Model RFP 2.0

Selection of Master System Integrator (MSI)

For Implementation of

Integrated Command and Control Centre

(ICCC)/ ICT Projects

in {CITY_NAME}

Section-2 Volume II: Scope of Work

Smart Urban Solution

RFP Ref/Tender No.:

Date:

RFP/Tender invited by: [SPV_Full_NAME]

Disclaimer

[The Authority may customize as per city's requirement]

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Glossary

Terms	Meaning
ANPR	Automatic Number Plate Recognition
AP	Access Points
ATCS	Adaptive Traffic Control System
AVLS	Automated Vehicle Locator System
BOM	Bill of Material
BQS	Bus Queue Shelters
CCHS	Central Clearing House solution
CCTV	Closed Circuit Television
CCC	Command and Control Centre
CONOPS	Concept of Operations
COP	Common Operating Platform
CSP	Cloud Service Provider
DBA	Database Administrator
DC	Data Centre
DNS	Domain Name Server
DR	Disaster Recovery
DRC	Disaster Recovery Centre
EMD	Earnest Money Deposit
EMS	Enterprise Management System
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
ETM	Electronic Ticketing Machine
E-Procurement Portal	Means electronic tendering system of Authority
FMS	Facility Management Services
FRS	Functional Requirement Specifications
GIS	Geographical Information Systems
GPRS	General Packet Radio Service
GPS	Global Positioning System

GSM	Global System for Mobile Communication
GUI	Graphical User Interface
IaaS	Infrastructure as a Service
HDPE	High-Density Polyethylene
HO	Head Office
ICCC	Integrated Command and Control Centre
ICT	Information and Communication Technology
IDS	Intrusion Detection System
IMS	Infrastructure Management System
IOE	Internet of Everything
IoT	Internet of Things
IP	Internet Protocol
IPS	Intrusion Prevention System
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITMS	Intelligent Traffic Management System
LAN	Local Area Network
LOI	Letter of Intent
LOA	Letter of Award
KPI	Key Performance Indicator
MCC	Mobile Command Centre
MeitY	Ministry of Electronics & Information and Technology
MLCP	Multi-Level Car Parking
MoHUA	Ministry of Housing & Urban Affairs
MoU	Memorandum of Understanding
MPLS	Multi-Protocol Label Switching
MSI	Master System Integrator
MTBF	Mean Time Between Failure
MTTR	Mean Time to Repair
NFC	Near Field Communication
NIC	National Informatics Centre

ONVIF	Open Network Video Interface Forum
O&M	Operations and Maintenance
OEM	Original Equipment Manufacturer
OFC	Optical Fibre Cable
OGC	Open Geospatial Consortium
OS	Operating System
OTP	One Time Password
OWASP	Open Web Application Security Project
PaaS	Platform as a Service
PKI	Public Key Infrastructure
PIS	Public Information System
PA System	Public Address System
PDUs	Power Distribution Units
PIS	Passenger Information System
PoE	Power over Ethernet
PoP	Point of Presence
PTZ	Pan Tilt Zoom
QR Code	Quick Response Code
RF	Radio Frequency
RFID	Radio Frequency Identification
RFP	Request for Proposal
RLVD	Red Light Violation Detection
RoW	Right of Way
RTO	Recovery Time Objective
RPO	Recovery Point Objective
SaaS	Software as a Service
SCADA	Supervisory control and data acquisition
SCM	Smart Cities Mission
SLA	Service Level Agreement
SMPS	Switched Mode Power Supply
SMS	Short Message Service

SNMP	Simple Network Management Protocol
SOP	Standard Operating Procedures
SOS	Save Our Souls. SOS is International Morse code distress signal
SRS	System Requirement Study
TPA	Third Party Auditor
TRAI	Telecom Regulatory Authority of India
TRS	Technical Requirement Specifications
TSP	Telecom Service Provider
UAT	User Acceptance Testing
UPS	Uninterrupted Power Supply
URL	Uniform Resource Locator
VA	Video Analytics
VM	Virtual Machine
VMD	Variable Message Display
VCA	Video Content Analysis
VLAN	Virtual Local Area Network
VM	Virtual Machine
VMS	Video Management Software/System
WAN	Wide Area Network
{MUNICIPAL_SHORT_NAME}	{MUNICIPAL_FULL_NAME}
Authority	{SPV_FULL_NAME}

1- Solid Waste Management

1.1 Overview

The management of solid waste in India continue to be a challenge not only because of environmental and aesthetic concerns but also because of the enormous quantities of waste generated every day. Municipal solid waste generation per capita in India ranges from approximately 0.17 kg per person per day in small towns to approximately 0.62 kg per person per day in cities. The quantity of the waste generation in cities depends on the living standards of people, cultural traits, the economic activities and weather conditions of the city.

ICT enabled solid waste management system is expected to address the challenges through monitoring mechanisms, instant communication, data-based decisions making and automation to bring efficiency and cost effectiveness across the SWM life cycle, convenience to the citizens and cleaner & healthy environment.

1.2 Key Issues

The main challenges of typical solid waste management in urban ecosystem are as follows:

- Lack of information about the waste collection time/schedule for a particular area/location
- Lack of efficient mechanisms for monitoring/tracking the pickup vehicles, vehicle cleaning, collected waste, waste transferred at treatment & disposal site and SWM staff deployed at work in real time.
- Lack of real-time information about quantity of waste to be picked up and processed.
- Volume of waste lying unattended for days causing citizen complaints and health issues
- Due to the absence of real time data, urban utilities are not able to quickly respond to the unexpected situations in real time with reference to vehicles, locations, waste volume, staff deployed and citizen complaint

1.3 AS-IS Analysis

[City to provide sufficient information covering entire value chain]

1.3.1 City SWM process

Current Processes from waste generation, collection, transfer, transportation processing and disposal of different types of wastes

1.3.2 Current Organization Setup

[List the setup]

1.3.3 Current Technology being used, IT System in operation and Vendor Ecosystem

[Provide brief details]

1.3.4 Activities which are outsourced and reason of outsourcing

[List the activities]

1.4 Indicative Key Outcomes and KPIs

- Waste Collection
    a. Dry Waste
    b. Wet Waste
    c. Medical Waste
    d. E-Waste
    e. Hazardous Waste
    f. Construction & demolition Waste
- Residential D2D Waste Collection %
    a. Waste Collection- Dry
    b. Waste Collection- Wet
    c. Vehicle Deployed- Dry Waste
    d. Commercial D2D Waste Collection
    e. Segregation of waste at source
- Vehicle Tracking and Monitoring
- Manpower Tracking and Monitoring
- Road Cleaning
- Street Sweeping
- Processing Plants
    a. Dry Waste Processing
        i. Collected
        ii. Processed
        iii. Recycled
    b. Wet Waste Processing
        i. Collected
        ii. Processed
        iii. Recycled
    c. Medical Waste Processing
        i. Collected

ii. Processed

iii. Recycled

d. E-Waste Processing

i. Collected

ii. Processed

iii. Recycled

e. Hazardous Waste Processing

i. Collected

ii. Processed

iii. Recycled

f. Construction & demolition Waste Processing

i. Collected

ii. Processed

iii. Recycled

1.5 Key components (Process Flow to be provided)

- Waste pickup vehicle tracking (door to door waste collection vehicles as well as large vehicles for waste transfer to disposal sites)
- Pick up routes of each vehicle and locations on GIS map
- Estimation of the waste to be picked up at locations
- Monitor and report the amount of waste and type picked up at locations and delivered at target destinations
- Digital citizen complaints registration system and systematic allocation of them to respective staffs as well as monitoring of progress in it
- Monitor the SWM assets and staff deployed at work for the efficient utilization of the same
- Manage routes, vehicles and SWM personnel dynamically through data based automated mechanism
- Reduce vehicle trips and routes incorporating real time traffic inputs for efficiency and reduced traffic
- IoT gateways, network switches, copper, fibre optic or wireless connectivity to interconnect the local system components and also to the datacenter/cloud.
- Desktop and mobile application for SWM administration, citizen's operations, field staff, service/repair.

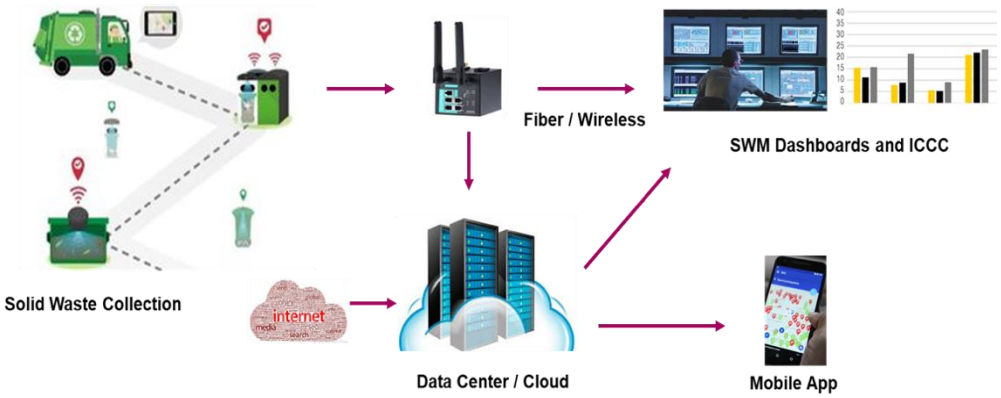

Figure 1: (ILLUSTRATIVE) Process Map of Solid Waste Management

This diagram is only one of the representations and does not suggest any architecture or design choices to realize the solution.

1.6 Functional Requirements

Note: 1. The response should be descriptive and cross referenced.

Note: 2. Mentioning response as Yes/No/Not applicable (NA) will be treated as non-compliance to the clause /specific requirements.

#	**Functional Requirements** **(The text in RED color means configurable parameter)**	**Bidder's Response (How functionality shall be met)**
	Solid Waste Monitoring and Tracking:	
i	Solid Waste Management (hereafter referred as SWM) desktop and mobile application should be able to create and update waste pick up points, routes, starting point, ending point and priority order of pickup points for routes. Note: Mobile application (on mobile phone or handheld device) is for the SWM management/enforcement/field/service personnel on the move.	
ii	Solid Waste Pick up vehicles of all types should have the GPS location tracking mechanism to monitor the current location of the vehicle and movement pattern at an accuracy of 3 meters. Note: 3-meter accuracy is required to decipher the vehicle movements to ensure the vehicle has come to both sides of the roads/adjacent roads. SWM mobile device may serve the purpose of GPS tracking too	
iii	SWM application should record the real time status of the waste pick up (Pending, partial, complete) for every pickup location or across 10	

	pickup points and to be communicated to the SWM application within 2 minutes for viewing in the SWM mobile and desktop applications. Note: The real time tracking, reporting and viewing of the waste pick up status is needed for the dynamic planning and changes in the waste pick up activities/plans.	
iv	The SWM application should be able to dynamically do the following and also communicate to SWM desktop application and mobile application within 2 minutes Change in vehicle route/pick up points Change in SWM staff assignments Changes based on traffic conditions, missed pick up points, waste waiting to be picked up, repeated issues/complaints Assignment of additional routes/pick up points for a vehicle / SWM personnel Vehicle, Routes, personnel optimization recommendations with details Automatic mode and manual mode (refers to the possibility to accept/reject the recommendations and also make manual changes) Communication on the plans and changes to SWM staff and field personnel	
v	SWM application should support weighbridge monitoring and the weight of the vehicle, entry time, exit time and vehicle number plate details with the image of the waste in the vehicle to be reported within 2 minutes the vehicle enters as well as exit the premise.	
	Bin/D2D Waste Collection and Segregation	
i	SWM application should record the quantity and type of waste picked up at every pickup location or across 10 pickup points and communicated to the SWM within 2 minutes for viewing in SWM desktop and mobile application. Note: The real time tracking of the quantity of waste is needed for the dynamic planning and changes in the waste pick up activities/plans.	
ii	SWM desktop and mobile application should support the following functionality • Update the status of citizen reported complaints for any pickup location with description text and picture • Quality of segregation of waste (Wet waste, dry recyclables, domestic hazardous waste, sanitary, horticulture, construction &	

	demolition waste) done at source for any pickup location with description text and picture • Decision taken regarding pick up and fines indicating the exact address (not only location), description text and picture Note : This information is to captured and displayed to facilitate enforcement and citizen culture change	
	Manpower and Asset Deployment, Scheduling and Tracking	
i	SWM desktop and mobile application should be able to create, update and view all the SWM personnel, on duty/leave/Planned to be on leave at the city/region level, report alerts and make recommendations per route/region/city level to track and manage the workforce	
ii	SWM desktop and mobile application should be able to create, update and view all the assets and their information for the city/region to track and manage all the assets.	
iii	SWM desktop and mobile application should support error reporting and diagnostics for all assets for the city/region and the errors should be discretely identified and reported as : Hardware issue, Software issue, Network issue, Power failure and pending duration of the issue to enable faster trouble shooting and repair.	
iv	SWM desktop and mobile application should be able to create, update and close service tickets and track the issue type, resolution, resolution time and SLA adherence/breach. Critical issues impacting the SWM functionality and user experience should be resolved within 4 hours. The system uptime should be calculated from the duration of critical issues reported.	
v	GPS based mobile device to register the attendance/presence of SWM administrative and field staff through biometrics registration at fixed locations and also anywhere on field including the location of their presence. The device should communicate the attendance data within 2 minutes of its capture at the device to the SWM application and SWM application should generate consolidated attendance/presence reports at every one hour during the day and on end of the day and report anomalies and alerts against staff allocations	
	Citizen Complaints Management Mechanism and Dashboard	
i	• SWM mobile application for the citizen should support following functionality. • Report SWM issues as per specific categories (Vehicle not arrived, waste not picked up, partially picked up, waste scattered	

	around, sweeping not done, dead animal, violation of landfill guidelines) for any location with description text and picture. • Status, expected time of resolution, Resolution with description from SWM department for attending the issue • Reopen closed complaints • The expected time of arrival (ETA) of SWM pick up vehicle for any location • Weight of waste picked up daily at a location for last 3 months' relative position with reference to the area/city, Trend (Up/down/no change) • Quality of waste segregation at a location for last 3 months' relative position with reference to the area/city, Trend (Up/down/no change) • Note: This information is to be captured and displayed to facilitate enforcement and culture change	
ii	SWM desktop and mobile application should provide reports and dashboards as follows at minimum and should be available for view, download and send via e-mail. • Number of vehicles on duty/not on duty per route/area/city with vehicle details • Number of people on duty/not on duty per route/area/city with employee details • Number of routes, pick up points per route with lat/long positions and details • Number of pick-up points, the waste picked up/pending/missed with lat/long positions and details • Route and pick up point violations for the vehicles • Vehicle start time, end time, stop locations, stop duration, vehicle fill status • The weight of waste picked up at a pickup point/10 locations/region/city with type of waste • The weight of the waste with type delivered at different sites (Landfill, Compost/energy plants…) • Quality of segregation of waste at a pickup point/region/city • Citizen complaints, Location, Resolution, Time taken to resolve, SLA breaches • SWM staff attendance, anomalies against allocations and alerts	

	• SWM administrative decisions for pick up points, Resolutions • Fines per location/address/region/city • SWM pick up locations, Vehicle locations and Customer complaint locations with details on GIS map and provision to zoom in/out for details Note: Additional reports, insights and recommendations would be helpful to facilitate enforcement and culture change	
iii	The SWM system should provide a support call telephone number for the citizens to call and get immediate support on SWM issues.	
iv	SWM system could introduce the following Smart technology components in the SWM system • Smart waste bins which could indicate the bin weight/fill level to gauge the waste waiting to be picked up and the same to be communicated to the SWM application in every 5 minutes. • Video cameras installed around the waste bins to monitor the waste scattering and the image/alerts are to be sent to the SWM application every 5 minutes for prioritized/exceptional actions. • Foul smell detection sensors installed around the bins and alerts on different severity levels of foul smell is sent to SWM application every 5 minutes for prioritized/exceptional actions. • Animal repellent modules are installed around the bins to repel, dogs, cows, pigs and cats to avoid animals scattering the waste around the bins Note: All these smart technologies are difficult to install, operate and maintain in the Indian context and expensive and hence may include in the SWM system only after careful consideration and only if it is absolutely necessary	
v	The SWM application should support predictive modelling to help the dynamic planning and optimization of SWM activities including personnel assignments considering the following • The waste pickup history data for locations/routes/areas • Vehicle, SWM personnel assignments • Special events, festivals, trends, any other factors which could influence waste generation	
v	SWM application should be able to receive payments for the fines through Cash, Debit card, Credit card, Net banking and e-wallets.	

	SWM desktop and mobile application should enable the above features based on the user login for the categories like Administrator, Operations, field staff and Service/Repair.	
	General Functional Requirements	
i	SLA Compliance Tracking: SWM application should be able to monitor and report misuse (presence of unregistered/ illegal/ illegitimate activities, entry and exit of vehicles), disaster/ emergency alerts and lack of adherence of landfill guidelines and standards on 24/7 mode and should be supported through images including citizen reported issues as proof. Note: This could be effectively done through Video surveillance of the landfill site, continuous monitoring/ video analytics-based alerts in addition to the citizen reported issues	
ii	APIs and Data Management: All the data from the above functions should be made available through Application Interfaces (APIs) for other applications including ICCC to consume	
iii	The SWM application should store all the data sets including the images and videos at the data center for 1 year and should be available for view, download and send via e-mail.	
iv	Uptime and Availability: The entire SWM system (hardware, software and applications) should function for 2 hours with power supply backup in case of a power failure and there should not be any loss of functionality or data during the power supply switching.	
v	Uptime and Availability: The SWM system software should support widely used browsers for the web applications, operating systems for mobile applications and strictly company with GDPR for handing all types of data.	
vi	Uptime and Availability: The SWM system components should be chosen to withstand and work well in the ambient/operating temperature, pressure, rain/water surge, dust and humidity levels for the target location.	
vii	Uptime and Availability: The SWM system should be operational meeting all the functional requirements and the defined user experience for 98% of the time which will be calculated on monthly basis. This should be verifiable from the system uptime calculated and reported.	
	Integration with ICCCs	
i	Integration of all the IT systems and solutions deployed for the SW management with ICCC through APIs	

ii	Data Backup and Archival: Provisions to archive and backup the data generated by sensors, cameras, devices, systems and solutions	

The functional requirements should be read in reference to the Solid Waste Management Rules, 2016 published in the Gazette of India, Part-II, Section-3, Sub-section (ii) Ministry of Environment, Forest and Climate Change dated 8th April 2016, and relevant standards for product specification as shared in the annexure of this RFP document.

1.7 Technical Requirements

[The Authority may include the component specific technical requirement here which are vendor/ technology agnostic]

Note: 1. The response should be descriptive and cross referenced.

Note: 2. Mentioning response as Yes/No/Not applicable (NA) will be treated as non-compliance to the clause /specific requirements.

S.No.	Technical requirement	Bidder response (How the functionality will be met?)
1		
..n		

Note: The functional requirements and technical specifications provided in this RFP are indicative and carry guiding rule. The MSI is free to offer products and solutions which meet requirements of the RFP focusing on the outcome, future scalability, security, reliability and adherence to specified SLA under this RFP, in line with applicable standards & best practices adopted in the industry.

The MSI is encouraged to design an Optimized solution which is technically superior, innovative, proven, better in terms of functionality and is cost effective. Any specified parameters mentioned in the scope/technical requirement in the RFP may be considered if it is required for meeting current & future requirements during the contract period. The MSI is fully responsible for the specified outcome to be achieved.

The MSI is required to provide supporting document in the technical bid justifying the approach & design of offering the solution. The technical marking is specified in the evaluation criteria mentioned in the Volume I of the RFP document

1.8 Bill of Quantities

[To be derived from Detail Project Report Prepared by Smart Cities technical experts].

As per Format given in Annexure A.2.14, A.2.15 and Annexure A.3.2 of Volume I of the RFP.

2- Smart Parking

2.1 Overview

Residents of {CITY_NAME} are facing trouble in finding parking space and frequently find themselves without change. In order to address such challenges, a Smart Parking solution with mobile friendly citizen application that alerts residents/visitors where the parking space is available is envisaged which allows them to pay through mobile wallets, bank wallets using their mobile phones.

This will help citizens to know the vehicle parking availability in and around a locality, parking rates, parking offers, book a parking slot, navigation to the parking place and make payment through digital payment methods or automated parking meters. The system will bring convenience to the citizens, higher throughput, reduced traffic due to reduced parking search, increased utilization of parking lots, reduced revenue leakage and more parking revenue.

2.2 Key Issues

The Challenges Faced in the City with Parking are-

- High Parking Search Time
- Traffic Congestion on Road
- Poor Usage of Parking Space
- Poor Occupancy in Parking Lot
- Less Revenue / collection, Less effective parking operations
- High Parking violations, Accidental Hazards
- Stress to user & dissatisfaction
- Pollution-High Emission of gas
- No flexibility in Parking Charges
- Suspicious parking / Lack of security arrangements in Parking
- No real time tracking, data/report for analysis for future need/expansion
- Add/Modify

2.3 AS-IS Analysis

[City to provide sufficient information covering entire value chain]

2.3.1 City Parking process

[Current Processes from data collection, processing, analysis payment of different types of parking]

2.3.2 Current Organization Setup

[List the setup]

2.3.3 Current Technology being used, IT Systems in operation and Vendor Ecosystem

[Provide brief details]

2.3.4 Activities which are outsourced and reason of outsourcing

[List the activities]

2.4 Indicative Key Outcomes and KPIs

{CITY_NAME} objectives envisaged by implementing Smart Parking Management system are:

- Integrated Multilevel Car Parking (MLCP) and on/off-street parking with advanced real-time parking availability information on-demand through mobile application to its users.
- Reduced congestion through improved capacity of arterial & collector streets through regulated parking that does not block smooth movement of through traffic.
- Reduce leakages in parking revenue through utilization of digital payment methods for paying parking charges
- Enable time and location specific parking tariff to be implemented to facilitate demand management
- Enable enforcement of penalties on parking violations and collection of penalties via Enforcement mobile application.
- Enable dynamic parking tariff to be implemented to facilitate demand management
- Provide users with advanced information and guidance on mobile handsets for availability of parking spaces in and around their destinations
- Integration with Central Control Centre for viewing, analyzing the CCTV feed and monitoring and managing of Smart Parking
- Optimizing the parking spaces across city for example 60/45-degree parking
- City to add/ modify as needed

2.5 Key components **(Process Flow to be provided)**

2.5.1 System components

A typical parking management system may consist of the following components. Based on the technology used, one may not need all of these or may be even more than these.

- Sensors, cameras for Individual slot occupancy detection, vehicle counting/classification, Automatic Number Plate Recognition (ANPR).

- Parking entry receipt dispensers, local compute and storage devices, access management barriers and parking meters for payments.
- Electronic displays to communicate the parking availability and parking offers to the parking lot users.
- IoT gateways, network switches, copper, fiber optic or wireless connectivity to interconnect the local system components and also to the datacenter/cloud.
- Desktop and mobile application for parking management administration, operation and service/repair.
- End user mobile application for parking availability search, offers, booking and payment.
- Desktop/laptop computers, payment receipt printers, power backup.

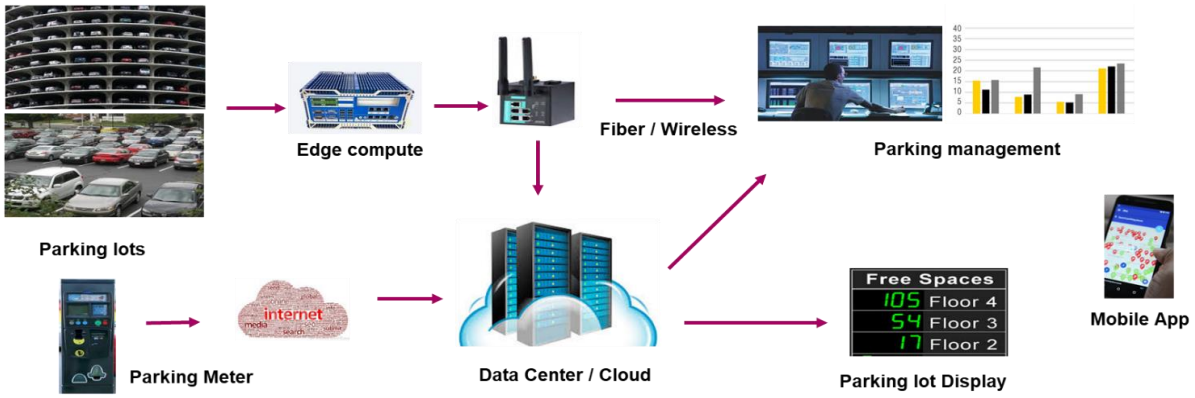

Figure 2: (ILLUSTRATIVE) This diagram is only one of the representations and does not suggest any architecture or design choices to realize the solution.

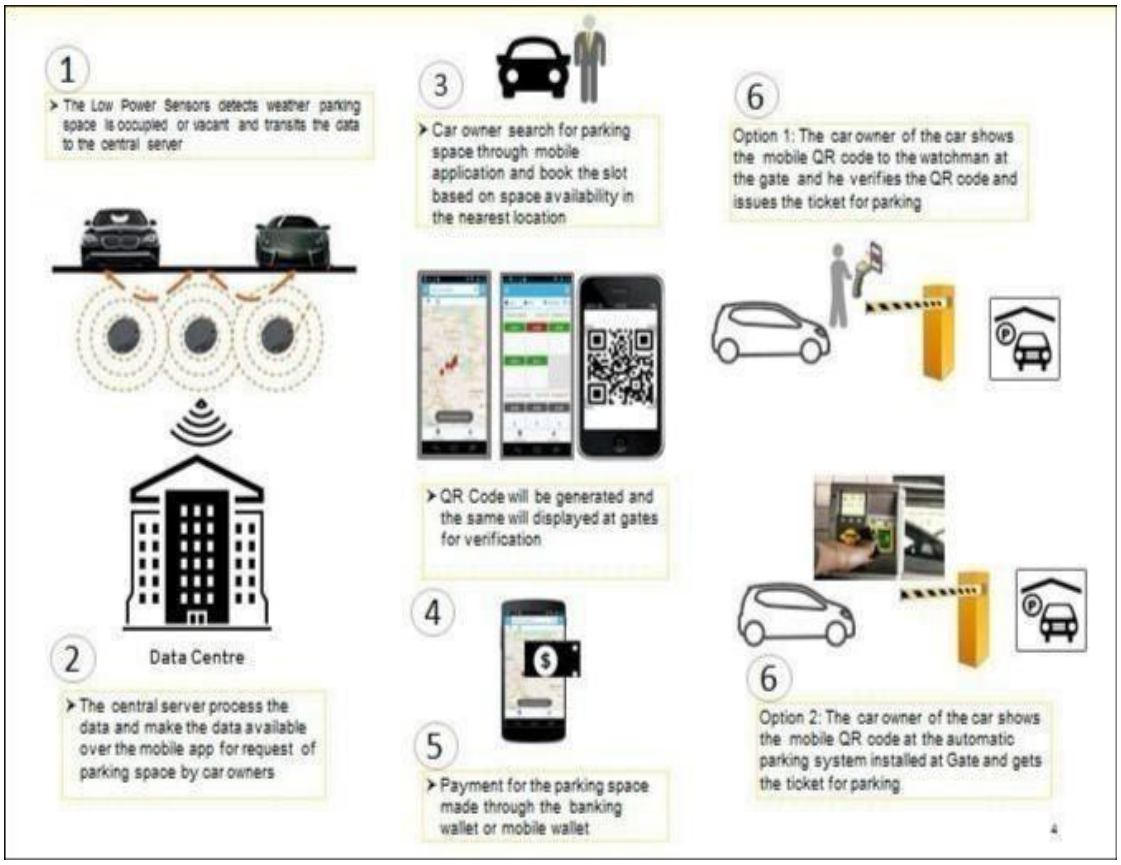

Figure 3: (ILLUSTRATIVE) Overview of Smart Parking environment

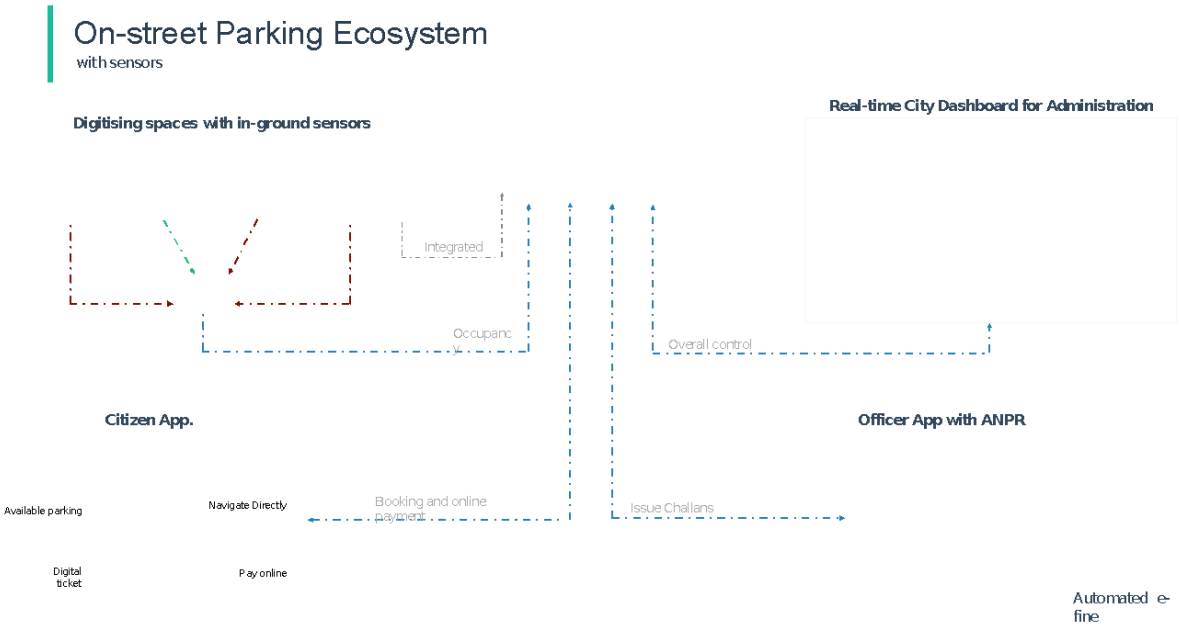

Figure 4: Overview On-street Parking Ecosystem (Sensors Optional)

2.5.2 User experience

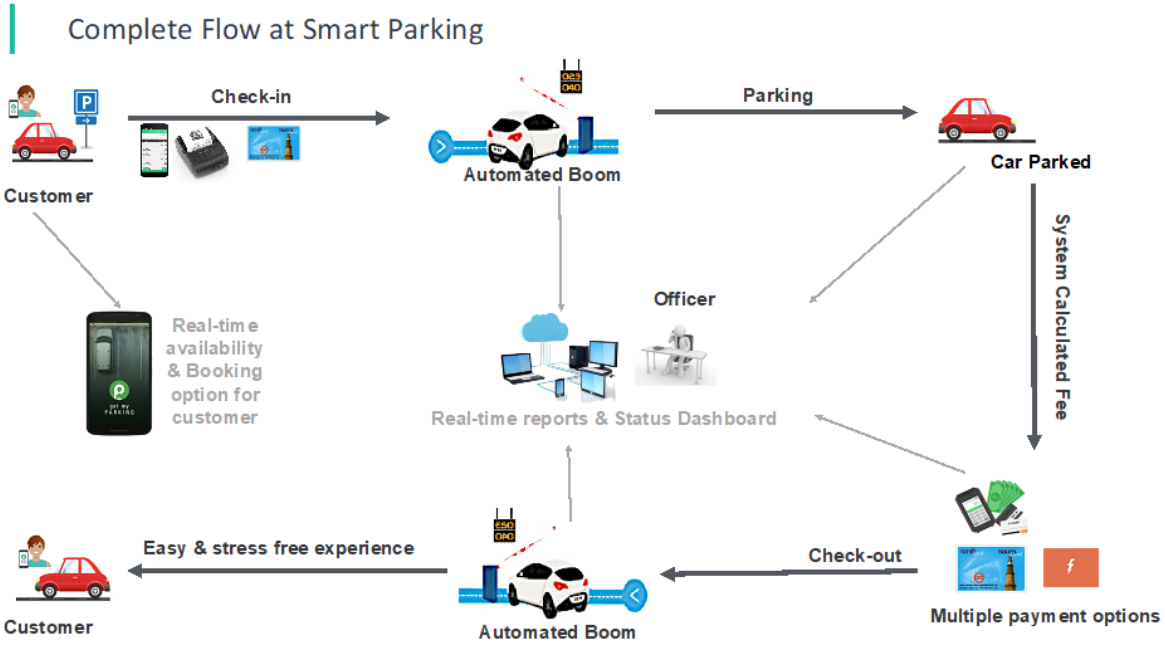

Figure 5: (ILLUSTRATIVE) Overview On-street Parking Ecosystem ILLUSTRATIVE)

This diagram is only one of the representations and does not suggest any architecture or design choices to realize the solution.

2.6 Functional Requirements

2.6.1 Available Options: Smart Parking System

There are various models across the industry to implement Smart Parking Management System will include following features, {CITY_NAME} may decide based upon feasibility study, parking slots available, social and other economic factors.

- ***Multi-Level Parking System [MLP]***: consists of all indoor / covered / underground parking areas. It shall include, but not limited to, entry and exit parking equipment and automatic barriers, sensors for recognition of each parking slot, loop sensors, slot availability information, advanced slot booking facility and map-based guidance system, LED signage and CCTV at entry and exit.
- ***Off-Street Parking lots***: consists of demarcated areas for parking near a street or road. It will include, entry and exit parking equipment, cameras, automatic barriers, handheld devices, advance booking of parking facility and map-based guidance system, LED signage and CCTV at entry and exit.
- ***On Street Parking***: consists of individual marked parking slots on streets/ roads. It should include, but not limited to, recognition of each parking slot (ECS) using magnetic-cum-optical or magnetic-cum-Infrared sensors/cameras and slot availability, handheld devices,

information and map-based guidance system up to individual slots, LED Signage, and CCTV coverage of the entire parking area.

- ***On-Street Parking Lots (Limited timings)*:** consists of all areas which are being used for limited timings parking and are open uncovered spaces. It shall be equipped with basic smart parking solutions including recognition of each parking slot (ECS) through magnetic-cum-optical/magnetic-cum-infrared sensors, map-based guidance and overall parking availability information, LED signage, CCTV Camera Covering Whole Parking area.
- ***Temporary Parking Lots (on need basis):*** consists of parking, which are temporarily asked for by {CITY_NAME} as per its requirements and are to be used for parking of vehicles for particular functions for short duration, in open uncovered spaces, which are not covered under above scenarios.

The details for closed and open street parking are captured in the functional requirements.

S No.	Functional Requirement
Common for all types- Parking management desktop and mobile application should:	
1	Be able to create and update parking location, blocks, isles, slots, reservations and the parking rates. Note : Mobile application (on mobile phone or handheld device) is for the parking management/enforcement/service personnel on the move.
2	Support demand based dynamic pricing and provide the option to select between fixed price and demand-based price in the application.
3	Be able to create, update and view all the assets and their information for a parking place to track and manage all the assets. All these data should be made available through Application Interfaces (APIs) for other applications to consume.
4	Support error reporting and diagnostics for all assets for a parking place and the errors should be discretely identified and reported as: Hardware issue, Software issue, Network issue, Power failure, All of these or some of these and the pending duration of the issue to enable faster troubleshooting and repair. All these data should be made available through Application Interfaces (APIs) for other applications to consume.
5	Provide parking slot availability and occupancy information. The information should be updated within 15 Seconds of change of status (free/occupied) of a parking slot. All this data should be made available through Application Interfaces (APIs) for other applications to consume.
6	Provide parking slot utilization, pricing details, fee collection for each type of vehicle, parking offers applied, total collection for a specified time of the day, days, months and years and should be available for view, download and send via email.

	All this data should be made available through Application Interfaces (APIs) for other applications to consume.
7	Be able to receive payments by scanning/manually entering the unique identification code in the parking entry receipt and accept payment through Cash, Debit card, Credit card, Prepaid card and e-wallets.
8	Calculate the final settlement amount based on the type of vehicle, duration of the stay, user privileges, loyalty points and issue a tax invoice/receipt with all these details and the vehicle number.
9	Support the option for users to buy monthly, quarterly or yearly passes for hassle free parking and payment experience.
10	Enable the above features based on the user login for the categories like Administrator, Operations and Service/Repair.
11	Support the following functionality. Searching for a parking place within a specified radius and price range and book slot. Display the parking lot on the map, available slots (Vehicle category wise), parking price and parking offers. Navigation to the parking location. Probability of getting a parking place by the time you reach there. Note : Probability of getting a parking place is a data analytics intensive feature and includes it as needed.
12	The parking display should support the following functionality. Display available slots (Vehicle category wise), parking price and parking offers. Readable from a minimum 100-meter distance at day and night while driving. Wireless connectivity to the parking application for the data. Note : Include displays as needed at required places to help the user to find the parking information while driving.
13	Store all the data sets including the images and videos locally at the parking location for 48 hours and in the data center for 1 year and should be available for view, download and send via email.
14	The parking management Desktop application at any location should be able to function for 48 hours even if it is not connected to the data center.
15	The entire parking management system (hardware, software and applications) should function for 2 hours with power supply backup in case of a power failure and there should not be any loss of functionality or data during the power supply switching.

16	Be chosen to withstand and work well in the ambient/operating temperature, pressure, rain/water surge, dust and humidity levels for the target location.
Multi-Level Carparking	
1	If the parking slots are not available at a parking place, the user should be allowed to enter the parking place (as it is not possible to go back from queue) instructing to leave the parking place immediately. The time within which the user has to exit without getting charged for this entry should be configurable in the parking Desktop and Mobile application.
2	The entry to the parking place should be system controlled and managed by the automatic barrier. The system should issue a parking entry receipt with unique identification code to the user at the entry (will be used for payment and exit). All these procedures should be completed within 5 seconds after a vehicle comes to the barrier and the user or System (automatic) start the access procedures.
3	The barrier at entry and exit should have the safety features like glow in the dark, reverse on contact, auto sway away etc. to avoid accidents, damages to the vehicles and injury to people.
4	The vehicle number and image of the number plate should be captured at the time of entry and exit of the parking lot and should be stored. Note: This requirement would need Camera hardware and Automatic Number Plate Recognition software with an accuracy of >95% (for standard number plates) to be part of the solution.
5	Parking management desktop and mobile application should provide vehicle over stay and hot listed vehicle alerts to enable enforcement. Note : This would need vehicle plate number to be captured during entry to the parking lot or while being parked inside the parking lot.
6	Vehicle inbuilt RFID tags and Fast tags to be considered in the parking management Desktop and mobile application for future enhancement and shall only require the installation of RFID readers to make it operational.
7	The system should be able to operate in the fully automated/unmanned mode. This means the barrier should open up on number plate/face recognition/unique code kind of inputs at the entry and exit and the payments will be only digital. Note : Though this will increase the throughput and convenience but will also increase the system cost hence to be included only if it is necessary.
8	In the case of multilevel parking places, the availability at every floor (not isles) should be informed to the user through the user mobile application and parking displays (if parking displays are included in the requirements)

9	In the case of multilevel parking places, the availability at every aisle should be informed to the user through digital displays for isles to avoid users searching for the reported free slots on a particular floor. Note: This will increase the system cost as it would need occupancy detection of isles or even individual slots plus additional displays for isles and hence to be included only if it is very much required.
	The parking attendant should be able issue the parking entry receipt using the parking mobile application with no changes to the other requirements. Note : This could help to reduce the queue to enter into a parking lot during peak hours.
10	The parking attendant should be able receive payments using the parking mobile application by scanning/manually entering the unique identification code in the parking entry receipt and accept payment through Cash, Debit card, Credit card, Prepaid card and e-wallets with no changes to the other requirements. Note : This could help to reduce the queue to make payments at the exit.
11	The user should be able to make payment in the parking meter installed near the parking slots by scanning/manually entering the unique identification code in the parking entry receipt and make payment through Cash, Debit card, Credit card, Pre paid card and e-wallets. Note : Parking meters are expensive and to be considered if it is needed to reduce the queue to make payments at the exit.
On street parking	
1	The car parking operator application should be able to guide the user within 20 meters closer to the available parking slot. Note : This will increase the system cost as it would need occupancy detection of smaller blocks or even individual slots plus but should be included to avoid searching for the reported free slots on the streets.
2	The car parking operator application should have an inbuilt parking meter. The user should be able to start the meter entering the vehicle number, parking slot number, expected duration of the parking and pay in advance from a mobile parking application up on parking the vehicle. On closing the parking meter, the parking invoice/receipt to be sent to the user preferred method. Note: This is a cheaper option compared to the expensive parking meters installed near parking slots.
3	The user should be able to make payment in the parking meter installed near the parking slots by entering the vehicle number, parking slot number, expected duration of the parking and make payment through Cash, Debit card, Credit card, Prepaid card and e-wallets.

	Note: Parking meters are expensive and to be considered only if it is absolutely necessary as the parking meter in user/parking attendant's mobiles is a cheaper option.
4	The parking attendant should be able to start the inbuilt parking meter for any parking slot by entering the vehicle number and parking slot number and issue a parking entry receipt to the user. The user should be able to pay the parking attendant by scanning/manually entering the unique identification code in the parking entry receipt and make payment through Cash, Debit card, Credit card, Prepaid card and e-wallets. The parking invoice/receipt could be sent to the user preferred method or the attendant should be able to provide a printed receipt on the spot.
5	Parking management desktop and mobile application should provide vehicle overstay and hot listed vehicle alerts to enable enforcement. Note: Hot listed vehicle reporting would need vehicle plate number to be captured while the vehicle is being parked inside the parking lot.

Trend analysis for parking violations, prediction analysis such as waiting time for parking availability, prediction/forecast of parking spaces requirements in the city etc.

Open Street parking

The open car parking operator can have the small mobile app to feed the status into the main car parking app, allowing status availability and then use mechanism such as QR code or equivalent.

2.7 Technical Requirements

[The Authority may include the component specific technical requirement here which are vendor/ technology agnostic]

Note: 1. The response should be descriptive and cross referenced.

Note: 2. Mentioning response as Yes/No/Not applicable (NA) will be treated as non-compliance to the clause /specific requirements.

S.No.	Technical requirement	Bidder response (How the functionality will be met?)
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..n		

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The MSI is required to provide supporting document in the technical bid justifying the approach & design of offering the solution. The technical marking is specified in the evaluation criteria mentioned in the volume 1 of the RFP document.

2.8 Bill of Quantities

[To be derived from Detail Project Report Prepared by Smart Cities technical experts]

As per Format given in Annexure A.2.14, A.2.15 and Annexure A.3.2 of Volume I of the RFP.

3- e-Governance & Citizen services Applications

3.1 Overview

SMART captures the important attributes of Good Governance i.e., Simple, Measurable, Accountable, Responsive and Transparent governance.

ICT in governance has been experienced in the form of e-Governance, which redefined the way Governments work, share information, engage citizens and deliver services to external and internal clients for the benefit of both government and the clients that they serve.

Governments harnesses information technologies to reach out to citizens, business, and other arms of the government to: a)Improve delivery of services to citizens, businesses and employees b) Engage citizens in the process of governance through interaction c) Empower citizens through access to knowledge and information and d) Make the working of the government more efficient and effective

This results in enhanced transparency, convenience and empowerment; less corruption; revenue growth; and cost reduction.

Authority intends to implement a robust Smart governance & citizen services solution for delivering efficient and effective citizen centric services as well as improving municipal finance/expense management and administrative functions.

The Smart governance solution, while modular, should be capable of providing all the functionality described in this section as an integrated platform.

The MSI shall ensure that all the modules under Smart Governance are integrated with the overall project. MSI shall create an enabling platform to link the relevant features with the Citizen Services.

The applications designed and developed for the departments concerned must follow best practice and industry standards. In order to achieve the high level of stability and robustness of the application, the system development life cycle must be carried out using the industry standard best practices and adopting the security constraints for access and control rights. The solution should comply to the below standards as applicable:

(a) At least comply with the published e-Governance standards, frameworks, policies and guidelines available on http://egovstandards.gov.in (updated from time-to-time); and

(b) The Smart governance solution shall be of leading industry standards and as per requirements mentioned in IS 18006 (Municipal Governance Reference Architecture).

(c) Shall comply to applicable elements of data layer reference architecture (IS 18002) as well as IS 18000 (UNIFIED DIGITAL INFRASTRUCTURE – ICT REFERENCE ARCHITECTURE (UDI-ICTRA), Section 8.12

3.2 Key Issues

[City to identify and add here]

3.3 AS-IS Analysis

[City to provide sufficient information covering entire value chain]

3.3.1 City Governance process

[Current Processes from situational analysis, data collection and advanced analysis viewpoint]

3.3.2 Current Organization Setup

[List the setup]

3.3.3 Current Technology being used, IT System in operation and Vendor Ecosystem

[Provide brief details]

3.3.4 Activities which are outsourced and reason of outsourcing.

[List the activities]

3.4 Indicative Key Outcomes and KPIs

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

3.5 Key components **[Process Flow to be provided]**

The components envisaged to be included in Smart Governance & Citizen services solution are. Further details on each of the block can be taken from IS 18006 Municipal Governance Reference Architecture standard. The MSI is required to provide supporting documents in the technical bid justifying the approach & design of offering the solution. The indicative technical marking is specified in the evaluation criteria mentioned in the volume 1 of the RFP document.

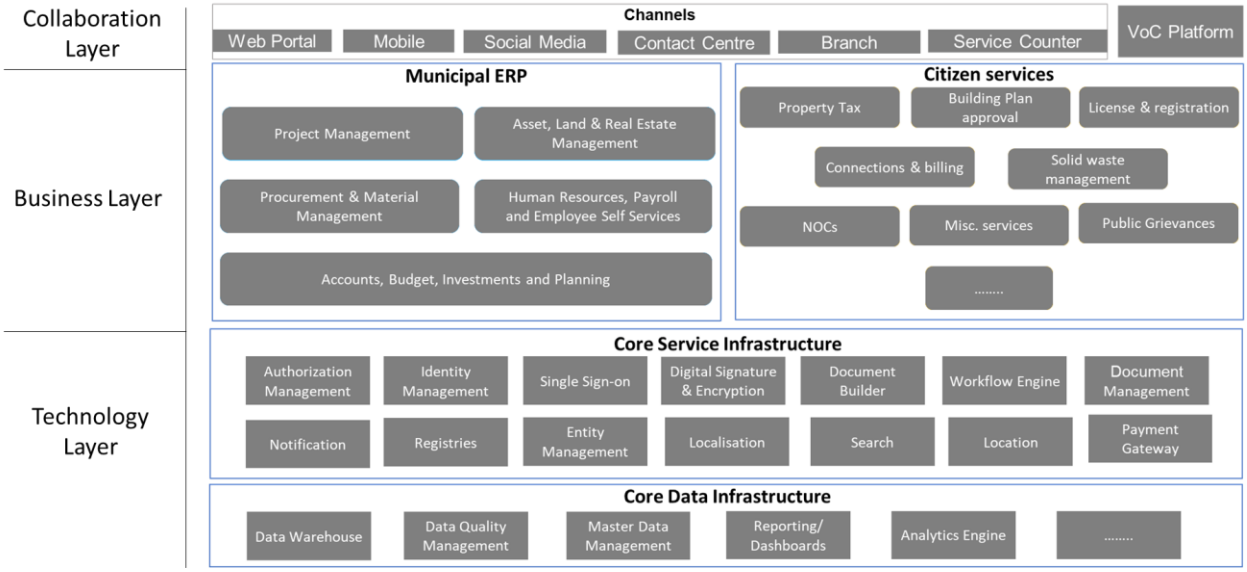

Figure: 1 (ILLUSTRATIVE) This diagram is only one of the representations and does not suggest any architecture or design choices to realize the solution.

3.6 Functional Requirements

MSI to provide techno-functional compliance and overall solution against requirement details provided in layered architecture in IS 18006.

3.6.1 Functional Requirements – Citizen service

- Citizen services
    - Property Tax Management
    - Trade license Management
    - Building Plan Approval
    - License & Registration
    - Connections and Billing
    - NOCs
    - Citizen grievance system
    - Add/Modify

3.6.2 Functional Requirements – Municipal ERP

- Accounts, Budget, Investments and Planning
- Asset, Land and real estate Management
- Project or Works Management
- Procurement and Materials Management, and

- Human Resource, Payroll & Employee Self service
- Document Management System
- Add/modify

3.6.3 General Requirements

The Modules specified shall be developed based on approved requirements. Apart from above, if some services are already developed/under development phase by the specific department, such services shall be integrated with the ICCC System. These services shall be processed through department specific applications in the backend.

The user of e-Governance services should be given a choice to interact with the system in the local language in addition to English.

The application should provision for uniform user experience across the multilingual functionality covering following aspects:

- Front end web portal in English and local language
- E-forms (Labels & Data entry in local languages). Data entry should be provided preferably using the Enhanced In script standard (based on Unicode version 6.0 or later) keyboard layout with option for floating keyboard.
- Storage of entered data in local language using UNICODE (version 6.0 or later) encoding standard.
- Retrieval & display in local language across all user interfaces, forms and reports with all browsers compliant with Unicode version 6.0 and above.
- Facility for bilingual printing (English and the local language)

Application should have a generic workflow engine for citizen centric services. This generic workflow engine will allow easy creation of workflow for new services.

At the minimum, the workflow engine should have the following features:

- Feature to use the master data for the auto-populating the forms and dropdowns
- Creation of application form, by “drag & drop” feature using meta data standards
- Defining the workflow for the approval of the form
- First in First out
- Defining a citizen charter/delivery of service in a time bound manner
- Creation of the “output” of the service, i.e., Certificate, Order etc.
- Automatic reports of compliance to citizen charter on delivery of services
- Delay reports

The e-governance application should have a module for management of digital signature including issuance, renewal and suspension of digital signatures based on the administrative decisions taken by the city.

Bidders shall ensure using Digital signatures/e-authentication (Aadhar Based) to authenticate approvals of service requests etc.

<<Cities may add more conditions to encourage MSIs to propose Superior, Proven solutions>>

3.7 Technical Requirements:

[The Authority may include the component specific technical requirement here which are vendor/ technology agnostic]

Note: 1. The response should be descriptive and cross referenced.

Note: 2. Mentioning response as Yes/No/Not applicable (NA) will be treated as non-compliance to the clause /specific requirements.

S.No.	Technical requirement	Bidder response (How the functionality will be met?)
1		
..n		

Note:

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The MSI is required to provide supporting document in the technical bid justifying the approach & design of offering the solution. The technical marking is specified in the evaluation criteria mentioned in the volume 1 of the RFP document.

3.8 Bill of Quantities

[To be derived from Detail Project Report Prepared by Smart Cities technical experts]

As per Format given in Annexure A.2.14, A.2.15 and Annexure A.3.2 of Volume I of the RFP.

4- Smart Street Lighting

4.1 Overview

As part of the core urban infrastructure and to create a safe environment for pedestrians and drivers alike, the cities have been implementing Street lighting systems as a key public service for citizens' safety.

Intelligent street lighting refers to public street lighting that adapts to movement by pedestrians, cyclists and cars. Intelligent street lighting, also referred to as adaptive street lighting, dims when no activity is detected, but brightens when movement is detected.

Traditional street lighting systems lead to higher energy consumption and increased maintenance costs. Accordingly, in order to have a long-term sustenance, it is prudent to implement latest energy efficient smart street lighting system. Smart lighting system is different from traditional, stationary illumination, or dimmable street lighting that dims at pre-determined times.

Street lights will play an essential role in creating smarter and more efficient cities. The main aim of a new smart street lighting system is to control energy efficient LED street lights to turn on only when needed and to remain in a dim state otherwise. The system integrates technologies such as: Passive Infrared (PIR) sensor, ZigBee wireless network and dimmable LEDs.

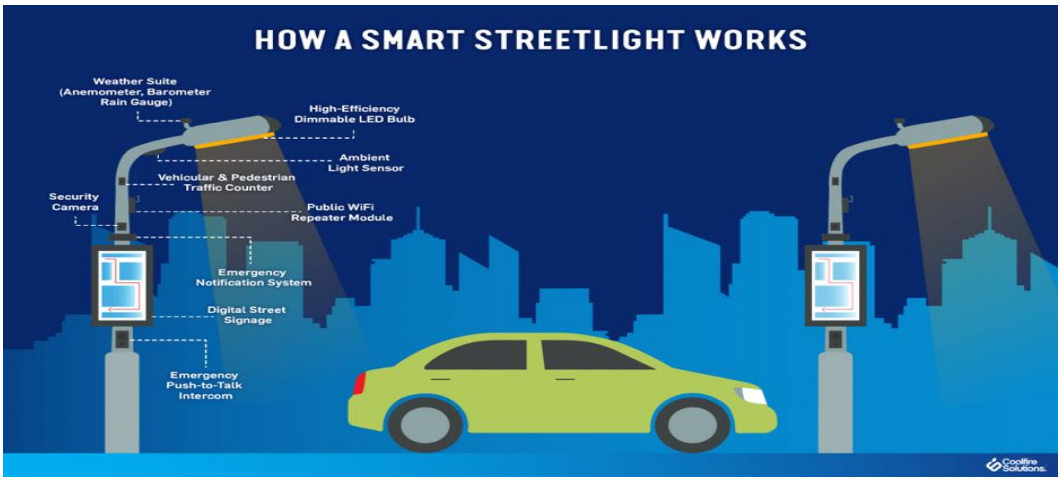

Figure: 1 (ILLUSTRATIVE) This diagram is only one of the representations and does not suggest any architecture or design choices to realize the solution.

4.2 Key Issues

Currently, existing traditional streetlight system is facing issues like-

- Lack of information about the real time status of the streetlights and area.
- Lack of proper system for monitoring and operating lights ON/OFF schedule
- Lack of system to optimize the efficiency of streetlight system as per requirement
- Managing independent unit of streetlight in terms of turning ON/OFF, fault detection & replacement.

- Lack of system to enhance security by lighting dark areas in human presence.
- Lack of centralized system to view energy consumption, current light status and real time map-based visualization
- Lack of system to get inputs from other sources to customize control.
- High energy consumption which results in high amount of generated energy.
- Maintenance of the traditional streetlight system is comparatively difficult.

The Authority intends to implement an energy efficient LED based Street Light System bundled with motion & ambient light sensors along with Smart controllers within the existing landscape to:

- Operate the streetlights in three states (Dual DIM/Bright/Off) automatically as per the real time field requirement.
- Automated controls that make adjustments based on conditions such as occupancy or daylight availability.
- Policy driven central controlling mechanism to regulate the street lighting intensity and energy consumption.
- Real time tracking and management of street lights.
- Automatic illumination adjustment based on human presence by triggering multiple lamps to surround the person with a safe circle of light.
- Automatic status updates or failure alerts to remote servers.
- Learn the existing occupancy pattern and predict occupancy patterns for future planning
- Detect failures of LED bulbs and other circuitry and generate alarms for maintenance automatically
- Enhance security by lighting dark areas in human presence Intelligent weather adaptive lighting control
- Crowd sourcing or defective light reporting.

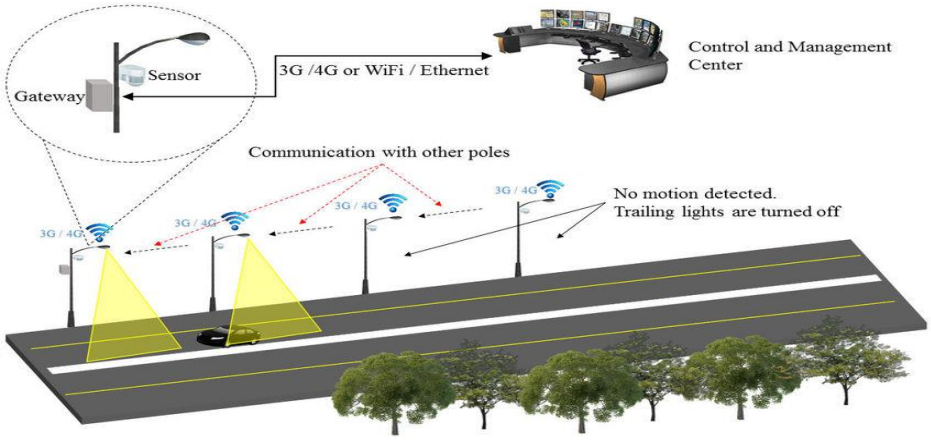

Figure 2 : Working of Smart Street Lights (ILLUSTRATIVE). This diagram is only one of the representations and does not suggest any architecture or design choices to realize the solution.

4.3 As-IS Analysis

4.3.1 City Streetlight Management process

[Current Processes from situational analysis, data collection and advanced analysis viewpoint.]

4.3.2 Current Organization Setup

[List the setup]

4.3.3 Current Technology being used, IT System in operation and Vendor Ecosystem

- Total No. of Traditional Street Lights: [ ]
- Total No. of High Masts with LED – [ ] lights
- Total No. of LED Street Lights – [ ]
- Total length of the street to be covered - [ ]

4.3.4 Activities which are outsourced and reason of outsourcing

Out of these total streetlights, [No. of streetlights to be covered under this project] streetlights are under the scope of work for Smart Light System. MSI will install Smart Warm LED luminaries with individual controller on smart street light poles to remotely on/off and monitoring of these LEDs. The scope includes:

- LED based Smart lighting fixtures with all fittings & fixtures (Motion & Ambient light sensors).
- Smart Controllers mechanism.
- Network connectivity for streetlight poles, high masts, controllers and integration city operation center.

MSI shall provide the replacement of all defective LED luminaries and other equipment's related to LED luminaries free of cost during the contract period.

4.4 Indicative Key Outcomes and KPIs

- Predict the Lumens level based on ambient light
- Set the Dynamic Lighting Policy based on predicted Lumen level to reduce the energy consumption of the Lights and thereby saving on the electricity cost for the [city].
- Provide location/status of Street Lights, Control Street Lights status.
- Identify any abnormalities in the Light sensors and provide alerts to ICCC for proactive maintenance of the sensors before the sensors breakdown.
- Percentage of households with authorized electrical service.
- Percentage of electrical connections covered through smart meters.
- Average number of electrical interruptions per year.

- Average length of electrical interruptions per year.
- Percentage of total energy derived from renewable sources.
- Energy consumption per unit - street lighting
- Percentage of new and redeveloped buildings following green building norms
- Total energy consumption per capita

4.5 Key components [Process Flow to be provided]

A typical smart street lighting system may consist of the following components-

- Smart LED Streetlight with in-built smart features like Daylight sensor, Remote connectivity with GPRS, Auto location with GPS, Astronomical Clock, Remote lighting management tool, and Micro Energy Meter
- Solar PV panels and Gel Battery integrated LED Streetlights in case of a standalone system
- Street light control panels placed at feeder level with feedback facility using GSM/GPRS/ETHERNET
- Lighting control management system- to convey number of fixtures ON/OFF status in group for the street lighting fixtures in a lighting circuit
- Software platform- cloud-based web application to allow the user/customer to manage street lights & analyze lighting data remotely over secured access on web browser from any location and any secured laptop/computer device with active internet connection
- Security features for Smart LED Street Lighting Control with strong password and 2-factor authentication for login to smart lighting management software

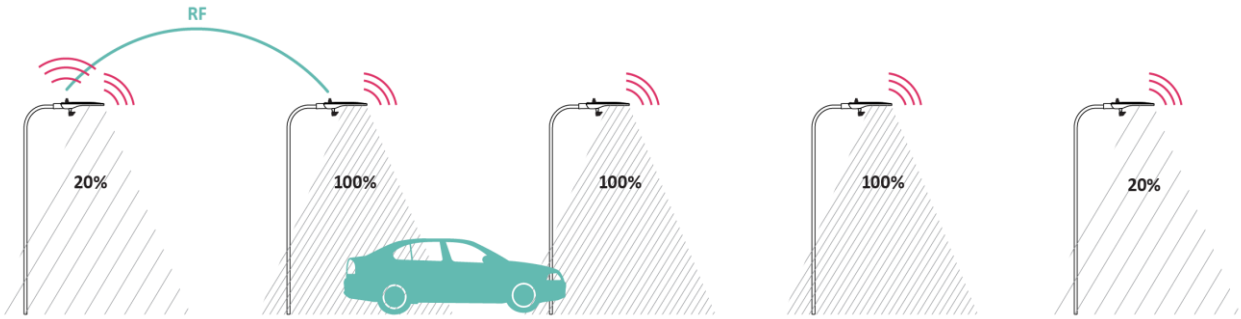

Figure 3: Energy Consumption Diagram (ILLUSTRATIVE). This diagram is only one of the representations and does not suggest any architecture or design choices to realize the solution.

4.6 Functional Requirements

4.6.1 Smart Lighting Operation Management System

- Individual switch on/off, increase/decrease luminosity as per ground situation

- Policy based Operation example: set up policies like light up alternate lights during low traffic density, increase the luminosity of the lights as per time of the day, ambient lighting conditions., enhance security by lighting dark areas in human presence, time-based scheduling with intelligent weather adaptive lighting control.
- Real time status of the Smart Lighting System on a city GIS map.
- Automatically switched on /off on the basis of lux level. There should be a manual override and it should be monitored when used.
- Amount of electricity used in street lighting. There should be information about the amount of natural lux levels and that created by the streetlights on a 24 X 7 basis. This analysis would help the Authority for allocating the amount of power required for streetlights. The same analysis would also be used for changing the source of power to solar power in future.
- Lux levels along with cameras on the street as well as capacity management report to help analyze if any Light has fused before time (before burn hours as specified in the supplier's documentation.)
- Learning occupancy pattern and predict occupancy state for future planning. SLA management and security, audit compliance.
- Smart Warm LED luminaries with individual controller on smart streetlight poles to remotely on/off and monitoring of these LEDs.
- Monitor voltage, current, voltage fluctuation, power consumption for each individual light as well as a group of lights and city areas.
- Detect failures of LED bulbs and other circuitry and generate alarms for maintenance automatically.
- Enhance security by lighting dark areas in human presence Intelligent weather adaptive lighting control.
- Learn occupancy pattern and predict the occupancy patterns for future planning.
- Crowd sourcing or defective light reporting.

4.7 Technical Requirements:

[The Authority may include the component specific technical requirement here which are vendor/ technology agnostic]

Note: 1. The response should be descriptive and cross referenced.

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4.8 Bill of Quantities

[To be derived from Detail Project Report Prepared by Smart Cities technical experts]

As per Format given in Annexure A.2.14, A.2.15 and Annexure A.3.2 of Volume I of the RFP.

5- Intelligent Public Transport Management

5.1 Overview

Safe and smooth travel is an indicator of quality of life in a Smart City. Transportation is one of the major challenges in many of the Indian cities because of lack of public transport facility in compare to travel demand, inadequate capacity of existing public transportation, road safety concerns, overcrowded road network, poor traffic management, parking issues, poor road conditions, lack of non-motorized transport system and safe walkways for pedestrians. Most cities also lack integrated transportation plans leading to huge demand-supply gap and poor transportation networks.

Urbanization, population growth, climate change and dwindling resources put increasing pressure on infrastructure systems worldwide. Infrastructure operators are looking for intelligent solutions to respond to these challenges.

Through IT and automation, we can help to reap the full potential of urban infrastructure. The idea is to build intelligent transportation management capabilities within {CITY_NAME} that will help optimize existing infrastructure, increase efficiency, reduce operation costs, improve safety and resiliency, and reduce environmental burdens.

A holistic intelligent Public Transport system needs to meet the following requirement of a city:

1. Understanding the travel demand of people and freight through various modes of transportation.
2. Integrated Transit management system, including planning for multimodal transport connectivity till last mile.
3. Planning Non-Motorized Transport.
4. The management of payments that involve transport-associated activities.
5. Energy reduction for urban sustainability.
6. Integration of parking places.
7. Electric vehicle charging stations.
8. Adopting Vision Zero to reduce road accidents
9. Developing Smart Biking facilities
10. Pedestrian security
11. Disabled friendly transportation system.

The broad objective of the Smart Transport system is to enhance operational efficiency, to support decision making.

5.2 Key Issues

- Easy access to passengers
- Passengers feeling secured, when riding the transport

- Cleanliness and regular maintenance of the buses
- Simplified Payment
- Security (both IT and Infrastructure security) – On the move and while at the depot.

5.3 AS-IS Analysis

[City to provide sufficient information covering entire value chain]

5.3.1 City Public Transportation Management process

[Current Processes from situational analysis, data collection and advanced analysis viewpoint.]

5.3.2 Current organization Setup

[List the setup]

5.3.3 Current Technology being used, IT System in operation and Vendor Ecosystem

[Provide brief details]

5.3.4 Activities which are outsourced and reason of outsourcing

[List the activities]

5.4 Indicative Key Outcomes and KPIs

- Geographical coverage of public transport
- Availability of public transport
- Mode share of public transport
- Percentage of road network with dedicated bicycle tracks
- Percentage of interchanges with bicycle parking facilities
- Mode share of non-motorized transport
- Availability of Passenger Information System
- Availability of paid parking spaces
- Availability of EV charging units
- Percentage coverage of footpaths – wider than 1.2 m
- Percentage of traffic intersections with pedestrian crossing facilities
- Extent to which universal accessibility is incorporated in public rights-of-way
    - Information available to public Continuity of public transport Services% change in peak hour journey time along routes where IPTS has been implemented
    - Public Transport journey time reliability – deviation from scheduled timetable

- Improve Environmental Impacts
    - Change in CO2 emissions per vehicle km
    - Percentage of interchanges with bicycle parking facilities
    - Change in number of hours where NOx levels are above threshold
    - Change in PM10 emissions per vehicle km
    - Change in number of hours where transport noise is above dB threshold
    - Number and utilization of EV stations
- Cities to add/modify as per city objective

5.5 Key Components [Process Flow to be provided]

The Key components include Computer Aided Dispatch / Automated Vehicle Location System (CAD/AVL) for tracking, monitoring & dispatch functions for selected vehicles and resources (staff), Automated Fare Collection System, Passenger Information System (PIS), Depot Management System

Vehicle Tracking: The Automated Vehicle Location System (AVLS) shall primarily use GPS based location tracking devices mounted on the vehicle as primary source of data for tracking purposes. The location and associated data acquired from the vehicle units shall act as input source for tracking and operations process management required by user executing their specific functions. The AVLS system shall enable Authority operations team to monitor vehicle movement in real-time and synthesize the AVL field data to deliver the same on the public information system devices installed on Bus stations, Terminals, Buses, Authority customer portal, mobile information delivery system in case of public transit application. The AVL data from vehicles other than the transit vehicles shall be delivered to individual process owners within Authority for further use and processing based on the requirements identified for individual departments.

The backend tracking system should be AIS-140 (Automatic Industry Standards-140) compliant and the certification must be obtained from certifying agencies authorized by MoRTH for carrying out AIS-140 certification. The backend tracking platform should be integrated with VAHAN and ERSS.

Automated Fare Collection System: Automated fare collection system shall generally be a contactless, end-to-end solution for collecting fare payments and replacing traditional ticketing system with automated ticketing. It will comprise automatic gate machines, ticket vending machines, recharging terminals, and ticket checking machines. This system will facilitate efficiency in fare collection, improves the overall transaction rate, and saves extensive amount of time, thereby, minimizing waiting time in queues and searching for cash to buy tickets. In addition, it shall be an easy method for revenue collection and may offer travellers to carry one card to use for all transit modes.

Passenger Information System (PIS): The passenger information system shall be a very important exponent of Transit Management System and render a very important consumer facing service. Accurate and timely transit information delivery shall enable consumer trust on public transport service and also aid modal shift in the long term, as the reliability and availability becomes evident to the users.

The passenger information system shall be an integrated service which shall utilize tracking data from vehicles which is centrally processed for the purpose of arrival and departure time estimation. The system shall deliver ETA/ETD information on schedule or request basis depending on the type of end point application or device. The system shall deliver ETA / ETD to fixed display devices installed on bus stations at a set frequency or on bus movement basis.

Integrated Depot Management system: This module shall enable to automate depot Operations, which include workshop management, fuel management, traffic management, vehicle management, and so on. The module shall also cover administrative activities and stores requirement.

5.6 Functional Requirements

Vehicle Side

1. Process oversight by tracking of vehicles and reporting non-compliant actions
2. Streamlining business processes through automation, integration and workflows.
3. Improve emergency response times by integrating vehicle locations with local traffic conditions.
4. Enhance decision making by
    - Enhancing reporting capabilities;
    - Incorporating processes based on best practices
5. Providing central level reporting requirement compliance (reporting requirement to be provided at design and documentation stage)
6. Infrastructure Management System on the buses –
   The devices like OBU, Display boards and RFID readers should be registered in the ICCC. The same devices should be mapped to vehicles and locations. All this data should also go to the "CMDB". Working status of the devices are to be made available in the system.
7. Some additional business requirements, specific to transit agency, include:
    - Enhance efficiencies of staff
    - Reducing the need for redundant data entry
    - Improve and provide necessary reports and access to data through inquiry or drill down capabilities and auditing

Depot Side

1. Improve Vehicle Maintenance: By providing systematic planning for vehicle, the maintenance will cut down the vehicle idle time for non- operational buses/ferries, vehicle routine maintenance, breakdown ratio shall come down, automated alert for maintenance, vehicle on time departure from depot, easy to check vehicle in/out status according to schedule time, vehicle transfer between depots/divisions in the future.
2. Improve Scheduling and Planning: Having vehicle allotment for the scheduling shall be easy, crew and vehicle assignment shall be once in the system, if any changes required system shall

allow them to update the changes, schedule cancellation or new schedule allocation. This reduces frequent manual intervention and error free operation.

3. Improve Information Accuracy: Store module shall have history of stock, material forecasting, accurate information of spare parts, warranty details, spare tracking provides accurate information.

Mobile Application and Web Portal for smart transport

The solution shall have a mobile application and a web portal to help the passengers to get information about the buses, search and view bus schedules on various routes and deliver ETA based on their real time location.

- Real-time bus/ferry tracking system
- Complete information on bus/ferry routes and stops to commuters
- Real-time ETA for a combination of bus/ferry route and stop
- Real-time tracking for the bus/ferry on the map
- Mobile Application for Android mobile devices
- System shall show the time table of the buses/ferries, fare structure etc.
- Purchase of Tickets by making online payment

5.7 Technical Requirements

[The Authority may include the component specific technical requirement here which are vendor/ technology agnostic]

Note: 1. The response should be descriptive and cross referenced.

Note: 2. Mentioning response as Yes/No/Not applicable (NA) will be treated as non-compliance to the clause /specific requirements.

S.No.	Technical requirement	Bidder response (How the functionality will be met?)
1		
..n		

Note:

The functional requirements and technical specifications provided in this RFP are indicative and carry guiding rule. The MSI is free to offer products and solutions which meet requirements of the RFP focusing on the outcome, future scalability, security, reliability and adherence to specified SLA under this RFP, in line with applicable standards & best practices adopted in the industry.

The MSI is encouraged to design an Optimized solution which is technically superior, innovative, proven, better in terms of functionality and is cost effective. Any specified parameters mentioned in the scope/technical requirement in the RFP may be considered if it is required for meeting current

& future requirements during the contract period. The MSI is fully responsible for the specified outcome to be achieved.

The MSI is required to provide supporting document in the technical bid justifying the approach & design of offering the solution. The technical marking is specified in the evaluation criteria mentioned in the volume 1 of the RFP document.

5.8 Bill of Quantities

[To be derived from Detail Project Report Prepared by Smart Cities technical experts]

As per Format given in Annexure A.2.14, A.2.15 and Annexure A.3.2 of Volume I of the RFP.

6- Environmental Management

6.1 Overview

Environmental pollution, particularly of the air, is nowadays a major problem that unknowingly affects lives in the cities. Air Pollution is defined as the presence of contaminants or pollutant substances in the air that Interfere with human health or welfare, or produce other harmful environmental effects and it is important that the citizens know of the air that they breathe.

{CITY_NAME} Citizens & visitors to City can enjoy unique experiences that keep them feeling good by knowing city's environment condition at different locations.

Environmental Management solutions can be used to determine the quality of air (And water, SWM, Energy,) and the environmental parameters to enable a deeper understanding of the polluting sources like vehicles, industries, construction or natural reasons etc.

It is recommended to deploy Environment Sensing Units spread across a region, to create a larger data pool leading to better understanding of spatial and temporal trends in air pollution to take measures for corrective actions.

6.2 Key Issues

Rapid urbanization, which strains basic infrastructure, coupled with more frequent and extreme weather events linked to global climate change is exacerbating the impact of environmental threats. Common environmental threats include flooding, tropical cyclones (to which coastal cities are particularly vulnerable), heat waves and epidemics.

Owing to the physical and population density of cities, such threats often result in both devastating financial loss and deaths. Making cities more resilient against these environmental threats is one of the biggest challenges faced by city authorities and requires urgent attention.

6.3 AS-IS Analysis

[City to provide sufficient information covering entire value chain]

6.3.1 City Environmental Management process

Current Processes from situational analysis, data collection and advanced analysis viewpoint. (includes epidemic management steps here too)

6.3.2 Current Organization Setup

[List the setup]

6.3.3 Current Technology being used, IT System in operation and Vendor Ecosystem

[Provide brief details]

6.3.4 Activities which are outsourced and reason of outsourcing

[List the activities]

6.4 Indicative Key Outcomes and KPIs

- Improved monitoring of city environmental parameters
    - Temperature, Humidity
    - Ambient Light
    - Level of Noise Pollution
    - CO, NO2
    - Mosquito density
    - Water quality of public surface water bodies
    - City to add/ update based on city objective
- Improved communication with citizens through other city solutions like City App, PA system, ECB etc. based on city environmental parameters
- Improved management of pandemic situations in the city

6.5 Key components [Process Flow to be provided]

A typical Environment Management solution may consist of the following components. One may not need all of these or may be even more than these based on the technology and design used.

- Sensors to measure the pollutants and other environmental parameters
- Electronic displays to communicate the measured levels to the citizens
- IoT gateways, network switches, copper, fiber optic or wireless connectivity to interconnect the local system components and also to the datacenter/cloud.
- Desktop application for administration, operation and service/repair.

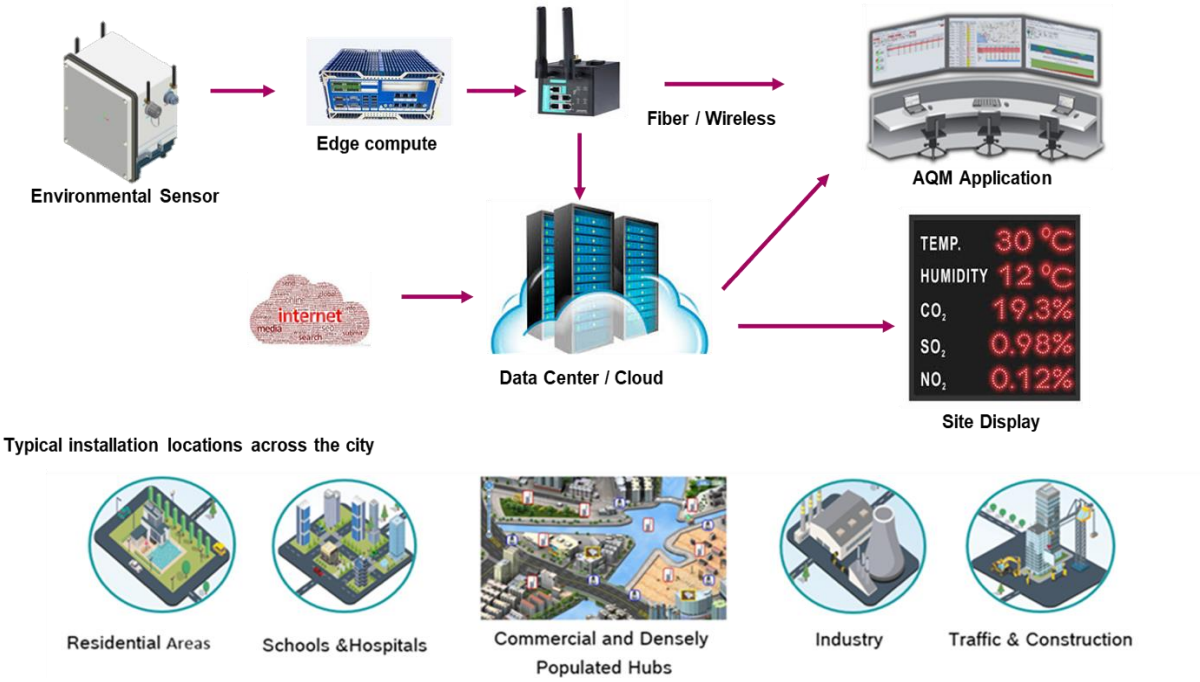

Figure 1: This diagram is only one of the representations and does not suggest any architecture or design choices to realize the solution.

6.6 Functional Requirements

The MSI shall;

a) Install environment sensors (as per the functional requirement) to display environment related information at various strategic locations through variable message display (VMD) system.

b) The environment sensors shall be integrated with the ICCC to capture and display/ provide feed on Temperature, Humidity, Pollutants like So[X], No[X], Co[X], PM2.5, PM10, Noise Pollution, etc. The data it collects should be location-marked.

c) Various environment sensors should sense the prevailing environment conditions and send the data to the ICCC where real time data resides and the same shall be made available to various other departments and applications for decision making.

d) This information should be relayed instantaneously to signage – large, clear, digital-display screens which let citizens know regarding the prevalent environmental conditions.

e) Environmental sensors recorded data shall be used by Smart Environment Mobile application to enable user for alarm management and notification of environmental details on real time basis.

f) Mobile app should be developed for Grievance Redressal of Citizen – where citizen can take the picture, upload the same with Geo Tagging. The complaint should be automatically forwarded to the respective staff, with escalation within specified timelines supported with multilingual text to speech, speech to text and speech to speech systems.

g) The system should provide ability to ;

i. View Air Quality Index across city, levels of various constituents (CO, CO2,SO2,NO2, PM10) etc.

ii. Correlate the data emanating from various Environmental sensors in different areas of city with respect to city mobility/traffic

iii. Communicate the levels of AQI and Noise in locality to citizens, businesses and industry on daily basis

iv. View the hotspots across various areas in city where high noise cases are reported by citizens

v. Predict the poor quality of air and water on various dimensions like timelines, seasons where there is high density of markets, industry or shops.

vi. Spread awareness at chronic location/spots identified over VMD, website, mobile app, WhatsApp etc.

vii. Allocate and monitor noise complaint to the on-field squad to take intervention as per defined SoPs.

viii. View the heat-map of noise pollution over different dimensions

ix. Educate the masses using bulk SMS, email and messages about best practices

x. Send the aggregated data of AQI and Noise to concerned authority to address the problems through policy.

xi. Address the noise issue by issuing advisory to local businesses, marriage gardens etc.

xii. View hospitals and staff/beds/medicine availability in real time.

xiii. Provide City wide Hot-Spot Analysis based on lab reports.

xiv. Correlate cause like the impact of water quality, air quality, stress on diseases reported at primary, secondary and tertiary care.

xv. Do the predictive analytics over the past data to predict the outbreak of disease in community

xvi. Coordinate with Hospitals, Labs and on-field staff in real time using handheld devices etc. Ability to coordinate with Hospitals, Labs and on-field staff in real time using handheld devices etc.

xvii. View heat-map of different diseases on different dimensions over city maps

xviii. Provide awareness drive for citizens in targeted areas through email, SMS, WhatsApp, VMD etc. as per preventive healthcare SoPs

xix. Coordinate with Sanitation Department and other line department to take corrective action.

The Sensors should be ruggedized to be deployed in open air areas on streets and park . They should be able to read and report at least the following parameters

- Temperature, Humidity
- Ambient Light, Sound
- CO, NO2
- Mosquito density

6.7 Technical Requirements

[The Authority may include the component specific technical requirement here which are vendor/ technology agnostic]

Note: 1. The response should be descriptive and cross referenced.

Note: 2. Mentioning response as Yes/No/Not applicable (NA) will be treated as non-compliance to the clause /specific requirements.

S.No.	Technical requirement	Bidder response (How the functionality will be met?)
1		
..n		

Note:

The functional requirements and technical specifications provided in this RFP are indicative and carry guiding rule. The MSI is free to offer products and solutions which meet requirements of the RFP focusing on the outcome, future scalability, security, reliability and adherence to specified SLA under this RFP, in line with applicable standards & best practices adopted in the industry.

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The MSI is required to provide supporting document in the technical bid justifying the approach & design of offering the solution. The technical marking is specified in the evaluation criteria mentioned in the volume 1 of the RFP document.

6.8 Bill of Quantities

[To be derived from Detail Project Report Prepared by Smart Cities technical experts]

As per Format given in Annexure A.2.14, A.2.15 and Annexure A.3.2 of Volume I of the RFP.

7- Smart Traffic Management

7.1 Overview

Towns and cities are facing traffic-related challenges, from improving safety, to addressing mobility-related emissions and reversing levels of congestion. Congestion is one of the most prevalent transport challenges in large urban agglomerations. Pollution, including noise generated by circulation, has become an impediment to the quality of life and even the health of urban populations. Further, energy consumption by urban transportation has dramatically increased, and so the dependency on petroleum.

7.2 Key Issues

The main challenges of Traffic Management in urban ecosystem are as follows:

- Traffic congestion and parking difficulties.
- Longer commuting
- Public transport inadequacy
- Difficulties for non-motorized transport
- Loss of public space
- High infrastructure maintenance costs
- Environmental impacts and energy consumption.
- Accidents and safety

7.3 AS-IS Analysis

[City to provide sufficient information covering entire value chain]

7.3.1 City Traffic Management process

[Current Processes from situational analysis, data collection and advanced analysis viewpoint.]

7.3.2 Current Organization Setup

[List the setup]

7.3.3 Current Technology being used, IT System in operation and Vendor Ecosystem

[Provide brief details]

7.3.4 Activities which are outsourced and reason of outsourcing

[List the activities]

7.4 Indicative Key Outcomes and KPIs

- Reduction in stoppage time
- Optimized cycle times of intersection to regulate and maintain free flow of traffic to enhance the efficiency of the road and transport infrastructure.
- Extent of signal synchronization
- Increased Travel Speed
- Improve Traffic Services: The traffic services to the public can be improved through the user-friendly presentation of the various traffic information in real time.
- Higher Productivity: Achieving improvement in the productivity, logistics and other economic activities by obtaining the precise-real time information on transport due to the availability of data on traffic flow in key areas of the city.
- Real Time Information and Response: The real time information at the control room shall enable the operator to take necessary actions based on the real time information, arranging alternate route to VIP convoys, diverting the traffic to different routes etc.
- Improved and accurate Traffic violation detection for the following traffic rules violations:
- Red Light Violation Detection
- Speed Violation Detection
- Free Left Blocking Violation Detection
- No Helmet Detection
- Triple Ride Detection
- No Seatbelt Detection
- Driver Talking on Phone while Driving
- Improved Traffic Related Emergency Notification and Personal Security
- % emergency vehicle dispatches facilitated by ICCC or Dial 100 or Dial 108
- % urban intersections providing safety enhancements for pedestrians and disabled or other vulnerable road users
- Traffic-related fatality per lakh population (livability index)
- Change in number of all reported accidents per vehicle km
- Change in severity of accidents (i.e., numbers killed or serious injured) per number of accidents reported
- Change in crime reports relating to illegal parking
- Improve Environmental Impacts
- Change in CO2 emissions per vehicle km

- Percentage of interchanges with bicycle parking facilities
- Change in number of hours where NOx levels are above threshold
- Change in PM10 emissions per vehicle km
- Change in number of hours where transport noise is above dB threshold
- Add/modify

7.5 Key components (Process Flow to be provided)

a) Automatic Number Plate Recognition (ANPR)

b) Red Light Violation Detection (RLVD)

c) Speed Violation Detection (SVD)

d) Vehicle Detector

e) Adaptive Traffic Control System (ATCS)

f) Traffic Analytics

g) e-Challan

h) Video Management & Operator Functions

7.6 Functional Requirements

[Note: 1. The response should be descriptive and cross referenced.

Note: 2. Mentioning response as Yes/No/Not applicable (NA) will be treated as non-compliance to the clause /specific requirements**]**

General

- The system should support centralized or decentralized architecture.
- The system should support all databases.
- The system should support virtual computing environment and should support virtualization platforms on all popular operating systems.
- The system should allow the operator to set the effective timing of the various applications such as Red Light, Speed, ANPR during the day.
- The system should have published APIs to interface with external systems such as Command and Control Application, Incident Management System, Intelligent Transportation Management System etc.
- The system should have integration with the e-Challan Management System or should have facility to generate the challan using Challan generation software.
- It should offer the functionality to the operator to generate e-Challans automatically or manually.

- The system shall be able to export all violation data captured including snapshots to the Challan Generation software being used by the state police / transport department, for further processing.
- The system should have the capability to integrate with the VAHAN / SARATHI system to fetch vehicle related details as required and as made available by the VAHAN / SARATHI system.

7.6.1 Automatic Number Plate Recognition (ANPR)

- The System should automatically detect a vehicle in the camera view using video detection and activate license plate recognition.
- The System should automatically detect the license plate in the captured video feed in real-time and the system should perform Optical Character Recognition (OCR) of the license plate characters.
- System should be able to detect and recognize the English alpha numeric license plate in standard fonts and formats for classes of vehicles such as cars, Heavy Commercial Vehicles, Three Wheelers and Two Wheelers.
- The system should capture standard vehicle's number plates with an accuracy of at least 80% at day time and at least with an accuracy of 70% at night time.
- The System should store JPEG image of vehicle and license plate and enter the license plate number into the database along with the date, time stamp and site location details.
- The system should detect the color of all the vehicles on best effort basis, in the camera view during daytime and label them as per the predefined list of configured system colours. The system should store the color information of each vehicle along with the license plate information for each transaction in the database.
- The system should identify the category of the vehicle such as cars, Heavy Commercial Vehicles, Three Wheelers and Two Wheelers and should store this information along with the license plate information for each transaction in the database.
- The system should have an option to store certain license plates of vehicles which are stolen or suspicious. The system should have the functionality to enter such license plate numbers to lists such as "Wanted", "Suspicious", "Stolen" termed as hot lists of vehicles. The system should allow the user to import the vehicle license plate data in the hot lists stored in Excel sheets for batch operation.
- The system should generate an automatic alert in the ICCC, when it detects the vehicle from the hot list/s through the ANPR camera. The system should give an instant alert in such case. The system should also have the functionality to send the alert via email and SMS to designated email addresses and mobile phone numbers.
- The system should allow the operator to change the hot list category of the vehicle and accordingly the new hot list category should be reflected in the records stored in the

database. E.g., on retrieval of stolen vehicle, system entry should be changed from "Stolen" to "Retrieved".

- The system should be able to store license plates numbers of at least ……. suspected vehicles at a time and should generate an Alert if any one of the vehicles is found crossing the stop line (irrespective whether the signal is GREEN or RED) in form of Video popup at the Monitor and/or SMS on Cell phones.
- The system should have the functionality to trace the movement of a vehicle of interest on GIS Map. The Function should show the trajectory of the vehicle drawn on the map. The vehicle of interest should be tracked for all the junctions where it is detected through ANPR.
- The system should give an option to the operator to edit the license plate number of the vehicle. The system should show the license plate of the vehicle in a zoomed window for easy inspection of the license plate number. The system should keep audit trail of any license plate number edited by the operator.
- The system should have function of quickly searching the number plate based on the following criteria:
    - full or partial number of the license plate,
    - color of the vehicle,
    - classification of vehicle,
    - Junction Name
    - Event Type (e.g., ANPR, Red Light Violation, Speed Violation, etc.)
- The ANPR system should improve the number plate detection for up to 90 percent for four-wheeler vehicles with standard and non-standard number plates during the day and night time (with proper illumination / provision of IR light).
- The system should detect the vehicles with no license plate and should raise an alert along with the video and snapshots of the vehicle.
- The system should allow the operator to set traffic rule such as “no heavy vehicles during certain time of the day” for selected traffic junctions. The system should identify the heavy vehicles and generate an alert in case the vehicle is violating the rule within the configured time.

7.6.2 Red Light Violation Detection (RLVD)

- The system should capture the License Plate of the vehicles violating the red light or stop line when the signal is Red.
- The system should have provisions to either detect red light status by taking the signal feed from the traffic signal controller or by video analytics by recording the evidence snap showing the violating vehicle and the traffic signal status.
- The system should have an in-built tool to facilitate the operator to compose detailed evidence by stitching video clips from any IP camera in the junction (including but not limited

to the red-light violation detection camera, evidence camera), and any other surveillance cameras in the vicinity of the spot of incidence.

- The system should have the functionality export the violation evidence with water mark and encryption as per the techno-legal requirements.
- The system should synchronize the evidence camera, license plate recognition camera and store the record in database with License plate image, image of the vehicle, and at least five snaps showing clearly that the vehicle is crossing the red light / stop line while the signal is RED. This event should be corroborated with the video clip archived in the VMS system at the ICCC. It should be possible to intimate the incidence in real time through SMS to the designated mobile phone.
- The system should allow mapping of multiple ANPR cameras to a single evidence camera associated with the traffic junction.
- The system should allow capturing multiple evidence snaps based on the time duration before, during and after the event.
- The system should allow restricting an operator to a single or multiple traffic junction/s and associated cameras.
- The system should have function to forward the generated alerts to designated email and mobile phone number.
- The System should also record the video of all the cameras/selected cameras using a predefined and user configurable schedule. The recorded video can be searched using the following filters:
    - Appearance of a particular license plate.
    - When the signal is RED
    - When the signal is GREEN
    - During any given date-time span
- The system should generate alert when the signal light doesn't change for the pre-configured duration. The system should allow the user to set minimum and maximum time for the signal light status change.

7.6.3 Speed Violation Detection (SVD)

- The system should be video based speed violation detection system and no other element like laser, radar, sensor and loop etc. to be used for speed detection.
- The offered system should be able to detect vehicle license plates along with speed violation detection for vehicles having speed in excess of …..KMPH (with suitable camera with required frame rate) with an accuracy of at least ±2KMPH as compared to conventional speed laser gun system. The system should generate an automatic alert in case of a speed violation.

- The technology should have been certified/tested by a reputed Indian test laboratory or institute under central government. Such certificate/test report should be submitted along with technical bid.
- The system should have the capability to classify the vehicle under categories such as car, three wheelers, two wheelers, heavy vehicle, etc.
- The system should allow the operator to set different speed limits for different categories of vehicles.
- The event window should show the video associated with the event. The window should also show at least five snapshots associated with the event.
- The system should allow the operator to flag the event for storing the event perennially.

7.6.4 Traffic Analytics

- The system should have the proven technology-based video analytics for intelligent traffic management applications such as:
    - No Helmet Detection System
    - Triple Ride and No Helmet Detection System
    - Free Left Blocking Detection
    - Object classification for detection of stray animals on the road
- The system should work on centralised and decentralised architecture.

No Helmet Detection

- System should have the capability to capture image of two-wheeler rider not wearing a helmet and should have automatic number plate recognition (ANPR) of the violating vehicle with auto-localization and OCR conversion. The system should have the capability to detect the 'no helmet' instance for the rider and pillion.
- The system should collectively identify and detect the motor bike, the rider and the pillion (if applicable), helmet for the rider and the pillion and the number plate. The system should be able to differentiate between a helmet and various other conditions such as the bald head, person covering the head with a cap or dupatta or pagree, or any other headgear.
- The system should be able to differentiate a person sitting on a motor bike and a pedestrian in the close proximity of the motor bike.
- The system should be able to detect the speed of the motor bike.
- On detection of No-Helmet, the system should generate events, store them and should allow retrieval of such events on need basis for later analysis.
- The system should be able to search and show the report of the No Helmet violations based on the day, time of the day, license plate number (partial or full), location name etc.
- System should have capability to identify and eliminate non-standard crash helmets like industrial safety helmets, sports helmets (cricket, cycling, etc) and mark them as invalid.

- System should integrate with challan generation software and RTO database to generate challans for No-Helmet violation event with details like violation image, time stamp, date, vehicle number.
- No- Helmet detection system should seamlessly integrate with traffic management systems like ANPR, RLVD, Speed Detection and should have unified user interface.

Triple Ride Detection

- The system should have the capability to detect the persons riding triple seat on the motor bike. The system should capture the number plate of the motor bike with ANPR and generate an alert with the evidence video.
- The system should be able to detect the No Helmet violation for persons riding in triple ride.

Free Left Blocking Violation Detection

- The system should detect the vehicle blocking the free left traffic wherever it is allowed.
- The system should capture the number plate of the vehicle blocking the free left traffic from the front side.
- The system should generate an automatic alert with the details of the vehicle blocking the traffic.

7.6.5 Adaptive Traffic Control System (ATCS)

- The ATCS should address typical Indian driving and traffic conditions such as poor lane discipline and high heterogeneity. The traffic signal controller should be ready for integrating with Vehicle priority system (Ref light enforcement system, and other similar applications). The software and hardware supplied should comply with applicable standards for interoperability and data sharing between different applications.
- Objective of the ATCS would be to minimize the stops and delays in a road network to decrease the travel time with the help of state-of-the-art technology.
- The adaptive traffic control system shall operate in real time with the capacity to calculate the optimal cycle times, effective green time ratios, and change intervals for all system traffic signal controllers connected to it.
- Identify the critical junction of a corridor or a region based on maximum traffic demand and saturation.
- The critical junction cycle time shall be used as the group cycle time i.e., cycle time common to all intersection in that corridor or region.
- Stage optimization to the best level of service shall be carried out based on the traffic demand.
- Cycle optimization shall be carried out by increasing or decreasing the common corridor cycle time based on the traffic demand within the constraints of Minimum and Maximum designed value of cycle time.

- Offset correction shall be carried out to minimize number of stops and delays along the corridor for the priority route. Offset deviation measured using distance and speed between successive intersections shall be corrected within 5 cycles at a tolerance of +/- 5 seconds maximum.
- The system shall have provision to configure priority for upstream signals as default. The ATCS software shall continuously check the traffic demand for upstream and downstream traffic and automatically suggest the priority route to the higher demand direction.
- Develop appropriate stage timing plans for each approach of every intersection under the ATCS, based on real time demand
- Propose timing plans to every intersection under the ATCS in every Cycle
- Verify the effectiveness of the proposed timing plans in every cycle
- Identify Priority routes
- Synchronize traffic in the Priority routes
- Manage and maintain communication with traffic signal controllers under ATCS
- Maintain database for time plan execution and system performance
- Maintain error logs and system logs
- Generate Reports on request
- Graphically present signal plan execution and traffic flow at the intersection on desktop
- Graphically present time-space diagram for selected corridors on desktop
- Graphically present network status on Desktop
- Make available the network status and report viewing on Web
- The ATCS shall generate standard and custom reports for planning and analysis. Report formats to be finalized during design stage.
- Shall provide a decision support tool for assessing strategies to minimize congestion, delays and emergency response time to events with real time traffic data fusion and control of traffic signaling infrastructure on ground.
- Shall calculate customizable Key Performance Indicators (KPI) to quickly assess the results
- Shall generate alerts to the operator that trigger on customizable conditions in the network
- Shall distribute both collected and calculated traffic information via a variety of communication protocols and channels, ensuring high interoperability degree and thus acting as a “traffic data and information hub”.
- Shall create a traffic data warehouse for all historic traffic information gathered from the hardware installed on the road network.
- Shall operate in real time that is continuously updating the estimates on the state of the network on the basis of data collected continuously over time.

- Shall operate the traffic lights with the adaptive traffic controls, based on the current and forecasted traffic demand and the current incidents, thus optimizing the green waves continuously throughout the network
- Enable a smart public transport priority respecting the delays for all road users at once with the adaptive signal controller
- Junctions with similar traffic patterns can be grouped flexibly into sections or sub- areas. The system shall allow group of compatible junctions to be linked and operated in a coordinated manner to optimize traffic operations in a real time basis. It shall be possible for the operator to lock junctions, sub-areas together causing them to operate on a common cycle length if desired
- Pedestrian zone scheme: The system shall allow individual signal groups to be switched on or off according to time of the day as required to facilitate for special pedestrian zone operation. Should be capable of pre-programmed in site configuration data being activated or de-activated by time scheduling. Should be capable of being activated by central system or at controller connected to the system
- Traffic adaptive control: The system shall be capable of utilizing inputs from the detectors to dynamically implement the most suitable cycle time, splits and offset to optimize traffic operations on the junction network on a real-time basis. The system shall be equipped with flexibility to handle partial or total failure of detectors in an appropriate and logical manner.
- A controller drop procedure shall be provided to safely transfer a controller from the central computer-controlled state to local control. The drop procedure shall allow for the drop of controller either in the total network, a section or an individual controller, as desired by the operator, both manually and through the activity scheduler. The drop could be planned or emergency situation.
- Traffic adaptive system green wave route pre-emption capability should not require special pre-emption hardware. Route pre-emption can be applied to a single junction or a series of junctions to allow emergency (fire/ambulance/VVIP) vehicles. The software shall be capable to simultaneous operation of two or more route pre-emption plans
- Communications Monitoring – The System shall monitor the status of the communication continuously and shall provide for the "recording" of all pertinent data for any specified controller into a disk file. The recorded data shall include the current time, second by second current operating information (e.g., timing plan data, etc.), and the current communications messages being transmitted and received between the control computer and the field control equipment. Once there is any lack of communication from any one of the local controllers, an alarm shall be raised to indicate that the controller is off-line or there is a communication alarm. An appropriate message shall be recorded in the System alarm and event log and fault databases
- System shall deliverable measurable performance for the important use-case for Adaptive traffic control system for the benefit of the end user.
- The system should be able to handle emergency priority routing on a consistent basis.

- Adaptive Traffic Control System shall offer traffic signal optimizing functionalities, use data from vehicle detectors and optimize traffic signal settings resulting improved vehicle delays and stops. The system shall also allow interconnecting individual area controllers and thus enabling traffic monitoring and regulating functionality from the central location. This shall allow each intersection controller to be monitored from central control for proper functionality. Any corrective action can be initiated either automatically based on status information or by an operator. The real time detection data shall be communicated to the ICCC by each controller.
- ATCS shall be driven central control system, on real time basis, with the capacity to calculate the optimal cycle times, effective green time ratios, and change intervals for all system traffic signal controllers connected to it which in turn can also work in configurable manner
- The system after update, creating or expanding database, including the addition of new junctions or deleting of existing junction should not require system reboot

Reports

System shall generate Corridor based and Intersection based reports. The application software shall generate the following reports, but not limited to the below. All the reports shall be possible for selected dates.

- Intersection based reports
- Stage Timing report – The report shall give details of time at which every stage change has taken place. The report shall show the stage sequence, stage timings and stage saturation of all stages of all cycles for a day.
- Cycle Timing report – The report shall give details of time at which every cycle has taken place. The report shall show the cycle sequence and cycle timings for all the cycles in a day.
- Stage switching report – The report shall give details of time at which a stage switching has taken place. The report shall show the stage sequence, stage timings and stage saturation for a day.
- Cycle Time switching report – The report shall give details of time at which a cycle switching has taken place. The report shall show the cycle sequence and cycle timings for the cycle in a day.
- Mode switching report – The report shall give details of the mode switching taken place on a day.
- Event Report - The report shall show events generated by the controller with date and time of event.
- Power on & down: The report shall show time when the master is switched on, and last working time of the master controller.
- Intensity Change – The report shall show the brightness of the signal lamp is changed according to the light intensity either manually through keypad or automatically by LDR with time stamp.

- Plan Change – The report shall show the time of change of plan either through remotely through a PC or Server.
- Time Update – The report shall show the time when the Master controller updated its time either manually or through remote server.
- Mode Change – The report shall show the time when Master controller's operating mode is changed either manually or a remote server. The typical modes are FIXED, FULL VA SPLIT, FULL VA CYCLE, FLASH, LAMP OFF and HURRY CALL.
- Lamp Status Report – The report shall show lamp failure report with date and time of failure, color of the lamp and associated phase
- Loop Failure Report –The report shall show the date and time of detector failure with detector number and associated phase.
- Corridor Performance Report – The report shall show the saturation of all the intersections in a corridor for every cycle executed for the corridor and the average corridor saturation for a day
- Corridor Cycle Time Report – The report shall show the Corridor cycle time, Intersection cycle time, Mode of operation and degree of saturation of all the intersections in a corridor for every cycle for a day

Graphical User Interface

The application software shall have the following Graphical User Interface (GUI) for user friendliness

- Network Status Display – This online display shall indicate with appropriate color coding on site map whether an intersection under the ATCS is online or off. On double clicking the intersection a link shall be activated for the traffic flow display for the intersection.
- Traffic Flow Display – This online display shall indicate the current traffic flow with animated arrows, mode of operation, stage number being executed and elapsed stage time.
- Saturation Snapshot – This display shall show the current saturation levels of all intersections in a corridor.
- Reports Printing/ Viewing – This link shall allow selection, viewing and printing of different reports available under ATCS
- Time-Space Diagram – The time-space diagram shall display the current stages being executed at every intersection in a corridor with immediate previous history.
- Junctions shall be plotted proportional to their distance on Y-axis and time elapsed for the stage in seconds on X-axis.
- Junction names shall be identified with each plot.
- Currently running stage and completed stages shall be identified with different colors.
- Stages identified for synchronization shall be shown in a different color.
- Speed lines shall be plotter for stages identified for synchronization to the nearest intersection in both directions.

- The system shall have other graphical interfaces for configuring the ATCS, as appropriate.

7.6.6 Video Management & Operator Functions

- The system should have built-in Video Management features for continuous recording of the traffic cameras. The system should have the following functionality:
    - Continuous recording of every lane video irrespective of presence of vehicle.
    - Such recording schedules can be continuous, event based, schedule based, trigger based etc.
    - Archive Search using dates, time, event etc.
    - High Availability/Redundancy of Recording & Database
- The system should have a single operator client for all ITMS related functions including video management functions and configuration of the system.
- The system should allow the operator to create continuous recording schedule for the camera based on the time of day and day of week. It should be possible to set the camera recording schedule for a single camera or a group of cameras or all cameras.
- The system should have the functionality to restrict the user to login from a specific workstation.
- The system should be able to show Live video in multiple matrix layout for all the cameras in the system in real time. At least 1x1, 2x2, 3x3, 1+5, 1+7 views must be supported. The system should have the function to enable multiple matrix layouts to appear on the screen with configurable on-screen duration for each matrix layout.
- The system should allow configuring cameras in multiple groups independently. It should be possible to assign all, single or multiple groups to operators. At least 100 such groups should be possible with unlimited number of cameras in each group. It should be possible to assign camera/s to single or multiple groups simultaneously.
- It should be possible to drag and drop cameras from the camera directory to the display screen.
- The system should allow creation of customised, layered maps using standard picture files and it should be possible to drag and drop the cameras on the map for easy navigation based on the location on the map. It should be possible to select any camera or group of cameras on the map for live viewing or archive viewing.
- The system should allow creation of events for any camera from the drop-down menu. Such an event, when stored, should be searchable based on the camera, time, and event type. It should be possible to write description about the event.
- The system should show event notification from the cameras on the map itself. The operator should be able to click on the event notification of a particular camera on the map and the system should open the event window on the operator screen.
- The system should integrate with online maps such as Google Maps, OpenStreetMap.

- The system should generate an alert when the total available storage drops below the configured threshold limit.
- The operator console should show icons for the quick understanding of the system health status related to camera status, junction server status, database server connection status and storage status. The respective icons should change the color when any of the system component has problems. The health status should have the following information in drill down report format:
    - System map showing all junction servers in the system. Clicking a junction server entry should lead to details of the junction server such as camera status, real time utilization of server resources such as cores, RAM and storage. Drilling further down, camera details should be available such as camera name, IP address, major and minor stream, real time bitrate and frames configured for analytics.
    - Storage Status showing central storage and all the network drives and utilization of the storage
    - All the users logged into the system with the time since login. It should be possible to force log-out the user, send a message to the user and mirroring the desktop of the user from the same screen.
    - Recording server status showing status of the live recording of the cameras in the central server, list of junctions which are sending live feed, total events generated at each junction and events pending to synchronized.
- The system should have a dashboard which should show the following information:
    - Status of analytics, events and clips generated at junction servers
    - Camera-wise status showing processed and dropped frames
    - Event clip generation time, status of transfer of clips from junction server to central aggregation server
- The operator console should show vital system parameters for components such as Database Server, Media Servers, Local Workstation and Storage System (all available storages). The client should show the parameters such as CPU Core Usage, RAM Utilization and Storage Utilization.
- The system should have reports such as camera uptime availability, camera recording percentage, recording status, critical events, incident video, etc.
- The system should provide facility to search for the cases of violations occurred during any specific span of time, and provide a statistical analysis of the number of such incidences occurring during various days of the month, various months of the year in graphical format. A report of all such incidences should be automatically generated by the system in a spreadsheet (.xls format),and can be automatically emailed to the designated email addresses.
- The system should allow the users to download multiple segments of the video, which are encrypted with password from single or multiple cameras from the archive with an option to

tag each downloaded segment with text messages. The Video segments should be downloaded in a single folder along with excel spreadsheet where details of each of the video segments are listed as hyperlinks to the exported video.

- The system should allow the operator to configure email account and SMS gateway for sharing various alerts through email and SMS.
- The system should maintain log of various system generated alerts. The system should also maintain full audit trail in the logs.

Local Processing Unit (LPU)

- The LPU should be installed at the junction level in IP 55 enclosure.
- The LPU should support functionalities such as ANPR, Red Light Violation, Speed Violation, Free Left Blocking Violation.
- The system should run on outdoor, industrial grade multi core processor-based server and should be able to cover at least……(Nos) lanes.

Data Security

- The proposed system should have the capability to transfer the data to ICCC through proper encryption in real time. Proposed application for traffic violation detection system should adhere to National Cyber Security Policy to ensure that the critical information processed and stored by the proposed application is secure from cyber-attacks / hacking / hijacking.
- System should be able to detect Wrong Direction Vehicle Movement in the ANPR camera view and also read the number plate using ANPR technology.
- Integration with CCTNS & Transport Dept Systems: Bidders need to ensure that there is seamless integration between various Government databases and security of citizens & their assets is carried in a holistic manner. Please note that some of the integration would need to be through web services while in some cases it may be required to maintain local databases.

7.7 Technical Requirements

[The Authority may include the component specific technical requirement here which are vendor/ technology agnostic]

Note: 1. The response should be descriptive and cross referenced.

Note: 2. Mentioning response as Yes/No/Not applicable (NA) will be treated as non-compliance to the clause /specific requirements.

S.No.	Technical requirement	Bidder response (How the functionality will be met?)
1		
..n		

Note:

The functional requirements and technical specifications provided in this RFP are indicative and carry guiding rule. The MSI is free to offer products and solutions which meet requirements of the RFP focusing on the outcome, future scalability, security, reliability and adherence to specified SLA under this RFP, in line with applicable standards & best practices adopted in the industry.

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The MSI is required to provide supporting document in the technical bid justifying the approach & design of offering the solution. The technical marking is specified in the evaluation criteria mentioned in the volume 1 of the RFP document.

7.8 Bill of Quantities

[To be derived from Detail Project Report Prepared by Smart Cities technical experts]

As per Format given in Annexure A.2.14, A.2.15 and Annexure A.3.2 of Volume I of the RFP.

8- City Surveillance

8.1 Overview

Primarily the function of police, these refer to operations to enhance the safety of the public and provide necessary surveillance information to Police for both reactive and predictive policing. CCTV surveillance has been an important component across multiple cities with increasing usage of video analytics to aide police in spotting potential incidents and managing them as they happen.

8.2 Key Issues

The main challenges of surveillance in urban ecosystem are as follows:

- The rate of urbanization is increasing and with city growth comes an increase in crime and safety concerns due to concentrated populations
- Lack of surveillance cameras on a Pan City basis results in delays in crime detection and response
- Riots and vandalisms go undetected on a real time basis in lieu of absence of CCTV cameras at important places
- Lack of intra department real-time coordination, with voice and multimedia services
- Need for intelligent analytical capabilities by police
- Fragmented decision making due to lack of inter-departmental collaboration
- Citizens do not have access to a dedicated Emergency Response System

8.3 AS-IS Analysis

[City to provide sufficient information covering entire value chain]

8.3.1 City Security process

Current Processes from situational analysis, data collection and advanced analysis viewpoint.

8.3.2 Current Organization Setup

[List the setup]

8.3.3 Current Technology being used, IT System in operation and Vendor Ecosystem

[Provide brief details]

8.3.4 Activities which are outsourced and reason of outsourcing

[List the activities]

8.4 Indicative Key Outcomes and KPIs

- Supporting law enforcement agencies in 24x7 surveillance and monitoring
    - Emergency Services Response Time: Average response time for Emergency Services
    - Number of CCTV cameras installed in the city per unit of road length
    - Number of recorded crimes per lakh population
    - Extent of crimes recorded against women, children and elderly per year
    - Location wise analysis of crimes in the city
    - Creation of emergency corridor/ passage for passing of fire response / police/ ambulance teams
- Proactive identification of security issues leveraging intelligent analytics from the surveillance system
- Supporting active response during emergency & disaster situations
- Providing secured access to video at any time from any network location
- Situation/Rule based alerts based on user inputs
- Automated response based on events including communication of alerts to relevant authorities like Fire, Hospitals, etc. for swift response in case of emergencies;
- Access to historic video data for investigative purposes
- Improved Crowd management and Security Breach handling

8.5 Key components [Process Flow to be provided]

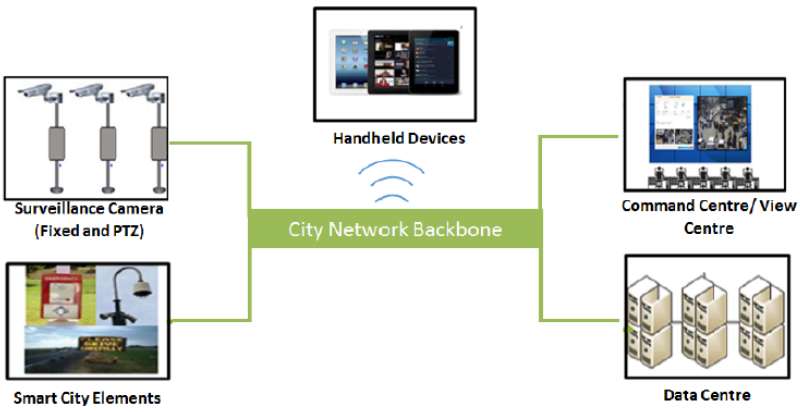

Figure 1: Process Map of City Surveillance (ILLUSTRATIVE). This diagram is only one of the representations and does not suggest any architecture or design choices to realize the solution.

As highlighted in the figure above the network comprises of group of CCTV cameras, which are connected to Video management system which stores and converts the video input as per the output requirement.

The converted video feed is relayed to the ICCC, which is monitored by operators. On the event of detection of an incidence or possible cause of event, an alert is generated. Based upon the nature of alert the operator informs the concerned department for their timely response and resolve of the incident.

This diagram is only one of the representations and does not suggest any architecture or design choices to realize the solution.

8.6 Functional Requirements

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#	Functional Requirements	Bidder's response
1.	**Surveillance system**	
	The Surveillance System shall be a fully distributed solution, designed for large multi-site and multiple server installations requiring 24/7 surveillance.	
	The solution shall offer centralized management of all devices, servers and users.	
	The Surveillance System should not have any limit on the number of cameras to be connected for Surveillance, Monitoring and recording. Any increase in the no. of cameras should be possible by augmentation of Hardware components	
	The Surveillance System shall support distributed viewing of any camera in the system using Video walls or big screen displays	
	The Surveillance System shall support alarm management. The alarm management shall allow for the continuous monitoring of the operational status and event-triggered alarms from system servers, cameras and other external devices	
	It should be possible to integrate the Surveillance System with 3rd-party software, to enable the users to develop customized applications for enhancing the use of video surveillance solution. (e.g., integrating alarm management to initiate SMS, E-Mail, VoIP call etc.)	
	Rule Management: The system shall support the use of rules to determine when specific actions occur. Rules shall define what actions shall be carried out under specific conditions. The system shall support rule-initiated actions such as: Start and stop recording	

	Set non-default live frame rate Set non-default recording rate Start and stop PTZ patrolling Send notifications via email Pop-up video on designated Client Monitor recipients	
	Video Analytics Capabilities: It should offer the use-cases as listed in the Section 12 Domain use cases of the Vol II Section 1.	
2.	**Facial Recognition Capabilities: Face Recognition System (FRS)**	
	It shall be designed for identifying or verifying a person from various kinds of photo inputs from digital image file to video source.	
	The system shall offer logical algorithms and user-friendly, simple graphical user interface making it easy to perform the facial matching.	
	The system shall be able to broadly match a suspect/criminal photograph with database created using photograph images available with Passport, CCTNS, and Prisons, State or National Automated Fingerprint Identification System or any other image database available with police/other entity.	
	The system shall be able to: i. Capture face images from CCTV feed and generate alerts if a blacklist match is found. ii. Search photographs from the database matching suspect features. iii. Match suspected criminal face from pre-recorded video feeds obtained from CCTVs deployed in various critical identified locations, or with the video feeds received from private or other public organization's video feeds. iv. Add photographs obtained from newspapers, raids, sent by people, sketches etc. to the criminal's repository tagged for sex, age, scars, tattoos, etc. for future searches. v. Investigate to check the identity of individuals upon receiving such requests from Police Stations. vi. Enable Handheld mobile with app to capture a face on the field and get the matching result from the backend server.	
3	**Video Management Capabilities**	
	The system shall allow an operator to view live / recorded video from any camera on the IP Network.	
	It should allow switching of video streams across the system.	

	ICCC/Police personnel shall have following access to the video feeds of the cameras of their jurisdiction: Viewing rights to all the live Camera Feeds Viewing rights to the stored feeds Access to view Alerts / Exceptions / Triggers raised Trail Report on specific person / object / vehicle for a specific period / location Personalized Dashboard (depending upon grade of police officer) Accessibility to advanced analytics on recorded footages Advanced search based on various filters like alarm / event, area, camera, etc.	
	Event Handling Capabilities: The camera shall be capable of recording an event as pre and post event images to on-board SD Media Card and share it with ICCC Events may be triggered using camera motion detection or from an external device input such as a relay. Support for various type of Logs such as System Log, Audit Log Alert Log Event Log should be available.	
	Recording and Storage: The proposed storage solution should ensure video feeds availability for …. days. After …. days, the video feeds should be overwritten or archived unless they are flagged or marked by the Police or Authority for investigation or any other purpose. The video feeds of all relevant cameras capturing the incident in question should be stored until the Police or Authority deem it good for deletion For incidents that are flagged by the Police, Authority or any court order, the video of the relevant portion from all relevant cameras should be stored/archived separately for investigation purposes and a committee at Authority can decide when this video feed can be deleted Regardless of the above, the image of the License plate extracted by ANPR software, along with the timestamp and location of the image capture will stored for a period of …. Months Audit trail of the system to be maintained on permanent basis / as per the backup policy defined. Retrieval time for any data stored should be max. …. hours for critical data & … hours for other data.	

	The Recording System shall run independently of the Video Management system and continue to operate in the event that the Management system is off-line.	
	Investigation Scene Rebuilding • It should be possible to select the cameras for synchronized and simultaneous archived viewing. It should be possible to record the videos being rendered from these cameras into a single video. Such a single video should support up to eight such cameras in vertical, horizontal or overlay fashion. An easy feature of cloning the time stamp from one camera to multiple other cameras for synchronous archived viewing should be available. • For quick investigation of the alerts, it should be possible to configure cameras in small functional group/s. In case of an alert in any one camera in the group, live video from other cameras in the group should be popped up automatically on the operator screen.	
	The system should enable tracking of the vehicle on a GIS map to locate any suspicious / identified vehicle. The Cameras should transmit quality video feed (clear, un-blurred, jitter free, properly lit, unobstructed, etc.).	
	The network design should ensure that the Packet losses are less than 0.5%.	
	Integration with ECB and Citizen App for SOS Management should be available.	
4	**Integration with ICCC**	
	Integration of all the IT systems and solutions deployed for the Surveillance management with ICCC should be through APIs The alerts generated in ICCC should be handled in a coordinate manner with following; i. Rule engine module for event/alarm handling ii. SOP (Standard Operating Procedure) tool for administrator to configure the SOP responses based on each alert. iii. Integration with the Incident Management system for the users to log in the incidents and the alerts, view the report from the module about the incidents etc. iv. Alert processing such as Acknowledging the alert, emergency response, SOP for the alert. v. Connecting the next steps as per the SOP like informing Police\Fire departments based on the incident etc.	

8.7 Technical Requirements

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