IoT Based Accident Prevention System

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Abstract— In this IoT Based world, a sensor based accident prevention system has been developed to prevent accidents in hilly terrains. This system alerts the driver of the vehicle in one side about the vehicle coming from the opposite side. This is done by keeping an ultrasonic sensor in one side of the road before the curve and keeping a LED light after the curve, so that if vehicle comes from one end of the curve, sensor sense and LED light glows at the opposite side. The same can be done for the other side too. Well the above logical conditions appears to be simple but it will have certain problems in the following random conditions:

1) Once both car cross each other over the U-turn then they pass over the sensor on both the side. Due to this again the LED lights on both the side will turn ON giving a false or useless alarm which must be avoided.
2) What will happen if any one car (even both cars) stops (due to whatever reason) after crossing either of the sensors.

The solution to the above problem can be provided by programming the microcontroller in a smart way. We have to install two sensors, two traffic poles (with two LED's of RED and GREEN colour on each pole) on both the ends of the curve. After the vehicle enters the curve from one end, the red LED on the other end of the curve glows(and the green LED turns OFF) and remains ON unless the sensor in the opposite end of the curve detects the vehicle leaving the curve(turn RED LED OFF and GREEN LED ON).

Keywords: IoT, LED, Ultrasonic sensor, Accident Prevention System

I. INTRODUCTION

Many IOT experts have developed a sensor based accident prevention system which is a revolutionary step in today's accident prone world. Since the expert has provided a first step toward a change with this system our second step should be to enhance the system so that it can be more efficient and provides solution to multiple problems due to which accident occurs. After doing a research on the system, I came across with a certain set of problems along with a single solution to these problem. The previous system has certain problems in the following random conditions:

1) Once both car cross each other over the U-turn then they pass over the sensor on both the side. Due to this again the LED lights on both the side will turn ON giving a false or useless alarm which must be avoided.
2) What will happen if any one car (even both cars) stops (due to whatever reason) after crossing either of the sensors.

To avoid these problems in curve roads, I am introducing an enhanced version of this sensor based accident prevention system.

Ultrasonic sensor which is also called as obstacle sensor sends signal as a pulse from trigger. If vehicle is present, a signal will hit the vehicle and it is received by the sensor. At that time RED light will glow at the other side of the curve. The light remains glowing unless the sensor in the opposite side detects the car leaving the curve. If the car gets stuck in the middle of the curve road, the light will still glow alerting the driver about blockage on the road. In the absence of the vehicle the signal will not be received by the sensor and the GREEN light remains glowing. As soon as the RED light glows, the driver can slow down the vehicle and he could even stop it if it is necessary. This sensor based light system can be applicable when the driver cannot see the vehicle coming from the other end of the curve. Using this enhancement to the previous system, we can make all the mountain roads and curved roads safer from accidents and save thousands of lives.

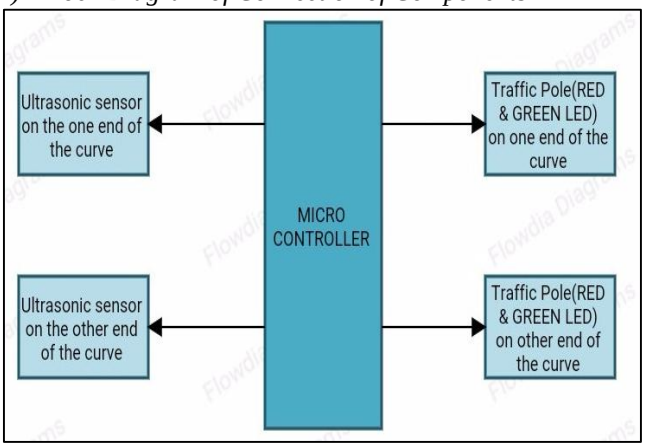
II. SYSTEM DESIGN

The design of this system mainly consists of two parts: they are hardware design and software design. Hardware design consists of sensors like ultrasonic sensors and microcontroller and LED's. Microcontroller Software design is done for sensing the vehicle or obstacle and to operate the LED's by using the Arduino IDE 1.8.6 tool which is open source software. Programming can be done by using embedded C or C++. Operating system that we used is Windows 10. The LED here used is of Green and Red colour and uses maximum +5V DC supply.

A. Hardware Design:

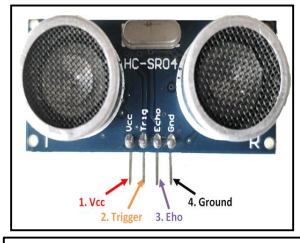
We have used microcontroller, two traffic poles with RED and GREEN LED's on each side of the curve road, and two ultrasonic sensors.

1) Block Diagram of Connection of Components

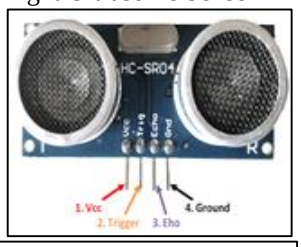


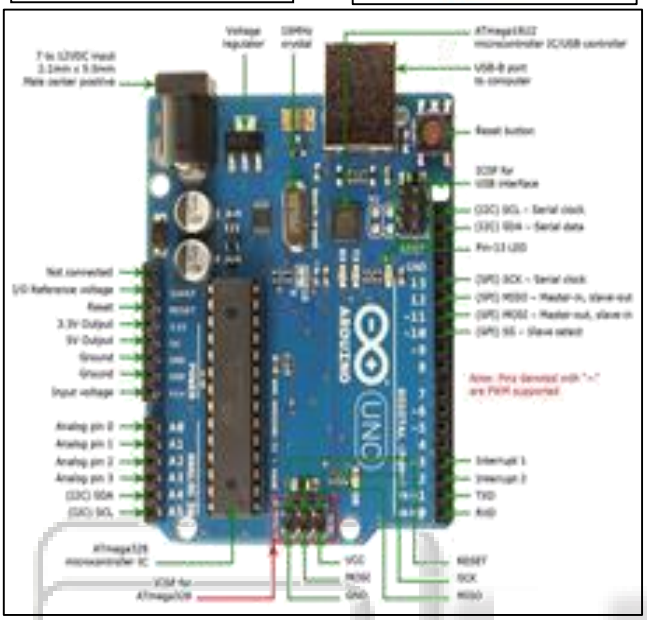
Ultrasonic sensor has four pins. They are +5V, VCC, GND, Trig pin and Echo pin. Here the Trigger pin is the Output pin and the Echo pin is the Input pin. Ultrasonic sensor send the signal in the form of pulse from the trigger pin. When the signal hits the object it will reflected back and received by echo pin. Microcontroller UNO processes this data and operates the LED which is connected to the output pin of the Microcontroller Arduino UNO.

Left Ultrasonic Sensor



Right Ultrasonic Sensor



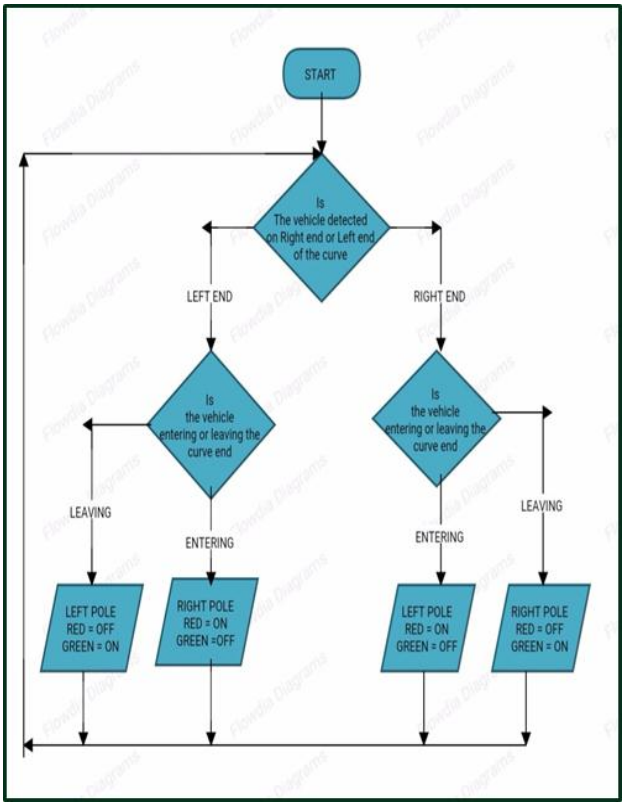


2) PIN Connection Table between Arduino, Sensors and LEDS:

ARDUINO PINS	SENSORS AND LED PINS
+5V Output	VCC of left and Right Ultrasonic sensors
GND	GND of left and right Ultrasonic sensors
PIN 0	Trig PIN of right sensor
PIN 1	Trig PIN of left sensor
PIN 2	Echo PIN of left sensor
PIN 3	Echo PIN of right sensor
PIN 4	Red LED on the left side of the curve
PIN 5	Green LED on the left side of the curve
PIN 6	Red LED on the right side of the curve
PIN 7	Red LED on the right side of the curve

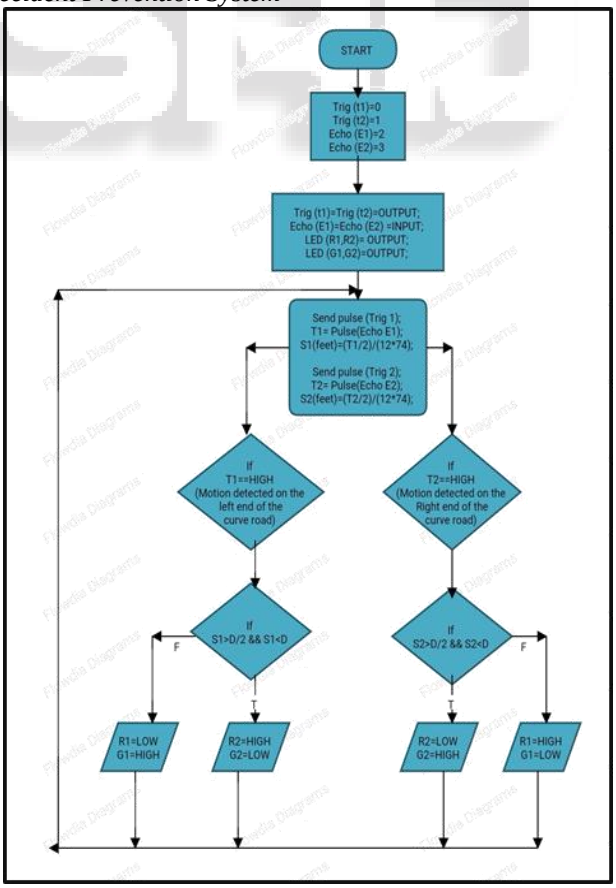
3) Flow Chart for Working Principle of Sensor Based Accident Prevention System

In the presence of vehicle the sensor senses the vehicle, the RED Light will glow at the other end of the curve. In the absence of the vehicle, the sensor will not sense and GREEN light will glow. This process repeats continuously.



B. Software Design:

1) Flow Chart for Software Design of the Sensor Based Accident Prevention System



CRITERIA---- VEHICLE MUST TRAVEL ON THE LEFT SIDE OF THE ROAD

2) Designation in Flow Chart

t1	Trigger pin on the left sensor
t2	Trigger pin on the right sensor
E1	Echo pin of the left sensor
E2	Echo pin of the right sensor
T1	Pulse for left sensor
T2	Pulse for right sensor
S1	Distance between left sensor and the vehicle
S2	Distance between right sensor and vehicle
D	Width of the road
R1	Red LED on the left traffic pole
G1	Green LED on the left traffic pole
R2	Red LED on the right traffic pole
G2	Green LED on the right traffic pole

This figure shows the flowchart of software design of microcontroller which is programmed by Arduino IDE tool which is open source software. Programming can be done by embedded C. Operating system that we used is windows 10. We place two sensors SENSOR1 (left side of the curve road) and SENSOR2 (right side of the curve road). As shown in figure first initialize trigger pins(T1 of SENSOR1 and T2 of SENSOR2) to input of Arduino and LED's of traffic poles(R1 and G1 are red and green LED's of the left pole and R2 and G2 are red and green LED's of the right pole) to the output pin of Arduino. Then send pulse through trigger and receive it through echo. Convert the received value into distance (between the sensor and the vehicle- S1 and S2 depending on the motion detected on left or right end). Then check if the motion is detected in the left or right end of the curve. If T1 is high then motion is detected on the left end of the curve and if T2 is high then motion is detected on the right end of the curve. Based on the values of T1 and T2 the following condition are executed.

a) For motion in left end of the curve:

If the calculated distance between the sensor and the vehicle (S1) is greater than half the width of the road (D), then we can say that the vehicle is entering the curve and hence we alert the driver on the right end of the curve by glowing red led (R2) on the right end of the curve. If the calculated distance between the sensor and the vehicle (S1) is less than half the length of the road, then we can say that the vehicle is leaving the curve and hence the driver on the left end of the curve gets a green signal (G1 glows).

b) For motion in right end of the curve:

If the calculated distance between the sensor and the vehicle(S2) is greater than half the length of the road(D), then we can say that the vehicle is leaving the curve and hence the driver on the right end of the curve gets a green signal (G2 glows). If the calculated distance between the sensor and the vehicle (S2) is less than half the length of the road, then we can say that the vehicle is entering the curve and hence we alert the driver on the left end of the curve by glowing red led (R1) on the left end of the curve.

III. EXPERIMENTAL DATA AND RESULTS

1) STEP 1: The following code is uploaded on the Arduino Uno by using the software Arduino IDE.

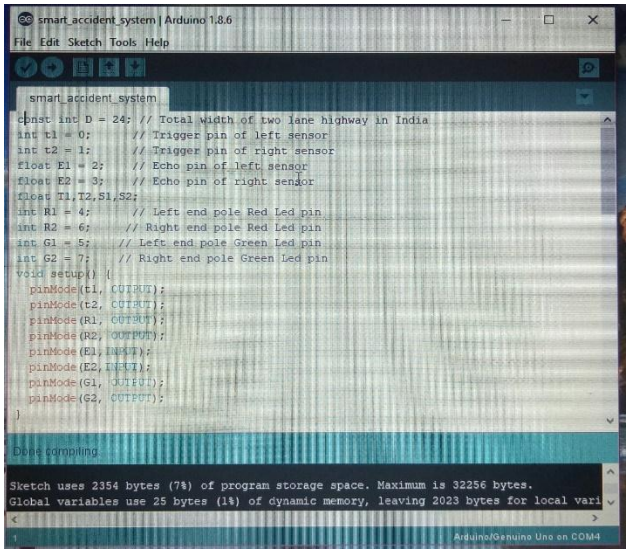


Fig. 1:

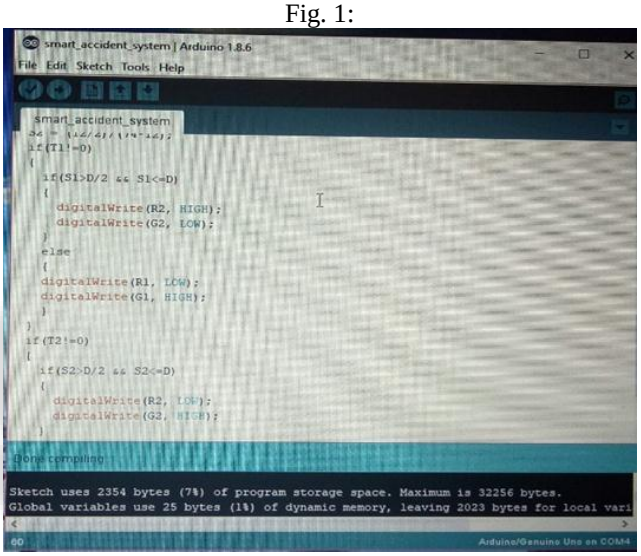


Fig. 2:

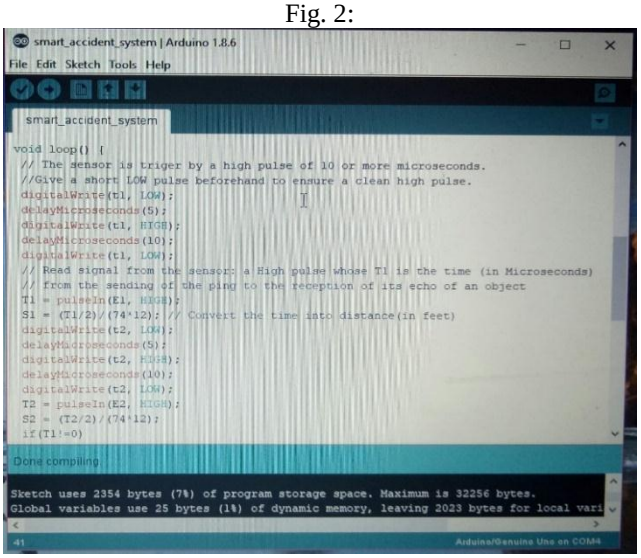


Fig. 3:

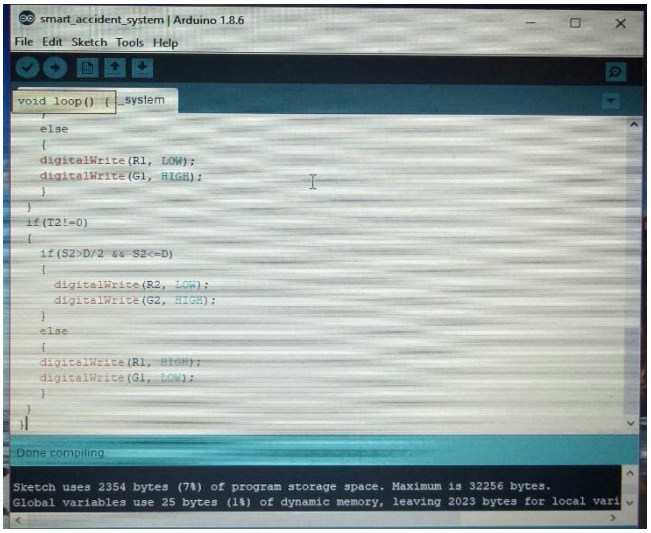
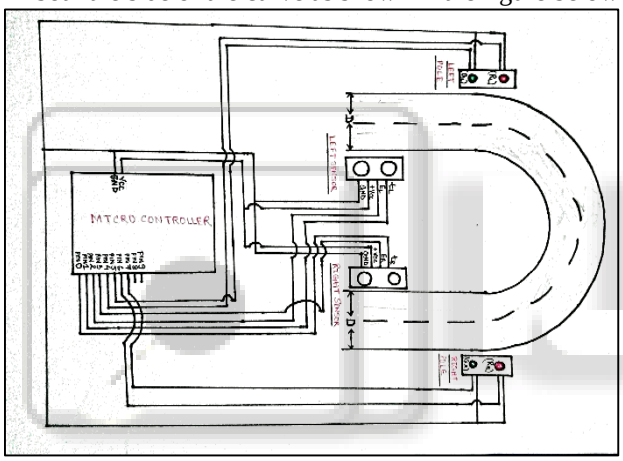


Fig. 4:

2) STEP 2: Two ultrasonic sensors are placed on the left and right side of the curve as shown in the figure below. Two traffic poles with Red and Green LEDs are placed on both the side of the curve as shown in the figure below



3) STEP 3: A vehicle is allowed to enter at the left end of the curve. We will clearly observed that the red Led on the other side glow. Similarly, when the vehicle is allowed to enter the curve through the right end the red Led of the other end glow.
4) STEP 4: In the same way, when the vehicle leaves any one of the curve end the green Led glows automatically indicating the passage is clear.

IV. ADVANTAGES

1) Low power consumption system.
2) Installation cost is very less.
3) Automatic system.
4) More advance and secured as compared to previous system.

V. FUTURE WORK

To protect the sensor from being damage due to the bad weather in the hilly areas.

VI. CONCLUSION

The main purpose of writing this paper is provide solution to certain problems that will occur in the previously built Sensor Based Accident Prevention System. This is done by programming the microcontroller is very smart way. Along with this, we have to install two sensors, two traffic poles (with two LED's of Red and Green colour on each pole) on the both end of the curve. Once, the vehicle enters the curve from one end, the Red Led on the other end will automatically glows (and the green Led turns OFF) and remains ON unless the sensor in the opposite end of the curve detects the vehicle leaving the curve (turn Red Led OFF and the Green Led ON). From this, we can make all the mountain roads and curved roads safer from accidents and save thousands of lives.

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