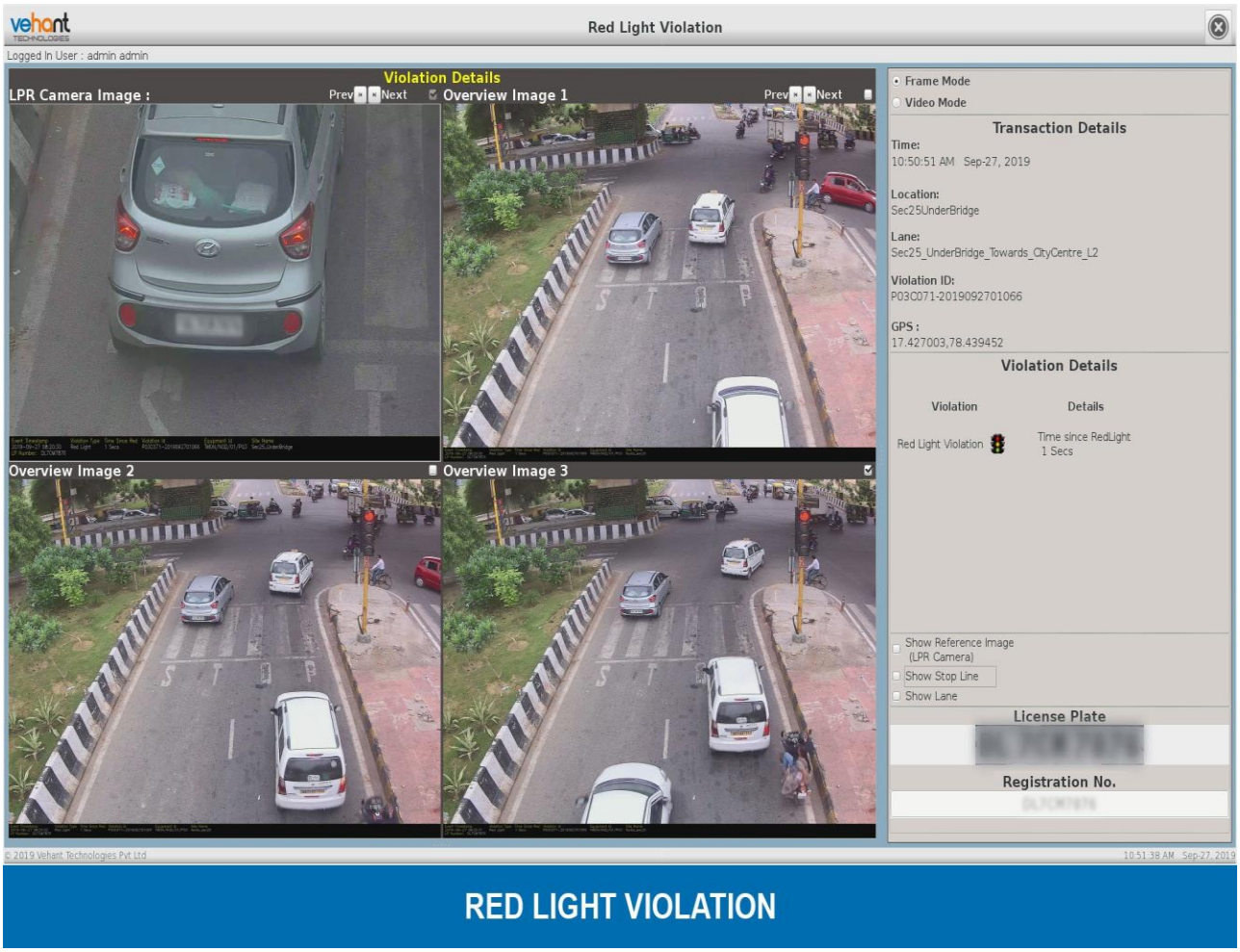
4.5.1 How Does RLVD Work?

The overview camera continuously monitors the red light after the signal has turned red
Any vehicle that violates the red-light rule, the entire violation scenario is captured by the overview camera.

- **ANPR Camera Capture:** ANPR cameras positioned at intersections capture images or videos of vehicles passing through the red traffic signal.
- **Optical Character Recognition (OCR):** The ANPR system processes the captured images or video frames through OCR technology, extracting the license plate number from the vehicle.
- **Violator Identification:** The extracted license plate number is compared to the m-Vahan database or another relevant vehicle registration database to identify the owner of the violating vehicle.
- **E-Challan Generation:** Once the violator is identified, the RLVD system automatically generates an E-challan (electronic traffic violation notice) with the necessary details, including the violation date, time, location, and the registered owner's information.
- **Command Center Review and Verification:** Before finalizing the issuance of the E-challan, the photographic or video evidence is reviewed at the Command Center. Traffic police or authorized personnel verify the accuracy and legitimacy of the violation claim.
- **Upload to NIS Portal:** After the verification process, the RLVD system uploads the E-challan details and evidence to the National Informatics Centre (NIS) portal or a centralized traffic violation database.
- **Traffic Police Verification:** The traffic police further verify the claim and the evidence uploaded on the NIS portal to ensure its accuracy.

- **E-Challan Dispatch:** Upon successful verification, the traffic police approve the E-challan, and it is sent to the registered owner of the violating vehicle through email or SMS, notifying them about the traffic violation and the corresponding fine or penalty.

By integrating various components of the traffic management system, including ANPR cameras, OCR technology, the m-Vahan database, and a centralized portal like the NIS portal, the RLVD process becomes efficient and streamlined. The system helps enforce traffic regulations, promote road safety, and improve traffic management by providing evidence-based and automated methods to penalize red-light violators. Compliance with privacy regulations and strict verification processes ensures the accuracy and fairness of the E-challans issued to the violating vehicle owners.



RED LIGHT VIOLATION

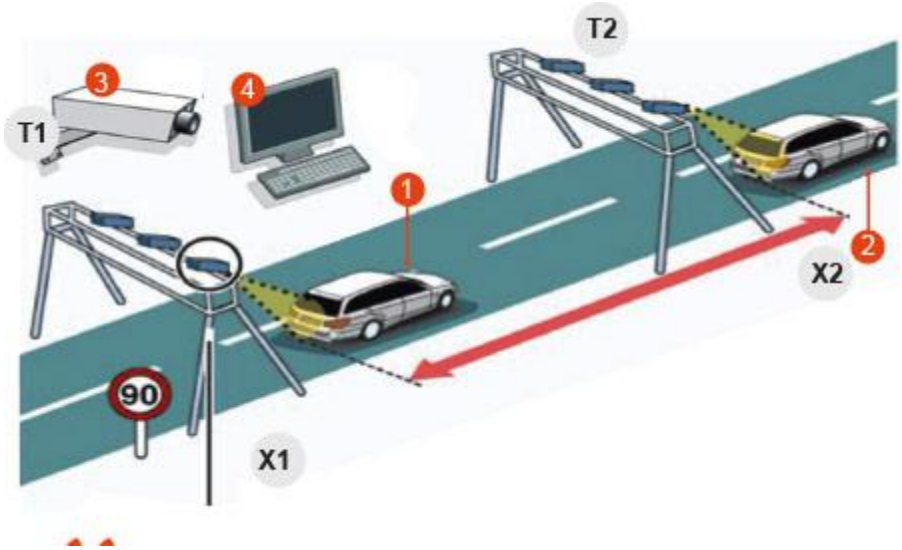
4.6 Speed Violation Detection (SVD) System: -

Speed Violation Detection (SVD) System is a technology-based solution designed to identify and record vehicles that exceed the speed limit on roads or highways. The primary objective of SVD is to promote road safety by enforcing speed regulations and reducing the risk of accidents caused by speeding vehicles. **The SVD is placed at 10 locations in Ranchi.**

4.6.1 How Does SVD Work?

- **Vehicle Passage:** The vehicle passes through the first gantry, located at X1, where the system captures the rear-image of the vehicle's license plate at timestamp T1.

- **Second Gantry Passage:** The vehicle continues on its route and passes through the second gantry located at X2. Again, the system captures the rear-image of the vehicle's license plate at timestamp T2.



- **Data Transmission:** The data, including the license plate images and corresponding timestamps (T1 and T2), is transmitted to the Command Center for further processing and analysis.

- **Speed Calculation:** At the Command Center, the sectional speed of the vehicle is calculated using the time taken (T2 - T1) to cover the distance between the two gantries (X2 - X1). This calculation provides an accurate measurement of the vehicle's speed within that specific section of the road.

- **Speed Limit Comparison:** The calculated sectional speed is then compared to the posted speed limit for that particular road segment.

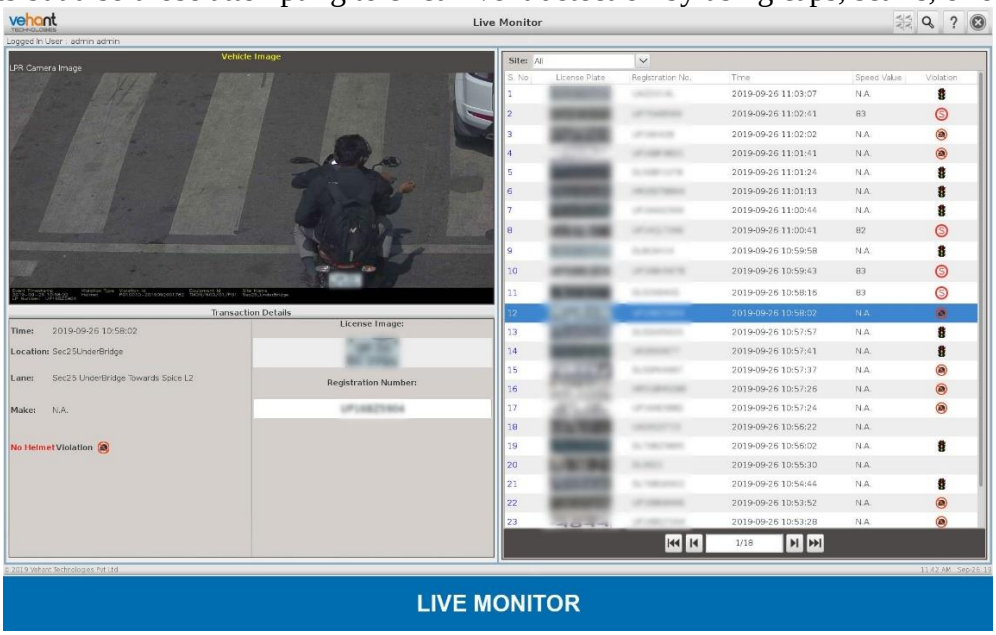
- **Violation Determination:** If the calculated sectional speed exceeds the permissible speed limit, the system identifies the vehicle as a violator of the speed limit.

After which challan is generated by following the same steps as mentioned in RLVD.

4.7 Oher Violations And Features: -

4.7.1 No Helmet Detection

The No Helmet Detection System (NHDS) is a technologically advanced solution designed to monitor and track two-wheeler riders who violate traffic laws by not wearing helmets while driving on the road. The system operates in real-time and utilizes sophisticated algorithms to detect not only riders without helmets but also those attempting to circumvent detection by using caps, scarfs, or other head coverings.



NOTE: The No Helmet Detection System (NHDS) is an advanced technology designed to identify two-wheeler riders who are not wearing helmets while driving on the road. However, it is important to acknowledge that the system may occasionally detect Sikh individuals wearing turbans as potential violators, as turbans might resemble non-standard head coverings to the automated algorithms. It is crucial to understand that wearing a turban is a religious privilege for Sikhs and not a violation of traffic laws.

To ensure fairness and sensitivity in enforcing helmet laws, the NHDS has been designed to allow for manual intervention by the Command and Control Center (CCC) personnel. When the system flags a Sikh individual wearing a turban as a possible violator, the CCC has the authority to manually reject the alert and not issue any penalty or fine. This manual review process takes into consideration the religious significance of turbans for Sikh riders and exempts them from the mandatory helmet-wearing requirement.

4.7.2 Wrong Way Detection System

The Wrong Way Detection System is a technology-based solution designed to identify and alert authorities about vehicles that are traveling in the wrong direction on roads or highways. This system aims to prevent accidents and enhance road safety by promptly detecting and responding to wrong-way driving incidents.

4.7.3 Room For More Violation Detection System

Regarding specific violations like Triple Riding, No Seat Belt, and Use of Cell Phone while driving, it's important to note that the configuration and enforcement of these violations through the Vehant software would depend on the requirements and permissions set by the local traffic authorities. As with any automated enforcement system, ensuring the correct implementation of new violation detections involves following certain procedural steps:

- **Obtain Permission:** The Ranchi Command and Control Center (CCC) would need to seek permission from the Traffic Police or relevant authorities to enforce e-challans for these specific violations using the Vehant software.
- **Software Update:** After obtaining permission, the CCC would proceed to update the Vehant software, ensuring that it includes the appropriate sections of the Indian Penal Code (IPC) corresponding to the newly identified violations.
- **Thorough Testing:** The CCC would thoroughly test the updated software to ensure its accuracy and effectiveness in detecting Triple Riding, No Seat Belt, and Use of Cell Phone violations.
- **Official Launch:** With the necessary updates made and public awareness campaigns completed, the CCC can officially launch the enforcement of e-challans for Triple Riding, No Seat Belt, and Use of Cell Phone while driving through the Vehant system.

4.7.4 Other Features

- The Data Base has a list of VIP's number so n case of emergencies the an be tracked down faster as well as they are immune to certain violations in special situations.
- The Traffic lights can be controlled manually through C4. Which is very helpful in making of green corridor.

4.8 Variable Message Sign Boards (VMSB): -

4.8.1 What is VMBS?

VMSB, short for Variable Message Signs Board, is an electronic display panel used for managing road traffic. It is an intelligent system capable of showing both text and graphic messages, making it an effective tool for controlling traffic and providing information to drivers.

These display boards are typically installed on roadways and highways to communicate important messages to travelers. They serve various purposes, including warning about traffic congestion, accidents, roadwork zones, speed limits, and other incidents like terrorist attacks or safety alerts. In urban areas, VMSBs are also used in parking guidance systems to direct drivers to available parking spaces and offer relevant parking-related information.

The VMSB system can be integrated with other traffic control and management systems, making it an essential part of modern traffic management solutions. With the ability to display variable messages in both text and graphics, VMSBs offer flexibility and customization to suit the specific needs of each region where they are deployed.

In the context of Ranchi Smart City, VMSBs are managed using VNC (Virtual Network Computing) Software, enabling remote access and control of the display messages on each Variable Message Signs Board. Each VMSB location has a unique IP address, allowing individualized management and control of the displays in different areas of the city.

4.8.2 Advertisement Using VMSB

- VMSB can be used to advertise different things and will help in generate revenue.

4.9 Emergency Call Box (ECB) System: -

Placed at 50 junctions in Ranchi, ECB is a full-duplex communication device which can be used in case of emergency to contact with C4 and receive immediate help.

4.9.1 What are the features of ECB?

- Easy installation
- Weather Resistant
- LED display
- Solar power option
- Excellent network Compatibility
- User-Friendly
- Better Security in term of power-fail or system fail
- One button speaker phone.
- Network Compatible
- Audible in noisy environments (i.e. roadside, mining)
- Filters background noise
- Autonomous Power supply by Solar Panel.

4.9.2 What is full-duplex communication?

Full duplex communication refers to a type of communication where data transmission can occur in both directions simultaneously. In other words, it allows two devices or parties to send and receive data simultaneously without waiting for one party to finish before the other can transmit data.

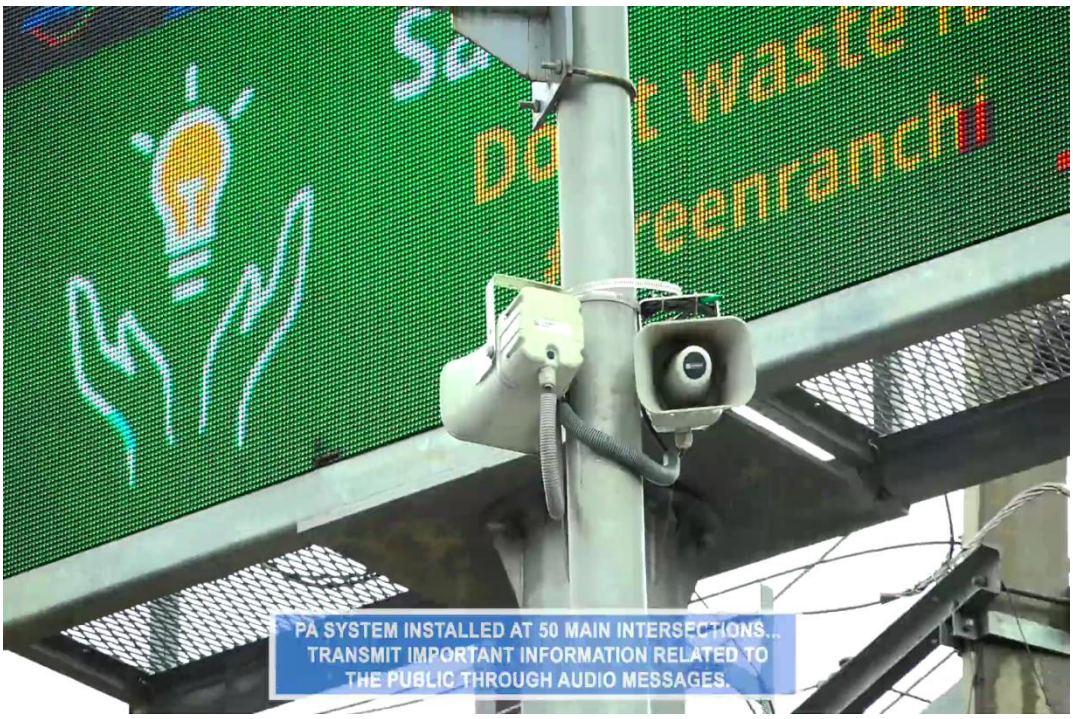
4.10 Public Address System: -

Placed at 50 main intersections in Ranchi, the PA system helps in transmitting important information related to the public through audio message. It a simplex communication system hence only allows one way communication which in turn makes it different from ECB and is cheap to install.

4.10.1 Why is PA system useful?

PA systems are essential in public venues where clear announcements are necessary to reach a large audience over a considerable distance. High-quality public address and voice evacuation systems play a crucial role in addressing security and safety challenges in smart cities by facilitating effective communication between citizens and security forces.

These systems are especially vital in crowded and high-traffic locations, such as bus stations, commercial areas, metro and railway stations, where frequent audible messages are required. Implementing a real-time Public Announcement System (PAS) is a pressing need for public safety. Voice announcement systems utilize dynamic, natural-sounding voices to relay important information efficiently and accurately.



Automated announcements play a vital role in communicating with people across various locations quickly and effectively. An IP-based PA and Emergency communication system in the Intelligent Traffic Management System (ITMS) ensures seamless service delivery.

The announcements cover a wide range of critical information, such as traffic route modifications, road blockades, ambulance movements, traffic diversions for VVIP movements, accidents, and public demonstrations. Additionally, pre-recorded messages can provide valuable updates on weather conditions and air and noise pollution levels, benefiting the public with relevant information.

In summary, high-quality PA systems and voice evacuation solutions are essential components of smart city infrastructure, facilitating effective communication and ensuring the safety and well-being of citizens and visitors.

4.11 Other Components: -

- **WAN (Wide Area Network):** A WAN is a geographically distributed network that spans large distances, connecting multiple LANs or sites across cities, countries, or even continents. It enables seamless communication and data exchange between remote locations, facilitating collaboration and resource sharing among geographically dispersed users. WANs use various technologies like leased lines, MPLS, or the Internet to interconnect sites.

- **VLAN (Virtual Local Area Network):** VLANs divide a single physical network into multiple isolated virtual networks, each with its own broadcast domain. By segmenting traffic, VLANs enhance network security, improve performance, and simplify network management. Devices in the same VLAN can communicate with each other as if they were on the same physical LAN, regardless of their physical location.

- **Routers:** Routers are networking devices that operate at the network layer of the OSI model and serve as traffic directors on a network. They forward data packets between different networks or subnets based on IP addresses. Routers use routing tables to determine the best path for data transmission, ensuring efficient data delivery across complex network infrastructures.

- **Subnets:** Subnetting involves dividing a large IP address range into smaller subnetworks. This practice optimizes IP address allocation, enhances network security, and reduces network congestion, especially in large organizations with numerous devices. Each subnet operates as a separate network within the larger network.

- **MAC Addresses:** MAC addresses are unique identifiers assigned to network interface cards (NICs) of devices. They facilitate data link layer communication within a LAN, allowing devices to exchange data directly with each other. MAC addresses are essential for devices to communicate on the same local network.

- **User Types:** Different user types categorize users based on their roles, permissions, and access levels within a network. User types are used in authentication and authorization processes to ensure secure data access and proper network management. Common user types include administrators, regular users, and guest users.

- **Tags:** Tags are labels assigned to network resources, such as devices or virtual machines, to categorize and organize them based on specific attributes. Tags simplify resource management, making it easier for administrators to search, filter, and group network elements. Tags are particularly useful in cloud environments and large-scale networks.

- **Service Level Agreements (SLA):** SLAs are contractual agreements between service providers and customers that define the quality and availability of services. SLAs outline performance metrics, response times, and penalties for non-compliance, ensuring reliable and responsive service delivery. They are crucial in maintaining high-quality services and customer satisfaction.

- **Helpdesk:** A helpdesk, also known as a service desk, provides technical support and assistance to users facing IT-related issues. It serves as a single point of contact for users to report problems, request assistance, or seek information. Helpdesk teams use ticketing systems to track and prioritize issues, ensuring timely resolution and efficient support.

- **Switches:** Switches are networking devices that operate at the data link layer and connect

multiple devices within a local network. They forward data packets to the intended destination based on MAC addresses, reducing data collisions and improving network performance. Switches enable devices to communicate efficiently within the same local network.

- **Ports:** Ports are connection points on networking devices where data packets enter or exit the device. Each port is associated with a specific MAC address or IP address. Ports facilitate communication between devices on a network and can be physical (e.g., Ethernet ports) or virtual (e.g., software-defined ports).

- **Static IPs:** Static IPs are IP addresses manually assigned to network devices that remain constant and do not change over time. Unlike dynamic IPs assigned by DHCP servers, static IPs are beneficial for devices that require consistent addressing, such as servers and network equipment. Static IPs are essential for services that need a fixed address for easy access.

- **ARP Table (Address Resolution Protocol Table):** The ARP table is used by network devices to map IP addresses to corresponding MAC addresses. When devices need to communicate within a local network, they use ARP to find the MAC address of the destination device based on its IP address. The ARP table helps devices efficiently transmit data packets to the correct recipients.

- **Infrastructure Health and Monitoring:** Continuous monitoring and assessment of the overall health and performance of network infrastructure to ensure smooth operations and early detection of potential issues. Monitoring tools provide real-time insights into network performance, availability, and security. By tracking various parameters, administrators can proactively address network problems and maintain optimal network performance.

- **CIDR (Classless Inter-Domain Routing):** CIDR is a system for allocating IP addresses more efficiently by using variable-length subnet masks. CIDR allows networks to be divided into smaller, more manageable subnets, reducing IP address wastage and optimizing address allocation. It has become the standard for IP address assignment, enabling the Internet to accommodate the growing number of devices.

5. Applications & Portals Used

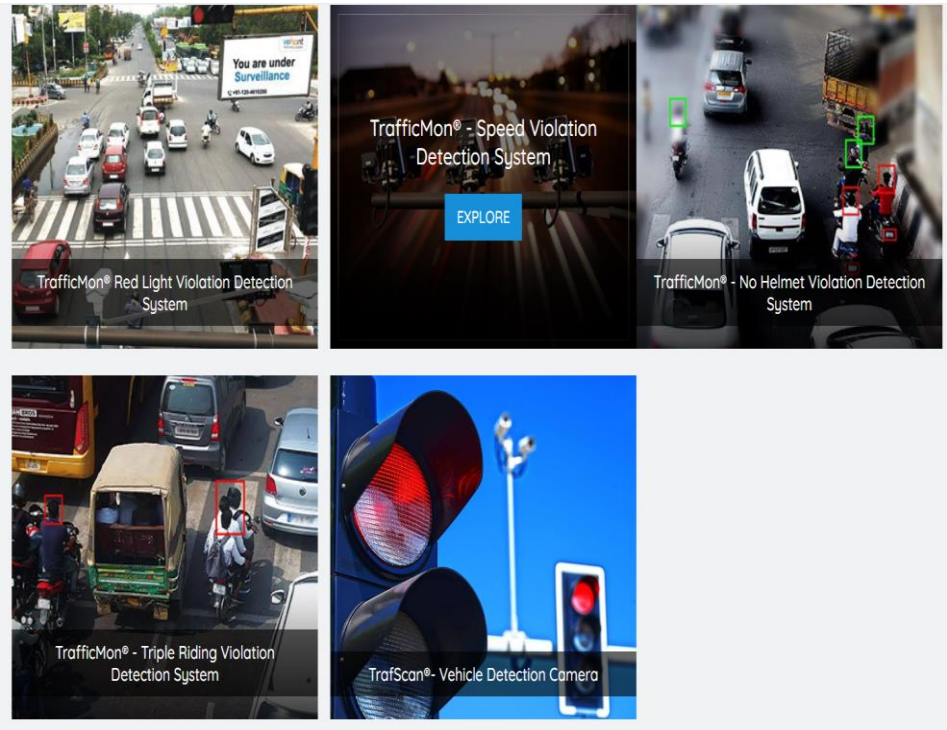
5.1 Vehant : -

5.1.1 Vehant use in RSC

- Vehant Technologies plays a significant role in the smart city of Ranchi through its implementation in the Automated Traffic Control System (ATCS). As a leading technology company specializing in advanced traffic management solutions, Vehant's technology is leveraged to enhance traffic regulation and safety in the city.

- The ATCS powered by Vehant utilizes a variety of cutting-edge solutions, including Automatic Number Plate Recognition (ANPR) systems, Red Light Violation Detection (RLVD) systems, and Speed Violation Detection (SVD) systems. These technologies work seamlessly together to monitor and manage traffic on roadways, intersections, and critical junctions.

- ANPR cameras efficiently read license plate numbers, enabling accurate vehicle tracking and identification. RLVD systems help enforce traffic regulations, ensuring compliance with red light signals and promoting safe driving behavior. Meanwhile, SVD systems monitor vehicle speeds to detect speed violations and encourage responsible driving habits.



- By leveraging Vehant's intelligent and robust technology in the ATCS, Ranchi's smart city is equipped with a comprehensive and effective traffic management infrastructure. This integration enhances road safety, reduces traffic violations, and optimizes traffic flow. Moreover, the real-time data and insights provided by Vehant's solutions enable traffic authorities to make informed decisions and proactively address traffic-related challenges in the city.

- With Vehant's support, Ranchi Smart City continues to make significant strides in building a safer, more efficient, and sustainable urban transportation system. The ATCS's success reflects the positive impact of technology in transforming traffic management and contributing to the overall development and progress of Ranchi as a smart and modern city.

5.2 VNC Software: Empowering Remote Access and Collaboration

5.2.1 What is VNC?

VNC (Virtual Network Computing) software has transformed the way individuals and organizations remotely access and control computers. This powerful technology allows users to connect to and operate a computer from a different location, facilitating remote desktop access, troubleshooting, and collaborative work.

5.2.2 What is the benefit of VNC?

- Access from Anywhere: VNC software provides remarkable flexibility by granting remote access to computers from any location with an internet connection. Users can connect to their office computers from home, access files on the go, and provide remote support to clients or colleagues.
- Eliminating Proximity Limitations: Physical distance is no longer a barrier, enabling users to work or assist others remotely, ultimately enhancing productivity and efficiency.

- Virtual Control: VNC enables users to remotely connect to a computer and access its desktop as if they were physically present. This allows tasks such as file access, application running, and troubleshooting on the remote computer.

- Efficient Alternative: VNC software proves cost-effective compared to traditional remote access methods. Users can utilize existing devices and internet connectivity, reducing the need for expensive hardware or infrastructure.

- Seamless Connectivity: VNC software is designed to be cross-platform compatible, allowing users to connect and control computers across different operating systems. It supports Windows, macOS, Linux, and mobile platforms.

- Fostering Teamwork: VNC facilitates screen sharing, allowing multiple users to view and interact with the same desktop simultaneously. This promotes teamwork, knowledge sharing, and remote presentations.

- Protecting Data: VNC software prioritizes security with encryption protocols and authentication mechanisms to safeguard remote connections. Options like password authentication and encrypted communication channels ensure confidentiality and integrity.

In the Ranchi Smart City Control Room, VNC (Virtual Network Computing) software enables remote access and control of various smart city operations. Operators can monitor traffic systems, surveillance cameras, emergency communication, smart infrastructure, and Variable Message Signs (VMS) from a centralized location. This ensures efficient traffic management, enhanced security, and real-time communication with the public for improved smart city initiatives.

5.3 RANCHI CITY APP: -

5.3.1 Introduction

The Ranchi City App is a mobile application designed to provide residents and visitors of Ranchi city with a convenient and comprehensive platform. It offers a range of features and services to enhance accessibility, engagement, and convenience for users.

5.3.2 Key Features

- **Real-time Information:** The app provides real-time updates on traffic conditions, public transportation schedules, and other essential information related to the city's infrastructure.

- **Events and Entertainment:** Users can explore and stay updated on local events, cultural activities, festivals, and entertainment options happening in Ranchi.
- **City Services:** The app offers access to various city services, such as bill payments, public utility services, and municipal updates.
- **Emergency Alerts:** Residents receive timely emergency alerts and notifications from the city administration, ensuring public safety during critical situations.
- **Smart Parking Solutions**: The app may include features to help users find available parking spaces in crowded areas and streamline the parking process.
- **Tourism and Sightseeing:** Visitors can access information about popular tourist attractions, historical sites, and recommended places to visit in Ranchi.
- **Public Grievance Redressal:** The app may enable users to raise and track complaints, facilitating efficient resolution of public grievances.
- **City Navigation:** Built-in navigation features assist users in finding directions to specific locations, facilitating easy travel within the city.
- **Weather Updates:** The app may provide weather forecasts and updates, assisting users in planning their activities accordingly.
- **Local Business Directory:** Users can discover nearby businesses, restaurants, shops, and services, promoting local businesses and enhancing convenience for residents

5.4 ChartedBike: -

5.4.1 Introduction

The Charted Bike App is a smart mobility solution designed to revolutionize the way residents and visitors travel within Ranchi Smart City. This user-friendly mobile application aims to promote sustainable transportation options and reduce traffic congestion by providing easy access to bike-sharing services.

5.4.2 Working

The app allows users to locate and unlock bikes available for sharing at designated docking stations across the city. Users can also reserve bikes in advance, ensuring a hassle-free experience when planning their journeys. Additionally, the app offers real-time navigation to guide users through the best and safest routes for their bike trips. Live traffic updates are provided to help users make informed decisions to avoid congested areas.

5.5 GIS(Geographic Information System): -

5.5.1 What is GIS?

GIS stands for Geographic Information System. It is a computer system that integrates, manages, analyzes, and maps data related to specific locations on Earth's surface. By connecting data to maps, GIS allows the integration of location-based information with descriptive data, helping users understand spatial patterns and relationships. It plays a crucial role in various industries and scientific fields, aiding in improved communication, efficiency, and better decision-making. GIS technology can compare and contrast different types of information, including data about people, landscapes, and various infrastructure elements. It enables users to discover relationships between different geographic features and understand how they interact with each other, facilitating better spatial analysis and planning.

Link:- https://gis.rsccl.in/GIS/Home/GISPortal

5.5.2 How does GIS work?

Geographic Information System (GIS) works by capturing, storing, managing, analyzing, and visualizing geospatial data, which is data linked to specific geographic locations on the Earth's surface. The fundamental concept of GIS revolves around the integration of location data with descriptive information, enabling the representation of real-world phenomena on digital maps and facilitating spatial analysis.

- **Data Collection:** GIS begins with data collection. Various sources contribute to geospatial data, including satellite imagery, GPS (Global Positioning System) data, aerial surveys, surveys conducted on the ground, and existing maps. The collected data can include attributes related to the location, such as population, land use, elevation, infrastructure, and natural features.

- **Data Storage:** Once collected, the geospatial data is stored in a GIS database. The database organizes the data in layers, each representing a specific type of information, such as roads, land parcels, water bodies, or administrative boundaries. This organized data structure allows for efficient retrieval and analysis.

- **Georeferencing:** Georeferencing is the process of aligning the data to specific geographic coordinates. This ensures that each piece of data is associated with its accurate location on the Earth's surface. Georeferencing enables the integration of data from different sources and allows meaningful spatial relationships to be established.

- **Data Integration and Analysis:** One of the core functionalities of GIS is the ability to integrate diverse datasets and analyze them spatially. GIS allows users to overlay different layers of information, creating visual representations of relationships and patterns between different geographic features. Spatial analysis tools in GIS enable users to perform queries, measurements, statistical analysis, proximity analysis, and more.

- **Map Visualization:** GIS generates maps as a visual representation of the analyzed data. These maps can display various layers of information, such as points, lines, polygons, and raster data. Users can customize the appearance of the maps, apply symbology, and create thematic maps to highlight specific attributes or patterns.

- **Decision Making and Planning:** GIS is a valuable tool for decision-making and planning processes. It aids in identifying trends, predicting outcomes, and evaluating scenarios. Policymakers, urban planners, environmentalists, and businesses use GIS to make informed decisions about resource management, infrastructure development, emergency response, and environmental conservation.

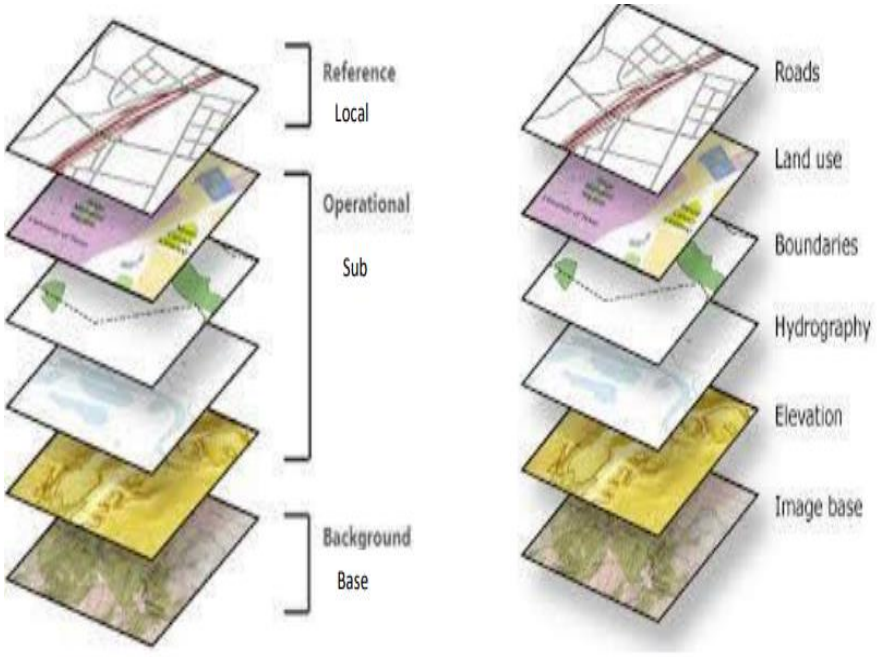
- **Data Sharing and Collaboration:** GIS allows for data sharing and collaboration across various platforms. Users can publish maps and datasets on the web or share them within an organization. This fosters better communication, data exchange, and collaboration among stakeholders working on different aspects of a project.

5.5.3 Layers Of GIS

In Geographic Information System (GIS), layers are a fundamental concept used to organize and manage different types of geographic data. Layers are individual datasets that represent specific geographic features or themes. Each layer corresponds to a unique set of attributes and spatial information, and they can be combined to create a complete and informative representation of a geographic area.

- **Definition of Layers:** In GIS, layers are analogous to transparent sheets stacked on top of each other. Each layer contains distinct information about a particular aspect of the geographical landscape, such as roads, rivers, land use, buildings, vegetation, administrative boundaries, or elevation data.

- **Data Organization:** Layers allow GIS users to manage and organize diverse data efficiently. By assigning each type of geographic data to a separate layer, it becomes easier to manipulate and analyze specific information independently.



- **Layer Hierarchy:** In a GIS project, multiple layers can be combined to create a comprehensive map. Each layer can have its own order or hierarchy, determining which layers are displayed on top of others. For example, a layer containing roads might be placed above a layer with land use information, so the roads are visible on top of the land use representation.

- **Data Integration:** The strength of GIS lies in its ability to overlay multiple layers and analyze how they interact with one another. By combining different layers, users can identify spatial relationships, patterns, and trends that might not be apparent when viewing each layer individually.

- **Thematic Mapping:** Layers are used in thematic mapping, where specific attributes of a layer are visually represented on a map using colors, symbols, or shades. For example, a land use layer might be symbolized with different colors to represent residential, commercial, or industrial areas.

- **Spatial Analysis:** GIS allows for spatial analysis by applying operations on layers. Various analysis tasks, such as buffering, spatial queries, intersection, and proximity analysis, involve using multiple layers to gain insights into spatial relationships and patterns.

- **Data Sharing:** Layers make it easier to share and exchange GIS data with others. By organizing data into layers, it becomes simpler to provide specific information to different users without sharing the entire GIS dataset.

- **Dynamic Visualization:** Layers in GIS provide a dynamic visualization of the geographic world. Users can selectively turn layers on or off, alter their display properties, and toggle between different combinations of layers to explore the data from various perspectives.

5.5.4 Why GIS?

GIS (Geographic Information System) is often preferred over Google Maps for command control rooms due to several key reasons:

- **Customization and Integration:** GIS platforms provide a higher level of customization and integration options compared to Google Maps. Command control rooms require the integration of various data sources, such as live feeds from surveillance cameras, real-time traffic data, weather information, emergency alerts, and more. GIS allows seamless integration of these diverse data layers, creating a comprehensive and customized view of the city's operations.

- **Data Security and Privacy:** Command control rooms deal with sensitive and critical data, including security information and emergency response protocols. GIS solutions can be hosted on private servers, providing better control over data security and ensuring that sensitive information remains within the organization's infrastructure.

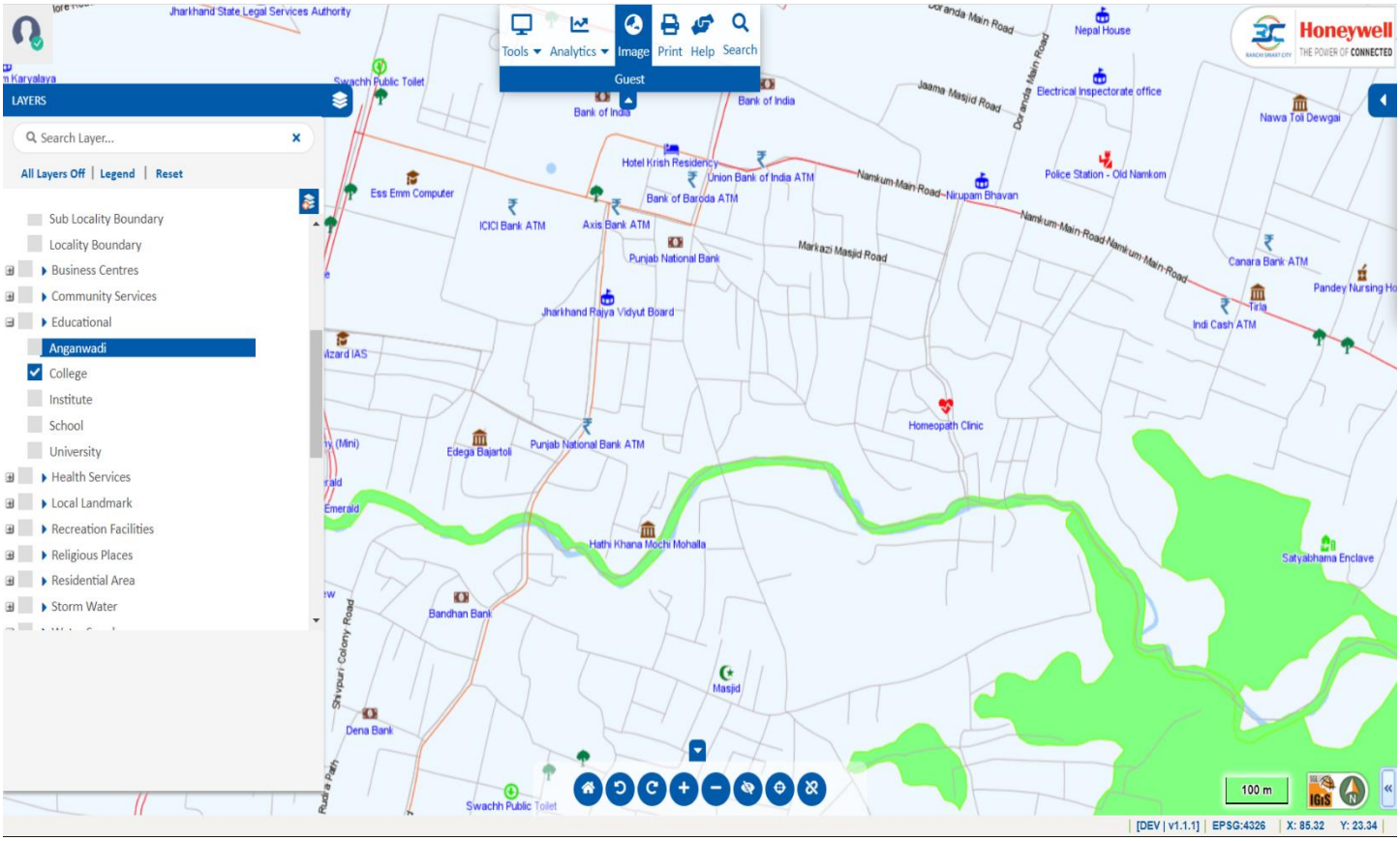
- **Spatial Analysis and Visualization:** GIS platforms are specifically designed for spatial analysis and visualization. They offer advanced geospatial tools and analysis capabilities that go beyond simple map display. These tools enable command control room operators to perform spatial queries, proximity analysis, heat mapping, and other complex analyses, aiding in better decision-making and emergency response planning.

- **Offline Capabilities:** In some scenarios, command control rooms may need to operate without an internet connection. GIS systems can be set up with offline capabilities, allowing continuous access to critical data even during internet outages.

- **Custom Data Layers:** GIS enables the creation of custom data layers based on specific requirements. Command control rooms can add layers for infrastructure data, public utilities, emergency services, and more, tailored to the city's needs. This level of customization is often not achievable with standard mapping applications like Google Maps.

- **Local Data Hosting:** In sensitive situations, some command control rooms may prefer to host their data locally to maintain full control over information and ensure data privacy. GIS allows organizations to host data on their servers or infrastructure, offering more control over data management.

- **Better Performance for Large Datasets:** Command control rooms deal with a massive volume of real-time data from various sources. GIS platforms are designed to handle and process large datasets efficiently, providing better performance and responsiveness.



- **GIS Applications for Smart Cities:**
  - Site Selection & Land Acquisition
  - Environmental / Legal Compliance
  - Planning, Design & Visualization
  - Construction & Project Management
  - Sales & Marketing
  - Facility Management (FM)
  - Operations & Reporting

5.6 NMS(Network Management system): -

5.6.1 What is NMS?

A Network Management System (NMS) is a software-based solution used to monitor, control, and manage the components of a computer network. It provides network administrators with a centralized platform to oversee the network's performance, identify and troubleshoot issues, and optimize network operations. The primary goal of an NMS is to ensure the network operates efficiently, securely, and reliably.

5.6.2 Key Features of NMS

- **Network Monitoring:** The NMS continuously monitors the network infrastructure, including routers, switches, servers, and other devices. It collects data on network traffic, bandwidth utilization, device status, and other performance metrics. Real-time monitoring helps detect anomalies and potential issues promptly.

- **Alerting and Notifications:** The NMS is equipped with alerting mechanisms to notify administrators about network faults, performance degradation, and security breaches. Alerts can be sent via email, SMS, or other notification methods, ensuring timely responses to critical events.

- **Performance Analysis:** NMS provides tools to analyze network performance trends and historical data. Network administrators can identify patterns, forecast capacity requirements, and optimize resource allocation based on performance insights.

- **Configuration Management:** NMS enables centralized configuration management for network devices. It allows administrators to remotely configure and update network devices, ensuring consistency and reducing the risk of configuration errors.

- **Fault Management:** NMS identifies and troubleshoots network faults and issues. It helps pinpoint the root cause of problems and facilitates quick resolution, minimizing downtime and service disruptions.

- **Security Management:** NMS plays a vital role in network security. It monitors network traffic for suspicious activities, detects security breaches, and enforces security policies. It can also facilitate the implementation of access controls and security measures.

- **Inventory Management:** NMS maintains an inventory of network devices, software, and hardware. It tracks device details, configurations, and software versions, simplifying asset management and ensuring compliance.

- **Reporting and Visualization:** NMS generates comprehensive reports and visualizations to provide network administrators with a clear overview of the network's health, performance, and security. These reports aid in decision-making and facilitate communication with stakeholders.

- **Scalability and Flexibility:** NMS is designed to handle networks of varying sizes and complexities. It should be scalable to accommodate network expansion and flexible to adapt to evolving network technologies.

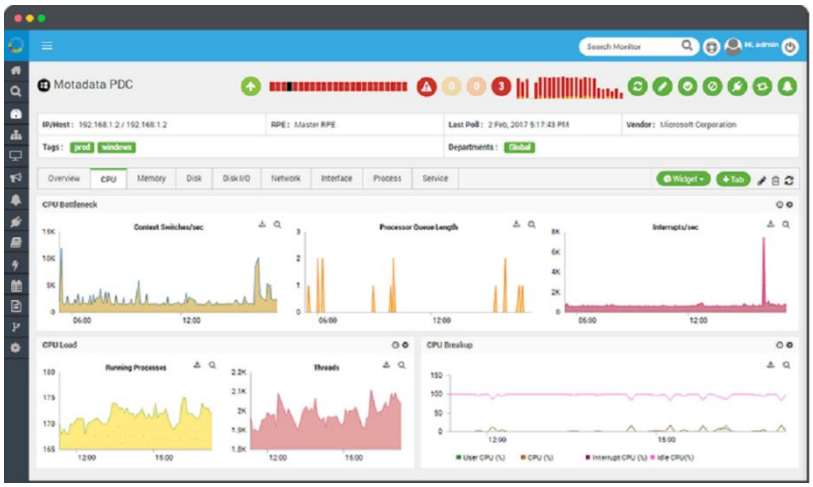
5.6.3 Motadata

Motadata is an IT monitoring and management software that derives business insights by real-time processing, correlation and intelligent visualization of IT network and security information data. It can collect data from multiple sources, in any format, and analyse it for insights.
Motadata provides reliable, secure and automated Network Configuration Management to RSC, with different configurations. It is all AI driven:

- **AI-Driven Network Configuration Management:** Utilizing AI-driven network automation, Motadata simplifies configuration changes, ensuring a smarter and healthier network.

- **Automated Configuration for Change, Backup & Restore:** Instead of manual execution, Motadata automates recurring complex configuration changes across multiple devices.

- **Advanced Remediation with Runbook:** The integration of Python in Runbook enables advanced monitoring and troubleshooting capacities, enhancing the remediation process.



- **Change Monitoring & Management:** Motadata provides alerts and tracks configuration changes, allowing administrators to have complete control over device configurations.

- **Audit & Notification:** Configurable audit logs and notifications keep administrators informed of device configuration changes, aiding in quick replacement of failed elements.

- **Network Security & Compliance:** Motadata helps enhance network security by identifying vulnerabilities through a vulnerability assessment and ensuring compliance with critical security standards.

- **Unified Dashboard for Smart City Projects**: Motadata's network and log management solution allows IT admins to monitor and manage the entire IT infrastructure of smart city projects, including network elements, servers, applications, CCTV, sensors, PA systems, and more, from a centralized dashboard.

- **Scalability & Vendor Agnostic Platform:** Motadata offers the ability to monitor numerous devices, existing and future, through a unified dashboard. It seamlessly integrates with third-party systems and is vendor, access, device, and network agnostic.

- **SLA Compliance & Helpdesk Integration:** Motadata ensures compliance with Service Level Agreements (SLAs) for uptime and downtime, and integrates with Helpdesk Systems for automated incidents reporting.

- **Efficient Network Management:** In a smart city project, Motadata serves as an NMS tool, providing an overview of the city's network on a single screen, updating every minute. It facilitates connectivity checks, firewall setup, and device organization through switches.

- **Collaboration with BSNL:** Motadata collaborates with BSNL to form a Network Management System under the Service Level Agreement (SLA), ensuring effective network monitoring and management.

- **Cisco and TP Link Switches:** In smart city projects, Motadata relies on switches from Cisco and TP Link for efficient network connectivity and data organization.

Overall, Motadata's comprehensive network management and log monitoring capabilities make it a valuable tool for smart city projects, ensuring seamless communication, optimal performance, and proactive issue resolution for a connected and efficient urban environment.

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