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Smart Safety and Accident Prevention System for Curve Roads

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Abstract - *According to recent check, 10 percent of the total vehicle accidents be on twisted roads in hill stations. To get relieve from that unwelcome situation, an IoT grounded Accident Prevention System for wind Roads has proposed then. The intention of this work is to give a safe trip by avoiding accidents substantially at the hairpin bends. To advise the motorists of both the vehicles approaching at both ends, by provoke business warning signals and TV display that indicates the appearance of a vehicle ahead on the contrary side of the bend. However, it'll be grueling to manage similar twisted roads since motorists will not be suitable to see other vehicles or objects approaching from the contrary end of the wind, if the auto is not in atrocious condition. We suggest to change motorists' perception of the auto approaching from the contrary side during U-turns in order to reduce these incidents.*

Key Words: **Arduino UNO, Ultrasonic Sensor, Buzzer, 16X2 LCD Display, I2C Module, Stepdown Transformer.**

1. INTRODUCTION

As the population grows, so do the chances of an accident happening. Today, the prevention of these accidents is a major concern. The fundamental cause of all of these accidents is negligence, the negotiation of safety measures, and so on. As technology advances at a faster rate, safety measures are also being modified, but accidents continue to occur. Mountain roads, narrow curve roads, and T roads are some of the world's most dangerous routes. The most perilous mountain routes are very small and contain many turns. In such cases, drivers may be unable to notice the car approaching from the opposite direction.

The majority of road accidents occur at high speeds or when the driver is unaware of other vehicles approaching from behind, especially in sharp curves. The current method utilizes convex mirrors at curves to allow the driver to easily notice vehicles approaching from the other direction. This method works during the day but not at night. The biggest difficulty with curve roads is that the other end of the curve road cannot be seen by the driver due to impediments such as trees in the middle, which causes a high frequency of accidents.

Sensors are installed at hairpin corners in the proposed system; they operate exceedingly well at night. The problem can be solved by installing sensors on each side of the bends. Sensors can also be calibrated to meet specific requirements. In the same way, the sensor on the opposite side of the curve provides a signal to the vehicle approaching from the opposite direction.

2. RELATED WORK

Several measures have been put in place to prevent traffic accidents, such as the introduction of GSM and GPS thanks to modern technology, which can be useful in tracking cars involved in collisions but not those that could have been avoided. Another strategy involves placing glasses at road bends and utilizing a horn to warn oncoming traffic.

To reduce the possibility of accidents at turnings, the government has implemented a variety of measures, including the provision of glasses so that automobiles approaching from the other side are aware of their presence.

3. PROPOSED SYSTEM

An ultrasonic sensor is used in an accident-prevention system. Ultrasonic sensors, an I2C, and an Arduino were all used to avoid the accident. Along with ultrasonic sensors, buzzers, LEDs, and LCD displays are installed on both sides of the road. Ultrasonic sensors identify the direction from which the cars are approaching to warn drivers and prevent crashes. The controller then sends signals to buzzers, LEDs, and LCD screens, which display "car is Ahead."

4. SYSTEM DESIGN

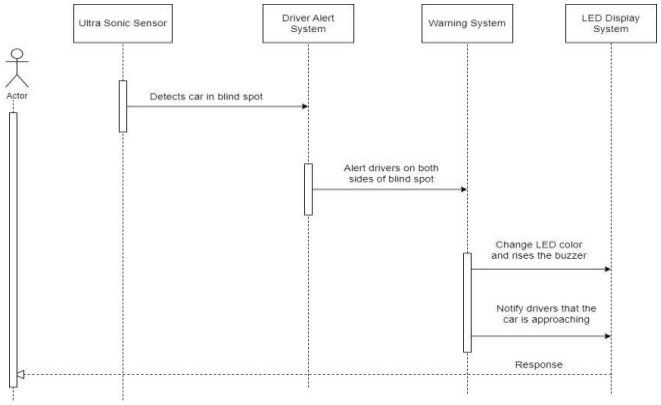

Fig -1: Sequence Diagram

5. MODULE DESCRIPTION

Arduino IDE: The Arduino IDE is a free and open-source software development environment for authoring, compiling, and uploading code to the Arduino microcontroller board. It is built on the Processing programming environment and contains a code editor, a compiler, and a boot loader that allows code to be uploaded to an Arduino board over USB.

The IDE supports several programming languages, including C and C++, and provides a simple interface for developing and uploading code to an Arduino board. It also offers a number of libraries and examples that make working with the board's hardware and peripherals easier.

The Arduino IDE is cross-platform and works on Windows, macOS, and Linux.

Arduino UNO: The Arduino UNO board has total 32 pins. It has a total of 20 digital input/output pins and 6 analog pins.

Description of each pins**:**

- Pins 0-13: These pins can be configured as input/ output, they can only read digital signals (buttons) or send digital signals (LED).
- Pin 0,1(RX,TX): Also known as serial communicator where the pin is used for serial communication. It receives the data from the computer or any other devices.
- Pins A0 - A5: These pins are analog pins, they are capable of reading analog data (voltage, temperature, etc.). They can also be used as digital pins.
- Reset: This pin is used to reset the board and start the boot loader.
- 5V and 3.3V: These pins provide the regulated power to the board and can also be used for powering the external components.
- GND: It provides protection for the board as well as the external components.
- PWM Pins: These pins are used to convert digital to analog by varying the width of the pulses. The pin numbers are 3, 5, 6, 9, 10, 11 are used as PWN pins.
- The Arduino can be activated by connecting it with the system/computer through serial USB port or by 12V DC adapter.

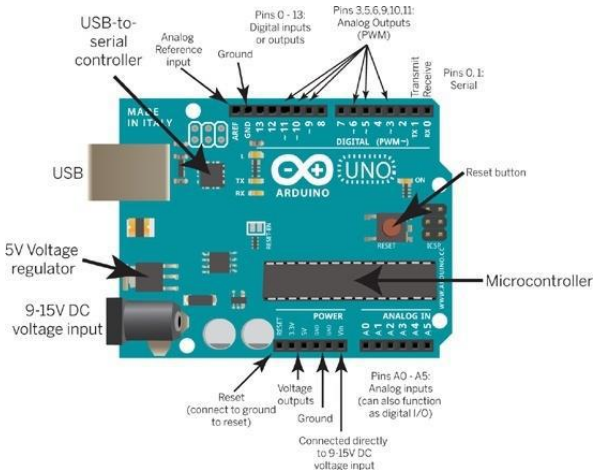

Fig -2: Arduino UNO

Ultrasonic Sensor: Ultrasonic sensors are devices that use sound waves to determine the distance between an object and the sensor. They work by producing high-frequency sound waves from a transducer, which bounce off an object and return to the sensor. The sensor detects the time it takes for sound waves to bounce back and calculates the distance depending on the speed of sound. These sensors are utilized in a range of applications, including object detection, distance measuring, level sensing, and flow measurement.

Fig -3: Ultrasonic Sensor

I2C Module: The I2C (Inter-Integrated Circuit) module is a communication protocol that allows several electronic devices to connect with each other using only two wires: a clock line (SCL) and a data line (SDA). It is commonly utilized in embedded systems and microcontroller-based applications. The I2C module normally consists of two primary components: the master device and the slave devices. The master device is in charge of starting the communication and controlling the bus. The slave devices respond to the master's requests and supply data or conduct activities as needed.The I2C module is normally made up of two primary components: the master device and the slave devices. The master device is in charge of starting communication and controlling the bus.

Fig -4: I2C Module

LCD Display 16X2: A LCD 16x2 display is a form of alphanumeric display that is commonly seen in calculators, clocks, and digital thermometers. The display can show a variety of characters, such as letters, numbers, and symbols, and it can be controlled by a microcontroller or other electronic device. To generate the characters, the display employs a liquid crystal layer placed between two transparent electrodes. When a voltage is applied to the electrodes, the liquid crystal molecules align to control the amount of light transmitted through the display.

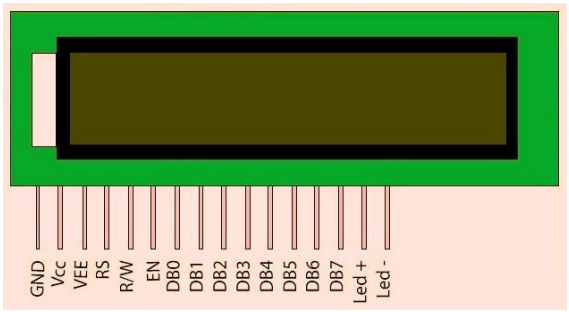

Fig -5: LCD Display 16X2

Center tapped Stepdown Transformer: A transformer with a center tap on its secondary winding is referred to as a center-tapped step-down transformer. The secondary winding is intended to provide a lower voltage output, whereas the primary winding is intended to be coupled to a higher voltage source. The output voltage is measured using the secondary winding's center tap as a reference. Half of the output voltage is present between one end of the secondary winding and the center tap, while the other end of the secondary winding and the center tap likewise provide half of the output voltage, but with the opposite polarity. In power supply and other situations when a lower voltage is necessary, this kind of transformer is frequently utilized.

Fig -6: Center tapped Stepdown Transformer

Diode IN4007: A general-purpose rectifier diode is the IN4007 type. A diode is an electrical component that only permits one path of electricity to pass while blocking the other way. The IN4007 diode has a maximum forward current capacity of 1A and a maximum reverse voltage capacity of 1000V. Power supply and other circuits that need to convert alternating current (AC) to direct current (DC) frequently employ rectifier diodes like the IN4007. The diode conducts and enables current to flow in the forward direction while obstructing flowing in the reverse direction when the AC input voltage is positive. The diode inhibits forward current while permitting a modest amount of reverse current when the AC input voltage is negative.

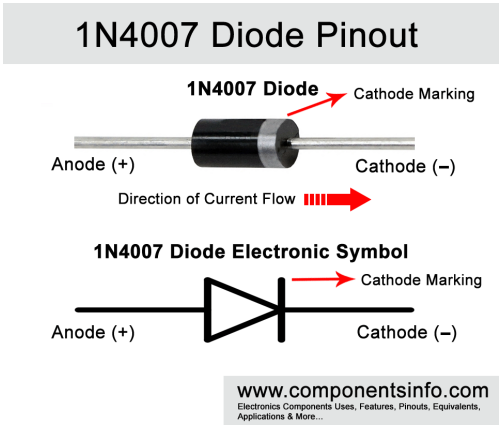

Fig -7: Diode IN4007

Voltage Regulator L7815: A voltage regulator integrated circuit with a set output voltage of +15V DC is called the L7815. It belongs to the well-known 78xx series of voltage regulators, which are frequently employed in electronic circuits to produce a steady DC voltage from a fluctuating input voltage. An input terminal, an output terminal, and a ground terminal make up the three terminals of the L7815 device. The output voltage is set at 15V DC with a maximum output current of 1.5A, while the input voltage ranges from 17V to 35V DC. To dissipate the extra power produced when

it adjusts the voltage, the device is intended to be used in conjunction with a heat sink.

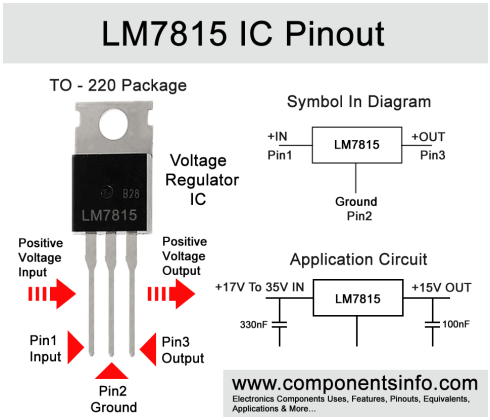

Fig -8: Voltage Regulator L7815

Electrolytic Capacitor (1000microFarad): A voltage regulator integrated circuit with a set output voltage of +15V DC is called the L7815. It belongs to the well-known 78xx series of voltage regulators, which are frequently employed in electronic circuits to produce a steady DC voltage from a fluctuating input voltage. An input terminal, an output terminal, and a ground terminal make up the three terminals of the L7815 device. The output voltage is set at 15V DC with a maximum output current of 1.5A, while the input voltage ranges from 17V to 35V DC. To dissipate the extra power produced when it adjusts the voltage, the device is intended to be used in conjunction with a heat sink.

Fig -9: Electrolytic Capacitor

Buzzer: A buzzer is an electronic device that emits an audible tone or sound when an electrical signal is applied to it. Buzzers are a sort of sounder that typically comprises of a piezoelectric device or an electromagnetic coil and diaphragm. Electromagnetic buzzers create a magnetic field by energizing a magnetic coil with an electrical signal. The magnetic field vibrates the diaphragm, resulting in an audible tone.

Fig -10: Electromagnetic Buzzer

LED Bulbs: LED (Light Emitting Diode) lights are a type of lighting technology that uses a semiconductor to turn electrical energy into light. LEDs are highly efficient, long-lasting, and available in a wide range of colours and intensities, making them attractive for a wide range of lighting applications.One of the primary benefits of LED lighting is its efficiency. They use significantly less energy than standard incandescent bulbs, which means they can assist to cut energy expenses and carbon emissions.

Fig -11: LED Bulbs

6. WORKING

When object arrives near the ultrasonic sensor 1, it starts to detect. Then I2C module 1 helps to display content in LCD display 1 i.e, “Vehicle Ahead”. Similarly, when object arrives near the ultrasonic sensor 2, it starts to detect. Then I2C module 2 helps to display content in LCD display 2 i.e, “Vehicle Ahead” When object is too close to the sensor it will display “Go slow” with red light and when its far it will display “Vehicle Ahead” with green light.

7. EXPERIMENTAL RESULTS

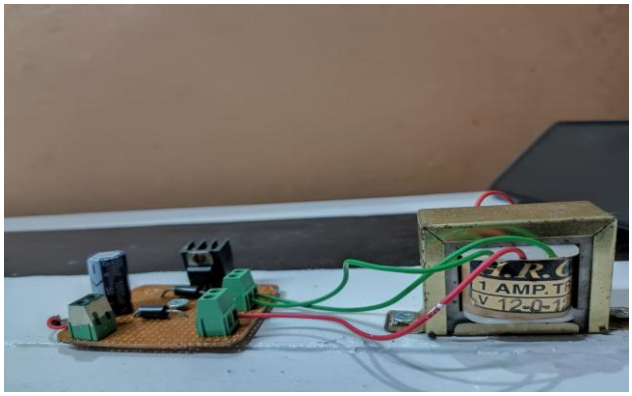

Fig -12: Step-Down Transformer

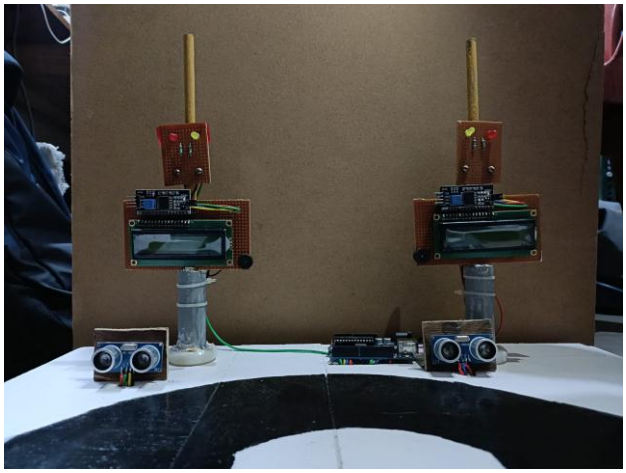

Fig -13: Ultrasonic Sensors with LCD display

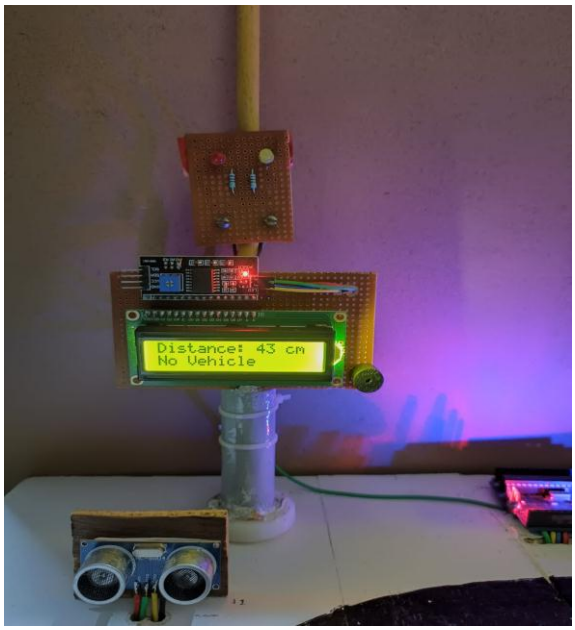

Fig -14: LCD display working

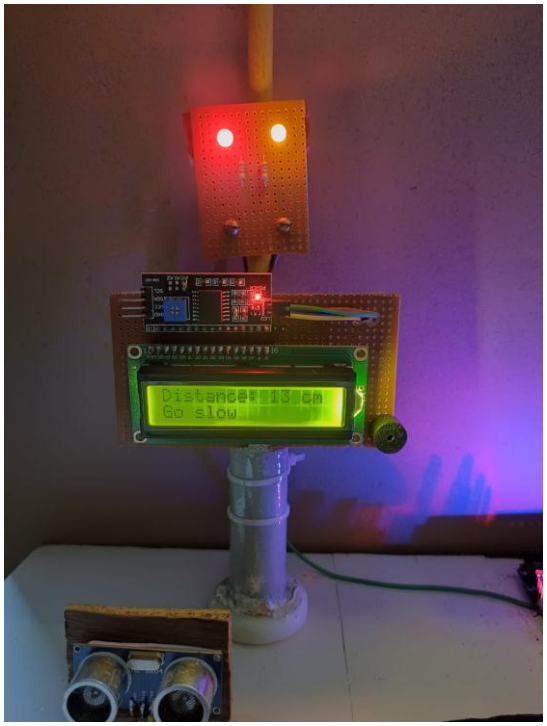

Fig -15: Sensor detects vehicle and cautioned driver

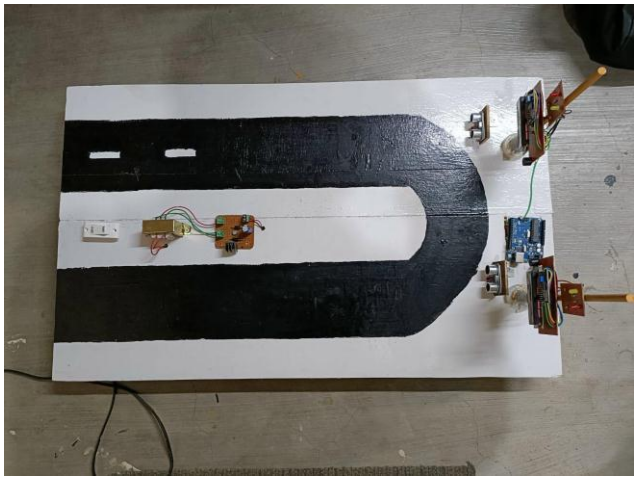

Fig -16: Representation of the project

8. CONCLUSIONS

The objective of this initiative is to decrease the number of collisions that occur on winding and hilly roads. This is done by mounting an LED light and an Ultrasonic sensor on the side of the road, one before the bend and one after. The Ultrasonic sensor detects a vehicle approaching from one end of the curve, and the LED light lights on the other side, setting off buzzers and flashing "Vehicle Ahead" on LED displays. This will allow us to save a great number of lives.

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