Vehicle Traffic Monitoring System Using Internet of Things (May 2018)

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***Abstract*—The present day increase in vehicle traffic is one of the liabilities for this highly growing and competitive world. The existing systems of vehicle traffic monitors have been successful in coping up with the various factors that affect daily life and has helped to overcome he difficulties of common man to travel better despite raising traffic. Thinking of the developing innovations and improvement in the Internet of Things, the implementation of a vehicle traffic monitoring system using IoT would provide a faster, efficient and yet accurate results. With the rising population spending most of their time travelling, stuck amongst traffic, finding a way to reduce this time will make it fruitful for everyone. The paper hence shows a method using IoT devices to get a control of vehicle traffic and has introduced a system to avoid congestion and facilitate better travel experience. The project aims in processing and monitoring data sent by IoT connected vehicles and then use this data to resolve various problems faced by passengers. This helps the passenger to avoid highly crowded routes and find the suitable paths of their choice. The system koutilizes new and simple technologies for real-time collection, organization and transmission of information to provide an efficient and accurate estimation of traffic density in any specific area.**

***Index Terms*—Internet of Things (IoT), Traffic Monitoring System, Congestion Control, Global Positioning System(GPS), Infrared (IR) sensors**

I. INTRODUCTION

THIS paper focuses on the method to control and monitor the vehicle traffic using sensors and update the database frequently. This makes it easier for users and they get updated faster.

The internet of things (IoT) is the network with various devices like vehicles, home appliances and many other devices. which is embedded with electronics, sensors and various modes of connectivity in order to connect and exchange data. The IoT makes it easy for us to connect together, facilitating the ability for access and retrieval of data whenever and wherever one needs them.

IoT is interconnecting large number smart devices, making its way to fulfill every basic to complex activity every day. The existing research work on IoT has been immense and has been carried out in various fields like smart home systems, insurance, healthcare, transportation etc. All over the world vehicles increase day by day so a good traffic monitoring system will be a solution to all these problems of transportation. The main aim of the project is to track and control vehicle traffic.

Details are stored in database, gets updated and reflected to show the user with the changes and provide required information like source to destination paths that could be taken, obstacles ahead, vehicle count, speed and distance between the vehicle hence, controlling the vehicle traffic. The increase in density of vehicles in routes all over the world makes it difficult for transportation. Also, in the present busy world nobody has the time to ask people which way to choose to reach a particular destination. So here the aim is to resolve the problems during transportation and make it easy for the passengers.

The Internet of Things (IoT) term was derived in 1999 by Ashton. IoT has become a growing technological trend in recent years. It has gained significant attention in academia and computing industry during the past decade. IoT promises a world where all the smart objects around us are connected to each other and spontaneously communicate with each other with the minimum human intervention. IoT offers much more facilities as compared to other networking approaches like LAN, Ethernet, wired/wireless, etc. hence it has become the main reason of research interest in current computing era. The goal of IoT is to create a better world for the human beings.

IoT is the new and emerging model in the computing which spontaneously links physical and virtual smart objects. IoT has high volume contextual information which enables context- aware smart applications like: Healthcare, home and office, entertainment, ticketing, smart building, medical technology, telecommunication and media, transportation and logistics, automotive, aerospace, aviation and supply chain management, disaster alerting, recycling, agriculture, breeding and environmental monitoring, smart environment, smart home, smart cities, smart water, smart meter, retail, logistics, industrial control, smart animal farming, smart agricultures, domestic and home automation, e-Health, security and emergencies [1].

There is rapid increase in the vehicles perhaps traffic congestion on the road is also increases. Now, it is a very serious problem because on road, more number of vehicles are present and due to that the congestion in traffic increased along with the increase in pollution and more time is waste on road traffic every day. Therefore, vehicle traffic monitoring is one of the most recent issue which plays an major role to reduced the travel time, improve the traffic efficiency, etc.

All over the world number of vehicle is increases [2]. Let us consider for India, in 1991 number of register cars were 119161.By 2015, the registered number of cars are 224030. In 2020, it will become 573513, that means number of vehicle will increase almost by double compare in 2015. And in 2050 number of cars (vehicles) will increase by 4 times i.e.

1019710. With this increasing pace, we can predict that, in future as the number of cars (vehicle) will increases the traffic on the road will also increases along with the pollution(Fig.1). To avoid the traffic congestion, to monitor the traffic density and to know the current traffic situation, we proposed a solution vehicle traffic monitoring system using IoT.

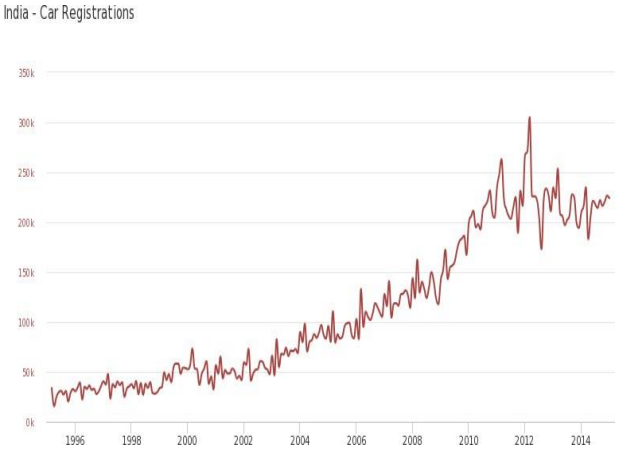

Fig.1. Car registrations in India from 1996-2014

The proposed system will measure the real-time traffic density controls the traffic congestion on road using dynamic management of traffic signals. For understanding, let us consider an example: A vehicle wants to go from any source to a destination then, the user will login into proposed website with the login details and it will be able to find out the real- time traffic density also user can able to find out optional routes to go to destination to avoid road traffic. So, efficiency of congestion in traffic will improve. User can predict the future pollution and accordingly user can increase the greenery. We can also manage the traffic signals by monitoring the traffic density to avoid traffic congestion on road using network communication between the server and hardware module via Bluetooth.

One of the key enablers for having smooth traffic flows and better mobility is to rely on real-time traffic monitoring systems. These systems allow road operators to implement intelligent traffic management strategies such as the dynamic adjustment of timing and phasing of traffic lights and the adaptive road congestion charging. Moreover, better informed travelers will plan smartly their journeys and hence potentially contribute in reducing traffic jams. Traditional real-time traffic monitoring usually get real- time data from GPS equipped fleets and fixed sensors installed in specific locations. In this paper, a new real-time traffic monitoring based on emerging vehicular communication systems is proposed. The system enables traffic monitoring with higher reliability, accuracy, and granularity.

When traffic light indicates red, the vehicle count is taken and once the vehicle count reaches a peak value the green indication is shown immediately so that the vehicles are cleared. The vehicle count is taken using the IR sensor, similar strategy is applied so that vehicle density is controlled in every junctional area. The ultrasonic is used to detect the distance between vehicles and keeping track of the speed by taking into account the average speed of the vehicles. Every vehicle in the road should make sure to maintain a certain distance between them for safe drive.

II. RELATED WORK

Collaborative traffic-monitoring (CTM) systems exploit the location information continuously collected from vehicles. Location data are very sensitive information that made privacy a major obstacle for the widespread usage of CTM systems [3]. Bluetooth traffic monitoring system (BTMS) is capable of identifying vehicles and estimate their travel time (TT) in a route. This information is key for intelligent transportation systems. Although BTMSs are currently deployed in several cities throughout the world, there is no formal methodology for the TT estimation they generate. In this paper, we first analyze the specific features of the Bluetooth technology that affect the TT estimation. In particular, we study the reliability of the measurements, the representativeness of the estimates, and the issues regarding multiple detections and outliers. Based on this knowledge, we propose a comprehensive methodology for the TT estimation that considers exclusively information from vehicles. We filter these vehicles through a simple process that uses the available dedicated inquiry access code. In order to illustrate our proposal, we performed an experiment deploying commercial Bluetooth detectors on a freeway under real traffic conditions. The resulting BTMS provided highly reliable TT estimations with a 5-min resolution.

Global Positioning System tracking is a method of working out exactly where something is. A GPS tracking system, for example, may be placed in a vehicle, on a cell phone, or on special GPS devices, which can either be a fixed or portable unit. GPS works by providing information on exact location. It can also track the movement of a vehicle or person. So, for example, a GPS tracking system can be used by a company to monitor the route and progress of a delivery truck, and by parents to check on the location of their child, or even to monitor high-valued assets in transit. Utilising existing networks for the development of CTM is cheaper and needs no extra deployments. However, such systems require more work for strengthening security and privacy.

PA-CTM uses a novel autonomous location update mechanism, ALUM, which is managed by moving objects according to traffic conditions and does not require the existence of a trusted third party for controlling the location update mechanism. The proposing of ALUM is similar to the mix zones in dedicated infrastructure traffic-monitoring systems. Our experimental results show that ALUM is effective for traffic monitoring and it reduces communication cost significantly.A design of a novel, cost-effective, and intelligent realtime traffic monitoring systems using wireless smart sensor networks. Reliable and computationally efficient algorithms were developed for vehicle counting and speed estimation[4]. Vehicles are

fabricated with significant amounts of ferrous materials (e.g., iron, steel, nickel, or cobalt) that cause a small, local disturbance in the Earth's magnetic field flux lines. Vehicles are characterized by different structures, causing varying disturbances on geomagnetic field components (*B*X, *B*Y, and *B*Z). Such disturbances represent a vehicle's magnetic signature, which is unique and can be measured using a magnetic sensor. In this work, vehicle detection is achieved using FXOS8700CQ—a digital intelligent sensor combined with 3D magnetometer and accelerometer sensors. In this paper a novel, reliable, and computationally efficient algorithm for vehicle counting and speed estimation were developed. Validation studies showed 99.95% accuracy for detection of all vehicle classes at various speeds. Speed estimation accuracy 96.11%. Estimated cost for a single node is $40.

[5] Mobile cellular networks can serve as ubiquitous sensors for physical mobility. propose a method to infer vehicle travel times on highways and to detect road congestion in real-time, based solely on anonymized signaling data collected from a mobile cellular network. Most previous studies have considered data generated from mobile devices active in calls, namely Call Detail Records (CDR), an approach that limits the number of observable devices to a small fraction of the whole population. The approach overcomes this drawback by exploiting the whole set of signaling events generated by both idle and active devices. While idle devices contribute with a large volume of spatially coarse-grained mobility data, active devices provide finer-grained spatial accuracy for a limited subset of devices. The combined use of data from idle and active devices improves congestion detection performance in terms of coverage, accuracy, and timeliness. The method is applied to real mobile signaling data obtained from an operational network during a one-month period on a sample highway segment in the proximity of a European city, and present an extensive validation study based on ground-truth obtained from a rich set of reference datasources—road sensor data, toll data, taxi floating car data, and radio broadcast messages. [6]A new real-time traffic monitoring based on emerging vehicular communication systems is proposed. The system enables traffic monitoring with higher reliability, accuracy,and granularity. The clusterbased V2X traffic data collection mechanism is able to gather more than 99% of the available data and reduce the overhead to one quarter when compared to other approaches. New advanced real-time TMSs that can provide accurate and scalable traffic monitoring will be enabled with the emerging vehicle to vehicle and vehicle to infrastructure (V2X) communication systems.V2X technology will enable a large set of new safety and non-safety applications and contribute in having next generation of Intelligent Transport Systems (ITS) including TMSs. In order to fully take advantage from the emerging V2X applications, ITS requires novel communication technologies and protocols.

III. DESIGN AND METHODOLODY

Using IoT devices and interconnected components the system designed gives accurate and faster results than existing systems. The satellite traffic monitors existing may provide erroneous information but this design makes sure not to do so. The ability of every IoT device to interconnect and communicate with each other is made use of in the proposed solution. The vehicle data with its speed and count at each lane is collected collectively and compared. The design proposed have not been experimented in the real time due to cost issues yet the positivity and results will be satisfactory if done. The simulation(Fig.3) of the whole model was done using a model with congested environment of traffic and toy vehicles and various scenarios where tested.

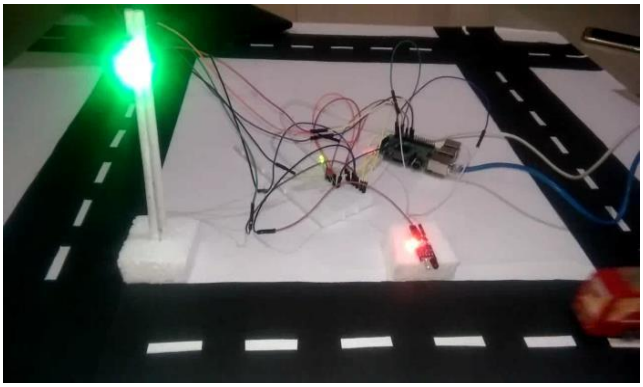

Fig.3. Simulation model of vehicle traffic monitor

We consider an environment with large number of vehicles. The environment consists of traffic lights linked to infrared sensors and ultrasonic sensors (in case of the simulation model). The infrared sensor will detect any object when it becomes an obstacle to the transmitting signal. This scenario will help in keeping track of total number of vehicles passed and hence the count. This helps us obtain the vehicle count. The congestion is kept track of and it facilitated to control the overall congestion hence resulted. Also by an overall comparison of the various lanes one can also determine which route to take and which not to. The exact time required to reach any destination can also be determined. The using of ultrasonic sensor is done to get a minimum distance track between vehicles. This is only added as a safety measure as this has been already implemented in many of the recent editions of moto vehicles. Keeping track of distance between vehicle will help in avoiding various hazaradous accidents. Also the sensor keeping track of the distance makes sure to also check for average speed of all vehicles in the area. Strict following of the speed limit is also on eof the reasons for the accident levels in India. Hence a system keeping track of the average speed and hence making sure all vehicles on the road should work on maintaining them will make it easy for the traversal in highways and also reduce risky situations.

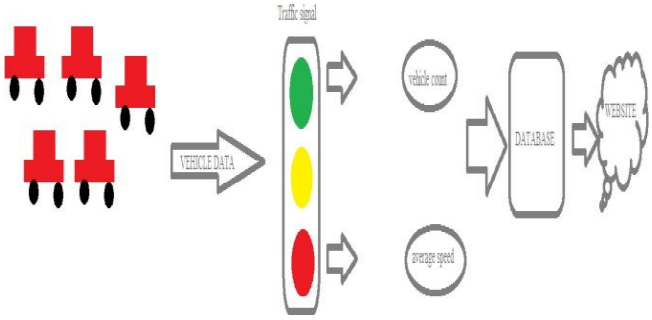

Fig.2. Design of the vehicle traffic monitoring system

The system design is shown in Fig.2. In the simulation model infrared sensors have been used instead of them the real-time systems using this methodology can use efficient senors for detecting vehicles which ranges its detection power till kilometers. Also the website can be modified to provide various login details for privacy. Linking the system with various area maps also will be great hike to the system provided with efficient accurate and time to time updating.

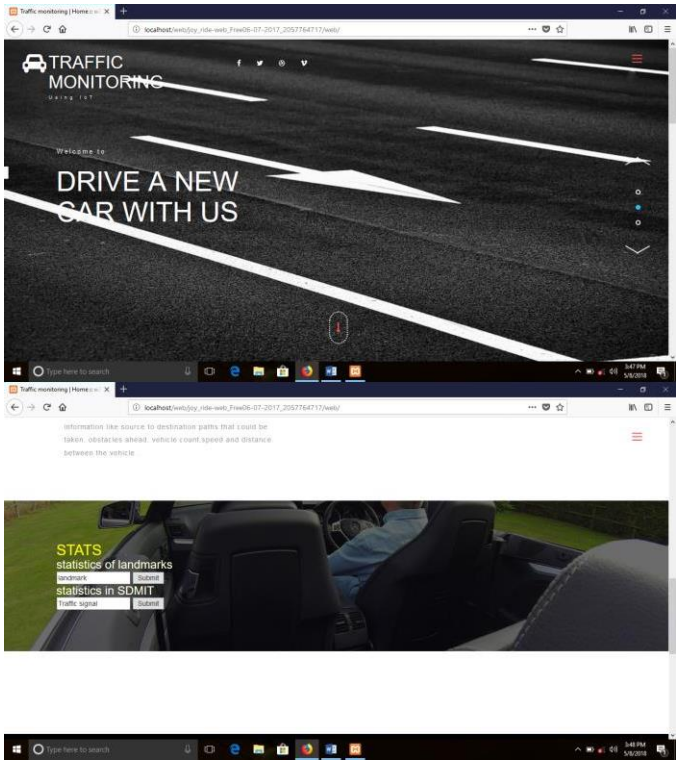

Fig.4.The front end website with user interface

IV. EXPERIMENTAL RESULTS

The vehicle count, speed and all other calculated results are reflected to the front end website (Fig.4.). This website takes data from the SQL database shows the user with the results. The front end created has a textbox provided to enter the landmark where the traffic data has to be analyzed and checked and when entered by the user it hence retrieves information from the current database. Also the statistics of the current location of the user can also be obtained in the next place on the website.

V. CONCLUSION

With increasing traffic, a system to detect and control high congestion in areas become important. Even though the implementation of such a system needs a lot of work with its cost rising and taking a lot of time once implemented this will provide a stunning and cool result when spread around. The system proves to be efficient, accurate and lee prone to errors.

VI. REFERENCES

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