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# Smart Workers Helmet

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***Abstract*** **- Industrial workers are around things that can hurt them like air really hot temperatures and they can fall down or get sick. The helmets they wear do keep their heads safe. They do not have a way to check on the workers all the time.This paper is about a helmet, for workers that uses a small computer called an ESP32 microcontroller. This helmet has sensors, including an MQ135 gas sensor, a DHT11 temperature and humidity sensor an MPU6050 fall detection sensor, a MAX30102 heart rate sensor and a NEO- 6M GPS sensor.The system checks the air and the workers body all the time. Sends this information to the internet using Wi-Fi. If something is wrong the helmet. Flashes a light and it also tells the supervisors where the worker is.The special helmet is an idea because it is cheap, small and it really works to keep workers safe and get them help faster when they need it. The Smart Worker Helmet is a way to monitor industrial workers and make sure they are okay.**

**gas detection, DHT11 for temperature monitoring, Mhahe worker's pulse rate to identify possible health emergencies. • Provide real-time alerts and location tracking to enable faster rescue operations. This system has wide-ranging applications in several industries, including: Construction Sites: Helps monitor worker safety and detect falls or hazardous conditions. Mining Industries: Detects harmful gases and ensures worker health monitoring in underground environments. Industrial Plants and Factories: Provides protection against toxic gases and high temperatures. Oil and Gas Industries: Helps monitor worker safety in hazardous work environments. Disaster Rescue Operations: Can be used by rescue teams working in dangerous or unstable environments.**

## I. INTRODUCTION

Worker safety is a critical concern in industries such as construction, mining, and manufacturing, where employees are exposed to hazardous gases, extreme temperatures, and accidental falls. Traditional safety helmets only provide physical protection and cannot monitor the worker's health or environmental conditions. Recent advancements in the Internet of Things (IoT) enable wearable devices capable of real-time monitoring and remote supervision.

This work proposes an IoT-based Smart Worker Helmet that integrates multiple sensors with an ESP32 microcontroller to monitor gas concentration, temperature, heart rate, motion, and GPS location. The system generates immediate alerts through LEDs and a buzzer while sending real-time notifications to supervisors via the Blynk platform, enabling rapid emergency response and improving workplace safety.

## III. EXISTING SYSTEM

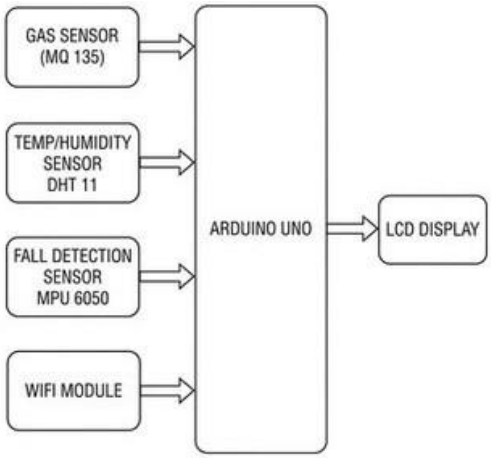


fig 1: Block diagram

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The proposed Smart Helmet system is developed by embedding and IoT technologies to monitor real-time environmental and worker health conditions, as illustrated in Fig. 3.1. Data from the MQ-135 gas sensor is sent to the main controller, Arduino Uno, along with the data from the DHT11 temperature and humidity sensor, the fall detection sensor MPU6050, and the heart rate and $SpO_2$ sensor MAX30102. The data collected is processed for detection of hazardous conditions like harmful gases, abnormal temperature, worker falls and abnormal vital signs.The processed data is shown on LCD and then wirelessly transmitted using a WiFi module for remote data monitoring. This allows for continuous monitoring, rapid emergency notifications and better worker safety, while doing away with the need for manual supervision.

## III. PROPOSED METHOD

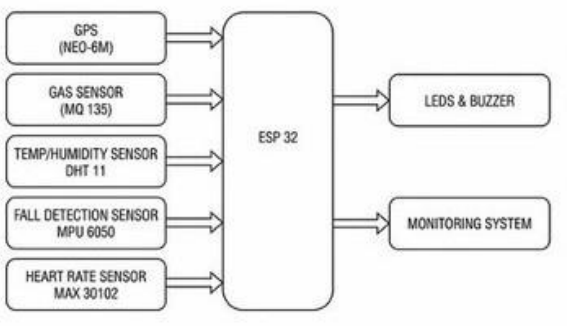


fig 2: Proposed diagram

The Smart Worker Helmet is a wearable safety system designed with Internet of Things (IoT) technology to enhance the safety of workers in dangerous work settings, like construction sites, mines and industrial plants. The ESP32 microcontroller to simultaneously collect and process multiple physiological and environmental parameters in real- time.

All data from the gas sensor MQ135, temperature sensor DHT11, motion sensor MPU6050, heart rate sensor MAX30102 and GPS module NEO-6M is received by the ESP32. The MQ135 is used for detecting harmful gases and the DHT11 is used to monitor the temperature and humidity surrounding the sensor. The MPU6050 detects the acceleration and orientation to detect sudden movements and accidental falls. The MAX30102 is used to continuously measure the worker's heart rate, while the GPS module supplies real-time location data in a case of emergency.

The ESP32 reads the data from the sensors and sends them to a safety threshold to compare. When abnormal conditions occur, like toxic gas leakage, high temperature, high or abnormal heart rate, or fall, the system will alarm the worker with an buzzer and LED indicators. The sensor data and GPS location are then sent to the Blynk IoT platform via the ESP32's Wi-Fi module, allowing supervisors to keep track of the worker's location and take immediate action in case of emergencies.

The proposed system integrates environmental monitoring, health monitoring, fall detection and location tracking in a single portable device. This integrated approach is one of the most efficient solutions for improving safety of all workers in industry, and reducing the time to respond in case of an emergency, in comparison with existing systems monitoring only one or two safety parameters, but at a higher cost and complexity.

## IV. DESIGN AND WORKING

The proposed Smart Worker Helmet is an IoT based wearable safety system based on ESP32 microcontroller. It includes all the necessary sensors, such as an MQ-135 gas sensor, DHT11 temperature and humidity sensor, MPU6050 fall detection sensor, MAX30102 heart rate sensor, and NEO-6M GPS module that continuously sense the worker's environment, health, and location. The ESP32 collects and processes sensor data, and then transmits it to Blynk IoT by Wi-Fi, allowing the data to be monitored in real-time. If hazardous conditions, like toxic gas leakage, high temperature, abnormal heart rate, fall, are detected, the system will immediately switch on LED indicators and a buzzer and send an alert with the worker's GPS location to the monitoring dashboard. This integrated design allows for real-time monitoring, quick reaction and safer working conditions for the worker in hazardous environments.

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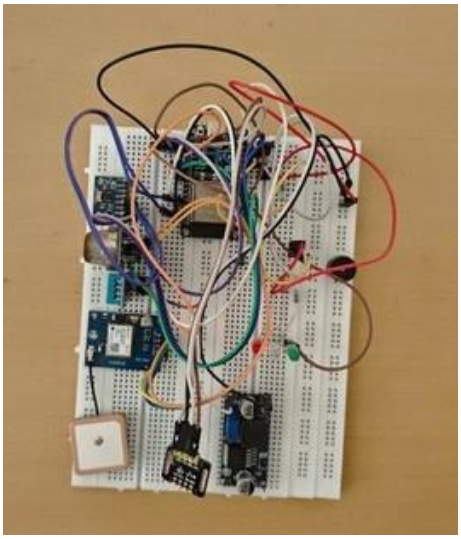

fig 3 .Hardware Setup

## V. RESULTS

The proposed Smart Worker Helmet could be successfully developed and tested with the integration of ESP32 microcontroller and integrated sensors. Gas concentration, temperature, humidity, fall events, HR, and GPS location were monitored in real-time. The data from the sensors were transmitted via Wi-Fi to the Blynk IoT platform, allowing for remote monitoring. The system is able to correctly identify abnormal situations (high gas level, high temperature, fall events) and alert the worker on the buzzer and LED indicator and also on the system monitoring dashboard with the worker's location. Experimental results show that the proposed system is reliable for real-time monitoring and can be used to improve the safety of the workers, as they can respond quickly to the emergency situation.


fig 4 .Software output

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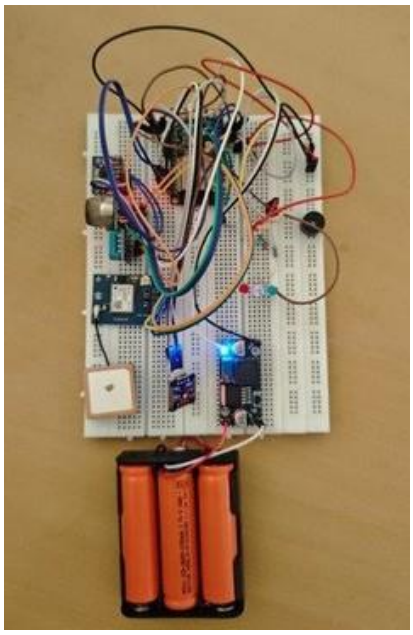

fig 5 .Module when powered up

## VI. CONCLUSION AND FUTURE SCOPES

The proposed smart worker helmet is a viable IoT based solution to improve the workers safety in hazardous environments. The integration of the gas sensor, temperature sensor, heart rate monitor, fall detection sensor, and GPS sensor with the ESP32 microcontroller allows for real-time monitoring and instant alerts in emergency situations via the Blynk IoT platform. The developed prototype proved to be reliable and could be used to decrease the accidents in the workplace because it can be used for timely intervention.

The system can be further improved in the future by incorporating more environmental and health sensors, incorporating AI-based hazard prediction and using long- range communication technologies like LoRa or NB-IoT. Further enhancement of monitoring, scalability, and industrial deployment can be provided with cloud-based data analytics and a dedicated mobile application.

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