Arduino Nano Based Anti-Sleep Smart Alarm Using an IR Proximity Sensor

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Abstract

IR Proximity Sensor and Arduino nano are being used in making different types of devices today. There are mainly two types of LEDs in IR sensor, in which one works as IR transmitter and other as IR receiver. IR radiation is mainly absorbed by black objects. Our work is based on a principle that when a person's eyes are open, the IR radiation is absorbed by the black pupil of the eyes, but when the eyes remain closed for a long time, the IR radiation emitted by the IR transmitter is reflected by the eyelids and absorbed by the IR receiver. The received signals are transmitted to the Arduino nano input pin by the IR Proximity Sensor's signal pin, due to which output pin of Arduino nano gets activated by uploaded programme. Arduino IDE application is being used to program the Arduino board. The proposed work is cost-effective, easy to implement an innovative idea to enhance driver safety.

Keywords: Anti-sleep alarm, Arduino Nano, IR proximity sensor, Smart glasses, Asleep.

Introduction

In the last few years, it has been seen that the incidents of accidents on the road have increased due to the driver falling asleep. This is a matter of great concern. Many scientists have presented their projects to solve this problem, through which the driver can be informed in time and wake him from sleep. While traveling very long distances and driving at night, the driver often falls asleep which, leads to a major accident which leads to death for the driver and other people on the road. During our literature review, we found that some scientists have combined different sensors to create devices that can be used to prevent such horrific incidents. Literature review reveals that various solutions have been proposed to address this issue, including eye-tracking, heart rate monitoring, and steering behavior analysis. W. Deng and his co-worker [1] proposed a survey of wearable devices for driver drowsiness monitoring. Driver fatigue detection using head movement analysis and Arduino-based approach was proposed by M. Patel and A. Thakkar [2], Implementation of Arduino-based smart wearable system for health monitoring system were developed by Nawaz [3] and his coworker, Low-cost drowsiness detection system using Arduino and multiple sensors developed by Ahmed et al [4], Smart glasses design for fatigue detection based on head movement using embedded systems was innovated by Park et al [5]. R. Kumar and his coworker [6] implemented smart wearable device for fatigue detection using microcontroller whereas C. A. Perez at al [7] prepared Real-time drowsiness detection using infrared sensors. S. Polur [8] and his team mainly focus on designing and implementation of an anti-sleep alerting system using Arduino and sensors. Al-Emran et al [9] proposed the systematic review on Wearable devices for drowsiness detection. Infrared sensors for proximity sensing and gesture recognition in wearable applications were analyzes implemented by N. B. Carvalho and P. Pinho [10].Wearable devices, particularly microcontrollers such as Arduino, provide an accessible platform for building drowsiness detection systems along with Infrared (IR) proximity sensors and other useful gazettes. Recent

innovations and development in wearable technology make the devices compact, cost-effective solutions for monitoring driver alertness. Among these, smart glasses have emerged as a promising option due to their convenience and seamless integration into the user's daily activities. By using sensors to track head movements and eye behavior, smart glasses can offer a non-intrusive and real-time method to detect signs of fatigue and alert the user to potential danger. In this project, we are developing anti slip alarm using IR proximity sensor with Arduino which will beep based on the movement of eyelids. IR radiation is absorbed by mainly black objects and does not reflect. We are developing this project using the same principle. When IR radiation falls on the pupils of our eyes, then due to the pupils being black, that radiation is absorbed, as a result of which no alarm is emitted. But when the eyelids are closed for a period of 3 milliseconds, then the IR radiation sent by the IR transmitter is reflected by the eyelids and is received by the IR receiver and according to the developed program, the alarm is emitted and wakes up the driver from sleep. The objective is to create a cost-effective, wearable solution that enhances driver safety by providing timely alerts to prevent fatigue-related accidents.

2. Components and Working Principle

2.1. Components

Sr.No.	Name	Quantity	Components
1	Arduino nano	1	Arduino nano
2	IR Sensor	1	IR Proximity Sensor
3	Alarm	1	Buzzer

2.2. Working Principle

IR radiation is mainly absorbed by black objects. Using this principle, different types of human yogi devices are being manufactured. Our project is based on a principle that when a person's eyes are open, the IR radiation is absorbed by the pupil of the eyes, but when the eyes remain closed for a long time, the IR radiation emitted by the IR transmitter is reflected by the eyelids and absorbed by the IR receiver. The received signals are transmitted to the Arduino board by the IR Proximity Sensor, due to which the market gets activated through programming by the Arduino board. When the eyelids are closed for a period of 3 to 5 seconds, then the IR radiation sent by the IR transmitter is reflected by the eyelids and is received by the IR receiver and according to the developed program, the alarm is emitted and wakes up the driver from sleep. The objective is to create a cost-effective, wearable solution that enhances driver safety by providing timely alerts to prevent fatigue-related accidents.

3. Arduino programming

```
const int irSensorPin = 8;
const int buzzerPin = 9;

unsigned long closeDuration = 0;
unsigned long thresholdTime = 3;
bool isEyeClosed = false;

void setup() {
   pinMode(irSensorPin, INPUT);
  pinMode(buzzerPin, OUTPUT);
```

```
    digitalWrite(buzzerPin, LOW);
}

void loop() {
    int sensorValue = digitalRead(irSensorPin);

  if (sensorValue == LOW) {
   if (!isEyeClosed) {
    closeDuration = millis();
    isEyeClosed = true;
   }

   if (millis() - closeDuration >= thresholdTime) {
    digitalWrite(buzzerPin, HIGH); // Activate buzzer
   }
  }
  else {
   isEyeClosed = false;
   digitalWrite(buzzerPin, LOW);  }
}
```

4. Result and Discussion

The project, deals with IR Proximity Sensor that two types of LEDs one works as IR transmitter and other as IR receiver, Arduino nano board. This is a compact and versatile microcontroller suitable for wearable applications and alarming device called as buzzer. The IR proximity sensor's VCC and GND pin's are connected to the 5V and GND pins of the Arduino Nano. The IR proximity sensor's signal pin (Input) is connected to digital pin 8 of the Arduino Nano. Output device (buzzer) is connected to digital pin 9 as shown in figure 1.
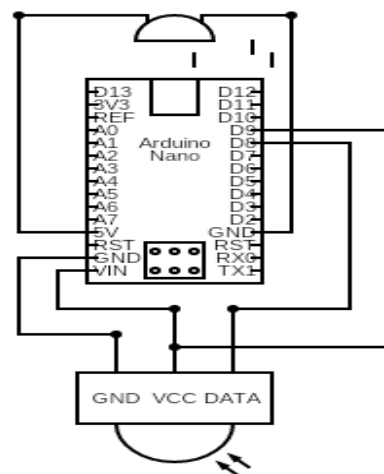

Fig1. Circuit diagram

A small rechargeable battery is used to power the Arduino Nano and connected components. Arduino IDE application is being used to program the Arduino board. IR radiation is mainly absorbed by black objects and does not reflect. This project works on same principle. When IR radiation falls on the black pupils of our eyes, no reflection is observed due to the pupils being black, that radiation is absorbed, as a result of which no alarm is observed emitted. But when the eyelids are closed for a specific interval of time, in this work we have programmed the device for 3 seconds then the IR radiation sent by the IR transmitter LED is reflected by the eyelids and is received by the IR receiver LED the alarm is start functioning and wakes up the driver from sleep.

5. Conclusion

On behalf of above discussion it can be concluded that this work successfully demonstrates a low-cost, Arduino Nano-based anti-sleep alarm system integrated into smart glasses provide straightforward effective solution for reducing fatigue-related risks, especially for drivers. An IR proximity sensor mainly monitor's eye closure duration and a buzzer start issue a warning beep on the bases of programme uploaded in Arduino nano micro-controller to alter the drive from accident.

6. Acknowledgement

7. References

1. W. Deng, Z. Wu, Y. Liu, and W. Wang, "A survey of wearable devices for driver drowsiness monitoring," *Sensors*, vol. 21, no. 1, pp. 1-20, 2021.
2. M. Patel and A. Thakkar, "Driver fatigue detection using head movement analysis and Arduino-based approach," *International Journal of Scientific Research in Science, Engineering and Technology*, vol. 7, no. 5, pp. 1-6, 2020.
3. M. Nawaz, T. Adil, and S. H. Hussain, "Implementation of Arduino-based smart wearable system for health monitoring," *Advances in Science, Technology and Engineering Systems Journal*, vol. 5, no. 5, pp. 336-341, 2020.
4. S. A. Ahmed, M. Y. Bin Muhammad, and N. A. H. J. Ahsan, "Low-cost drowsiness detection system using Arduino and multiple sensors," *Journal of Advanced Research in Applied Mechanics*, vol. 72, no. 1, pp. 1-10, 2020.
5. J. H. Park, B. S. Yoo, and S. R. Oh, "Smart glasses design for fatigue detection based on head movement using embedded systems," *Electronics*, vol. 10, no. 8, pp. 952-962, 2021.
6. R. Kumar, V. S. Shekhawat, and N. S. Rathore, "Implementation of a smart wearable device for fatigue detection using microcontroller," *Procedia Computer Science*, vol. 167, pp. 2287-2296, 2020.
7. C. A. Perez, S. A. Jacklin, and E. J. Garcia, "Real-time drowsiness detection using infrared sensors," *Applied Sciences*, vol. 11, no. 4, pp. 1-18, 2021.
8. S. Polur, N. Jayasundar, and R. Prasad, "Design and implementation of an anti-sleep alerting system using Arduino and sensors," *International Journal of Computer Applications*, vol. 182, no. 8, pp. 20-24, 2018.
9. A. Al-Emran, M. Shaalan, and K. Almohammadi, "Wearable devices for drowsiness detection: A systematic review," *IEEE Access*, vol. 8, pp. 106697-106707, 2020.
10. N. B. Carvalho and P. Pinho, "Infrared sensors for proximity sensing and gesture recognition in wearable applications," *Journal of Engineering and Technology*, vol. 5, pp. 98-110, 2019.