Group-3
Engineering Design

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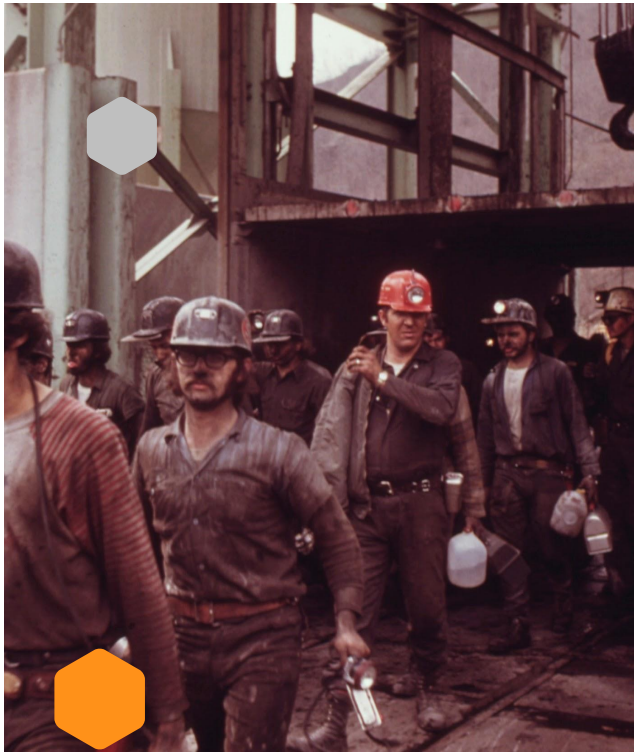
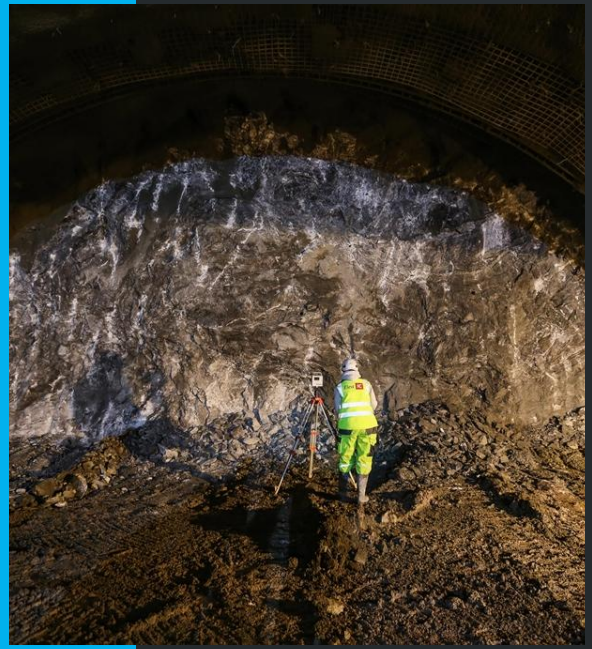


Our Project

MINING HAT OPTIMISATION FOR HAZARDOUS CLIMATES IN MINES AND TOXIC ATMOSPHERE AND MONITOR THE HEALTH OF MINERS



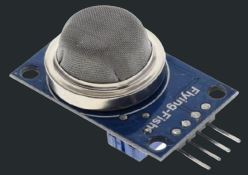
Problem Statement : The Hazards in Mining

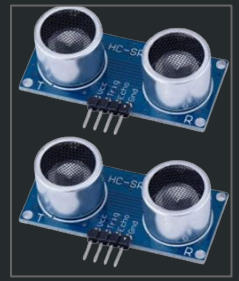
Working in mines is very dangerous. Workers are exposed to toxic gases, high temperatures and thousands of other potential hazards at any moment.

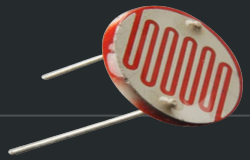
Smart helmet is one of the systems that prevents damage to mine workers.

Solution

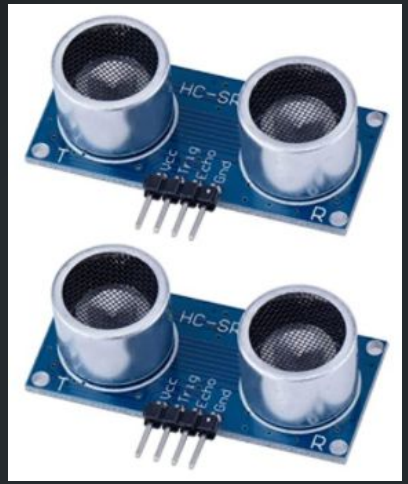
- Light weighted and with a equipped with multiple sensors to assist the work
- Is a solution for low heighted mines and dusty environment.
- The gas mask will be equipped in front of the helmet, needless to wear externally.
- Made of colloid coagulating components like charcoal to reduce the in toxicity of the air intake





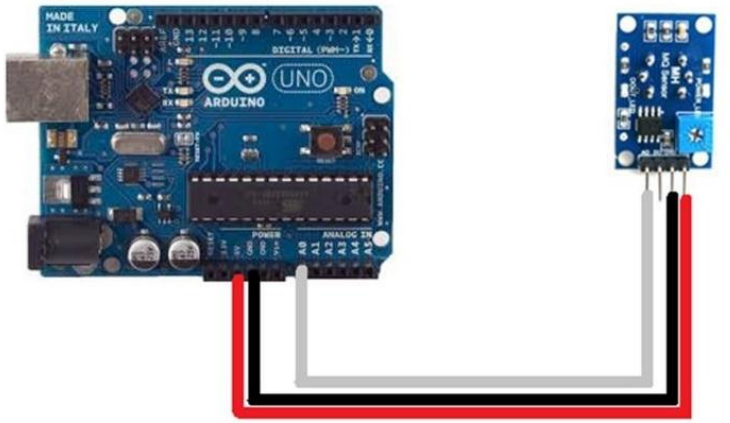


CIRCUITAL COMPONENTS



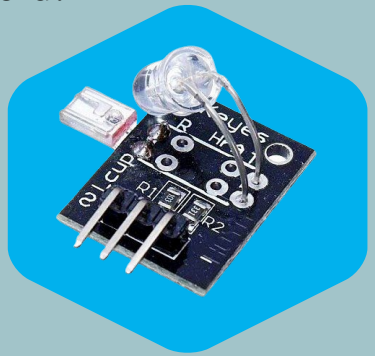
Air Purity Sensor

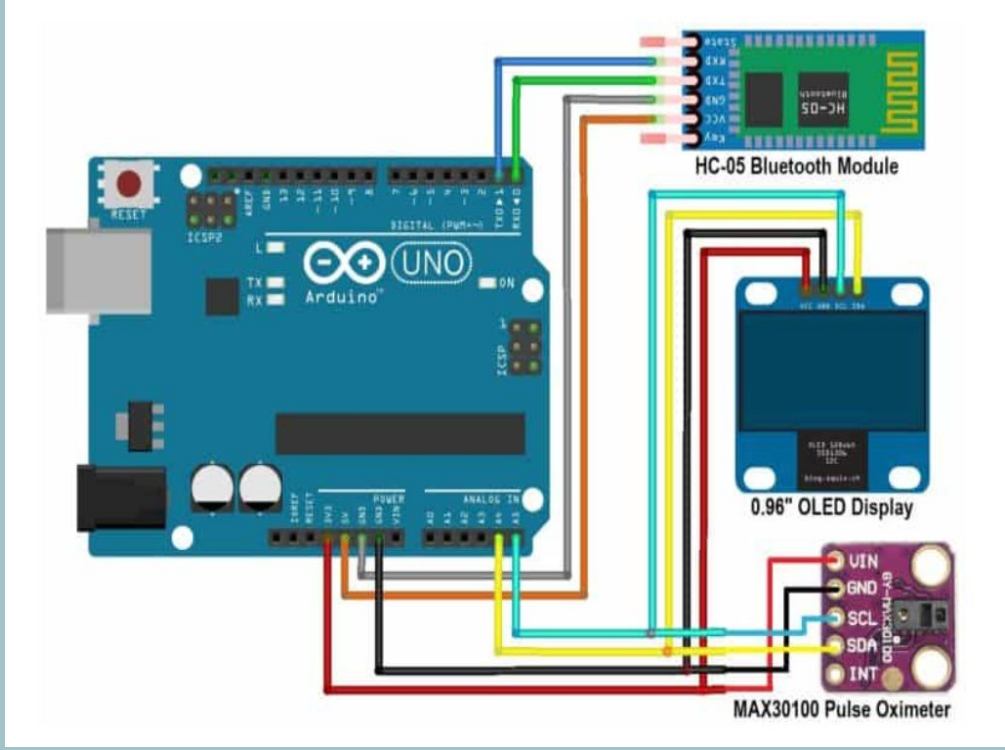
- The Major Impurities That We Have Are So2, No2 And Heavy Metals, So The Sensors Must Alarm Us When The Concentration Goes Beyond The Allowed Level.
- Exposure of more than 5 ppm of SO2 can cause airway resistance in healthy individuals.So, the sensor will alarm us for a conc of 5 ppm
- For NO2, the sensor will alarm us when the concentration reached 5 ppm and if the miner is an asthmatic, 0.1ppm



Heartbeat sensor and the Temperature Sensor will detect the heartbeat and Body temperature of workers in regular intervals and will report it to the main office in case the heartbeat falls below a certain threshold.

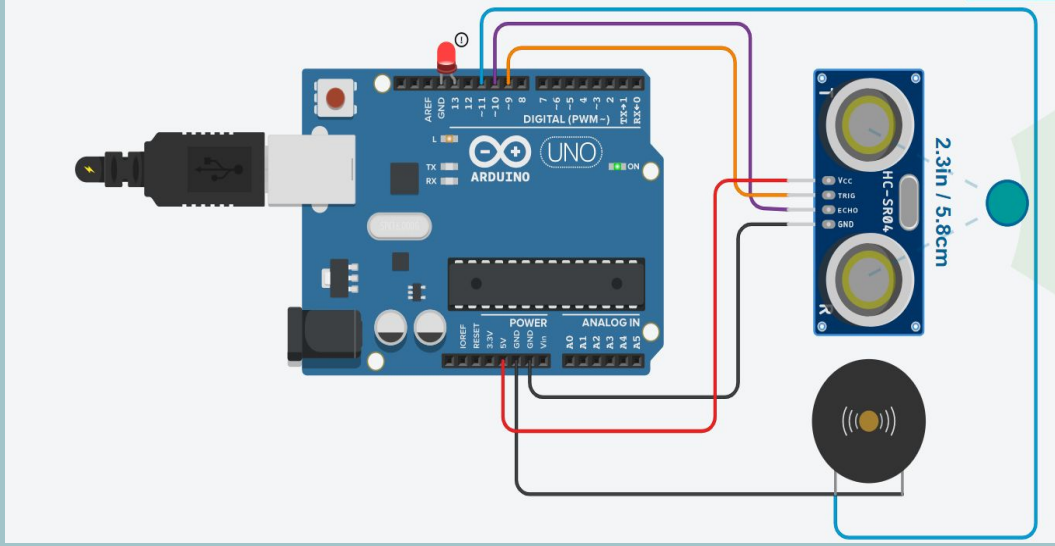
Heartbeat Sensor

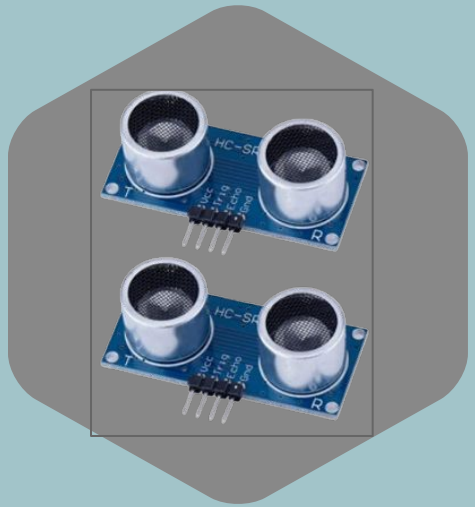




Height sensor

- Sometimes miners have to work in very congested and low heighted mines.
- Due to lack of proper illumination inside the mines, miners may sometimes misjudge the height of the mine and this may end up in accidents which lead to injuries.
- To solve this problem we have designed an ultrasonic distance alarm which rings out a tone of 330 Hz when the distance between the helmet and the mine's ceiling is very less(around 40 cm).



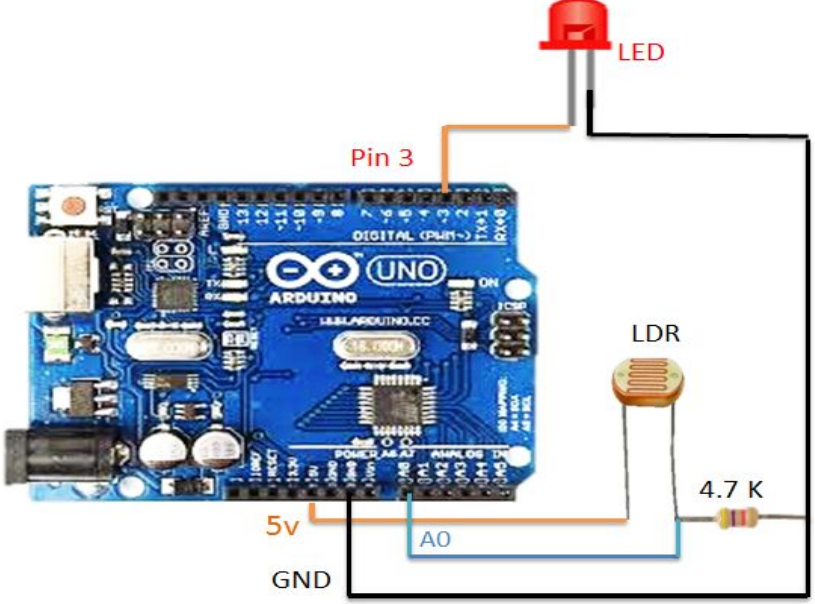


LIGHTNING CONTROL

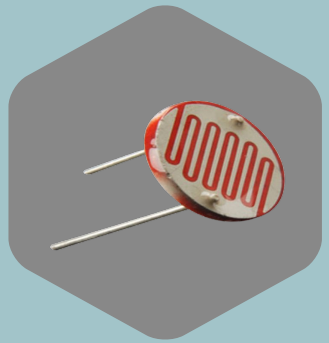
Lighting is vitally necessary underground, and it is very important to ensure that there are no failures and the lamp used is efficient as possible

Automated Lighting

The LED will be off in complete brightness, and as the brightness in the surrounding decreases, the LED begins to glow brighter.



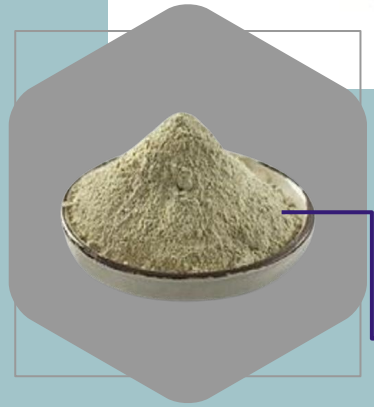
Light Detection using LDR and Arduino



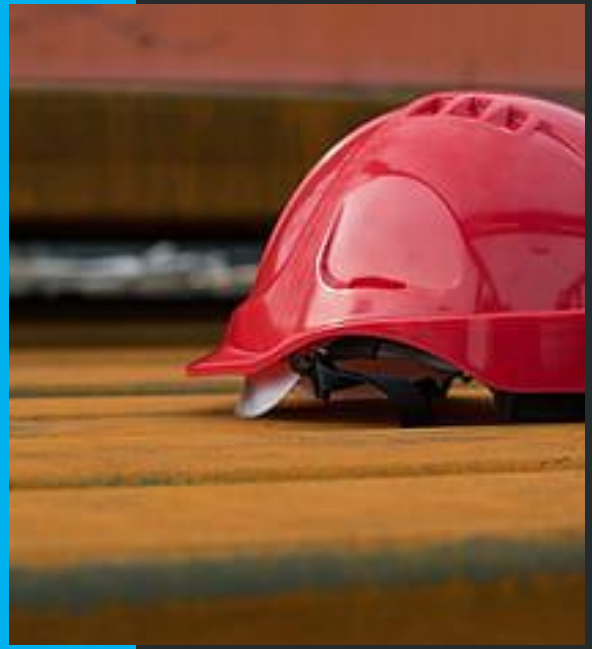
Gas Mask

- **PHYSICAL DESIGN**
- Design to be chosen such that can be used with the hat.
- Additional , eye gear
- Compact , comfortable , flexible

- **CHEMICAL DESIGN**
- Charcoal
- Calcium Bentonite



Charcoal + Ca-Bentonite



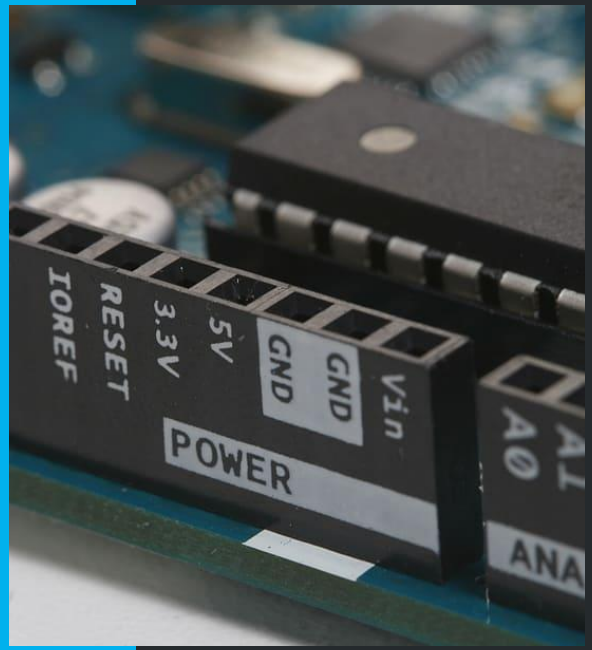
Design Structure

The helmet comprising of the above components is designed in the following manner:

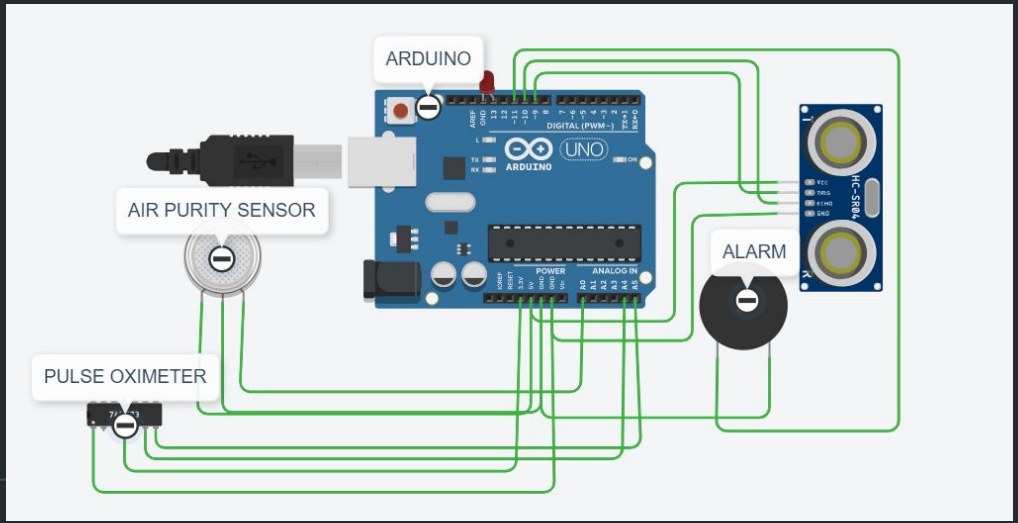
The Ldr and ultrasonic sensor are on the exteriors to regulate the light output and keep an eye on the height of the mine. The heartbeat sensor is behind the head to take the pulse reading. The air purity sensor is on the rear to keep a tab on the smoke levels. The sensors will be giving output through buzzer sounds.

The gas mask is attached in front of the helmet to eliminate the need to wear it externally.

Circuital Structure

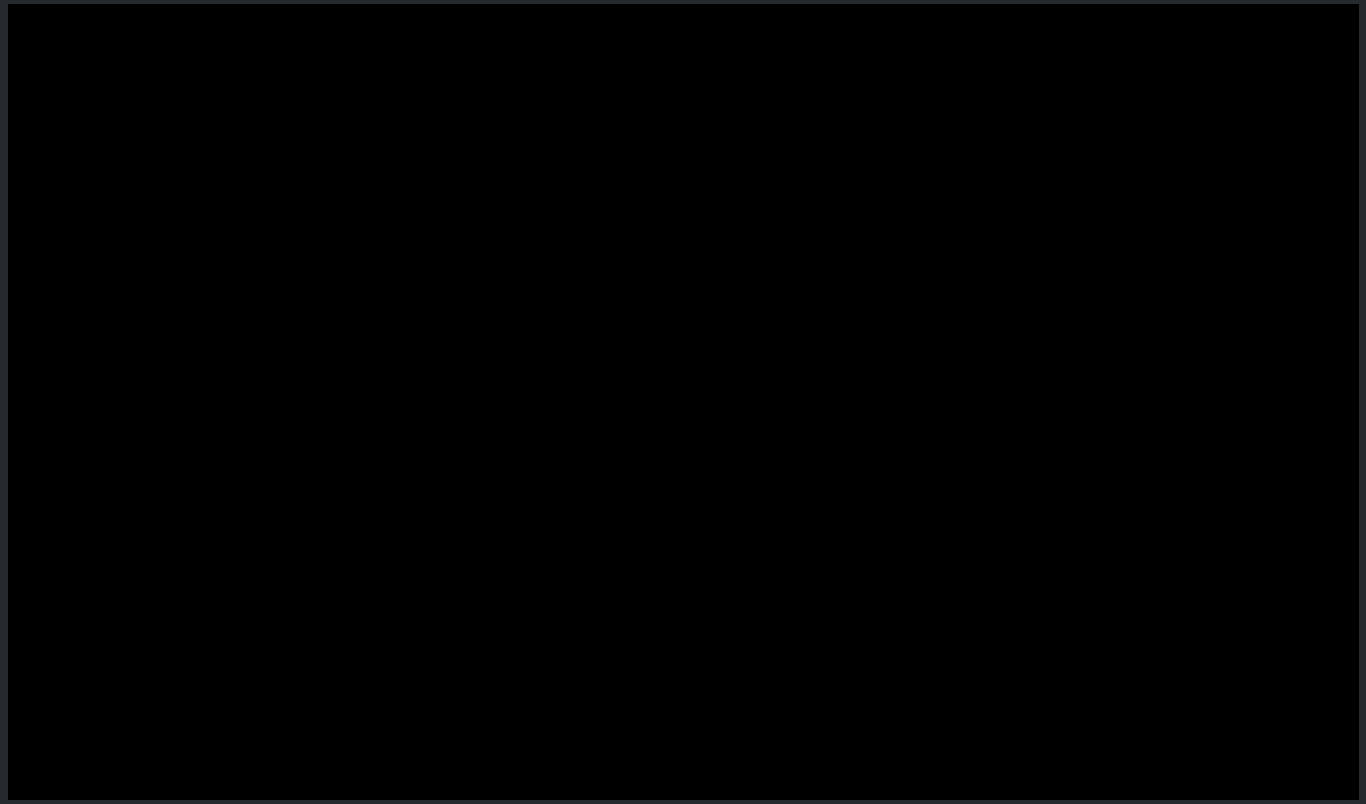


Arduino will be used as the main circuit board for managing the sensors. The output will be given using the buzzer which has it's output tone modified for different sensors.
The functioning of the circuit will be carried out by the wires flowing internally in the helmet.



Arduino Code

```
int smoke=A1;
int sensorThres=400;
#define trigPin 9
#define echoPin 10
int Buzzer = 11;
int ledPin= 13;
int duration, distance;
const int ldrPin = A0;
int Threshold = 550;
int const PULSE_SENSOR_PIN = 2;
int Signal;

void setup() {
      Serial.begin (9600);
      pinMode(trigPin, OUTPUT);
      pinMode(echoPin, INPUT);
      pinMode(Buzzer, OUTPUT);
      pinMode(ledPin, OUTPUT);
      pinMode(smoke,INPUT);
      pinMode(ldrPin, INPUT);

}
void loop() {

   digitalWrite(trigPin, HIGH);
   delayMicroseconds(10);
   digitalWrite(trigPin, LOW);
   duration = pulseIn(echoPin, HIGH);
   distance = (duration/2) / 29.1;

 if (distance >= 40 || distance <= 0)
      {
      digitalWrite(Buzzer,LOW);
      }
 else {

      tone(Buzzer,330);
      delay(50);
      noTone(Buzzer);
 }
 int analogSensor=analogRead(smoke);
 if(analogSensor>sensorThres){
   tone(Buzzer,1000,200);

 }
 else{

   noTone(Buzzer);
   }
   delay(500);


int ldrStatus = analogRead(ldrPin);
if (ldrStatus <= 200) {
digitalWrite(ledPin, HIGH);
}

else {
digitalWrite(ledPin, LOW);

}


Signal = analogRead(PULSE_SENSOR_PIN);

 Serial.println(Signal);

 if(Signal > Threshold){
   tone(Buzzer,100);
   noTone(Buzzer);
 } else {
    digitalWrite(Buzzer,LOW);
 }
 delay(1000);

}
```



Thank You

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