# Application of Intelligent Transport System for Sustainable Transport System in Smart Cities

*Tarun Dewangan*[*], *Rakesh Mehar*[**], *Ashutosh Kumar Agarwal*[***]

## Abstract

This study presents applications of artificial intelligence for development of sustainable transport systems in smart cities in India. There is huge gap between the demand and supply of the public transport in most of the urban cities in India. Due to rapid urbanization India has realize the importance of developing smart cities to improve the quality of life of people and to captivate foreign investment to build superior quality of infrastructure in India. The majority of the Indian cities are facing the problem of congestion, safety, inadequate public transport facilities, inappropriate information, inadequate parking spaces and environmental pollution. Sustainable transport system can eliminate these problems by providing safer, faster, comfortable, efficient and environment friendly system and can help in development of smart cities by the implementation of intelligent transport system. Hence, there is urgent need to develop intelligent transport system in Indian Cities which can play a key role in development of sustainable transport system. Therefore, the main requirement is to adopt artificial intelligence for development of smart cities in India. The main objective of this article is to present the major application of intelligent transport system for the development of sustainable transport system in smart cities. This study can be used in the implementation of intelligent transport system for development of sustainable transport system in smart cities in India.

***Keyword:*** Intelligent transport system, Parking management, Passenger information system, Intelligent parking system.

## Introduction

Public transport system is a significant component of transport system and it plays a key role in development of sustainable transport system. The root cause of all the problems of transport system in today's world are excessive rate of urbanization and commuters dependency on private vehicles rather than public transport.

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In developing countries like India, most of the population and economic growth is taking place. Rapid urbanization has made the movement of people from the rural areas to urban cities [1]. Urbanization in Indian Cities is putting enormous pressure on transportation infrastructures to respond to an increasing travel demand with greater strength and efficiency of the public transport system [2]. With this increasing urbanization, urban areas are expected to house 40% of India's population and contribute 75% of India's GDP by 2030 [3]. Thus, due to increasing urbanization the Indian government has now realized the need of developing smart cities in urban area and announces to develop '100 smart cities' in urban areas [4]. The main concern of new public transport system in today's world is to control the increasing rate of urbanization and to reduce the traveller's dependency on private vehicles to make the transportation system more sustainable. According to census 2011, there was an increment in million plus cities from 35 in 2001 to 55, consisting of 107.9 million urban (39%) population [5]. Figure 1 presents the forecasting of vehicle population in India [3].

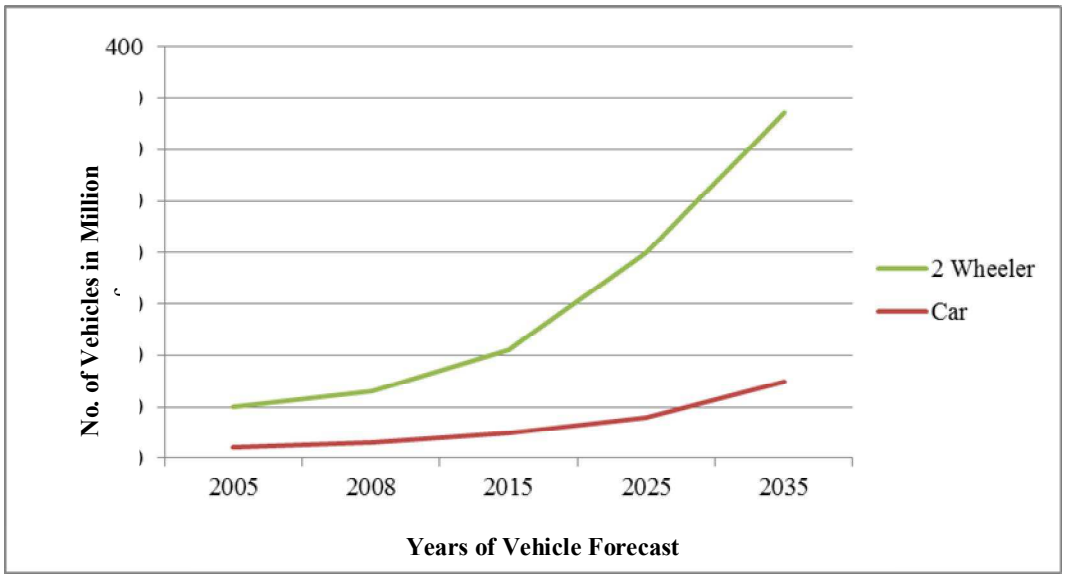


**Figure 1.Forecast of Vehicle Population in India**

There is enormous gap between the demand and supply of the public transport in most of the urban cities in India and these cities are facing the problem of congestion, inadequate public transport facilities, inappropriate information, inadequate parking spaces and environmental pollution. Sustainable Transport in smart cities provide solutions that take advantage of Intelligent Transport System which assure superior quality of life, reduced costs and increased efficiency [6]. Intelligent transportation system plays a significant role in today's transportation system and is an essential expansion for development of a sustainable transport due to concerns regarding the economic, environmental, safety and social equity [7]. Hence, there is urgent requirement of developing Intelligent Transport System for safer, effective, efficient access, proper information and mobility into the future while considering economic, social, and environmental needs [8]. The main objective of this study is to present the major application of intelligent transport system for developing sustainable transport system in smart cities of India. It is expected that this

study will be helpful for transport planners to build up sustainable transport system with implementation of artificial intelligence system. This article consists four sections, first section presents the introduction of intelligent transport system and major issues in today's transport system. Second section highlights the basic requirement of public transport system in smart cities in India. The third section presents major application of intelligent transport system in smart cities in India. The last section presents important conclusions drawn from this study.

## Requirements of Sustainable Intelligent Transport System

Most of the developing countries like India, due to lack of intelligent transport system facing various problems like environmental pollution, accidents, congestion, overcrowding, lack of information and parking space etc. At present India is leading country in the world in traffic accidents and has the extremely high fatality rate of road accidents in the world. Therefore, there is immediate requirement to develop intelligent transport systems in Indian cities for traffic control management and to deal with the rising threat of traffic accidents and fatalities. Intelligent Transport System plays a significant role in improvement of traffic control and management, passenger information system i.e. real-time traffic information and route navigation systems, information related parking space availability etc. Table 1 presents the requirements of intelligent transport system and its application for sustainable transport system in smart cities.

**Table 1.Requirements of Sustainable Transport System in Smart Cities**

| No. | Requirements of Sustainable Transport System | Application of ITS |
|---|---|---|
| 1 | Realistic traffic information system for efficient and safe traffic movement | Developing Passenger Information System based on current traffic situation |
| 2 | Least travel time with minimum delays and stops | Developing synchronized traffic signal system with proper traffic management system |
| 3 | Environment friendly transport system for least environmental degradation i.e., air and noise pollution | Developing proper traffic control and management authority to check standards of vehicles for their registration and issue of license. |
| 4 | Safety of vehicles, drivers and pedestrians and reducing accident rate | Developing congestion free routes and safety and emergency management system |
| 5 | Reliable transport system | Developing passenger information system and economical public transport system |
| 6 | Proper parking spaces at affordable price | Developing intelligent parking system for economical and efficient parking |
| 7 | Efficient revenue collection with economical transport system | Developing electronic ticketing system, online booking system for public transport |
| 8 | Comfortable and affordable system to users | Developing terminal facilities and passenger information system at stops and intermediate sections. |

Hence application of ITS to develop smart cities considers the basic requirements of Sustainable Transport System in India. Intelligent Transport System can play a key role in resolving the crucial issues in Indian cities like congestion, environmental degradation, safety issues, parking problems and public transport facilities.

## Application of Intelligent Transport System

Intelligent transport system can be implemented to makes the transportation system sustainable, which is major concern of today's world. Also, India need world class infrastructure for the success of recently addressed projects by Indian government i.e., "Make in India" and "Smart City" which requires transportation system with better accessibility and adequate information which is possible with the implementation of Artificial Intelligence System. The Intelligent Transport System can be implemented to develop superior transport facility, passenger information system, intelligent traffic control and management system, intelligent parking system and environment friendly transport system. Hence this study presents application of advance technologies to enhance the quality of transport system with real time passenger information, safety, reliability, comfort and to reduce the road accidents, stops and delays and environmental pollution.

## Development of Superior Transport Facility

Indian cities are provided with poor qualities of transport facilities, and least safety measures, which distract the passenger to use public transport and travellers turn towards private vehicles. Provision of superior facilities with implementation of artificial intelligence system in transport system can be adopted to make the transport system more sustainable.

- For public transport terminal facilities generally provided with proper sitting and waiting arrangements, in addition to this, it can be provided with digital display board showing information related to buses like bus routes, location, next bus and charges details and public transport vehicles can facilitate recreation means during journey to captivate more passengers.
- Electronic toll system can be used to reduce the delays at toll plaza. Innovative technologies can be used to make transport modes faster and safer with integration of multi-technologies such as bus transit, metro rail and other modes.
- The vehicle can be provided with superior design to enhance the comfort and light material can be used to increase power weight ratio. Vehicles can be attached with GPS system to develop collision free system and to reduce rate of accidents.

## Development of Passenger Information system

In India, the transport system lacks appropriate passenger information, passenger information system can provide the real time traffic situation, routes and location of buses, weather condition, incidents identified and busy routes etc. The passenger information system provides all the necessary information to the passenger so those passengers can response accordingly. Intelligent transport system can be applied to generate all the necessary information and make them available for passengers so that this system helps the passenger to react accordingly. Figure 2 presents the detailed passenger information system.

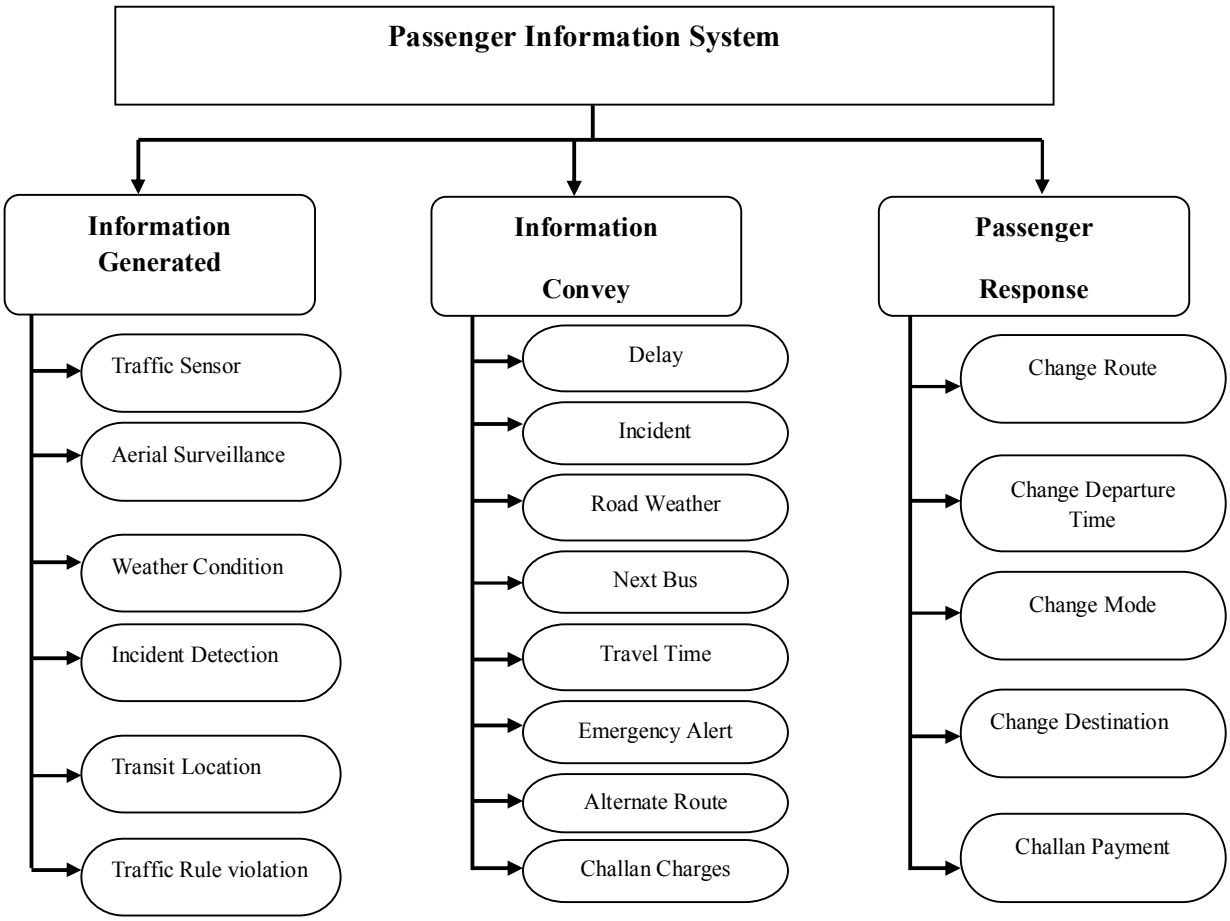


**Figure 2.Passenger Information System**

## Intelligent Traffic Control and Management

Intelligence transport system includes various implementations of advance technologies in traffic safety by use of CCTV camera attached with central monitoring system for observing various sections of road network, public transit vehicles and terminal station. Another component of traffic control and management is traffic demand management which can be easily managed by proper observation of real time traffic situation with the use of artificial intelligence system. Traffic signal can be synchronized properly to reduce the delays at intersection with application of artificial intelligence system. ITS can be applied for revenue collection and management using electronic ticketing system and for better transparency, data can be handled by digital system. Figure 3 presents development of intelligent traffic control and management system.

## Intelligent Parking System

Intelligent Parking System has interesting functional system that assures an easy parking with no damages, parking within minimum possible time at any suitable place and get a message if the parked vehicle has been damaged anyhow while the driver is not present in the car.

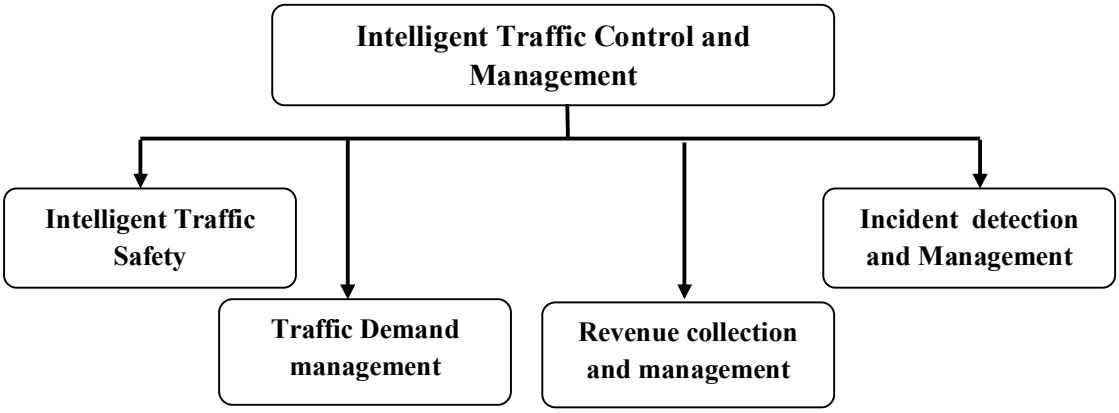


Figure 3.Intelligent Traffic Control and Management System

The IPS system provides a planning of path that is being displayed on the computer system to specify the directions of vehicle and provide guidance to driver for parking of vehicle. This system includes algorithmic car movement system and the damage message system. The system should be able to provide guidance automatically to the driver and would also facilitate users to get notified when their car get damaged while their vehicle is being parked [9]. Figure 4 presents block diagram of intelligent parking system.

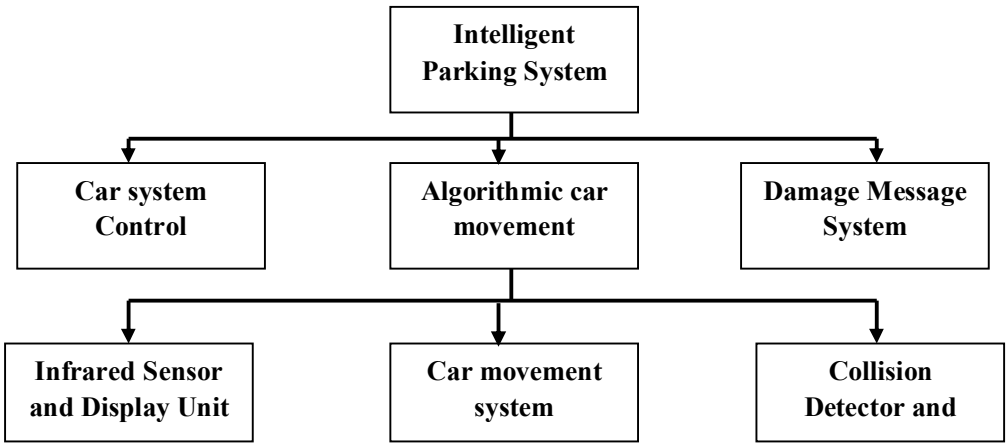


Figure 4.Application of ITS in Intelligent Parking System

## Development of Environment Friendly Transport System

The transport system today faces major challenges because of rapidly growing transport demand. The main challenges of inefficient transport system are to control the environment pollution. Therefore, this study promotes development of energy-efficient technologies for development of environment friendly transport system. The advance technologies can be applied to encourage clean technology vehicles like electric motors can be used and vehicles with alternate fuel like bio diesel and compressed natural gas. For better enforcement, the air polluting and noise creating vehicles can be detected with the use of sensors and automatic challan system can be used to collect charges from such vehicles.

## Conclusions

The important conclusions drawn from this study are:

- Excessive urbanization has developed a vast gap between demand and supply of the transportation services and creating various transport problems like uncomfortable journey, congestion, parking problems, increase in accidents rate, inappropriate information and environmental pollution etc. So there is urgent requirement to develop sustainable transport system using ITS in smart cities in India.
- This study has identified the basic requirements of Sustainable transport system with implementation of Intelligent transport system i.e., realistic traffic information system, minimum travel time, environment friendly, efficient and economical transport system, safer and reliable transport system.
- This study presents the major application of Intelligent transport system for development of Superior transport facility, Passenger Information System, Intelligent traffic control and management system, Intelligent parking system and Environment friendly transport system to enhance the quality of transport system, adequate passenger information, safety, comfort and to reduce the road accidents, stops and delays and environmental pollution.

It is expected that that this study will be helpful for transport planners to develop sustainable transport system with the implementation of intelligent transport system in smart cities in India.

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