IOT Applied in ITS

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Abstract: - In order to implement the Internet of things, the case study uses the technologies associated with sensors installed in the vehicle in order to identify the vehicle when it passes through a portal and the associated information available as RFID (Radio Frequency Identification): temperature, average speed, doors and other relevant information. The paper presents a case study in order to use ITS technologies applied to conduct activities, mainly for the bus tracking. The case study is proposed with this paper, using the concept of IoT (Internet of Things) is the inspection of trucks.

Key-Words: - IoT, BRT, RFID, BRT, Mobility, Transportation

1 Introduction

Technological developments in recent years reflect intensely all aspects of social life creating new ways of thinking, feeling and acting in society, also called "Technological Society" [1]. The use of technological resources at day by day of society is changing behavior, and especially, introducing new values and establishing forms of relationship and interaction. Considering accessible cost, the technology could applied to monitor the vehicle, enabling increased effectiveness and significantly changing society.

This paper presents an effective solution for the surveillance of bus athwart the use of IoT (Internet of Things) technologies and integration with ITS, allowing in real-time to identify each vehicles and his position.

The Internet has revolutionized the world, as no other invention was able to do. The integration of computers over telecommunications networks allowed create a mechanism of information dissemination worldwide and means to collaboration and interaction between the peoples and computers, independent of their geographic localization.

The technological evolution that began with the first research on packet switching and ARPANET (Advanced Research Projects Agency Network) and ITS technologies, permitted to expand the infrastructure horizons in various dimensions as scale, performance, functionality, operational and management aspects of global and complex computer network infrastructure.

Actually, the Internet is a large infrastructure of

information what involves many aspects: technological, organizational and community. And ITS influence reaches not only to technical fields of computers and telecommunications but whole society that uses the facilities supplied by Internet to realize electronic commerce, exchange information and community operations.

On October 24 of 1995, the Federal Networking Council defines the term Internet as the global information system that is logically linked together by a globally unique address space based on IP (Internet Protocol) to support communications using the TCP/IP (Transmission Control Protocol/ Internet Protocol) suite and provides uses or make accessible, publicly or privately, high level services layered on the communications and related infrastructure described. [2]

The email was one of the first Internet applications and continues to be invaluable because it allows communication between two or more people in an extremely easy way, also the multimedia environment of the Internet is another great application, and this feature has changed the way to do marketing, to serve customers, to do business, to educate, to learn. Online service with video, high quality video, content translation into other languages, electronic medical records of patients with decentralized Internet access, with emphasis on distance education at the level of training posts and tutorials for classes, interactive voting and elections are examples of services on the Internet. In Brazil, there are several success stories, such as the delivery of income tax over the Internet and issuance of invoice, both in terms of convenience for the population and in terms of reducing costs for the case of the government.

There are several groups of researchers working on development of the Future Internet concepts in order to provide an overview, trends and tendencies. These groups study and define the future of the internet architecture, including capacity, ubiquity, scalability and virtualization. In addition, these groups are discussing the focus of the Future Internet as service-centrism, neutrality, openness, diversity, extensibility, flexibility, usability, simplicity and sustainability. [3]

According FIRE (Future Internet Research and Experimentation), the internet has become the anchor of world economies, forming financial and healthcare markets, energy and transport services, and is likely to become more important in the future because it creates a new big business and is transforming existing segments. For example, the future health systems expected to use the Internet to increase the accessibility, quality and efficiency through medical information systems with electronic record patients systems, remote patient monitoring and healthcare delivery, generating improved diagnostics and imaging technologies. [4]

The future internet is governed by four areas, as shown on figure 1: Social, Psychological & human interaction, Technical and Economic and it is necessary to develop Policy, Governance, Operations & management and Regulation & legislation issues. At future the internet will have a great influence at people's life, it is expected that in 10 years the internet will have 40% of influence in everyone's day and in 20 years will be 60%, as shown on figure 2, so the Internet will present constantly in day-by-day activities.

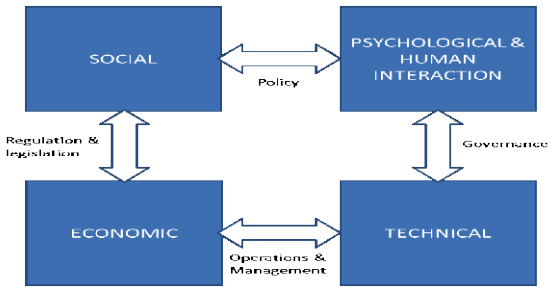
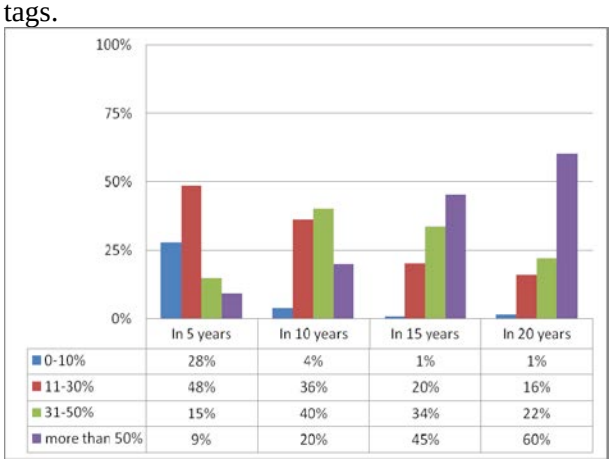


Fig.1: Key Issues for Future Internet

People will use the internet much more in the future, so it is essential to understand what the future internet will have to change to meet, in an interview now voice communication and basic data is needed, social networks, the primary source of news and information. In 10 years, the demand will be entertainment, maintenance day life and interconnection of people and machines, and interconnection of humans with machines and sensors
tags.



	In 5 years	In 10 years	In 15 years	In 20 years
0-10%	28%	4%	1%	1%
11-30%	48%	36%	20%	16%
31-50%	15%	40%	34%	22%
more than 50%	9%	20%	45%	60%

Fig.2: Percentage of day influenced by internet [4]

In order to delivery public services may turn to internet to access these services, it is necessary to increasingly deeper interaction between providers

and end-users and greater trust and security.

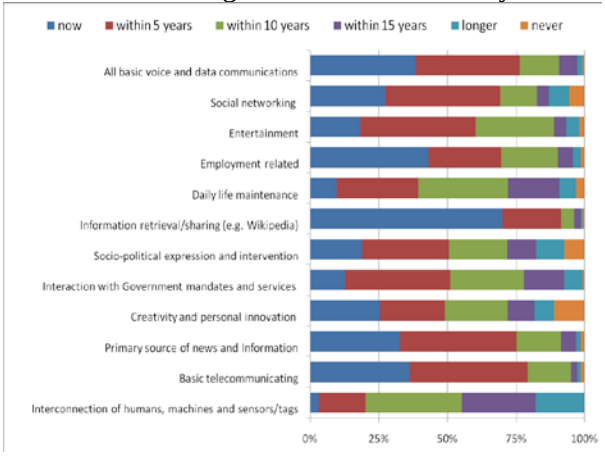


Fig.3: Forms of Interaction

In the future context of the Internet, there is a discussion to implement the IoT (Internet of Things), which refers to everyday objects interconnection network so that everyone can access any object over the internet. The idea is to implement in everyday objects to a device that will allow interaction with him, so that people can receive information about the object status, temperature, status and so forth. For example, a drug will have a device that will collect information on the temperature and pressure from production to retail, so that consumers can access this device and verify this information in a specific period, then the consumer can check whether the drug was properly stored [14] [15].

The device developed using several technologies. For example: Alcatel-Lucent developed Touch tag that is an RFID service for consumers, application developers and operators. The consumers can trigger what Touch tag calls applications, which can include opening a webpage, sending a text message, shutting down the computer. [5]

2 Understand the Problem

The BRT is a transport system that offers quality services at low cost and short-term deployment compared to other modes of transport. So many cities are the choosing as an ideal solution for mass transportation, meeting the daily needs of people for displacement in urban centers. The BRT concept consists of key elements to focus on the operation planned, adequate infrastructure, technology, effective management and quality service to passengers.

The ITS system consists of a technological matrix intended for the operation and management of urban mobility. It consists of sets of information systems, communication, control, monitoring, sensing, acting and others. It aims to provide greater operational efficiency of transport and transit operations services, and provide comfort and safety for users of BRT services.

One of the many features of IIS to the BRT is to monitor the bus and performed using various technologies. In this context, this study evaluates the use of the RFID tag as a possible solution to improve the BRT bus monitoring.

3 Solution Proposition

To solve the problem presented in the anterior topic is necessary to use an integrated solution, consisting of equipment, means of communication and integration with ITS. For this purpose, this paper proposes the solution presented in this topic.

Equipment

The solution is the development and implementation of a device that can collect product status information or the bus and deliver it over the Internet.

The proposal is to use an active RFID tag with sensors connected to them. The sensor designs depend on the need or demand for each product supplied, for example, optical sensors used to control the door opening and closing, the motor speed sensors to monitor and control engine operation, etc. [13].

To read the labels, RFID must be installed on highways, airports, ports and major portals strategic points to take RFID reading and writing of tags, and especially to provide information via the Internet, Figure 5.

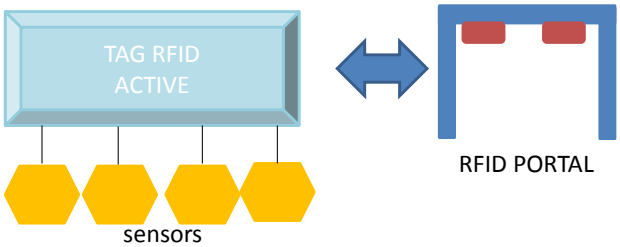


Fig.5: Equipment

RFID

The RFID technology allows the identification and location of a given object using radio frequency at short range (typically 0.5 to 5m) and can be used both for identification of vehicles (as in the Brazil DENATRAN SINIAV project), and identification of cargo through containers, pallets, cases, individual products or bulk [10][11]. Through reading equipment (readers and antennas) installed at strategic locations, can become a key tool in an integrated solute ion for tracking, see figure 6.

[12][14]

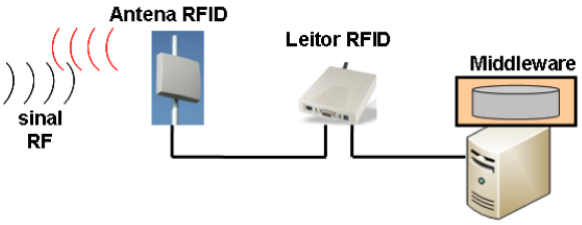


Fig.6: RFID Architecture

The main strengths of RFID for identification are:

- The vehicle identification accuracy is typically higher than the automatic reading of plates by OCR. RFID systems have accuracy rates of at least 95%, with typical results above 99%;
- There are Brazilian government projects with the participation of research centers dedicated to the subject, such as the design of SINIAV DENATRAN for identifying vehicles nationwide, and the project BRASILID for the standardization of RFID tags and infrastructure to identify any kinds of products in circulation in the national supply chain and logistics.

Moreover the technology has points of attention that must be taken into consideration in the projects:

- The technology is intrusive, it requires an tag RFID are installed across the fleet of vehicles;
- Identification by RFID typically references a family of radio technologies and standards for short distances that include both active devices (self-powered) or passive (powered by the electromagnetic field radiated by the reader antenna), and may require a different communication protocols, requirements information security, storage and processing capabilities. This wide range of options means that there are solutions for all cases. It is necessary a project of readers, antennas, tags, software and operating model for each desired state supervision of vehicles.

The proposal is to install an RFID tag on each bus, so to spend on each portal the bus can be identified on both the aspect of the position regarding the date and time. Considering the following two portals and the date and time of data you can calculate the average time of each bus and to anticipate the arrival of the same at the next bus stop. Depending on the average speed values it can be concluded that there are problems on the road, such as obstructions and thus an alert can be generated for someone to check what is happening. As shown in Figure 6.

Another possibility is the bus itself store data in the RFID tag, thus to pass over the portal. Tt sends this data that can be processed on the server. Among the data, it can be informed vehicle speed, number of passengers on the bus, and other information. In this case, the bus is equipped with sensors that collect data and store the RFID tag.

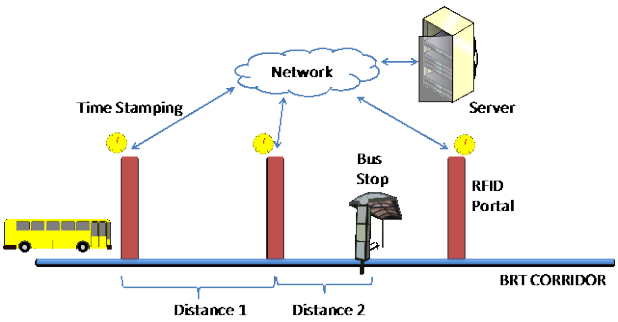


Fig. 6: Bus Monitoring

If the RFID tag damaged, you cannot identify the bus, which can interfere with the operation of BRT. The solutions that do not use real-time traffic system, when the bus passes through a portal may send a signal to the traffic signal controller in the field to trigger green, this solution is practical, however, the number bus that can pass through traffic is high, and there is a possibility to suspend the cross, not allowing any vehicle pass.

4 Conclusion

The IoT will enable a breakthrough for intelligent transport systems, because information relating to any object (vehicles, parts, lights, signs, goods, etc.) will be available via the Internet and may contain information about the environment in which this object inserted. With this, the ITS can provide more accurate information to stakeholders that make up the system, allowing decisions occur easily.

The use of RFID tag is feasible for monitoring the bus and allow the system to perform ITS taking appropriate decisions in every situation. The implementation of the solution is simple, with the greatest difficulty lies in defining the location of each portal.

Another interesting point is that there are government programs that use RFID tags for tracking vehicles, cars, buses and trucks. Thus, the application of RFID tag is a trend.

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