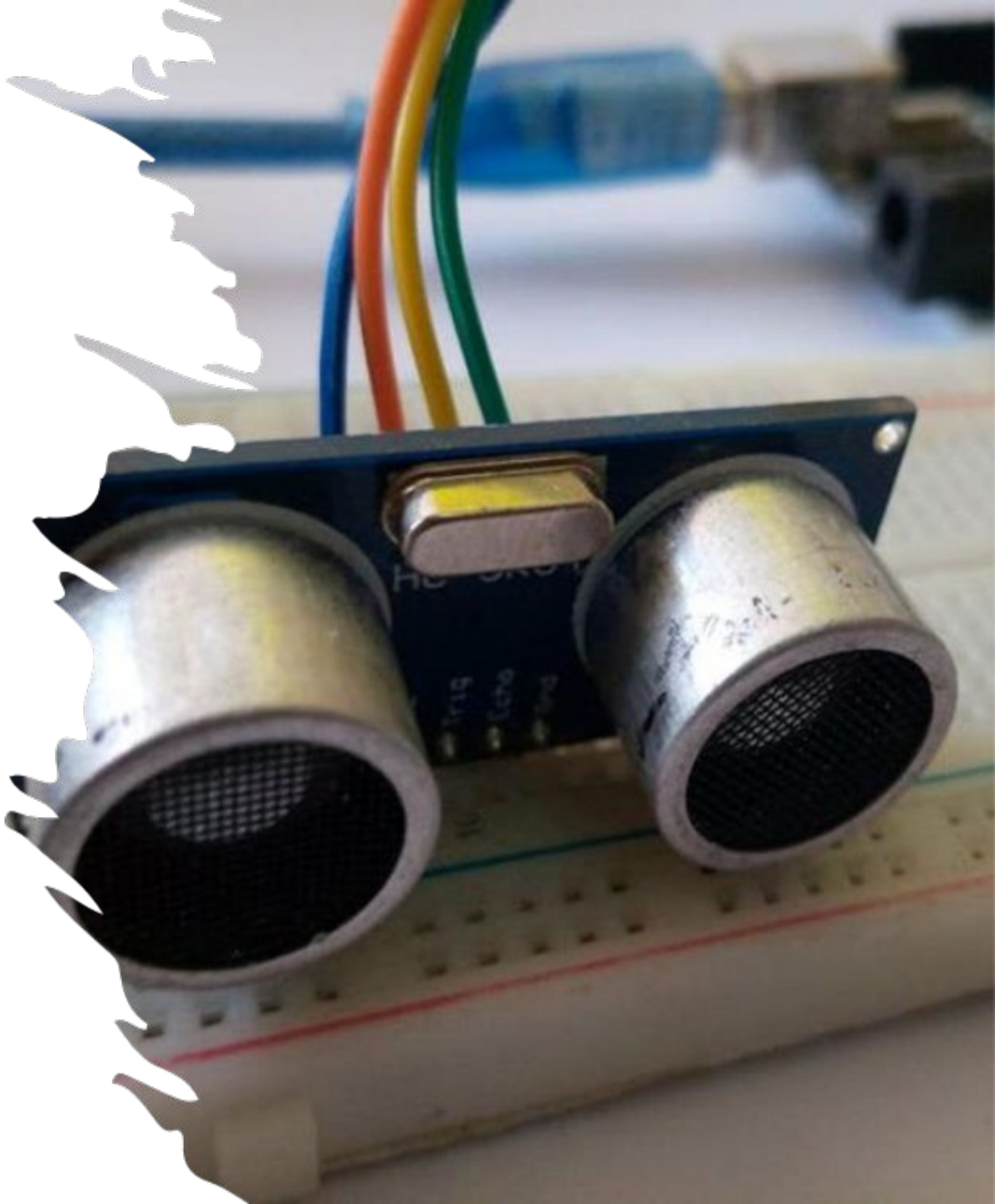
EMBEDDED SYSTEMS PROJECT

Developing an obstacle detection system to assist the visually impaired individuals



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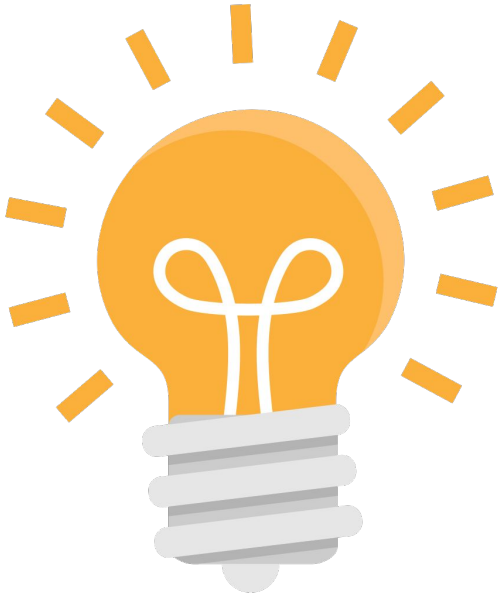
BROAD AREA:

Ultrasonic sensors find extensive application across diverse fields due to their ability to measure distance without physical contact. In industrial automation, they monitor liquid levels, detect objects in manufacturing lines, and ensure precision in robotics.
In automotive technology, they enable parking assistance, collision avoidance, and autonomous driving features.
In healthcare, they facilitate non-invasive medical imaging and diagnostics.
Additionally, ultrasonic sensors play a crucial role in security systems for intrusion detection and surveillance.
Their versatility, reliability, and non-intrusive nature make them indispensable in various domains for accurate distance measurement and object detection.

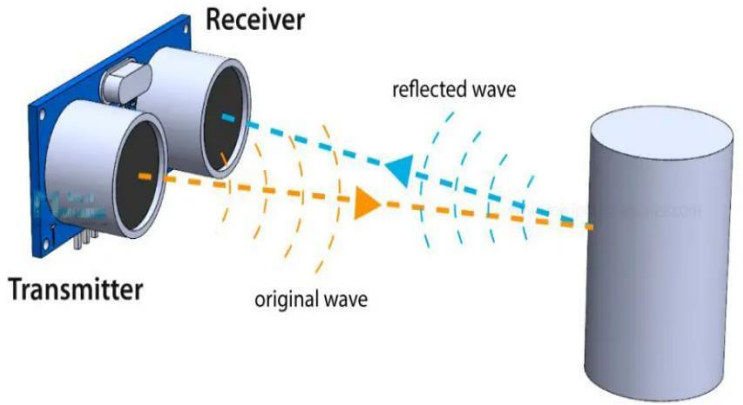


PROBLEM STATEMENT

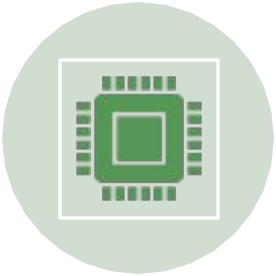
Limited accessibility to real-time obstacle detection systems hampers the mobility of visually impaired individuals.

Current assistive technologies lack precision and real-time monitoring, impeding effective navigation for the visually impaired.

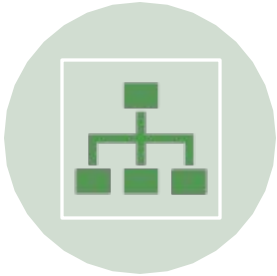
Our NodeMCU-driven system integrates ultrasonic sensors and an LCD display to provide accurate, real-time obstacle detection, enhancing mobility and independence for the visually impaired.



OBJECTIVES



Developing a low-cost, portable microcontroller-based electronic system



Assistive devices for individuals with visual impairments to detect

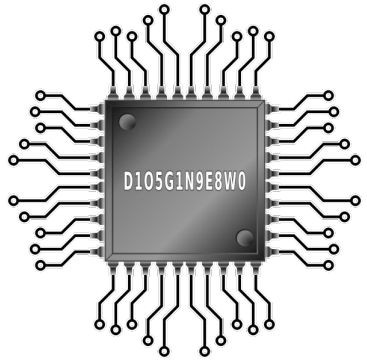
Providing a buzzing vibration on crossing threshold distance

Adding a water puddle detection as a future prospect

COMPONENTS REQUIRED

Hardware Components:

- NodeMCU ESP8266 microcontroller
- Ultrasonic Sensor
- LCD Display Module
- Buzzer
- Jumper cables
- USB Cable Type A/B
- Breadboard



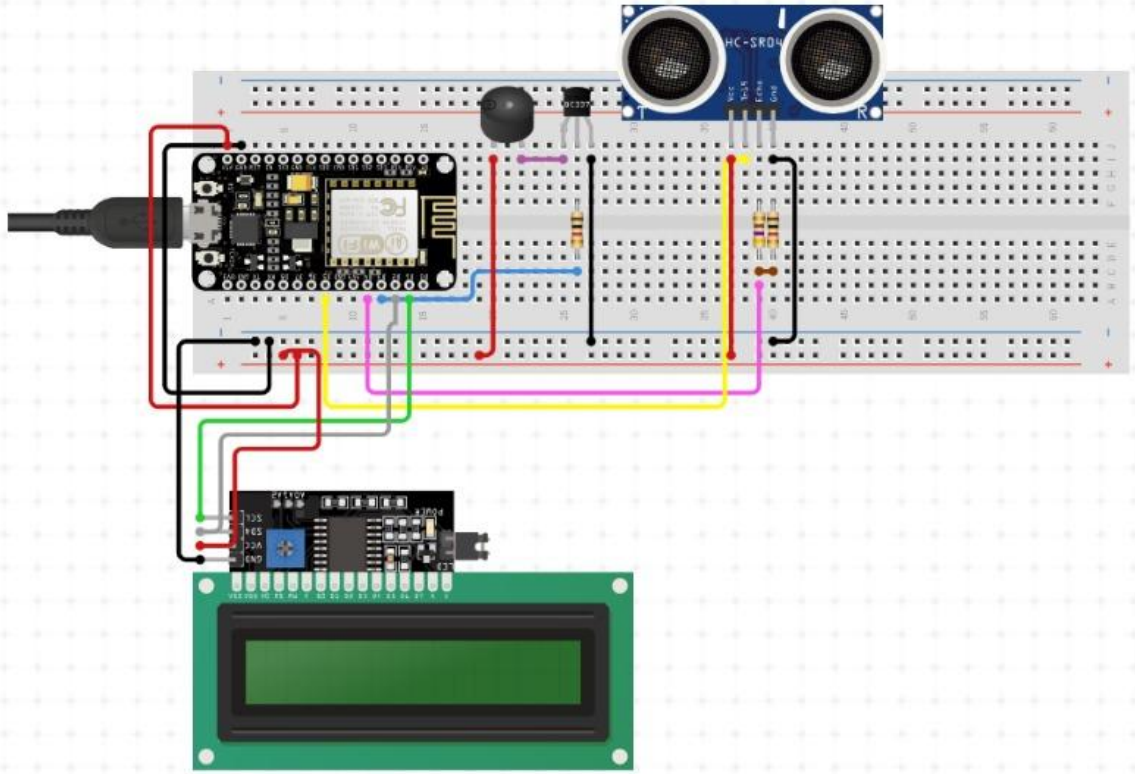
Software Components:

- Arduino IDE
- NodeMCU Firmware
- LCD Display Library

WORKING OF PROJECT

- The project uses a pair of ultrasonic transducers comprising of 1 transmitter and 1 receiver.
- The transmitter can deliver 40 Khz ultrasonic sound while the maximum receiver is design to accept only 40Khz sound waves.
- Whenever an obstacle obstructs the signals of ultrasonic transmitter it reflects the signal towards the ultrasonic receiver.
- The program is so written in MC to calculate the distance getting from ultrasonic module.
- The distance measured activates the buzzer to alert the user according to the threshold defined.
- Formula Used for distance measurement

  Distance = (Speed of Sound * Time taken)/2



CIRCUIT DIAGRAM

```
const int trigPin = D3;
const int echoPin = D0;
const int buzzer = D8;
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

long duration;
int distance;
int safetyDistance;

// Set the LCD address to 0x27 for a 16 chars and 2 line display
LiquidCrystal_I2C lcd(0x27, 16, 2);

void setup() {
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT);   // Sets the echoPin as an Input
  pinMode(buzzer, OUTPUT);   // Sets the buzzer as an Output
  lcd.begin();
  lcd.backlight();

  Serial.begin(9600);       // Starts the serial communication

  lcd.backlight(); // Turn on the backlight
}

void loop() {
  // Sets trigPin HIGH
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(100);
  digitalWrite(trigPin, LOW);
```

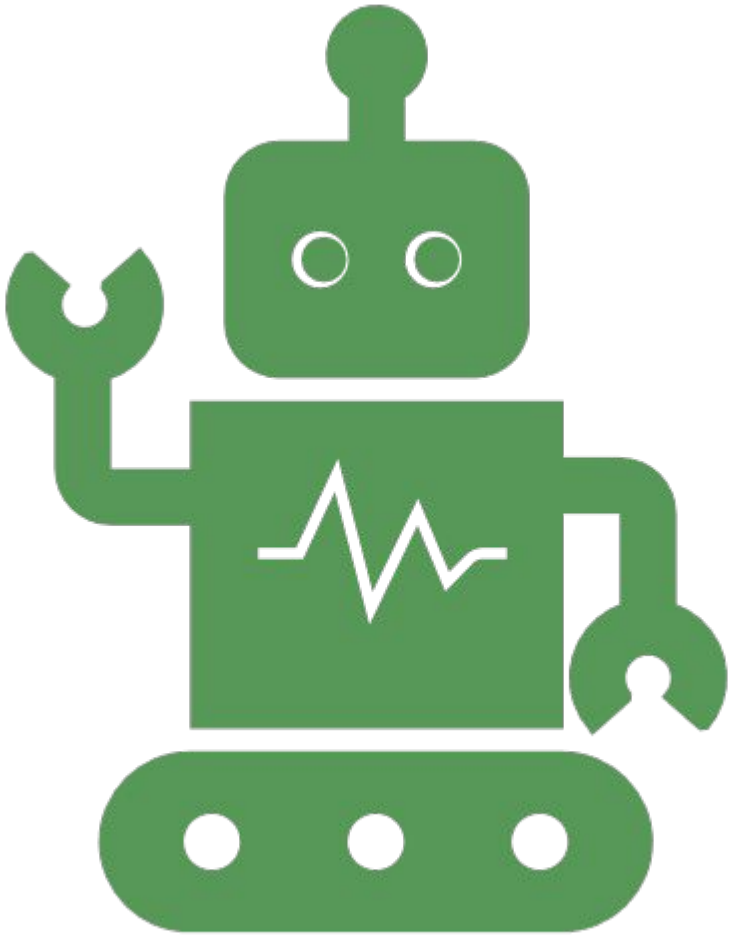
CODE

```
31
32      duration = pulseIn(echoPin, HIGH);
33      // Calculating distance
34      distance = (duration / 2) / 29.1;
35
36      Serial.print(distance);
37      Serial.println("CM");
38      delay(300);
39
40      // Prints the distance on the Serial Monitor
41      Serial.print("Distance: ");
42      safetyDistance = distance;
43
44      // Display distance on LCD
45      lcd.clear();
46      lcd.setCursor(0, 0);
47      lcd.print("Distance(cm):");
48
49      lcd.setCursor(0, 1);
50      lcd.print(distance);
51      // lcd.print(" CM");
52
53      // Sound buzzer if distance is less than or equal to 5
54      if (safetyDistance <= 10) {
55        digitalWrite(buzzer, HIGH);
56        delay(100);
57      } else {
58        digitalWrite(buzzer, LOW);
59      }
60    }
```

CODE

RESULT

The project achieves an NodeMCU-based obstacle detection system using ultrasonic sensors, providing feedback through buzzing sound or vibrations to aid visually impaired individuals in navigating obstacles. User testing validates its effectiveness, readiness for deployment, and potential to enhance mobility and safety in various environments.



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