A Smart Traffic Management System for avoiding Traffic Congestion Using Internet of Things (IoT)

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ABSTRACT

Over the decades, there has been a sudden increase in the number of vehicles on the road. Traffic congestion, is agrowing problem faced by everyone these days. Manual control by policemen over Trafficis not sufficient. Also, existing time for the signal at all circumstances (low and high Traffic density) has not solved the problem. No proper IR sensor are available to identify the exact number of vehicles in a signal, due to which even when there are no vehicle to pass the signals are on green. The effective solution to solve a high Traffic congestion , vehicle collision problems and the priority of emergency vehicles is also proposed by using internet of things. Cloud are used for internet based computing, where it experiences different services such as server, storage and application to deliver the respected organization. Cloud computing store data on the internet which must provide continuous update so that it can handle Traffic smoothly. We further use load cell to approximately calculate the amount of time required to clear the Traffic on a particular road based on the density of Traffic. RF transmitters are used in emergency vehicles to transmit signal to RF receiver mounted on Traffic signal. This makes sure the signal is turned green to let the emergency vehicle pass by. This system employs key technologies: Internet of Things, Load Cells and RF Transmitters and Receivers to collect, store, manage and supervise Traffic information. Multiple advantages of the work are: Cost effectiveness, reduction in waiting/ travelling times with cost and fuel efficiency are the major concern.

Keywords: Load Cells, Internet of Things (I0T), RF Module, PIC Microcontrollers, LCD Display.

INTRODUCTION

The term internet of things was developed by Kevin Ashton of Procter and Gamble in 1999. Internet of things connects the gap between physical world and virtual world. Internet of things provides a platform for working of smart devices which can be connected for various applications which is used for sending and receiving some dataor information which can be further processed to generate meaningful analytic results. I0T has two main parts; Internet being the backbone of connectivity, and the Things that refers to objects or devices. With the increasing number of vehicles owned by individuals, Traffic Congestion is an ever rising problem.Out of many various reasons for Trafficcongestion, vehicles waiting for a longer time at a signal lights also contribute significantly for the same. Emergency vehicles blocked by such huge Traffic can putlife‟ s in danger. There is currently no mechanism available for the clearance of Traffic in suchscenarios of an emergency. The existing systems of manual control of Traffic or predefined time for change of Trafficlights are inefficient. The goal of Trafficcongestion and management system is to clear the accumulating Trafficas soon as possible. It is a known fact that even when there are less vehicles on one lane and more on another, the green signal is turned on for the same time thus wasting precious time on green signal for empty roads. This paper proposes a solution to solve this and also aims at providing priority to emergencyvehicles stuck in the Traffic jam. The emergency vehicles are provided with RF transmitters, the RF receivers are mounted on the signal lights. The sensor then detects the emergency vehicle and lets to pass . The road on which the emergency vehicle is located is then traced and that corresponding signal is turned green..

RELATED WORK

In the field of I0T, many systems are proposed in order to control and manage the Traffic system effectively. Each of the systems use different types of technologies, components for managing Trafficcongestion like IR Sensors, RFID‟ s,Trafficwarning systems, Big Data, Bluetooth and many more. The following are some the works that are related to our project. Over the Decade, the Internet of Things evolution has been unimaginable. Recently, various driver assistance systems have been actively developed that uses both information communication technology and on-board sensors. Invisibility of Traffic signal caused by huge vehicles blocking the view, prevent

Traffic congestion in toll gate and give advanced collision warning to the drivers. A microcontroller with a RF module will be installed and is programmed to connect to each automobile passing by. Later it displays signal status on the Traffic signal status display system installed inside the automobile. This system installed in the vehicle is also capable of giving collision warnings to the driver.

I0T links the objects of the real world to the virtual world. It constitutes to a world where physical objects and living beings, as well as virtual data and environments, interact with each other. Urban I0Tsystem that is used to build intelligent transportation system (ITS) has been developed. I0T based intelligent transportation systems are designed to support the Smart City vision, which aims at employing the advanced and powerful communication technologies forthe administration of the city and the citizens.

ITS usestechnologies like Near field communication (NFC) and wireless sensor network (WSN). Automation combined with the increasing market penetration of on-line communication, navigation, and advanced driver assistance systems will ultimately result in intelligent vehicle highway systems (IVHS) that distribute intelligence between roadside infrastructure and vehicles and in particular on the longer term, are one of the most promising solutions to the Traffic congestion problem .The most frequently used component for Traffic congestion control is IR sensors. The objective of IR sensors is that, using the IR transmitter and receiver decreases delay, fuel wastage, wear and tear of vehicles, collisions, Traffic jams, frustration of passengers and drivers. An IR sensor is placed at the Traffic lights. This IR sensor will detect the Traffic on the road and will then label that Traffic as light, normal or heavy Traffic. The assumption of the Traffic by the IR sensor will be taken by the microcontroller and that will be sent to the webpage through the GPRS module installed. To measure the Traffic density, other than IR sensors Inductive looping as an instrument, concept was developed. A microcontroller was programmed to receive information about Traffic density on different lanes, as measured by the inductive loops. An

Automated Highway System (AHS) represents theevolution of the current interstate highway systemmaking use of both intelligent vehicles and smart highways. The latter would include roadside monitors that will measure Traffic flow, patterns of vehicular Traffic volume, vehicle

speed, vehicular routes, heavily Trafficked intersections, and ways to prevent gridlock in vehicle-intense urban centers. The Traffic flow is evaluated at one-way, perpendicular intersections by use of paired infrared (IR) sensors, an IR LED and an IR photodetector .There are many approaches that are followed by different countries. Each adopted Trafficmanagement techniques have some loopholes.

In the countries like USA, San Jose, California, Portland etc follow Adaptive Traffic Control System. This system creates more Traffic towards residential streets. This system partially reduces the congestion on US arterial roadways. More initial cost for both field equipment and Traffic management center management. Higher maintenance cost for the field components. More difficultly initial system setup and tuning process. In Sydney, Oakland County, Michigan, Sydney Coordinated Adaptive Traffic System is followed. SCATS sometimes fail to manage dynamic timing of signal phases at Traffic signals, meaning that it fails in finding the best phasing for the current Traffic situation, if Traffic is hectic. There is only average of 7.8 % reduction in delay. Active Traffic Management system is followed in Washington state and Minnesota. It includes multiples strategies to smoothen the high Traffic and leads to confusion. This technique is time consuming. It disturbs the network by injecting artificial probe Traffic into the network. Hence create Trafficcongestion.

Split Cycle Offset Optimization Technique is followed in Dubai. The technique used requires high operational cost and mainly concerned on highways. Only delay reduction of up to 19% during special events, 8% decrease in travel time, 17% decrease in delay 7% travel time. Optimized Policies for Adaptive Control is followed in Northern Virginia. Only 5-6% improvement in delays is obtained. Performance measure like logged measures of effectiveness, including average cycle lengths, vehicle counts by phase, and average phase green times and estimated speeds is not completely achieved. The proposed methodology uses which load cells reduces the wastage of time, fuel consumption, Traffic congestion. It also provides special clearance of Traffic for emergency vehicles that are deployed with RF transmitters in it. When an emergency vehicle, pass the RF signal, it is received by RF receiver that is placed at about 10-15 meters from emergency vehicle. Hence incidents like Traffic congestion or disturbance in Traffic system is completely

avoided. During orange signal, complete details of vehicles in the specified road will be uploaded to the cloud. Information about the required time will be displayed, depending on the density of the Traffic during green signal.

EVOLUTION OF ALGORITHM

Consider four roads like R1, R2, R3 and R4. In each road load cells are deployed at an appropriate distance. When it is R1, each and every vehicle passes the load cell. The load cell is programmed in such a way that, it calculates the weight of each vehicle‟s specified weight even if it is moving simultaneouslydepending on the position of the vehicle and its pressure towards the load cell. If ten vehicles pass the load cell, each type of vehicle‟s count will be incremented. For example, two wheelers, three wheelers and four wheelers are the type of vehicles. Later total count of all vehicles is calculated for the computation of time duration to be displayed. These processes are carried out when the signal is red. When the signal is yellow, the details about the density of Traffic will be uploaded to cloud. Information about the density of Traffic can be observed using the URL provided. During green signal, time duration for passing the vehicle will be displayed. If there are any emergency alert by emergency vehicles, RF receivers which are placed at Traffic signal receives the signal from RF transmitter that are deployed at emergency vehicles. Consider if all four roads have the signal like 00, 01, 10 and 11. If road R2 is in green signal, that road will receive 00 signals. If emergency vehicle arrives, depending on the green signal, the driver needs to send specified signal (like 00, 01, 10, 11) through RF transmitter. Hence that road is been cleared.

Algorithm

//Description: emergency_ veh (trans, receiver)

//Input: 00, 01, 10, 11 signals from Emergency

vehicles

//Output: Clearance of road Traffic for emergency

vehicles

Step1: switch (signal)

case 00: clearing road R1

case 01: clearing road R2

case 10: clearing road R3

case 11: clearing road R4

End of algorithm.

PROPOSED WORK

This system is developed to overcome the major disadvantage of the existing system and hence it enhances thefeatures existing system for better Traffic control and management. In this model the load cells are placed beneath the roads, and as the vehicles pass on the road, the load cells convert the load acting on them into electrical signals. Thenumber of vehicles on the road are then approximated and depending on the density of the Traffic, this model calculates the amount of time to be dedicated to clear the Traffic on each side of the road. The Traffic density is further updated in the cloud where the end user can for see the Traffic by logging into the URL which is dedicated for this purpose. The waiting time period is then displayed on the Traffic signal. This process happened when the signal is red. When the signal is turned yellow only the time period is updated in the cloud for the users to have Traffic density information. When the signal turns green, the reverse count of remaining time is displayed on theTraffic signal board. The distinguishable feature of proposed system is that it is feasible and preference is given to the emergency vehicle such as an ambulance. During an emergency, if an ambulance happens to get struck on a particular road due to high Traffic, then the driver can raise a request by using the RF transmitter fixed in the ambulance. The signal is then passed to the RF receivermounted on the Traffic signal and the signal of that roadis turned green.

Due to heavy traffic on road due to tremendous increase in population the number of accident occurs on roads are also increasing day by day, to prevent accidents from signals, all the signaled roads must be provided with circles where vehicles come turn to the circle and move on their way, which reduces the speed of driver slows down automatically so that the accidents can be prevented.

THE ADVANTAGES OF THE PROPOSED SYSTEM ARE:

- The equipment is cost-effective.
- The electronic units can be deployed at Traffic junctions for enforcing Traffic regulation across cities.
- It helps reduce waiting and travelling times hence save fuel and money.
- The end users can always have a foresight about the Traffic through the android application and take smart actions.

- A provision for emergency vehicles to pass the signal is also a major cause of concern.
- In general, theI0T plays an important role in the Traffic management enhancing the efficiency of information transmission, improving Traffic conditions and management efficiency, Traffic safety, and reducing management costs.

THE FUTURE ENHANCEMENTS INCLUDE

The proposed Traffic system based on the I0T consists of a large number of RFIDs and sensors that transmit data wirelessly. This calls for improved security to protect such massive amounts of data. It,,s a challenge for future research to ensure the security of smart objects in the Traffic monitoring management system in case of a cyber crime or an intentional interest to a member of the I0T infrastructure.

They can also place sensors and cameras at each signals so that sensors will have a count on the number on vehicles waiting in the signals, so that they can analyze how many vehicles are moving each and every second and they can also take some prevention to avoid it.

More advanced systems can be built which can help control Traffic at the tolls too.

CONCLUSIONS

Our work presents a real-time Trafficinformation collection and monitoring system to solve the problem of real-time monitoring and controlling road vehicles. An intelligent communication network is created in an effort to help Traffic flow and alleviate Traffic problems in large cities. The proposed system employs key technologies: Internet of Things, Android application, Load Cells and RF Transmitters and Receivers to collect, Store, Manage and Supervise Traffic information.

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