ISSN (Online) : 2278-1021
ISSN (Print) : 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 2, February 2014

Technology Driven Intelligent Transport Systems for Better Sensor Networks

PERISETTY NAGA SANTHAN[1], Dr.R.V.KRISHNAIAH [2]

M.Tech Student, Department of ECE, DRK-Institute of Science & Technology, Hyderabad, A.P, India[1]

Principal, Department of ECE, DRK -Institute of Science & Technology, Hyderabad, A.P, India[2]

Abstract: Sensors and networks are growing in technology faster. Moreover the wireless communications have witnessed a quantum leap in growth with the introduction of 3G and 4G technologies. Due to these there are plethora of emerging applications in various fields pertaining to military and civilian with respect to transport, health care, industrial automation, and personal communications. However, the automobile industry does not witness much change since its inception but trying to adapt information technology in terms of GPS related navigation systems. There are applications in this regard such as lane-departure warning, adaptive cruise control, and parallel parking. This has paved the way for transport infrastructure to be mixed with those mechanical and telecommunications systems in order to have accident alert systems, traffic monitoring, and electronic toll collection. Many researches came into existence for intelligent transportation systems. Recently Tewolde reviewed the present state of the art technologies being deployed for intelligent transport systems. In this paper we build a prototype application that demonstrates the proof of concept. The empirical results are encouraging.

I. INTRODUCTION

Mobile technologies have witnessed innovations in the industry of late. There is 360 degrees transformation in the systems when compared with traditional systems. These technologies are being used in transportation systems in order to make the systems energy efficient, environment friendly, safer, powerful, easier to drive and control besides making them flexible. There are many factors that are to be considered in order to make transportation systems to be more efficient and technology friendly. When vehicles are considered with respect to common use, there are certain problems such as lack of good design, fuel efficiency, urban mobility and so on [1]. It is expected that the technological innovations in future can address the challenges faced by transport systems as of now. The vehicles with wireless communication capabilities with other such vehicles can have great impact on the transport systems. The use of information technology paves pay to revolutionize the way vehicles are operated and used in future. This is also expected to reduce number of accidents and related deaths in the process [2], [3], [4].

Many research universities existed in the civilian research that includes contributions from companies like Google could manage making vehicles with highly responsive sensors that make the life of vehicle users easy. A suite of sensors are made available such as GPS, wheel encoder, internal navigational systems, video camera, radar, and laser scanners. Algorithms such as artificial intelligence algorithms are being used in order to map sensors and environment to make best out of the sensor networks. Moreover the sensors are wireless in nature which will make them more convenient in order to work effectively. Real time decisions can be made by these control systems that can help improve the overall experience of the intelligent transportation systems [5]. There are many success stories with respect to vehicle deployment and usage with the help of innovative protocols.

In this paper we studied the sensor and network systems that can be used to make an intelligent transport system. This paper has been influenced by the work done by Tewolde [6]. We built a prototype application that demonstrates the intelligent transport system and its adaption to new technologies. The remainder of this paper is structured as follows. Section 2 provides overview of intelligent transportation systems. Section 3 provides prototype and anticipated results while section 4 concludes the paper besides giving future directions.

II. INTELLIGENT TRANSPORTATION SYSTEMS

This section provides more details about Intelligent Transportation Systems (ITS) that will give insights into the way how they work and the technology usage. In real world the transportation infrastructure includes road conditional hazard sensing, central data collection road hazard and traffic warnings to vehicle, road condition data from vehicle, zoom, road and traffic data for analysis and real time display, speed and position data from thousands of cars, traffic monitoring, public safety notification of traffic or hazards, highway dept. notification of hazardous road conditions and so on. The schematic overview is shown in Figure 1.

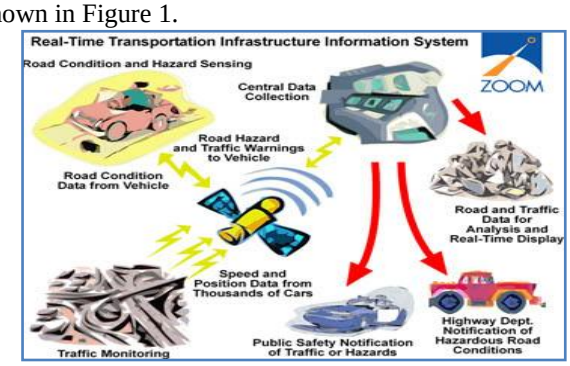

Figure 1 – Schematic overview of real time transportation infrastructure

ISSN (Online) : 2278-1021
ISSN (Print) : 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 2, February 2014

ITS has many users. They include public transport customers, commercial operators, and motorists. They actually relay on the ITS in order to make well informed decisions pertaining to travelling. They can also estimate road conditions, weather conditions, construction and maintenance works, safety, travel time and so on. Road networks and future planning can be made ease with intelligent transport systems. Figure 2 shows road usage scenario that reflects the effectiveness requirement for intelligent transport systems.

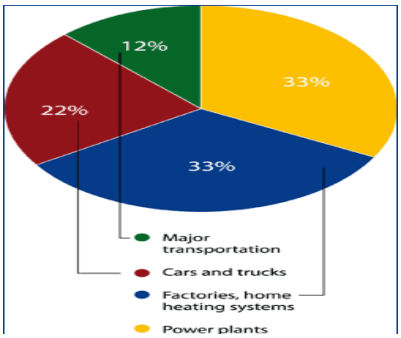

Figure 2 – ITS usage by various vehicles and other systems

As can be seen in figure 2, it is evident that ITS is being used by many public and private transport systems besides power plants, factories, and home monitoring systems. The vehicles that make use of road transportation on various days has been found and presented in Figure 3 which reflects the vehicles power hour on three specific days in 2003.

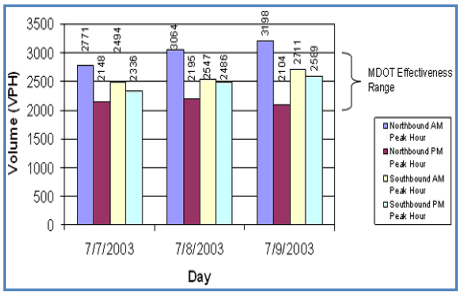

Figure 3 – Number of vehicles that make use of road transportation

As seen in figure 3, it is evident that the road transportation has number of vehicles that differ in peak hours and normal hours in the morning and evening. These vehicles need highly technology driven intelligent transportation mechanisms that help the road users to travel with safety. Technology driven solutions are already existed but they need to be improved further for pin point accuracy. ITS is being used to help increased motorization in the context of increased population density [7]. For the purpose of law enforcement, it is essential to have intelligent transportation systems in order to count the external and in-vehicle automatic occupancy. Programs like ExpressPark are being used for intelligent transportation systems [8]. The usage of more advanced mechanisms can help in having mechanisms that provide information pertaining to parking space and the allotment of parking space with perfect estimation and management [9]. The ITS can also be used to effectively reduce accidents with emergency response systems in place [10]. Standardization efforts are on the way in order to make the ITS usage more robust and real time for best results [11]. ITS infrastructure technologies are being used as well in order to help road ways with ITS integration [12], [13].

There are in-roadways sensor technologies like pneumatic road tube sensor networks, inductive loop detector, magnetic sensors for detecting metallic objects, piezoelectric sensors for finding mechanical impact and vibrations. There are over roadway sensor technologies like video image processors, microware radars for radio detection and ranging, infrared sensors for applications pertaining to traffic monitoring, ultrasonic sensors for transmission of sound energy, and passive acoustic array sensors for the detection of acoustic energy and so on. There are in-vehicle ITS technologies like navigational aid with the help of GPS, lane departure warning system that assists drivers, drowsy driver warning systems that can help drivers of vehicles [14], blind spot monitor [15], adaptive cruise control to maintain the vehicle speed, traffic sign recognition with sensor technology [16], collision advance system, and automatic crash notification system. There are vehicular communication systems that are integrated with ITS and GPS besides many wireless communication with the new technological innovations in telecommunication systems. With respect to wireless networks we studied Groundhog, Sensys, and Dust Networks SmartMesh.

III. THE PROTOTYPE AND ANTICIPATED RESULTS

We built a prototype application that demonstrates the effectiveness of the usage of ITS for various advantages mentioned earlier in this paper. The application we built makes use of the general infrastructure described and illustrated in Figure 1. We used available technologies like 3G, sensors and other communication systems in order to demonstrate the efficiency of application. The simulation results reveal that the ITS can help road users and also government in one way or other in order to improve the overall transport conditions and reduce the death toll due to accidents on national and international highways. The prototype is still in its inception and not a full-fledged one. It is being improved further. In future its will be able to adapt new technologies that come from time to time. However we expect that the death percentage gets reduced greatly over the next 5 years when our system is made fully functional. The envisaged results are presented here. The vehicles in use and anticipated results till 2015 are presented figure 4.

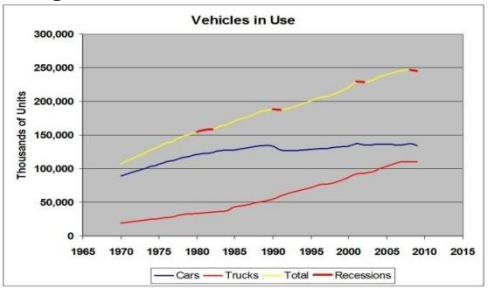

Figure 4 – Anticipated and actual results of vehicles in use

ISSN (Online) : 2278-1021
ISSN (Print) : 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 2, February 2014

As can be seen in figure 4, it is evident that the usage of cars and trucks is growing steadily. However, there are recession's periods that also reflect in the figure. Figure 5 shows the anticipated reduction of deaths in accidents in near future.

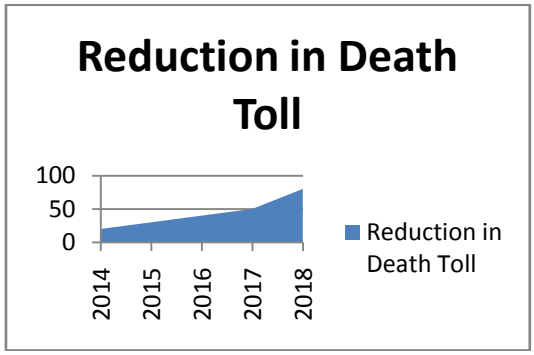

Figure 5 – Anticipated reduction of death tool with effective usage of ITS

As can be seen in figure 5, the future can witness the reduction of death toll increasingly every year as the usage of intelligent transport systems will be in place. This will help drivers, vehicles owners, road users, administrators; governments and so on as the overall effectiveness of transportation systems are improved.

IV. CONCLUSION AND FUTURE WORK

In this paper we studied the technology enhancements related to communications and transport. Especially we focused on the intelligent transport systems. We built a prototype application to demonstrate the way the innovative technologies to be used in intelligent transport systems. Out work has been inspired by the review of technologies made recently by Tewolde. Our experiments with respect to the intelligent transport systems helped in studying and reducing traffic congestion, minimizing oil consumption and so on. We made use of sensors and network technologies in the prototype application which demonstrates how the intelligent systems can be built with the advancements in the technologies like 3G, 4G, sensors and other communications systems such as wireless networks. These technologies help to overcome the drawbacks of traditional systems that do not use much of the state of the art technologies. The adaption of these technologies brings energy efficient sensing and greater flexibility in installation and maintenance of the networks. We intend to work further in future in order to improve the prototype to adapt to other technologies that come from time to time in future.

REFERENCES

[1] W. J. Mitchell, C. E. Borroni-Bird, and L. D. Burns, "Reinventing the Automobile – Personal Urban Mobility for the 21st Century," The MIT Press, 2010.
[2] "Car takes long drive – by itself," China Daily, August 2011, http://www.chinadaily.com.cn/cndy/2011-08/03/content_13037633.htm
[3] "Autonomous Vehicle Navigates the Streets of Berlin," September 2011, http://autonomos.inf.fuberlin.de/news/press-release-92011
[4] Erico Guizzo, "Autonomous Vehicle Driving from Italy to China," IEEE Spectrum, September 2010, http://spectrum.ieee.org/automaton/robotics/roboticssoftware/autonomous-vehicle-driving-from-italy-to-china
[5] Erico Guizzo, "How Google's Self Driving Car Works," IEEE Spectrum, October 2011, http://spectrum.ieee.org/automaton/robotics/artificialintelligence/how-google-self-driving-car-works
[6] Girma S. Tewolde, "Sensor and Network Technology for Intelligent Transportation Systems", IEEE, 2012.
[7] Wikipedia, "Intelligent Transportation Systems," http://en.wikipedia.org/wiki/Intelligent_transportation_system
[8] ExpressPark Intelligent Parking Management, City of Los Angeles Department of Transportation, 2010.
[9] N.H.H.M. Hanif, M. H. Badiozaman, and H. Daud, "Smart parking reservation system using short message services (SMS)," 2010 International Conference on Intelligent and Advanced Systems (ICIAS), Kuala Lumpur, Malaysia, 2010.
[10] Intelligent Transportation Systems Joint Program Office, "Intelligent Transportation Systems Safety Solution preventing Crashes and Saving Lives," http://www.its.dot.gov/factsheets/pdf/ITSA%20ITS%20Saves%20Lives.pdf
[11] Intelligent Transport Systems, The European Telecommunications Standards Institute (ETSI), http://www.etsi.org/website/Technologies/IntelligentTransportSystems.aspx
[12] L.A. Klein, D. Gibson, and M.K. Mills, "Traffic Detector Handbook," Federal Highway Administration, US Department of Transportation, Washington, DC, 2006.
[13] L.E.Y. Mimbela and L.A. Klein, "A summary of Vehicle Detection and Surveillance Technologies used in Intelligent Transportation Technologies," The Vehicle Detector Clearinghouse, August 2007, http://www.fhwa.dot.gov/policyinformation/pubs/vdstits2007/vdstits2007.pdf
[14] Ford's wake up call for Europe's sleepy drivers, http://media.ford.com/article_print.cfm?article_id=34562
[15] Wikipedia, Infinity M, http://en.wikipedia.org/wiki/Infiniti_M
[16] A. Lorsakul and J. Suthakorn, "Traffic Sign Recognition for Intelligent Vehicle/Driver Assist System Using Neural Network on OpenCV," The 4th International Conference on Ubiquitous Robots and Ambient Intelligence, 2007.

BIOGRAPHIES

Perisetty naga santhan has completed B.Tech (E.C.E) from Sindhura College of engineering & technology and pursuing M.Tech (E.C.E) in DRK institute of science and technology, JNTUH, Hyderabad, Andhra Pradesh, India. His main research interest includes in Electronics, Embedded & VLSI Systems.

Dr.R.V.Krishnaiah, did M.Tech (EIE) from NIT Waranagal, MTech (CSE) form JNTU, Ph.D, from JNTU Ananthapur, He has memberships in professional bodies MIE, MIETE, MISTE. His main research interests include Image Processing, Security systems, Sensors, Intelligent Systems, Computer networks, Data mining, Software Engineering, network protection and security control. He has published many papers and Editorial Member and Reviewer for some national and international journals.