Microcontroller based Industrial Applications

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Drowsiness Detection System

BATCH:24

KUNCHEPU SAI VARDHAN

PARNAPALLI VAMSI KIRAN

PEDDIBOINA VENKATA CHARAN KUMAR

KUKKALREDDY JAGADEESWAR REDDY

Problem statement:

Drowsy driving poses a serious risk to road safety, leading to accidents and fatalities. The challenge is to develop an effective drowsiness detection system using Arduino and PIR sensors to alert drivers and mitigate the dangers of driving while fatigued.

Scope of solution:

The proposed drowsiness detection system offers a comprehensive solution to address the pervasive issue of drowsy driving. By leveraging Arduino microcontrollers and Passive Infrared (PIR) sensors, the system provides realtime monitoring of drivers' eye movements to detect signs of drowsiness accurately. Its scope extends to various vehicle types, including cars, trucks, and buses, making it adaptable to diverse transportation scenarios. Furthermore, the

system's affordability and simplicity facilitate widespread adoption, benefiting both individual drivers and fleet operators.

Additionally, the system's integration with existing vehicle technologies allows for seamless implementation and compatibility with modern vehicles. The solution's effectiveness in detecting drowsiness and its immediate alert mechanism contribute significantly to enhancing road safety and reducing the incidence of accidents caused by driver fatigue. Overall, the scope of this solution encompasses a broad range of applications, making it a valuable tool for improving transportation safety worldwide.

Abstract:

Drowsy driving is a significant safety concern, contributing to numerous accidents and fatalities on roads worldwide. In response, this study presents a drowsiness detection system utilizing Arduino microcontrollers and Passive Infrared (PIR) sensors. The system aims to mitigate the risks associated with drowsy driving by monitoring drivers' eye movements in real-time.

The PIR sensor continuously scans the driver's face for signs of motion, identifying periods of inactivity indicative of drowsiness. Upon detecting prolonged periods of inactivity, typically exceeding 5 seconds, the system activates an alert mechanism comprising a buzzer and LED.

This immediate alert prompts drivers to take corrective actions, such as resting or pulling over, to mitigate the risk of accidents caused by driver fatigue. The system's affordability, simplicity, and effectiveness make it a promising tool for enhancing road safety and reducing the incidence of drowsy driving-related accidents.

Introduction:

Drowsy driving is a significant contributor to road accidents worldwide, posing a threat to driver safety and public health. To address this issue, we introduce a drowsiness detection system leveraging the capabilities of Arduino microcontrollers and Passive Infrared (PIR) sensors.

This system aims to detect signs of drowsiness in drivers by monitoring their eye movements in real-time. By continuously monitoring the driver's face, the PIR sensor detects changes in motion indicative of alertness or drowsiness. When prolonged periods of inactivity, typically 5 seconds, are detected, the system triggers an alert through the activation of a buzzer and LED.

This real-time alert mechanism aims to prompt drivers to take corrective actions, such as resting or pulling over, thereby reducing the risk of accidents caused by drowsy driving. The simplicity, affordability, and effectiveness of this system make it a valuable tool in enhancing road safety and mitigating the dangers associated with driver fatigue.

Required components to develop solutions:

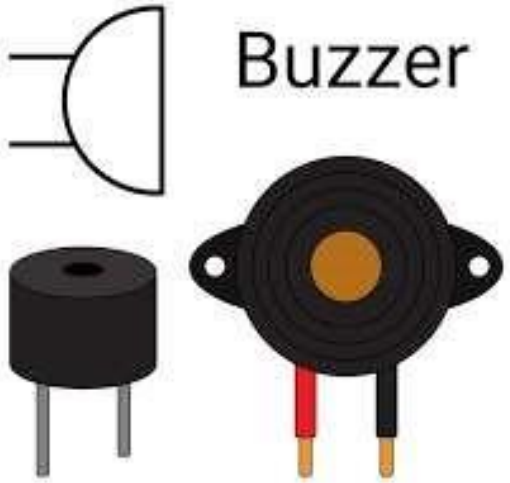
- Arduino Uno
- PIR Sensor
- Buzzer
- LED
- Power Supply
- Connecting wires

Detailed explanation for each component:

Arduino UNO:-

An Arduino Uno is a small, programmable microcontroller board that you can use to create all sorts of electronic projects. It has inputs and outputs that you can control using code you write on your computer. Basically, it's like a tiny brain for your electronics projects, allowing you to control lights, motors, sensors, and much more!

Buzzer:-



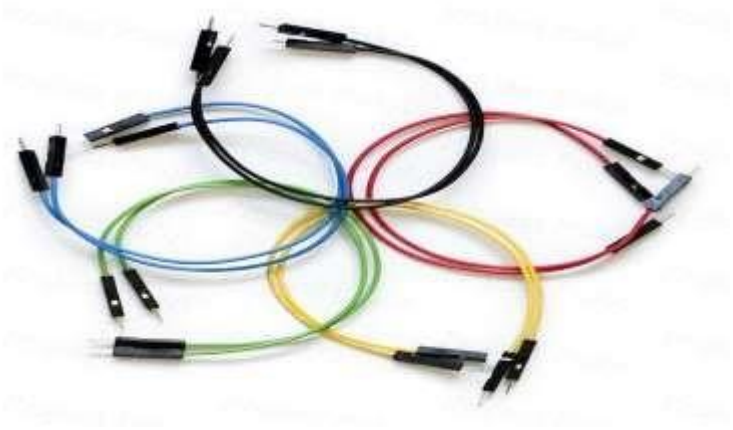
A buzzer is an electrical device that produces a buzzing sound when an electrical current passes through it. It's commonly used in various applications such as alarms, timers, and signaling devices to audibly alert or indicate something. Buzzer typically consists of an electromagnet coil and a vibrating diaphragm or armature. When current flows through the coil, it creates a magnetic field that attracts the armature, causing it to move and produce the buzzing sound.

LEDs:

LEDs (Light Emitting Diodes) are semiconductor devices that emit light when an electric current passes through them, used in various applications for efficient lighting and displays. They consume less energy, have longer lifespans, and offer a range of colors

PIR sensor:

A Passive Infrared (PIR) sensor is a type of motion sensor that detects infrared radiation emitted by objects in its field of view. It consists of a pyroelectric sensor that generates a voltage when exposed to heat changes caused by motion. PIR sensors are commonly used in security systems, automatic lighting, and drowsiness detection systems. They have a wide detection range and are sensitive to human body heat, making them suitable for detecting motion in indoor and outdoor environments. PIR sensors are typically inexpensive, easy to use, and consume low power, making them popular for various applications requiring motion detection



Connecting Wires:-

Connecting wires involves joining two or more conductive materials to establish an electrical pathway for current flow. This connection is typically achieved by twisting, soldering, or using connectors such as terminals or wire nuts. It's crucial to ensure proper insulation and secure connections to prevent electrical hazards.

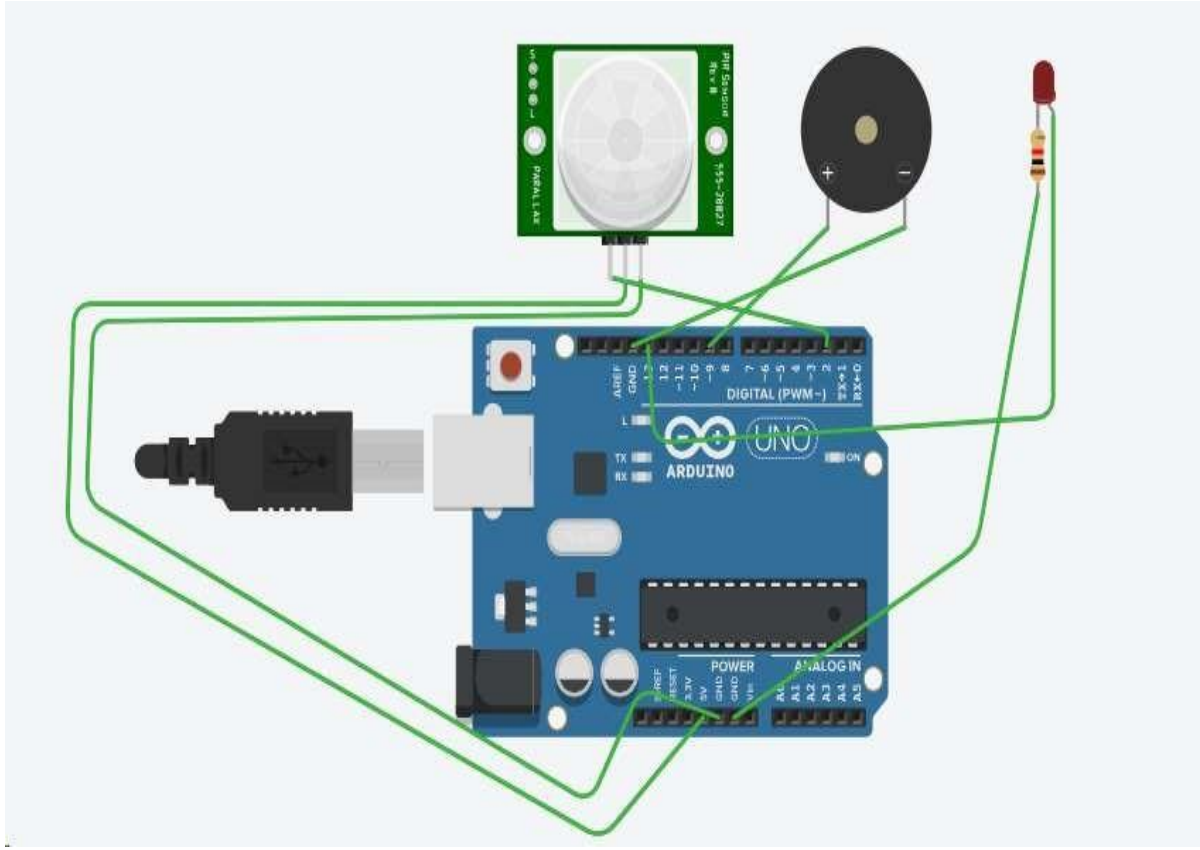
Software required:

Tinkercad

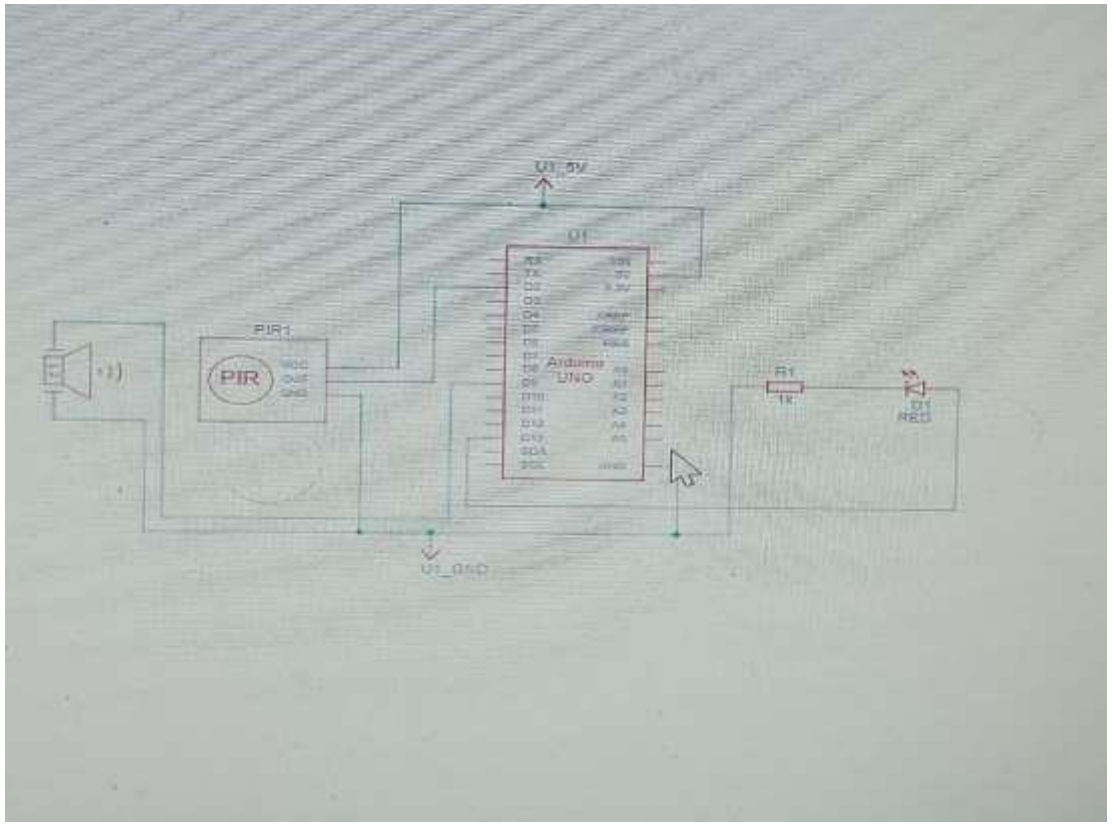
Arduino IDE

ARDUINO
IDE

Simulated circuit:



Schematic Diagram:



Video of the Demonstration:

Code for the solution:

```
#define PIR_SENSOR_PIN 2 // Adjust pin number based on your setup
#define LED_PIN 13 #define
BUZZER_PIN 9 unsigned long
eyesClosedStartTime = 0; boolean
eyesClosed = false; void setup() {
 pinMode(PIR_SENSOR_PIN, INPUT);
 pinMode(LED_PIN, OUTPUT);
 pinMode(BUZZER_PIN, OUTPUT);
} void loop()
{
 if (digitalRead(PIR_SENSOR_PIN) == HIGH) {
  // Motion detected (eyes open)
  digitalWrite(LED_PIN, HIGH); // Turn on LED
  eyesClosed = false; // Reset the flag
 } else {
  // No motion detected (eyes closed)
  digitalWrite(LED_PIN, LOW); // Turn off LED
    if (!eyesClosed) {
```

```
      eyesClosedStartTime = millis();
      eyesClosed = true;
    } else { if (millis() - eyesClosedStartTime >= 5000) { //
      5 seconds have passed, sound the buzzer
      digitalWrite(BUZZER_PIN, HIGH); // Turn on buzzer
      delay(1000); // Buzzer duration
        digitalWrite(BUZZER_PIN, LOW); // Turn off buzzer
      }
    }
  }
 delay(100);
}
```

Conclusion:

In conclusion, the drowsiness detection system presented offers a cost-effective and efficient solution to mitigate the risks of drowsy driving. By leveraging Arduino microcontrollers and Passive Infrared (PIR) sensors, the system accurately detects signs of drowsiness in real-time. Its immediate alert mechanism prompts drivers to take corrective actions, thereby enhancing road safety and reducing the incidence of accidents caused by driver fatigue. The simplicity, affordability, and effectiveness of this system make it a valuable tool in promoting safe driving practices and safeguarding public health on roads.