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Development Of Smart Traffic Light Scheduling

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ABSTRACT

Creating a density-based, self-adaptive traffic signal system is the goal here. Poor utilization of the same time slot for each of the crossroads' traffic lanes manifests itself in several different ways, including slower speeds, longer journey times, and increased vehicle waiting. To develop, with the help of sensors and other Internet of Things devices, a system that will enable the traffic management system to make judgments on the distribution of travel time for a particular lane based on the volume of traffic in other lanes (Internet of Things). The fundamental objective of this paper is to make it so that one does not have to wait for the opposing signal to turn green if there is no traffic on that signal. This signal will be disregarded by the system, and it will proceed to the next one in the sequence.

Key words: traffic control, Smart Traffic Light Scheduling, light signal controllers.

1. INTRODUCTION

In India, it is practically impossible to cross the street without becoming stuck in traffic because there is a bottleneck at nearly every corner. There is a significant issue, and traffic lights that operate according to a set schedule are not the answer to the problem. Because of this, the vehicles that are stopped at the intersection experience a great deal of difficulty and delay as a result of the fixed-cycle light signal controllers. Manual traffic control is a common occurrence, which is a huge problem since it slows down the flow of traffic by deciding the time slot for each side of the road. This is a major problem because manual traffic control is a typical occurrence [1]. Because of the amount of manual labor involved, we have been motivated to develop "Smart Traffic Light Scheduling," which is a system that regulates traffic based on the number of vehicles present and allots a certain period of time to the light signal based on how much traffic is present [2]. This concept, if implemented in the real world, would help relieve some of the congestion that currently exists at the crossroads [3]. In order to put this project concept into motion, it is necessary to first detect the amount of traffic on either side of the road and then process the information and data that is gathered as a result of those detections.

This intelligent traffic system has several critical functions, the most important of which are to maintain a smooth flow of traffic, move the maximum number of cars, and prevent collisions between the various types of vehicles [4]. In addition, the scheduling of such an advanced system is already done in a manner that is convenient for the users, which results in a considerable reduction in the number of traffic offenses. At practically every junction in India, there is traffic gridlock [5]. It is a big issue because traffic lights that are based on a specific time period do not alleviate the problem. Fixed-cycle light signal controllers also lengthen the wait time for vehicles at the intersection, generating significant inconvenience and delay. We frequently see traffic cops manually regulating traffic, which is an even worse problem because they manually pick the time period for each side of the road, making the procedure even slower [6]. This laborious work inspires us to create a system that controls traffic depending on the number of vehicles on each side of the road and allots time to the light signal accordingly, resulting in "Smart Traffic Light Scheduling." This concept has a real-world application and would aid in managing excessive traffic at the crossroads [7].

To put this research idea into action, we need two parts: detecting the density of vehicles on each side of the road and processing the information and data collected to schedule the signal lights. Another advantage of such a smart system is that it greatly decreases traffic violations because the scheduling is already done in the most convenient manner, taking into account the users.

2. Methodology

The process can be divided into the following three stages:

Even if every crossing at every crossroads is equipped with a traffic light, our system may still function normally in some circumstances.

- If there is no traffic at a particular intersection, the system will bypass that traffic light and proceed to the next one in the sequence.
- Imagine there is no car at signal 1, and the system now allows vehicles at signal 2 to pass because there is no vehicle there. This could very well take place. Signal 2 will be succeeded by signal 3, which will be utilized by the system in place of signals 1 and 4, respectively.

We have a four-light traffic system that will come to a complete halt if there is no traffic at any of the other lights before proceeding to the next one if there is traffic at any of the other lights.

The Arduino will be used in this project to read the data from the ultrasonic sensor and then compute the distance to the target [8]. The traffic signals will be adjusted to reflect the presence of an automobile within a predetermined distance of the signal.
Because we wanted to read continuously from the ultrasonic sensors while simultaneously handling signals, which required the use of a delay, the primary objective was to eliminate delays whenever possible. As a direct consequence of this, we are able to finish our issue

statement as well as all of the reading that is required in the smallest amount of time that is feasible [9].

The solution that we came up with was to make use of a function known as an interrupt that is called by the timerone library. This function is utilised to repeatedly measure a specific length of time in microseconds.

This function will operate the traffic lights while also reading the sensors in a continuous loop.

To assist us in determining the answer to this question, we have set up four ultrasonic sensors in the shape of a crossroads [10]. Arduino will take the data from these sensors and use it to determine the distance between you and the station based on where you currently are. The ultrasonic sensors have a range that extends from 2 centimeters to 400 centimeters. After an object is deflected by an ultrasonic sensor, the sensor itself sends off an ultrasonic wave, which is then picked up by an echo. The formation of a wave requires that the trigger be set to its high position for ten microseconds in order to produce an eight-cycle, forty-kilohertz sonic burst. This burst will make contact with the object and be detected by the echo. The duration of time, measured in microseconds, that the wave spent traveling will be revealed by the echo. After that, we can compute the distance traveled by using the formula S = v*t.

LEDs are connected to the Arduino by resistors with a value of 220 ohms. Both the resistor and the LED are required to be used. It is the responsibility of the resistor to control how much current flows through the LED. The light-emitting diode will stop working if you do not utilise it. If you are working with an LED, the resistance that you need to use can be anywhere from one hundred to ten thousand ohms. Increasing the value of the LED results in a decrease in the amount of current it draws.

3. Results and Discussion

In the context of this project, data will be gathered through the utilization of an ultrasonic sensor, and the Arduino will be used to compute distance measurements. When a vehicle approaches within this distance, the traffic lights will be activated or turned off, respectively.

Because we needed to read continuously from the ultrasonic sensors while simultaneously controlling signals that required a delay function, our primary goal was to get rid of any delay that might occur. Because of this, we are able to finish our reading in the shortest amount of time feasible, which enables us to provide a response to the problem statement.

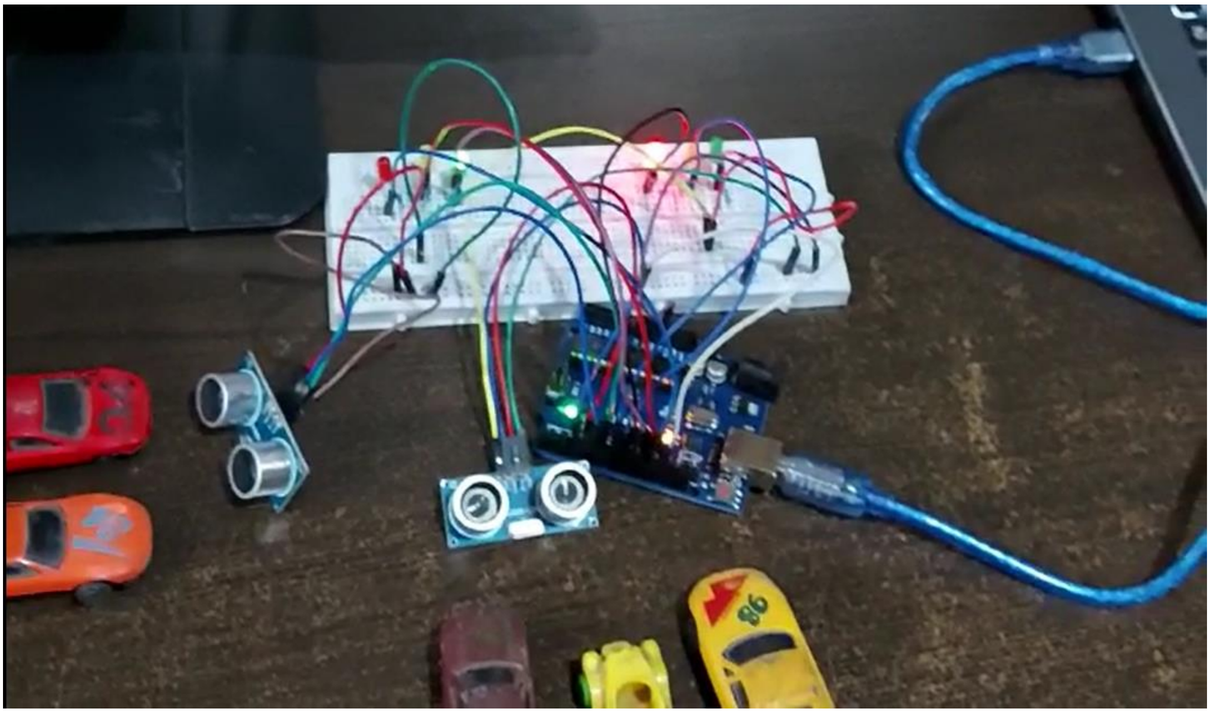
At the conclusion of each interval, we make use of our timerone library to invoke an interrupt function. This method iteratively repeats a given time period measured in microseconds. The readings from the sensors will be gathered in this location, and a feedback loop will be used to regulate the traffic lights. –

The ultrasonic sensors are arranged in a crossroads configuration, with their backs to one another in each of the four positions. Readings from the sensors on board will provide the distance measurement for the Arduino. The range of distances that may be accurately measured by ultrasonic sensors ranges from two centimeters up to four hundred centimeters.

As a result of their trigger, ultrasonic sensors emit an ultrasonic wave, which is picked up by the echo after an item has been deflected. When the trigger is high for 10 microseconds, a sonic burst with 8 cycles and a frequency of 40 kHz is sent to the object. The echo then receives the wave after it has made contact with the object and then reflected back. By utilizing the echo, we are able to determine the amount of time, in microseconds, that the wave took to travel. It is possible to determine how far one has traveled by applying the formula S = velocity times time.

When connecting a series of LEDs to an Arduino, it is essential to make use of resistors with a 220 ohm rating. When connecting the LED, a resistor is required to complete the circuit. The LED's current is kept under control by the resistor. If we don't utilize the LED, it will burn out and stop working eventually. When working with the LED, a resistance ranging from 100 ohms to 10k ohms can be utilized. When the value of an LED is increased, the amount of current that it draws decreases.

The project will be carried out in this manner going forward. We were able to create our software and achieve our goals as a result of the extensive range of concepts and libraries that were available to us.



So that is how we will carry out the project. We were able to develop the software and obtain the expected results by utilizing numerous principles and libraries.

4. Conclusion: The connections were made as required for the project and then the traffic light signals were seen to change according to the density of vehicles on each side of the crossroad. The project successfully ran on the compiler as well as the hardware system that we built, thus, solving our problem statement.

The completion of the project went quite well, I learned so many new things while I was building it, and I got to know various methods as to how we can implement a particular problem statement. I was able to learn the practical use of IoT. The project helped me gain new skills and practical implementation of the code we write on our systems. Arduino provides an open platform for developers to make up projects like this one. Making the project manually myself in the IoT lab of my university helped me in getting acquainted with the components of the lab and how we can use them as per our various requirements.

Overall working on this project was fun as it wasn't only some work to perform and write, but a project to be demonstrated using hardware.

Moreover, this project has given me an understanding of new topics that I was unaware of and made me confident that I can come up with a better approach to the new projects I take in this domain afterward.

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