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IOT BASED U-TURN VEHICLE ACCIDENT PREVENTION SYSTEM(BLINDENDS)

S. Sivaprakash[1], Dr. Princess maria john, Ph.D.[2]

II MCA Students, Master of Computer Applications, Hindusthan College of Engineering and Technology, Coimbatore, India[1]

Assistant Professor, Master of Computer Applications, Hindusthan College of Engineering and Technology, Coimbatore, India[2]

Abstract: This mostly happens on tight mountain routes, hairpin curves, and U-turns. When driving in this position, the car coming from the other direction is invisible to the driver. Thousands of people lose their lives in auto accidents as a result each year. A automobile approaching from the side should be warned in order to prevent more collisions. Before the bend in the road, place the ultrasonic range detection sensor on one side, and after the bend, place the light indicator system on the other. An ultrasonic sensor on one side of the road uses a light system to transmit a signal to the other side of the road when a car approaches from a distance. The driver may stop the vehicle in response to a warning and hold it there until the other vehicle has passed. Additionally, a bell will be employed to alert that approaching car's driver.

Keywords*:* Electrical, Internet Of Things, u-turn, blindends, ultrasonic

I. INTRODUCTION

The problem of U-turn vehicle accidents is addressed, especially in blind regions where conventional safety measures might not be sufficient. An IoT-based system utilizing an Arduino Uno, an HC-SR04 ultrasonic sensor, and LEDs is being developed to prevent U-turn accidents by alerting drivers in real-time.

The primary microcontroller for processing and control is the Arduino Uno. HC-SR04 Ultrasonic Sensor: Essential for spotting possible U-turn situations, this sensor determines an object's proximity. Lights (Red, Green, Orange): Visual cues that alert drivers to the possibility of a U-turn and direct them accordingly. 1kΩ resistors: Used with LEDs to ensure appropriate current regulation. To detect vehicles in blind areas and estimate distances, use the HC-SR04 sensor.Define a U-turn detection threshold distance that, when exceeded, activates the alert system.

Figure 1 illustrates the block diagram of the Internet of Things.

Red LED: Warns motorists to drive carefully when a U-turn is about to occur.

Green LED: Signals a safe distance and assures vehicles that a U-turn is not imminent.

Orange LED: Maybe an intermediate alert or transitional stage.

Establish the foundation for upcoming growth in the Internet of Things by integrating sensors and networking modules. Permit data transfer to a cloud platform or centralized server for real-time data processing and monitoring.

Take into account simple ways to integrate the system with dashboards or other vehicle interfaces already in place. Put your best effort into making the alert system easy to use so that drivers can understand them. Try to lower the amount of U-turn collisions by giving drivers prompt and unambiguous warnings.Use technological innovation to solve blind spot issues and improve overall traffic safety.

II. HOW IT WORKS

Ultrasonic sensors are integrated into the blindends (Internet of Vehicles) U-Turn Vehicle Accident Prevention System to improve safety during U-turn movements. These sensors are mounted on the car in a deliberate manner to cover blind areas that are important for U-turns. They use high-frequency sound waves to detect items nearby by analyzing the echoes of those waves. The sensors continually measure blind spots during a U-turn maneuver by timing the time it takes for sound waves to return from obstructions. A microprocessor or other processing device onboard processes this data, determining the location and distance of objects observed in relation to the vehicle's path.Upon detecting an obstruction within a predetermined range while performing a U-turn, blindends triggers the warning mechanism. The red LED lights are used by this device to visually inform the driver. When an obstruction is detected by the flashing red lights, the driver is alerted and must move quickly to avoid an accident. To further reassure the driver throughout the maneuver, the system also turns on the green LED lights to show when the path is clear.blindends uses the orange LED lights in situations where prudence is advised but no action is required right away. These lights alert drivers to any hazards ahead by acting as a warning light. Through the use of LED lights, blindends improves the driver's situational awareness and facilitates the making of well-informed judgments when performing U-turns.blindends can instantly transmit alerts to a central server or neighboring vehicles thanks to the incorporation of IoT technologies. Beyond the safety of a single vehicle, this connectivity facilitates collaborative safety measures that improve overall road safety. Additionally, blindends gathers information on impediments that are detected and the reactions of drivers, enabling feedback mechanisms that support continual improvement.

By continuous observation and modification, blindends supports the continuous development of automotive safety systems. Its use of LED lights and ultrasonic sensors offers a thorough method for identifying and alerting drivers to possible risks when making U-turns. blindends seeks to enhance road safety for all users by lowering accident rates and integrating sensor technology with visual alerts.

III. SYSTEM OVERVIEW

BLINDENDS, an IoT-based U-Turn Vehicle Accident Prevention System, is a complete safety solution made to improve driver awareness and stop collisions when making U-turns. Fundamentally, blindends uses cutting-edge sensor technology, such as ultrasonic sensors, to identify objects in blind areas. In order to provide thorough detecting capabilities, these sensors are carefully placed on the car to cover all of the areas that are normally concealed during U-turns. blindends uses its ultrasonic sensors to continuously scan its surroundings while doing a U-turn. These sensors use high-frequency sound waves to identify items nearby, including cars, people, and barriers, by analyzing the echoes of those waves. blindends precisely measures the distance and location of observed objects in relation to the vehicle's trajectory by timing the sound waves' return. When an obstacle is detected within a predetermined range, blindends alerts the driver by triggering its warning system.

The system has the potential to provide the driver with prompt and efficient warnings by utilizing visual, audio, or haptic feedback. For instance, blindends might make use of LED lights to give visual alerts when there's an impediment in the way of the car. Not only can blindends alert the driver, but it can also use Internet of Things (IoT) to instantly interact with other cars or a central server. Through the facilitation of cooperative hazard avoidance actions, this communication allows blindends to communicate information about detected impediments with neighboring cars, so improving overall road safety. The highly flexible and adaptive nature of blindends allows it to be adjusted to various vehicle types and driving situations. Because to its modular architecture, installation and integration with current vehicle systems are made simple, reducing implementation costs and interference with vehicle operations. Moreover, blindends has feedback mechanisms built in to help it perform better over time. blindends can improve its algorithms and detecting capabilities to ensure maximum efficacy in averting accidents by gathering data on barriers identified and driver reactions. All things considered, blindends is a noteworthy development in auto safety technology that provides a proactive method of preventing accidents when doing U-turns. By combining cutting-edge sensors, real-time communication, and adaptive features, blindends seeks to dramatically lower accident rates and enhance road safety for both vehicles and pedestrians.

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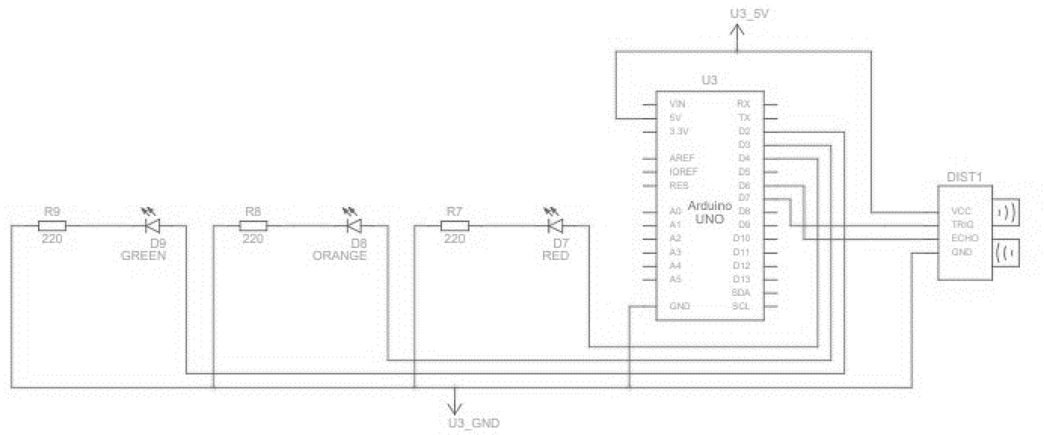

Figure 3: System Block Diagram

IV. HARDWARE DECERPITION

A. ARDUINO UNO

An open-source platform called Arduino is used to construct electronics projects. Arduino is made up of two parts: an actual programmable circuit board, also known as a microcontroller, and an IDE (Integrated Development Environment) software that runs on your system and is used for writing and uploading computer code to the actual board.

Figure 4:Arduino Uno

Using microcontroller kits, Arduino is an electronic both software and hardware corporation, project, and community of users that creates interactive things and digital devices that are capable of controlling and sensing real-world items. The Free Software Foundation's General Public License (GPL) or the GNU Lesser Public Public License (LGPL) are the licenses under which the project's hardware and software are available, allowing anybody to share the software and build Arduino boards. Commercial preassembled Arduino boards are available, as well as DIY kits. The project's board designs make use of several controllers and microprocessors. These systems include sets of input/output (I/O) pins, both digital and analog, that may be interfaced to other expansion boards (also known as "shields") and other circuits. The boards provide serial communications ports for loading software from personal computers, including Universal Serial Bus (USB) on certain variants.

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A variant of the C and C++ programming languages is mainly used to program the microcontrollers. The Arduino project offers an Integrated Development System (IDE) based on the Processor language project in addition to utilizing conventional compiler tool chains.

The Arduino project began as a course for students at the Interaction Design Institute Ivrea in Ivrea, Italy, in 2005. Its goal was to give both experts and beginners a simple and affordable approach to design gadgets that use sensors and actuators to interact with their surroundings. These kinds of gadgets are frequently designed for novice enthusiasts and include motion detectors, thermostats, and rudimentary robots. Hardware from Arduino is open-source. The Arduino website has the hardware reference designs, which are made accessible under a Creative Commons Attribution Share-Alike 2.5 license. There are additional layout and production files available for certain hardware variants. The GNU General Public License, version 2 governs the publication of the IDE's source code. However, there has never been an official Bill of Materials for Arduino boards.An early Arduino board with an Atmel ATmega8 microcontroller chip (black, bottom right) and an RS-232 serial interface (upper left); the power connector is at the lower left, the six analog input pins are at the lower right, and the top has 14 digital I/O pins.

An Atmel 8-, 16-, or 32-bit AVR microcontroller (ATmega8, ATmega168, ATmega328, ATmega1280, or ATmega2560) is the main component of an Arduino board; but, since 2015, microcontrollers from other manufacturers have also been utilized. Single-row pins or female headers are used on the boards to make connections easier for programming and integrating into other circuits. These might be connected to shield-named add-on modules. An I/C serial bus may be used to separately address many, potentially stacked shields. A 16 MHz crystal and a 5V linear regulator are standard on most boards.

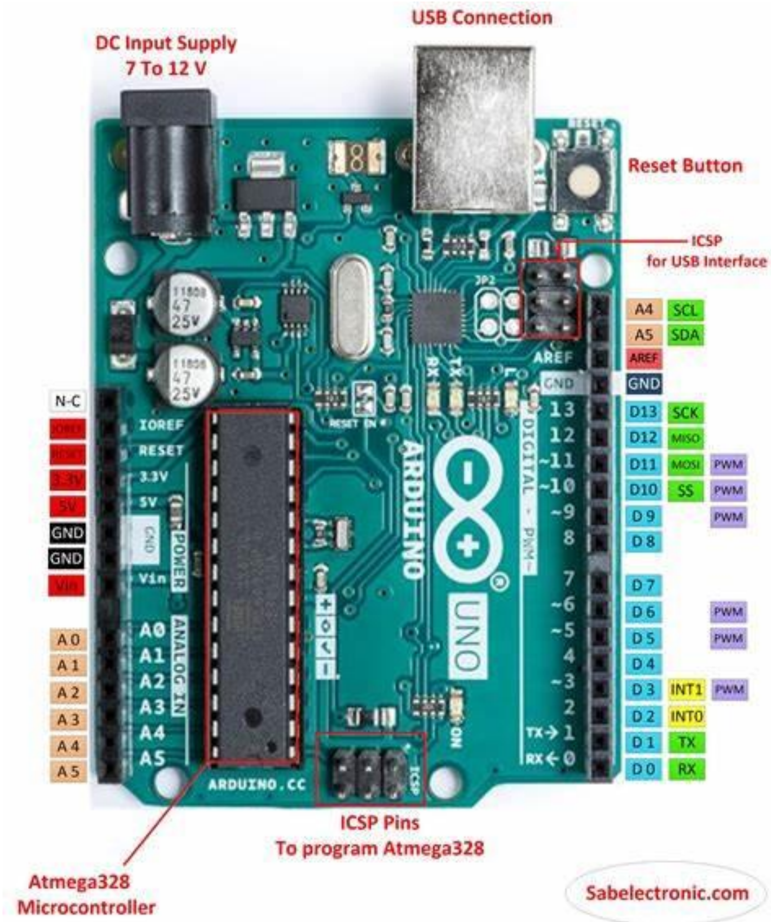

Figure 4.1: Pin Description of Arduino Uno

Digital Pins (0-13): These pins can be individually configured as digital input or output pins. They can read digital signals (0 or 1) or output digital signals.

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Analog Pins (A0-A5): These pins can be used as analog inputs. They provide a 10-bit resolution, meaning they can read analog voltages from 0 to 5 volts and convert them into integer values ranging from 0 to 1023.

Power Pins:
5V: Provides a regulated 5V supply from the board's voltage regulator.
3.3V: Provides a regulated 3.3V supply from the board's voltage regulator.
Vin: This pin can be used to supply voltage to the board when using an external power source. It can accept voltages from 7V to 12V.

GND (Ground): These pins are common ground connections.
PWM (Pulse Width Modulation) Pins (3, 5, 6, 9, 10, 11): These pins can produce analog-like outputs using PWM. They can simulate analog voltage levels by rapidly switching between HIGH and LOW states.

Reset Pin (RESET): This pin is used to reset the microcontroller.
ICSP (In-Circuit Serial Programming) Header: This header provides access to the SPI (Serial Peripheral Interface) pins (MISO, MOSI, SCK) and the reset pin for programming the Arduino using an external programmer.

UART (Universal Asynchronous Receiver/Transmitter) Pins (RX, TX): These pins are used for serial communication with other devices. RX (Receive) pin is for receiving data, and TX (Transmit) pin is for sending data.

AREF (Analog Reference): This pin is used to provide an external reference voltage for the analog inputs. By default, it uses the internal 5V reference, but you can use an external voltage reference by connecting it to this pin.

Crystal Oscillator Pins (XTAL1, XTAL2): These pins are connected to the crystal oscillator used for timing the microcontroller.

LEDs:
TX, RX LEDs: These LEDs indicate the activity on the TX and RX pins, respectively.

Power LED: Indicates that the board is receiving power.

LED (pin 13): This LED is connected to digital pin 13. You can control it using digitalWrite().

Specifications

Microcontroller	ATmega328P
Operating Voltage	5V
Digital I/O Pins	14 (D0 - D13)
Analog Input Pins	6 (A0-A5)
Clock Speed	16 MHz
Flash Memory	32 KB
Wi-Fi	Not supported
Operating Temperature Range	-40°C to +85°C
Input Voltage	5V (via USB or VIN pin)
Output Voltage	5V
Current Consumption	~varies
USB-to-Serial Chip	CH340G
Programming Interface	USB
GPIO Pins	PWM, I2C, SPI
Onboard Antenna	No
Dimensions	68.6mm x 53.4mm
Compatible IDEs	Arduino IDE

Working
The Arduino uno is a development board that utilizes the ATmega328P microcontroller module, allowing digital and analog input/output capabilities. Here's a general overview of how the Arduino uno works:

• Microcontroller and CPU:The Arduino Uno utilizes the ATmega328P microcontroller, featuring an 8-bit AVR processor. This processor manages tasks, executes commands, and handles input/output operations on the board.

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- Voltage Regulation:Similar to the NodeMCU, the Arduino Uno operates at 5V, regulated by an onboard voltage regulator. This ensures stable voltage levels for reliable operation of connected components.
- Digital and Analog I/O:The Arduino Uno offers 14 digital I/O pins (D0-D13) and 6 analog input pins (A0-A5). These pins can be configured as inputs or outputs to interface with various digital and analog devices, allowing for versatile project designs.
- Wi-Fi Connectivity:Unlike the NodeMCU, the Arduino Uno does not have built-in Wi-Fi connectivity. However, you can add Wi-Fi capabilities to the Arduino Uno using additional modules or shields, such as the ESP8266 module or the ESP32, enabling communication over Wi-Fi networks.
- Programming and Communication:Programming the Arduino Uno is typically done using the Arduino IDE. The board utilizes a USB-to-Serial chip (such as the ATmega16U2 or CH340G) to facilitate communication between the board and the computer for uploading code, monitoring output, and debugging.
- GPIO and Communication Protocols:Similar to the NodeMCU, the Arduino Uno's GPIO pins support various communication protocols such as PWM, I2C, and SPI. These protocols enable communication with different devices and sensors, expanding the board's capabilities.
- Operating System and Applications:The Arduino Uno does not run an operating system like the NodeMCU. Instead, it executes code directly uploaded to the board. This code is typically written in C/C++ and can implement a wide range of applications, including IoT projects, robotics, automation systems, and more.
- Power Consumption:The Arduino Uno's power consumption varies depending on its operational state. Efficient power management strategies, such as using sleep modes and optimizing code, can help reduce energy consumption, especially in battery-powered applications.

B. Ultrasonic sensor

A device that uses ultrasonic sound waves to gauge an object's distance is called an ultrasonic sensor. It operates on the same echolocation mechanism as dolphins and bats. The ultrasonic pulses the sensor emits are used to measure the time it takes for sound waves to return back after colliding with an item. The distance that lies between the sensor and something is then computed using this information.

Figure 4.2: Ultrasonic sensor

Pin Description

Transmitter: The ultrasonic waves that the sensor emits are normally in the ultrasonic range, which is above human hearing frequencies, usually around 40 kHz.

Receiver: When reflected waves strike an item and ricochet back, the sensor's receiver picks them up. Calculation: Distance = (Speed of Sound * Time) / 2 may be used by the sensor to determine the distance to the object by measuring the amount of time it takes for the waves to return. Since the wave travels to and from the object, the distance is half of the total distance traveled.

Output: The sensor's output, which may be an analog voltage, a signal that is digital, or a pulse width modulation (PWM) signal, may be used to determine the computed distance.

Ultrasonic sensors are frequently employed in many different applications, including:

Distance Measurement: They are widely used to measure the distance between a sensor and an object, as previously mentioned.

item Detection: Within a certain range, ultrasonic sensors are able to identify the presence or absence of an item. They are employed in proximity sensing, which detects an object's vicinity without making physical touch.

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Collision Avoidance: Ultrasonic sensors are used in robotics and automation to prevent collisions with barriers.

Level Measurement: The level of liquids in containers may be determined using ultrasonic sensors.

Parking aid: Ultrasonic sensors are frequently utilized in parking aid systems in vehicle applications.

Flow Measurement: They are useful for determining the liquid's flow.

Specifications

Operating Voltage	5V DC
Input Voltage	5V DC
Maximum Current Consumption	70-100 mA
Operate Time	Around 5-10 ms
Release Time	Around 1-5 ms
Isolation Voltage	Around 1000V between input and output circuits
Dimensions	commonly around 40mm x 30mm x 18mm

Working

- Activation Signal: Instead of a control signal to activate a relay, an ultrasonic sensor emits ultrasonic waves (sound waves with frequencies higher than the human audible range) to detect objects in its vicinity.
- Transducer: The ultrasonic sensor contains a transducer that emits ultrasonic waves and receives the echoes reflected back from objects.
- Echo Reception: After emitting ultrasonic waves, the sensor waits for the waves to bounce off nearby objects and return as echoes. The time taken for the echo to return is used to calculate the distance to the object.
- Distance Calculation: By measuring the time elapsed between sending the ultrasonic pulse and receiving its echo, the sensor calculates the distance to the object using the speed of sound in air.
- Object Detection: Based on the calculated distance, the ultrasonic sensor determines whether an object is present within its detection range and provides feedback accordingly.
- Continuous Operation: Ultrasonic sensors often operate continuously, emitting pulses at regular intervals to maintain awareness of the surroundings and detect changes in object positions.
- Output Signal: The output signal of an ultrasonic sensor typically provides distance measurements or presence detection information to a microcontroller or other control system for further processing.

V. SYSTEM FLOW

- Connect the TRIG 2- out in ultrasonic to pin 7 in Arduino
- Connect the ECHO 3- out in ultrasonic to pin 6 in Arduino
- Connect the GND pin ultrasonic in to GND pin in Arduino
- Connect the VCC pin in ultrasonic to 5.5 V in Arduino Connect the LED to ARDUINO
- Connect the RED LED in pin 4 in Arduino
- Connect the YELLOW LED in pin 3 in Arduino • Connect the GREEN LED in pin 2 in Arduino

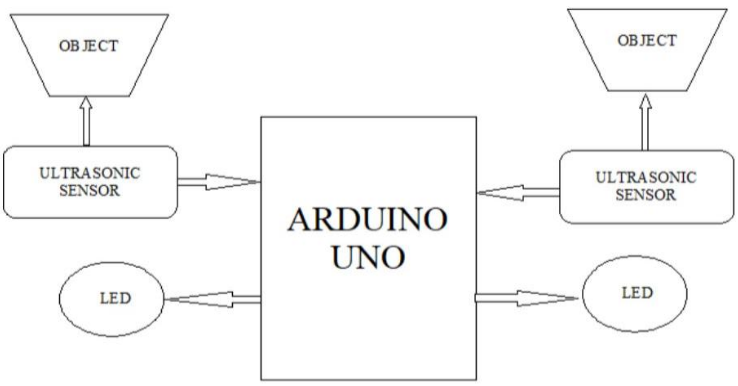

Figure 5: Flow Diagram

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VI. RESULT AND DISCUSSION

By addressing blind areas during U-turns, the IoT-based U-turn vehicle accident prevention system seeks to improve road safety. An Arduino Uno microcontroller, an HC-SR04 ultrasonic sensor, 1kΩ resistors, and red, green, and orange LEDs are all used in the system. When a U-turn is detected within the predetermined threshold, the ultrasonic sensor operates by measuring the distance between the vehicle and potential impediments. The warning mechanism is then activated by the LEDs. The driver should proceed with caution as the red LED alerts them to a possible hazard. On the other hand, the green LED signals a safe distance, enabling the driver to continue without taking any chances. By providing an extra layer of awareness, particularly in situations when visual clues may be restricted, this clever technology eventually helps to reduce accidents involving U-turns.

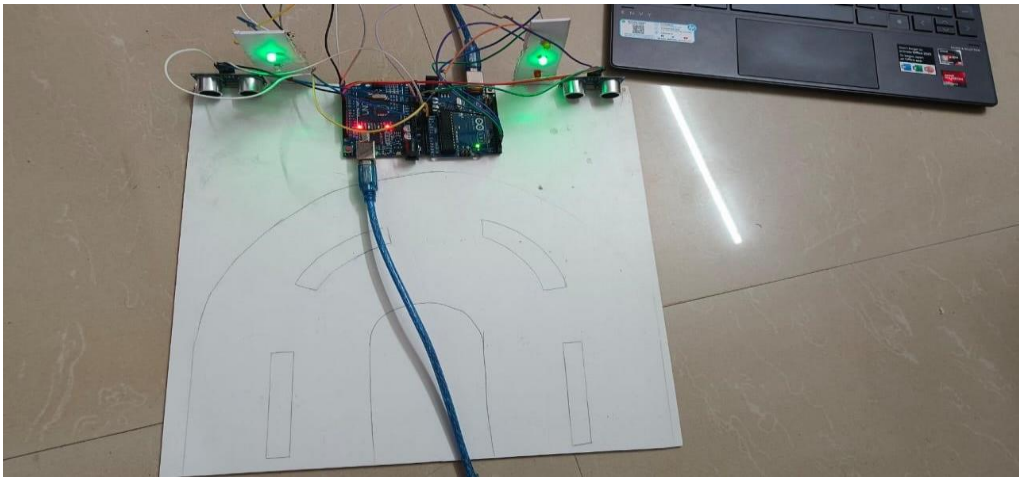

Figure 5.1 demonstrates the process of iot based u-turn vehicle accident prevention system (blindends)

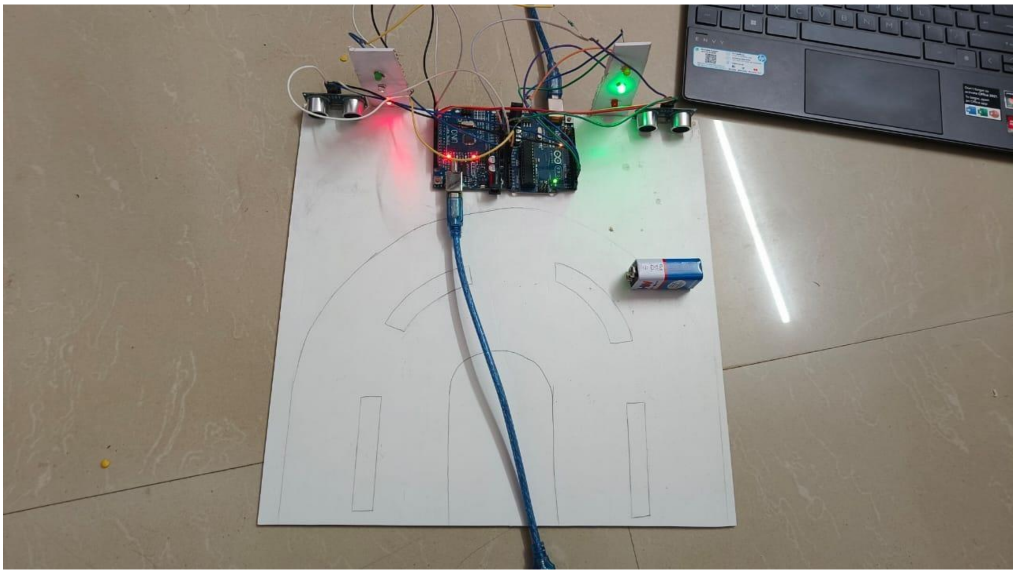

Figure 5.2 illustrates the procedure for activating the red led using the ultra sonic sensor.

VII. CONCLUSION

In summary, an important step has been taken toward improving road safety with the development of the IoT-based U-turn vehicle accident prevention system for blind spots. This system makes use of an Arduino Uno, an HC-SR04 ultrasonic sensor, 1kΩ resistors, and red, green, and orange LEDs. Using real-time distance measurements and LEDs for visual cues, the system successfully recognizes U-turns in blind places.The research showed that using straightforward yet efficient IoT solutions to solve certain road safety issues is feasible.

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The U-turn, which frequently results in accidents in blind areas, was precisely detected by the system through the use of ultrasonic sensor technology. The addition of LEDs provided nearby cars and pedestrians with an understandable and unambiguous visual alert.Notwithstanding the system's potential, it is critical to recognize its shortcomings and difficulties. Environmental elements that could affect the sensor's function include noise interference and different lighting. Furthermore, the current implementation is stand-alone; adding connectivity features for data transmission in real time or vehicle-to-vehicle communication could improve usefulness even further.

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