Influence and Establishment of Smart Transport in Smart Cities

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Abstract

In the modern era, the concept of smart cities is becoming more and more popular with each passing day. Smart transportation is the key branch of smart cities. IoT can tackle issues including traffic congestion, automatic fare collection detection, road safety accidents, and limited vehicle parking facilities. In our paper, we will talk about IoT based smart traffic regulating systems. The smart traffic regulating system composed of intelligent sensors deployed at the site is used to monitor the traffic and accordingly regulate the timings of traffic signals. Lanes having lesser traffic may have a green signal for a lesser duration as compared to a lane with higher traffic. How we can handle different traffic problems by implementing smart architecture in smart cities.

In this paper, we will also talk about how the implementation of autonomous vehicles will impact our current transportation system and how it will be very useful in the coming times.

Keywords

IoT, Smart Cities, Intelligent Systems, Smart Transportation

1. Introduction

The purpose of this paper is to highlight the need for an intelligent transportation system.

Smart Transportation is a well-known review point since it manages an assortment of ordinary issues and has a huge impression in a cutting edge smart city. Furthermore, the nature of the issues it addresses encourages the employment of both IoT and ML technology. This review will check out the current pattern in the utilization of AI and the web of things in smart transportation, just as the exploration inclusion in every one of the smart transportation categories. Therefore, the review centres around the latest examination work that influence IoT and additionally AI ways to deal with settling the smart transportation categories [28, 29].

The Internet of Things is radically changing the transportation business [30, 32]. Next-generation intelligent transportation systems will improve economics, public safety, and the environment by optimising the flow of people and products. Smart transportation frameworks will robotize our streets, railroads, and air terminals, change traveller encounters and reshape how freight and product are followed and conveyed, introducing huge business openings for framework integrators, free programming sellers (ISVs), specialist organizations, and other arrangements suppliers[17,19]. With the speed of urbanisation, motorization, and modernization, the urban population is expanding, quicker automobiles are being produced, and urban traffic congestion is increasing. The population is increasing, the urban transportation infrastructure is overburdened, and the resultant environmental noise, air pollution, energy waste, and other issues are affecting today's world. Transportation in big cities has become a critical challenge in both developed and developing countries across the world. As we can see in the diagram given below, the increasing number of vehicles on the road have also taken up a graph which indicates why there is a clear need to enhance our traffic signals and transportation systems with the new technologies like IoT,

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Autonomous Vehicles, etc. Otherwise, in the coming days, there will be a lot of chaos that will become impossible to handle[16, 26, 27].

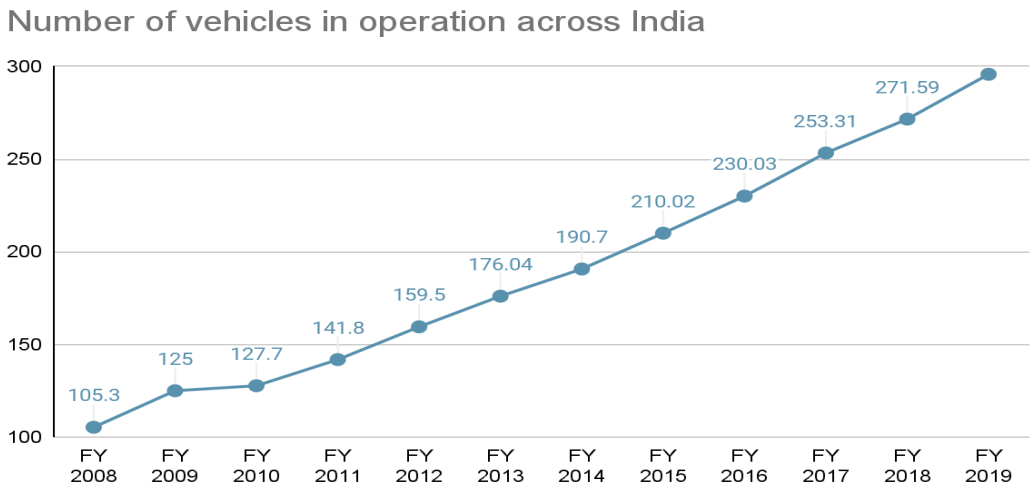

Figure 1: Number of vehicles in operation across India
Source- Statista

2. Related Work

The established integrated system analysis environment aids ITS in the smooth integration of diverse models, resulting in the assembly of an existing structure that performs significantly better than previous models. As a result, the system integration process has been simplified, allowing ITS to be installed across the country without difficulty.

Multivariate analysis [3, 18] allows for the simultaneous examination of many items using a statistical measure. This approach allows for simultaneous examination of several variables. Various multivariate analysis approaches have been presented and can be used depending on the situation.

Table 1
Related work on Smart Transportation.

Ref. No.	Publication year	Proposed technique	Traffic safety	Energy efficient	Merits
[4]	2009	Pollution-free transportation	No	Yes	Handles traffic in an efficient manner
[5]	2014	Pollution-avoidance transportation	Yes	Yes	Reduction in emission of CO_2 by using electric vehicles
[6]	2015	Green transportation	No	Yes	Traffic handling with sustainability is given importance
[7]	2015	Safe and sustainable transportation	Yes	Yes	Traffic congestion is handled efficiently

[8], [9]	2016	Green transportation	Yes	No	Proposes a pollution free technique which helps in vehicular movement
[10], [11]	2016	Collision-free transportation	Yes	No	Determination of braking response time and steering response time
[12], [13]	2017	Collision-free transportation	Yes	Yes	Safe system design with collision warning
[14]	2018	Congestion avoidance transportation	Yes	Yes	Time of arrival (TOA) based localization, using automatic braking for collision avoidance

3. Smart Transportation and its Intelligence

The integration of advanced management techniques with technology into the transportation sector is called "smart transportation." These advances provide ingenious ways to identify support for a variety of transportation and transportation management methods, enabling customers to be more educated and can use transportation networks in safer and smarter ways.

Intelligent Transport Systems involves leveraging some advances from basic management frameworks such as vehicle routes; Signal control systems; programmed license plate verification or automatic speed camera to monitoring applications such as security CCTV framework and to furthermore more advanced gadgets that are working on a real-time basis, taking inputs and generating relevant outputs (for example smart parking system)[20, 21].

A smart transportation framework can be imagined as involving three essential functionalities. This incorporates smart streets, smart vehicles and smart parking.Smart streets are carried out by the use of different sensors and actuators to make driving more secure and green. Smart vehicles are equipped with real-time gadgets empowered with computational and correspondence capacities to have the option to collaborate with one another for social prosperity. Also, smart parking manages a self-sufficient parking framework to help drivers in picking a reasonable parking place for their vehicle. As the Internet of Things innovation grows, many new technologies [22] are manufactured in order to increase the quality of individuals' lives. Urban areas are getting "more brilliant" and smart city apps are developed to pursue the latest innovative improvements. With the presentation of IoT in the transportation system, transportation frameworks start to "feel", "think" and “make decisions”, prompting the advancement of ITS (Intelligent Transport System). The Intelligent Transportation System has attracted the attention of many experts because of the huge potential of additional upgrades in it [25]. Amongst the main spaces of attention in smart transportation, route advancement or navigation is an interesting one. Utilizing information using clients' cell phones [15], or with physical units set at different locations on the streets [16], different software attempts to predict traffic blockage and suggests ideal path choices, limiting travelling times and subsequently decreasing emission from vehicles and utilization of energy. Furthermore, to decrease the utilisation of energy more, such streetlamps are suggested that can recognize traffic situations and work as needed, instead of being continually on with a period plan. IoT gadgets have been generally prefered to make smart parking systems, as well. Researchers have suggested new smart parking systems that permit various functionalities from increasing the capacity and accessibility of a parking garage to limiting the searching tim [31]e. In addition, systems that have the capability to detect street surface irregularity with the inputs from the sensors joined to the vehicles or the inputs from the driver’s smartphone have been suggested. By identifying terrible street conditions, accidents might actually be controlled from happening.

4. Smart infrastructure for Smart Cities

Smart cities always try to grow in every field and use different technologies to excel in different sectors such as education, health, electricity and water services, etc which results in increasing the comfort levels of the citizens of the city. Transportation is also one of them which a smart city would always like to be the best of its kind[17]. Cities are getting aware of smart infrastructure for intelligent transportation systems very frequently and the below graph shows how spending on ITS in the US increased from 2010 to 2018.

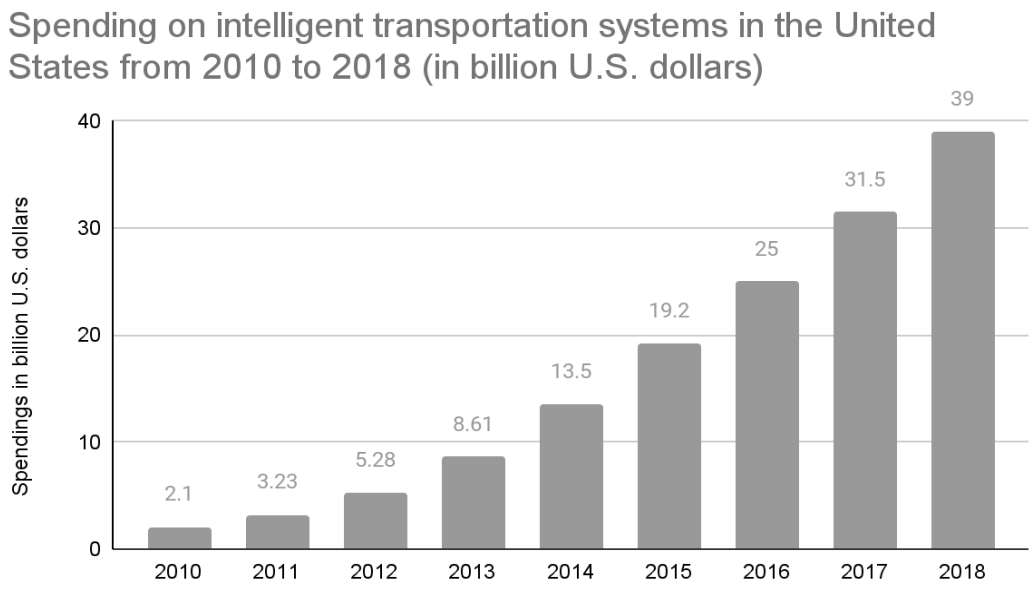

Figure 2: Spending on intelligent transportation systems in the United States from 2010 to 2018 (in billion U.S. dollars)
Source- Statista

Now to achieve better transportation in a smart city, smart architecture is a necessary condition. The smart architecture consists of the usage of various technologies from basic management systems like interconnected traffic control systems, number plate recognition systems to screen monitoring systems such as CCTV security systems and much more advanced interconnected technologies that process real-time data from various sources and provide useful output in up-gradation of the transportation system[23].

5. Impact of Autonomous Vehicles

The term Autonomy refers to a state of an object when it is in its self-governing mode. So

an Autonomous Vehicle (AV) is a vehicle that takes decisions by itself after analysing the inputs given by subsequent sensors and devices[24]. These vehicles are in testing mode right now but are developing day by day. In around 5-10 years these autonomous vehicles will conquer the market of transportation. Now why the use of AVs is increasing rapidly is discussed below.

The most important reason that the use of AVs is increasing is they are capable of decreasing one of the most common problems of transportation section that is accidents. This is merely based on the fact that autonomous vehicles get rid of a major factor ie. “mistake done by humans” during an accident [18].

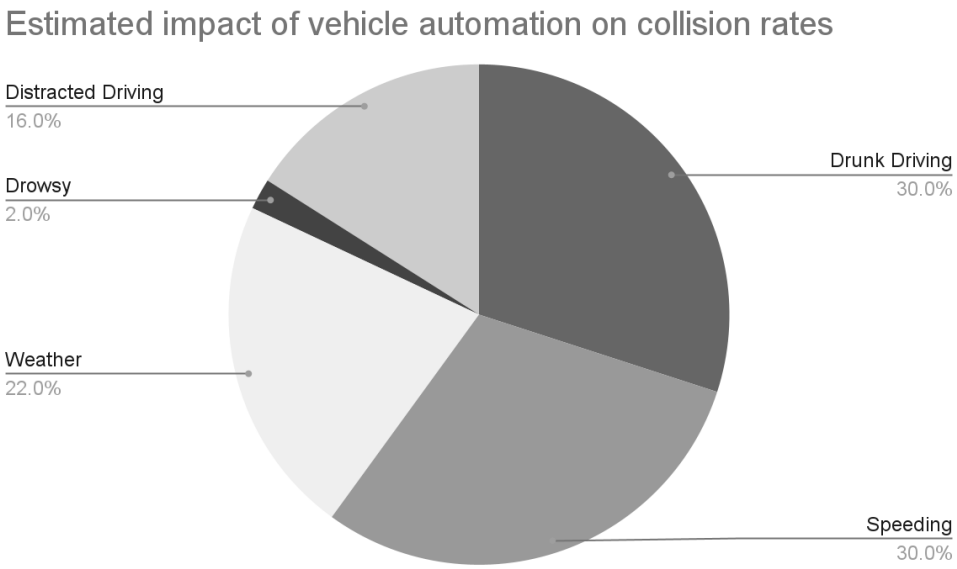

Figure 3: Estimated impact of vehicle automation on collision rates
Source- Statista

As shown in the pie chart above 30% of the deaths are caused due to drinking and driving. Now the AI system will never be drunk preventing one-third of the accidents. And Like-wise AVs can be programmed to not Overspeed preventing another third of the accidents. AI will also not be distracted or get drowsy, controlling another 16% + 2%. Finally, we are only left with 22% of accidents that are due to weather. This is how we can have control over accidents using Autonomous Vehicles. The graph given below estimates how the Automation of vehicles impact the collision on road in 2030.

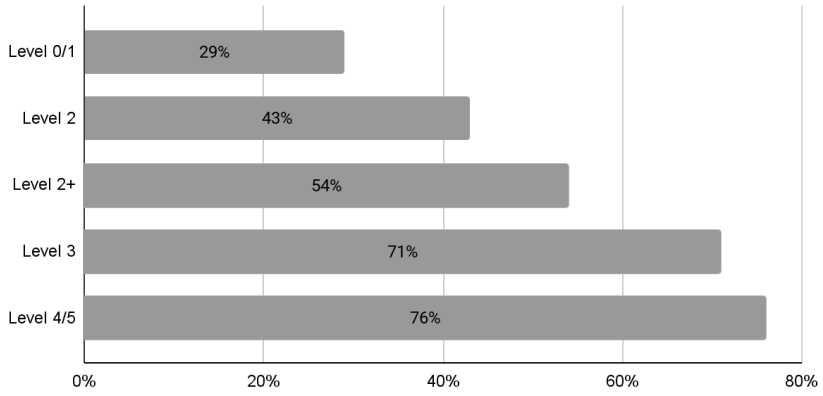

Figure 4:Estimated reduction of collision rates to no automation in 2030, by automation level
Source- Statista

6. Conclusion

The development of the internet of things and cloud innovation technologies like edge computing offer a few potential problems outcomes in the field of smart transportation for smart cities. IoT based smart transportation gives constant information to the users about accessibility, traffic lights, shortest distance and thus use smart signboard which utilizes the advantage of internet of things to display the useful information about the place such as different possible paths, conditions and temperatures etc. The IoT based

traffic lights will allow smooth functioning of traffic and hence fewer jams and traffic chaos. Autonomous vehicles are in trend and can be soon seen as future transportation.

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