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CAR ACCIDENT PREVENTION SYSTEM

by

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A project report submitted to

Dr.PRAKASH V

SCHOOL OF ELECTRONICS ENGINEERING

in partial fulfilment of the requirements for the course of

ECE4003 EMBEDDED SYSTEM DESIGN

in

B. Tech. ELECTRONICS AND COMPUTER ENGINEERING

TABLE OF CONTENTS

BONAFIDE CERTIFICATE

Certified that this project report entitled- Car Accident Prevention System is a bonafide work of **Ujjwal Gupta, KPS Shivratna, Himanshu Singh Baghel and and Priyanshu Prasad** with Reg no 19BLC1133,19BLC1012,19BLC1072 and 19BLC1017 carried out the Project work under my supervision and guidance for **ECE4003-Embedded System Design.**

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ABSTRACT

Road accidents have been a major cause for concern across the Indian subcontinent. In 2019 alone, the country reported over 151 thousand fatalities due to road accidents. Each year, about three to five percent of the country's GDP was invested in road accidents. The accident avoidance measures used nowadays are all static and old. Also, there is no proper accident detection mechanism.

We will be making a Drowsiness Detection Car Safety device. A countless number of people drive on the highway day and night. Taxi drivers, bus drivers, truck drivers and people traveling long-distance suffer from lack of sleep. Due to which it becomes very dangerous to drive when feeling sleepy. The majority of accidents happen due to the drowsiness of the driver. So, to prevent these accidents we will build a system using Python, OpenCV and Arduino which will alert the driver when he feels sleepy.

Drowsiness detection is a safety technology that can prevent accidents that are caused by drivers who fell asleep while driving. It is an intermediate Python project to build a drowsiness detection system that will detect that a person’s eyes are closed for a few seconds. This system will alert the driver when drowsiness is detected. It will also help in alarming the nearby drivers that the car is slowing down as the driver is not awake.

ACKNOWLEDGEMENT

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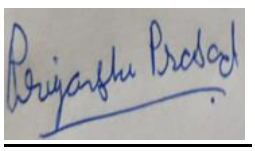
We also take this opportunity to thank all the faculty of the School for their support and their wisdom imparted to us throughout the course.

We thank our parents, family, and friends for bearing with us throughout the course of our project and for the opportunity they provided us in undergoing this course in such a prestigious institution.



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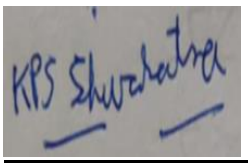
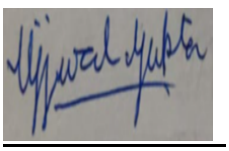


KPS Shivratna (19BLC1012)



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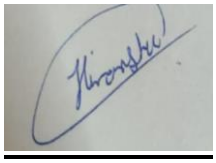

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1. INTRODUCTION

1.1 OBJECTIVES AND GOALS

This project proposes a system for early Prevention of accidents. Our project uses Face Recognition technology to monitor the vehicle continuously and also to access and control remotely. The IoT devices placed in vehicles are designed and are acquainted with sensors to Prevent accidents immediately. The system is also acquainted with a camera to detect drowsiness of the driver and alarm a buzzer when the driver, and if detected signal a high output alarm.

1.2 APPLICATIONS

The system will overcome the drawbacks by providing accurate and reliable results after analyzing the condition of a driver while driving.

The system can be used in a wide range of locomotives such as trucks, cars and light vehicles to provide a safe journey throughout.
In future, this system can be developed into an inbuilt system by vehicle manufacturers and installing an infrared camera, high output

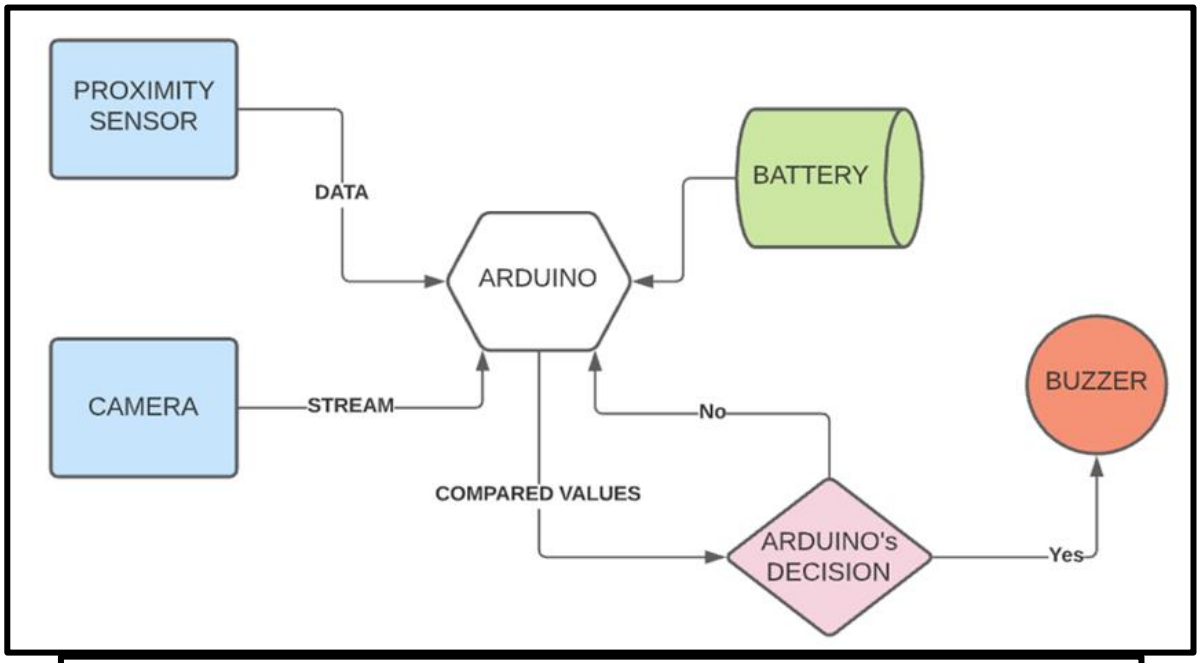
1.3 FEATURES

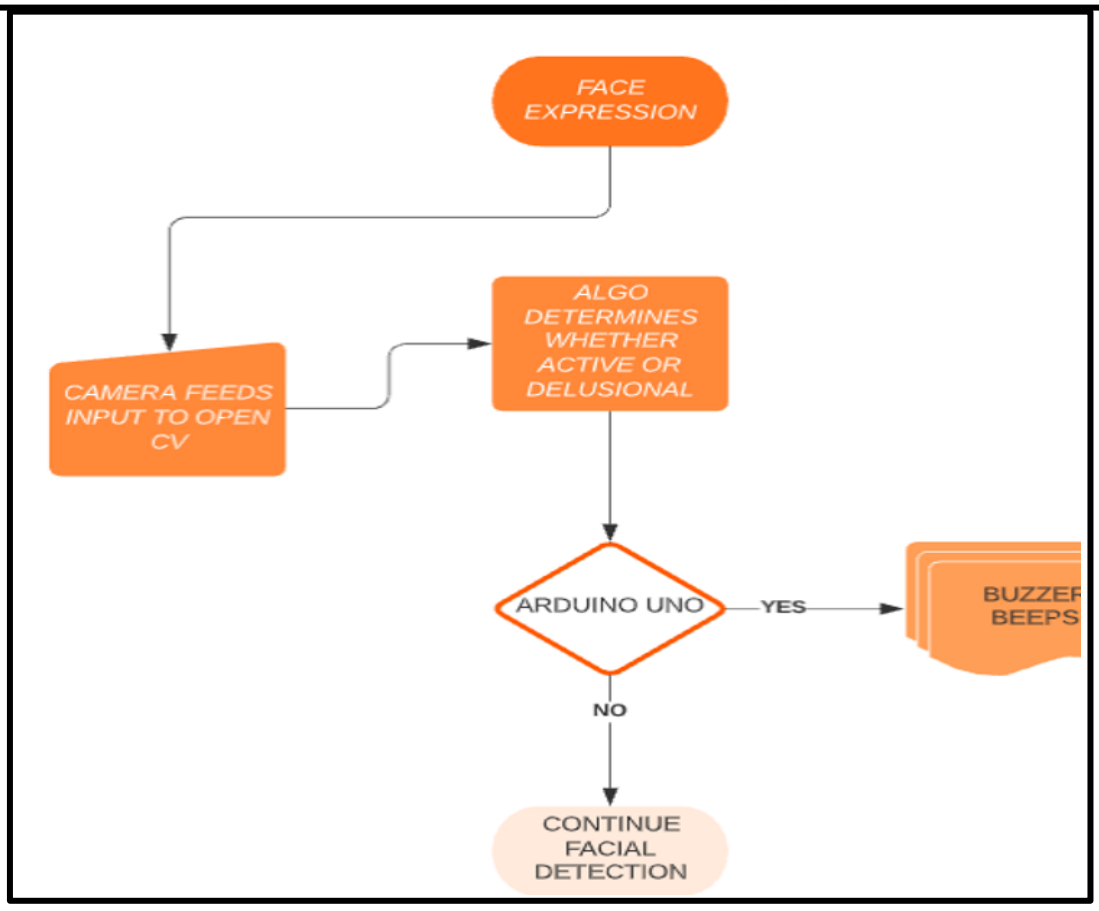
- Modern Safety features like Image Processing and IOT involved in working on this project.
- Project utilizes car system to sound buzzer and turn on the Turn Lights indicator in parking mode to notify nearby cars that someone is asleep in this car
- Using minimal complexity in algorithms and logic the system is very fast and can be very spontaneous while preventing any accident.

2.DESIGN

2.1 BLOCK DIAGRAM

Hardware and Software Architecture





2.2 HARDWARE ANALYSIS

1. Ultrasonic sensor : **HC-SR04** ultrasonic distance sensor. This economical sensor provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm.
2. Arduino UNO Rev3 : Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button.

MICROCONTROLLER	ATmega328P
OPERATING VOLTAGE	5V
INPUT VOLTAGE (RECOMMENDED)	7-12V
INPUT VOLTAGE (LIMIT)	6-20V
DIGITAL I/O PINS	14 (of which 6 provide PWM output)
PWM DIGITAL I/O PINS	6
ANALOG INPUT PINS	6
DC CURRENT PER I/O PIN	20 mA

DC CURRENT FOR 3.3V PIN	50 mA
FLASH MEMORY	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)

3. **Buzzer :** arduino buzzer is also called a piezo buzzer. It is basically a tiny speaker that you can connect directly to an Arduino. You can make it sound a tone at a frequency you set. The buzzer produces sound based on reverse of the piezoelectric effect.

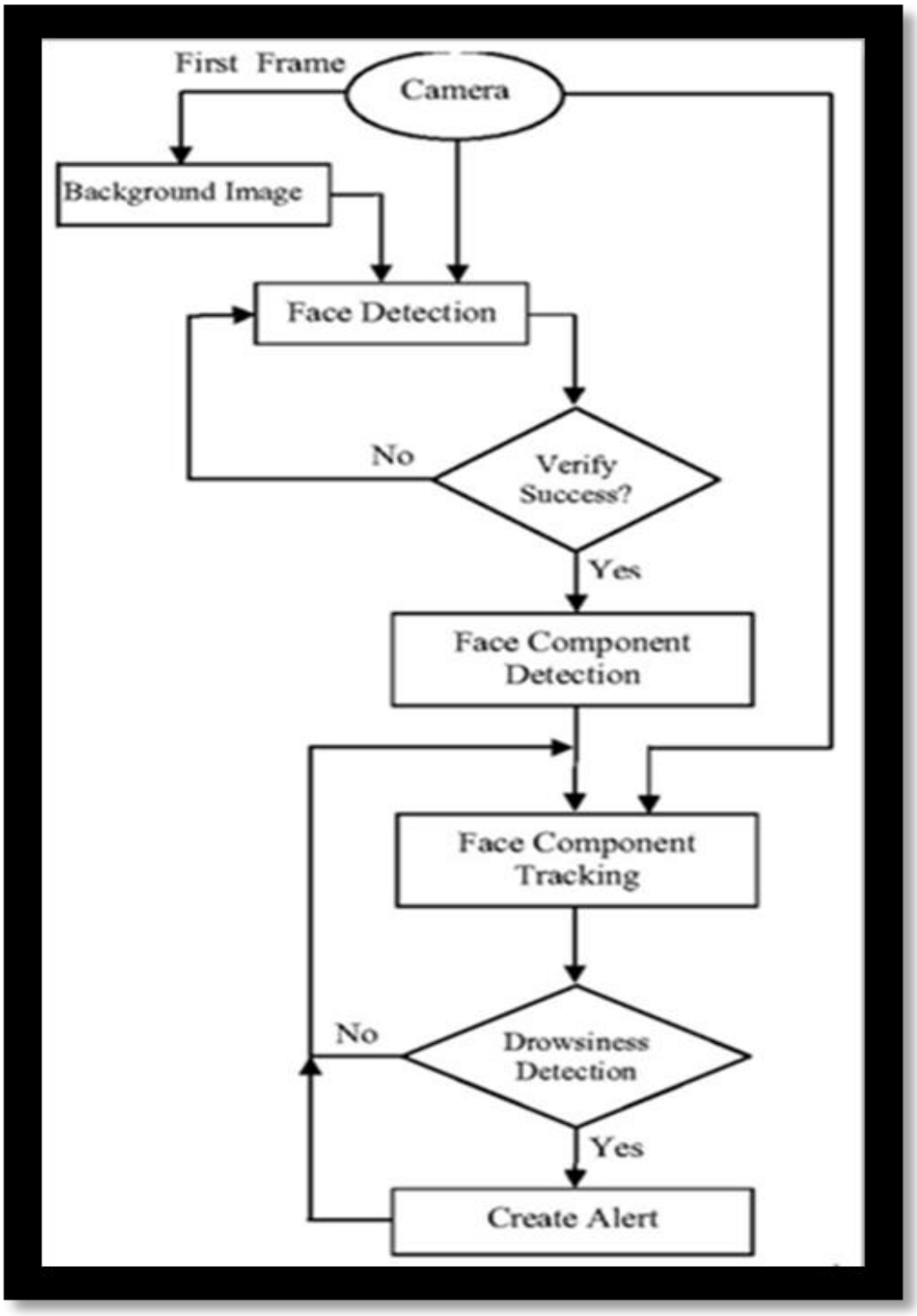
4. **LED 1:** It indicated that the driver drowsiness detection system is currently activated.

5. **LED 2 :** This LED blinks when the driver drowsiness is detected.

6. **LED 3,4 :** They will be acting as the side lights(hazard lights) of the car which will blink if drowsiness is detected to alert other people around the vehicle.

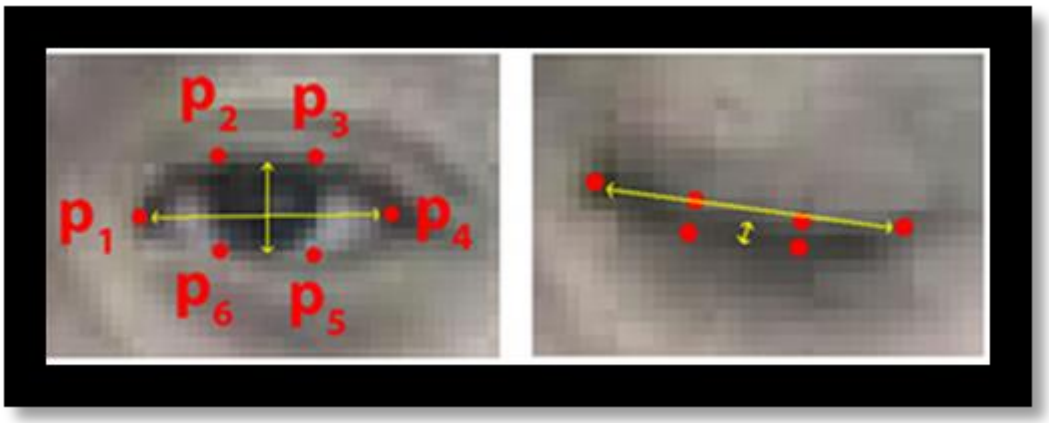
SOFTWARE ANALYSIS

- **ALGORITHM**



- The Algorithm detects the face in the pre-processed image by using facial landmarks produced by dlib library.
- In the detected face region, the algorithm finds the face landmark
- To detect eye region, the correct array slices from the set of face landmarks is detected.
- Set the ear threshold = 0.25.
- Calculate ear (eye aspect ratio) to determine whether the eyes of the driver are closed or not while driving.
- Check to see if the eye aspect ratio is below the "blink/closed" eye threshold.
- If it is, increment counter, the total number of consecutive frames where the person has had their eyes closed.
- If the counter is greater than 50, alarm sounds and **"Alert!"** Is created

Algorithm to calculate the EAR(Eye Aspect Ratio)



EAR algorithm:

Step 1: Use the Detected Eye region from the algorithm.

Step 2: Compute the Eye Aspect Ratio to determine if the eyes are closed.

Step 3: If EAR satisfies the drowsy condition then move to step 5.

Step 4: If EAR is normal then go to Step 1.

Step 5: Sound Alarm.

The formula used for calculation of EAR is as follows:

$$\mathrm{EAR} = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

SNAPSHOTS OF THE PYTHON SCRIPT

```
# initialize dlib's face detector (HOG-based) and then create the facial landmark predictor
print("[INFO] loading facial landmark predictor...")
detector = dlib.get_frontal_face_detector()
predictor = dlib.shape_predictor("D:\SEM 5\ESD\Driver-drowsiness-detection--master\shape_predictor_68_face_landmarks.dat")

# grab the indexes of the facial landmarks for the left and
# right eye, respectively
(left_Start, left_End) = face_utils.FACIAL_LANDMARKS_IDXS["left_eye"]
(right_Start, right_End) = face_utils.FACIAL_LANDMARKS_IDXS["right_eye"]

# start the video stream thread
print("[INFO] starting video stream thread...")
vs = VideoStream(src=0).start()
time.sleep(1.0)

# loop over frames from the video stream
while True:
        # detecting frames and converting them to gray scale
    frame = vs.read()
    frame = imutils.resize(frame, width=450)
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)

        # detect faces in the grayscale frame
    rects = detector(gray, 0)

        # loop over the face detections
    for (rect) in rects:
                # computing facial landmarks and then converting them to numpy array
        shape = predictor(gray, rect)
        shape = face_utils.shape_to_np(shape)

    # draw rectangle overthe detected face
        (x, y, l, h) = face_utils.rect_to_bb(rect)
        cv2.rectangle(frame, (x, y), (x + l, y + h), (58,39,152), 5)
```

Sending signal to Arduino using Serial Communication

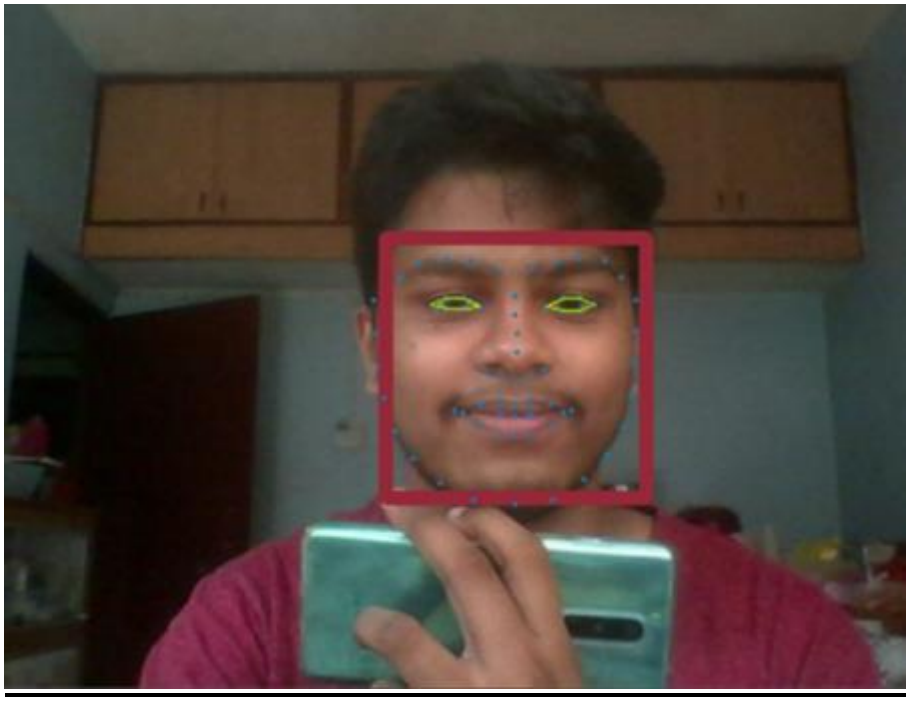
```
                    # checking if the alarm file is supplied and if so then play the alarm
if ala!= "":
    winsound.PlaySound(ala, winsound.SND_ASYNC)
                    #passing the value to write on the arduino
    Arduino.write(b'1')
    time.sleep(1)
    winsound.PlaySound(None, winsound.SND_PURGE)
            # displaying alert message
cv2.putText(frame, "DROWSINESS ALERT!", (10, 30),cv2.FONT_HERSHEY_SIMPLEX, 0.7, (0,0,255), 2)
```

CODE FOR ARDUINO

```
#define echoPin 2 // attach pin D2 Arduino to pin Echo of HC-SR04
#define trigPin 3 //attach pin D3 Arduino to pin Trig of HC-SR04

// defines variables
long duration; // variable for the duration of sound wave travel
int distance; // variable for the distance measurement

int LEDB=11;
int LEDR=9;
int BUZR=6;
int tim = 1;  //the value of delay time
int serial;

void setup()
{ Serial.begin(1);
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an OUTPUT
  pinMode(echoPin, INPUT); // Sets the echoPin as an INPUT
  pinMode(LEDR, OUTPUT);
  pinMode(LEDB, OUTPUT);
  pinMode(BUZR, OUTPUT);
}

void loop()
{  digitalWrite(LEDB, HIGH);
  // Clears the trigPin condition
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  // Sets the trigPin HIGH (ACTIVE) for 10 microseconds
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  // Reads the echoPin, returns the sound wave travel time in microseconds
  duration = pulseIn(echoPin, HIGH);
  // Calculating the distance
```

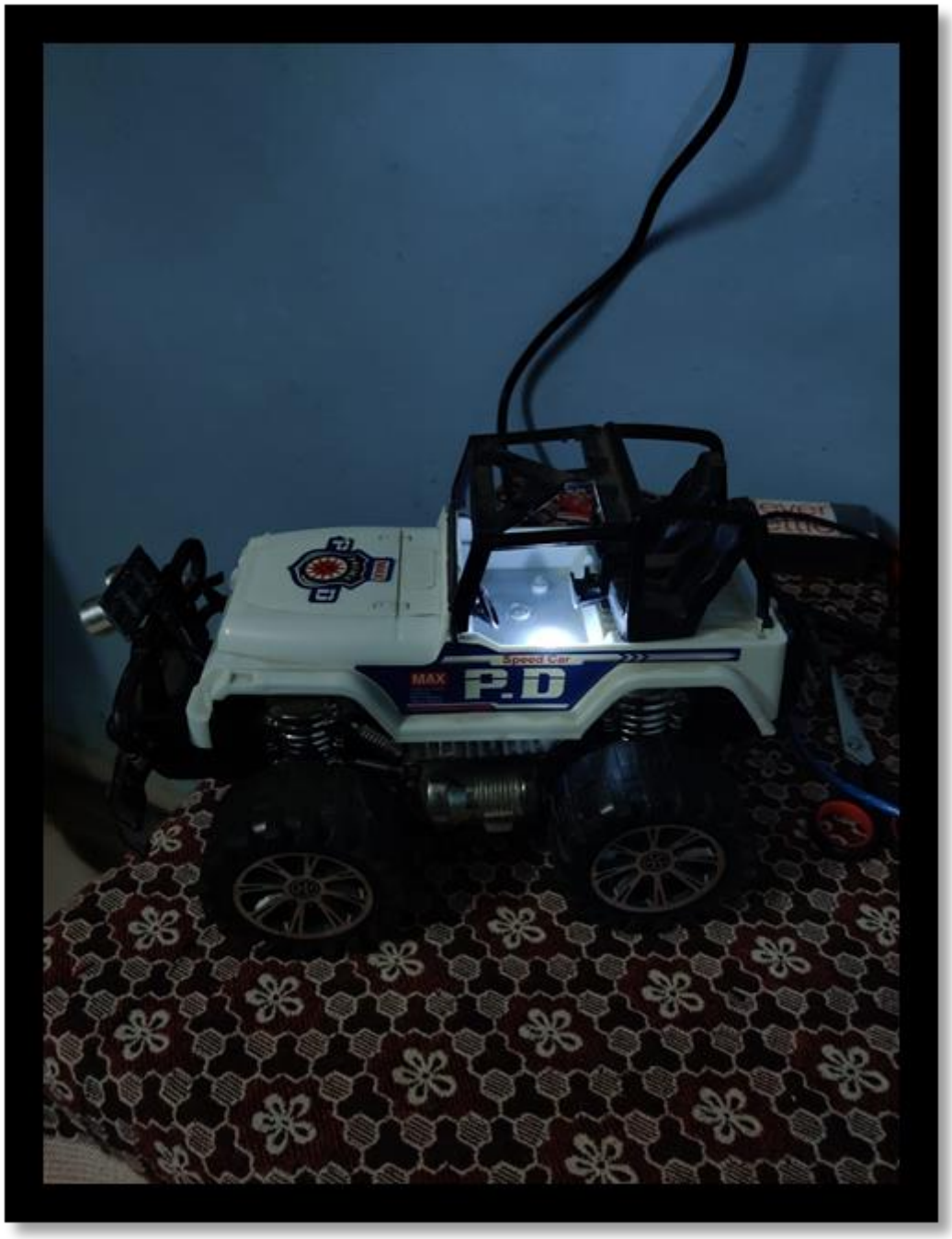
SNAPSHOTS OF THE RESULT

- **EYES OPEN-NO ALARM**



- **EYES CLOSED- ALARM!!**

Car System is on Denoted by White Light.

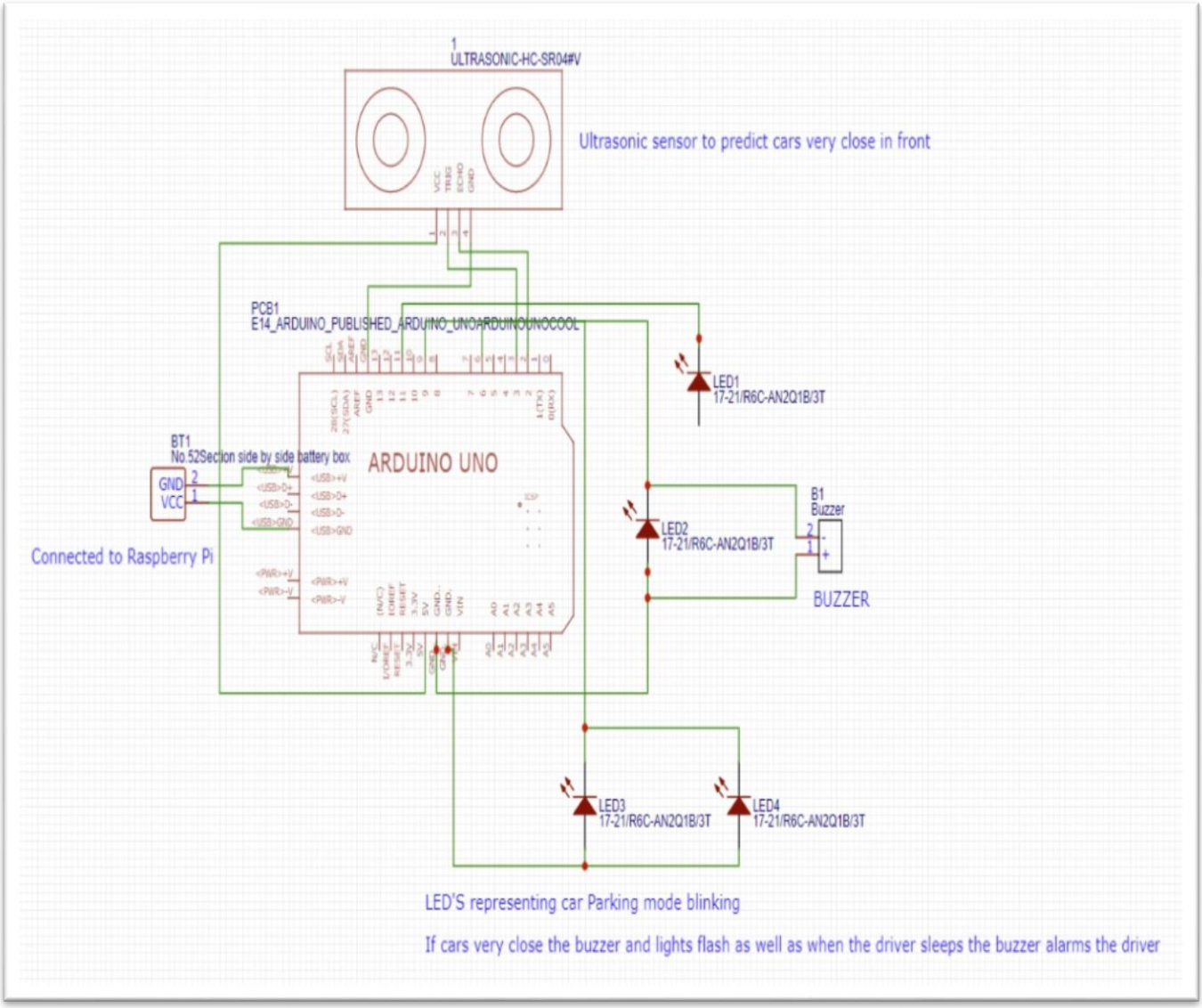


USE CASE

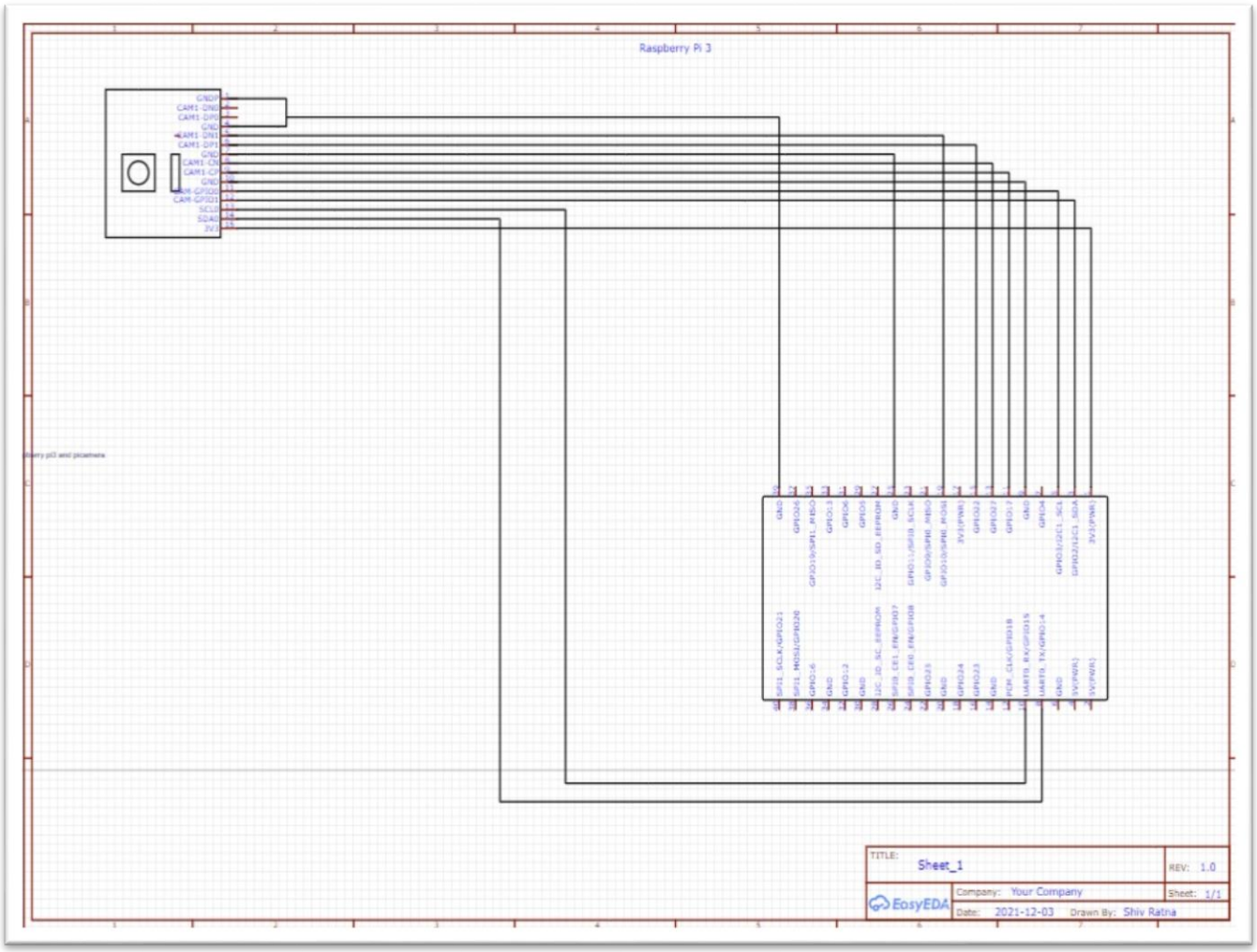
If distance sensor finds object closer than safety distance blue light in car indicates alarming with buzzer inside car

Ultrasonic sensor in front of car also left and right indicator when driver falls asleep while driving system is alerted and indicator start blinking to inform nearby users to pass slowly

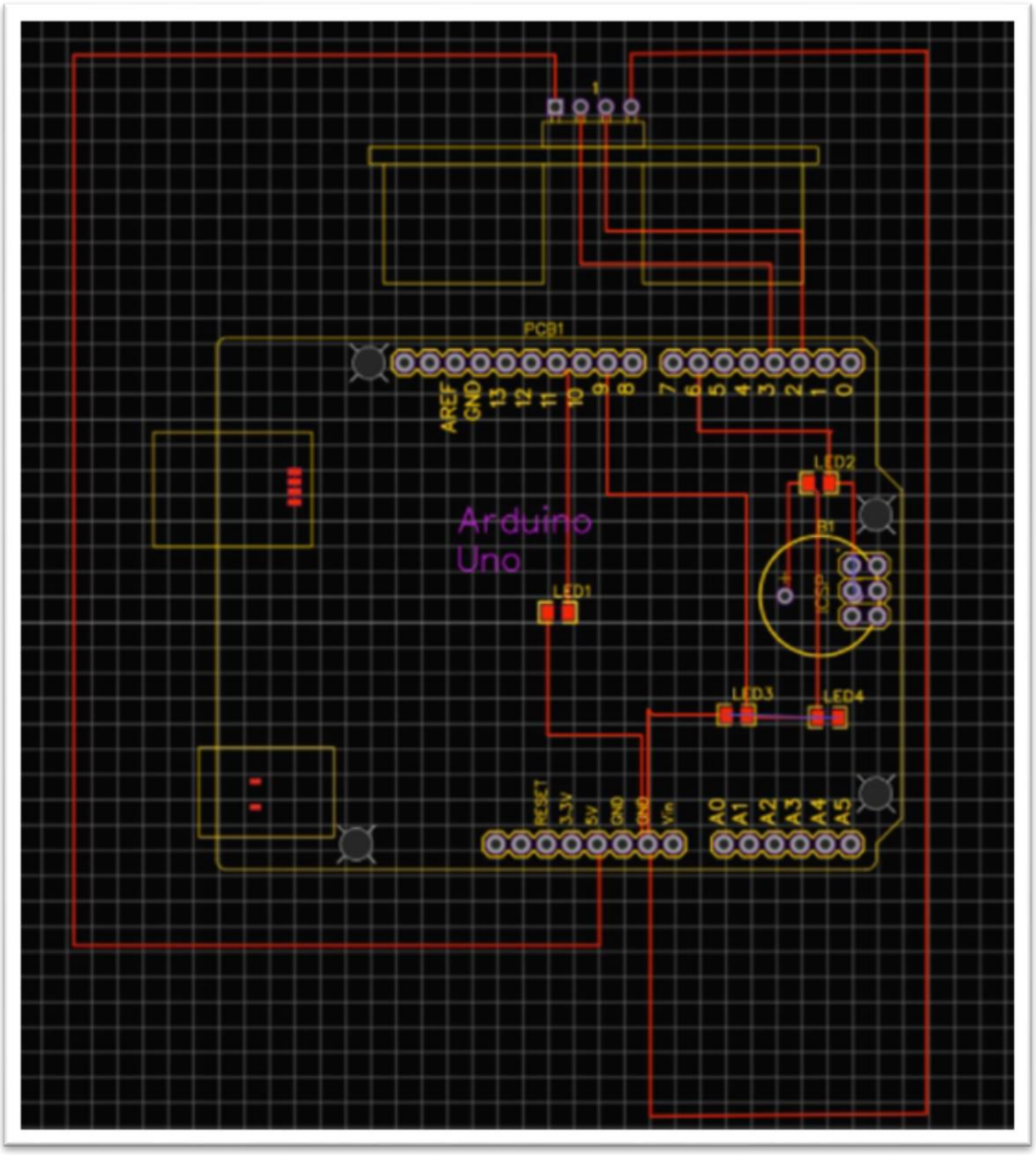
SCHEMATIC DIAGRAM -Arduino UNO and the Components



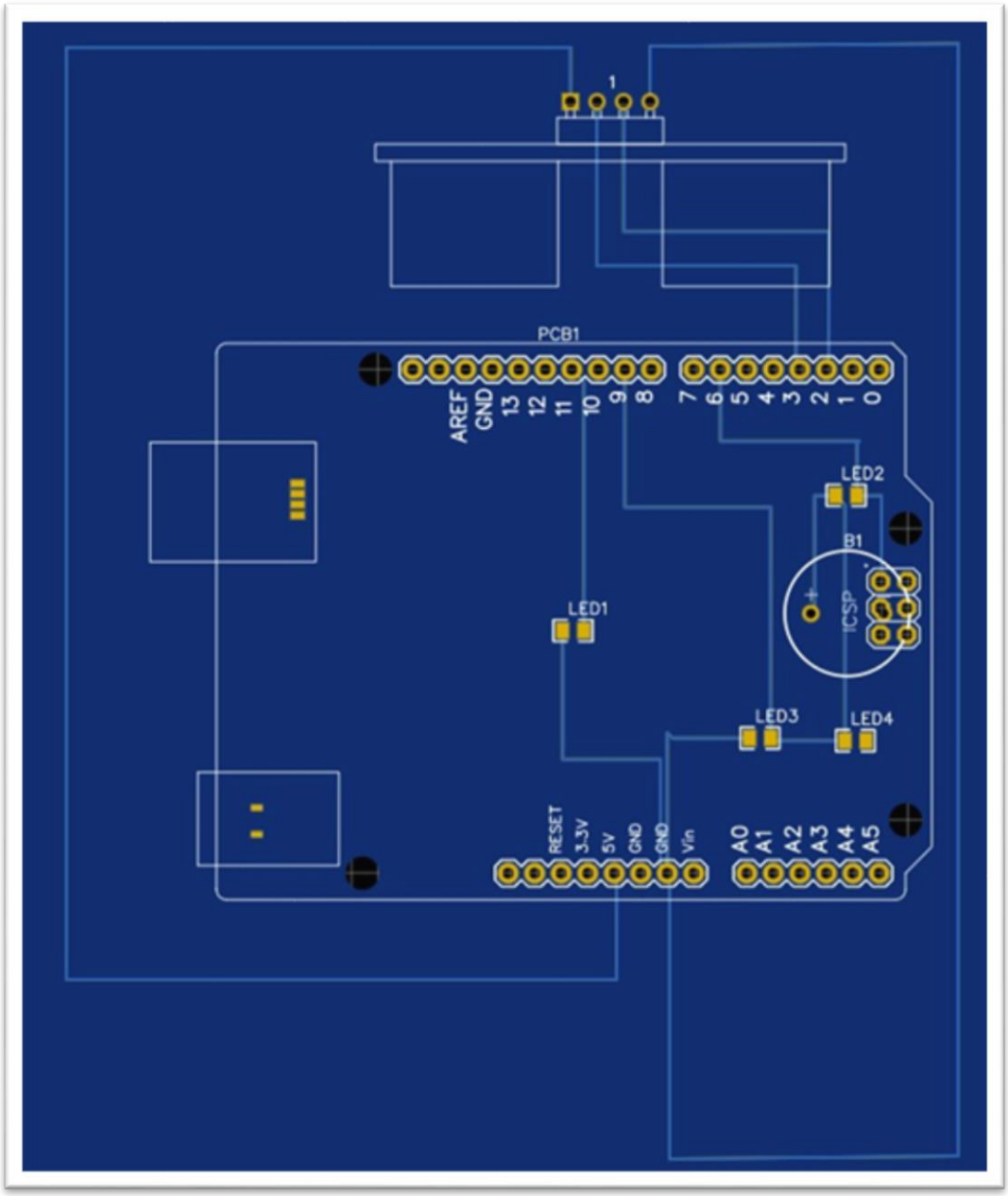
If we would have Raspberry Pie ans Pie Camera then this is the module



PCB DESIGN


PCB1
AREF
GND
13
12
11
10
9
8
7
6
5
4
3
2
1
0
LED2
R1
Arduino
Uno
LED1
LED3
LED4
RESET
3.3V
5V
GND
GND
Vin
A0
A1
A2
A3
A4
A5

2D VIEW OF THE PCB



CONCLUSION AND INFERENCE

Thus we were able to detect drowsiness of the driver and with the application of the ultrasonic sensor we were able to ascertain the proximity of the vehicle with respect to other object (eg another person or vehicle) .If driver drowsiness was detected by calculating the EAR ratio or if the proximity to some object decreases beyond a threshold level then a buzzer will be invoked to alert the driver with respect to the situation.

4.2 Future Work

- We will try to reduce the manufacturing cost of the PCB fabrication process as well as reduce the size of the PCB involved.
- We will also try to improve the efficiency of the EAR algorithm to predict even more accurate results.
- We will try to add more wireless features to the device like using a GSM module to send any emergency message to the nearby hospital or home etc
-

4.3 Cost

- Arduino uno - Rs 600
- Ultrasonic Sensor – Rs 300
- Buzzer – Rs 250
- Led Kit- Rs 30
- Raspberry Pi – Rs 3000
- Camera – Rs 1200

Total Cost – Rs 5400 (approx.)

Engineering Cost – Rs 7000 (approx.)

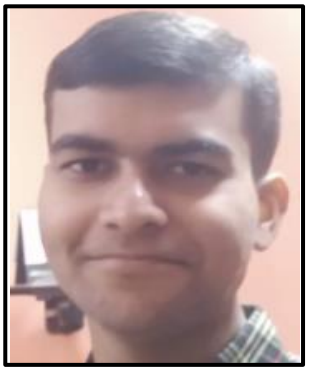
REFERENCES

LIST OF PUBLICATIONS

REFERENCE JOURNALS:

1. https://ieeexplore.ieee.org/document/9418317/
2. https://www.researchgate.net/publication/338157166_Automatic_Vehicle_Accident_Detection_and_Messaging_System_Using_GPS_and_GSM_Module
3. https://circuitdigest.com/microcontroller-projects/arduino-based-accident-alert-system-using-gps-gsm-accelerometer
4. https://www.researchgate.net/publication/339608958_ARDUINO_based_accident_prevention_and_auto_intimation_system
5. https://issuu.com/irjet/docs/irjet-v7i2622

BIODATA



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