Intelligent Transportation Real-Time System

System Requirements Specification

November 2007 (revised October 2009)

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and the
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1. Concept of Operations

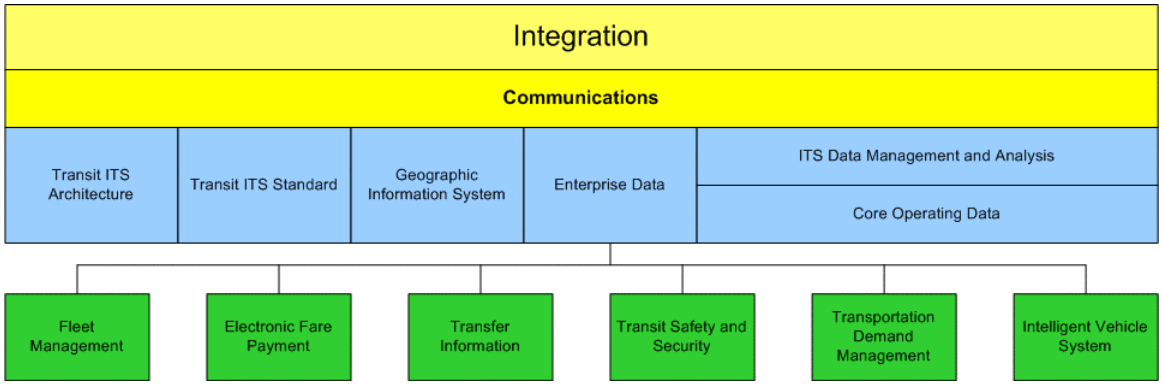
The following specification describes an Intelligent Transportation System (ITS) and has been designed for use by rural or small urban paratransit transportation providers. Specifically, it provides a passenger the ability to schedule a demand/response bus trip to a designated location or activity. The passenger will contact a dispatch center to schedule the trip. The dispatch operator will receive information from the passenger such as name, address, telephone number, etc. as well as the destination of the bus trip. The dispatch operator will then enter the passenger information into a scheduling software package. The software will provide a report identifying the bus and time the passenger will be picked up. The dispatch operator will notify the passenger with all the information about the trip. On the day that the trip is scheduled, the passenger will arrive at the scheduled time and pick up point to wait for the bus. When the bus arrives, the passenger will board the bus and be greeted by a message that says, “Good Morning, Mrs. Chavez. This is Bus # 3”. The passenger will know that they are on the correct bus. The passenger will then be taken to the scheduled drop-off point and arrangements made for the return trip – if not previously scheduled.

2. Scope

This specification includes all of the components and software needed to install, integrate and operate an ITS system as well as technical specifications identifying the operating parameters of each component. This document also includes specifications on equipment for the dispatch center, onboard the vehicle, and interfacing with the customer.

As referenced in Advanced Public Transportation Systems: State-of-the-Art Update 2006, the specifications address the areas assembled in the Transit ITS typology classification.

Transit ITS Typology - 2006



2.1 References

Standards from the following references have been used in the development of this document:

Advanced Public Transportation Systems: The State of the Art Update 2006

National ITS Architecture; U.S. Department of Transportation; Version 5.1

One-Stop Transit Information: Guidelines For Development of Regional Transit Information Systems in Texas; Laura L. Higgins and Cynthia W. Gilliland; October 2002

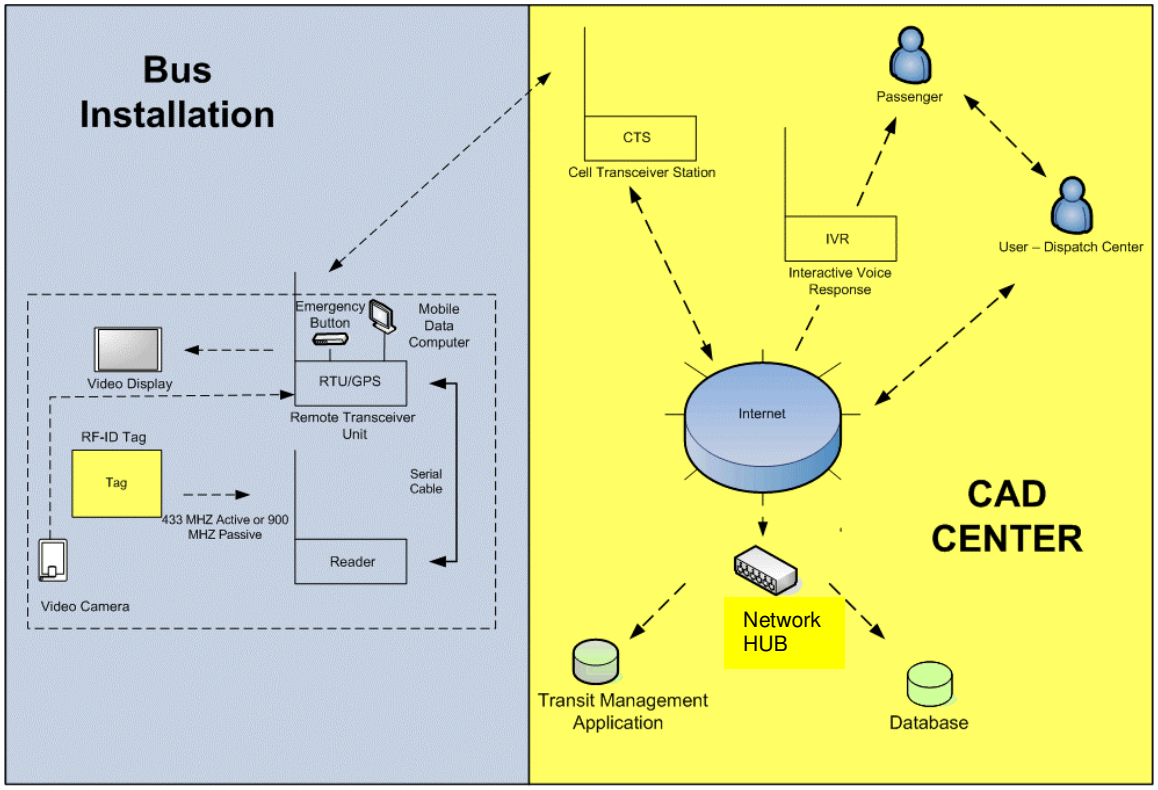
ITS Technology Evaluation & Integration Analysis, ITS Project Partners, November 2006

An Audit Report On The Medical Transportation Program, Texas, Department of Transportation, October 2007

2.2 ITS Schematic

The following diagram represents the ITS system schematic described in this ITS Specification document and provides the framework for developing an integrated transportation system. Additional components and functionality may be added in future implementations of the ITS System.

Note: Future technology or upgrades in hardware and software may affect the functionality of the system. Care should be taken in utilizing components which have specifications differing from those outlined in this document.



3. Technical Specifications

The technical specifications are divided into three separate areas:

- Computer Aided Dispatch Center;
- Onboard vehicle; and,
- Passenger interface.

3.1 Computer Aided Dispatch (CAD) Center

The transit agency dispatch center is the center hub for all communications associated with the operation of a transit system. Incorporated into this center are the hardware, software, and communication technologies to interface between the operating bus and each individual client.

3.2 Onboard Vehicle

Installed on the vehicle are the necessary hardware and software components to send and receive information from the dispatch center. These components provide up-to-the-minute trip status, messaging, vehicle/driver information, and scheduling changes.

3.3 Passenger Interfaces

The passenger will interface with the system in two ways. First, they can access the Transit Management Software via the Internet to request a trip. The system will provide a form that will be used to enter required information about the passenger and the trip. Second, the passenger can check on trip status via the Internet or telephone. This allows the passenger to determine if the vehicle is on time or running behind schedule.

4. Computer-Aided Dispatch (CAD) Center

Incorporated into the dispatch center are the hardware, software, and communication technologies to interface between the operating bus and each individual client. This section details the specifications for each component.

4.1 Transit Management Software

Transit Management Software incorporates advanced logistics algorithms and geographic information systems to accomplish fully-automated, computer-assisted and manual routing/scheduling for the paratransit and demand response industry. With integrated data management, scheduling, routing, dispatching, billing, reporting, and database maintenance functionality, Transit Management Software enhances customer service while providing greater efficiency and reduced operating costs. The software should be expandable to add additional modules, such as Automated Vehicle Location/Mobile Data Communications (AVL/MDC), fixed route display, Interactive Voice Response (IVR), and coordination.

Transit Management Software should include the following features:

Customer Management

Document and manage customer information to include name, address, level of service required, and passenger ride history

Vehicle Management

Location and schedule of vehicles and maintenance schedule

Driver Management

Driver name, address, driver history, and driver schedules

Trip Request Management

Ability to request trip via phone, e-mail, and Internet

Schedule Management

Ability to schedule passengers on-demand and optimize routes – passenger advisory as to the status of their scheduled trip(s)

Billing

Ability to import and export data for billing purposes

Reporting

Ability to generate reports for information in database about trips, routes for the day/week/month, passengers, status of vehicles and vehicle schedules, passenger histories, etc.

Customization

Ability to customize applications to either provide additional functionality or only provide functionality required. This can be done using the manufacturer's API.

Examples of existing software packages are (this is not an all-inclusive list): RouteMatch, Trapeze, EDAPTS, CCRAFT, and SHAH.

4.2 Hardware

Hardware needed in the dispatch center includes workstations and servers to manage the day-to-day operations and store information needed for report generation as well as interfacing with passengers and agencies. The hardware needed is detailed as follows:

4.2.1 Transit Management Software - Workstation

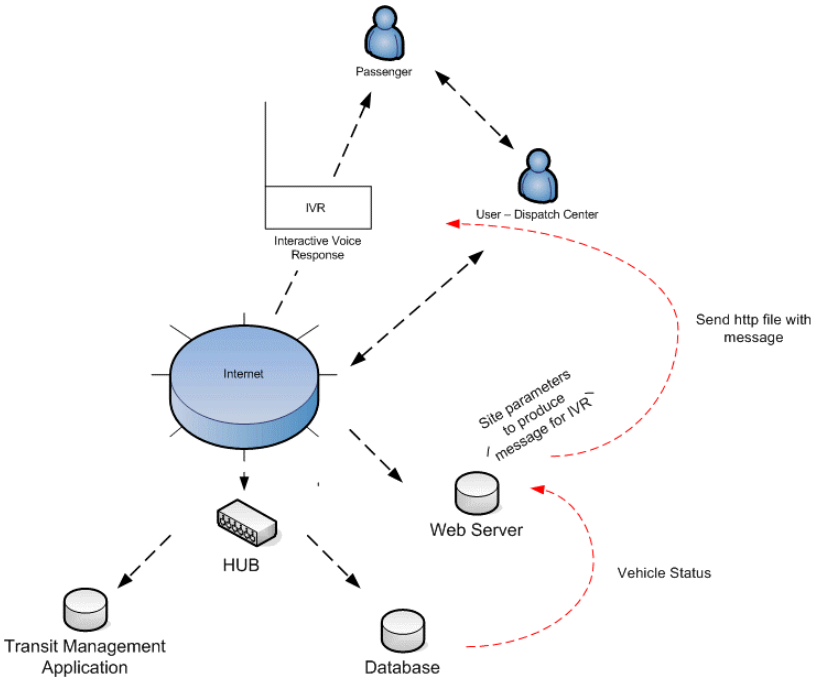
Component	Hardware	Operating System Version
Processor	Pentium 4 – 2.0 GHz or higher	Windows 2000 Profession or XP Professional
Memory	512 MB	
Hard Drive	40 GB	
Video Card	32 MB	
Network Card	10/100 MB	
Monitor	10" Monitor	
UPS Battery Backup		

4.2.2 Transit Management Software - Server

Component	Hardware	Operating System Version
Processor	Pentium 4 or Xeon 2.0 GHZ	Windows 2000 Profession or 2003 Professional
Memory	1024 MB	
Hard Drive	RAID 1 (mirrored) or RAID 5 (3 drives)	
Network Card	10/100 MB	
Redundant Power Supplies		
UPS Battery Backup		

4.2.3 Interactive Voice Response (IVR) – Web Server

Passengers can automatically be notified on trip/bus status through an automated, outbound calling system. The IVR will work with the Transit Management System to determine bus schedule and status. Based on current information, the IVR system will be set-up to automatically call the passenger and notify them of the bus status.



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Component	Hardware	Operating System Version
Relational Database Management System		MS SQL 2005
Processor	Dual Core AMD Opteron™ Processor 165	Windows 2000 Profession or 2003 Professional
Memory	4GB RAM	
Hard Drive	320 GB SATA2 Drive	
Network Card	2z 1G bit Network	
Redundant Power Supplies		
UPS Battery Backup		

4.2.4 Relational Database Management System - Server

All data generated by the ITS system will be stored in a relational database such as MS SQL, allowing the user to generate reports and enable a very scalable system with a robust database which can continue to grow with more data.

Component	Hardware	Operating System Version
Processor	Dual Core AMD Opteron™ Processor 270	Windows 2000 Profession or 2003 Professional
Memory	8GB RAM	
Hard Drive	320 GB SATA2 Drive	
Network Card	2z 1Gbit Network	
Redundant Power Supplies		
UPS Battery Backup		

4.3 Data Transfer

4.3.1 Between dispatch center and the vehicle

Using the manufacturer's API or additional module, a software interface can be implemented to transfer information to and from the vehicle and the Dispatch Center. The interface transfers the information using XML to be stored in the centralized data repository.

4.3.2 Between dispatch center and the passenger

Two software interfaces will be developed between the passenger and Dispatch Center.

1 – Passenger will login through the Internet to submit a trip request.

2 - Passenger will be notified of vehicle status through IVR system.

4.4 Communication Protocol

NTCIP (National Transportation Communication Interface Protocol) communication protocols will be the standard used for transferring data between field devices and the centralized computer system using the XML language.

5. Onboard Vehicle

5.1 Hardware/Software

5.1.1 Mobile Data Computer (MDC)

The MDC module enables wireless communication between mobile data terminals (installed in vehicles) and dispatchers, allowing for real-time updates and adjustments. This tool provides up-to-the-minute trip status, messaging, vehicle/driver information, and scheduling changes. The driver easily operates the MDC by responding to messages and selecting operational function keys during events. The MDC can also be set-up so that the driver will not be disrupted while driving. MDC functionality includes the following:

- Transfer of Electronic Manifests
- Electronic Trip Insertions
- On-the-Fly Schedule Modifications
- Automated Dispatch and ETA
- Automated Performance Monitoring
- Automated Stop Arrival
- Emergency Response
- Electronic Odometer Reading
- On-Board Navigation

5.1.2 Automatic Vehicle Locator (AVL)

The AVL module provides accurate positioning information, as received from vehicle-mounted GPS devices, to improve greater organizational productivity and vehicle safety. When used in conjunction with the MDC module, AVL helps to reduce costs, improve efficiency and security,

and maximize customer service. By incorporating AVL/ MDC modules, organizations can extend the value and features of Transit Management Software.

Features include the following:

- Find Closest Vehicle
- Predict Late Vehicles and Service Disruptions
- Predict Estimated Time of Arrivals
- Locate All Vehicles
- Monitor Vehicle Speed
- Display Planned vs. Actual Route

Specifications for MDC/AVL components include but are not limited to the following:

Physical Specifications

16 bit processor

12-channel GPS receiver

Emergency key

–22° F to +150° F operating temperature with LCD display heaters to ensure the display is readable at temperatures below 32° F

Keypad with adjustable back-lighting, audible and tactile feedback

Rugged ABS enclosure

LED indicators for Text, Channel, Messages, and Power

Pulse odometer reading

Inputs/Outputs

Minimum of 3 inputs, 2 programmable input/outputs, ignition sense input, and 3 open-drain (open-collector) outputs

Odometer interface

Communications port for either direct to radio connection or RS232 to 3rd party communications device

3 spare RS232 ports for interface to peripheral devices such as electronic fare boxes, printers, etc.

J-1850 interface

Keyboard input for QWERTY style rugged keyboard

Display

Transflective, graphical display with a minimum of 240x64 pixels

Minimum of three (3) different sizes of character sets
Minimum eight (8) line display
Adjustable backlighting for visibility in low-light environments
Adjustable contrast
LCD display heaters for operation in cold temperatures

Memory

512 KB Flash ROM
384 KB Static RAM
No less than 35 KB of data storage space specifically dedicated for trip information
Options for additional memory storage

Communications

Built-in high-speed RF modem – data speeds up to 9600 bps
Built-in wireless data network modem

Audio Options

MDC should have an audio matrix capability such that when interfaced to a private (voice) radio system the following functions are supported:
Accept two audio inputs
Route these inputs to any one of three audio outputs

Accessories

Adjustable pedestal or dash mount, depending on the vehicle type.
Cabling for connections to the applicable on-board radio/data modem equipment, power and any desired peripherals.
Any additional antennas required for data modems or the GPS receiver.

5.1.3 Global Positioning System

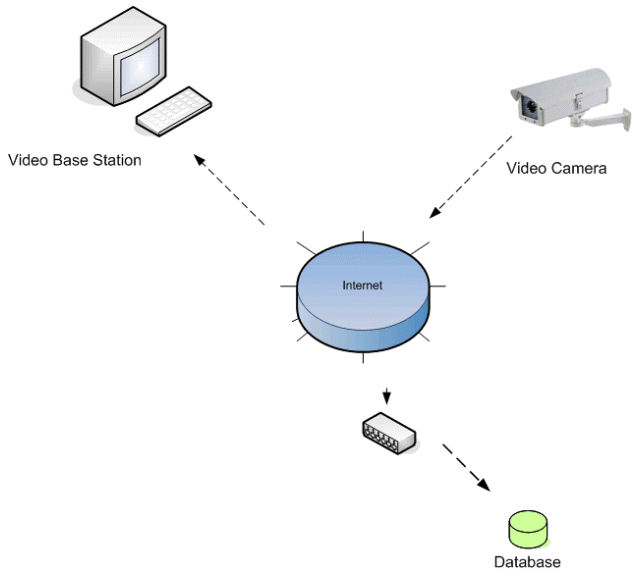
Incorporated into the MDC, the GPS unit utilizes the standard government GPS system of 24 satellites to track the location and speed of each vehicle. The location is tied to the RFID system enabling the ability to track where passengers get on and off the vehicle. The GPS unit is also used to trigger RFID reader logging at speeds above 3 MPH when using active readers. Additional functionality and efficiency could include the following:

- GPS Delta Distance – Sets the minimum distance in yards each vehicle must travel before an automatic vehicle position update will be sent.
- GPS Delta Time – Sets the minimum time in minutes that must elapse after the vehicle has moved before an automatic vehicle position update will be sent.
- GPS Min Time – Sets the minimum time in minutes that must elapse after the vehicle has moved before an automatic vehicle position update will be sent.

Integrating the GPS system with the MDC / AVL systems provides the following features:

- Retrieve vehicle locations and GPS coordinates on demand
- Schedule regular updates of GPS coordinates
- Detailed maps to help dispatchers assist drivers
- Passenger updates dynamically reflected
- Track and monitor vehicles real-time
- Retrieve vehicle locations and GPS coordinates on demand

5.1.4 Video Camera



For added security and safety, a wireless WebCam can be installed in the vehicle capturing images inside the vehicle for review or history. The camera is configured using the manufacturer's software - images will be transferred through the MDC. Images will only be transferred as scheduled since they impact the level of communications and may interfere with other data.

System requirements include:

- PC with 550 MHZ processor or better
- Internet Explorer
- Active X
- Windows 98SE/ME/2000/XP

5.1.5 Audio/Video System

Audio and video systems can be implemented onboard the bus to allow communications between the driver and passengers. These A/V capabilities can also be expanded to enhance the trip for the passenger to include video monitors and CD/DVD players. An example of these technologies could include some of the following components:

<u>TV Behind Driver Seat</u>
20" Digital LCD HDTV

<u>Flip Down Screens</u>
13" Digital LCD Displays

<u>Public Address System</u>
Microphone and speakers to allow communication from the driver to the passengers.

<u>Dash-Mounted Stereo</u>
In-dash AM/FM Stereo with CD and DVD

5.1.6 RFID Readers

Each vehicle will be equipped with an RFID reader to monitor passengers getting on and off the vehicle. The active and passive systems work differently in the way each accomplishes its task. For the passive system, as passengers embark or disembark the vehicle, the reader picks up the individuals ID and reports back through the communications system. Located on the vehicle, monitors can be used to welcome the passenger or alert the driver of who is boarding the vehicle.

For the active system, when the vehicle proceeds at approximately 3 miles/hour, the system takes inventory of the individuals on the vehicle. The system is programmed to take count every 3

minutes after the vehicle reaches 3 mph. The speed is determined by the GPS system on the vehicle, reducing the amount of integration into the vehicle.

Active RFID Wristbands/Watches

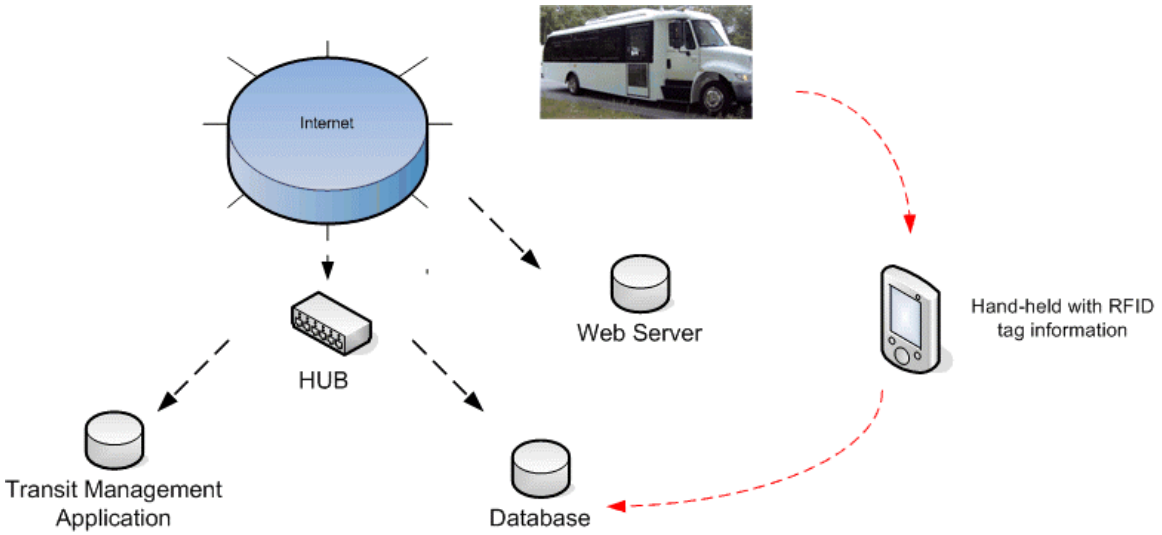
In quantity, the Active RFID tags may be developed into many forms. At the core, the tag is a small circuit board that may be integrated into watches, MP3 players, ID cards, key fobs, etc. The tags, in conjunction with the RFID readers have a typical range of 60 meters. Each tag can be set to transmit intermittently in cycles of 5 seconds to 5 minutes. Typical passenger applications set these at 35-second intervals achieving a reliable manifest within 3 minutes and a typical battery life of 3 years.

Passive RFID Badges

Passive RFID may be implemented for a less expensive solution. For the passive RFID option, badges can be printed via an administrative process and delivered to the passengers - this can be a passenger ID or other identification. The badges are typically printed with a picture and bar code on the front with name, if required. These tags read well when within approximately 30" of a reader as when embarking the vehicle. They can be in a purse, bag or held out as identification. In each case the reader located at the door reads the tag.

5.1.7 Electronic Vehicle Inspection System

State and federal law mandates pre-and post-trip vehicle inspections. Traditionally, these inspections have been performed via paper and pen, often resulting in incomplete tracking and recording of vehicle conditions. Electronic Vehicle Inspection Reports offer fleet owners a new level of safety, compliance, communication and performance.



RFID tags are placed in critical safety zones around the vehicle. Using a handheld reader, the driver will conduct their inspection placing the reader a few inches from each tag. Once the inspection is complete, the data is transmitted to a secure server and stored in a database. Reports can be generated and disseminated to various departments for action.

5.1.8 Fare Boxes

Fare Collection Systems can integrate to transit agencies applications including passenger counters, CAD/AVL systems, and bus diagnostic systems. Using the manufacturers API(Application Programming Interface), communication can be developed between the Fare Collection System and back-end systems such as financial systems. If a “SmartCard” is used, the system will automatically update the financial system through the customized developed communication.

The Fare Collection System should have the capability to handle;

- Bills (multi-currency)
- Bill Throughput
- Bill Orientation
- Coins
- Magnetic Strip Card Validation
- Magnetic Ticket Card Types
- Smart Cards

5.2 Communications

Communication systems provide data and/or voice communications for transit planning, maintenance, operations, and incident management, including coordination with transportation providers and public safety organizations. Communication technologies include:

- Analog Radio (voice)
- Digital Radio (voice and data)
- Broadband Wireless Network
- Wireless Local Area Networks
- Mesh Network
- Text Paging

- Satellite Communications
- Cellular Telephone
- Cellular Data Communications (for remote data collection such as AVL)
- Internet

The transfer of voice and data within a transit agency is critical to streamlining day-to-day operations. These communication systems provide data and/or voice communications for transit planning, maintenance, operations, and incident management, including coordination with transportation providers and public safety organizations. Many communications options could be implemented, but care should be taken to identify the best technology for your area. Consultation with local communication providers will help to identify communication parameters such as: bandwidths and potential dead zones where communications cannot occur. Bandwidth is dependent on the number of users and data traffic, and will need to be monitored closely. Typically a system can be implemented with local cell phone carriers which often are capable of transmitting data on the backchannels of their existing system.

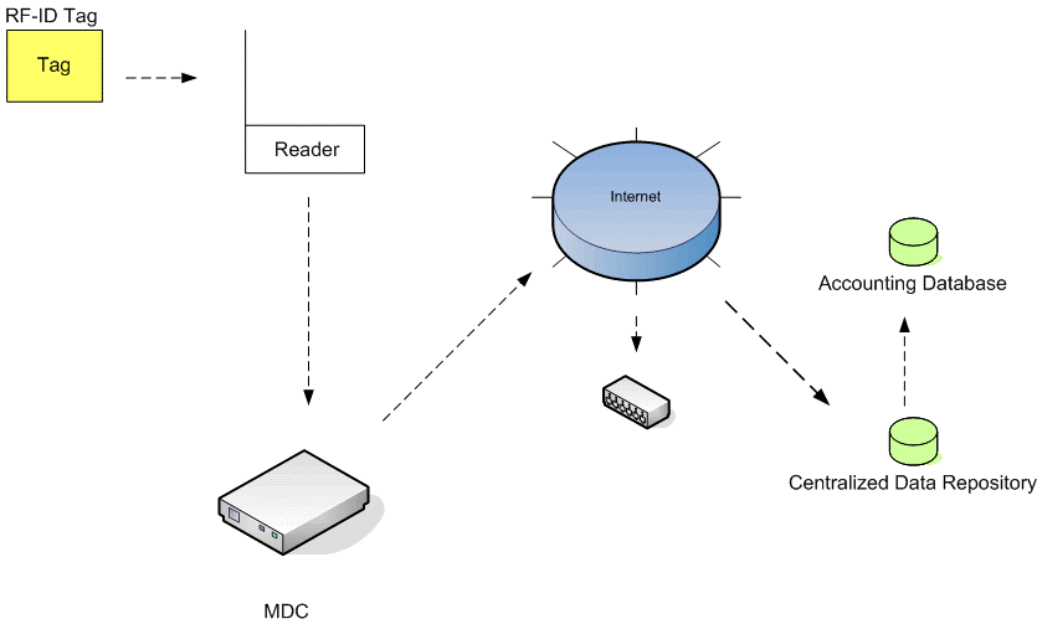
NOTE: In ITS implementations, other types of communications may need to be considered based on service providers and coverage areas. This may include 2-way radio or other types of wireless networks.

6. Passenger Interface

Additional services will be available to the passenger including the following:

- Payment of Trip
- Scheduling
- Interfacing with Agencies

6.1 Payment



Swipe Card

Using the RF-ID technology, a card will be used as a SMART Card for trip purchase. Once the passenger swipes the card, it is validated with the CAD Center and then the data transferred to the CAD Center accounting database which updates the passenger's account.

6.2 Scheduling

Automated scheduling capabilities can be enabled which allow passengers to schedule their pick up via telephone, computer, or handheld device.

6.3 Interfacing with Agencies

Other capabilities to be considered when implementing a CAD system is the ability to interface with different agencies for direct pre-qualification of potential passengers and for direct billing.

7. Application Functions

This subsection provides a summary of major software performance functions.

Requirement #	Short Description
7.1	Automatically track vehicle location in real-time
7.2	Schedule passenger using Transit Management Software
7.3	Automatically determine schedules and efficient route
7.4	Automatically notifies passenger of any schedule changes or notifies passenger of vehicle status
7.5	Passenger identified while boarding vehicle and determine if passenger boards correct vehicle
7.6	Download of schedule and route information to MDC
7.7	Update route information and transmit to CAD Center
7.8	Notification to CAD center that passenger has boarded vehicle and has arrived at destination
7.9	Ability to send and receive two-way messages
7.10	Send information to vehicle driver of any schedule or route changes
7.11	All vehicle locations and vehicle routes are displayed on MDC and at the CAD center using GIS.
7.12	Display customer greeting on video display
7.13	System will determine number of passengers on vehicle
7.14	ID Card used as Smart Card
7.15	Audio and Visual Display available on vehicle for general information, news alerts, emergency information, etc.
7.16	Emergency alerts sent automatically from vehicle to designated receiver
7.17	Vehicle maintenance data and schedules are automatically updated
7.18	Data stored in centralized data repository
7.19	System reports can be generated
7.20	Data and/ or voice communications
7.21	Provide safety and security

7.1 Automatically track vehicle location in real-time

Using GPS location, the system automatically tracks vehicle location, with scheduled route and actual route indicated on the GIS map display.

7.2 Schedule passenger using Transit Management Software

Passengers may have the ability to schedule a trip using Transit Management Software via phone, e-mail, or the Internet using a form provided. A database is required to contain all passenger information.

7.3 Automatically determine schedules and efficient route

Transit Management Software automatically schedules passengers and provides route optimization. Routes may change depending on passenger demands or status of vehicles.

7.4 Automatically notifies passenger of any schedule changes or notifies passenger of vehicle status

Through an IVR system, a passenger can be notified via telephone, e-mail or Internet as to the status of their scheduled vehicle/trip, allowing passengers to adjust their plans accordingly.

7.5 Passenger identified while boarding vehicle and determine if passenger boards correct vehicle

While boarding the vehicle, passengers are identified by the RF-ID reader, which sends information to the CAD center to determine whether the passenger is boarding correct vehicle. If not, driver will be notified.

7.6 Download of schedule and route information to MDC

When the driver logs in to the Transit Management System on the MDC, the system downloads an entire days worth of work schedules and number of trips. Each trip record summary is displayed, and the driver can select a trip to obtain detailed trip information.

7.7 Update route information and transmit to CAD Center

When the driver logs into the Transit Management System on the MDC, information is transmitted to the CAD Center including driver status, odometer reading, vehicle location and route information.

7.8 Notification to CAD center that passenger has boarded vehicle and has arrived at destination

All trip related information which is required to be verified or captured is performed on the vehicle using the MDC. The trip record includes arrival, departure, no show, etc. Through the MDC, the driver will select function that the passenger has arrived at destination. This captures the time/date stamp, location and odometer reading from the vehicle and automatically transmits data to the CAD center. The RF-ID reader also captures information when passengers leave the vehicle.

7.9 Ability to send and receive two-way messages

The system provides the capability for drivers to send and receive two-way messages. The message selected is sent to the CAD Center with GPS and a time stamp. The following are examples of messages:

- Request Voice
- Flat Tire
- Require Supervisor
- Send Mechanic
- Out-of-Service
- Back-in-Service
- Refueling

7.10 Send information to vehicle driver of any passenger, schedule or route changes

Dispatchers need the ability to send canned and free messages to an individual driver or broadcast messages to the entire fleet. The message can include any schedule or route change.

7.11 All vehicle locations and vehicle routes are displayed on MDC and at the CAD center using GIS.

Dispatchers can create AVL and MDC data views, using GIS, associated with the real-time wireless sent to the Transit Management Software. Views will be available for both drivers and dispatchers.

7.12 Display customer greeting on video display

The RF-ID reader reads the passenger ID and captures the passenger information. Once the passenger has been validated, a greeting message will be displayed on a video display welcoming the passenger.

7.13 System will determine number of passengers on vehicle

The RF-ID system determines the number of passengers on the vehicle. While in motion, the number of passengers will be validated.

7.14 RF-ID Card used as Smart Card

The passenger's RF-ID card can also be used as a Smart Card, enabling the passenger to use the card to pay the trip fare. When the card is swiped, the information will be sent to the CAD

Center and imported into the accounting system. This process gives the Service Provider the ability to track all trips and validate the passenger.

7.15 Audio Output and Visual Display available on vehicle for general information, news alerts, emergency information, etc.

The vehicle's video display will display information for passengers to view while on the vehicle. General information about additional passenger services can be displayed. Any news or weather alerts or emergency information can also be transmitted from local resources to provide passenger security and safety. This information will also be transmitted audibly.

7.16 Emergency alerts sent automatically from vehicle to designated receiver

An emergency button enables the driver to send an alert immediately in case of an emergency. The alert will be sent to a designated receiver or receivers such as 911, CAD Center, etc.

7.17 Vehicle maintenance data and schedules are automatically updated

An EVR system using RD-ID tags will provide data to determine if any vehicle maintenance is required and update maintenance schedules. The CAD Center will be automatically notified when vehicle service is required.

7.18 Data stored in centralized data repository

All data from the Transit Management Software, data generated from components and external data sources can be stored in a centralized data repository managed by a Relational Database Management System.

7.19 System reports can be generated

Reports will be generated from different sources including Transit Management Software, an Electronic Vehicle Inspection System, and using a Report Writer, generate reports directly from the RDBMS.

7.20 Data and/or voice communications

Data will be transmitted through various types of infrastructure discussed in Section 2.2.4. Data transmitted will be binary and voice, including:

- Data from vehicle to CAD Center;
- Data from CAD Center to vehicle; and,
- Data from CAD Center to passenger.

7.21 Provide safety and security

The system detailed in this document provides safety and security through various methods including on-board video cameras, emergency alert systems, and constant data and voice communications.

8. Dependencies

The successful implementation of the ITS system described in this SRS is dependent on the following factors:

- Service providers' budget and funding constraints;
- Staff resources to ensure that data and information are kept up-to-date;
- Vehicle retrofitted and modified including electrical systems;
- CAD center infrastructure;
- GIS-based software requires an accurate base map;
- Availability of cell or radio communications to collect and transmit timely information;
- Management support and commitment to populate systems with timely, accurate and usable data;
- Future technology or upgrades in hardware and software may affect the functionality of the system.

9. Training Requirements

Each installation requires training. The amount of training will be dependent on the nature of the system involved and the existing expertise of the transit or demand-response personnel charged with operating the system. The following basic training will be required for successful operation of the system:

- Computer knowledge;
- Familiar with different technologies – GPS, Video CAM, Networks, MDC;
- Ability to trouble-shoot issues; and,
- Internet knowledge.

Competence in each area should be determined in advance of the purchase of any ITS system and/or provisions should be made for training as part of the purchase, installation, and operations process.

10. Maintenance

The management and maintenance of the hardware and software outlined in this SRS is critical to the operation of the system. Resources will be required to maintain the system along with maintenance contracts on each hardware and software component. Maintenance fees should be included as part of the bid and contract.

11. TEJAS Medicaid Trips

TxDOT's Medical Transportation Program serves eligible recipients in three programs:

- Transportation for Indigent Cancer Patients,
- Children with Special Health Care Needs, and
- Medicaid (the largest of the three programs).

The Medical Transportation Program is responsible for providing non-ambulance transportation services to eligible recipients. Recipients are eligible if:

- A medical necessity exists;
- No other means of transportation are available;
- The mode of transportation is the most cost effective mode available that does not endanger the recipient's health; and
- The facility is reasonably close to the prior authorized health care service that meets the recipient's health care needs.

TxDOT's Medical Transportation Program operates three call centers that schedule transportation, advance funds to individual drivers or their attendants, and record complaints received about medical transportation services.

The Medical Transportation uses the Transportation Electronic Journal for Authorized Service (TEJAS) system, to schedule appointments and process claims. The list of approved riders for the following day is available for download as a text file from the TEJAS Medical Transportation System website. Once downloaded, providers have their own process for taking this data and scheduling their drivers. In order to use an automated trip scheduling system, it is necessary to enter each trip into the software system. This can be performed one trip at a time or in other cases, an automated feed into a scheduling system has been developed.

Although automated upload interfaces to Scheduling Software exist, cleanup of the downloaded file is still manually done before feeding it into the scheduling system. A utility can be developed to provide a data mapping template so that each provider can specify how to map data, it will clean address data (scrub), provide additional data such as trip purpose, standing order end dates and other functionality that may be defined during requirements gathering phase. The format of the new download is yet to be defined and it may be determined that an interface for each user to customize the format of the download will be required.

12. Future Features

The ITS system described in this document is very scalable. Other functionality and/or features can be added to the system, such as:

- Develop interface to Medicaid State system to determine passenger qualification;
- Develop infrastructure that supports the flow of information between various fleet management systems such as rural areas;
- Use of infrastructure and technology for providing data to help transit agencies make critical incident and disaster response;
- Link traffic and transit operations centers to operate network performance across multiple transportation modes;
- Provide dynamic matching for ridesharing and automated service coordination in suburban and rural areas;
- Provide intelligent vehicle systems and intelligent onboard vehicle integrations with Intelligent Software Agents (ISA); and,
- Implement advanced and newer communications infrastructure such as MeshNET.

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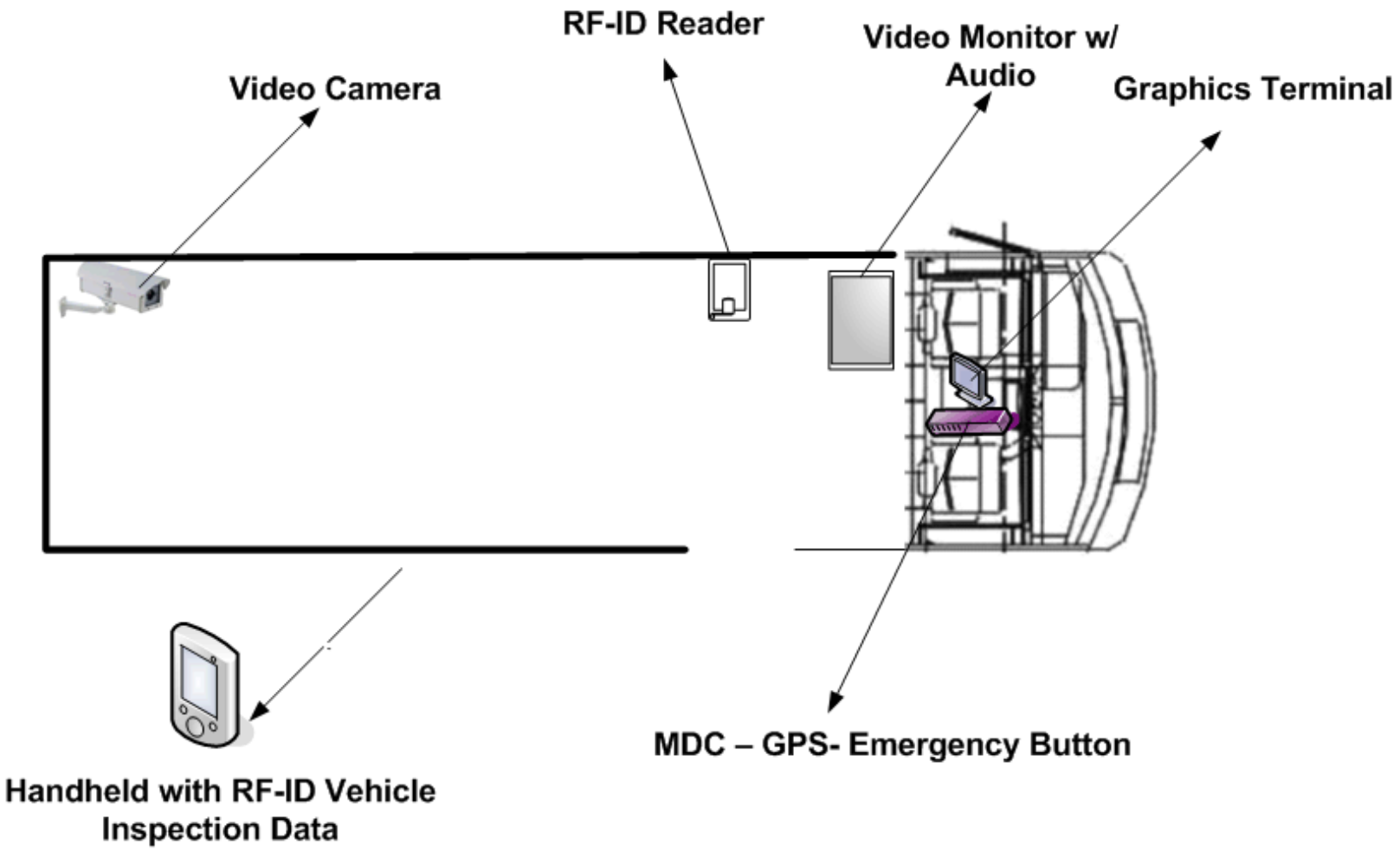
Vehicle Layout

Bus Exterior

Bus Interior



Appendix I

Definitions, acronyms, and abbreviations

API – Application Programmer's Interface

Software developing tool for building system and data interfaces, and customizing software.

AVL – Automatic Vehicle Location

System for tracking vehicles by using a GPS system and displaying results on a GIS map.

CAD – Computer Aided Dispatch

Transit agency dispatch center using computer systems to automate business processes

COTS – Commercial Off the Shelf

Software or hardware available to be purchased immediately through vendors, resellers, distributors, etc.

CTS – Cell Transceiver Station (Base Transceiver Station)

This contains the equipment for transmitting and receiving of radio signals (transceivers), antennas, and equipment for encrypting and decrypting communications with the Base Station Controller (BSC).

EVIR – Electronic Vehicle Inspection Report

Vehicle Inspection System using a handheld reader and RF-ID tags placed around the vehicle

GIS – Geographic Information System

GIS is a system for capturing, analyzing and managing data with attributes. Vehicle locations can be identified on a GIS map which can include many layers of information including streets, landmarks, etc.

GPS – Global Positioning System

GPS is a fully functional Global Navigation Satellite System. Using satellites, the system enables the GPS receiver to determine its location, speed and direction. Therefore, a vehicle with a GPS onboard can be tracked.

ITS – Intelligent Transportation System

By deploying technology, data and system integration and efficient business processes, an Intelligent Transportation System is developed.

IVR – Interactive Voice Response

Passengers can automatically be notified on bus status through an automatic outbound calling system. The IVR will work with the Transit Management System to determine the bus schedule and status. Based on current information, the IVR system will be set-up to automatically call the passenger and notify them of the bus status.

MDC – Mobile Data Computer

In the vehicle, the MDC will be used by the driver to receive and send information. It will contain a screen to view information

PC – Personal Computer

PC's will be used at the dispatch center to access the Transit Management System and other programs.

RDBMS – Relational Database Management System

All data being generated by the ITS system will be stored in a relational database such as MS SQL. This allows the user to generate reports and enables a very scalable system with a robust database which can continue to grow with more data.

RF-ID – Radio Frequency Identification

Information can be stored in RF-ID tags and read by RF-ID reader. Passenger information will be stored and read to determine if passenger has boarded the correct bus.

RTU – Remote Transceiver Unit

The RTU communicates with a particular piece of equipment and transfers the information back to the CTS.

SRS – System Requirements Specification

The SRS will provide specifications that are required to develop and deploy an ITS system.

TxDOT - Texas Department of Transportation

TxDOT, in cooperation with local and regional officials, is responsible for planning, designing, building, operating and maintaining the state's transportation system. This SRS has been developed for TxDOT and will be reviewed by everyone involved.

VPN – Virtual Private Network

VPN is a communications network tunneled through another network, and dedicated for a specific network. This type of network can be used to transfer information to the CAD center.

TCP/IP - Transmission Control Protocol (TCP) and the Internet Protocol (IP)

TCP/IP is the set of communications protocols that implement the protocol stack on which the Internet and most commercial networks run.

WI-FI – Wireless Fidelity

Wi-Fi is wireless technology for transferring data to and from the CAD center and vehicles.

XML – Extensible Markup Language

XML provides the format to transfer data. It allows any system that understands the format to import data.