

Vehicle Accident Prevention System at Hairpin Turns

Using IR Sensors and Arduino

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Abstract—In the world, India ranks top in road accidents. Mainly road accidents are caused due to High speed or when the driver is not aware of the other vehicles coming opposite to it especially in the deep curves. Such types of curves are called as HAIR PIN CURVES. The existing system makes use of convex mirrors at the curves so that the driver can easily detect the vehicle coming in the opposite direction. This system works well during the day but not effective in night. The proposed system makes use of sensors at hairpin curves which work very efficiently during the night time. Placing the sensors at each side of the curves will help us to solve the problem. The usage of sensors is that if the vehicle is 10 meters away from the curve the sensor sends the signal to the vehicle coming in opposite direction in the form of light. In the same way the sensor at the other side of the curve will send signal to the vehicle coming from the opposite direction. In this way by using sensors we can avoid a greater number of accidents mainly at the deep curves. Reducing the rate of accidents increases the well-being of a person.

Index Terms—Arduino , Cables , Connector , IR Sensors , Buzzers , Power Supply , PCB Breadboards , Hairpin Bends.

I. PROBLEM DEFINITION

According to million death study (MDS) about 2.3 million people die in India per year. In that 137K is because of road accidents. That about 377 peoples per day. In that 3.7% are because of unexpected obstacles. There are many risky roads and bends in the world like mountain roads, narrow curve roads and hair pin bends for ex. Kolli hill roads, Gata Loops, 3-Level Zig-zag roads in Sikkim, Leh Manali Highway. Hairpin turns are often built when a route climbs up or down a steep slope, so that it can travel mostly across the slope with only moderate steepness and are often arrayed in a zigzag pattern. Highways with repeating hairpin turns allow easier, safer ascents and descents of mountainous terrain than a direct, steep climb and descent, at the price of greater distances of travel and usually lower speed limits, due to the sharpness of the turn. Highways of this style are also generally less costly to build and maintain than highways with tunnels. Hairpin curves are used when the terrain is very steep. Roadways will have a maximum grade that a vehicle or truck can traverse. The zigzag component of the picture above minimizes the grade, or steepness of the roadway. If you have ever ridden a bike up a steep hill, you might have found yourself zigzagging back and forth across the roadway to get up the hill. The same principle applies here. When designing a roadway, there

are guidelines as to the length of the radius of curve based primarily on the design speed. The faster the design speed, the longer the radius of the curve. Truck traffic is a major factor in the design criteria for the minimum radius of curvature. Turning templates are used to determine if a truck can make the turn without too much of tracking. A bend in a road with a very acute inner angle, making it necessary for an oncoming vehicle to turn almost 180° to continue on the road. Such turns in ramps and trails may be called switchbacks in American English. While driving on roads at hairpin section, many drivers face accident which results them into serious injuries or even death. The main reason behind this accident is curves and bends of roads while turning in Ghats. It becomes difficult to see vehicles coming from other lane and turning drivers usually have to assume a way for turning at such critical section this creates a great risk of life other reason for accident in hairpin section is that only one vehicle can turn at turnings at a time. If two vehicles come face to face while turning, it creates a chance of accidents and it becomes difficult to handle. At night, due to no streetlights it becomes a difficult task of driving on hairpin bends and especially while turning. It becomes more difficult at night to make a turn as vehicle coming from another side of road is not visible due to darkness.

II. LITERATURE REVIEW

A. “Sensor Based Accident Prevention System” Author: Aravinda B, Chaithra Lakshmi C, Deeksha, Ashutha K[1]

This paper is introducing sensor based accident prevention system:- That is we are keeping ultrasonic sensor in one side of the road before the curve and keeping a LED light after the curve. Ultrasonic sensor which is also called as obstacle sensor sends signal as pulse from trigger. If vehicle is present signal will hit the vehicle and it is received by the sensor. At that time light will glow at the other side of the curve. In the absence of the vehicle the light will not glow because the signal will not be received by the sensor. As the signal senses the vehicle light will glow that is indication to driver that some vehicle is arriving from the front side. The driver get noticed the signal and slow down or stop the vehicle if necessary. This type of sensor based light system can be applicable when the driver unable to see the vehicle coming from other end of the



Fig. 1. Connector cable

road. Using this idea we can make all the mountain roads and curve roads safer from accidents and can save thousands of lives a year. The aim of this paper is to decrease the number of accidents in curve roads. This is done by alerting the driver by means of LED light which glows when vehicle comes from the other side of the curve. The vehicle is detected by the help of Ultrasonic sensor which is interfaced to the micro controller Arduino UNO. By this we can save thousands of lives in the curve roads.[1]

B. "Diminishing Road Accidents On Sharp Curves Using Arduino". Ranga Sreedhar Galla [2]

Has studied the main purpose of this paper is to reduce accidents on hilly and slippery roads. In curve roads the other road end of vehicle cannot be seen by driver. At night many times accidents may happen by huge intensity of head light from opposite side of vehicles. Also, the light intensity problem occurs both on curved roads and mountain roads at night because of this type of problem thousands of people lose their lives. The solution for this problem is alerting the driver about the vehicle coming from opposite side. This is done by keeping an ultrasonic sensor on 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 senses and LED light glows at the opposite side.[2]

C. "Smart Road Safety and Vehicle Accident Prevention System for Mountain Roads" Kartik Venkata Mutya, Sandeep Rudra[3]

Has studied the road traffic accidents are being recognized as a major public health problem in number of countries with alarmingly increasing fatalities in developing countries. Careless and rash driving as a result of excessive waiting and blind corners is attributed as one of the most important factor for all road accidents. An estimated 1.2 million people lose their lives in road traffic crashes every year, and another 20 to 50 million are injured. A docile, economical mechanism

to prevent these road accidents is the need of the hour. It is hoped that the mechanism presented in this article would help in alleviating this concern especially in correspondence with large vehicle accidents on highways by being easily implemented in low income countries and this mechanism can save thousands of lives.[3]

D. R. Saranya, R. Arun Kumar [4]

This paper concludes that, Accidents may take place in various factors drunk and driving, Texting while driving, Speeding, Distractions, Sleeping while driving. Among Drowsiness is reason for most of the accidents. While driving at the speed of 100km/hr. driver falls sleepy within 4 seconds the buzzer will enable.[4]

E. "Implementation of Vehicle Mishap Averting System Using Arduino Microcontroller", R.S Rakul[5]

The Unit has been designed to prevent an accident by collision. The 'heart' of the Unit is Arduino microcontroller which performs all the vital tasks of the system. And it will be discussed in the following subsequent sections. This system will receive information from the Ultrasonic transceiver, and accordingly transmit the data via the Wi-Fi router to the controller. Through the buzzer indication, light emitting display, and liquid crystal display, the vehicle information will be shown to the vehicle users. The primary purpose of the system is to prevent collision between two or more vehicles when they take a turn on U-bends.[5]

III. SYNOPSIS OF LITERATURE REVIEW

The purpose of these papers is to reduce the number of accidents in curve roads. This is done by warning the driver by means of LED light which glows when vehicle comes from the other side of the curve. The vehicle is detected by the help of IR Transmitter and Receiver sensor which is interfaced to the microcontroller Arduino Uno. In this we can save thousands of lives in the curve roads on the ghat section.

IV. PROJECT PLAN

A. Setup

1) Setting up the Arduino: We used the Arduino IDE to write and upload the code via the cable

```
int irSensor = 12;
int buzzer = 7;
void setup()
{
  Serial.begin(9600);
  pinMode(irSensor, INPUT);
  pinMode(buzzer, OUTPUT);
}
void loop()
{
  int value = digitalRead(irSensor);
  Serial.println("");
  Serial.print("Sensor Value = ");
  Serial.print(value);
```



Fig. 2. Connector cable

```
if(value == 0)
{
    digitalWrite(buzzer, HIGH);
}
else
{
    digitalWrite(buzzer, LOW);
}
delay(50);
}
```

2) *Connecting sensors:* We use jumper wires to connect the arduino to sensor and buzzer

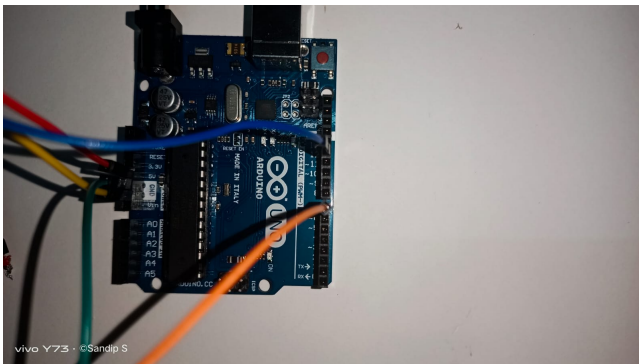


Fig. 3. Jumer wire connection

3) *Final model:* This is the final connection. The LED is connected after the model is completed. A 9V battery is used as power source for the arduino.

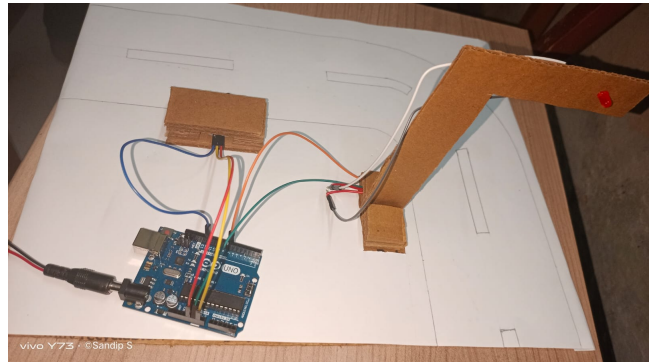


Fig. 4. Final connection

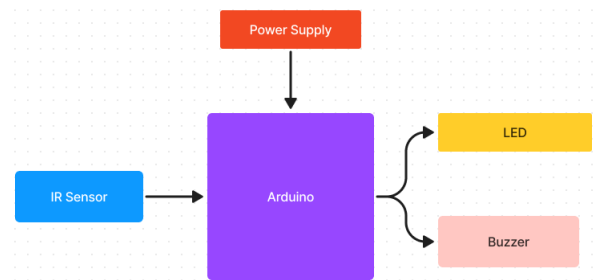


Fig. 5. Block Diagram

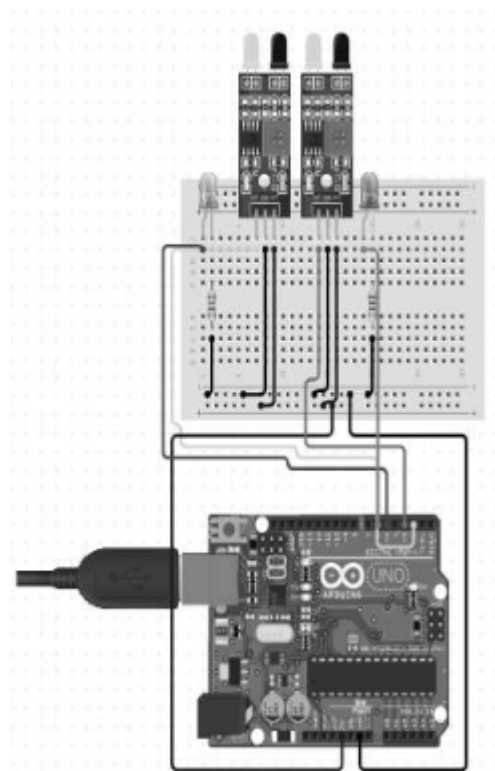


Fig. 6. Schematic Diagram

V. SKETCH

A. Block diagram

B. Schematic Diagram

VI. COMPONENTS REQUIRED

A. ARDUINO UNO

The Arduino Uno is a microcontroller board which is open source used to insert the code as input using USB and can get the expected output. This platform consists of physical programmable path board or IDE (Integrated Development Environment) that runs on computer, used to mark and upload computer code to the physical board. The ATmega328 on the board comes preprogrammed with a boot loader that allows uploading new code to it without the use of an outside hardware programmer. Arduino board design uses a mixture of microprocessors and controllers. The boards are set with digital and analog input/output (I/O) pins that may be interfaced to a choice of development boards or breadboards (For prototyping) and other circuits. The microcontrollers can be programmed using C and C++ programming languages [3].

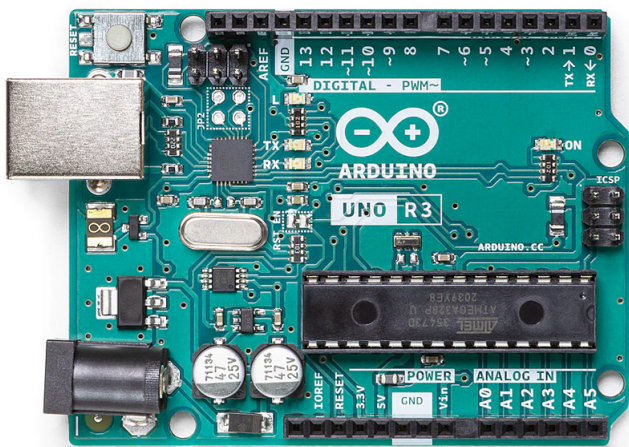


Fig. 7. Arduino UNO top view

B. IR SENSOR

Infrared sensors are being used as proximity sensors and they can be passive or active. Passive infrared sensors are basically Infrared detectors. These sensors do not use any infrared source and detects energy emitted by obstacles in the field of view. The active infrared sensors consist of two elements which are infrared source and infrared detector. Infrared source includes an infrared laser diode. Infrared detectors include photodiodes or phototransistors. The energy emitted by the infrared source is reflected by a purpose and falls on the infrared detector. An IR sensor consists of an IR LED then an IR Photodiode; mutually they are called as Photo – Coupler or Opto – Coupler. When the IR transmitter emits radiation, it reaches the thing and some of the radiation reflects reverse to the IR receiver. Based on the force of the reception by the IR receiver, the output of the sensor is defined [4].

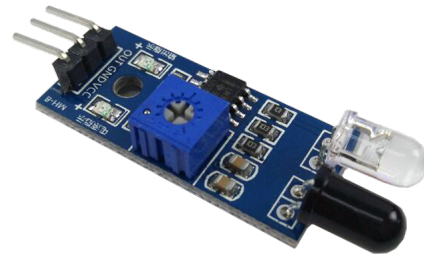


Fig. 8. IR Sensor

C. BUZZER

An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell siren



Fig. 9. Buzzer

D. LED LIGHTS

Light Emitting Diode (LED) is an electronic device of a semi-conductor source that emits light when an electrical current is passed through it. The early LEDs are to produce only red light, but the current LEDs can produce several different colors, including red, green, and blue (RGB) light. The recent advances in LED technology have made it probable for LEDs to produce white light as well. LEDs are generally used for indicator lights (such as power on/off lights) on electronic devices. They also have few other applications, with electronic signs, clock displays, and flashlights. You can typically identify LEDs by a series of small lights that make up a bigger display. The capable nature of LEDs allows them to produce brighter light than other types of bulbs while using less energy [5].

E. OTHER ITEMS

- Resistors
- Transistors
- Diodes
- Push buttons

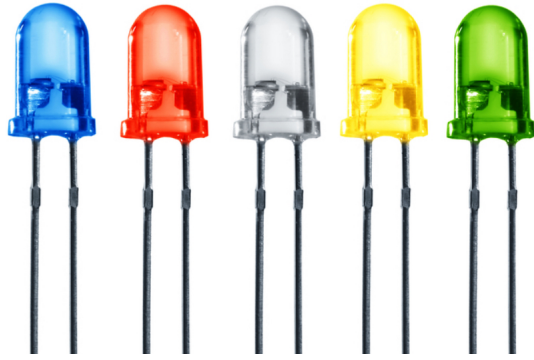


Fig. 10. LED



Fig. 11. Jumper Wires

- IC
- Capacitors
- Cables and Connectors
- PCB and Breadboard

VII. WORKING MECHANISM

It uses an IR sensor, which is placed on one side of the hairpin bend. This IR sensors are senses by the side of the downhill section of the road. The sensors is connected to ATmega328P microcontroller through wires. Based on the output of sensors, position of vehicles on other side of the bend is detected which is provided as an input to the microcontroller. The microcontroller which works on a power supply of 9V runs a Priority algorithm which triggers the warning LEDs to glow and thereby intelligently controlling the movement of vehicles at the bend. Warning LEDs are placed at the side of the uphill section of the hairpin bend

VIII. CONCLUSION

The experiment are started with sensor, it senses the vehicle with the help of IR Sensor. In this project we

are alert the driver by blinking. The clash avoidance at hairpin bend is able to transmit data which is sensed from other side of the road. The system is completely integrated and can give alert to the driver by using LED. This system helps to detect the vehicles by Using their IR Sensor. This system provides the information about the vehicles coming from the opposite side of the vehicles in the Ghats section. This system is useful when the driver can't see the vehicle in the opposite side of the vehicle because of long curve roads in the Ghats section. Thus the system offers the safety and security to the driver.

IX. FUTURE SCOPE

- 1 Arrangements to protect the sensor from being damaged in critical places.
- 2 Decrease the size of unit so that it occupies small place and easily kept in narrow roads.
- 3 Implementing the system to detect number of vehicles and velocity of vehicle and try to specificate the natural calamities if happen alert may rise on buzzer for no further accidents.

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