Archives of
Transport System
Telematics

Volume 8

Issue 4

November 2015

Capabilities for development an ITS system in the city of Wroclaw

K. TOPOLSKA, M. TOPOLSKI
WROCLAW SCHOOLS OF BANKING, Fabryczna 29-31, Wroclaw, Poland
EMAIL: Katrzyna.Topolska@wsb.wroclaw.pl

ABSTRACT
The article presents opportunities for the Intelligent Transport System for the city of Wroclaw. In the first part the authors illustrate the current state of the system. The next section presents the results of studies into roads in the city of Wroclaw. The survey respondents were included, i.e. drivers, transport companies and employees of the police, the ambulance and fire brigade. The Author's research tool was a questionnaire, and the study was conducted using a diagnostic survey. The remaining results show some disadvantages of the system and new perspectives of its development. On the basis of studies the authors presented improvements of the overall architecture of the system. This will allow the police and internships brigades to work more efficiently with primarily alert.

Keywords: Intelligent transport system, development of telematics system

1. Introduction

The aim of the paper is to present a positive impact of intelligent systems on the urban infrastructure, and to show the possibility of using the ITS to improve transport efficiency while reducing the negative effects of transport development in large urban agglomeration. The paper provides background information on Intelligent Transport Systems, presents examples of the use of these systems in Wroclaw, and shows the benefits of modern techniques in transport.

2. The concept of Intelligent Transportation Systems

Wroclaw is a city situated on the Odra River and six other smaller rivers. It is the fourth in terms of population and the fifth largest city in terms of Poland's surface. Systematically major cultural festivals take place there. In recent years there has been a boom of investment (IBM, LG Philips, Volvo, Toyota, Siemens, HP, 3M, Whirlpool and many others). It should also be one of the largest academic centers in Poland with the University of Technology and three universities at the forefront.

The English ITS abbreviation stands for the Intelligent Transportation System.

The project aims to implement the ITS system and to increase effectiveness and efficiency of the transport system of the City of Wroclaw. It is to be a tool for the implementation of the city's policy to optimize the use of the transport infrastructure.

The system aims to inform road users about traffic conditions and about the best route for travelling in an urban agglomeration [5].

The ITS system will be a tool used by municipal services. This system will be equipped with a large computer system which, through the acquisition of data from the traffic controls and measurement devices, and public transport vehicles in Wroclaw and processing in the Traffic Management Centre and Public Transport will make information available to road users, public transport passengers and other institutions.

The acquired and processed information system will optimize the work of the ITS traffic light controllers, electronic boards

control the text on the roads and public transportation stops, and support the event management traffic and public transport. It will decide which columns of vehicles will go first, and will inform drivers and MPK passengers about accidents. The Intelligent Transport System will control traffic on 158 intersections in Wroclaw.

It is a program based on 1440 cameras that monitor different aspects of the traffic in the city. Almost all of them are already installed. With the right software, they recognize the vehicle type and on the basis of observations of a column of vehicles decide which one is more important so that, for example, fast trams did not have to wait at intersections. The system has a function to program the light cycles on a particular occasion, e.g. a mass event in the stadium. Such information can be repeated every time there will be a match, when such a solution will be optimal and will be remembered, the system can repeat the task and quickly set the green light on the route of the fans and thus change the organization of the lights in the city.

Boards with bus information run already, in addition to vehicle departure times MPK will display messages e.g. about failures. Information about the accident from the MPK driver will radio for ITS Traffic Control Centre Street. Strzegomska. Employees of the Communication Centre will enter the accident to the computer and send it to an array landing. Information for the drivers will be displayed on the boards after the computer system will measure the average speed of travel on a given section based on readings from cameras, and then sum up the travel times along the entire route [8, 9].

The ITS costs the city zł 109 million, of which 87 million zł is a grant from the European Union.

The ITS project with a subproject ZSTS and a Supplementary Project will provide an ITS system.

The specific objectives of the ITS project are as follows:

- Improvement of traffic in the city
- Improving public transport vehicles
- Increase in road safety

The ITS project includes the following components:

- Implementation of traffic control in selected passageways of the city, including selected intersections of Wroclaw and the environment Stadion EURO 2012.
- Implementation of area traffic control (RIA) in selected areas;
- Implementation of Dynamic Information stops (DIP) at selected stops;
- Implementation of Information Subsystem Traffic Conditions (PERUCHU and INFO ITS);
- Implementation of the Parking Information Subsystem (ENPARK);
- Implementation of video surveillance at selected intersections (road event management subsystem);
- Implementation of Traffic Management Centre functioning correctly necessary to carry out the whole task.

Each tram is equipped with a radio transmitter and antenna tracks through which they communicate with the system and the exact location and parameters of a vehicle. Images from cameras placed at intersections are analyzed by a special software which distinguishes the type of vehicle, the number of counts, analyzes the pace of the journey, follows the length of the queue, the data is sent to the headquarters of the ITS. The data from the cameras and transmitters is processed and analyzed by the program, sent from the center of the intersection of the ITS to allow a faster ride by public transportation. ITS Headquarters sends signals to change light cycles to local computers control. The system sends additional information about threats and impediments on roads and also about real time accidents [6, 7].

Upon completion of the delivery and implementation of various components of the ITS system in Wroclaw, traffic engineers are entering a phase of its complete life. Already at this stage, you will see a lot of real benefits of the operation of the ITS presented in the table 1:

Table 1. The benefits from the implementation of the ITS system [own study]

The benefits from the implementation of the ITS system	before	after
reduce time changes at the crossroads	2 months	1 day
coordination of work lights for trams	random, fixed length cycles	adapted to the situation at the crossroads
flow of information e.g. on difficulties	difficult	immediately
information on travel times of vehicles MPK	lack	shown in real time
the possibility of reaction	after departure and observations in the place of	remote
improve traffic measurement	once in several years manually	permanent and continuous measurement
improving the safety of passengers and drivers	in accordance with the procedures	integration of services, shortened response time special events
support services eg. the police	impossible	create an electronic archive of video and archiving the state of traffic lights

Officials announce further improvements to the system and its upgrades. Traffic engineers also think about making changes. There is a proposal to install countdowns under the lights for trams.

3. The benefits of Intelligent Transport Systems

The benefits of inteligent transport systems [2, 10]:

- Increase in the capacity of the road network by 20–25%
- Improving road safety (reducing the number of accidents by 40–80%)
- Reduced travel times and energy consumption (about 45–70%)
- Improving the quality of the environment (reduced emissions by 30 - 50%)
- Enhanced comfort of travelling for drivers, passengers and public transport users
- Reduction of the cost of road fleet management
- Reduced costs associated with the maintenance and renovation of roads
- Increasing economic benefits in the region.

Officials claim that the ITS has done a lot of good in monitoring the situation on the streets. Currently, traffic engineers have a preview of a thousand cameras deployed in over a hundred intersections on their computers. This allows them to respond faster, make any adjustments. In the past you had to watch it on the spot.

The system informing drivers about current difficulties and dangers allows them to make a decision on the selection of a different, better, increasing comfort and overall traffic flow in the city. The ITS is unable to eliminate all traffic jams in the city, but has improved traffic flow greatly and increased the throughput of intersections in Wroclaw.

The ITS also eliminated a lot of paperwork, e.g., in cooperation with the Wroclaw police and other services. It provides the ability to create electronic archive of video and archives the status of traffic lights. Even after 2 years, you can see (e.g. in the event of an accident) that the light actually pointed signaling. Thanks to the system we can also permanently and continuously measure the amount of traffic. Previously, traffic measurements were taken manually. Now thousands of detectors still count and classify the traffic condition.

An undoubted advantage of the system is also provided by the fact that it integrates all services. Hence the response time for exceptional events has been dramatically shortened. You can quickly make joint decisions and implement them in practice.

Using recordings in situations of road accidents (bumps, deductions) by the police as evidence in disputes.

Thanks to the system drivers and passengers of public transport also gained quick information e.g. about handicaps. Currently, drivers and passengers are informed about the difficulties almost immediately on the boards of light. It was used even during high water failure on the street Oławska. In addition, the boards at bus stops show real MPK vehicle travel time (except for emergency situations, the system shows the electronic form of timetable) [4, 5].

The results of subjective evaluation by the user of the ITS system is shown in Fig. 1-4 traffic. The research area is divided into 14 areas in Wroclaw. The study was conducted among 147 people. Surveys were carried out in Wroclaw in the area of major and minor interchanges, at bus stops and public transport. Assessments of the main assumptions that are made in the project implementation of intelligent transport system in Wroclaw.

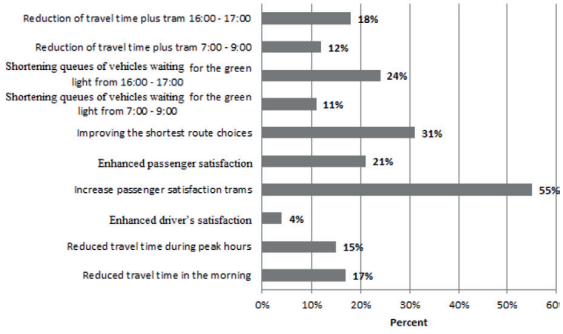

Fig. 1. Sensation of drivers and passengers following the introduction of the ITS in Wroclaw [own study]

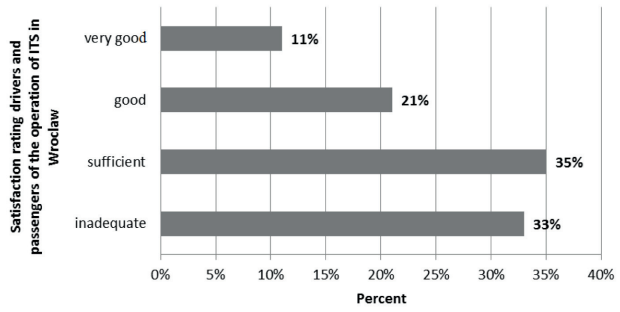

Fig. 2. Satisfaction rating of drivers and passengers with regard to operation of ITS in Wroclaw [own study]

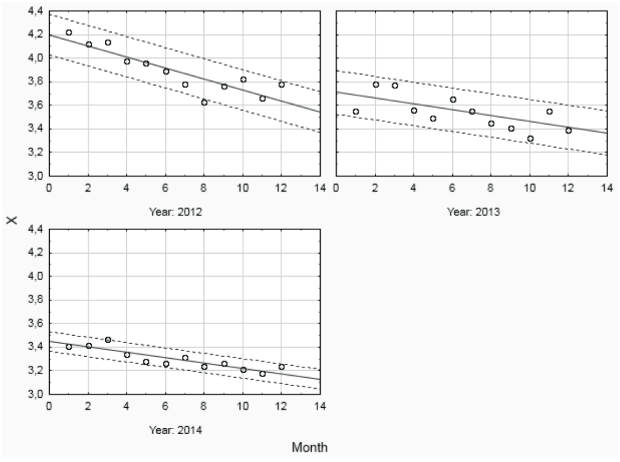

Fig. 3. Satisfaction rating of drivers and passengers with regard to operation of the ITS in Wroclaw by year and month of the study [min=1, max=5] [own study]

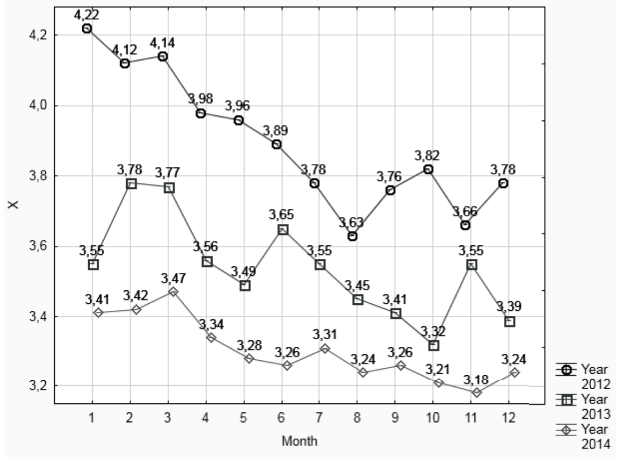

Fig. 4. Satisfaction rating of drivers and passengers with regard to operation of the ITS in Wroclaw by year and month of the study [min=1, max=5] [own study]

4. Conclusion

Implementation of the ITS system in Wroclaw meant to allow effective and efficient completion of the policy of Wrocław Municipality in extent to optimize the use of the transport infrastructure. The system also provides participants with a maximum of useful traffic information on traffic conditions and optimal methods of movements.

The ITS system in Wrocław optimizes work of traffic lights, controls the electronic text arrays on roads and public transportation stops and supports the management of traffic and public transport. The aim of the implementation of the ITS system in Wroclaw was the reduction of travel time of cars.

The capital of Lower Silesia is one of the most congested cities in Poland. This problem mainly concerns the center, where there are a lot of narrow streets. The functioning of the system is the effective management of traffic lights.

The ITS system supports a lot more than 110 major intersections. Analyses show that time of travelling by car was shortened in the morning by about 17%, in the afternoon by about 14%. It also decreased the queue of cars waiting for the green light. Engineers are still working on modifications of intersections, assigning priorities such as public transport for example Trams plus.

Despite the fact that the people responsible for the establishment and functioning of the ITS unequivocally say that the system works flawlessly, there are those who are its enemies. It is alleged that the capital, which was intended for the creation of ITS-in is too large (was approx. 110 million), and that it hinders more than it helps. The fact is that there are errors in timetables and on the electronic boards on the streets. You cannot forget, however, that the system is constantly expanding, creating new algorithms, parameters, calculates the travel time and trying to create the most favorable route to travel.

Bibliography

[1] ERNST T., UEHARA K., MITSUYA K.: Network mobility from the InternetCAR perspective, 17th International Conference on Advanced Information Networking and Applications (AINA'03), (2003)

[2] GRANQVIST, J. et al. : Transport telematics-architecture, FITS (2003)

[3] HUNT P., et al.: "Scoot - a traffic responsive method of co-ordinating signals , ttrl report 1014, Transport and Road Research Laboratory, Crowthrone, Berkshire U.K., Tech. Rep.,(1991)

[4] JIROVSKY, V., et al.: Transport telematics – Systemic view, WSEAS press, World Scientific and Engineering Academy and Society, Athens (2013)

[5] KALAŠOVÁ A., KRCHOVÁ Z.: Telematics applications and their influence on the human factor, EDIS ZU, p. 196, (2006)

[6] KOWALEWSKI M., KOWALCZYK B., PARAPURA H.: Sieci i usługi telekomunikacyjne w zarządzaniu kryzysowym, Telekomunikacja i techniki informacyjne, 1-2/2011

[7] ŁACNY J., ZALEWSKI W.: Telematics as an instrument for improving the effectiveness, security and safety of transport, in Burnewicz J. (ed.), Innovative perspective of transport and logistic, Chapter 8, Wydawnictwo Uniwersytetu Gdańskiego Gdańsk (2009)

[8] MARKUSIK S.: Infrastruktura logistyczna w transporcie; t.III. Środki transportu, Wydawnictwo Politechniki Śląskiej, Gliwice (2013)

[9] SMITH, J. et al.: Traffic modelling guidelines. Traffic manager and network performance best practice. Version 3.0. Transport for London (2010)

[10] http://zdium.wroc.pl [date of access 30.03.2015]