Smart Intelligent Traffic Signal System

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ABSTRACT

Traffic congestion is a serious problem in many major cities around the world and has become a major issue for travellers in all towns. The latency of the corresponding light is hardcoded in the signal and does not rely on traffic. It creates unnecessary delays for passengers, which could not be feasible in every situation, as if they were in time, is essential to everyone. Density, pace, and flow are the three-basic metrics for the study of road traffic. As the number of road users is constantly increasing and the resources provided by the current infrastructure are limited, traffic control has now become a very important issue. Ambulances are also one of the major problems posed by heavy traffic. The goal of this project is to tackle traffic congestion, which is a serious problem in many urban cities around the world. The traffic intensity is regulated by an Arduino. This device includes an IR transmitter and an IR receiver which are placed on either side of the road. The IR device is triggered whenever a vehicle passes between the IR transmitter and the IR receiver. The purpose of the use of an IR sensor is to identify vehicles. Based on the number of car density, the Arduino makes a decision and therefore changes the traffic light delays. If the intensity is greater, the LED will appear longer than the normal average and vice versa. It ensures that the position of the traffic lights is dictated by the number of cars. This helps to reduce traffic congestion and has scope for further expansion in the future. By calculating the traffic lined up on a particular road, the signal timings are changed to enable the particular path to be cleared and then the next one to be filled. It also consists of an emergency override that requires traffic officials to manually activate a particular signal when an ambulance or a large vehicle appears on that road.

Keyword: *Traffic signal control, Traffic management, Smart city, Arduino*

1. INTRODUCTION:

Traffic congestion is one of the key issues in metropolitan cities. It has made life burdensome for commuters. In the current case, highways are guarded by a larger proportion of vehicles. The main reason for traffic congestion is rising unemployment and flexible working hours. There is a greater possibility of congestion by aligning with fixed times in the workplace. The daily routine of the commuters is interrupted by traffic congestion. This leads to a delay in reaching the destination. The traffic control system automatically changes the timings of the traffic signalling based on the density of vehicles on a particular lane using a traffic detection unit and also gives priority to emergency vehicles with the help of a signal adjustment unit. A microcontroller is interfaced with the traffic detection unit and signal adjustment unit. The infrared sensors serve as the traffic detection and density unit on a particular lane. An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings. If the density value from the vehicle exceeds the pre-set value, or is continuously increasing over a chosen period, the system automatically changes the timing duration of the signals.

There are also no priority services for priority vehicles such as ambulances, fire brigades, etc. Special services should therefore be given to priority cars. Traffic congestion and mismanagement can result in a long wait, a loss of fuel and energy. It is therefore important for the implementation of a rapid economic and effective traffic control network. The current system can be improved by the use of software and sophisticated traffic control systems.

2. LITERATURE SURVEY:

2.1 LITERATURE SURVEY 1

One of the most real ways to deal with this problem is by using traffic control signals at intersections. Nowadays, most signal controls are implemented with static cycle time control or manual control. These traditional methods for traffic signal control fail to deal efficiently with situations of traffic congestion. Therefore, this study takes benefit from one of the Artificial Intelligence (AI) fields which is Expert System (ES) and which can be called the Rule-Based System (RBS). The researchers designed a new expert system called Traffic Lights Expert System (TLES). TLES uses a rule base as the knowledge representation and the evidential reasoning as the inference engine. This system can allocate a suitable dynamic cycle time at the intersections. The system is connected to the hardware design to control the traffic lights and monitor congestion levels at the intersection using Arduino and Infrared Radiation (IR) sensors.

2.2 LITERATURE SURVEY 2

The major goal of the project is to make traffic management systems work dynamically using the Internet of Things, Infrared sensor and Image Processing to make traffic systems work efficiently. Traffic management automation systems in the market aims to computerized the traffic lights, operates on a periodic schedule to control the light (red/yellow/green) uses various technologies like GSM, NFC focuses on the basic operation of an electrical switch. Our project plan to provide an automated IR-sense based solution that makes traffic signals to shift the lights (red/yellow/green) dynamically. We plan on implementing the project for one junction "Proof-of-Concept" for this paper, which includes traffic lights, IR-sensors, Wi-Fi transmitters, and Raspberry Pi microcontroller. The sensed data gathered from an IR sensor is transmitted by the Wi-Fi transmitter which is received by the raspberry-pi controller. Based on this compilation it dynamically shifts the time of the red signal and the user gets an intimation of the status of the signal on his way. The Raspberry Pi controller works as a central console, it determines which sideways of the road signal is to get open or close. The central console gathers all the data from sensors and stores it in the cloud which intimates traffic status to a mobile device.

2.3 LITERATURE SURVEY 3

Density-based traffic control system, which allocates different time slots to each road according to vehicle density. The vehicle density is measured in three zones low, medium and high. The traffic density in each lane is measured using IR sensors. Accordingly, the traffic signal lights give the green light based on the vehicle density. This system also comes with RF signal override control in case of emergency vehicles such as fire brigade and ambulance. The RF transmitter and a GPS module are placed in the emergency vehicle. Whenever the override feature is activated, the green light is given in the desired lane for some time by blocking all the other lanes by giving them red light. So, this is also a priority-based system. This system, therefore, offers advantages over conventional traffic control system.

2.4 LITERATURE SURVEY 4

The project aims to design a density-based traffic light control system interfaced with a barrier gate and a GSM technology. The signal timing changes automatically with the density of the traffic and delay is provided with the help of a microcontroller. When the signal is red the interfaced barrier gate closes and a buzzer notifies the closing of the gate, thereby blocking the traffic but when the signal is green the same barrier opens and allows the proper flow of vehicles to avoid traffic jams. The density of traffic is detected using the IR sensor and the output is given to the microcontroller for timing change of the signal, and buzzer action. In front of the barrier gate, a stop line is drawn and with the help of another IR sensor, the vehicle is tracked whenever it crosses the stop line. If the vehicle crosses the stop line, the intimation is given to the nearby control room, carried out by GSM technology. PIC microcontroller is used for signal timing change based on the density of traffic.

3. EXISTING SYSTEM:

According to this scenario, the scientific community developed several studies concerning traffic congestion using electronic devices with Arduino platforms. Therefore, our study has been structured by:

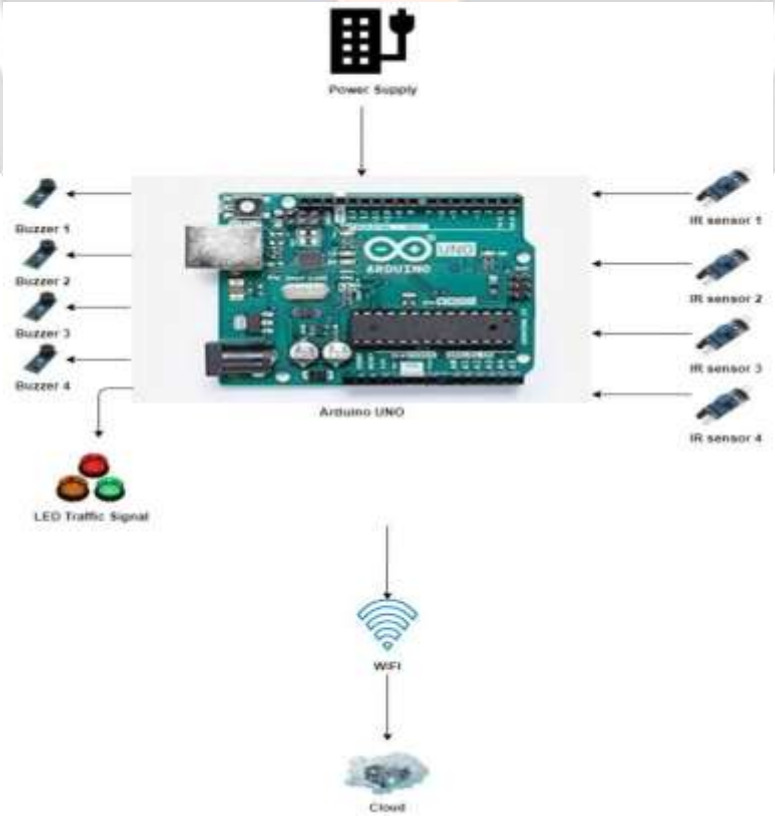
- the type of collection of data
- its application
- its topology and
- its method of analysis.

In relation to the type of collection of data, there are two subdomains: Eulerian and Lagrangian. In regards to Eulerian studies uses the method of analysis of images captured by cameras, uses magnetic sensors to collect data, applied the inductive method, are based on Bluetooth sensors that pick up signals from devices that emit these waves, use different type proximity sensors, uses infrared sensors, includes a combination of ultrasonic sensors, Bluetooth and laser. As an alternative, there is a Lagrangian type proposal, which uses moving devices such as cell phones. For instance, capture data across nodes located in the vehicles, while using mobile phones to read the traffic. Furthermore, there are studies that merged both Eulerian and Lagrangian sub-domains, using wireless sensors networks (WSN) and GPS cell phones. Regarding the application developed, it presents an application to observe the flow in real-time, focuses on finding traffic trends, enhance the simulation of traffic, focuses on making a description of the traffic. With regard to the use of a network topology centralized signals from nodes in one central to incorporating ZigBee devices. Finally, in reference to the method of analysis of the data collected, it uses a mathematical model, incorporates software agents, and finally apply origin-destination matrixes.

4. PROPOSED SYSTEM:

The limitations of the current traffic system are eliminated in the proposed system. In this system, Arduino UNO is interfaced with IR sensors to change the timing of the traffic signal automatically to ensure that there is free movement of vehicles on road. The problem caused due to fixed time delay is eliminated. The proposed system is observed to be more efficient than the existing traffic controller in terms of reducing delay and emergency override feature. IR sensors are used to detect the obstacles (i.e. vehicles). It detects the vehicles based on the IR light transmitter and receiver and then based on the density the values in the signal get automated. These IR sensors are very much helpful in finding the density of the vehicle in real-time. It detects the vehicles in all the lanes which are kept in particular ranges so that we can able to identify the number of vehicles which are present in the particular route and we can able to automate the signals. The normal IR sensor can able to detect up to 10m range and even higher if tuned. So, these IR sensors are set up to particular distances within the specified range by which the sensor detects and each sensor detects the obstacles like vehicles and provides the recorded values to the database. The traffic signals are automated mainly based upon the sensor values recorded and by this, we can able to reduce and monitor the amount of traffic present in the particular area. The entire architecture specifies about sensing and storing the data in the cloud to show the users the updated environment about the traffic congestion and signal details in real-time using this system.

5. ARCHITECTURE DIAGRAM:



6. CONCLUSION:

The proposed system is a density-based traffic monitoring system that provides effective traffic lighting regulation by dramatically reducing excessive road waits. The number of IR sensors mounted will define the traffic intensity spectrum and therefore act as a priority-based system as it offers emergency override functionality. The future purpose of this project rests on the successful implementation of a real-time control device by enhancing the system's accuracy. Deployment of the proposed system on a large scale produces advantages such as less pollution and therefore less fuel consumption.

7. FUTURE ENHANCEMENTS:

The sound detection sensors can be used to identify the ambulance, fire brigades and police sirens which will automatically override the system and can let pass the emergency vehicles in the signal thereby reduces the unwanted waiting time of emergency vehicles. The congestion intervals in the day can be identified and based on that the algorithm can be set to give a more efficient output.

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