Review on Intelligent Transportation System: A Technical Aspect

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Abstract— Intelligent Transportation system is an established route to resolve or at least minimize traffic problem. Highway Traffic Management System (HTMS) is one of the important functional Systems of Intelligent Transportation Systems (ITS). Traffic congestion has been increasing worldwide as a result or increased motorization, urbanization, population growth and changes in population density. Congestion reduces efficiency of transportation progress and increases travel time, air pollution and fuel Transport System holds a good point. Intelligent transportation technologies such as Wireless communications, Computational technologies, and Sensing technologies have been proposed. Intelligent transportation applications are also introduced. Intelligent Transport System provides a single solution for transport companies to schedule and monitor buses with the help of advance technologies such as Global Positioning System, Wi-Fi etc. Intelligent Transport System facilitates better public transport services by considering the earning, safety and time saving This article provides a comprehensive summary of ITS by providing a brief outline of existing technology and recent trends followed by the highlights of future research directions of this domain.
Keywords: Intelligent Transportation System, Sensing Technology, Wireless communication

I. INTRODUCTION

The rapidly increasing vehicle population in India, spurred by the population boom and economic upturn lays a critical burden on traffic management in the metropolitan cities and town of the country.

People are used to the greater mobility and hence when it comes to mobility Transportation especially road transportation is the one which is easily accessible to everyone. There is no doubt in higher the people using the transportation system more will be the transportation conflicts (accidents), and hence there comes the demand of proper systematic demand for transportation system which is capable of handling large mass of people on wheels safely and it is made sure that it is environment friendly as well. ITS is an emerging global phenomenon benefiting public and private sectors both. ITS makes it possible to implement a number of government regulations and processes more economically, and to improve corporate productivity through time savings, reduced operating costs and energy consumption, and enhanced reliability and safety.

II. ITS – AT A GLANCE

Intelligent Transport System (ITS) is a transport system which makes a vehicle or vehicles to function smoothly during its journey time and provides safety and comfort to an individual vehicle or a network of vehicles using the advanced techniques like Global Positioning System and Global Navigation Satellite System, Cooperative Intelligent Transport System. Intelligent Transport System can be applied for every mode of transportation viz. roads, railways, water or air. The services that are provided by Intelligent Transport System for both passengers and cargos are of more curious.

Internet along with sensors and satellites has been increasingly playing an important role in transportation system. GPS, GNSS and CCTV cameras, road-side variable message signs helps in protection against the threats in the transport system, reduces interruptions in traffic, enrich travel time and effectively reduces the rate of accident & crashes.

ITS aims to facilitate a national multi-modal surface transportation system that features a connected transportation environment around vehicles of all types, the infrastructure, and carry-in passenger devices to serve the public good by leveraging technology to maximize safety, mobility, and environmental performance.[3]

III. ITS TAXONOMY

The most commonly used classification of ITS is based on the positioning of the system as follow.

A. Vehicle level:

Technologies implies within vehicles, containing sensors, data processors and display that provides information to the driver.
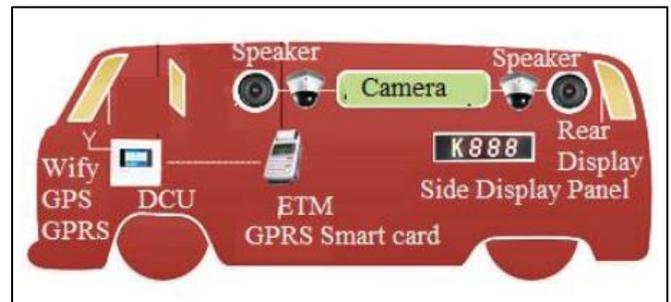

Fig. 1: Vehicle Level

B. Infrastructure Level:

By using sensor, imported traffic data collected by side of road. Tools of communication provide drivers with pertinent information to manage traffic better. These tools include roadside message, GPS alerts and signals to change traffic flow.
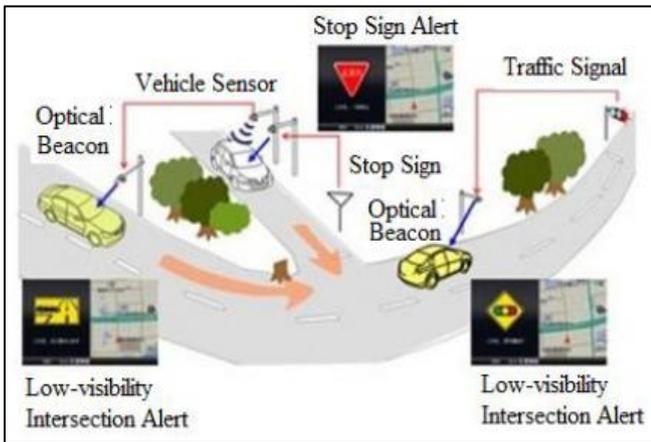
Fig. 2: Infrastructure Level

C. Cooperative Level:

Communication between vehicles, and between infrastructure and vehicles involving a synergic combination of vehicle level and infrastructure level technologies.
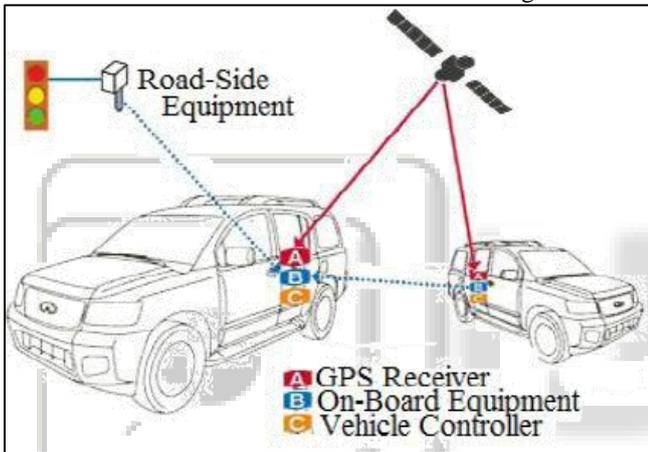

Fig. 3: Cooperative Level

1) Area of IT's

− Arterial and Freeway management system
− Transit management system
− Incident management system
− Emergency management system
− Regional multimodal and traveller information system

IV. TECHNOLOGY – THE SOLUATION

A. Smart Traffic Management System

The planned framework deals with traffic control system STMS as the core module and it has the sub-modules. The Traffic Control System manages and controls the heavy traffic during pre-defined rush period on the road. It uses the video monitoring system to identify excess traffic through video camera and when the amount of vehicles in particular path increases a pre-calculated threshold value, it informs the traffic control in charge of STMS with an alarm indicating "traffic limit reached" and prevents any further vehicle to enter in that path.[6]
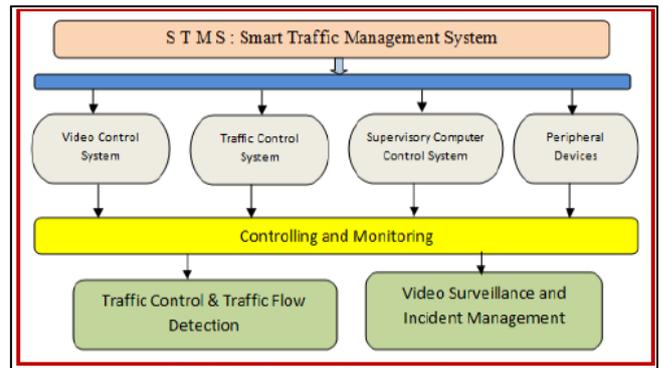

Fig. 4: Module of STMS

B. Highway Data Collection

HDC technology guarantees accession of traffic data in ITS. This technology is based on the applications of GPS, GNSS, GSM and GPRS that work with the help of sensors embedded in the cars and provide base data to the traffic control centre for reckoning, examining, resolving and est[ablishing traffic overcrowding, travel time. Moreover, it collects the wind velocity, weather data and terrain data.[8]

C. Electronic Toll collection

ETC, actually runs through Dedicated Short Range Communication. In this system, a device known as On Board Unit (OBU) is installed in the vehicle and another device known as Road Side Unit (RSU) is installed on the road in the toll station. Both these units communicate each other within the range of 30 meters. Without giving a pause more than 10 seconds, the toll is collected from the car owner automatically by the interaction of OBU and RSU. By installing such system, it has been found that the overcrowding at toll stations has been lowered by 40%. In turn it increases the performance of toll stations and decreases the delays in traffic system.[8]
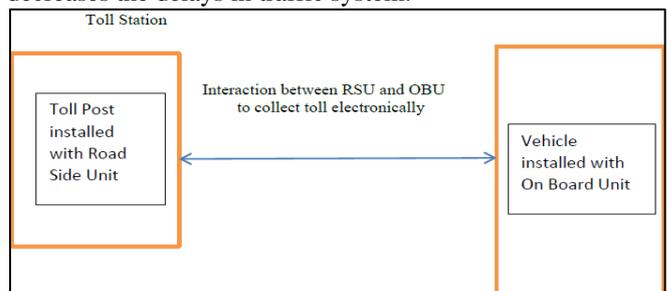

Fig. 5: Electronic Toll Collection

D. Sensing Technology in ITS

This technology runs by the duration required by a computer system to complete a particular task, therefore end to end delay and synchronicity is very important for such systems. In wireless sensor network (WSN) the sensors or nodes are installed for data collection through different long range connections like satellite, Wi-Fi, WIMAX, etc. Sensor network exist in different types such as thermal for collection of temperature data, acoustic for noise collection, infra-red for humidity data collection etc. These sensors have sufficient capacity to supervise or track various conditions namely temperature surveillance, dampness in the air, vehicle motion, pressure, noise, speed, direction etc.

Power unit, Transceiver, Sensing unit and Processing unit are the four components of sensor node. An additional unit is used for tacking the location.[8]
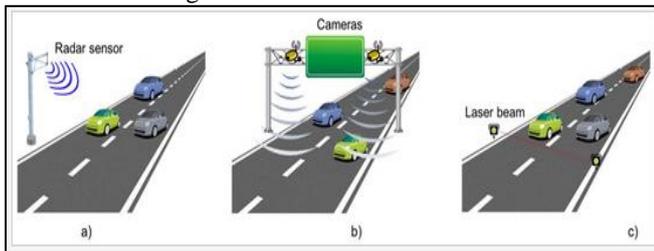

Fig. 6: Application of Sensor

E. Speeding Detection:

Speeding is a major contributory factor to road accidents, and it increases both the risk of an accident occurring, and the severity of that accident.

1) Point speed cameras:

These measure the speed of a vehicle at a short point on the road, such as at an accident black spot, using radar detection, and conventional camera film. Vehicles exceeding the speed limit are sent a fine and in some member states a driver's license is also endorsed.

2) Average speed cameras:

Installed over a stretch of road, these are linked to number plate recognition systems that calculate the average speed of a car over that stretch.

Fig. 7: Speed Detection Camera

F. Passenger Information System:

ITS has the ability to provide real time information to public transport passengers (RTPI) through a variety of media such as at-stop displays, SMS messaging and the internet. A schematic representation of a typical system is shown below. Theoretically, these systems should lead to some energy saving by promoting modal shift from car to bus, but the evidence to demonstrate such a shift is limited – although a few schemes introduce for safe running of the system.
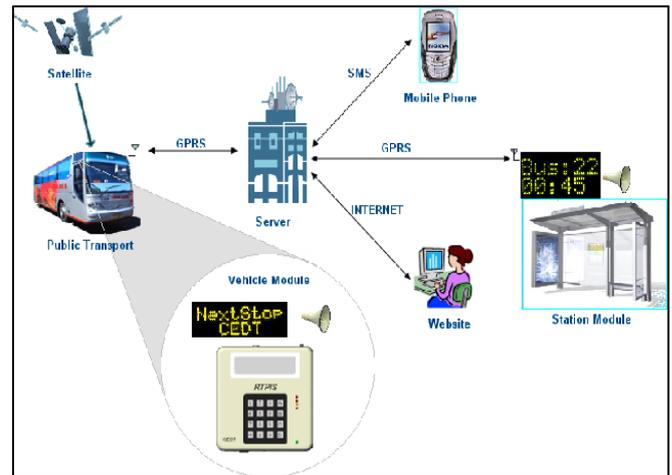

Fig. 8: Schematic representation of system

V. SUSTAINABLE APPROACH

Many of the Intelligent transportation system are deployed on basis of environmental friendly and sustainable.

1) Improve the safety of the nation's transportation system.
   – Reduce number and severity of fatalities and injuries
   – Reduce severity of collisions
2) Increase the operational efficiency &capacity of the surface transportation system.
   – Reduce disruptions due to incidents
   – Improve the level of service and convenience provided to travellers
   – Increase roadway capacity
3) Reduce energy and environmental costs associated with traffic congestion.
   – Reduce harmful emissions per unit of travel
   – Reduce energy consumption per unit of travel.
4) Enhance present and future productivity.
   – Reduce costs incurred by fleet operators and others
   – Reduce travel time
   – Improve transportation systems planning and management
5) Enhance personal mobility and the convenience and comfort of the surface transportation system.
   – Provide access to pre-trip and en route information
   – Improve the security of travel
   – Reduce traveler stress

VI. CONCLUSION

The results of this literature review have shown that Intelligent Transportation System is a broad field which covers many technologies and they plays a significant role in the technology era. ITS deployments have the possible to offer the following benefits: improved safety, efficiency, mobility, accessibility, intermodal connections. Through the Intelligent transportation system, many areas take advantages. The beneficiaries' areas are arterial, freeway, freight, transit, incident, emergency, and data collection, toll collection, environmental issue, traveler information and archived information management. This paper presents a

wide-ranging area of intelligent transportation system and its applications and range of technologies.

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