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ADVANCED NAVIGATING OF INTELLIGENT TRANSPORT SYSTEM

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ABSTRACT

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. Increase in traffic density in the world results inmore andmore congestion, airpollution and accidents. Hence Intelligent Transport Systems (ITS) has been emerged as a solution to various transport related issues. ITS is defined as the set of applications which are advance and aim to apply intelligent information and communication technologies in order to provide services for transport and traffic management.ITS have combined various technologies such as Data Collection, Communication, Data Mining, Machine Learning, Artificial Intelligence and Database Management. By combining these information technologies ITS have provided various applications such as Traffic control, Fault detection system, in vehicle information and navigation systems and driver assistance 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.

Keywords:*Automotive Navigation System, ITS, Management System, Parallel Transportation.*

1.INTRODUCTION

The 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. ITS, encompass a broad range of wireless and wire line communicationsbased information, control and electronics technologies. Transport is the fundamental for the everyday functioning of economy and the society. Now a day's not only civil and mechanical engineering areas deal with research and development of transportation. Rather the computer science engineering concepts such as Artificial Intelligence (AI), machine learning, communication, internet and many other emerging engineering and information sciences areas become the core of ITS.Therefore, ITS is defined as the set of applications which

are advance and aim to apply intelligent information and communication technologies in order to provide services for transport and traffic management. ITS plays a crucialpart in reducing many problems like air pollution, long travel time, fuel consumption, traffic congestion and accidents, which have been increased due to growth in population. ITS organizations are doing countless efforts in order to find solutions for these critical issues by developing traffic communication and vehicular networking [1,2].

Traffic control and management paradigm is divided into 5 distinct phases [3]. In the initial phase computers are large in size and expensive. Therefore whole traffic management is done using centralized model. In the second phase microcomputers are introduced which also lead to the introduction of Traffic Signal Controller (TSC). Each TSC consists of storage capacity and computing power to handle one intersection. In the third phase introduction of Ethernet (LAN) and wireless networks enables resource and information sharing. In this internet era, retrieving lots of data from remote sites and processing it requires lots of network bandwidth. To solve this problem mobile agents and agent based computing is introducedin fourth phase. Mobile agents require only runtime and run computations near data which reduces the communication cost and time. But this agent based computing require large computational resources. Moreover there are continuous improvements in On Board Equipment's (OBE) and Global Positioning Systems (GPS) in transport infrastructure. Now the IT industry has been revolutionized by cloud computing. It is a paradigm that provides on demand computing resources to users on pay per use basis. In recent years Parallel transportation andManagement System become the hot spot in traffic management systems. Parallel transportation andManagement System use Artificial Transport System (ATS) which incorporate artificial systems, parallel execution and computational experiments. ATS helps to evaluate and optimize various traffic control strategies [3]. ATS can make use of cloud computing concepts to very well coordinate the resources and also keep a check on the work of strategies to enhance the performance of traffic systems and minimize hardware requirements.

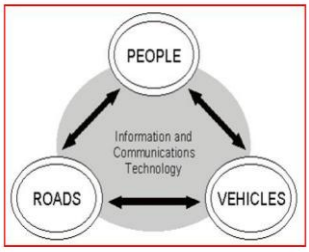

Figure 1: Show the Communication of ITS

1.1 Technologies used in ITS

The area of ITS is supported by three technologies: Data collection technologies, communication technologies and common database system. Further advance techniques are also included in ITS which are discussed in literature review. The description of basic technologies is given:

1.1.1 Data collection technologies

The prime requirement of ITS is accurate and comprehensive data. In recent years distinct techniques have been proposed and implemented for the improvement of data collecting methods. The data collection technologies are mainly divided into two categories: infrastructure-based technology (Inductive loops, sensors, CCTVs) and vehiclebased technology (GPS, cell based and floating car technologies).

1.1.2 Communication technologies

There are numerous communication technologies that are available to be used in ITS. The methods differ with respect to capacity, price and working strategy. These technologies vary from telephone lines to advance technology such as General Packet Radio Service (GPRS) and finally various Adhoc wireless communication and wireless broadband technologies. Vehicular Ad hoc NETworks (VANETs) have become popular in wireless communications for intelligent inter vehicle communication [4, 5].

1.1.3 Database management

ITS also makes use of databases for managing the information related to traffic as well as to get a overview of the network based on information received.

1.2 ITS Applications

The various ITS applications are described as follows:

1.2.1 Traffic Control

It focuses mainly on prioritizing the modes of transport such as buses, cyclist, pedestrians and other emergency vehicles in order to evaluate the performance and study the reasons for traffic emissions and congestion.

1.2.2 Disaster management systems

Various technologies are used for this purpose in order to smooth the traffic flow and to provide medical and other related help in such cases.

1.2.3 Vehicle information and navigation systems

In vehicle information system warns drivers about adverse climate conditions, road surface conditions, traffic jams and hazards including accidents. Navigation systems provide vehicle location information in real time and route guidance for driver to take optimum route.

1.2.4 Driver assistance systems

In order to save the driver from accidents these systems have replaced some human driver decisions with machine decisions which also help to achieve smoother vehicle control.

1.2.5 Air pollution control

Road transport is the major source of air pollution which has caused impact on human health and environment quality. Various models and protocols are used in ITS to control air pollution [6,7].

2. BENEFITS OF INTELLIGENT TRANSPORT SYSTEM 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.

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.
- Enhanced economic productivity.

3. CLASSIFICATION Of ITS

3.1 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 decisionmakers 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, traveler's information system and electronic payment system.

3.2 Advanced Traveler Information System (ATIS)

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.

3.3 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.

3.4 Automated Highway System (AHS)

An 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 AHSequipped vehicle might pull into the designated lanes, perhaps similar to some of today's High Occupancy Vehicle (HOV) lanes.

3.5 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 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.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.

3.6 Electronic Toll Collection System (ETC)

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 (noncontact 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 ETC 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.

4. PARALLEL TRANSPORT

In geometry, parallel transport is a way of transporting geometrical data along smooth curves in a manifold. If the manifold is equipped with an affine connection (a covariant derivative or connection on the tangent bundle), then this connection allows one to transport vectors of the manifold along curves so that they stay parallel with respect to the connection.

The parallel transport for a connection thus supplies a way of, in some sense, moving the local geometry of a manifold along a curve: that is, of connecting the geometries of nearby points. There may be many notions of parallel transport available, but a specification of one – one way of connecting up the geometries of points on a curve – is tantamount to providing a connection. In fact, the usual notion of connection is the infinitesimal analog of parallel transport. Or, vice versa, parallel transport is the local realization of a connection. Or Parallel

transport before defining a general notion of curvature for an arbitrary space, we need to know how to compare vectors at different positions on a manifold. Parallel transport provides a way to compare a vector in one tangent plane to a vector in another, by moving the vector along a curve without changing it.

As parallel transport supplies a local realization of the connection, it also supplies a local realization of the curvature known as holonomy. The Ambrose-Singer theorem makes explicit this relationship between curvature and holonomy.Other notions of connection come equipped with their own parallel transportation systems as well. For instance, a Koszul connection in a bundle also allows for the parallel transport of vectors in much the same way as with a covariant derivative. An Ehresmann or Cartan connection supplies a lifting of curves from the manifold to the total space of a principal bundle. Such curve lifting may sometimes be thought of as the parallel transport of reference frames. Parallel transport of a vector around a closed loop (from A to N to B and back to A) on the sphere. The angle by which it twists, {/display style/ alpha}, is proportional to the area inside the loop.

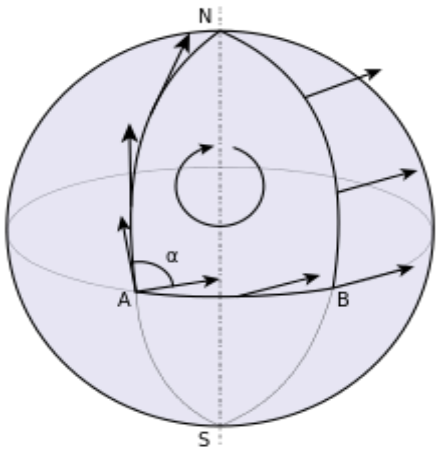

Figure.2: Parallel transport.

5. LITERATURE 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 manual screening (we have read their title, Abstract and conclusion part to assess them) found most relevant papers. Some of the papers which were foundto be weak in context to our review were also dropped from selected list. Review of all papers is presented.

Shandiz et al [8].proposed a method for controlling traffic lights to have maximum flow in route and which results in moving traffic. Tis 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 centers activate monitoring traffic and then datacenter requests extra buses from public transport management. Simulation results show that the system can automate the air pollution assessment. In [9] 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 find important information like traffic flow and accidents. Allof this information helps user to take optimal routes. In [10] 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). In [11] described Intelligent Sensor Information System (ISIS). In order to reduce crime and antisocial behavior on public transport systems, an active CCTV approach ISIS can be used. Event composition component is used to directly detect small events and combine them to deduce events with linguistic meaning. In the overall system architecture, to generate alert in real time over a wireless network On-board event recognition is combined with control room software. Alazawi et al [4]. Proposed an emergency response system for disasters and specially focused on transport system. In this paper, technologies such as VANETs, disaster management system is proposed by integrating mobile and cloud computing technologies. The proposed system is evaluated on the basis of the brunt of disaster on the transport system and comparing it with traditional disaster management system. In proposed a scheme which consist of smart city framework that share traffic condition related information to help drivers in taking appropriate decisions. The communication between the vehicles and road side units is provided by Vehicular and Adhoc NETwork (VANET). The smart city framework has warning message module which consists of Intelligent Traffic Lights(ITLs). This module traffic information, make decision about routes and inform driver about current traffic conditions. In [12] 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 positioning. 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. In [13] focused on improving the tools for making decisions while natural disasters. It has described development and use of Intelligent Disaster Decision Support System (IDDSS) and its capabilities to respond and plan in foods. Therefore using IDDSS, the concept of risk, susceptibility and resiliency for disaster management can be improved. In [14]proposed an intelligent traffic control system. In the proposed system each vehicle is equipped with Radio Frequency Identification (RFID) tag which is impossible to remove and they can only be read by RFID readers. RFID reader also counts no of vehicles during specific duration to determine

networkcongestion and based on that the duration of green light for that path. It also helps in determining stolen vehicle. Zig bee module CC2500 is used to provide a wireless communication between emergency vehicles (e.g. ambulance) and traffic controller. The prototype of system is tested for different combination of input and experimental results are found good.In [15] introduced a new strategy named Weighted Congestion Coefficient Feedback Strategy (WCCFS). Through this technique any dynamic information can be produced and shown to guide the users on road. The simulation results are compared with three existing technologies. The results demonstrate that WCCFS is better than other technologies. WCCFS can very well improve the conditions on road and also ease the effectsof congestion caused by traffic jam. To relief the government, in [16] plan to develop Artificial Emergency Planning System (AELPS). AELPS describes the characteristics of elements in emergency system by using artificial society theory based on agent based modeling. AELPS generates results that can be used in emergency planning. AELPS framework assembles various components such as Pollution, Medical and rescue subsystem, Geology subsystem, Weather subsystem, Epidemiology subsystem and Transportation subsystem to provide disaster relief. Alsabaan et al [7] focused on creating an Economical and Environment Friendly Geo cast (EEFG) protocols to minimize fuel consumptions and emissions. They proposed the method to integrate vehicular networks with fuel models. These models are Comprehensive Modal Emissions Model (CMEM) and Virginia Tech Microscopic model (VT-Micro) and Geo cast protocols. The basic idea is to send Traffic Light Signal (TLS) related information to vehicles to reduce emissions and fuel consumption. Geo cast protocols with TLS play a key role inthis model. VT-Microscopic model is used to measure fuel consumptions and CO_2 emissions. Vehicles calculate environment friendly speeds after getting TLS information. Simulation results show that EEFG protocols can reduce CO2 emissions and fuel consumptions. Li et al [3]introduced a prototype for traffic management. He aimed to combine Agent-based traffic management with cloud computing. Traffic management based on agents use adaptability and mobility of mobile agents to deal with transport issues. Intelligent transportation cloud can help these systems to provide large amount of storage, computing resources, decision support and environment for traffic management strategies. More use of mobile agents also requires computing and power resources which can be provided through cloud computing.In [17] promotedthe vision of Vehicular Clouds (VCs) and various security challenges in vehicular clouds. In VC, vehicular resources which are less utilized such as power, Internet connectivity and storage are rented out or shared between customers. Hence the adoption of VC concept has various privacy and security issues which are need to be addressed. The security challenges specific to VCs are authentication of vehicles, tangled locations and identities, building trust relationships etc. A directional security scheme is provided in this paper to handle these security challenges.In [18] presented rule based iterative Artificial Transportation System (ATS) design process. In ATS traffic simulations are done in synthetic way to deal with traffic issues from complex system point of view. The simulation results are conducted on prototype that consists of multi agent platform. The prototype is able to generate traffic behaviors such as congestion and helps in evaluating traffic rules. In [19] proposed universal framework based on evaluated hybrid Assisted GPS (A-GPS) and Uplink Time DifferenceOf 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, processing analysis, presentation of trafficflow information and optimization. A new approach 'Pinpoint-Temporal' sampling frequency method is presented in Data analysis component.

6. AUTOMOTIVE NAVIGATION SYSTEM

An automotive navigation system is part of the automobile controlsor a third party add-on used to find direction in an automobile. Ittypically uses a satellite navigation device to get its position datawhich is then correlated to a position on a road. When directions areneeded routing can be calculated. On the fly traffic information canbe used to adjust the route.

7. ANALYSIS

Analysis of review work can be classified into two aspects of Intelligent Transport System (ITS): Transport related issues and Techniques involved in solving these issues.

7.1 Transport Issues

Increase in traffic due to population growth has raised various issues such as traffic control, air pollution, crime control, disaster management, congestion control and proper navigation systems. Summarizes various issues which have been focused in literature review. It can be concluded that the major challenges in most of the work related to ITS are Traffic control, congestion control and disaster management. However air pollution, crime control, efficient navigation and resource management are less focused by researchers.

7.2 Techniques for Solving Transport Issues

Various issues reported require real time information to solve them. Therefore various technologies and techniques are proposed by various researchers in order to solve them. Various active CCTV cameras and sensors are used to provide real time information. GPS technology is combined with different image processing techniques to have more advance navigation systems. In addition to this several advance technologies such as VANETs, cloud computing, agent based computing have been introduced to make transport system more efficient and intelligent. Summarizes the techniques used by various researchers to solve transport issues. Researchers are exploring number of techniques to solve transport related issues. However till date Sensors, VANETs, Vehicular cloud computing and Agent based techniques are found to be the best solution in current scenario. For the further improvements due to technological advancements other techniques might be effective in future using Advance GPS, Smart Traffic lights, RFID readers.

8. CONCLUSION

Explosive growth in traffic density and population has raised various issues such as air pollution, congestion and accidents that have become the area of research. Hence Intelligent Transport System (ITS) is used to solve these

transport related issues. ITS combines various technologies such as data collection, communication, machine learning and data mining to provide transport related services. These services include Traffic control, navigation systems, driver assistance systems and Fault detection systems. In addition to this ITS also solves transport related issues such as disaster management, congestion control and air pollution. Further enhancement in ITS include addition of new techniques such as internet of vehicles, vehicular cloud computing, Agent based computingwhich includes the introduction of Artificial Transport System. By combining these techniques the ITS can be made more efficient in solving transport related problems.

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