CERTIFICATE

This is to certify that the minor project entitled **"INTELLIGENT TRANSPORTATION SYSTEM"** has been completed successfully by:-

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Department of civil engineering, Government engineering college NAWADA (2019-2023), NAWADA Bihar under the supervision and guidance of PROF. SHUBHENDU AMIT (Head of department, dept of civil engineering NAWADA) during 7th semester

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DECLARATION

"We Do hereby declare that this submission is our own work conformed to the norms and guidelines given in the prospectus of institute and that to the best of our knowledge and belief, it contains no material previously written by neither any person nor material (data, theoretical analysis, and text) which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning except where due acknowledgement has been made in the text"

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We take great pleasure to present you our work done during this project on **"INTELLIGENT TRANSPORTATION SYSTEM "** in the 7th-semester civil engineering department as a part of a minor project as prescribed by the board of studies of G.E.C, NAWADA, for the course of civil engineering.

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Regarding omissions if any, I express my sincere apology & undertake all Responsibilities

ABSTRACT

Intelligent Transportation Systems (ITS) depend on information and control technology to perform their functions. Transportation practitioners are familiar with some of these technologies, such as loop detectors. However, a range of less well-known technology and device principles are critical to ITS functions. Information and control systems are at the heart of ITS, but human factors are still crucial and theoretically complex. ITS services and goods, in particular, are focused on integrating a broad range of data about transportation networks, passengers, and automobiles. They can be used on networks to enhance network management and productivity; on vehicles to improve protection, reduce travel times, and reduce polluting emissions; and by travelers to make issuing tickets and payment easier and provide accurate information. ITS can be mode-specific or multi-modal, and it encompasses all of the core components of transportation systems, including automobiles, facilities, travelers in vehicles, and vehicle drivers. These systems are designed to improve traffic quality by reducing traffic congestion. It provides users with advanced traffic information, local corner information, actual running information, flight status, and other features that help commuters save time while also improving their comfort and safety. This paper introduces ITS-supporting technology and describes why human factor specialists should be involved in the design of ITS infrastructure and tools at an early stage.

OBJECTIVE

The objective of an intelligent transportation system (ITS) is to improve transportation efficiency, safety, sustainability, and user experience through the integration of advanced technologies and data analytics. Here are some key objectives for an ITS:

- Enhancing Traffic Management
- Improving Safety
- Enhancing Public Transportation
- Intelligent Parking Management
- Integration of Emerging Technologies

INTRODUCTION

1.1 ITS (INTELLIGENT TRASPORTATION SYSTEM)

Intelligent transportation system is used for analysing the information. ITS is used to control communication technologies for road transportation to improve safety and efficiency.

Figure1: Complexity of traffic in India

An important metric for economic growth of any country is its burgeoning vehicle ownership. However, the indirect effect of vehicle ownership is acute traffic congestion. India has, in the past decade, seen an astronomical increase in vehicle ownership and associated road blocks and traffic snarls in its metropolitan

The principal reason for traffic congestion in India is that the road space and infrastructure have not improved on par with the traffic [2]. The seriousness of the problem is reflected in the report of World Bank that estimates the economic losses incurred on account of congestion and poor roads alone run as high as $6 billion a year in India.

Intelligent Transportation Systems (ITS) is a tested route to mitigate traffic congestion problems. ITS can be broadly defined as the use of technology for improving transportation systems. The major objective of ITS is to evaluate, develop, analyse and integrate new technologies and concepts to achieve traffic efficiency, improve environmental quality, save energy, conserve time, and enhance safety and comfort for drivers, pedestrians, and other traffic groups [4-6]. An overview of ITS can be schematically represented as shown in Figure 2. 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.

ITS is improved by using wireless and wire line communication-based information, control and electronic technologies. Now a days over speeding is a key issue in the traffic control system to overrule the issue. Dophler Phenomenon is used for speed measurement.
Keywords: Traffic Environment, Genetic algorithm, Machine Learning, Big Data, Image Processing

1.2 BENEFITS OF ITS

A. INCREASING SAFETY

- The main motive of using ITS is to provide the public safety on the roads. In the past several years the trend of driving had been changed, thereby increasing the road accidents.
- So to avoid or get guided before any incident to happen the ITS lays a vital role, ITS will guide the user through voice as well as gives an alert to the user about the traffic or congestion ahead, so that the user may act accordingly . With this the ratio of unwanted accidents will be decreased to some extent.

B. DELIVERING ENVIRONMENT BENEFITS

- The major benefit of ITS is to deliver the environment alerts if any. The sensors are being placed along the road side so that they can record the temperature, humidity and other environmental factors. Calculating all the factors, the values will be sent to the central server where the values are been stored in the database.
- If any user is subscribed to this activity he may get an alert about the environment. The forecast and precast weather report will also be sent to the user.

C. CAPACITY

- "Throughput ITS also keeps a track on the congestion before it took place. All it is done by getting the number of vehicles on each and every lane.
- If the number of vehicles are more on single lane, then ITS takes a decision to route the traffic into another lane. Thus decreasing the risk of congestion of the particular lane.
- It also keeps tracks on the capacity of the vehicles running on the road at a particular time on particular lane. It will also send an alert to user that at some particular on time the congestion will fee! high on some particular lane

D. INFORMATION

- Dissemination Delivering the report of the road about the congestion there are many other ways to present to user such as using Dynamic Message Signs (DM$), Variable Message Signs (VMS) and Highway Advisory Radio (HAR).

E. ENHANCING MOBILITY AND CONVENIENCE

- Intelligent transportation system can be enhanced in satellite based vehicle navigation and various other application which can deliver the real time traffic information to the user.
- User can check the status of the traffic and other information where they are heading before departing from their homes

1.3 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.

1.4 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

1.5 SOME APPLICATIONS ARE USED IN INTELLIGENT TRANSPORTATION SYSTEM

- MACHINE LEARNING
- ARTIFICIAL INTELLIGENCE
- INTERNET OF THING
- SENSOR
- GPS

2. COMPONENTS OF ITS

Traffic Management Centre (TMC) is the fundamental units of ITS. It is basically a technical setup administred by the transportation authority, where the data is collected and analyzed for further operation of TMC depends on the components like automatized collection, data transmission to TMC, precise analysis of received data and communication of trustworthy analyzed information to traveler.

2.1: Data Collection:

Real time observation and strategic planning needs precise, extensive and prompt data collection through verified hardware and competent software, that lays the foundation of further ITS functions. Automatic vehicle identifiers, GPS based automatic vehicle locators, sensors, cameras, etc. are few hardware used for data collection. These hardware are connected to the servers, generally located at data collection centres, which store large amounts of data for further analysis. The hardware mainly record the data loke traffic time, location, surveillances, travel speed, travel time, traffic count, vehicle weight, delay, etc.

2.2: Data Transmission:

This aspect of ITS consists of transmission of collected data from field to TMC and analysed information from TMC to traveler. Rapid and real time information communication is the key to proficiency in ITS implementation. Traffic related announcements are communicated to the traveler through VMS, internet, short rang communication (DSRC) using radio and continuous Air Interface Long and medium Range (AILM) using cellular connectivity and intra-red links.

2.3: Data Analysis:

The data that has been collected and received at TMC is processed further in various steps which, consists of error rectification, data cleaning, data synthesis and adaptive logic analysis. Inconsistencies in the data and errors are identified with specialized software and rectified that is further altered and pooled for analysed further to forecast traffic scenario which is made available to deliver appropriate information to users.

2.4: Traveller Information:

Travel Advisory System(TAS) is used to inform the dependable transportation updates to the travelling users. This system delivers real time information like travel time, travel speed, delay, accidents on roads, change in rout, diversions, work zone conditions, etc. This information is delivered by wide range of electronic devices like variable message signs, highway advisory radio, internet, short message services, automated cell phone messaging, public radio announcement, television broadcast and other modern media tools.

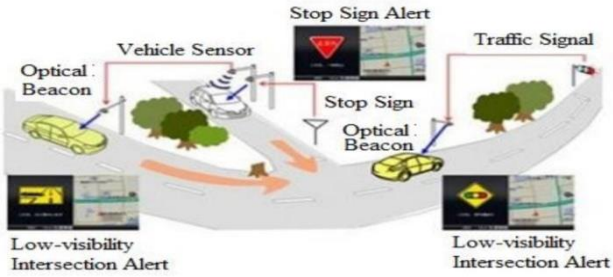
3. ITS TAXONOMY

3.1 The most commonly used classification of ITS is based on the positioning of the system as given below.

VEHICLE LEVEL

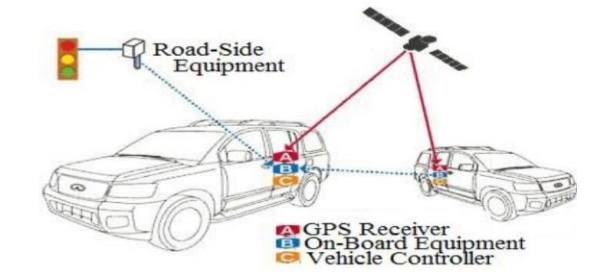
Technologies deployed within vehicles, including sensors, information processors and displays that provides information to the driver.

INFRASTRUCTURE LEVEL



Sensors on and by the side of roads collect important traffic data. Tools of communication provide drivers with pertinent information to manage traffic better. These tools include roadside messages, GPS alerts and signals to direct traffic flow.

CORPORATE LEVEL



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

3.2 ADVANCED TRAFFIC MANAGEMENT SYSTEMS (ATMS)

Integrates various sub-systems (such as CCTV, vehicle detection, communications, variable message systems, etc.) into a coherent single interface that provides real time data on traffic status and predicts traffic conditions for more efficient planning and operations. Dynamic traffic control systems, freeway operations management systems, incident response systems etc. respond in real time to changing conditions [Figure 3].

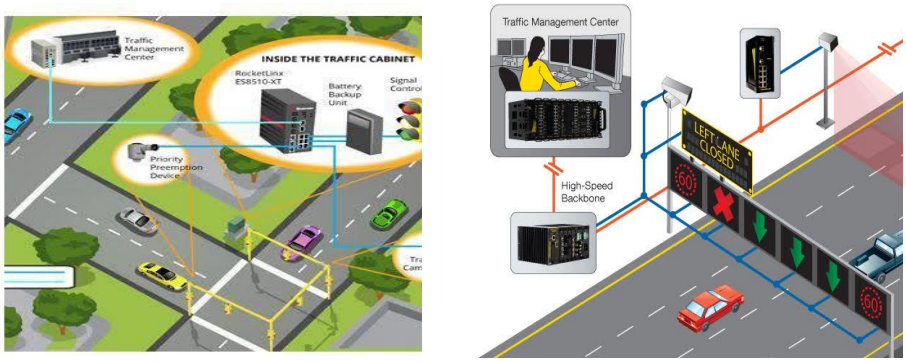


Figure 3: Examples of ATMS

3.3 ADVANCED TRAVELER INFORMATION SYSTEMS (ATIS)

Provide to users of transportation systems, travel-related information to assist decision making on route choices, estimate travel times, and avoid congestion. This can be enabled by providing different information using various technologies such as:

- GPS enabled in-vehicle navigation systems
- Dynamic road message signs for real time communication of information on traffic congestions, bottlenecks, accidents and alternate route information during road closures and maintenance
- Website to provide a colour-coded network map showing congestion levels on highways (a.k.a. congestion index).

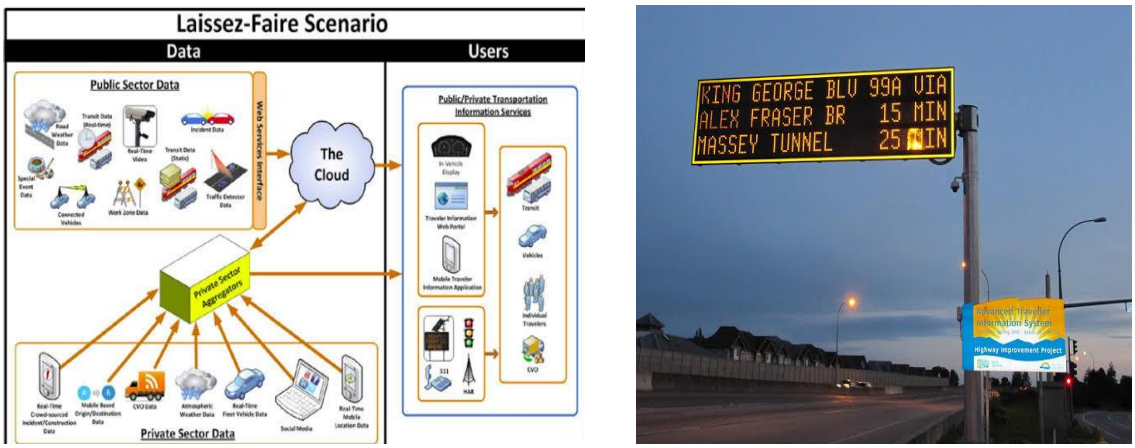


Figure 4: Examples of ATIS

3.4 ADVANCED VEHICLE CONTROL SYSTEMS (AVCS)

are tools and concepts that enhance the driver's control of the vehicle to make travel safer and more efficient [10]. For example, in vehicle collision warning systems alert the driver to a possible imminent collision. In more advanced AVCS applications, the vehicle could automatically break or steer away from a collision, based on input from sensors on the vehicle. Both systems are autonomous to the vehicle and can provide substantial benefits by improving safety and reducing accident induced congestion. The installation of high tech gadgets and processors in vehicles allow incorporation of software applications and artificial intelligence systems that control internal operations, ubiquitous computing, and other programs designed to be integrated into a greater transportation system.

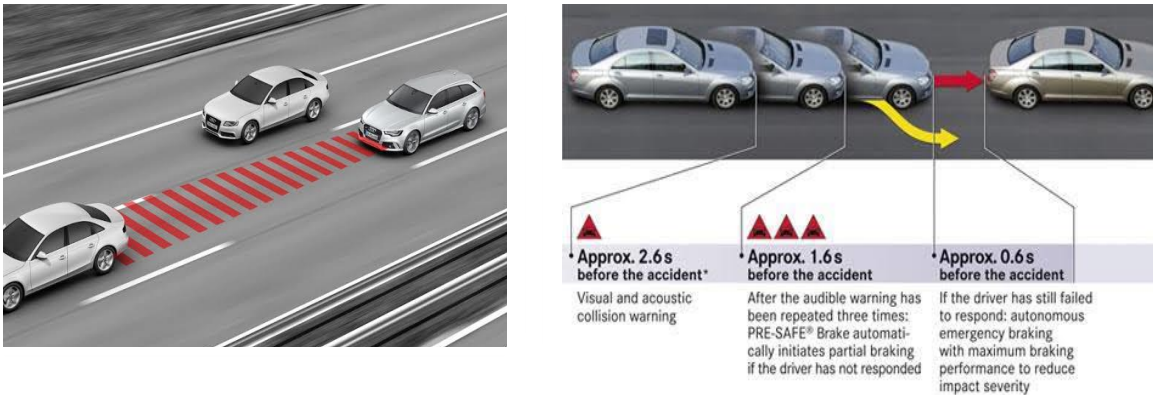


Figure5: Examples of AVCS

3.5 ADVANCED PUBLIC TRANSPORTATION SYSTEMS (APTS)

Applies state-of-art transportation management and information technologies to public transit systems to enhance efficiency of operation and improve safety. It includes real-time passenger information systems, automatic vehicle location systems, bus arrival notification systems, and systems providing priority of passage to buses at signalized intersections (transit signal priority).

Figure6: Examples of APTS

4. MAIN OBJECTIVES OF ITS (INTELLIGENT TRANSPORTATION SYSTEMS)

4.1 ONBOARD DRIVER ASSISTANCE & WARNING SYSTEM (ODAWS)

- ODAWS incorporates vehicle-borne sensors for monitoring driver propensity and vehicle surroundings to deliver acoustic and visual alerts for driver assistance.
- The project involves the development of sub-modules such as the navigational unit, driver assistance console, and Millimetre Wave RADAR (mmWave radar) sensor.
- The mmWave RADAR is an extremely valuable sensing technology ideal for detection of objects and providing information on range, velocity and angle of these objects.
- The navigational sensor provides a precise geo-spatial orientation of the vehicle as well as trends in driving behaviour.
- The ODAWS algorithm is used to interpret sensor data and offer real-time notifications to the driver, boosting road safety.

4.2 BUS SIGNAL PRIORITY SYSTEM (BSPS)

- Bus signal priority System is an operational strategy that modifies normal traffic signal operations to better accommodate in-service public buses at signal-controlled intersections.
- Unlike a blind priority that is given for emergency vehicles, here it is a conditional priority, which is given only when there is an overall reduction in delay for all vehicles.
- The developed system will enable to minimise person delay by providing priority to public transport buses, either through Green extension or Red truncation, considering all vehicles approaching a signalised intersection.
- Green Extension provides extra time for a detected transit vehicle to clear an intersection. Green extension is most applicable when transit runs at the back of the vehicle queue, as is common at the first signal after a far-side stop.
- Red Truncation provides a green phase.

4.3 COMMON SMART IOT CONNECTIVE (COSMIC)

- It is a middleware software providing standard based deployment of IoT adhering to oneM2M (Machine -To Machine) based global standard.
- oneM2M is the global standards initiative that covers requirements, architecture, API (Application Programming Interface) specifications, security solutions and interoperability for Machine-to-Machine and IoT technologies.
- It facilitates users and application service providers in various vertical domains to use application agnostic open standards and open interfaces for end to end communication with well-defined common service functionalities complying with oneM2M standard.
- With this in view, CoSMiC common service layer is used to interface any vendor specific standards and for increasing interoperability with smart.

5. LITRETURE REVIEW

In order to conduct progressive review on ITS, we have searched various digital libraries which include IEEE, ACM, Springer, Elsevier and Google scholar database. We found 28000 results based on the search string for this review. We have downloaded the research papers from the searched results and based on man-ual screening (we have read their title, Abstract and conclusion part to assess them) found most relevant papers. Some of the papers which were found to be weak in context to our review were also dropped from selected.

- Shandiz et al.8 proposed a method for controlling traffic lights to have maximum flow in route and which results in moving travel. This is algorithm uses real situations. The sensors send the traffic flow information on a computer, and then based on Genetic Algorithm (GA) timing of green light is adjusted. Simulation result shows the full capacity of cross and road is reached based on real data. In aims to view the relationship between transport emissions and air quality concentrations and also to allow them to communicate. Air Quality Stations send air data to Data center then based on that data the Data center Request restriction from traffic management. After restricting vehicles Traffic monitoring center activate monitoring traffic and then data center requests extra buses from pub-lic transport management. Simulation results show that the system can automate the air pollution assessment.

- In9 reported project SMARTY for viable transport and mobility in smart cities. All its services mainly rely on the collected data by social and environmental sensors. It consists of social sensing module that senses data from social networks, tweets etc. and urban sensing module. Data is further processed using some mining techniques to and important information like traffic flow and accidents. All of this information helps user to take optimal routes

- In10 proposed a new Parallel Transportation Management Systems (PTMS). It is basically deals with analyzing models and making decisions for those. PTMS consist of components such as Operator Training System for Transportation (OTST), Dyna CAS (Testing and evaluation component), Agent based Distributed and Adaptive Platforms for Transportation Systems (ADAPTS) and ITOP (Actual control and management component of traffic equipment and system).

- In12 gave a new scheme to provide accurate GPS information for land vehicle monitoring systems. In the proposed technique GPS integrity check is provided at each level to check the quality of output of GPS position-ing. GPS Doppler information checks integrity of vehicle’s velocity which improves the results of map

matching process. The final step confirms the correctness of the algorithm for map matching.

- In15 described the role of telematics in transport sys-tem. Telematics can strengthen characteristics of transport while reducing its bad impacts. It helps to reduce various transport system issues such as air pollution, energy use, congestion without any extra contribution.

- In22 proposed universal framework based on evaluated hybrid Assisted GPS (A-GPS) and Uplink Time difference Of Arrival (U-TDOA). The framework is designed for real time road transport data collection system. The framework based on ANN integrates several technologies for traffic data collection, state analysis, pro-cessing analysis, presentation of traffic flow information and optimization. A new approach 'Pinpoint-Temporal' sampling frequency method is presented in Data analy-sis component.

- In23 proposed a service based Intelligent Transportation System Framework (s-ITSF) to provide efficient accident management. It provides various ser-vices such as before/after accident management and traffic information data through Vehicular Cloud Computing (VCC). The proposed framework provides Accident Management Center (AMC) to identify level of damage and Accident Management Organization (AMO) is used to provide facilitiesin accident area. Transportation and Accident Database Center (TADC) is used to provide information for prevention of accidents by collecting and managing traffic information.

- In25 proposed a model to integrate cloud computing and vehicular networks to share computational resources are allocated proposed architecture consists of central, vehicular and roadside cloud are cloud resources are allocated through game theoretical approach. Resource reservation method is used for migration of virtual machines. Experimental results show significant reduction of service dropping rate.

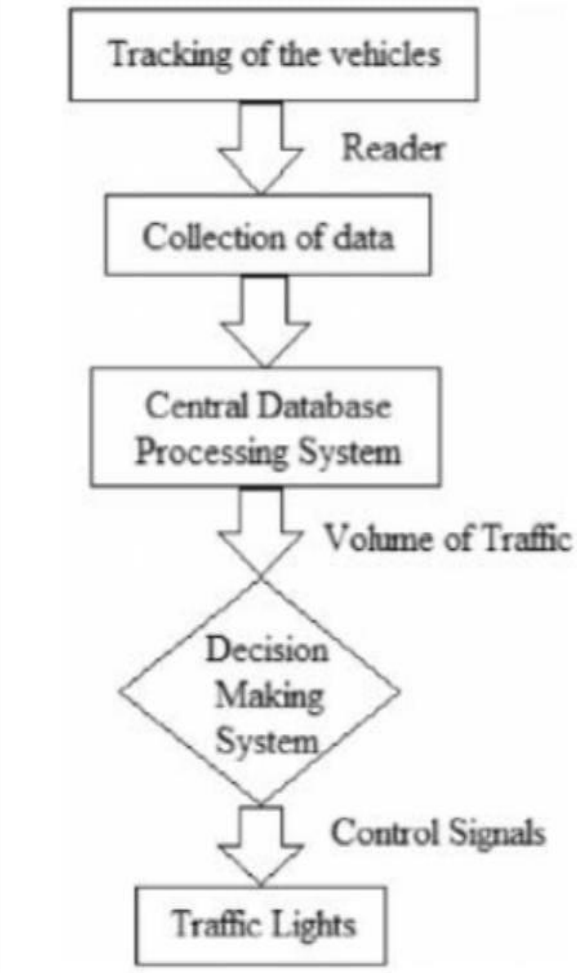
- In27 proposed a Vehicular SMS System (VSS) in order to problems such as traffic jams and road accidents are proposed VSS uses the concept of cellular network by using SMS systems in order to provide VANET services. In comparison to VANETs, VSS are less costly. However it requires more research to solve privacy and trust issues.

6. METHODOLOGY

6.1 Any technique that uses information and control technologies can be divided into small functions:

A. Collection of Data
B. Processing of Data
C. Decision Making System

Arrangement and inspection support based on information. Multiple forms of wireless communication technologies have been introduced for the intelligent transportation system. Communications of radio modem on UHF and VHF frequencies are highly used for short and long-range communication in transportation system.



It is focused Collection of Data:

On the data which collects from the congestion area. it also involves the tracking of vehicles in lanes. in this the algorithm is independent.

Processing of Data:

There are so many possible lanes and data are automatically collected and observed and simplified the data and then send to different input and output signals and it is required by Traffic Light Algorithm. some of parameters which can include length, queue, inflow, and outflow.

6.2 TECHNOLOGIES USED

The technologies used are:

A. Sensing Technologies
B. Inductive Loop Detection
C. Car Floating Data/Car Cellular Data
D. Wireless Communication

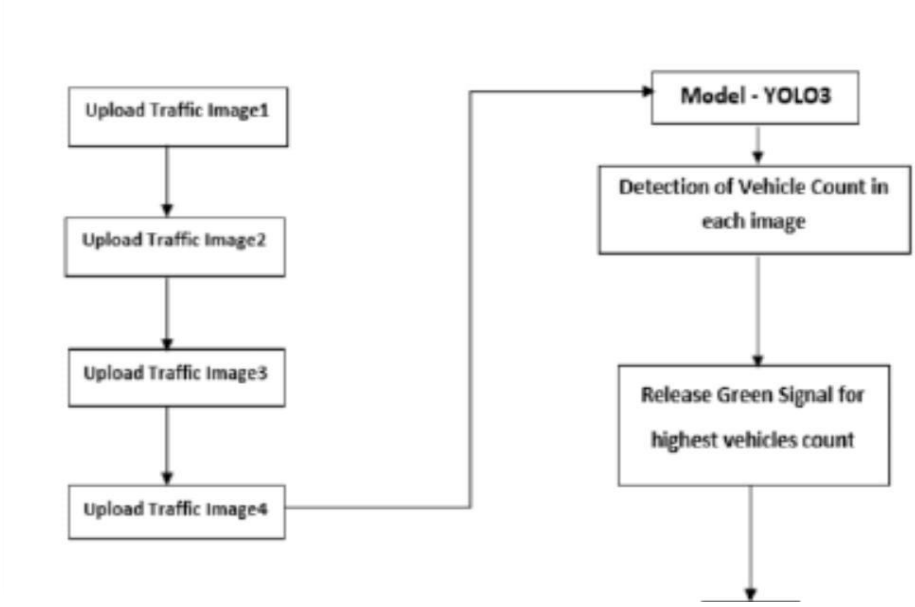
SENSING TECHNOLOGIES: Sensing technologies have greatly enhanced the technical capabilities and safety benefits of its. These sensor technologies include inductive loop that can read the vehicles speed, the number of vehicles moving and also the size of the vehicles.

- Infrastructure Sensors
- Vehicle sensors

WIRELESS COMMUNICATIONS: Intelligent Transportation system has been proposed various wireless communication systems. they are:

- short range wireless communications
- long range wireless communications

INDUCTIVE LOOP DETECTION: To detect the vehicles inductive loops are used and it is placed in roadside. it count the vehicles using simple detectors in one minute of time and also it can be placed in different number of lanes/junctions. In this the vehicles are going with high speed.



6.3 ALGORITHMS

Step1. Open the application.

Step2: User have to upload 4 images in 4 traffic lanes one by one in the order.

Step3: After uploading of these images it goes to mode-YOLO3.

Step4: It detects the no of vehicles are passing.

Step5: And also count.

Step6: Release Green signal for highest vehicles count.

Step7: So it is being processed under video surveillance.

Step8: Stop

6.4 WORKING PROCEDURE

This project intends to design a system which uses deep neural network algorithm which is a subset of artificial intelligence, which will provide intelligence to the current traffic control system present at a four-way junction. This system is mainly aimed to replace the timer of traffic control system with artificial intelligence system. Nowadays most cities are equipped with CCTV cameras on the roads and the junctions, the basic idea is to collect the live video from the CCTV cameras and detect the number of vehicles on each lane and feed the data into another machine learning algorithm. according to the data of each lane changes into the light phase of the green signal. This system mainly aims to increase the traffic efficiency by increasing vehicle flow which will reduce waiting time for the vehicles.

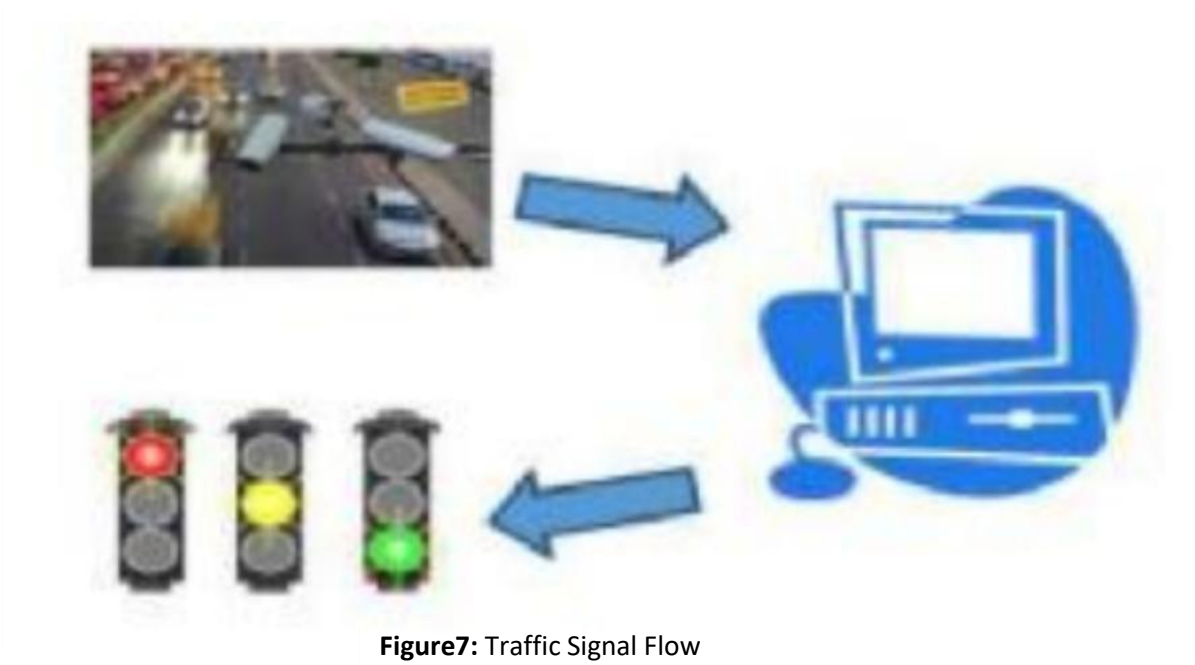


Figure7: Traffic Signal Flow

detecting vehicles:

To detect the number of vehicles. For that we are using neural network algorithm as the basis of the design. Framework for the neural networks is must before starting to design the algorithm. We used Tensor Flow framework and Keras framework to create a neural network which will detect number of vehicles. A convolution neural network is used which is one type of neural network. The datasets will be fed into the designed neural network so to train the neural network in order to get highly accurate results.

6.5 RESULTS

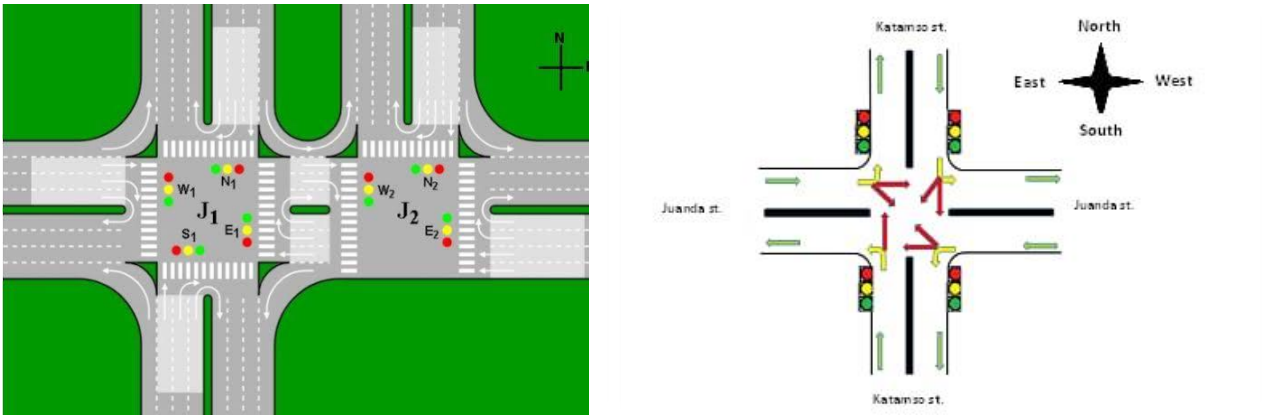


Figure8: Four Lane Intersection

7. ITS PRACTICES IN INDIA

Quite a few ITS projects have been implemented in India mainly in Metros and other big cities like Delhi, Ahmedabad, Bangalore, Chennai, Pune, etc. These various projects are of individual nature, and focus limited functions of the ITS, like traffic signal management, organized parking management, public transportation management, and highway toll collection centres to name a few. Most of these projects and pilot projects and are in primary operating stages for future large-scale implementation.

Few examples of exiting ITS practices in India.

7.1: CHENNAI:

- Chennai has initiated Advanced Traffic Management system. This system compares of putting up a complete monitoring system using surveillance centres for traffic rules violators, especially at junctions, named as Traffic Regulatory management System (TRMS). Special purpose cameras having latest technology and high resolution image capturing capacities like Automatic number plate reader cameras, Pan tilt zoom Cameras, and CCTV cameras have been installed at various locations junctions.
- Automatic Traffic Control systems, along with TRMS helps to supervise and adjust the traffic flows without physical interference in deciding and changing the duration of signal waiting time, by the computerized analysis of next three signalized interselection and its synchronization. Apart from these systems, FM radio is also one of the significant sources of transmitting crucial blockages due to extreme weather, etc. in Chennai.

7.2: MUMBAI:

- Mumbai has implemented an Area Traffic Control Project that deals with the management of traffic flows at major junctions.
- Technological help is also taken from the latest gadgets like, accelerometer guns, smart cameras for vehicle number detection radar sensors, etc.

7.3: BENGALURU AND HYDERABAD:

- A pilot project has been introduced where real-time traffic scenarios of major intersections and their secondary connector roads can be obtained through the Internet in Bengaluru and Hyderabad. The real-time images are available 24 by 7 on this internet-based portal for those major intersections and these images are updated at every 15 seconds interval.
- In addition to an internet advisory information system, an SMS-based system is also available to road users and motorists to get the updates for traffic jams and restricted accesses due to ongoing construction and maintained activities.

7.4: NEW DELHI:

- In the year 2009 a pilot project known as „The traffic people‟ Was launched to provide real-time traffic conditions and updates of in-and-around New Delhi (including the NCR region). Basically, with a web-based platform, this project was initiated for providing morning and evening peak-hour traffic condition of selected locations. The idea was also to initiate an SMS service with monthly subscription charges, but this service failed to function due to weak response from the people and unviability of the data.

8. ISSUES AND CHALLENGES OF ITS IN INDIA

A. Worked bank study reports some of the key concern that India is facing in implementing ITS: inefficient road network structure, financial boundaries observed in the government, unorganized and out of control urbanization and population growth, lack of willingness and also resources for operations and maintenance of the roads, lack of automation demand and road user awareness, negligence avoidance of decision makers
B. . Efforts have been made to employ ITS application has been implemented, which is comprehensive and focus on all aspects. This scenario says that through the ITS application are becoming popular with transportation authorities, still there are lot of avenues for it to flourish, all needed is a systematic approach.
C. Benefits of ITS can only be seen to the fullest when the application is done at road network level and not in small scale or corridor level. Apart from existing ITS application in India, much needed aspects of focus has to emergency management, congestion management, advanced traffic management systems, advanced traveler information systems, commercial vehicle operations, advanced vehicle control systems, etc. looking at the present transportation context. However, present projects show potential future advancements in ITS in India.
D. The steps that can help overcome the ITS standard for its various constituents and application; formulation of ITS regulatory authority under combined supervision of Ministry of Road Transport & highways and ministry of Urban Development which will monitor, regulate and document the upcoming and ongoing ITS projects; setting up fully functional Traffic management Centers for coordinating the urban and regional ITS activities; evolving a set of methodologies for automatic data collection techniques for Indian Traffic condition; setting up a national data repository for ITS; involving multiple stake holder like academia; government agencies and industries for better decision making and implementation of ITS application

to enable ITS application in wide spectrum, the current infrastructure has to be made complete enough for its successful functioning.