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Density Based Traffic Management Using IoT

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Abstract

The Internet of Things (IoT) plays an important role in developing many applications, which could be sometimes real-world entities. The main objective of the project is to alter the time at the signal based on a number of vehicles. Depending on the number of vehicles passing through the IR sensor the time gets varied. If the number of vehicles is more it allocates more time so that there would be further decreased in a traffic jam. Microcontroller automatically adjusts the time gap between two successive intervals of time, which is commonly known as dynamic time adjustment system or dynamic traffic signal system based on density.The webpage which must give a continuous update so that it can handle traffic smoothly.

Key Words::Internet of Things, IR Module, Traffic Management.

1 Introduction

Internet of things (IoT) is, as for, contemporary functionality and best productiveness by uninterrupted connection of devices. Kevin

Ashton first proposed the term internet of things in 1999. Internet of Things is the future that transforms the real world physical objects into well-informed virtual objects. The lack of architecture standards for the industrial and connectivity in the IoT is a major threat.The reference frameworks for the Internet of Things are uniquely identifiable objects and their virtual representations.It connects heterogeneous communities. Industrial Internet and Industry 4.0 are the alternative names of IoT in North America and Europe respectively. The properties of the Internet of Things are dominance and attributes. IOT devices are inherently connected, we away from interacting with them and are commonly used for collecting and analyzing personal data. The Density Based transport system plays a major role to reduce the traveling time, waiting time, traffic conditions at a particular area, weather conditions, etc. Secondly, to monitor traffic signs, to monition the vehicle driver and control or disallow certain actions, traffic sign recognition is used. To support and disburden the driver, also driving safety and comfort, a fast real-time and robust automatic traffic sign detection and recognition is used. The automatic recognition of traffic signs is important for automated driver assistance system to provide the driver various information for safe and efficient navigation.But the traffic sign identification with respect to various background viewing conditions is a challenging task. Facilitate transportation difficulties, reduce traffic volume waiting time, understate overall travel time, effieciency,optimize the safety of cars and elaborate the benefits in economic ,health and environmental spheres can be upgraded by conventional traffic system. To improve time management and to overcome many flaws, the simple, low-cost andreal-time smart traffic light control system has made its implementation. To control various operations, to monitor the traffic volume, to calculate the density flow thru infrared sensors and to change the lighting modulation slots accordingly the microcontroller based system has to be used. Let us have a brief survey of the volume of vehicles that the number of vehicular purchasing is maximizing. Private vehicle sales are believed to be largely responsible for the increase in registration of vehicles. In 2014 in India, the total registrations stood at 1.94 crores. The highest vehicle registration in India, Uttar Pradesh, with 24.38 lakh number of vehicle registrations had been recorded in 2015. Maharashtra holds second place with 19.91

lakh number of registrations followed by 15.15 lakhs in Karnataka, which holds third. There is an expectation that countrys vehicle population could touch at least 35 crore number of vehicles from the present 18.6 crore number of vehicles in next 20-30 years. So governing of vehicles to manage the traffic is definitely a crucial one. The designed system consists of various subsystems such as an Infrared sensor, low power ,comparators and Energy Efficient Microcontroller and Here we focused on the development of intelligent traffic system i.e. signal light controller using IR sensors and Microcontroller. The limitation in a traffic control system in normal vehicle detection is that they have to be controlled only by the human [4]. The Density-based traffic management system provides an easy manner to measure the traffic snarl-up data final results in more efficacious control. Major vantage of utilizing the density-based control through the infrared sensor is that it is beneficial to both environment and economy [1]. The overall efficiency, accuracy and the capability of real-time flow control can be improved by this system. Each sensor has the capability of sensing the traffic density and litigate the data through microcontroller for performance. At each lane, each sensor is positioned at a specific calculated location over the line. The sensors are linked to the microcontroller via a wired connection. The result will be envisioned in the form of a number of seconds the signal has to beam.

2 ANALYSIS

In the analysis phase, it has been specifying the existing system and the proposed system. The analysis phase also focuses on providing details regarding both hardware and software requirements.

2.1 INDUCTIVE LOOP SYSTEM

The principle of Inductive loop detection system works with the principle that one or more turns of insulated wire are placed in the shoal exscind in the route. A lead-in wire runs from roadside pull box to the electronic unit and the controller located in the controller storage system. The induction of the wire is changed when a vehicle passes over the loop or stops. Obviously, there will be a change in the frequency. The controller will be receiving the

signal indication, which is the frequency change in the electronic unit. This inductive loop detection system is useful in getting the vehicle presence, passageway, occupancy and even the number of vehicles passing via a specified region. But there are few limitations in this system. The poor dependability of system due to improper connectivity made in the pull boxes and due to the diligence of sealant over the cutoff of the road. If this system is enforced in the poor pavement or where delving of the roads is frequent then the problem of dependability will be worsened.

2.2 VIDEO ANALYSIS

Video analysis comprises of a smart camera, which contains sensors, a processing unit,and a communication unit. The continuous traffic will be supervised with the help of smart cameras. The video, which is captured, is compacted to reduce the transmittal bandwidth. The raw data will be collected via video analysis. Traffic statistics will be done by this statistical data. These stats include average speed of vehicles, the frequency of vehicles and the lane occupancy. Following are the problems consociated with video analysis- 1. The system gets impacted in case of heavy rains or fog. 2. The total toll of the system will be quite high. 3. Night time surveillance requires thorough street light arrangement.

3 SYSTEM DESIGN

The Density Based Traffic Management System consists of mainly Microcontroller, which is the heart of the system, IR Sensors placed on top of every lane just far away from signal lights, Ethernet shield to intercommunicate with the website via the internet. IR sensors are arranged on each lane, above the road at a certain distance, say 500 m (each side of the junction). These IR sensors are connected to one microcontroller. The IR sensor collects the data that has crossed it and transfers it to the microcontroller. It will analyze which lane has more density and the green signal will be assigned to that specified lane which has much traffic [4]. The signal lights are connected to the micro controller, which reflects density in the form of green light. More time slice will be assigned to a particular

lane, which has much density. The lane which has less traffic gives its own time to another lane which has much density [5].

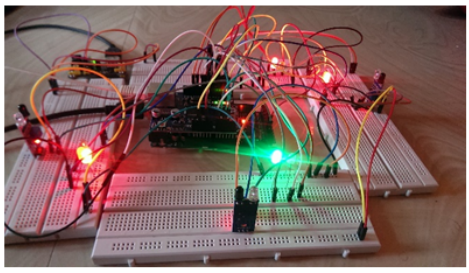


Fig 3.1:DENSITY BASED TRAFFIC MANAGEMENT SYSTEM

3.1 HARDWARE REQUIREMENTS

(a) Arduino Mega 2560:
The Arduino Mega Microcontroller can be simply a microcontroller-based, which has 54 input digital pins and output pins. In that 14 pins can be used a Pulse Width Modulation outputs, 16 analog pins, 4 Universal Asynchronous Receiver Transmitter (UART) serial ports, crystal oscillator of 16MHz, an ICSP(In Circuit Serial Programming), USB connection ,power jack and a reset button. Everything needed to abide by the microcontroller will be held. Just colligating with the computer with the help of USB cable to charge with an AC to DC adapter or simply to a battery. The Mega 2560 is a modified version of Arduino Mega. 2560 has 8 KB of SRAM, 4 KB of EEPROM and 256 KB of flash memory for storing code.
(b) IR Module:
IR Module is a mixture of of transmitter and receiver that emits IR energy and awaits for reflected IR energy to sense the presence of any obstruction ahead of the sensor module. The potentiometer on the module lets the user adjust the detecting range. Even in the total dimness, the sensor has a beneficial and static response. An IR sensor contains an LED and a Photodiode. Infrared radiations will be emitted by LED, which will be situated in IR sensor. The radiation, which will be emitted by IR transmitter, will be unconscious to the human eye. They can be called as IR sensors because they sense the radiation of an IR transmitter. IR receivers act as

phototransistors and photodiode. Normal photodiodes detect only infrared radiation. But IR Photodiodes are different. When IR transmitter emits radiation it hits the object and a part of the radiation will be reflected back to the IR receiver. Depending on the intensity to the receiverthe result of the sensor will be determined.
(c) Light Emitting Diodes:
The main component of the system is Arduino ATmega Microcontroller, could also be stated as the heart of the system. The microcontroller considers the input, which will be given from various interlinked devices, and externalizes the result which is responsible for the final output. Here, the microcontroller receives the number of vehicles that pass over, from the IR sensors, calculates the time slice respectively and exhibits the turnout. The count will be incremented whenever a vehicle crosses over from the IR sensor. IR sensor is placed over every lane, a bit far from the signal lights. So IR sensors consider every vehicles pass over as input and send it to the microcontroller, which computes the time slice for every lane, with respect to a number of vehicles and cast the output in the form of signal lights. To connect to the internet, Ethernet Shield is used.
(d) Ethernet Shield:
The Arduino Ethernet Shield modifies the Arduino to transfer data to anyplace globally with an internet connectivity. We can use it to receive notifications on the website like message arrival, bell ringing, etc.; remotely. The shield appropriates an unending amount of data by allowing to associate with any project to the internet. The shield will be attributed to an IP address and a MAC address. The MAC address is a unique identifier for each device, worldwide. Latest Ethernet Shields come with a label suggesting MAC address which must be used. In olden shields, there would not be any kind of MAC address but the same address would not be used. Genuine IP address looks at the configuration of the network. A recommendation could be a DHCP usage with the IP to the shield. It can also be specified with a network gateway. The upcoming shields also include resetting controller which assures that the Ethernet module is rightly reset on power-up. Old versions were not simpatico with the Mega and manually reset after power-up.

3.2 BLOCK DIAGRAM

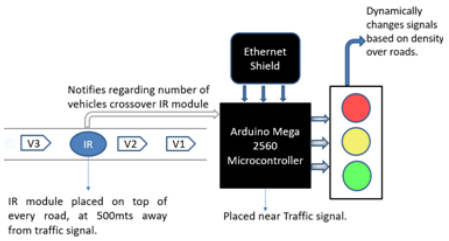


Fig 3.2.1: BLOCK DIAGRAM

The following block diagram shows the Arduino board, which gets in connection with the IR sensor, Ethernet shield, LED lights (red, yellow and green) and vehicles. V1 and V2 are the vehicles that passed over from the below of IR sensor, each placed above every lane. V3 is yet to cross the IR sensor. So with two vehicles passed it is counted as 2 and will be sent to the micro controller. The micro controller calculates how much time to glow the green light with respect to a number of vehicles crossed over the IR sensor. The Ethernet shield will be mounted over the micro controller is to depict the web page that shows that which lane is busy with traffic. The page will be refreshed for every two seconds. The micro controller is placed near the signal lights. Suppose two vehicles have passed the IR sensor. So the output, in the form of green signal lights, will beam for four seconds. For eight vehicles, it could be 16 seconds. The normal cyclic process of glowing will be broken when any lane is jammed with more number of vehicles.

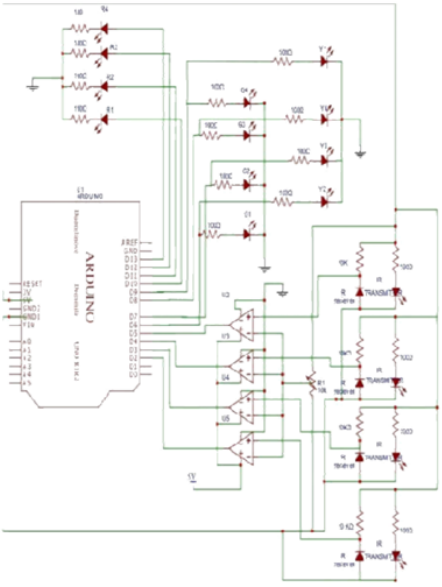


Fig 3: CIRCUIT DIAGRAM

The advantages that are projected by the design are– 1. This suits the best where the manual traffic control seems difficult. 2. Static time management becomes petty unmanageable because at one situation the fixed time becomes insufficient to clear the heavy traffic and conversely, less traffic clears a particular lane which becomes a time dissipation for the rest of the lanes.

4 WORKING MODEL

Initially,the microcontroller is fixed at the traffic signal lights. The four IR sensors are placed at the top of every lane, each, just away from signal lights. Ethernet shield is put on the microcontroller board which is used to interact with the internet through a website. So as vehicles pass through from down the IR sensors the number of vehicles will be counted and the information will be sent to the microcontroller. It calculates the time slice of each vehicle to be projected as output in the form of a green light beam. For each vehicle crossover, the time calculated for each vehicle will be 2 sec. So for additional vehicle pass through, multiple of 2 sec.

will be added. If there is continuous vehicle blockage at IR sensor, it is a denotation that traffic has reached a certain maximum limit and the green signal beaming time will be 50 sec (time will be set depending on particular area). The information regarding the number of vehicles pass over and green signal timing will be displayed on the webpage (with the help of Ethernet shield). Our future scope would be like if an ambulance or other emergency vehicle gets stuck in the traffic, particular lanes signal must turn green no matter what the signal before is.

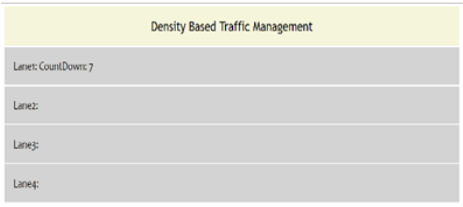
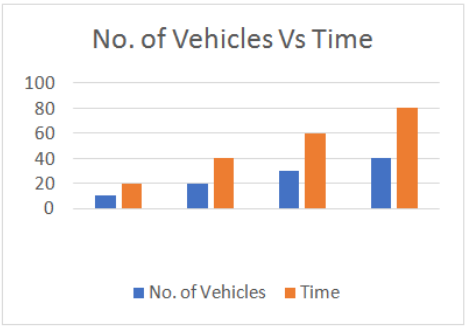


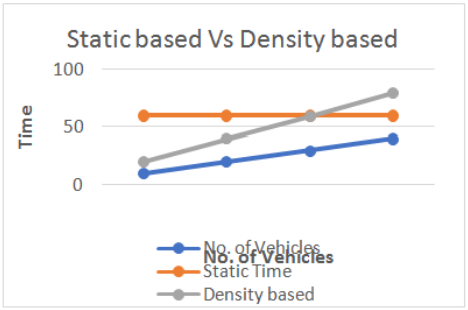
Fig 4: Web page showing green light is beaming at lane one with 7 seconds.

5 STATISTICAL DATA

The statistical data shows that the advancement of the density based traffic management system when compared with static based.



Graph 1: Showing No. of Vehicles Vs Time in Density-based traffic management.



Graph 2: Showing time lapse for Static based vs Density-based traffic management

6 Conclusion

Our work concentrates on Smart traffic management system using IR module which will annihilate the limitations of the subsisting system such as hugeeffectuation cost, dependence on the environmental conditions and so on. The purported system targets at effectualmanagement of traffic over-crowding. It is also cost-effective than the existing method.

7 FUTURE WORK

Moreover, the study shows the troubles in urbanite areas regarding exigency vehicle passage, everywhere around the world caused by congestions. The economies will get impacted by traffic congestion, worldwide. Especiallyurbanite areas are most forged under the emergency conditions. Congestions have a damaging impact on the natural world and hence the overall tone of life. The proposed system can be heightened or improved by using any other powerful communicating network called RF module.

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