ITS Functionalities for BRT

CLEDSON AKIO SAKURAI[1], CAIO FERNANDO FONTANA[2], BARBARA CARVALHO NEGRÃO[3], ANTONIO GIL DA SILVA ANDRADE[4]
[1,2,3]Departamento Ciências do Mar (DCMAR)
Universidade Federal de São Paulo (UNIFESP)
Av. Almirante Saldanha da Gama, 89 – Santos/SP

BRAZIL
caio.fernando@unifesp.br, akio.sakurai@unifesp.br, barbara.carvalho10@unifesp.br

[4]Departamento de Tecnologia da Arquitetura
Faculdade de Arquitetura e Urbanismo (FAU)
Universidade de São Paulo (USP)
Rua Lago, 876 - Butantã, São Paulo/SP

BRAZIL
gil.andrade@uol.com.br

Abstract: - The quality of the urban transport service is achieved through an efficient automation system, this system called ITS (Intelligent Transportation System), allows control over the operation and maintenance activities of BRT, BRT (Bus Rapid Transit) a system of public transport, with quality service and low cost that is being used in Brazil on a large scale. The complexity of the bus system brings problems to set the necessary equipment and systems. In this context, the article discusses the functionality of the equipment and systems that allow this warranty service, in order to standardize for BRT actors understand each of these equipment and systems and achieve the best outcome for the operation of the BRT.

Key-Words: - Equipment, System, ITS, BRT, Standardization, Transportation

1 Introduction

The BRT system does not only proposes a change in the public transport fleet and infrastructure, but rather a set of changes which together form a new concept of urban mobility because it is a mass transport system for passengers who provide urban mobility fast, comfortable, safe and efficient through segregated infrastructure with overdrive priority, rapid and frequent operation, marketing excellence and customer service.

The implementation of high-performance transport systems, efficient and environmentally sustainable consist of the political agenda of urban and environmental planners.

There is nothing more appropriate than BRT solutions, achievable medium and long term with moderate investment. BRT concepts are integrated homogeneously urban structures, timely solution as complete walkthrough or well.

The main BRT features are halls dedicated to public transport movement, loading and unloading of vehicles at the same level, making technology to process faster, high capacity vehicles, modern and cleaner, integrating with other transport modes, center operational control, prioritizing the traffic signal information in real time to the user, and so on.

The Bus Rapid Transit (BRT) is one of the most cost efficient engines for cities to develop quickly a public transportation system that can expand into a complete network and promote rapid and excellent quality service. Still in its original request, the BRT concept offers the potential to revolutionize the way of urban transport.

2 Problem Formulation

An important component for the BRT is the ITS. The ITS needs to implement a sophisticated automation control to integrate all components of

BRT and increase the quality of services offered by public transport. The elements that need to exchange information with each other usually are not from the same manufacturer, so there is a clear need to integrate these systems and propose solutions to facilitate the implementation of any element within the ITS for the BRT.

Due to this situation, this article presents the features necessary for the equipment and ITS systems in order to start the discussion of standardization. Surely, this is the first question to be raised and needs to be deepened in future discussions.

3 Specification of ITS Components

This chapter present the system specifications of ITS components in order to start the discussion for standardize the functionalities of ITS for BRT.

3.1 Electronic Ticketing System (SBE)

The described system of electronic ticketing does not consider interoperability with existing systems. If necessary, the architecture should be reviewed to address this need.

Electronic ticketing is a set of related processes for evaluating the use of public transport, with the BRT. The processes involved in this system are: user registration, Sales Force Automation, payment, raising Tickets Rates, account reconciliation and Management System.

According to the municipality's operational needs, sale and user registration can be performed over the internet terminals, self-service in the stations, mobile or authorized positions. To this end, the system considers the use of smart card to store user information and values. The user enters the BRT or departure terminal, pass the validators smart cards which are devices that verify the authenticity of the card, performs the output values stored on the card, and stores the same usage history. Usually these validations are equipped with turnstiles to physically contain user input.

The electronic ticketing system also contains a charging software that is responsible for performing the rate management, point of sale and all the equipment that make up the electronic ticketing system. This software is responsible for conducting a financial transaction between the entities involved in BRT.

The system also includes software that performs the analysis and reconciliation of the data to ensure the security of the electronic ticketing process and provide historical information for analysis of transport conditions and so allows the CCO set the number of vehicles required, use time, origin and destination, among others.

Finally, the BRT is a data communication system, which is responsible for data exchange between devices, systems and software in a secure way so as to ensure the functioning of SBE.

3.2 Support System Operation (SAO)

Operational support systems (SAO) consists of equipment, systems, platforms and services that automate, simplify and streamline inspection processes, supervision, operation, planning, support, monitoring and management of the public transport system. These systems also allow cost savings and greater efficiency, transparency in the operation and control of services.

The SAO will systematically organize the data operations in the provision of services, enabling the creation of an information base and provides valuable data for operation by each concessionaire and the supervision and control of the Secretary of Transportation, allowing cost reduction and rationalization costs.

AVL/CAD

These are systems that facilitate the management of transport operations, reduce response time to an incident in the field, report on the operation of onboard equipment and systems (telemetry), and offer support to drivers, providing updated information on the location of the bus to the central bus to and operation of each dealership, and positioning information of the state of buses in operation for users.

This system allows providing the following features:

- Monitoring and telemetry of the bus.
- Planning: statistics, historical data and information generated by AVL / CAD system.
- Remote access and control equipment.

Planning Services and Transportation Management

Are services that use the database of the public transportation system operation for the composition characteristics, sharing, planning and dynamic routing travels, assisted driving trip, sharing of transport and modal integration, increase the facilities and flexibility in composition of travel movements and the improvement of service.

Surveillance Systems

Are embedded systems and / or points of

embarkation and disembarkation platforms and the integration of stations and compounds terminal alarm devices (emergency button), closed circuit television (CCTV), feedback and accreditation of devices and access used to improve control internal and external physical spaces used by the transport system.

3.3 User Information System (SIU)

The user information systems consist of equipment, systems, platforms and services to promote wide, fast, up to date, objective and effective providing information and offering greater convenience, usability and user comfort in use services over the disclosure schedules , routes, fares and information relevant to the system in real time or not, through various media.

3.4 Operational Control Center (CCO)

The CCO should be managed through predefined procedures to ensure a standard for all events that occur during operation. These procedures must be described, they are known to all involved in the management of CCO and conveniently available through this system. This system should also register all unplanned events that occur during the operation and follow up of your solution, creating a record of events that serve to statistics and revision of operational procedures.

The CCO and all systems involved in the operation should be environments with controlled access. Initially all the people involved in the operation, employees or third parties must have an identification badge registered on a system that will give you access to the building entrance and the only environments where it really should act.

The entrance to the OCC room should have a tightening in access, in addition to being monitored twenty four hours by CCTV, all employees and third parties must be previously registered and access should be by a registration badge associated with a biometric system.

All systems involved in the transaction should require operator identification (login) before starting the work, this is also true for embedded systems where the driver identifies the onboard computer to take the vehicle in stations where vendors ticketing identify the PDV equipment before opening a box etc.

3.5 Planning Systems, Operational Optimization, Control and Regulation

The BRT system depends on time synchronization, reliability, regularity and integrated operation throughout your network. The Operational Planning system plans the order, operation, driving, timesheet, performance, staffing, allocation of vehicles, regularity, punctuality, etc. board computers for vehicles receive information of arrivals and departures at stations, gathering for garages, travel time between stations, etc. For this, the system requires integration with the operation of management systems, thus ensuring compliance with all the parameters set for it.

Are highly sophisticated, based on the use of operational data in real-time software with the help of mathematical algorithms and should be integrated as part of the operation management systems and integrated into systems and AVL applications (automatic vehicle location) deployed in buses, and issuing systems tickets, operation and monitoring.

3.6 Traffic Priority System

To expedite traffic is necessary to give priority to buses, but without disturbing the local traffic of other vehicles. So the SAO platform must have appropriate interface to allow, in the future, that any equipment or traffic controller, provide priority information of the bus system.

Operational data network should be extended to the garage responsible for the maintenance of vehicles and orders for the line.

The network must also be integrated into the Traffic Control systems in area or traffic management systems, integrating traffic signal controllers, VMS (variable message panels), CCTV systems and detection and surveillance, telemetry, etc., with the CCO.

The CCO, the traffic checkpoint monitors the operation making the necessary interventions suggested by the operating software and control to ensure compliance with the plan. On a large screen (video wall) the general supervisor and the other stations can monitor the position of all vehicles by reproducing the image of a synoptic map via conjunction with other images.

3.7 Security and Surveillance Systems

When security talks if the bus systems should be considered on two main fronts of security: The security of the data system and the safety of passengers.

Data System Security

For data security, the transmission of data on

clearing and authentication should be considered (held in conjunction with the Central System).

The application of these resources should follow the general requirements already established as the technical and functional requirements here explicit.

The communication and security module refers to the processes that will be developed directly by employees, platforms, systems, infrastructure and equipment installed in buses.

Included in this assembly, the data processor module and stored in validators data transmission to the data center via the communication network.

Passenger safety

Information and video surveillance for the safety of users of the systems should be created, as well as communications equipment with CCO to monitor the operation, safety, signaling and communication in general with users.

supervisory positions are responsible for monitoring the closed system of CCTV on the road and in all seasons. The supervisory team coordinates a security team that ensures the full functioning of the stations, roads and vehicles that operate within the system.

Operators of supervision stations must have at their disposal a CCTV system that has coverage across the board and BRT stations and have in some points of ease of camera handling in terms of rotation 360 and approximation of the image (zoom).

This position should be integrated with the competent authorities of the capital security or police force.

3.8 Communication Systems

One of the key systems for the operation of the CCO, stations and BRT itself is the communication system that can be divided into three subsystems:

Communication CCO and Data Center

Communication between the CCO and Data Center must be made through private data networks that provide service over optical fiber. These networks should be redundant where at least two connections must be hired from different operators and their paths are different fibers between the CCO and the Data Center. A third link, the radio can be hired increasing system reliability.

After specifying the functionality of systems can be defined in Executive Project, the bandwidth required for each of the links. This is important because you need to set standards for video systems that occupy a large bandwidth of the links.

Operational Data Network Corridor

Along the entire length of the BRT corridor will be built a fiber optic network connecting the steering equipment responsible for communication with the vehicles in operation.

The network must also be redundant, both the fiber optic segment scattered along the way, as in wireless communications with the vehicle running, stations and garages. The wireless part can be done by a free Wi-Fi and has a minimally communicative GPRS connection (or 3G) with fixed IP and contracted warranty service level through a telephone operator and data as a contingency.

Operational data network should be extended to the garage responsible for vehicle maintenance and orders for the line.

The network must also be integrated in traffic control systems in areas or traffic management systems, integrating traffic signal controllers, VMS (variable message signs), CCTV systems and detection and surveillance, telemetry, etc. with the CCO.

Mobile Communication Systems

Communication systems for all system elements with the mobility characteristic, for example, vehicles and people.

3.9 Data Center

The data center consists of equipment and systems responsible for managing, storing and processing all data and information generated by the system.

The data center usually has, as a minimum requirement, the energy self-sufficient or should have diesel generators able to keep all connected devices independent of the supply of the power utility. Daily backups and preventive maintenance should be performed, usually at peak times to maintain the reliability and data persistence. It is also requirement to keep the data center backup in different physical address of the main data center in case of natural or other disasters, such as floods or fires, the two plants can not be destroyed and you can restore the backup so the site is established.

It should also provide a security infrastructure to ensure that unauthorized access will not be made to systems and operational databases, providing data and information through the "web" without compromising the functioning.

3.10 Systems Traffic and Transit Management

For traffic systems and traffic management should be a priority, traffic signal, along with

exclusive lanes for buses, following the BRT standards. There should also be a traffic information system for the relevant local movement of BRT.

The system should also count on CCTV systems (used to support BRT operation), vehicle identifier system and inspection and telemetry transit systems.

To assist in the management, a system must be created, whose function is to provide a single interface to manage field devices through its control systems and existing management. The exchange of data between existing systems and this manager would be through, for example, the use of all standard ITE Data Dictionary / AASHTO Traffic Management (TMDD) Communications Center to the Traffic Management Centre or European standard DATEX II with Open Data Framework.

3.11 Technological Systems for Stations

Technological systems for the stations must take into account the communication networks already provided in this document for the reception and transmission of relevant data such as the expected time of arrival in a bus line. The stations should be equipped with easy viewing panels during the day of the period (high brightness) so that you can view the data without worrying about the brightness of the place.

3.12 Data Communication Network, Voice and Image

The data communication networks, images and voices are constituted by two systems: the primary and secondary communications systems that perform communication between the various systems and subsystems. Should enable the transmission and reception of messages in voice formats, data and images bi-directionally with integrity check of all input and output data as well as the ability to: IP number is set, the implementation of QoS (quality service) mechanism emulation private networks, network management application in real-time verification and validation mechanisms of communication packets and data traffic.

The primary communication system should allow the use of at least two complementary and simultaneous communication technologies, e.g., GSM / GPRS / EDGE and digital trucks or GSM / GPRS / EDGE, and WiMAX or WiMAX and WCDMA (3G), etc.

3.13CFTV System

The entire line of BRT and its stations and terminals should be monitored by a CCTV system with fixed cameras, and vehicles must have built-in cameras that show the entire vehicle length and a camera facing out of the vehicle showing the driver's vision.

You need to determine the pattern of each shot, and time keeps the same design for data links and image storage disk space.

Some fixed cameras should also be capable of being moved from CCO moving in one hundred and eighty degrees (or 360 degrees, depending on the function) and approaching the desirable object, and minimally two internal cameras station wagon and two outer chambers, each direction of the line. fixed cameras should be spread in visual media cover the BRT line across 100%.

The system should offer the possibility to show all or some images captured in real or recovered time of recording an image database and be available digitally in real time to the CCO and integrated with the traffic control systems and city traffic CCTV systems covered by the system, especially in the BRT area of influence.

These cameras are used to help center through the observation of the surface transportation system.

4 Conclusion

This first specification BRT characteristics aims to initiate a discussion on the topic, but also intends to standardize the understanding of the characteristics that an ITS for BRT must have for that BRT can provide excellent services. Furthermore, this standardization allows the actors involved in the development project, approval and operation can understand and unify understanding of each feature and avoid misunderstandings that might interfere with the correct operation of the BRT.

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