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IOT Based Smart Helmet

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Abstract - This project presents the design and development of a smart helmet equipped with gas, temperature, and humidity sensors, along with a microcontroller unit and a 16x2 display. The helmet is designed to be worn by miners and workers in other industrial settings to provide real-time data on their immediate environment. The helmet's microcontroller unit, based on the NodeMCU, collects data from the sensors and displays it on the helmet's display, allowing the user to monitor the conditions around them.
In addition to local monitoring, the helmet's data can be transmitted to a web or mobile application, providing remote monitoring and alerting features. The application can generate alert signals on a buzzer in response to high concentrations of harmful gases, ensuring that the user is aware of potential hazards in their surroundings.
The results of the project demonstrate the feasibility of a low-cost, wearable device that can improve safety and awareness for workers in hazardous environments. The smart helmet is versatile, and its design can be adapted to different industrial applications. This project lays the foundation for future research and development in the field of wearable technology for occupational safety..

Key Words: Smart Helmet, IoT, Accident Detection, Rider Safety, Alcohol Detection, GPS, GSM, Embedded System, Road Safety, Real-Time Monitoring.

1. INTRODUCTION

Industrial workers, especially miners, work in hazardous environments where they face a constant threat to their safety and health. To address this issue, we have developed a smart helmet that can help ensure the safety of miners and other industrial workers. The helmet is equipped with various sensors such as a gas sensor, DHT temperature and humidity sensor, and a 16x2 display. These sensors can detect gas concentrations, temperature, and humidity levels in real-time, providing valuable information to the workers. The main microcontroller unit used in this project is NodeMCU, which is used to display the data on a web or mobile app. The app also includes an alert system that triggers a buzzer when the gas sensor detects high concentrations of harmful gases. This project has the potential to significantly improve the safety of workers in various industries by providing them with real-time data on their working environment. Furthermore, this project can be expanded to incorporate additional sensors and features to further enhance its functionality and application in various industries.

2. Literature Review

"Development of an IoT-based smart helmet for industrial safety".

This paper describes the development of a smart helmet that uses IoT technology to monitor environmental hazards in industrial environments.

"Smart Helmet for Coal Mines Safety Monitoring and Alerting System"

This paper presents a smart helmet system that uses IoT sensors to monitor coal mines for gas leaks and other hazards.

"Design and implementation of a wearable IoT system for hazardous environments"

This paper describes the design and implementation of a wearable IoT system that can be used in hazardous environments such as chemical plants or oil refineries.

"Design and development of a smart helmet for real-time monitoring of hazardous gases in underground mines"

This paper presents the design and development of a smart helmet that uses gas sensors and IoT technology to monitor underground mines for hazardous gases.

"IoT-based smart helmet for coal miners using air quality sensors and wireless sensor network."

This paper presents an IoT-based smart helmet system that uses air quality sensors and wireless sensor networks to monitor coal mines for hazardous gases.

"A smart helmet with environmental sensing and location tracking for worker safety in confined spaces"

This paper describes a smart helmet system that uses environmental sensors and location tracking to improve worker safety in confined spaces such as underground tunnels.

"Smart helmet system for monitoring workers in hazardous environments"

This paper presents a smart helmet system that uses IoT sensors to monitor workers in hazardous environments such as chemical plants or oil refineries.

"IoT-based smart helmet for real-time monitoring of environmental parameters in industrial plants."

This paper describes an IoT-based smart helmet system that can be used to monitor environmental parameters in industrial plants.

"Smart helmet for mining industry safety"

This paper presents a smart helmet system that uses IoT sensors to improve safety in the mining industry.

"Wearable safety helmets with wireless sensing and data acquisition for hazardous work environments"

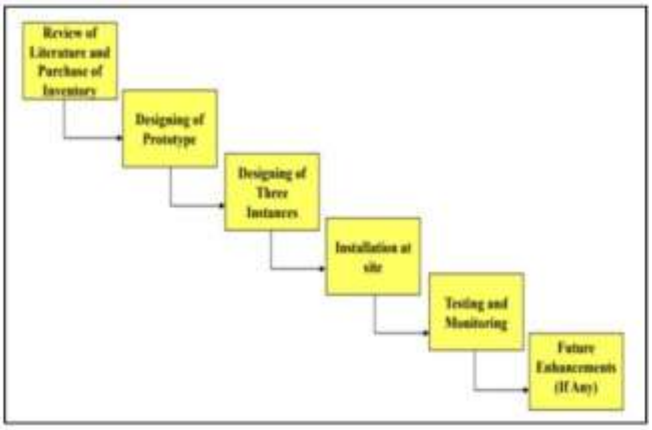
This paper describes the design and implementation of wearable safety helmets that use wireless sensing and data acquisition to monitor hazardous work environments.

"Smart helmet for safety in mining industry using IoT."

This paper presents a smart helmet system that uses IoT sensors to improve safety in the mining industry.

Deign and Implementation

Tasks Involvement



System Design: The first task is to design the system architecture and select the appropriate sensors, microcontroller unit (MCU), and other hardware components based on the project requirements.

Circuit Design: The circuit design involves creating the schematic diagram and laying out the printed circuit board (PCB) for the system. This includes connecting all the components, sensors, and other peripherals to the MCU and power source.

Programming: Programming involves writing the firmware for the MCU to communicate with the sensors, display sensor data, generate alert signals, and send data to the web or mobile app.

Testing: Once the circuit design and programming are complete, the system needs to be tested to ensure that it is working correctly. This involves checking the sensor readings, alert signals, and data transmission to the web or mobile app.

Integration: After testing is complete, the system components need to be integrated, and the final product needs to be assembled. This includes mounting the sensors and display on the helmet, connecting the PCB to the battery, and ensuring that everything is securely in place.

User Interface Design: A web or mobile app needs to be designed to display the sensor data and alert signals generated by the smart helmet. The app should be user-friendly, visually appealing, and provide real-time data.

Deployment: Once the system is fully assembled, tested, and integrated, it can be deployed for use. The system should be monitored regularly to ensure that it is functioning correctly and that the sensors and other components are calibrated correctly.

Task Innvolved in proposed project

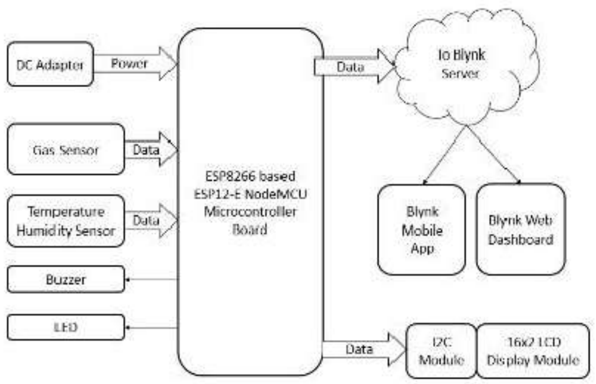
B. Working

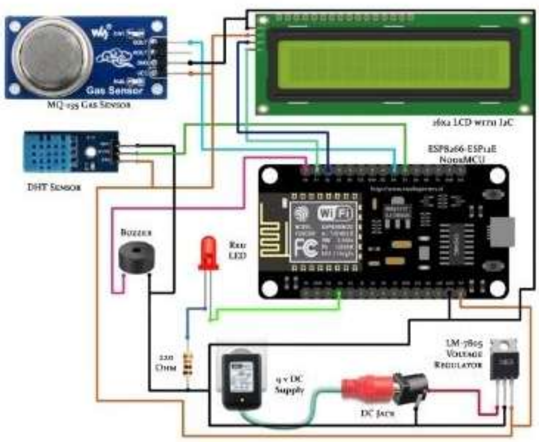
The smart helmet with gas sensors and other environmental sensors works by constantly monitoring the surrounding air for hazardous gases and other environmental conditions. The gas sensor in the helmet detects the concentration of harmful gases such as carbon monoxide, methane, and nitrogen oxides. The temperature and humidity sensors measure the ambient temperature and humidity levels.

The data from these sensors is sent to the microcontroller unit (MCU), which processes the data and displays the readings on the 16x2 display on the helmet. The user can read the data on the display and take appropriate action if the readings indicate hazardous conditions.

In addition to displaying the data on the helmet, the MCU also sends the sensor data to a web or mobile app. The app displays the real-time data and provides alerts if the readings exceed a preset threshold. For example, if the gas sensor detects high levels of carbon monoxide, the app will generate an alert and sound the buzzer.

C. Block Daigram





D. Circuit Daigram

E. NodeMCU Code for Arduino IDE

```
#include<NTPClient.h>
#include <ESP8266WiFi.h>
#include <WiFiUdp.h>
#include<DHTesp.h>
#define DHTTYPE DHT11

#define G_Sensor A0
#define LED D5
#define dht_pin D4
#define GAS_THRESHOLD 10 // Gas Value
#define TEMP_THRESHOLD 40 // Temperature Value
#define BUZZER D6

DHTesp dht;

#define BLYNK_PRINT Serial

#define BLYNK_TEMPLATE_ID "TMPLhwG5PVvh"
#define BLYNK_DEVICE_NAME "Irrigation System"
#define BLYNK_AUTH_TOKEN "rUMAxXFhl-Fj2pTRpvu2NLNYhuFiPL3q"

#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

// You should get Auth Token in the Blynk App.
// Go to the Project Settings (nut icon).
char auth[] = BLYNK_AUTH_TOKEN;

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "SRROBOTICS2G";
char pass[] = "SATISH@0744";

const long utcoffsetInSeconds = 19800;

WiFiUDPntpUDP;
NTPClient timeClient(ntpUDP,"pool.ntp.org",utcoffsetInSeconds);

void buzzer() {
  digitalWrite(BUZZER,HIGH);
  delay(200);
  digitalWrite(BUZZER,LOW);
  delay(200);
  digitalWrite(BUZZER,HIGH);
  delay(200);
  digitalWrite(BUZZER,LOW);
  delay(200);
}

void setup()
{
  Serial.begin(9600);
Blynk.begin(auth, ssid, pass);
```

```
  delay(100);
  pinMode(G_Sensor,INPUT);
  pinMode(LED,OUTPUT);
  pinMode(BUZZER,OUTPUT);
dht.setup(dht_pin,DHTesp::DHT11);
timeClient.begin();
}

void loop()
{
Blynk.run();
  int gas_read =
map(analogRead(G_Sensor),0,1023,100,0);
  float h = dht.getHumidity();
  delay(100);
  float t = dht.getTemperature();
  delay(100);
  Serial.print("Current humidity = ");
  Serial.print(h);
  Serial.print("%   ");
  Serial.print("temperature = ");
  Serial.print(t);
  Serial.println("C ");
  if(gas_read<GAS_THRESHOLD or
t>TEMP_THRESHOLD) {
    digitalWrite(LED,HIGH);
Blynk.virtualWrite(V3,1);
    buzzer();
    digitalWrite(LED,LOW);
    delay(400);
  }
  else {
    digitalWrite(LED,LOW);
    digitalWrite(BUZZER,LOW);
Blynk.virtualWrite(V3,0);
  }
  if(h>=0 and h<=101) {
timeClient.update();
    String currentTime = String(timeClient.getHours()) +
":" + timeClient.getMinutes() + ":" +
timeClient.getSeconds();
    Serial.println(currentTime);

Blynk.virtualWrite(V0,gas_read);
Blynk.virtualWrite(V1,t);
Blynk.virtualWrite(V2,h);
Blynk.virtualWrite(V4,currentTime);
  }
Blynk.syncVirtual(V3);
}
BLYNK_WRITE(V3) {
  int state = param.asInt();
  if(state==1)
  digitalWrite(BUZZER,HIGH);
  else if(state==0)
  digitalWrite(BUZZER,LOW);
}
BLYNK_WRITE(V6) {
  int state = param.asInt();
  if(state==1)
  digitalWrite(LED,HIGH);
  else if(state==0)
  digitalWrite(LED,LOW);
}.
```

Advantages and Disadvantages

A. Advantages

Real-time monitoring: The smart helmet continuously monitors the environment and provides real-time data, enabling users to take appropriate safety measures immediately.

Early warning: The smart helmet can detect hazardous gases and other environmental conditions and provide early warning, enabling users to take appropriate safety measures before any harm is caused.

Mobility: The smart helmet is mobile, making it easy to carry and use in different environments and settings.

B. Disadvantages

Limited range: The smart helmet's sensors have a limited range, which may not be sufficient for monitoring large areas or environments.

False alarms: The gas sensors may detect harmless gases or environmental conditions and trigger false alarms, leading to unnecessary disruption and cost.

3. CONCLUSIONS

In conclusion, the smart helmet with gas sensors and other environmental sensors is a valuable tool for monitoring the environment and detecting hazards in real-time. The project's objective is to provide a safety system that can be used in different industries, such as mining, construction, and agriculture. The smart helmet is equipped with gas sensors, DHT temperature, and humidity sensors, which continuously monitor the environment and provide real-time data. The data is displayed on a 16x2 display and can be accessed through a web or mobile app. The web and mobile app can also generate alerts on a buzzer, providing early warning and enabling users to take appropriate safety measures.

The project involves designing and implementing the hardware components, including the NodeMCU microcontroller, gas sensors, and display. The software involves programming the microcontroller, developing the web and mobile app, and processing the data generated by the sensors. The project has several advantages, including real-time monitoring, early warning, mobility, customizability, cost-effectiveness, and ease of use. However, it also has potential disadvantages, such as limited range, false alarms, maintenance requirements, power supply, data processing, and user acceptance.

Overall, the smart helmet with gas sensors and other environmental sensors is a promising safety system that can enhance safety and prevent accidents in different industries. The project's success depends on proper design, implementation, and maintenance, as well as user acceptance and compliance.

Future Scope

1. Integration with other safety systems: The smart helmet can be integrated with other safety systems, such as alarms, cameras, and emergency response systems, to enhance safety and improve response time in case of accidents.

2. Machine learning: Machine learning algorithms can be applied to the data generated by the sensors to identify patterns and anomalies, enabling more accurate and timely detection of hazards.

3. Wireless connectivity: The smart helmet can be equipped with wireless connectivity, such as Bluetooth or Wi-Fi, to enable real-time data transmission and remote monitoring.

4. Battery backup: The smart helmet can be equipped with a battery backup system, such as rechargeable batteries or solar panels, to ensure uninterrupted monitoring even in case of power outages

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