INTELLIGENT TRANSPORT SYSTEM

Report Submitted
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What is ITS?

Traffic control has been an issue since humans put the first wheels on the first cart. The modern world demands mobility. Cars represent the main method of mobility, but today’s congested highways and city streets don’t move fast, and sometimes they don’t move at all. Intelligent traffic systems (ITS), sometimes called intelligent transportation systems, apply communications and information technology to provide solutions to this congestion as well as other traffic control issues.

Intelligent Transportation Systems (ITS) represent a major transition in transportation on many dimensions. ITS is an international program intended to improve the effectiveness and efficiency of surface transportation systems through advanced technologies in information systems, communications, and sensors. ITS (Intelligent Transport Systems) is a system which is designed to promote advance technology, to ensure that the Electronic Toll Collection System (ETC) is effective and to support safe driving. With this system, people, roads, and vehicles use the latest information communication technology.

The intelligent transport system (ITS) takes the first step towards meeting this challenge by providing effective, reliable and meaningful knowledge to motorists in time. Problems like high traffic congestion, low transportation efficiency, low safety and endangered environment can be solved through innovative and sophisticated ways of handling latest techniques that have emerged in recent years in integrating information technology, electronics and telecommunication with roads and traffic management.

Intelligent transportation systems, or ITS, encompass a broad range of wireless and wireline communications-based information, control and electronics technologies. When integrated into the transportation system infrastructure, and in vehicles themselves, these technologies help monitor and manage traffic flow, reduce congestion, provide alternate
routes to travelers, enhance productivity, and save lives, time and money.

Intelligent transportation systems provide the tools for skilled transportation professionals to collect, analyze, and archive data about the performance of the system during the hours of peak use. Having this data enhances traffic operators’ ability to respond to incidents, adverse weather or other capacity constricting events.

**BENEFITS OF ITS**

The investments in ITS will help increase the benefits and efficiencies of transportation systems, thereby reducing the need for much costlier physical expansion of systems. This optimism is not to be confused as any kind of illusion that new infrastructure expansion in India can be avoided altogether by resorting to ITS. Significant expansion of infrastructure will still be needed in India for a long time to come. But including ITS in the overall development strategy of India’s transportation system can increase the number of beneficiaries of the system, significantly enhance the transportation-related safety which is a major concern in most parts of India and in some cases reduce the scale of infrastructure expansion. Thus, a realistic approach to ITS deployment in India would consist of a balanced component of ITS as part of the ongoing expansion of transportation system.

ITS initiatives in industrialized countries have clearly identified a number of benefits associated with such projects. Even though ITS projects are implemented with specific objectives with specific benefits in mind, the overall benefits to the society may prove to be quite substantial in many cases. For example, Toronto’s COMPASS Freeway Traffic Management System, one of the first and successful ITS projects in the world has been subjected to a great deal of scrutiny to evaluate its benefits. COMPASS has been found to reduce the incident response times from 86 minutes to 30 minutes, the overall vehicle delay by 5.3 million vehicle-hours per year, the overall emission by 3,100 tones per year and the operating costs of commercial vehicles by $55 million per year. Cities in the
United States have reported an increase in throughout by 25% and reduction in travel times by 25% after implementing appropriate ITS initiatives. The following is a list of identified benefits of ITS projects:

- Reduced rush hour congestion and delay
- Increased safety and personal security
- Time savings and operation efficiencies
- Reduced fuel consumption and emissions
- Improved customer service and reduced frustration
- Reduced road accidents and fatalities and
- Enhanced economic productivity.

PRESENT DAY TRAFFIC CONTROL AND ENFORCEMENT

With the advent of new technologies, it is necessary to update the information and implement, the know how after carefully going through the traffic problems. At present traffic police are regulating the traffic partially and remaining is controlled by semi and fully automatic systems. Most of the cities in India have the combination of manual as well as automated systems like signals, vehicle actuated signals, electronic toll collections, CCTV, Area traffic control, signal synchronization and coordination with local loop network.

To use or to adopt any system for a given environment, it is important to study and analyze the problem which helps to choose a particular method or system.

TRAFFIC PROBLEMS

- Traffic congestion and delays.
• Inadequate public transportation facilities, which run behind schedules, causing inconvenience to public.
• Inadequate road facilities, which is not proportional to traffic growth which is due to increase in number of vehicles with little or no space for widening or for any change.
• Prohibitive costs for any new facilities.
• High accident rates due to varying speed of vehicles and lack of discipline among road users.
• Shortage of manpower.
• Increase in air and noise pollution due to increase in number of vehicles.
• Acute parking problem in urban areas.
• Absence of effective monitoring and prevention of traffic violation.
• Non-cooperation from public for any new system or changes.

CLASSIFICATION OF ITS

Advanced public transport system: (APTS)

APTS technologies are a collection of technologies that increase the efficiency and safety of public transportation systems and offer users greater access to information on system operations. The implementation of APTS technologies is transforming the way public transportation systems operate, and changing the nature of the transportation services that can be offered by public transportation systems. The goal is to provide public transportation decision-makers more information to make effective decisions on systems and operations and to increase travelers Convenience and rider ship.

APTS technologies can be organized into three broad categories that describe the technologies relevance to transit applications. Each category is comprised of a variety of technology choices that are available to help transport agencies and
organizations meet traveler’s service needs while increasing safety and efficiency. The three APTS technology categories are: fleet management system, travelers information system and electronic payment system.

**Advanced traveler information system: (ATIS)**

Advanced travelers information systems (ATIS), a part of new technology applications in transportation, provide accurate and timely information that help travelers to select routes, times of travel and travel modes. They work even better with inclusion of geographic tourist guides and yellow pages that enable travelers to select destinations based on proximity to other places.

Deliver data directly to travelers, empowering them to make better choices about alternate routes or modes of transportation. When archived, this historical data provides transportation planners with accurate travel pattern information, optimizing the transportation planning process.

**Advanced Traffic Management System: (ATMS)**

This system can benefit the public with improved traffic and public safety, by monitoring the flow of traffic and making appropriate decisions in a timely manner. Additional benefits include less fuel consumption and reduced environmental impact. They employ a variety of relatively inexpensive detectors, cameras, and communication systems to monitor traffic, optimize signal timings on major arterials, and control the flow of traffic.

**Automated highway system: (AHS)**
An automated highway system (AHS) refers to a specially equipped highway lane in which vehicles are automatically controlled; that is, the vehicles steering, brakes and throttle are controlled by the system, not the driver. Vehicle-mounted sensors are used to judge the vehicle's position by visual data on the lane marking. It then uses this information to steer the vehicle. The system keeps the vehicle in the same lane provided it senses no obstacles in the road ahead. If it detects a slow-moving vehicle ahead, it directs the vehicle to change lanes, provided the way is clear. Once it has overtaken the obstacle, the system returns the vehicle to the original lane. If the next lane is occupied, the system slows the vehicle to maintain a safe braking distance. If a vehicle ahead has come to a stop, the vehicle is smoothly brought to a stop. The AHS lanes and the vehicles that operate on them are likely to have special sensors, computers and communications devices to permit the automated control. To travel on an AHS, a driver of an AHS-equipped vehicle might pull into the designated lanes, perhaps similar to some of today’s high-occupancy vehicle (HOV) lanes.

(Fig:1) **Automated highway system**

**Incident management system:**

Intelligent transportation systems offer many types of information. They may offer real-time information about traffic conditions, such as variable message signs (Fig:2) to warn of accidents or other delays. ITS controls the flow of traffic via traffic signals, or by opening and closing special gated lanes that allow commuters to access additional traffic lanes in one direction or the other, depending on the time of day, and the direction of the heaviest commuter traffic flow. Some applications provide fog sensors that activate road lights in areas where heavy fog can occur and cause extremely hazardous driving.
conditions. These fog sensors may also be used to send a message to a variable message sign located before the foggy section to warn motorists of the upcoming hazard.

(Fig:2) **Variable message sign**

They provide traffic operators with the tools to allow quick and efficient response to accidents, hazardous spills, and other emergencies. There are major corridors where traffic flows are very heavy. Any small incident obstructs the flow, resulting in huge losses in terms of fuel and time. Consequently, conducting surveillance on corridors and identifying incidents causing problems can be useful in saving economic losses. Surveillance systems are based on electronically operated cameras or loop detectors embedded in pavements. Enables authorities to identify and to respond to vehicle crashes or breakdowns with the most appropriate and timely emergency services, thereby minimizing recovery times.

**Electronic toll collection system:**
ETC is based on vehicle roadside communication system; more precisely, it is an application of electronic signature detection to passenger and commercial vehicle traffic for the purpose of collecting tolls.

Here is how it works: when a vehicle passes through the toll gate, a microwave tag (non-contact IC card) exchanges information both ways between the gate and the vehicle to automatically subtract the toll from, for example, a prepaid card or a bank account. This method offers a huge increase in efficiency compared to manual toll collection, and should reduce traffic congestion at toll-booths, save energy, and reduce exhaust emissions(Fig:3.1)

ETC (Electronic Toll Collection System) is a system by which drivers can pay tolls without having to stop at a tollbooth. The collection of fees is performed electronically by way of equipment installed in the vehicle and sensors at the toll location

(Fig:3) Electronic toll collection system    (Fig:3.1) Conceptual image of ETC

Advanced warning system: (AWS)

This system addresses the present accident caused when traffic slows down abruptly due to road conditions, forcing the driver to apply brakes and if they cannot apply brake in advance, it may cause crash to other vehicles and at the same time vehicle behind may crash into this vehicle. This leads to chain reaction of accidents. The information given to the driver when the vehicles come close either from front or back is conveyed through AWS which helps in preventing road crashes.

Vehicle Information and Communications System: (VICS)
In this system, the drivers are provided with real-time information on the traffic conditions via FM multiple broadcasting, radio waves. Here the traffic personnel can take a channel in FM band to update and inform all road users about the Traffic flow conditions and other information like congestion, jams, roadblocks, pollution levels etc. Road map (fig 4.1) quickly shows the driver the traffic conditions in surrounding areas. The map shows the driver which roads are congested. It also displays other traffic restrictions, such as expressway on-ramp closures. The driver can use this information to select the best route by using in-vehicle monitor.

(Fig:4) **Radio beacons (expressway)**  
(Fig: 4.1) **Schematic information display**

(Fig: 4.2) **In vehicle monitor**

**Video transmission:**

Surveillance of intersections, ramps and tunnels, incident detection or verification, and replacement of traffic signal loop sensors is an increasingly popular ITS tool. Lately,
communities have been installing cameras on traffic signals to record the license plates of cars whose drivers run a red light. All of these applications require distance between the site where the information is collected and the location where the information gets stored. Video transmission that incorporates 2-way data has grown as an ITS application. Vehicles with speed violations can be captured along with registration numbers using this system at places like mid block, junctions, etc. Automatic detection of unauthorized vehicles on restricted corridors and parking areas are possible, which improves the traffic control and safety. These are some of the applications of this system.

(Fig:5) Traffic sensor and traffic camera

NECESSITY FOR USING ITS

- Provides novel applications by smart technology.
• Systematically employs advanced technologies in the field of transportation to enhance benefits for road users.

• Improves the existing transportation services through interconnected embedded technologies.

• The mean speed can be increased by efficiently monitoring the vehicle speeds.

• Reduction in road crashes.

• Provides system to avoid collision, accidents, and improves night vision and road alertness.

• Enables the rapid arrival of emergency vehicles during accidents to transfer the victims to trauma care centers within the golden hour through incident management systems.

**ITS IN INDIA**

In India 70 State Transport Undertakings which together own and operate 1,13,000 Buses and, provide mobility to 65 million passengers a day, across the length and Breadth of the country. APTS technologies along with Fleet Management Systems can make use, to achieve sustainable and environmental friendly transportation for the 21st Century. In addition to the above technologies, institutional and market factors also play an important role in successful ITS deployment for enhanced safety, mitigation of environmental impacts of transportation systems, enhanced energy performance, and improved productivity.

ITS has been proved to be the optimal solution to the enigma of building and operating transportation systems to meet expeditiously growing urban travel demand in developed countries.

The most important task of ITS India will be the dissemination of ITS knowledge and imparting training for new professionals. ITS India would be able to bring the ITS Seminar Report of Md.Imthiyaz
expertise in the public and private sectors and academia under one umbrella. Taking into account the political, economic and linguistic differences in India from one region to another, the ministry of Surface Transportation may have to take the lead in establishing such an organization. In the Indian context, a professional body of this nature would be expected to consist of regional units in each state with a coordinating central body.

In 1980’s, number of developed countries started using advanced systems to control and regulate the traffic, accident prevention, parking, toll collections, signalization and other vital tasks. This is still to develop in India to suit our local ambience. Also the problems faced by us are different than those in developed countries. The very first equipment to be used in Indian environment was electronic toll collection along the newly created expressways viz., Delhi-Noida, Ahmedabad-Mehasana, Mumbai-pune, expressways which is functioning satisfactorily.

What we need for the present day in India is to save the lives of innocent people from onslaught of accidents, which is termed as “murder on wheels”. This is because every year more than rupees 7000 crores are being spent as compensation from authorities. Using ITS, it is possible to save the lives of the victims by transferring them to trauma care centers within the golden hour. Almost, more than 1% of GDP is just paid as compensation. In developed countries, a portion of this type of amount is spent in advance to improve road, traffic and other related conditions to prevent accidents beforehand, which are termed as “import cost”. In India, accidents are allowed to take place and compensation is paid later which amounts to a greater magnitude, which is termed as “export cost”. In this direction, number of technically advanced systems are available in the developed countries, whereas this is always a question mark in developing countries particularly in India.

What is needed in the present context is the mindset of policy and decision makers to use for Indian highways and problematic locations of urban areas. What ultimately is expected is co-operation from end user and the adaptation to the new system.

CONCLUSION
The potential of ITS technologies in improving the efficiency of transportation sector in India appears to be very promising based on the experience of other countries. It is understood that a national strategic ITS plan for India is needed for the effective development and deployment of ITS initiatives in India. A broad framework of such a plan is presented here to generate a discussion on the topic among transportation professionals and policy makers in India. The importance of professional cooperation in the area of ITS between the public and private sectors and the academia is also identified and a preliminary organizational set-up towards this end is presented in the form of ITS India.

In India many infrastructural projects are under construction and some are still in planning stage. Some of the ITS technologies like AWS, ETC, fleet management, incident management can be applied to achieve an efficient transport system. Public transport that is almost monopolized in Indian cities can utilize ITS based technologies for their effective operation. Since ITS technology is as old 20 years in the world, India will have to pick up this for its updating and on par with developed countries in modern transportation requirements.

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