POSSIBILITY OF IMPROVING PASSENGER INFORMATION SYSTEM IN BUS TRANSPORT USING CLOUD SERVICES

ABSTRACT

Every day we are witnessing the breakthrough of new technologies in all forms of passenger transport. The meaning of technology, future development, and application are based primarily on the finding of methods how to make life easier. Today’s development of information and communication technologies is directed to wide population of users equipped with sophisticated terminal devices. The starting point has been guided by the idea that the implementation of new technologies should fulfil the users’ requirements: what they want, where they want it and in the best possible way in which they want it. The research in this paper is directed to the problems of informing the passengers in the domain of bus transport. According to the ITS concepts an attempt is made to improve the fleet management systems, first of all through interactive participation of the drivers in the transport process, navigation of vehicles/drivers and telemetry (remote vehicle diagnostics). The preconditions of this type of management are mobile communications of the vehicle/driver with other participants in transport/traffic process. Mobile terminal devices installed onboard vehicle itself are becoming the elements of ITS communication infrastructure.

Unlike static information systems in bus transport, telephone or internet information about timetables and fares, with more efficient usage of ITS modules in the transport process the user can be provided access to a wide range of useful information before the trip and on the trip, and downloading of historical data on the trip itself.

The paper presents the new concept of providing information services in passenger transport based on the location of vehicle as transport entity by implementing cloud computing infrastructure.

Key words: traffic information, tourist information, fleet management, cloud computing, ITS, LBS

1. INTRODUCTION

Today we are witnessing an ever faster development of information and communication technologies. The restrictions of the classical approach to the development of the traffic system have led to the requirements for new coordinated solutions in road and other branches of transport.

The upgrade of the classical transport system, called Intelligent Transport Systems (ITS), has enabled a new approach and implementation of advanced control, and technical and technological solutions, achieving greater safety, efficiency and reliability of transport.

The transport profession which plans the ITS development has to have the knowledge about the possibilities of new technologies at their functional level. To fulfil useful functions,
ITS technology requires connection of participants in the information chain by implementing the module for data collection, fusion and processing of data, by implementing communication infrastructure for data transmission and distribution of information offering a series of communication services.

The mobility of transport system users means the application of different mobile communication systems with the respective services. The users today want everything and on the spot, with minimal waiting for the delivery of information. They want access on the move, constant connection and accessibility, and “customized” service.

Using the cloud computing model, the companies that are involved in the passenger transport can significantly raise the quality of service they provide to the passengers with significant reduction of initial capital costs. This lets them focus on the core activity itself, and minimize the resources necessary for work and control of IT infrastructure.

Under the condition of Internet connection accessibility cloud infrastructure allows fulfilment of users’ expectations and needs.

2. SYSTEM FOR PASSENGER INFORMATION IN CROATIA

2.1. Existing information system in bus transport

The provision of bus transport services should already be more than just transport. Higher quality of provided service does not only mean the quality of the transport means and relation to the user; today, the passenger expects more. By implementing innovative technologies in the provision of services it is possible to occupy a significantly better position on the market. The breakthrough of new technologies into this branch of transport on the Croatian market has not broken through in the real sense and therefore has large potential. Regarding the information level of the users the currently accessible are mainly pre-trip information and in the majority of cases they are not free for the user.

The currently available channels of pre-trip information of passengers in bus transport in Croatia are telephone and internet information, information by arriving to the information counter, and at some selling points of public display which is not interactive.

Passenger information in bus transport, especially on the Croatian area has not advanced except for the introduction of Internet pages which make information available although they have not been completely mutually integrated.

Figure 1 - The existing pre-trip information systems – counters and information distribution system by means of so-called “display information”
The available information channels in bus transport do not dispose of detailed information required by the user. The information has not been integrated with all the necessary data, and often it is neither precise nor updated.

In order to improve the service of informing the users, the application of new technological solutions in bus transport allows fulfilment of the users’ expectations regarding timely and complete information.

2.2. Advanced information systems supported by ITS modules

The passenger information service in ITS system includes the static and dynamic information about the transport networks, pre-trip and on-trip information services, as well as support to services that perform collection, saving and managing of information for the planning of transport activities.

The essence of ITS lies in the systemic management, and information-communication solutions built into the network infrastructure, vehicles, control centres, and various communication computer terminals. They encompass a wide range of new tools for transport network control, as good services for passengers.

ITS tools are based on three key notions:

- information,
- communication, and
- integration.

The notion intelligent denotes the ability of adaptive action in variable conditions and situations, where it is necessary to collect sufficient data and process them in real time. Although the human represents an intelligent element of the classical traffic system, the impossibility of networking and of using on-line information results in waiting, delays and finally inefficient transport.
The collection, processing and integrating data and information supply are the essence of ITS. The availability of the real-time information about the current traffic conditions on the network provides real-time information for trip planning.

By analyzing the existing specifications of trip information services, it may be concluded that they are oriented to satisfying the requirements of passengers and drivers in road traffic, but there are also connections to other branches (modes) of transport.

The trip information specification:

1. Pre-trip Information,
2. On-trip Driver and Passenger Information,
3. On-trip Public Transport Information,
4. Personal Information Services,
5. Route Guidance and Navigation.

The ITS pre-trip information service (Pre-TripInformation - PTI) is the first in the functional area of passenger information (TravellerInformation - TIITS). The purpose of PTI is to provide the users before starting the trip with high-quality updated data, i.e. information that will result in making a better decision and preparation for the trip.

The information can refer to planning of the trip by public transport means, road conditions, weather conditions, possible parking places, traffic queues, tourist and catering facilities and other information.

The key technologies that allow the realization of pre-trip information are information technologies (central database, provider computers, PCs, etc.) and telecommunication technologies (fixed and mobile telephony, GSM/UMTS, Internet, radio, TV-teletext, RDS, etc.).

On-trip information includes real-time information about the trip, estimate of travel time depending on the current conditions, availability of parking places, traffic accidents, etc. The information is provided via terminals at bus and railway stations, on squares, transit points, displays onboard vehicles or portable personal terminals. Using the advanced value chains in the distribution of information to the passenger’s terminal device in bus transport, it is possible to equip the vehicles with interactive devices at minimal costs or even without any cost at all, and make the trip for the passengers significantly more entertaining or more informative.

2.3. Reasons for improving the current information systems in bus transport

The reasons for improving the current information system and introducing new services are to provide the users with easier and improved access to real-time information, increasing the mobility and the level of users’ information, which is very important to the new generations of passengers who find this most important. Thus, significant comparative advantage is realized in relation to the providers of the same or similar transport services.
Information should reduce uncertainty in travelling and a better choice of transport modes, route selection, departure time, change of mode, guidance (navigation) to the destination, etc. based on updated information about the traffic system condition. The assumption is that better and faster information will create preconditions for better operation of the business subject. A satisfied passenger becomes a faithful user of the transport service provider and a continuous source of revenues, which is in fact the main goal in doing business.

3. FLEET MANAGEMENT IN BUS TRANSPORT IN PROVIDING INFORMATION BASED ON VEHICLE LOCATION

Fleet management are such systems that use satellite tracking of vehicles and some of the available mobile technologies of data exchange (GPRS) to forward real-time information about the vehicle and allow constant and full control of the fleet. Such specialized service assists significantly in monitoring the efficiency and control of the fleet and the drivers. The
new business concepts in telecom sector have opened up the possibility of offering new services based on the known information of the traffic entity. Using the advanced communication technologies it is possible to improve the information level of the potential users based on the Location Based Services (LBS).

For the LBS to be available, it requires the infrastructural elements: mobile device, applications, communication network, location components, server, service.

GPS location is one of the major subjects in using LBS services but not the exclusive method of locating the object in space. Using the Fleet management service by GPS technology or triangulation within the network elements of mobile communication systems, by means of mobile unit onboard vehicle the information about the vehicle or the entire fleet can be shared with other interested parties who may make use of the information in performing their activities. There are numerous such initiatives, e.g. ZG Traffic application (powered by SkyTrack.com). However, these are no professional solutions that would enable control and integration into the ITS system module, but rather they function by the distribution of contents via principles of social networks.

Apart from the fleet management service, the system has a huge potential by means of which it enables realization of the exchange of messages and mobile Internet service (MMS, e-mail) in the sense of information harmonized with the region in which the user is located, e.g. information about the history of the area through which one travels and cultural data about the location, tourist and gastronomic offers, meteorological, geographical, and other characteristics of the locality.

Presentation of the mentioned information are useful not only for the passenger but also for the promotion of the locality, even the space as a whole and finally they can be of wider economic significance.

With the fast development and widely spread information and telecommunication technologies integrated into mobile terminal devices, determining the location on the move has become everyday practice. The technologies include the Geographical Information System (GIS), Global Positioning System (GPS), Radio Frequency Identification (RFID), and various other technologies for positioning with more or less precision, coverage or costs of installation.

In introducing LBS service, important is the characteristic of the mobile devices whose hardware and software properties may satisfy a certain level of quality of using LBS services.

Mobile terminal devices feature high accessibility, significant implementation by the users, they are used within a huge part of the geographic area, and by using adequate applications they may become the sensors of the traffic system and the environment. The infrastructure of mobile terminal devices is shown as a platform that yields the best promise in the function of applying LBS. The success of LBS is direct value noticed by the user regardless of the technical complexity and current precision of results. If even an approximate result is observed as useful, the users will use the service again.

Depending on the design method we distinguish between two types of LBS applications: push and pull.

• Push services – imply that the user receives information as result of the user’s current location, which the user had not actively requested previously. The information can be sent to the user in compliance with a previous consent (e.g. information on certain threats) or without consent (e.g. various types of advertising when entering a new city).

• Pull services – the user actively uses the application and “pulls” the information from the network. The obtained information can be used in the context of better usability of the current position of the user (e.g. information about the nearest cinema).
Based on the numerous past studies several important factors for the success of location-based services have been noted. Among other things, that they are of direct advantage for the user, easy to use, provide fast processing of data, low in price or completely free service, etc.

The development methodology of the system allows simple adaptation and application with necessary improvement of the distribution methods through cooperation with the operators of mobile communication systems.

4. APPLICATION OF CLOUD COMPUTING PRINCIPLES IN PASSENGER BUS TRANSPORT

The notion of cloud computing is a model which allows access to the network at user’s request, more precisely access to computer resources such as access to servers, applications and services. The users can use “cloud” services when they want it, and the only thing the user needs is Internet access.

Cloud computing for the end user or provider of a part of the services applicable in passenger transport, means that there are no hardware purchasing costs, no more software licences or upgrades for the control, no new employees or consultants that need to be employed, no possibilities of leasing, no capital costs of any kind and no hidden costs. One uses only what one needs, and pays only for what one uses. It is precisely for these reasons that Cloud Computing represents a great advancement of IT evolution since it changes the way of thinking, developing, implementing, updating, maintaining and paying for the applications and infrastructure on which the service has been started.

Everyday problems that trouble the bus transportation, such as the decreasing number of passengers using public transport service, increase in competition, constant investments into maintenance and restoration of the fleet, constant growth of the fuel prices, etc. do not leave enough space for investments into new technological solutions. The application of new services according to the cloud paradigm does not represent CAPEX financial cost for the implementation into numerous transport means, but rather expansion of the supply of passengers within the same transport cost. This raises significantly the level of the quality of the offered service.

The companies that cannot afford capital investments into “traditional” information technologies are logical users of cloud services (i.e. cloud software solutions). However, this group includes also companies that deal with activities that are in their nature mobile, such as e.g. bus carriers.

Owing to cloud infrastructure the users can access the data in the “cloud” by means of different devices, anytime and anywhere, regardless of whether they are using desktop or portable computer, mobile phone or tablet.

By expanding the provided service for the bus transport users, using CLOUD infrastructure, the company has not only a more satisfied customer but also a database on their customers based on the digital identities applied during transport, which may be used for various marketing actions with currently available offer, such as e.g. last minute offers, loyal customer club, etc. Of course, ON-LINE purchase with instantaneous confirmation of ticket purchase on the mobile device of the user and of the service provider (bus driver and company headquarters) represents a step into the future technological development and service extension.

In Croatia one of the telecom operators offers fleet management services according to cloud principles. The currently available functions, applicable also in the control of transport entities for passenger transport include:
• Current location, speed and status of the vehicle in Croatia and abroad;
• History of the movement of vehicle by plotting the vehicle route;
• Detailed reports and statistics on the usage of vehicles on a daily, weekly and monthly basis:
  o Total distance and time of driving;
  o Location and time of vehicle stopping;
  o Speeding;
  o Visits to objects of interest or set movement zones;
  o Statistics and analytics of using the vehicle during and outside working hours;
  o Automatic sending of reports to e-mail addresses (XLS, PDF, etc.);
  o Interactive graphs of the speed and altitudes with location represented on a map;
• Selection of the travel type: private, on business, or locco ride;
• Administration of data on vehicles and drivers;
• Administration of user’s rights for inspection of vehicles and locations of interest;
• Simple export of all the reports in Excel and PDF and other formats;
• Information / Alerts on using the fleet by SMS or e-mail:
  o Entry/Exit from arbitrarily defined movement zones;
  o Usage during and outside working hours;
  o Speeding;
  o Announcement of vehicle servicing intervals;
  o Stopping at location longer than the time given;
  o Stopping at non-defined locations;
• Simulation of vehicle movement on a map;
• Presentation of optimal routes to the selected location on the map.

By additional integration of the obtained information on this principle, an entire series of new information functions for the driver as well as for the passengers onboard vehicle is possible. By fusion of the information about the travelling of the transport entity along the traffic network it is possible to offer additional services to all those interested in the condition within the traffic network. The transport entity here occurs as the sensor of the transport network, and for the fusion and distribution of the information obtained in this manner, it is additionally necessary to study the possibilities of implementing social networks as one of the most present communication platforms of today.

5. CONCLUSION

The notion “cloud computing” first came to life in the narrow, professional IT circles, and then for quite some time it was a purely marketing notion that failed to be understood by the majority of users. The development of cloud services made it clear that it was not just another marketing trick, but rather services that can significantly reduce IT costs and allow huge advancement in the operation of transport companies since it changes the way in which the advanced terminal equipment and services are purchased and implemented in the transportation process.

In the meantime “cloud computing” has become so significant that the discussion about these technologies is raised also to a political level in the European Union. At the World Economic Forum it was emphasized that in the context of European digital agenda a joint cloud computing strategy has to be developed. By exchange of the value chains in the process of delivering telecommunication services, the offer of information services for the needs of transport companies can represent a pure profit, rather than cost in implementation.
The issue of security and privacy is especially important from the perspective of successful ranking of the new “cloud” services on the market. It is, namely, precisely the issue of security and privacy which may represent a barrier for some users.

Information is power, and therefore the economic subject, in this case the bus carrier, with the application of new technological solutions and improvement of the provided service of informing will occupy a better position on the market. The breakthrough of new technologies in this branch of transport on our market has not made it yet in its full sense and therefore has an even greater market potential.

**LITERATURE**

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