



DETAILED PROJECT REPORT

FOR SMART SOLUTIONS FOR PUBLIC MOBILITY AND MUNICIPAL VEHICLE IN TUMAKURU

October 2017

Project Management Consultant for
Implementation of Smart City Mission Project of Tumakuru City



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LIST OF ABBREVIATIONS

ABD	Area Based Development
AVLS	Automated Vehicle Location System
CSS	Centrally Sponsored Scheme
CC	Control Centre
ETA	Estimated time of Arrival
ETD	Estimated Time of Departure
GDP	Gross Domestic Product
GPS	Global Positioning System
HPSC	High Power Steering Committee
ICMCC	Integrated City Management Control Centre
KSRTC	Karnataka State Road Transport Corporation
KUIDFC	Karnataka Urban Infrastructure Development & Finance Corporation
MoHUA	Ministry of Housing & Urban Affairs
PIS	Passenger Information System
PMC	Project Management Consultant
RFID	Radio Frequency Identification
SLNA	State Level Nodal Agency
SDLC	Software Development Life Cycle
SWM	Solid Waste Management
TSCL	Tumakuru Smart City Limited
TCC	Tumakuru City Corporation
ULBs	Urban Local Bodies
VTU	Vehicle Tracking Unit

1.0 Introduction

Tumakuru Smart City Limited (TSCL) envisages to improve the quality of urban utilities that are provided for in the TCC jurisdiction, accordingly the TSCL now invites Tenders for Supply, Installation, Commissioning, Integration, Operation & Maintenance of various components for the fulfillment of the desired goals pertaining to this particular report of the Tumakuru Smart City Limited, Tumakuru. The Public Mobility & Municipal Vehicle Tracking Includes Automated Vehicle Location System (AVLS) & Surveillance, Passenger Information System and Control & Satellite Centres. It includes supply, commissioning, maintenance, and capacity building for the proposed systems as per the report.

With the commissioning of this project, the TSCL envisions to provide an integrated systems of network that would enable the citizens and the various administrative bodies to have better access to the services and monitor them well. The municipal vehicles and public transport busses run by KSRTC are not equipped with GPS trackers, CCTVs etc. Through this project, the TSCL envisages to have the municipal vehicles to be tracked for better management, the KSRTC busses (for the Tumakuru city) to be installed with Passenger information systems (PIS) and CCTV cameras. These PIS information displays and CCTVs in the city busses would enable the passengers to manage the time well and be alerted about the up-coming stops, the distance/time taken between two stops etc. for the commuters to manage time well. The CCTVs on the other hand can prove to be enhanced security and safety feature for Tumakuru's public transit system.

The proposed solution will enable KSRTC and Tumakuru Municipal Corporation with the ability to track, record, and analyze how vehicles are performing in real time. These features will lead to improvements in public transit service and municipal solid waste collection system through better on-time performance and quicker response time to emergencies. The Location information along with other details such as the speed of the bus/vehicle, the route followed etc. will be used to provide the passengers waiting at the bus stops with the expected arrival time of the bus and also to keep the concerned municipal officials informed and updated regarding the waste collection process. The bus information will be displayed on boards installed at the bus stops, inside bus, websites, mobile apps etc. Also, 2 nos. of CCTV cameras shall be installed in each Bus for recording inside instances on real

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time basis. The CCTV camera recording will be stored in a local hard drive installed within the bus and the same will be synced with the cloud as and when the bus is connected with the required connectivity either in Bus Depot or through other arrangements for connectivity. The system Integrator is expected to size the cloud in such a way that at least 3 days old CCTV recording details can be restored from the cloud, if required. The system should also help in improving the efficiency of bus / municipal vehicle operation by generating various standard and exception reports.

The entire project would be software enabled and depend on the web based application which would integrate the various constituents of the project and their components for a better integrated approach towards the fulfillment of the scope and idea of the project. The software shall be offered using a web based solution that utilizes high resolution digital map of Tumakuru, e.g. Google Map or similar to show real-time position of the vehicles. The detail of the map to be procured by the bidder should be provided to TSCL.

2.0 Project Background

“Smart City is referred as the safe, secure, environmentally green, and efficient urban center of the future with advanced infrastructures such as sensors, electronics and networks to stimulate sustainable economic growth & a high quality of life” (Hall, 2000).

Rapid growth in small and medium scale urban centers plays an important role in economic and societal progress. However, it also strains a city’s infrastructure. Key challenges, such as traffic congestion, energy usage, public safety, and the building of sustainable communities are top of mind. Such challenges need to be addressed through the development and implementation of intelligent solutions. Smart cities are measured by the integration of their infrastructure and the intelligent ways by which they tackle challenges. A smart city puts emphasis on creating a system of networks to allow for a systematic flow of information and effective management of resources. Enabling integration and convergence with organizations and local authorities to provide solutions for the development of a smart city is crucial.

A Smart City offers decent living options to every resident. This would mean that it will have to provide a very high quality of life i.e. good quality but affordable housing, cost efficient physical infrastructure such as 24 x 7 water supply, sanitation, 24 x 7 electric supply, clean air, quality education, health care, security, entertainment, sports, robust and high speed interconnectivity, fast & efficient urban mobility etc.

Nearly 31% of India's current population currently resides in cities and contribute 63% of GDP (Census 2011). Urban areas are

expected to house 40% of India's population and contribute 75% of India's GDP by 2030. This requires comprehensive development of physical, institutional, social and economic infrastructure. All

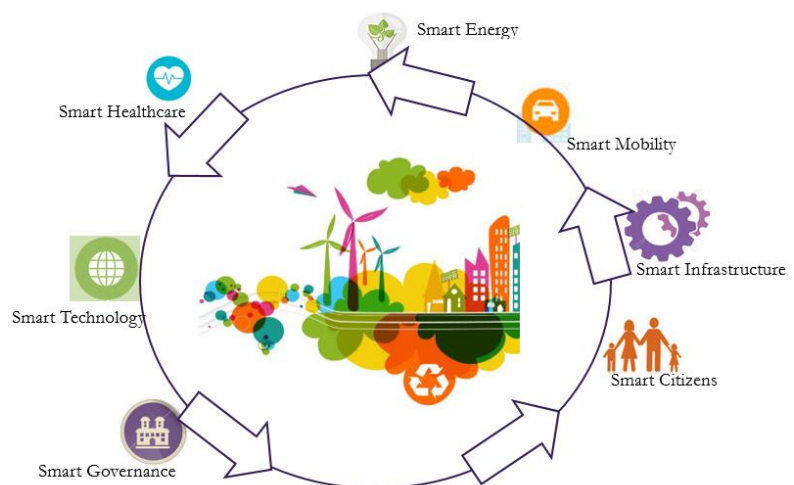


Figure 1: Smart Elements

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are important in improving the quality of life and attracting people and investment, setting in motion a virtuous cycle of growth and development. Development of Smart Cities is a step in that direction.

The Smart Cities Mission is an innovative and new initiative by the Government of India to drive economic growth and improve the quality of life of people by enabling local development and harnessing technology as a means to create smart outcomes for citizens.

The objective of the Smart Cities Mission is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions. The focus is on sustainable and inclusive development and the idea is to look at compact areas, create a replicable model which will act like a light house to other aspiring cities. The Smart Cities Mission is meant to set examples that can be replicated both within and outside the Smart City, catalyzing the creation of similar Smart Cities in various regions and parts of the country.

SMART CITIES MISSION STRATEGY

- Pan-city initiative in which at least one Smart Solution is applied city-wide
- Develop areas step-by-step – three models of area-based developments
 - City Improvement (Retrofitting),
 - City Renewal (Redevelopment),
 - City Extension (Greenfield)

The Smart City Mission is being operated as a Centrally Sponsored Scheme (CSS) and the Central Government proposes to give financial support to the Mission to the extent of Rs. 48,000 crores over five years i.e. on an average Rs. 100 Crores per city per year. An equal amount, on a matching basis, will have to be contributed by the State/ULB; therefore, nearly Rupees one lakh crore of Government/ULB funds will be available for Smart Cities development.

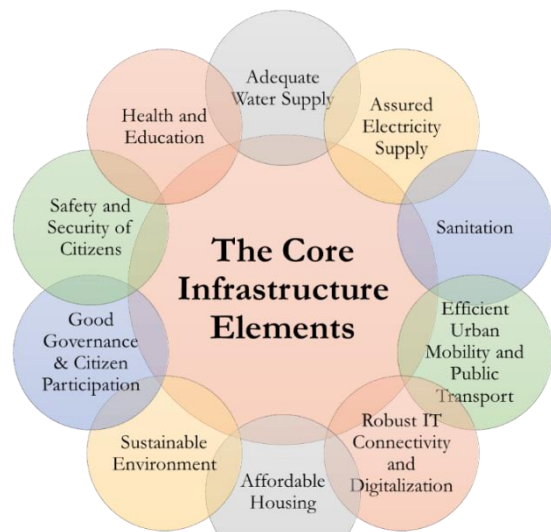


Figure 2: Smart City Infrastructure Elements

Accordingly, the purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology, especially technology that leads to Smart outcomes.

3.0 Project Structure

The Government of Karnataka has accorded approval for implementation of Smart Cities Scheme in the State. The High Power Steering Committee (HPSC) for Smart Cities Scheme has also been constituted under the Chairmanship of Chief Secretary with representatives of various State Government departments to guide the mission in the State.

The Karnataka Urban Infrastructure Development & Finance Corporation (KUIDFC) has been nominated as the State Level Nodal Agency (SLNA) and Mission Directorate by the Government of Karnataka.

The High Powered Steering Committee (HPSC) had recommended selection of six cities, viz., Belagavi, Shivamogga, Mangaluru, Hubballi Dharwad, Tumakuru & Davanagere for development under the Smart Cities Scheme based on the guidelines issued by the Ministry of Urban Development (MoUD), GoI.

These 6 Smart Cities prepared their “Smart City Proposal” for participation in the “City Challenge” and submitted the same to MoUD.

Tumakuru has been selected as one among the 100 Smart Cities to be developed in India under the Smart Cities Mission of the Government of India.

Tumakuru was selected in the second round of the challenge through its proposal that aimed at “Transforming Tumakuru from a mere EDGE CITY OF BENGALURU to the MOST PREFERRED DESTINATION within the region with a strong focus on economic development and provision of enhanced CONNECTIVITY, high QUALITY OF LIFE, ECOLOGICAL integration, and INCLUSIVE development”. Tumakuru’s Area-based development (ABD) proposal revolved around a retro-fitting of about 1400 Acres in the CBD area along with the Amanikere Lake to be an inclusive and thriving space catering to all user groups with the aim of decongesting the city centre, upgrading the available infrastructure & services, and integrating the built space and the environment.

To implement the above projects, an SPV named Tumakuru Smart City Company Ltd (TSCL) has been incorporated.

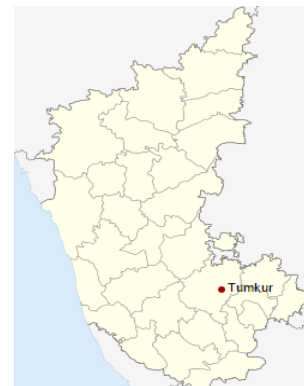


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A consortium of IPE Global Pvt. Limited, Grant Thornton India LLP and Aryavartha Design Consultants LLP has been appointed as the Project Management Consultants (PMC) for implementation of the Smart City Mission Project of Tumakuru City. The consortium has entered into agreement with TSCL for the above PMC.

4.0 Project Area: Tumakuru City

Tumakuru, the district headquarters of Tumakuru district in South East Karnataka, is an industrial city spread over about 48 Square Kilometers, popularly known as the City of Education and the City of Coconuts. Almost 7 years ago, Tumakuru was accorded the status of a City Corporation. Tumakuru is in close proximity to the Karnataka State Capital, Bengaluru which is located just 70 km South West of Tumakuru.



The following table summarizes some key facts about Tumakuru City.

Table 1: Facts about Tumakuru

Tumakuru City Population	305821 (2011 Census)
Area	48.21 Sq. Km.
Population Density	6300/km ²
Population of the ABD Area	43,941
ABD Area	5.48 Sq. Km.
Number of Properties	93494
Number of Wards	35
Length of Roads	575 Km
Sex Ratio	976
Literacy	88.91%
Total Water Supply	46-47 MLD
Per Capita Water Supply	115 – 120 LPCD
Temperature	Summer: 32°C – 40°C Winter: 17°C – 30°C
Elevation	822 m
Latitude	13.34°N 77.1°E
Distance from Bangalore	70 KM

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Connectivity	Nearest Airport – Kempegowda International Airport, Bengaluru (86 KM) Nearest Railway Station: Tumakuru Railway Station Nearest Major Railway Station: Yeshwantpur Railway Station, Bangalore (63 KM)
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Tumakuru is a primarily an agrarian economy with the major products being coconuts, millets, rice, pulses, areca nuts and oil seeds. In recent years however, the economy has been bolstered by several industries that have been set up around it. The major manufacturing industries are cotton clothes, blankets, ropes, watches etc. Several industrial houses are also operating here such as WIPRO, HMT, TVSE etc.

Tumakuru also is home to several temples, Dargahs and has places of religious importance. These sites are seeing a steady rise in visitors every year, with the floating population pegged at an average of about 5000 per day. It is also the Hub for various educational institutions.

5.0 Stakeholders in Tumakuru Smart City Project



Figure 4: Stakeholders of the Tumakuru Smart City Project

6.0 Project Component Description

The main tasks / works to be performed by the successful bidder and their responsibilities are as given below, which are indicative but not exhaustive:

- a) Automated Vehicle Location System (AVLS)
- b) Passenger Information System
- c) Control & Satellite Centres
- d) Web Applications related to the above

All the above components are inter-related and hence are required to work in sync with each other.

It is a requirement to track the following categories of vehicles:

- (1) KSRTC Intra-City Buses
- (2) Other Municipal Vehicles, including but not limited to SWM vehicles, Compactors, Tippers, etc.

The software shall be offered using a web based solution that utilizes high resolution digital map of Tumakuru, e.g. Open Street Map or similar to show real-time position of the vehicles. The software shall provide map based tracking and transit route line based tracking of vehicles by the control system. The software is expected to have enterprise capabilities which enables multiple user type to be enabled to carry out various functions like, Alarm Management, Vehicle Schedule Tracking, Speed Management, Stoppage Management, Route Replays, Vehicle Tracking dashboard etc. as a standard functionality. The software shall enable KSRTC and TCC to drill and analyze information and online data in a multi-dimensional manner. Comprehensive analysis and reporting capabilities are expected to be part of the application delivery which matches the world standard capabilities of AVLS systems.

7.0 Scope of Work

As part of Tumakuru Smart City initiatives, TSCL intend to make public transport and municipal solid waste collection system efficient by introducing following components:

- Automatic Vehicle Locator System (AVLS) in Intra-City Service Buses (49 Buses) and Municipal Vehicles (120 nos.)
- PIS to display schedule of buses at Bus Shelters (142 Nos.), Bus Terminal and Bus Bays
- Control Centre at KSRTC and Satellite Centre at TCC
- Website based information dissemination for passengers about the real-time location of buses.

The proposed solution will enable KSRTC and Tumakuru Municipal Corporation with the ability to track, record, and analyze how vehicles are performing in real time. These features will lead to improvements in public transit service and municipal solid waste collection system through better on-time performance and quicker response time to emergencies. The Location information along with other details such as the speed of the bus/vehicle, the route followed etc. will be used to provide the passengers waiting at the bus stops with the expected arrival time of the bus and also to keep the concerned municipal officials informed and updated regarding the waste collection process. The bus information will be displayed on boards installed at the bus stops, inside bus, websites, mobile apps etc. Also, 2 nos. of CCTV cameras shall be installed in each Bus for recording inside instances on real time basis. The CCTV camera recording will be stored in a local hard drive installed within the bus and the same will be synced with the cloud as and when the bus is connected with the required connectivity either in Bus Depot or through other arrangements for connectivity. The system Integrator is expected to size the cloud in such a way that at least 3 days old CCTV recording details can be restored from the cloud, if required. The system should also help in improving the efficiency of bus / municipal vehicle operation by generating various standard and exception reports.

The SI shall be responsible to carry out the detailed survey prior to submission of bid for the solution component requirement in order to finalize infrastructure requirement, operational & administrative challenges etc. The subsequent sections detail out the solution and scope with respect to the solution component. SI shall note that the activities defined within scope of work mentioned are indicative and

may not be exhaustive. SI is expected to perform independent analysis of any additional work that may be required to be carried out to fulfill the requirements as mentioned in this RFP and factor the same in its response.

The overall scope of the implementation will consist of supply, design, development, customization, testing, installation, commissioning, operation and maintenance of select components covering buses and other municipal vehicles in the city.

More specifically, the following will be the activities to be carried out by the SI:

- Conduct Requirement Analysis, Design, Develop, Test, Supply and Implement various components of the ITS.
- Size, Procure, Supply, Install, Commission, Configure, Test, Integrate and Implement all the required hardware and software for the project
- Manage, Maintain and Support all the Hardware and Software supplied and installed for a complete contractual period of three (3) Years on Supply and Operation Model basis. The system integrator will provide 10 nos. of resources required for managing the operations at the Control Centre and the Satellite Centre on a 2-shift (5 operators each) basis for a period of 2 years after Go-Live
- Train the KSRTC, TCC and other employees on usage of various ITS components.
- Set up cloud based data centre and provide cloud based data service to fulfill the ITS and VTMS requirement for two (2) years.
- Provide required communication sub system including procurement & installation of SIM cards on-bus tracking units and pay the charges for the required GPRS/GSM communication, for the entire O&M period of three (3) years.
- Supply, installation, customization and commissioning of Vehicle tracking application for buses and other municipal / other vehicles.
- Installation of CCTV cameras within the buses and provisions for storage and archival.

- Integration of ITS components with Integrated City Management Control Centre (ICMCC) application and Android application whenever required.
- Comprehensive warranty of all hardware and software during the contract period.
- Complete implementation and making the project successful by running it for warranty, support and maintenance period of three (3) years.
- Create and provision open APIs for integration of the solution with Tumakuru Smart City Integrated City Management Control Centre (ICMCC) whenever required. As in future all the operations of the city will be monitored from Integrated City Management Control Centre (ICMCC), hence its integration to share all kinds of data and sensor feeds is important. It is integral part of the scope of the System Integrator to ensure connectivity and operationalizing of this component with the ICMCC.
- TSCL intends to provide bus passes, cards, etc. in future and hence the web portal should have provisions for Pass application, Cards top-up using credit/debit/net banking facility.

7.1 Detailed Scope of Work

The main tasks / works to be performed by the successful bidder and their responsibilities are as given below, which are indicative but not exhaustive:

- a) Automated Vehicle Location System (AVLS).
- b) Passenger Information System.
- c) Control & Satellite Centres.
- d) Web Applications related to the above.

All the above components are inter-related and hence are required to work in sync with each other. A brief of these components are discussed as below.

7.1.1 Automated Vehicle Locating System (AVLS)

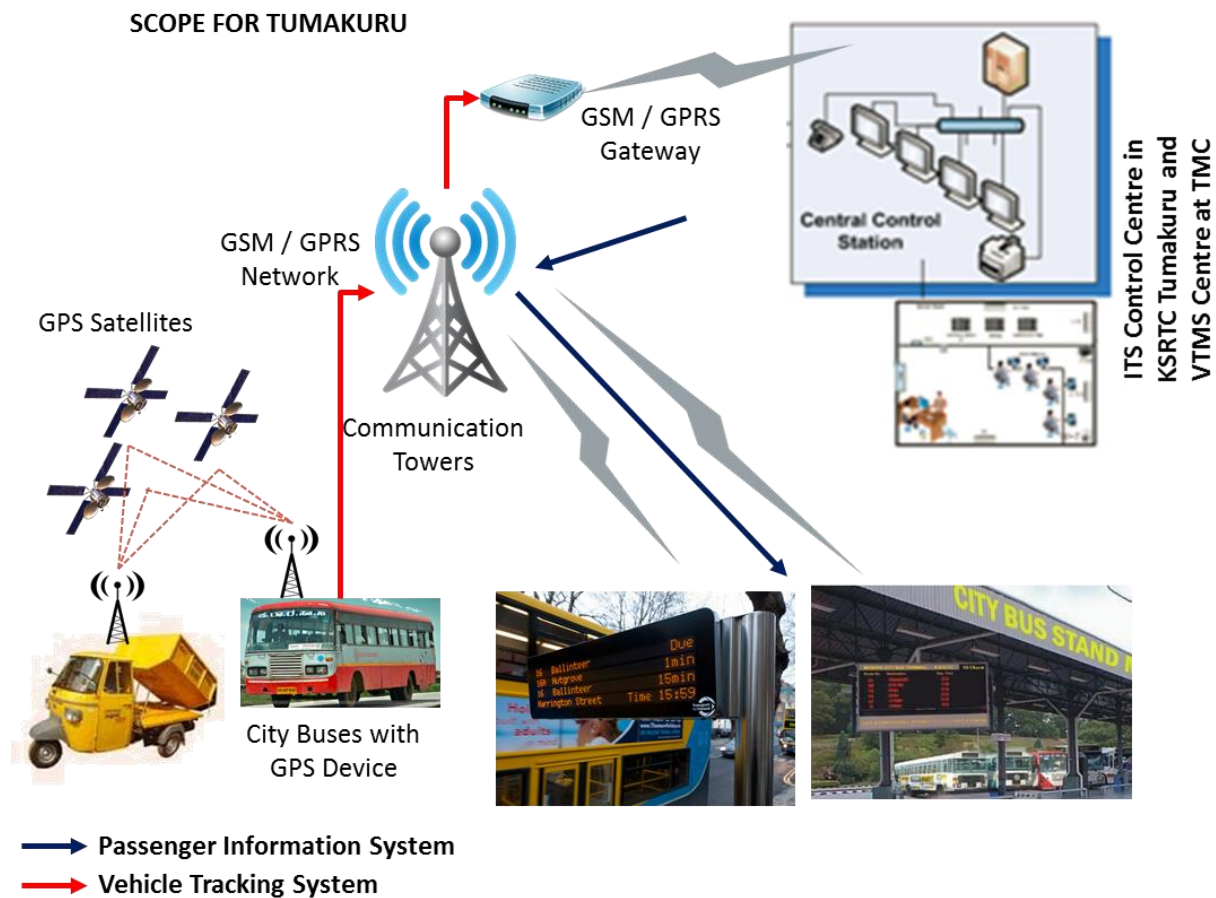
It is a requirement to track the following categories of vehicles:

- (1) KSRTC Intra-City Buses

- (2) Other Municipal Vehicles, including but not limited to SWM vehicles, Compactors, Tippers, etc.

Some of the above vehicles have been previously installed with GPS / GPRS and in-bus display instruments and it will be a requirement for the System Integrator to study the technical feasibility to ascertain whether these can be integrated with the solution developed (if possible), without the need to purchase additional devices or else remove the existing instruments for installation of new ones. However, for the vehicles where GPS / GPRS and display equipment is not available or not compatible, procurement of devices as per standards mentioned is required. The System Integrator will submit a detailed hardware requirement report after the study.

The software shall be offered using a web based solution that utilizes high resolution digital map of Tumakuru, e.g. Open Street map or similar to show real-time position of the vehicles. The detail of the map to be procured by the bidder should be provided to TSCL. The software shall provide map based tracking and transit route line based tracking of vehicles by the control system. The software is expected to have enterprise capabilities which enables multiple user type to be enabled to carry out various functions like, Alarm Management, Vehicle Schedule Tracking, Speed Management, Stoppage Management, Route Replays, Vehicle Tracking dashboard etc. as a standard functionality. The software shall enable quick decision making capability for control centre management staff, which shall be achieved by providing graphical tools for visualization. The software shall enable KSRTC and TCC to drill and analyze information and online data in a multi-dimensional manner. Comprehensive analysis and reporting capabilities are expected to be part of the application delivery which matches the world standard capabilities of AVLS systems. A dedicated battery will be installed for the VTUs in the bus to provide power redundancy to the entire system in order for it to run even when the buses are in stationary (ignition-off) condition. The proposed battery will be charged from the bus battery. The ITS application should be able to play video/picture/text based advertisement on the PIS display boards. The application shall contain the record of advertisement duration and generate the report.



The software should have capability of multi-screen based tracking system, so as to enable quick analysis and better insight into operational data of all activities within the system. The solution developed / deployed should be scalable to support at least 300 vehicles and up to 300 Bus Stops. In addition, unlimited number of geo-tagged locations should be supported by the solution. The solution proposed should also assist in integration with other smart city initiatives, for instance, Surveillance, Traffic management, etc. and this initiative should support works considering citizen as the centre of activities.

Since the solution shall be web-based software, it should be able to run on a Video Wall / Control Centre and it should have the provision of feeds available to multiple users and locations based on secure authentication. The video generated should be customized to the requirements of KSRTC / TCC / TSCL.

In the near future, TCC may go in for an RFID / other sensor based door to door collection system, whereby additional tracking mechanisms may be introduced for SWM vehicles. Bidders may be required to provide for appropriate reporting and matching of this data.

Even though the use cases to be performed as per this RFP are limited, prospective Bidders need to ensure that multiple other use cases shall be added in the future. Some of them would be tracking of vehicles related to Disaster Management, Geo-location of hospitals, etc. and waste segregation tracking. These are required to be appropriately considered when designing the solution.

7.1.2 Passenger Information System (PIS)

The PIS shall include all the components that are directed towards passengers. “Passengers” & “Commuters” in this context would also mean the commuters, prospective commuters who enquire about the KSRTC services; people who arrive at the bus stands to receive passengers. The terms ‘passenger’ and ‘commuter’ are used interchangeably. This sub-system should work on the data provided by the AVLS.

- a) ETA/ D in real-time application will be developed by the System Integrator by consulting all the stakeholders, including KSRTC and users. This real time information should be available through SMS / Internet / LED Boards installed at Bus Stands including information regarding incidents / cancellation / delays, etc. There should be provision to integrate mobile apps for dissemination of real-time information about location of buses.
- b) Real Time Information on the internet and SMS will be provided on Demand. SMS, and Internet based real time information should enable commuters to plan their trips in advance and make informed choices about their travel by bus.
- c) Real Information through SMS will be user defined and friendly including bus stop name, service type, route number, time of arrival at the very minimum. The System Integrator will be responsible for SMS, SMS gateway charges.
- d) System Integrator shall ensure smooth coordination and integration for the above.
- e) The PIS should have the capability of tracking vehicles based on their location, etc.
- f) An extension to the Passenger Information System should be provided to citizens to track other categories of vehicles and their ETA’s, for instance, location and estimated time of SWM vehicles.

- g) It is a requirement that the solution developed be integrated with commercially available Display Boards, which are proposed to be installed at Bus Stations / Bus Stands and in-Vehicle Passenger Information Systems.

7.1.3 Installation of CCTV Camera

The selected bidder shall install 2 nos. of CCTV Cameras within the bus in such a way that it covers the entire sitting space of the bus (including the driver's space). The recorded video will be stored in local storage installed at bus itself for a maximum of 7 days. The data stored in the local storage or storage installed within the bus should be transferred to the Cloud or central server on a periodic basis either with the help of internet (synced with the cloud or central server after a periodic time) or through manual intervention. The selected bidder shall explore the best methodology and the same should be pre-approved by the experts of TSCL and/or KSRTC. Control and Satellite Centres.

The AVLS and the PIS systems shall be linked through two (2) Control Centres to ensure appropriate storage of information generated by this system. The Control Centre shall be setup at the Divisional Office/Bus Terminal of the KSRTC, Tumakuru and the Satellite Centre shall be established at the Tumakuru Municipal Corporation.

The Control and Satellite Centres will act as a hub to manage and monitor service related data which will be viewable through a centralized web application. Activities at the control centre will comprise of monitoring services, incident management with defined escalation procedures. Activities will also include monitoring the health of all components (hardware, software etc.) of ITS project through automatic check system. KSRTC / TCC personnel will be trained to oversee the Control and Satellite Centres by the System Integrator. The Control and Satellite Centres will receive transactional data from on board devices applications into servers and Decision Support/ Business Intelligence (BI) Applications respectively to generate alerts and reports on revenue and operational parameters.

- a) It will be the responsibility of the System Integrator to set up the Control Centre in the allotted area. The control centre should be designed to seat at least 3 people. The Satellite Centre should be able to seat another 2 people.
- b) It needs to be ensured that the Control Centre and software and other applications are built on an open architecture and support sharing of the feeds / application to the ICMCC will be built.

- c) The applications developed for ITS and AVLS shall be hosted through Cloud Services for a period of 2 years. The Cloud Services must guarantee availability and uptime as per SLAs.
- d) The Control and Satellite Centres set up including all connectivity, hardware & software will be the responsibility of vendor.
- e) The System Integrator will train the KSRTC / TCC staff on using the systems and appoint personnel for trouble-shooting activities.
- f) All necessary civil infrastructure including furniture, air conditioner, backup power, all connectivity, etc. will be responsibility of the vendor. The space shall be provided by KSRTC and TCC.
- g) The Control Centre should have secure access systems and maintain a log of in/out.
- h) All applications that are part of ITS should be accessible from the Control Centre. The work stations should be web-enabled, provide for appropriate User Access (Role based, Read-only / Read-write) and other security controls.
- i) Solution & Technical Architecture of Control & Satellite Centres will be provided by the vendor which includes IT hardware and all system software including Operating systems, antivirus, etc. The agency should seek confirmation from KSRTC / TSCL / TCC before installation and commissioning of the Solutions, Technical Architecture and Equipment's at Control & Satellite Centres.

7.1.4 Web Applications related to the above

The application developed shall be of paramount importance and these will provide:

A. Web Applications

- a. For PIS related to KSRTC City Buses
 - i. Be able to provide bus routes and schedule information.
 - ii. Be able to plan a trip, including multiple routes on different buses.
 - iii. Information about the buses, search and view bus schedules on various routes and deliver ETA based on their real time location. System shall show the time table of the buses, fare structure etc.
 - iv. Be able to provide advertisement services on rental basis to commercial establishments through:

1. In-Bus Display Systems – Scrolling Advertisements

2. LED Panels at Bus Terminals – Footer Advertisements, Pop-Up Advertisements

- v. A revenue sharing model shall be designed with the selected bidder for the revenues generated through such advertisements.
 - vi. It must also be possible to relay important messages / communications from law-enforcement, disaster management, municipal authorities within the city to relay messages of importance in case of need.
 - vii. The PIS boards deployed for the project in Bus Terminals and inside buses must be able to display such important messages / advertisements.
- b. For Information related to Municipal Vehicles
- i. Track the vehicle information collecting garbage in the vicinity of the citizen, including meta-data and real time status of the vehicle.

B. Web Applications for Officials

- a. Provide officials to ensure appropriate monitoring and performance of vehicles, when they are not able to be physically present in the Control & Satellite Centres. Specific consideration should be provided for tracking and control operations on a small screen.

The following general requirements are intended to be adhered to ensure that the best in class web-portal is developed:

- a. Be able to work on low internet bandwidth
- b. OpenAPI Standards based development, and ensure integration with other solutions developed, especially since the Integrated City Management Control Centre shall be operationalized in the city soon. The System Integrator would be required to provide the integration with the ‘to be established’ ICMCC.
- c. Since all development is expected to be on Open standards, System Integrator will also be required to provide integration support for any other GPS / GPRS initiative executed by TSCL / TCC, including but not limited to tracking of vehicles, bikes, geo-tagged shelters, places, locations, etc.
- d. Latest Web Guidelines by Government of India
- e. Latest Accessibility Guidelines by Government of India / W3CG

- f. Security Standards Compliance to be demonstrated by ensuring a Security Audit Certificate is procured from a CERT-IN empaneled vendor.
- g. Use of latest visualization tools and techniques to ensure UI / UX is best in class.
- h. The solution developed should support revenue generation (in the form of advertisements, etc.)
- i. The time lag between the location acquisition (through GPS, etc.) and when it reaches the end consumer should not be more than 10 seconds. In case of Control Centre at KSRTC or Satellite Centre at TCC, it should not be more than 5 seconds.
- j. System Integrator shall develop a web portal covering all the requirements mentioned in this RFP, to access route information, route schedule, etc. by commuters.
- k. Only Location & Route Display on website for SWM Vehicles
- l. The Web Application should have the MIS and Dashboard facility. The MIS report format will be finalized in consultation with the Clients.

7.1.5 Others

- a. The System Integrator is expected to Procure, Supply, Install, and Commission and Maintain all necessary hardware, software and other items required during the complete project / contract period as mentioned in the RFP document.
- b. Training Details:
 - i. The System Integrator is required to provide training to approx. 50 selected/nominated employees of KSRTC and TCC on application related operations & reports generation etc.
 - ii. The successful bidder shall conduct all trainings at KSRTC / TCC Premises.
 - iii. Training should be conducted based on a requisite mix of theory & practical operational sessions. The trainings should be conducted in both Kannada & English and training manuals (in both languages) should be provided.
- c. All hardware & software procured should be from authorized OEMs with license, support and warranty for the complete project/contract period.
- d. KSRTC shall provide required data as per the requirement of the System Integrator for further processing of data and reports.

- e. Hand over all the project assets/material to KSRTC & TCC in working & operational condition at the end of the project duration.
- f. The System Integrator should provide location wise complete Bill of Material (BoM) with detailed specifications to be procured and installed at KSRTC / TCC. These assets should match with the list of BoM at the time of transferring of project assets due to completion/abandon of the project.
- g. The System Integrator shall procure and provide the minimum quantity of all the hardware, software etc. as mentioned as per the minimum indicative BoM and setup all these items at respective places of working. The items & quantities mentioned is minimum for this project, but it is the sole responsibility of the successful bidder to perform the appropriate sizing of all required items to make this project successful and meet the SLA requirements.
- h. It will be the responsibility of the System Integrator to get insurance of all the equipment supplied and installed at various locations/ inside vehicles for security purpose. Bidders are expected to adequately insure themselves and the client from all aspects related to this project.
- i. The System Integrator should:
 - i. Keep a watch on the health of the system to ensure minimum downtime of each of the component/equipment.
 - ii. Keep sufficient reserve stock of hardware devices deployed at zone. Maintain and upgrade the software components of the system.
 - iii. Conduct preventive maintenance in a scheduled manner and during off-peak hours
 - iv. Conduct corrective maintenance within stipulated time period as defined in Service Level Agreement (SLA).
- j. When the ICMCC is setup, the System Integrator should provide all assistance and support in ensuring Integration of all the components with the Control Centre / Satellite Centre established at KSRTC / TCC, in which monitoring & all other works related to operations, monitoring, maintenance and support should be carried out.

- k. The maps, etc. procured under this contract and the data developed (geo-tagging of locations, etc.) are required to be able to form a part of integrated and comprehensive GIS solution, which will be developed in the near future by TSCL / TCC.

7.1.6 Minimum MIS Reports required from the System

It is expected that a state of the art application shall be developed integrating the various components, including application, website / portal, etc. and all of these would be seamlessly linked. The following includes a minimum of the MIS requirements. Detailed MIS reports shall be confirmed by the System Integrator during the Design phase in consultation with KSRTC and TCC. The MIS dashboard to be developed / customized for KSRTC and TCC should be customizable and based-on hierarchy of officers of the respective departments.

Functionality	Requirements
Different Analytical and Alert reports	Generation of exception reports like deviation from schedule route, timing, Missing Bus stops, Punctuality factor etc. based on captured vehicle data Calculation of the actual distance (in Kilometres) travelled by the vehicle, using the map Real-time Reports: Speed Log, Stoppage Log, Summary Report Day Wise Summary Report Vehicle Wise Performance Day Wise, Week Wise, Monthly Performance Vehicle Wise Monthly Performance Calculation of the actual distance (in Kilometres) travelled by the vehicle using the digitized map. Engine On-Off tracking
Speed Log	
Stoppage Log / Geo-tagged location log	
Summary Report Day Wise	
Summary Report Vehicle Wise	
Performance Day Wise, Week Wise, Monthly	
Performance Vehicle Wise	
Monthly Performance	
Calculation of the actual distance (in Kilometres) travelled by the vehicle using the digitized map.	
Depot Report	
Deviation from schedule route or timing	Real-time Alerts:
Schedule Adherence Reports	Fleet Summary Vehicle Status Speed Violation

Functionality	Requirements
	Trip Miss alerts Real-time application data delivery for PIS Statistics: Monthly Performance

The reports shall be of the following categories:

1. Scheduled Reports: These reports should be generated by the system automatically and should be available as e-mail / SMS / web based reports to the authorized distribution list.
2. Ad-hoc reports: Ad-hoc reports should be generated based on a particular request by an official.

7.1.7 Approach

A standardized approach (SDLC, Waterfall, etc.) is required to be adopted in implementing the overall solution. The key simplified stages of this approach would be as follows:

1. Design:
 - a. Solution Design / SRS should present the detailed study of existing and proposed system, screen-mock ups, and integration requirements, amongst others.
2. Implementation:
 - a. Immediately after the design and on approval of SRS, the implementation phase should be executed and all features of the solution identified in the RFP, Proposal and Design should be converted to a robust working system.
 - b. While in the case of web portal, it is expected that majority of the requirements shall be captured during the design phase, System Integrator should ensure that constant and regular feedback is taken from the client and the same addressed in their application.
 - c. In additions with the above there will be mid-course corrections based on the demand and the requirements of the solutions.
3. Roll out / Go Live
 - a. Upon successful development and integration of all the components of the solution, a Go-Live certificate should be obtained from the client. The client will provide this upon its satisfaction as to the components being installed / implemented. This should also include

- a 7-day dry run period with live reports being generated from the system and the website is in full operational mode.
- b. During this time, the System Integrator should also close any minor or other identified issues and provide the security audit certificate.
- c. All documentation produced for this project should be of high quality. Bidders are required to note that they may also be requested to prepare / provide marketing and other documents, including presentations, etc. related to this assignment in both Kannada & English and should have appropriate personnel resources to deliver them.

7.1.8 Detailed Technical Architecture

SI shall submit the detailed Technical Architecture and description of the component, along with the bid, which should take into consideration following guiding principles:

- Scalability – Important technical components of the architecture must support scalability to provide continuous growth to meet the growing demand. The system should also support vertical and horizontal scalability so that depending on changing requirements from time to time, the system may be scaled upwards. There must not be any system imposed restrictions on the upward scalability in number of devices, hardware equipment or (cater to increasing load of internal and external users and their transactions) and capable of delivering high performance till the system is operational. SI shall clearly quantify the expansion capabilities of the application software without incurring additional cost.
- Availability – The architecture component should be redundant and ensure that are no single point of failures in the key solution components. Considering the high sensitivity of the system, design should be in such a way as to be resilient to technology sabotage. The system should be designed to have uptime for 99.99%
- Security – The architecture must adopt an end-to-end security model that protects data and the infrastructure from malicious attacks, theft, natural disasters etc. SI must make provisions for security of field equipment as well as protection of the software system from hackers and other threats. Furthermore, all the system logs should be properly stored & archived for future analysis and forensics whenever desired. The authority would carry out the security audit of the entire system upon handover and at regular interval during O&M period. Field equipment installed through this Project would become an important public asset. During the contract

period of the Project the SI shall be required to repair / replace any equipment if stolen / damaged / faulty. Appropriate insurance cover must be provided to all the equipment supplied under this project. The overarching security considerations are described below.

- a) The security services used to protect the solution shall include: Identification, Authentication, Access Control, Administration and Audit and support for industry standard protocols.
 - b) The solution should provide for maintaining an audit trail of all the transactions and should also ensure the non-repudiation of audit trail without impacting the overall performance of the system.
- Manageability – Ease of configuration, ongoing health monitoring, and failure detection are vital to the goals of scalability, availability, and security and must be able to match the growth of the environment.
 - Single-Sign On – The application should enable single-sign-on so that any user once authenticated and authorized by system is not required to be re-authorized for completing any of the services in the same session. For employees of KSRTC/TCC, the browser based application, through single-sign-on mechanism, will provide access to all the services (based on their roles and responsibilities), Help module, basic and advanced reporting etc. Similarly, for external users (citizens, etc.), based on their profile and registration, the system shall enable single-sign on facility to apply for various services, submit queries /complaints.
 - Interoperability Standards – Keeping in view the evolving needs of interoperability, the solution should be built on Open Standards. The SI shall ensure that the application developed is easily integrated with the existing applications. The code does not build a dependency on any proprietary software, particularly, through the use of proprietary ‘stored procedures’ belonging to a specific database product. The standards should:
 - 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) Be of leading industry standards.
 - Application Architecture:
 - a) The application designed and developed 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.

- b) The modules of the application are to be supported by the Session and Transaction Manager for the completeness of the request and response of the client request. The system should have a module exclusively to record the activities/ create the log of activities happening within the system / application to avoid any kind of irregularities within the system by any User / Application.

SI shall design and develop the system as per the Functional and System requirement specifications finalized.

7.2 Technical Specifications

The following are the minimum technical specifications that are required to be met. Bidders are encouraged to provide better specifications.

If during the implementation, it is found that some technical specification could not be met and the bidder proposes to provide alternate mechanisms to meet the requirement, the MD & CEO, TSCL shall be the deciding authority on the matter and shall take appropriate decisions, including reducing the financial amounts payable to the SI.

1. Passenger Information System - In-Bus Display

The given specification may be used for procurement of Display Boards.

1.1. Usability / Functionality / Capability

- 1.1.1. Amber colored, alphanumeric with graphic capability
- 1.1.2. In-built light sensor with continuously variable brightness control to enable the display intensity to change based on ambient light conditions
- 1.1.3. Viewing distance
 - a. Front – 50 meters minimum, for single line text, in day and night.
 - b. Inner – 15 meters minimum, for single line text in day and night.
- 1.1.4. Display Characteristics:

- a. Fixed, scrolling and flashing mode (with fixed route number, up to 6 characters, on front, side and rear signs).
 - b. Capability to show customized graphics.
 - c. The Display should be in Kannada and English
 - d. It should be possible to display, concurrently, different messages on each of the signs.
 - e. It should be able to display special signs like signs 'Ladies Special', etc.
- 1.1.5. Signs should have ability to retain the last message displayed in the memory of the sign even in the event of power failure and without the message being reloaded.
- 1.1.6. Display and voice announcement in English and Kannada using Microsoft fonts (or any other as specified in tender).
- 1.1.7. The system should have a capability as under:
- a. GPS triggered next stop display on Inner sign with synchronized voice announcement.
 - b. The inner sign should be able to display and announce up to three languages, one after the other in sequence. Display and announcements should be possible "before arrival" of the bus at the bus stop, "on arrival" of the bus at bus stop and "after departure" of the bus from the bus stop.
 - c. In event of GPS failure, the above functionality should be possible through manual intervention.
 - d. Emergency 'stop' request function - by pressing an emergency switch placed anywhere in the bus, the inner sign should display 'stop' message and buzzer located near the driver makes the sound alerting the driver to stop the bus.
- 1.1.8. Two-way communication with Control Centre (CC)
- a. It should be possible to change/choose/select a 'route' remotely over the air from back office and provide current route information to back office
 - b. It should be possible to transmit ad-hoc messages (English/Kannada) from back office to internal sign.
 - c. Back office should be able to check the version of firmware loaded on the signs.
- 1.1.9. The solution should allow a vehicle / route to be tracked on meeting geo-tagged locations.
- 1.1.10. Sign should be able to store 'diagnostic trouble codes' (DTC)' and data should be retrievable.

1.2. Other Specifications of Destination Signs

1.2.1. Display size

- a. Front: Minimum 200 x 1800 mm – one
- b. Rear and Side: Minimum 200 x 900 mm - one each
- c. Inner: Minimum 100 x 800 mm – one

1.2.2. Pitch

- a. Front – Maximum: H 13.4 mm x V 14.1 mm
- b. Side and Rear – Maximum H 10.5 mm x V 14.1 mm
- c. Inner 8 x 8 mm Maximum

1.2.3. LED and Display Quality – Front, Side and Rear Signs

- a. Amber coloured LED, dominant wave length 591 ~ 595 nm (colour matched and bin graded).
- b. UV resistant, diffused lens 4 mm (minimum) or ‘SMT PLCC2 standard package’
- c. Wide viewing angle 120° Horizontal & 60° Vertical
- d. Ensure enhanced readability with full clarity on scrolls and long life usage by incorporating non multiplexed system (constant current drive circuit) with typical LED Intensity 400 ~ 700 mCd at $I_f = 20$ mA, alternatively multiplexed design (maximum 4:1) with typical LED intensity 950~1150 mCd at 20 ma

1.2.4. Structure

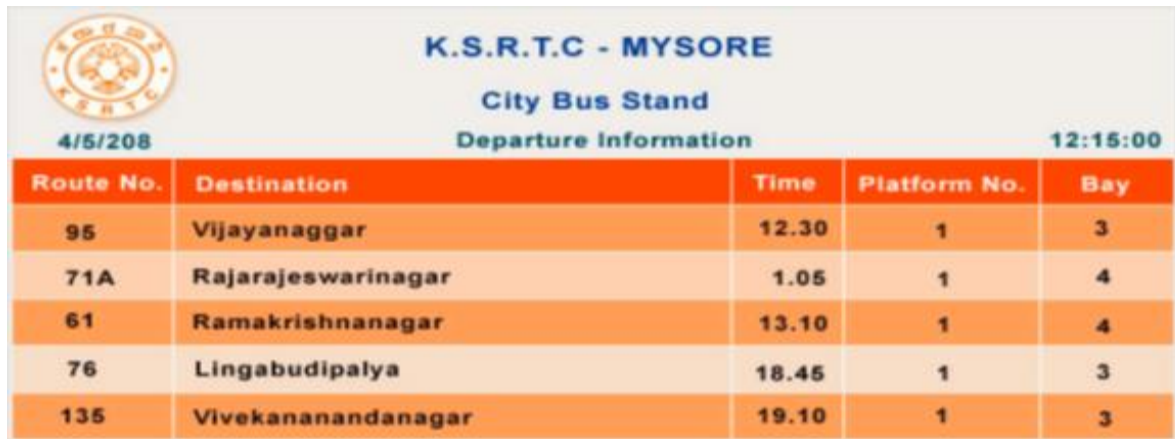
- a. Front, Side and Rear signs: Light weight structure with toughened glass fixed with UV resistant adhesive in front
- b. Inner Sign: Light weight structure with poly glass /acrylic/toughened glass.
- c. Electronic devices used to be 'automotive grade' rated for temperature -15°C to +80°C (so as to meet specified tests with conformal coated PCB boards
- d. Power to signs shall be supplied through bus multiplex wiring system

2. Passenger Information System – Bus Stop / Terminus Display

- 2.1. Passenger information will be pushed/pulled in real time while all other information shall be scheduled during non-peak hours.

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- 2.2. Display units shall be mounted on a rugged enclosure to withstand harsh environmental conditions with reasonable physical security. Fitment provision will have to be provided in the Bus stands along with necessary power supply made available. Display will be located at a convenient height to have a clear view of the message of next arrival bus.



Route No.	Destination	Time	Platform No.	Bay
95	Vijayanaggar	12.30	1	3
71A	Rajarajeswarinagar	1.05	1	4
61	Ramakrishnanagar	13.10	1	4
76	Lingabudipalya	18.45	1	3
135	Vivekanandanagar	19.10	1	3

Figure: Example of Transit Information Display on LED panel at Bus Terminal

- 2.3. Passenger Information System for Bus Terminal will have a 16-line industrial flat panel display from a recognized company.
- 2.4. One Integrated tamper proof casing for complete PIS Unit and should address physical security considerations
- 2.5. UPS with display for 15 to 20 minutes' back-up (to ensure smooth transition from main power supply to generator in case of power outages) desirable.
- 2.6. The LED unit will display details of arrival and departure information of the buses. The information of the buses such as Route Number, Destination and Estimated Time of Arrival (ETA) will be displayed. The LED units should be GPRS capable with capability to configure the system remotely. The refresh timing for ETA should be 30 seconds and configurable.
- 2.7. One Integrated tamper proof casing for complete PIS Unit addressing physical security considerations.
- 2.8. Provide any hardware like GPRS Communication system, networking, etc. required to run the PIS and advertisements on LED Display Units.
- 2.9. Aesthetic requirements such as fonts, colors, rows per page, display time to be remotely configurable and displayed based on business requirement.

- 2.10. It should be possible to choose one or more displays associated to Bus stop from the control room application and send the display text or graphical information to the selected displays over GPRS/3G/4G wireless connections.
- 2.11. The ETA information will be automatically routed to the respective bus stop displays from the control room application.
- 2.12. Display the ETA of all the buses approaching a particular bus stop on the bus stop display with accuracy of 85 % at ETA of 20 min.
- 2.13. The Bus Stop Display, which receives all such information, will display continuously until the next set of data is received
- 2.14. At any circumstances ETA displayed should not exceed the >20% error or ETA lesser than – 2 min to actual.
- 2.15. LED Display:
 - 2.15.1. Dimensions: 260mm x 1039mm
 - 2.15.2. Lighting type: Digital LEDs
 - 2.15.3. LED pitch: Max: 13.4 mm(H) / 10.0mm (V)
 - 2.15.4. Text: Static, Paging or Scrolling, over 1 or 2 lines
 - 2.15.5. Operating voltage: 09-32v DC
 - 2.15.6. Operating temperature: -15°C to +80°C
 - 2.15.7. Storage temperature: -15°C to +80°C
 - 2.15.8. Operating humidity: 95% max
 - 2.15.9. Certification: IP66

3. Automatic Vehicle Location (AVL) System

For KSRTC City Buses, the on board device will transmit real time GPS data of vehicle locations, to Control Centre at user configurable frequency (5 seconds or less), via 3G (GSM) / GPRS, for further processing and use, including that for signs on Bus Stops and Bus Terminals. The device shall be installed on the KSRTC City buses as per UBS II specification. However, for Municipal Corporation Vehicles, simple tracking of vehicles through GPS/GPRS devices should be implemented.

3.1 General Technical Requirements

- a. VTU shall consist of a GPS receiver with GPS Antenna, GSM/ GPRS receiver, Speaker and Microphone for hands-free voice communication to enable services such as vehicle tracking, communication and control in connection with a backend control centre system. The antenna shall be suitably located so as to provide reliable coverage.
- b. The Global position system (GPS) mounted as part of the Vehicle Tracking Unit in the bus will receive the longitude and latitude coordinates from the Satellite through a process of triangulation. This information is then sent across to the Control station at Tumakuru through the wireless communication link – GSM / GPRS. The application at the Tumakuru Control station on receiving the position inputs will update the display boards at the bus shelters / stops enroute and at the bus terminal platform display panel and the general display panel at the related bus terminals.
- c. The accuracy of the prediction time (Expected Time of Arrival-ETA) and ETD (Expected Time of Departure) should not vary more than +/- 2 minutes. The accuracy of the prediction of vehicle location should not vary more than +/- 3 meters.
- d. The location of VMU within the bus shall be easily accessible for maintenance and servicing but located to prevent tampering or unauthorized removal and shall be vibration & shock resistant, heat resistant, dust resistant and water / rain splash resistant and shall be tamper proof. It should not be inferior to relevant Indian or International standards.
- e. VTUs shall have Geo-fencing capability.
- f. Each VTU offered by service provider should have configuration to ensure required 10 Sec. update time for the vehicle position at all times.
- g. KSRTC must be able to modify the data arrival frequency and server IP any time.
- h. Redundancy to be provided in VTUs to ensure if GPRS fails due to unforeseen reason and then SMS facility is activated as a fall back mode.
- i. Each Base Transceiver Station (BTS) of offered service provider should have configuration to ensure required 10 Sec. update time for the vehicle position at all times in all BTS area.
- j. In case of loss of communication link, the VTUs shall have memory storage for at least 5000 way points to keep the data till the communication link is re-established. System memory should save data and not reset when unit is switched off or during power failure.

- k. The GPRS tracking unit fitted in the bus will also transfer the current LON/LAT data to the bus mounted display unit through RS 232 I/F for display /audio announcement of Bus Stops.
- l. The VTU software should be upgradeable/ configurable over the air (OTA).
- m. The VTUs should have at least IP65 or higher protection classification according to IEC 60529.
- n. The VTUs should have at least 4 programmable buttons (SOS button – 1 no. plus 3 buttons – configurable for different messages).
- o. The VTUs should support 2-way voice communication between Driver and Control Centre, with configured and allowed numbers only.
- p. The VTUs must be able to generate real-time Alerts to drivers for exceptions such as Over-Speeding, Harsh Braking, Harsh Acceleration, etc.
- q. The VTUs should support the configuration of parameters for Over-Speeding, Harsh Braking, Harsh Acceleration.
- r. The VTUs shall work on 12V DC or 24 DC Battery and the device should be powered by vehicle battery and not ignition. A dedicated battery should also be provided for power redundancy.
- s. The VTUs should be compatible for interfacing with other devices such as Display Controller over RS232 interface.
- t. VTUs application should generate tampering alerts.
- u. Availability of GSM communication network device in-vehicle > 98% - At any point in time minimum 98% of GPS units shall be functional

3.1.1. Driver Voice Communication

- Driver will be given an interface for the voice communication
- The Communication Headset will be provided to the driver to interact with Control Center. The driver will use the two-way communication facility made available to communicate with the Control center. The Control center can also contact any of bus drivers instantly to communicate messages. The driver can also use the audio system for announcing information regarding arrival of bus stations and incident management.

3.1.2. In-Bus Voice System

- The next arrival bus stop information and other necessary information can be announced inside the bus. The data for the announcement will be sent from VMU to Voice system through serial port. This in bus voice system will be in turn connected to a speaker.

3.1.3. Communication Specifications

a. GSM/GPRS specifications

1	GSM	Normal MS-SMS data
2	Frequency	900/1800/1900 (dual band) Class 4 (2W) at 900 MHz (EGSM) Class 1 (1W) at 1800 MHz or As per allowed bandwidth and frequency for operations in India
3	GPRS	Type B class 10
4	SIM	1.8V/3V
5	Antenna	Built-in suitable antenna for efficient operation with provisions for stable mounting
6	Certification	Equipment needs to be certified as per Indian or international standards CE or FCC

b. GPS specifications

1	Frequency	L1 (1575.42 MHz) frequency or as per allowed bandwidth and frequency for operations in India
2	C/A code	Standard Positioning Service
3	Channels	Minimum 16-Channels
4	Sensitivity	Minimum -158 dBm Acquisition without external assistance
5	Accuracy	Horizontal: <6 meters (50%) Altitude: <11 meters (50%) Velocity: 0.06 m/sec
6	Antenna	Suitable antenna for mounting on target vehicles (buses)

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3.1.4. Environmental specifications

1	Temperature	Operating -20°C to +70°C
2	Humidity	5% to 95% RH non-condensing at +40°C
3	Enclosure	Certified IP 65 or equivalent
4	Vibration	to meet SAE standards
5	Shock	to meet SAE standards

3.1.5. Physical specifications

- Assembly: Enclosed box as per standards with suitable mounting Integrated with chargeable battery pack

3.1.6. Electrical specifications

- Primary Power: Vehicle Battery 12/24 volts
- Battery Life: Mandatory 8 Hours normal operation

3.1.7. Firmware

- Over the Air Download of firmware as well as configuration parameters
- Store and Forward features for network dark zone

3.1.8. Others:

- a. Front Sign: Central
- b. Rear Sign: Central
- c. Side Sign: First window ahead of rear door
- d. Inner Sign: Centralize along the width of bus behind the driver's partition
- e. Speakers with Protective Grill: One each near the doors and others equally distributed across the length of the bus – Total no. 4
- f. SCU, Recorder, Amplifier: Secured and ventilated compartment right above the driver
- g. BDC: Ergonomically placed for driver ease
- h. Camera: as specified else where
- i. Combi Antenna: Suitable place to define inside the bus (preferably) with direct line of view for 'affixing' the unit.

3.2. Workstations / Desktops

S. No	Parameter	Specifications
1	CPU	Latest Generation 64bit X86 Quad core processor(3Ghz) or better
2	Memory	8 GB 1066 MHz DDR3 RAM with 16 GB Expandability.
3	Mother Board	Latest series 64bit Chipset, OEM Motherboard
4	Monitor	26 inch LED HD Digital Colour Monitor TCO-05 certified.
5	Display	Integrated on Board Full HD resolution with 16 Million or More colours
6	Hard Disk	1 TB 7200 rpm Serial ATA HDD or higher
7	Networking Features	10/100/1000 Network Card with remote booting facility, remote system installation, Asset tracking and security management, remote wake up
8	Ports	6 USB Ports (with at least 2 in front), audio ports for microphone and headphone in front.
9	Keyboard	104 Keys, heavy-duty normal English USB keyboard, having key life of 20 million keystrokes or more (same make and colour as base CPU)
10	Mouse	2 button optical USB scroll mouse with at least 10" mouse pad
11	DVD ROM Drive	8X or better DVD RW Drive.
12	Power supply	230 watts and above Energy Star compliant Ver 5.0, ACPI compliant or more SMPS power supply, should be capable to support fully configured PC
13	Power Management	Energy star 5.0 compliant for power saving
14	Operating System	Latest version of Microsoft Windows with latest service pack preloaded with license and recovery CD from direct named account of Microsoft with certificate of authenticity having OEM name and Linux OS
15	Bundled software	Standard bundled software pertaining to the model offered should be included in offer (Must be specified in the offer)
16	Warranty	For the complete project period
17	Productivity Software	Open Office
18	Antivirus	Latest ant virus with five year Upgrades / Update license
19	Certification	Windows , Linux

3.3. 55 inch LED UHD Display Board with Controller

Sr. No.	Parameter	Minimum Specifications
1	Screen Size	55" or higher
2	Resolution	Full high definition (1080p) 16:9 Widescreen
3	Contrast ratio	5000:01:00
4	Brightness	350 nit
5	Viewing angle	178 degree/178 degree (H/V)
6	Response time	8ms
7	Input	HDMI, USB, VGA, etc.
8	Control	On Screen Display (OSD) IR remote control
9	Operations	24 x 7 basis
10	Type	Industrial Grade with IP65 certification

3.4. Multi-Function Laser Printer

Sr. No.	Parameter	Minimum Specifications
1	Technology	Laser
2	Monthly duty cycle/RMPV (pages)	200,000/5K-20K
3	Print speed – simplex (A4)	Up to 41 ppm
4	Scan speed – Black/Color simplex	Up to 50/30 ipm
5	Scan speed – Black/Color duplex	Up to 19/14 ipm
6	Scan-to destinations	Email, Network folder, USB
7	Processor (MHz)	600
8	Memory (MB)	1,024
9	Hard disk drive (HDD)/Capacity (GB)	Yes/240
10	Connectivity	2 Hi-Speed USB 2.0; 1 Gigabit Ethernet 10/100/1000T network
11	Print resolution – Max/Best print quality (dpi)	Up to 1200x1200
12	Input capacity – Std/Max (sheets)	600/4,600
13	Output size – Min/ Max (mm)	76.2 x127/312x469.9
14	Automatic duplex	Yes
15	Energy Efficiency	BEE or Energy Star certified
16	Control panel display	m touchscreen

3.5. CCTV Cameras with 1 TB Local Storage per Bus

S No.	Features	Parameter
1.	Shutter Time	1/25(1/30)s to 1/50,000s
2.	Angle Adjustment	Pan: 0°- 360°, Tilt:0°- 90°, Rotate: 0°- 360°
3.	Wide Dynamic Range	120dB
4.	Synchronization	Internal
5.	Video Frame Rate	1080p @25 fps / 1080p @ 30fps
6.	AGC	Support
7.	D/N Mode	Color/BW/SMART
8.	White Balance	ATW/MWB
9.	BLC	Support
10.	Functions	Wide Dynamic Range, Digital noise reduction, Mirror, SMART IR
11.	Storage	1 TB local storage for each Bus

4. An Indicative Functional Requirements of the Proposed Application

1. The system will be web based and the bidder shall manage the ITS portal on a day to day basis for a period of three years. The typical activities cover standard portal visitor analysis, popular pages, page loading times, other maintenance activities such as changing website content, modification, restructure, initiating customer opinion polls etc. as required by KSRTC/TCC. This portal will be accessed by Commuters, Control Stations, other KSRTC /TCC staff and will be the single point entry for authentication and role based access.
2. Appropriate features for KSRTC to categorize complete operational area geographically into different division jurisdiction/sector for better management and establish control rooms.
3. Users will be classified based on roles with access levels across the application.
4. The GIS system shall provide for colour coded display (preferably with service class bus image) based on arrival times of buses at various bus stops. The following table illustrates the colour codes based on arrival times efficiency, all of them to be easily configurable:

Green	On time (defined as not more than 5 minutes early or 10 minutes late)
Orange	Early (more than 5 minutes early)
Yellow	Late (more than 10 minutes late)
Pink	Off-route

Blue	Not logged in
Arrow >	Point the direction of travel

5. The data structure and format will conform to standard practices adopted internationally and will have to be based on the Data Standards Definition framework widely accepted. The data elements may include vehicle description, identification, VTU details and other data elements as identified essential by the implementing vendor and KSRTC / TCC and its Project Management Agency
6. The database shall always be up-to-date on the movement of vehicles along with their defined schedules and destinations and details of the drivers/ conductors of the vehicles.
7. ITS application shall provide a graphical interface to make quick position related assessments. Application shall support dynamic monitoring of vehicles moving out of their defined routes and be able to raise alerts to be sent across to the driver of such vehicles.
8. ITS application software shall support facilities to zoom-in to enable close-up view of the vehicle of interest or to zoom-out to view all the vehicles on the screen.
9. ITS application software shall support both time mode (periodic update based on time interval) and distance mode (periodic update based on distance interval) configurable intervals.
10. ITS application software shall support calculation of distance travelled by a vehicle on a schedule/ trip and average distance travelled and time taken in a schedule for a period. Calculation of Travel time estimation between two places class-wise.
11. The interface of the application shall support multiple window views for an overview with capabilities to close up and enlarge a screen of interest.
12. ITS application software shall support for playing back the recorded details of the bus movement along the authorized route for a period of 1 months online and 6 months archive data.
13. ITS application software shall have provision for creating different roles and privileges for controlling accessibility (read only/Add/Modify) based on units (Bus stand / Depot / Division / Corporation) attached and roles and privileges.

14. The tracking and locating the vehicle(s) will cover all those buses that are equipped with monitoring units and shall include those in movement, those stationed in the bus depots/Bus stands/workshops/Pickup points, stops, etc. This features shall be available to the users on demand
15. Information elements that needs to be captured at the minimum include longitude, latitude, physical location with date and time stamps, bus number, schedule number, trip code and overlay this on a map
16. ITS shall provide the above data on demand with an overlay on the geographic map or as a text table on real time basis at pre-determined and configurable intervals
17. Display of real-time dynamic movement of buses plying on a selected route in both Text and on map, with relevant ETA (to the destination point of the route) displayed alongside
18. Facility to track real time and generate reports based on Defined vs. Actual movement of vehicles. The variance will include a set of preconfigured parameters such as defined routes, stoppages, etc.
19. The ITS receives the current position of all the buses from the Tracking Unit, will disseminate the data received and transfer the relevant information like the schedule No, Destination of the bus and the Expected Time of Arrival at that bus stop, to the bus stand display, which has requested for the data.
20. System shall support generalized enquiry for a jurisdiction based on run time parameters indicatively such as:
 - Real time / history of all trips that are more than a “X” minutes late (x input runtime by the user)
 - Real time- history / Record of a particular jurisdiction in maintaining ETA
 - Real time / history of All Trips or specific trips between two points with a feature to playback
21. ITS support real time enquiry from KSRTC / TCC Staff (or Commuter) between two points and for all the trips that are scheduled with pickup point/stop/bus-stand/place/sector and

ETA of destinations as well as the present position of the bus. The enquiry broadly supports response in terms of details of Time table, ETA, ETD of the buses all or sector wise.

22. System shall support real time enquiry of a bus location based on bus number/trip code and to know ETA at next or required place.
23. System shall support real time enquiry based on Bus Stops/Pickup point, Bus Stand, schedule no, trip id, bus no etc., to find out whether the bus passed a pickup point /stop / bus stand / place, to find out the nearby vehicle/s to a given place/location/pickup point bound to specified destination (which have not passed), to find out the nearby vehicle/s to a given vehicle which have not passed/just passed/on the same route or on different route. The output shall be possible both on map and text based display.
24. Response to the query shall be appropriate to the channel from which the enquiry was received such as SMS/ Web. SMS response will be perhaps a limited text message while that from the web shall have relevant text output / Table and if relevant vehicle locations of the current trips on a web page with an overlay on the map.
25. The system shall provision controlling display of vehicle/schedules based on user role for a query. Some vehicles may not be visible to public and visible only to certain roles with in KSRTC/TCC.
26. The display of vehicles on the map shall be colour coded based on parameters such as regular schedules, special services, services with reservation and non-reservation facilities etc. as per operational requirement of KSRTC/TCC.
27. As regards the Information (a specific type of enquiry) to be displayed on the PIS at each Bus-stand/ Bus Terminus will contain details of Trips codes with an ETA of the next 2 hours (configurable) platform wise/all. The details for display shall contain Estimated ETA, ETD (If relevant), etc.
28. ITS should enable KSRTC/TCC staff to query and visualize graphically patterns of poor on-time performance in order to take corrective actions
29. System shall provide actual distance between two places or points.

30. Alerts will be displayed on the monitoring console and an extract of the same will be available on the users dashboard for the user with their jurisdiction of operation
31. The Control Room operator shall be able to drill down to the exact location of the event by clicking on the alert and see the position of event drawn over the map along with driver, vehicle and standard description of event details related to the business rule.
32. Alerts from Moving / stranded buses enroute through the operation of a panic button provided in the VTU Unit.
33. Alerts will need to be generated in case of deviations from the authorized route and recorded in all cases for reporting and review
34. Alerts on exceptions for all other pre-configured parameters such as driver behavior, harsh acceleration/braking, non-stoppage at designated points, not meeting the ETA and ETD schedules etc. and logged into journey details of the bus for each trip
35. In case of vehicles that are moving, Alerts shall be flashed at the control room as well as the nearest two Bus stands i.e., through one that is passed and the one approaching Bus stand
36. SMS notification to concerned officials for specified schedules/vehicles regarding certain parameters like regularity, skipping stops, speed violations, etc.
37. Provision to capture information pertaining to incidents like riots, natural calamities, etc. and sending alerts to required bus stand.
38. Arrangement with a SMS service provider for providing the SMS service with a standard number
39. System will automatically reply (send SMS) to all SMS enquiries
40. The rate at which the SMS shall be charged to the end user is to be indicated and should comply to the guidelines from telecom authorities
41. Provide reports regarding number of SMS's received (category wise) and sent (category wise), cost of the SMS's and revenue generated for this service.

42. The system shall have provision to send SMS to concerned mobile numbers (KSRTC/TCC officials) by KSRTC users, on selected criteria, with customized message.
43. The revenue generated by this service shall accrue to KSRTC / TCC in proportionate manner and the commercial arrangement proposed for handling SMS shall be clearly provided by the bidder
44. The VTU unit shall not only operate outdoors but also be able transmit stored signals in an environment which may not have a very clear view of the sky
45. VTU should support 2-way voice communication between the driver of the vehicle and the various Control room for sending alerts from vehicle with preconfigured buttons for activating the voice communication with the central control station. The configuration shall allow communication only to the numbers maintained. The voice communication will be simple and activated through the press of a button.
46. The vehicle mounted communication hardware i.e., Audio Speaker and Microphone of the VTU needs to be located at appropriate place speaking listening and should be able to pick up audio from the driver
47. Information Display units will be supplied and mounted appropriately, configured and commissioned.
48. There are locations with multiple displays at a bus stand and are to be managed from the same system at the bus stand
49. Display systems needs to support Digital display of text, images and video on appropriate screens such as LCD, Plasma Panels, LED, etc. both in English and Kannada.
50. Displayed messages must be readable in high bright, day light.
51. Display system in addition to the display of information from ITS shall be capable of displaying advertisements and multimedia content at the bus terminals and may need to alternate between Passenger information and Advertisements.

52. The frequency and period of information display on PIS display shall be configurable from control location for advertisements and other transit information.
53. Display shall provide for modular configurable layout enabling parallel display of content on different areas of the screen – Real time Transit information (Routes, ETA, Type of service, Fare, Seats available etc.), Time/Date, Public announcements, Safety information, Commercial advertising, a ticker tape at the bottom for text announcements / advertisements, other local Tourist information.
54. All displays for PIS will have a refresh rate, ideally 1 minute or less.
55. The bus Stand display, which receives will display continuously until the next set of data is received

8.0 Proposed Tender Conditions

8.1 Pre-Qualification (PQ) / Eligibility Criteria

S. No	Basic Requirement	Specific Requirements	Documents Required
1	Legal Entity	<p>The Bidder (all members of the consortium) shall be in operations for a period of at least three (3) years as on the date of submission of proposal. Also, the bidder (all members of the consortium) should be registered with GSTN.</p> <p>The Bidder (all members of the Consortium) should be incorporated under the Companies Act, 2013, or a partnership firm registered under LLP Act., 2008.</p> <p>The lead bidder should be responsible for works for at least 51% of the total value under this contract.</p> <p>A member of any Consortium shall not bid either individually or as a member of another Consortium for this assignment.</p>	<ul style="list-style-type: none"> • Copy of certificate of Incorporation / Registration under Companies Act 2013 (for Indian companies) • Copy of Consortium agreement / JV agreement or Memorandum of Understanding to work together in case of winning the project. • In case of a consortium the same shall not consist of more than two companies including the lead bidder and shall be formed under a duly stamped consortium agreement. In case of a consortium, one of the partners shall be designated as a "Prime Bidder".
2	Company Financials	<p>The Bidder / Lead Bidder (in a consortium) shall have an annual turnover of at least INR 10 Crores</p>	<ul style="list-style-type: none"> • Copy of the certified and audited financial statements or CA certificate mentioning

S. No	Basic Requirement	Specific Requirements	Documents Required
		<p>in any of the two financial years over the last five (5) Financial Years.</p> <p>The Bidder (each member of the consortium) shall have a positive net worth as on 31st March 2017.</p>	<p>the turnover during the period.</p> <ul style="list-style-type: none"> • Certificate from the Statutory Auditor on Net Worth, for each bidder
3	Certifications	<p>The Bidder (any member of consortium) shall have any one of the following Certifications valid as on the date of submission of proposals:</p> <p>ISO 9001:2015</p> <p>ISO 20000:2011 for IT Service Management or equivalent certification</p>	<ul style="list-style-type: none"> • Copies of the valid certificate in the name of the Bidder.
4	Technical Capability	<p>The bidder or consortium partner shall have experience of design, supply, installation, commissioning, testing, operation & maintenance of at least one (1) AVL project for vehicle-based (buses or equivalent) transport system with a fleet of at least 50 vehicles (the operating environment of the vehicles should be similar in nature to that of motorized vehicle-based transport system in cities/townships/etc.), wherein the bidder shall have provided AVL system hardware to</p>	<p>Sole Bidder/any Member of Consortium/Sub-Contractor(s):</p> <ul style="list-style-type: none"> • Work Order / Contract clearly highlighting the scope of work, Bill of Material and value of the contract / order. • Completion Certificate issued & signed by the competent authority of the client entity on the entity's Letterhead <p>In case of large orders/orders with operations & maintenance phase, the completion may</p>

S. No	Basic Requirement	Specific Requirements	Documents Required
		<p>monitor, manage and control transit operations with a single work order value of not less than INR 2.5 Crores. In addition, the bidder should have the facility to integrated the AVL system with the Passenger Information sub-system to provide route and ETA (expected travel arrival) to passengers. The AVL projects should have been commissioned within the past 5 (five) years from the date of submission of the proposals and should have been in commercial operations for at least one year post implementation of the project.</p>	<p>specify successful execution and in-operation status of a part of the order meeting the requirement.</p>
5	Blacklisting	<p>A self-certified letter by the authorized signatory of the Bidder (all consortium members) that the Bidder (all consortium members) has not been blacklisted / debarred by any Central / State Government (Central/State Government and Public Sector) or under a declaration of ineligibility for corrupt or fraudulent practices as of must be submitted on original letter head of the Bidder with signature and stamp.</p>	<p>A Self Certified letter by an authorized signatory</p>

S. No	Basic Requirement	Specific Requirements	Documents Required
6	Authorization from OEMs	Manufacturers' (OEMs) Authorizations for Information Technologies - except for those technologies which the Bidder itself manufactures - are required for the following types/categories: <ol style="list-style-type: none"> 1. Automatic Vehicle Tracking (AVL) system 2. Hardware planned for the Control Centre 3. Software systems planned for the Control Centre such as Operating / network systems / databases, etc. 4. GPS software application that are proposed to be used off-the-shelf 5. Hardware planned for display inside/outside the vehicles and bus stops / bus terminals 6. Infrastructure Service Provider (Cloud Services) for hosting of applications. 	Letter of Authorization, as per template provided

8.2 Technical Qualification Criteria

The Bidder's technical solution proposed in the Technical Evaluation bid shall be evaluated as per the evaluation criteria in the following table. The Bidders are required to submit all required documentation supporting the evaluation criteria specified (e.g. detailed Project citations and completion certificates, client contact information for verification, profiles of Project resources etc.) as required for technical evaluation.

#	Evaluation Criteria	Total Marks
1	Qualification & Experience of Proposed Technical Resources:	20
2	Project Experience	40
3	Approach & Methodology & Solution Proposed	25
4	Product Specification & Technical Demonstration	15
Overall Technical Score		100

Important: Qualification criteria for technical evaluation and progression to commercial evaluation stage:

- Minimum 75% (75 marks) of the overall technical score total.

N.B. – Authority (or a nominated party) reserves the right to check/validate the authenticity of the information provided in the Pre-qualification and Technical Evaluation criteria and the requisite support must be provided by the Bidder.

The following sections explain how the Bidders shall be evaluated on each of the evaluation criteria.

Technical Bid Criteria & Evaluation

#	Criteria Category	Evaluation Criterion Details	Max Marks Allotted	Supporting Documents Required
A	Qualification & Experience of Proposed Technical Resources		20	
1	Qualification & Experience of Proposed Technical Resources	a. Project Manager (4 Marks for Qualification, 6 Marks for Relevant Project Experience) b. Systems Engineer (2 Marks for Qualification, 3 Marks for Relevant Project Experience) c. IT Specialist (2 Marks for Qualification, 3 Marks for Relevant Project Experience)	10 5 5	Detailed CVs in template, as prescribed

#	Criteria Category	Evaluation Criterion Details	Max Marks Allotted	Supporting Documents Required
B	Project Experience		40	
1	Bidders Competence Executing Large ICT Projects	The bidder (Lead Bidder in case of Consortium) should have experience in executing ICT projects worth at least INR 10 Crore in at least two of the last 5 years. More than INR 50 Crore = 15 Marks INR 21 Crore to 50 Crore = 10 Marks INR 10 Crore to 20 Crore = 7 Marks	15	For On-going Projects: • Copy of Work Orders & Client Certificates stating the current phase of contract
2	Bidders Competence Executing – GIS based Intelligent Transport System	The bidder (any consortium member) should have experience in executing projects that entails Automatic Vehicle Tracking System for: Between 50 to 100 vehicles = 15 Marks Between 100 to 200 vehicles = 20 Marks More than 200 vehicles = 25 Marks	25	• The project should be in Operation & Maintenance phase for a period of at least 1 year. For Completed Projects: • Copy of Work Order & Completion Certificates
C	APPROACH & METHODOLOGY		25	
1	Understanding of the Assignment	Understanding of the project and Conformity to functional requirements	2.5	A TSCL appointed panel will evaluate the

#	Criteria Category	Evaluation Criterion Details	Max Marks Allotted	Supporting Documents Required
2	Risks and Mitigation Plan	Identification of major risks and mitigation measures proposed	2.5	Approach & Methodology Proposals.
3	Architecture	Proposed Architecture and Solution Plan	5	
4	Approach & Methodology	Explain detailed approach and methodology for execution of the project along with project plan a. Project execution methodology including project phasing b. Deployment methodology c. Support methodology including service desk d. Training approach e. Cloud Hosting Architecture f. Work Plan	15	
D PRODUCT SPECIFICATIONS & TECHNICAL DEMONSTRATION			15	
1	Product Specification & Technical Demonstration	a. Compliance to Product Specifications – 5 Marks b. Technical Demonstration – 10 Marks	15	A TSCL appointed panel will evaluate the Presentation Proposals.

8.3 Commercial Bid Evaluation

- a) All the technically qualified bidders will be notified to participate in Commercial Bid opening process.
- b) The commercial bids for the technically qualified bidders shall then be opened on the notified date and time and reviewed to determine whether the commercial bids are substantially responsive. Bids that are not substantially responsive are liable to be disqualified at Authority's discretion.
- c) The bidder that has quoted the Lowest Total Price, L1 (CAPEX + OPEX for 3 Years) shall be treated as L1 and will be declared as the Preferred Bidder.
- d) Only fixed price commercial bids indicating total price for all the deliverables and services specified in this bid document will be considered.
- e) Any conditional bid would be rejected
- f) Errors & Rectification: Arithmetical errors will be rectified on the following basis: "If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected. If there is a discrepancy between words and figures, the amount in words will prevail".

Errors & Rectification: Arithmetical errors will be rectified on the following basis: "If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected. If there is a discrepancy between words and figures, the amount in words will prevail".

8.4 Proposed Payment Terms

During the project period, the System Integrator shall submit the deliverables as per the timelines mentioned below. The total duration of the Project shall be 42 (Forty-Two) Months. TSCL may provide extensions to the Service Provider on the same terms and conditions under original agreement after completion of 3 Years 6 months.

#	Deliverables	Timelines	Payment	Deliverable Criteria
1	Submission of Inception Report	T + 2 weeks	-	-
2	Approved FRS and SRS	T + 5 weeks	5% of CAPEX	Acceptance by TSCL, KSRTC & TCC
3	Completion of Hardware Supply, Installation & Commissioning & Testing at all locations	T + 15 weeks	35% of CAPEX	Submission of Sign-off form duly signed by the concerned authority of KSRTC and TCC
4	Pre Go-Live Readiness* + UAT	T + 20 weeks	20% of CAPEX	Successful conduction of UAT – meet all client’s requirements
5	Go-Live of all components	T ₁ = T + 24 weeks	20% of CAPEX	Go-Live Report
6	Successful Operation of all Hardware and Software Components post Go-Live for a period of at least 3 months	T ₁ + 12 weeks	10% of CAPEX	Certificate from KSRTC and TCC on successful operation of the system
7	O&M	T ₁ + 36 months	90% of OPEX + 10% of CAPEX (equated quarterly)	Monthly Status Report

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#	Deliverables	Timelines	Payment	Deliverable Criteria
			payments for 12 quarters)	
8	Handover of System	T ₁ + 37 months	10% of OPEX	Acceptance of Handover Report and completion of Knowledge Transfer

N.B

T = Contract Signing Date

Pre Go-Live Readiness shall mean all the Hardware, Software delivered under this project should be commissioned with the ITS Application to be developed under the project and also that the application is successfully deployed in the Cloud System. A sample test report should be submitted to the Client.

9.0 Estimated Project Cost

CAPEX

Sl. No.	Item	Unit	Qty.	Rate	Amount	Sub-Total	Total
1	In Vehicle Equipment					68,86,300.00	
a	GPS Devices for KSRTC Buses including accessories	Nos.	49	12,000.00	5,88,000.00		
b	GPS Devices for Municipal Vehicles	Nos.	120	8,000.00	9,60,000.00		
c	Set of In-Bus PIS Display (Front & Inner)	Sets	49	1,00,000.00	49,00,000.00		
d	GPRS Enabled Activated SIM Card	Nos.	169	100.00	16,900.00		
e	CCTV camera	Nos.	98	4,300.00	4,21,400.00		
2	Bus Stop Equipment					71,04,200.00	
a	PIS Display Boards at Bus Stops - 2 Lines with Controller	Nos.	107	45,000.00	48,15,000.00		
b	PIS Display Boards at Bus Stops - 4 Lines with Controller (High Density)	Nos.	35	65,000.00	22,75,000.00		
c	GPRS Enabled Activated SIM Card	Nos.	142	100.00	14,200.00		
3	Bus Terminal Equipment					19,25,000.00	
a	LED Panels - 16 Lines (for Common / Waiting Area Display)	Nos.	2	1,50,000.00	3,00,000.00		
b	LED Panels - 4 Lines (for Bus Bays)	Nos.	25	65,000.00	16,25,000.00		

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Sl. No.	Item	Unit	Qty.	Rate	Amount	Sub-Total	Total
4	Control Centre Equipment - KSRTC & Satellite Centre Equipment - TCC					16,90,000.00	
a	55 inch LED UHD Display Board with Controller	Nos.	1	3,00,000.00	3,00,000.00		
b	Work Stations / Desktops with Windows OS	Nos.	5	70,000.00	3,50,000.00		
c	Site Preparation, Setup, Connectivity, Network, Power Backup, Access Control, Furniture, Air Conditioner etc.	Lump sum	2	5,00,000.00	10,00,000.00		
d	Multi-Functional Printer (MFP)		2	20,000.00	40,000.00		
5	Software Solutions					97,00,000.00	
a	License Costs (Maps, Development Environment, etc.)		1	15,00,000.00	15,00,000.00		
b	Website Development		1	8,00,000.00	8,00,000.00		
c	MIS Customization		2	2,00,000.00	4,00,000.00		
d	Security Audit		1	5,00,000.00	5,00,000.00		
e	ITS (Combination of PIS and AVL Application) Application		1	65,00,000.00	65,00,000.00		
6	Training						
a	Training to KSRTC & TCC Nominated Employees		50	1,000.00	50,000.00	50,000.00	
A	TOTAL CAPEX COST (1+2+3+4+5+6) -without taxes :						2,73,55,500.00



OPEX

Sl.#	Item	Unit	Qty.	1 st Year	2 nd Year	3 rd Year	Total
1	Network Connectivity - Broadband Connectivity (4 Nos. including Redundancy)	Nos.	4	144,000.00	144,000.00	144,000.00	432,000.00
2	O&M Cost of the Software including required Manpower						
a	License Renewal Cost of the Software		22%	-	330,000.00	330,000.00	660,000.00
b	Technical Manpower for O&M Period	Nos.	2	795,240.00	795,240.00	795,240.00	2,385,720.00
c	Yearly Cost for 10 Nos. of Operator for KSRTC & TCC in 2 shifts	Nos.	10	3,240,000.00	3,240,000.00		6,480,000.00
3	AMC Cost of the Proposed Hardware		8%	-	1,365,952.00	1,365,952.00	2,731,904.00
4	Cloud Hosting Cost for 2 years - @70000 pm	Nos.	1	981,504.00	981,504.00	-	1,963,008.00
5	SIM Card (Only Data Cost) for Municipal Vehicles & PIS Boards at Bus Stops	Nos.	262	628,800.00	628,800.00	628,800.00	1,886,400.00
6	SIM Card (Voice and Data) Cost	Nos.	49	235,200.00	235,200.00	235,200.00	705,600.00
B	Total OPEX Cost			6,024,744.00	7,720,696.00	3,499,192.00	17,244,632.00
C	Project Cost for 3 years (A+B)						44,600,132.00
D	Contingency @ 5%						2,230,008.00
E	Total Project Estimate (C X D)						46,830,140.00

10.0 Annexures

Annexure 1: List of Bus Stops having Shelter

Locations with Bus Stops having Bus Shelters					
S. No.	Bus Shelter List	S. No.	Bus Shelter List	S. No.	Bus Shelter List
1	Kyathsandra	21	Kundur Cr	41	Jayanagara
2	Batavadi	22	Dibbur	42	Shettihalli
3	Batavadi	23	Banshankari Circle	43	Kaidala
4	SIT College	24	Sadashivnagar	44	Bheemasandra
5	SIT College	25	Ramkrishna Ashram	45	Medical College
6	Tumkur University	26	Shettihalli Gate		
7	Siddaganga High School	27	Shettihalli Gate Road Stop		
8	Siddaganga High School	28	Belagumba		
9	Bhadramma Choultry	29	Puttaswamayyana palya		
10	Bhadramma Choultry	30	Sira Gate		
11	Siddaganga College	31	Sira Gate		
12	Caltex Circle	32	Sridevi College		
13	Caltex Circle	33	Rangapura		
14	Caltex Circle	34	P & T Quarters		
15	Gubbi Gate Circle	35	SSIT Main Gate		
16	Kote Anjaneya Swamy Temple	36	SSIT Main Gate		
17	Amanikere Circle	37	Saraswathipuram		
18	Bypass	38	Maralurdinne		
19	Tuda Office	39	Nrupatunga		
20	Hanumanthpura	40	Bharadwaj Towers		

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Annexure 2: List of Bus Routes

BUS ROUTES				
#	Route-1	Route-2	Route-3	Route-4
SP/EP*	Kyathsandra B/S	Shettihalli	Oorukere	Siddaganga Math
	Girinagara	Jayanagara	Jail Cross	Kyathsandra B/S
	HMT/Fire brigade	HMS college	Rangapura	Girinagara
	Batavadi B/S	P & T quarters	Lingapura	HMT/Fire brigade
	Anjaneyaswamy Temple	Shattihalli gate	Shridevi collage	Batavadi B/S
	SIT college	Gopalakrishna Temple	Vanijya terige office	Anjaneyaswamy Temple
	SP office	DDPI Office	D C quarteres	SIT college
	College B/S	Badramma chowltry	Sira gate	SP office
	SS Circle	K R Extension	Maruthi CarShowroom	Collage B/S
	Siddaganga high school	Town Hall	Kodibasaweshwara	SS Circle
	Badramma chowltry	Tumkur B/S	Church circle	Siddaganga high school
	KR Extension	Kodibasaveshwara B/S	Tmk B/S	Badramma chowltry
	Town hall	Maruthi car show room	Town hall	KR Extension
	TMK B/S	Sira gate	Caltex	Town hall
	Town hall	Mahalakshmi Ext	Banashankari circle	TMK B/S
	Caltex	Venkateshpura	Sadashivanagara	Town hall
	B G palya Circle	APMC Yard	SSIT main gate	Caltex
	Gubbi gate	Anthrasanally By pass	Saraswathipuram	B G palya Circle
	Bypass	Anthrasanahalli B/S	Maralurdinne	Gubbi gate
	TATA Motars	Bovipalya		Bypass
	Bellavi cr/Bheemasandra Rly gate	S.L.N Extension		TATA Motars
	Medicle college	Yellapura		Bellavi cr/Bheemasandra Rly gate
	Den college			Medicle college
	Heggere B/S			Dental college
				Heggere B/S

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BUS ROUTES				
#	Route-5	Route-6	Route-7	Route-8
SP/EP	Belagumba	TMK B/S	TMK B/S	Tumkur Bus stand
	Kundur cr	Town hall	Town hall	Town Hall
	Jyothipura	K.R.Extension	K.R.Extension	K.R.Extension
	Bagya nagara	Badramma chowltry	Badramma chowltry	Bhadramma Chowltry
	By Pass	Siddaganga high school	Siddaganga high school	DDPI Office
	Hanumanthapura	SSCircle	SSCircle	Upparahally Gate
	Tooda Office	Govt College	Govt College	Upparahally Circle
	Stadium	SP office	SP office	Upparahally Maseedi
	S S Circle	SIT collage	SIT collage	Shivamookambika Nagara
	Kothitopu	Batavadi B/S	Batavadi B/S	Sacred Heart College
	KEB Choultry	Batavadi 1st main	HMT/Fire brigade	GSS Samudaya Bhavan
	Sreeramanagara	Prashanthangara	Girinagara	Geddalahally
	D.C.Office	Devarayapattana Hosa badavane	Kyathsandra B/S	Circle
	Tumkur B/S	Devarayapattana	SS Mutt Exhibn	Goolarive
	Townhall		Bandepalya cross	
	Caltex		SS Mutt Hospital	
	Banashankari Circle		MR Palya	
	Isra Choultry			
	Yasin Maseedi stop			
	Sadhashiva Nagar 2nd stage			
	Danapalace			
	Bypass cr			
	Ladies hostel cr			
	Rajevgandhi nagara			
	Melekote tudalayout			
	Gangasandra			

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BUS ROUTES				
#	Route-9	Route-10	Route-11	Route-12
SP/EP	Oorukere	Tumkur Bus stand	Tumkur Bus stand	Tumkur Bus Stand
	Jail Cross	Town Hall	Town hall	Town Hall
	Ranga ura	Caltex	K R Extension	Caltex
	Lingapura	Banashankari	Badamma chowltry	B G Palya Circle
	Shridevi collage	Sadashivanagara	Siddaganga high school	Gubbi Gate
	Vanijya terige office	SSIT Main Gate	S S Circle	Bypass
	quarteres	Gayathri Kalyana Mantapa	Govt College	Tata Motors
	Sira gate	P & T Quarters	SP office	Bheemasandra
	Maruthi CarShowroom	Gulur	SIT collage	Sri Rama Temple
	Kodibasaweshwara	Kaidala	Batavadi B/S	Bethaluru
	Church circle	Ettenahalli	Mahalakshmi Layout	Hanumanthanagara
	Tumkur B/S		Shanthiniketana Vidhyapeeta	Hanumanthapura
	Town hall		Man-unatha Na ara	Kannenahalli
	caltex		Gokula Badavane 2nd stage	Dibbur Cross
	B.G.Palya		Gokula Badavane	Bugudanahalli
	Gubbi ate		Baddihalli	Aralagunte
	gubbi gate by ass			Ballapura
	Under bridge			Ranganayakana Palya
	Dana lace			Eechalagunte Cross
	Yaseen maseedi			Thimmalapura Gate
	Isra chowltry			Bellavi
	Hemavathi office			
	Sadashivanagara			
	Ramakrishna Ashrama 5			
	Banashankari 2 nd Stage			
	Hemavathi Layout G			
	Maralur Dinne			

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BUS ROUTES				
#	Route-13	Route-14	Route-15	Route-16
SP/EP	Tumkur B/S	Tumkur Bus stand	Tumkur	Tumkur Bus stand
	Town hall	Church Circle	Sira Gate	Town Hall
	K.R.Extention	Kodibasaweshwara	Maseedi	K.R.Extension
	Badramma chowltry	Ayyappaswamy Temple	Putswamayyana palya	Bhadramma Chowltry
	Siddaganga high school	Ashwath Katte	Sathyamangala Bypass	DDPI Office
	SS Circle	Nanjundayya Thota	Sathyamangla	Upparahally Gate
	Govt College	Gubbi Gate Cross	Navile Hally Cross	Vijaya Nagar
	SP office	Dibbur Maale	Navile Hally	Shattihalli gate
	SIT college	Aralimara	Muttasandra	P & T quarters
	Batawadi B/S	Dibbur	Vaddarahalli Cr	HMS college
	HMT/Fire brigade		Swandenahalli	Jayanagara
	Girinagara Stop			
	Kyathsandra			
	School Stop			
	Chandramouleshwara Temple			
	Ayyappaswamy Temple			
	Bypass			
	Chowdayyana Palya			
	Channigayyana Palya Cross			
	Kallahalli Cross			
	Shaneswara Temple			
	Government School			
	Maseedi Road			
	Kesarumadu			

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Appendix 3: List of Bus Stops

LIST OF TOTAL BUS STOPS					
#	Bus Stop List	#	Bus Stop List	#	Bus Stop List
1	Kyathsandra B/S	48	D C quarteres	95	Ramakrishna Ashrama 5
2	Girinagara	49	Church circle	96	Hemavathi Layout G
3	HMT/Fire brigade	50	Banashankari circle	97	Gayathri Kalyana Mantapa
4	Batavadi B/S	51	Sadashivanagara	98	Gulur
5	Anjaneyaswamy Temple	52	SSIT main gate	99	Kaidala
6	SIT college	53	Saraswathipuram	100	Ettenahalli
7	SP office	54	Maralurdinne	101	Mahalakshmi Layout
8	College B/S	55	Siddaganga Math	102	Shanthiniketana Vidhyapeeta
9	SS Circle	56	Belagumba	103	Man-unatha Na ara
10	Siddaganga high school	57	Kundur cr	104	Gokula Badavane 2nd stage
11	Badramma choultry	58	Jyothipura	105	Gokula Badavane
12	KR Extension	59	Bagya nagara	106	Baddihalli
13	Town hall	60	By Pass	107	Bheemasandra
14	TMK B/S	61	Hanumanthapura	108	Sri Rama Temple
15	Caltex	62	Tooda Office	109	Bethaluru
16	B G palya Circle	63	Stadium	110	Hanumanthanagara
17	Gubbi gate	64	Kothitopu	111	Hanumanthapura
18	Bypass	65	KEB Choultry	112	Kannenahalli
19	TATA Motars	66	Sreeramanagara	113	Dibbur Cross
20	Bellavi cr/Bheemasandra Rly gate	67	D.C.Office	114	Bugudanahalli
21	Medicle college	68	Isra Choultry	115	Aralagunte
22	Den college	69	Yasin Maseedi stop	116	Ballapura
23	Heggere B/S	70	Sadhashiva Nagar 2nd stage	117	Ranganayakana Palya
24	Shettihalli	71	Danapalace	118	Eechalagunte Cross
25	Jayanagara	72	Bypass cr	119	Thimmalapura Gate
26	HMS college	73	Ladies hostel cr	120	Bellavi
27	P &T quarters	74	Rajevgandhi nagara	121	Chandramouleshwara Temple
28	Shattihalli gate	75	Melekote tudalayout	122	Ayyappaswamy Temple
29	Gopalakrishna Temple	76	Gangasandra	123	Bypass
30	DDPI Office	77	Batavadi 1st main	124	Chowdayyana Palya
31	Kodibasaveshwara B/S	78	Prashanthangara	125	Channigayyana Palya Cross

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LIST OF TOTAL BUS STOPS					
#	Bus Stop List	#	Bus Stop List	#	Bus Stop List
32	Maruthi car show room	79	Devarayapattana Hosa badavane	126	Kallahalli Cross
33	Sira gate	80	Devarayapattana	127	Shaneswara Temple
34	Mahalakshmi Ext	81	SS Mutt Exhibn	128	Government School
35	Venkateshpura	82	Bandepalya cross	129	Maseedi Road
36	APMC Yard	83	SS Mutt Hospital	130	Kesarumadu
37	Anthrasanally By pass	84	MR Palya	131	Ashwath Katte
38	Anthrasanahalli B/S	85	Upparahally Gate	132	Nanjundayya Thota
39	Bovipalya	86	Upparahally Circle	133	Dibbur Maale
40	S.L.N Extension	87	Upparahally Maseedi	134	Aralimara
41	Yellapura	88	Shivamookambika Nagara	135	Putswamayyana palya
42	Oorukere	89	Sacred Heart College	136	Sathyamangala Bypass
43	Jail Cross	90	GSS Samudaya Bhavan	137	Sathyamangla
44	Rangapura	91	Geddalahally	138	Navile Hally Cross
45	Lingapura	92	Circle	139	Navile Hally
46	Shridevi collage	93	Goolarive	140	Muttasandra
47	Vanijya terige office	94	Hemavathi office	141	Vaddarahalli Cr
				142	Swandenahalli