Intelligent Transportation Systems

Ganesh Khodwe[1], Manoj Kambale[2], Rahul Dongare[3], Prakash Dhangar[4], Shubham Shinde[5], Amul Waghela[6]

[1, 2, 3, 4, 5, 6] Department of Civil Engineering
[1, 2, 3, 4, 5, 6] GSMCOE Balewadi Pune 411045

Abstract- *Intelligent transportation systems (ITS) hold great promise for public works professionals seeking to optimize those public investment strategies that deal with traffic congestion and other growth pressures. Advanced traffic and fleet management systems as well as traveler information and vehicle-based systems can take advantage of information technology advances and private market products to substantially improve the productivity, connectivity, and safety of transportation. And as the new federal transportation act further spurs deployment of these systems, ITS research programs will continue to play a vital role in supporting such deployment and the overall evolution of ITS. Such research includes developing technology tools, providing testing and evaluation environments, and helping advance the state of the practice.*

I. INTRODUCTION

The term intelligent transportation system (ITS) refers to efforts to add information and communications technology to transport infrastructure and vehicles, in order to improve safety and reduce vehicle wear, transportation times, and fuel consumption.

ITS can be schematically represented as, state of art data acquisition and evaluation technology, communication networks, digital mapping, video monitoring, sensors and variable message signs are creating new trends in traffic management throughout the world.

Intelligent transportation systems are a tested route to mitigate traffic congestion problems. The major objective of ITS is to evaluate, develop, analyze& integrate new technologies & concepts to achieve traffic efficiency, improve environmental quality, save energy, conserve time & enhance safety & comfort for drivers, pedestrians, and other traffic groups.

The principal reason for traffic congestion in India is that the road space and infrastructure have not improved on par with traffic. The seriousness of the problem is reflected in the report of World Bank that estimates the economic losses incurred an account of congestion and poor roads along run as high as $6 billion a year in India. The direct solution of this problem by improvements in infrastructure is constrained by space availability and other logistic problems.

RESEARCH AND LITERATURE REVIEW "MULTIAGENT ARCHITECTURE FOR INTELLIGENT TRAFFIC MANAGEMENT SYSTEM"

Earlier the transportation system was not that effective but due to evolution of technology and invention of various modern techniques the transportation system has become much effective and user friendly.

The various software techniques used in transportation system like multiagent systems, ITMS,TCC, VDS etc. provide proper functioning of the transportation system & underlay various rules, regulations for safe effective travelling of users. BY JOSEFA HERNANDEZ(2002)

"APPLICATIONS OF GPS TECHNOLOGY IN THE LAND TRANSPORTATION SYSTEMS"

In this paper oveall study on various methods of improving the transportation systems with the help of Global Positioning Systems(GPS). BY G. MINTSIS in 2002

INTELLIGENT TRANSPORTATION SYSTEM USING SHORT RANGE WIRELESS TECHNOLOGIES"

Mostly accidents are occurred in day to day life therefore effective transportation system is much essential. In this paper propose using ZigBee for ITS and ZigBee is inexpensive which reduces the total cost of the system. BY Razi Iqbal(2011)

"INTELLIGENT ROAD TRAFFIC STATUS DETECTION SYSTEM THROUGH CELLULAR NETWORKS HANDOVER INFORMATION"

This paper is based on the study, to check the status of road traffic conditions through the use of cellular networks handover count. They have test this method in Lisbon, Portugal, from 39 cellular towers with an average daily traffic size of 20,500 vehicles.

"INTELLIGENT PARKING SYSTEM"

The basic concepts of the parking reservation system and parking revenue management system are discussed in this paper. The proposed ''intelligent'' parking space inventory

control system that is based on a combination of fuzzy logic and integer programming techniques makes ''on line'' decisions whether to accept or reject a new drivers request for parking. BY PANDA LUCIC

II. STUDIES AND FINDINGS

CHALLENGES IMPLEMENTING ITS:-

Given the technical feasibility and significant benefit-cost ratios, why have ITS systems not been deployed more broadly, especially in lagging nations?

One reason is that there are a number of challenges involved in developing and deploying intelligent transportation systems. ITS face a range of challenges, including system interdependency, network effect, scale, funding, political, institutional and other challenges.

Some challenges are inherent to intelligent transportation systems across all countries; others are specific challenges faced with regard to deploying intelligent transportation systems.

The ITS market is nascent in India. Even though most of the technologies have been successfully implemented in developed nations, there are major challenges in implementing such state-of-the-art technologies in India, as listed below:

- Integration of the ITS applications and introduction of standards or the framework for an international ITS architecture, and likely to face similar compatibility and inter-operability problems to the situation faced by the railway.

- Lack of definite guidelines and regulations and difficulties in physical implementation.

- Developing a nation-wide ITS data archive.

- India's ITS can't be entirely modelled on the existing successful ITS of other nations due to basic cultural, geographic & practical differences among the countries.

- High cost for ITS safety systems does not allow high penetration. Few people are willing to pay extra for safety systems and only few technologies are sufficient to ensure safety.

- Setting up a citywide ITS implementations with fully functional Traffic Management Centers for coordination of traffic activities.

MAIN OBJECTIVES OF "ITS":-

- To improve traffic safety

- To relieve traffic congestion

- To improve transportation efficiency

- To reduce air pollution

- To promote the development of related industries

TYPES OF ITS:-

1. Advanced Traveler Information Systems (ATIS)
2. Advanced Transportation Management Systems (ATMS)
3. ITS-Enabled Transportation Pricing Systems (ETPS)
4. Advanced Public Transportation Systems (APTS)

1. Advanced Traveler Information Systems (ATIS):-

Perhaps the most-recognized ITS applications, Advanced Traveler Information Systems (ATIS) provide drivers with real-time travel and traffic information, such as transit routes and schedules; navigation directions; and information about delays due to congestion, accidents, weather conditions, or road repair work. The most effective traveler information systems are able to inform drivers in real-time of their precise location, inform them of current traffic or road conditions on their and surrounding roadways, and empower them with optimal route selection and navigation instruc-tions, ideally making this information available on multiple platforms, both in-vehicle and out. As Figure 1 illustrates, there are three key facets to the provision of real-time traffic information: collection, processing, and dissemination, with each step entailing a distinct set of technology devices, platforms, and actors, both public and private. This report will examine several countries' strategies regarding the provision of real-time traffic information.

This category also includes in-car navigation systems and telematics-based services, such as GM's OnStar, which offer a range of safety, route navigation, crash notification, and concierge services, including location-based services, mobile calling, or in-vehicle entertainment options such as Internet access and music or movie downloads.

2 Advanced Transportation Management System:-

Advanced Transportation Management Systems (ATMS) include ITS applications that focus on traffic control devices, such as traffic signals, ramp metering, and the

dynamic (or "variable") message signs on highways that provide drivers real-time messaging about traffic or highway status. Traffic Operations Centers (TOCs), centralized traffic management centers run by cities and states worldwide, rely on information technologies to connect sensors and roadside equipment, vehicle probes, cameras, message signs, and other devices together to create an integrated view of traffic flow and to detect accidents, dangerous weather events, or other roadway hazards.

Another advanced transportation management system that can yield significant traffic management benefits is ramp metering. Ramp meters are traffic signals on freeway entrance ramps that break up clusters of vehicles entering the freeway, which reduces the disruptions to freeway flow that vehicle clusters cause and makes merging safer.

3. ITS-Enabled Transportation Pricing Systems (ETPS):-

ITS have a central role to play in funding countries' transportation systems. The most common application is electronic toll collection (ETC), also commonly known internationally as "road user charging," through which drivers can pay tolls automatically via a DSRC-enabled on-board device or tag placed on the windshield (such as E-Z Pass in the United States). The most sophisticated countries, including Australia and Japan, have implemented a single national ETC standard, obviating the need, as in the United States, to carry multiple toll collection tags on cross-country trips because various highway operators' ETC systems lack interoperability. This particularly has been a problem for the European Union, although the European Committee for Standardizatio is working to resolve this challenge (and has made considerable progress).

An increasing number of cities throughout the world have implemented congestion pricing schemes, charging for entry into urban centers, usually at certain peak hours, as a means to not only reduce congestion but also to generate needed resources to fund investments in public transportation and to reduce the environmental impact of vehicles. Singapore, Stockholm, London, Oslo, and Jakarta are just some of the cities that have put congestion pricing systems in place to reduce traffic congestion, smog, and greenhouse gases. By charging more at congested times, traffic flows can be evened out or reduced. As half the world's population now lives in urban areas, some economists believe that urban congestion and emissions will be virtually impossible to reduce without some form of congestion pricing.

3. Advanced Public Transportation Systems (APTS):-

Advanced Public Transportation Systems (APTS) include applications such as automatic vehicle location (AVL), which enable transit vehicles, whether bus or rail, to report their current location, making it possible for traffic operations managers to construct a real-time view of the status of all assets in the public transportation system. APTS help to make public transport a more attractive option for commuters by giving them enhanced visibility into the arrival and departure status (and overall timeliness) of buses and trains.

This category also includes electronic fare payment systems for public transportation systems, such as Suica in Japan or T-Money in South Korea, which enable transit users to pay fares contactless from their smart cards or mobile phones using near field communications technology

IDENTIFIED BENEFITS:-

ITS results in:

- Improved safety to drivers

- Better traffic efficiency

- Reduced traffic congestion

- Improved energy efficiency

- Environmental quality

- Enhanced economic productivity

- Traveler information

- Traffic management

- Demand management

- Road management

- Advance driving assistance

- Electronic Financial Transactions

- Commercial Vehicle Management

- Public Transport Management

- Incident and Hazard Response

III. CONCLUSION

• Demand for Intelligent Transportation Systems comes from the need to implement the effective information infrastructure to alleviate traffic congestion and carry out traffic simulation, real-time control, and communications networks.

• ITS applications currently in existence, and being developed, have tremendous potential to reduce the incidence and severity of road crashes.

• ITS provides many ways to reduce energy consumption from transport.

• The rapidly increasing vehicle population in India spurred by the population boom & economic upturn lays a critical burden on traffic management in the metropolitan cities & towns of the country. While India has already made a foray into intelligent transportation systems in organizing traffic, more extensive & urgent integration of advanced technology & concepts into mainstream traffic management is imperative. The adoption of local & information based technologies into vehicles infrastructure, traffic management & traveler information services have shown dramatic improvements in the safe & efficient mobility of people & freight in USA, European nations, UK, Japan, Middle East & Canada. ITS is still in its infancy in India, with decision makers, Key planners & agencies still in the process of understanding its potential.

• India ITS cannot be entirely modelled on the existing successful ITS of other nations due to basic cultural, geographic & practical differences amongst the countries. The existing concepts have to be thoroughly understood in order to modify them to fit the Indian traffic scenario. The design of an intensive ITS program hinges on following developments.

1. Technology: - The development & implementation of the advanced technologies is important to the successful management and operation of ITS in India. These technologies include electronic equipment's such as sensors, detectors & communication devices & application of global navigation satellite system (GNSS). This in turn hinges on cooperative work between the Government, academic research institutions & industry.

2. Modeling of Indian traffic: - A proper understanding of traffic system is important in the successful implementation of any reliable ITS systems. The existing models, developed for the western traffic conditions may not be suitable for the Indian traffic and hence there is a need to modify or develop models that can characterize the Indian traffic in a better way.

3. Supply Chain: - Seamless interconnectivity of the various branches of the transportation sector is essential to provide effective & secure movement of goods & services while improving the conservation of natural resources and reducing environmental impacts such as the effects of carbon emissions.

4. Energy and sustainability: - The ITS in India should closely work with the energy sector in the promotion of fuel efficient transport policies and practices, including the use of alternative transport fuels. Fuel efficient policies and practices will assist the country in achieving sustainable economic and environmental benefits through the application of intelligent transportation services.

5. Human Capital Development: - Human skills are important to ensure the development of seamless transportation systems. Given the population density of India and the varied skill sets available in the country, the ability of the work force to develop, manage & safely implement existing and emerging technologies is essential for ITS design and implementation.

A plethora of issues and challenges have to be tackled before India can have a fully operating ITS system. The main challenges perceived include-

• Establishing ITS standards applicable throughout the urban and rural sections of India.

• Designing an ITS that encompasses the heterogeneous vehicle population.

• Developing a comprehensive data collection system

• Establishing of a Data Centre

• Setting up active interaction between academia, industries and governmental agencies

• Government setting up rules and regulations of traffic that will aid in ITS implementation.

To meet the challenges in setting up a comprehensive traffic management system, the following tasks have to carry out: - Measurement and monitoring the performance of existing transportation management systems throughout the country.

- Establishing aggressive, yet achievable, near and long term performance goals for transportation systems.

- Optimizing the performance of transportation network through the use of real-time data, predictive traffic models, improved integration between individual systems, and other state-of-art tools and strategies for improving safety, mobility and the environment.

It is vital to plan key initiatives and activities which advance and improve the development and use of ITS in India. These include activities addressing the Global Navigation Satellite System (GNSS), encouragement of international standards development through liaison with the International Organization for standards, work force development/training, and improved supply chain management processes in sustainable fashion.

REFERENCES

[1] "APPLICATIONS OF GPS TECHNOLOGY IN THE LAND TRANSPORTATION SYSTEMS"

[2] "MULTIAGENT ARCHITECTURE FOR INTELLIGENT TRAFFIC MANAGEMENT SYSTEM"

[3] "INTELLIGENT TRANSPORTATION SYSTEM USING SHORT RANGE

[4] WIRELESS TECHNOLOGIES"

[5] "INTELLIGENT PARKING SYSTEM"

[6] http://www.skylineproducts.com/icws296w4/html/dynamicmessagesigns.html

[7] http://sdotblog.seattle.gov/wp-content/uploads/2009/07/IMG_ 0648.gif

[8] http://www.cflhd.gov/ttoolkit/flt/FactSheets/ITS/ADVANCED%20RURAL%20TRANSPORTATION%20SYSTEM%20%28ARTS%29.htm

[9] http://www.fhwa.dot.gov/ohim/tvtw/vdstits.pdf4

[10] HTTP://WWW.half-of-japanese-drivewhatjapanthinks.com/ 2006/10/20/nearly-rs-have-car-navigation-systems

[11] http://www.mlit.go.jp/road/ITS/1998HBook/chapter3/3-3e.html