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IOT BASED MULTI-FUNCTIONAL SMART HELMET FOR SAFETY MONITORING AND ALERTING OF MINE WORKERS

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Abstract: Modern security is one of the fundamental parts of industry extraordinarily the coal mine shaft industry. Gas explosions, ceiling collapse, falling debris, suffocation, and gas poisoning are among the risks connected to deep mining. The detection of hazardous events is a crucial aspect of the mining industry. With this architecture, a remote sensor organization can monitor underground mining conditions continuously from a base station. It provides continuous monitoring of dangerous gases such as CO, temperature, humidity, and decline detection in addition to emergency alarm, automated crisis light, and helmet-mounted sensor functionality. The principal justification behind the death of excavators is that because of any explanation diggers tumble down and black out additionally appropriate treatment isn't given them around then. The system sends an emergency alert to the supervisor in the event of a person falling for any reason to address this issue. A few laborers don't know about security and they do not wear head protectors. After that, a sensor was successfully utilized to ascertain whether or not a miner had removed his helmet. IOT innovation is used in the framework to transmit data from the base station to the subterranean mine. There is a ready switch at mines and base station for crisis reasons.

Index Terms - Wi-Fi, IOT, Coal Mine, Nodemcu .

I. INTRODUCTION

Mining is a multifaceted industry that includes intricate underground, tunnel-based, and other operations[1]. This implies different gambling factors which influences the well-being of diggers.In the Indian state of Jharkhand, the Chasnala mining disaster in Dhanbad almost claimed the lives of 372 miners. This was thought to be the worst disaster to ever befall the mining industry[2]. It's possible that excavators are unaware of external conditions, such as changes in pressure, temperature, and other factors. Excavators occasionally collide with heavy things, such as mining equipment or hard rock, which puts their lives in grave risk. In addition, breathing in hazardous gasses affects the miners and puts them in danger[3]. Diggers are currently unable to communicate with the outside world. For this situation, the shrewd cap framework turns into a fundamental and supportive measure to shield the excavators from different mishaps. This undertaking targets planning a shrewd cap for perilous occasion discovery, checking the encompassing ecological circumstances, and refreshing data like GPS area and sensor information to the focal control center for simple following and giving oxygen enhancements to stay away from the inward breath of noxious gases[4]. This gets the existence of excavators in mining ventures.

The survey yields a variety of data, including the finding that mining, India's most hazardous occupation, results in one death every third day. According to the International Labor Organization (ILO), mining employs only 1% of the global labor force but is responsible for 8% of all fatal accidents. Up to three billion tons of coal are produced annually by China's largest mining sector[5]. Despite accounting for 40% of global coal production, China is responsible for 80% of global mining activity[6]. This summary demonstrates the need for welfare measures to be implemented in order to preserve the diggers' way of life. This synopsis motivated us to present this project.

II. SYSTEM SYNOPSIS

A variety of sensors, including force, temperature, pressure, infrared, and gas sensors, are incorporated into the structure. The general climate is screened using a strain and temperature sensor. The proximity sensor is used when the excavators collide with heavy objects. An infrared sensor detects when a miner removes their helmet and notifies the central console. When harmful gasses are present in the surroundings, a gas sensor is used to detect their presence [7]. GPS is utilized to track the location of diggers in case something goes wrong. In case of an extraordinary problem, the digger physically operates the alarm switch to request assistance from the main control center. A Programmed lighting framework is organized involving an LDR sensor in light disappointment circumstances. In critical situations, these data are transmitted wirelessly to the central console.

III. EXISTING SYSTEM

In the current framework mining cap guarantees to safeguard the excavator’s head from a few wounds. Monitoring the natural condition turns into a difficult aspect of the current framework. Since the cap is excessively weighty, and awkward to work with the diggers will generally eliminate the protective cap from their head [8]. In the event of its evacuation diggers are inclined to perilous circumstances. There is no current brilliant cap that can concentrate on the climate and settle on choices to support specialist assurance.

IV. REASONS FOR PROPOSAL

Guaranteeing the safety of miners in the event that elevated temperatures, pressures, or forces result in mining mishaps.

➢ To facilitate communication between the coal excavators and the outside world within the mines.

➢ To monitor conditions within the mines and provide comfort to the diggers in case of an emergency. GPS is used to track miners' movements.

➢ The discovery of hazardous gasses.

➢ Alarm the excavators at whatever point the head protector is eliminated.

V. PROPOSED SYSTEM

We have carried out an extreme defensive cap that accompanies numerous sensors for different locations and examinations. The risky gases, first and foremost, are identified by utilizing gas sensors. An excavator removing the mining hat from their head was the second dangerous incident. To determine when the digger's cap is off, an infrared sensor was successfully grown. The third dangerous event is defined as one in which an object strikes an excavator in the head with a force greater than a threshold, as determined by the force sensor implanted for identification. Hazardous conditions that are not foreseeable, including temperature and stress, are transmitted from the control center using transmitters to enable continuous monitoring. GPS also makes it possible to easily track the digger's location. The digger physically operates the alarm switch, which is used in extreme crisis situations to request assistance from the main control center.

VI. HARDWARE TOOLS

1. ESP-8266 Module
2. Relay Module
3. 5V Charger
4. IR Sensors
5. Gas Sensor
6. DHT-11 Sensor
7. LDR Module
8. Buzzer
9. LED Strips
10. Smart Camera

VII. SOFTWARE TOOLS

1. Arduino IDE
2. Blynk Cloud
3.V380 app

VIII. BLOCK DIAGRAM

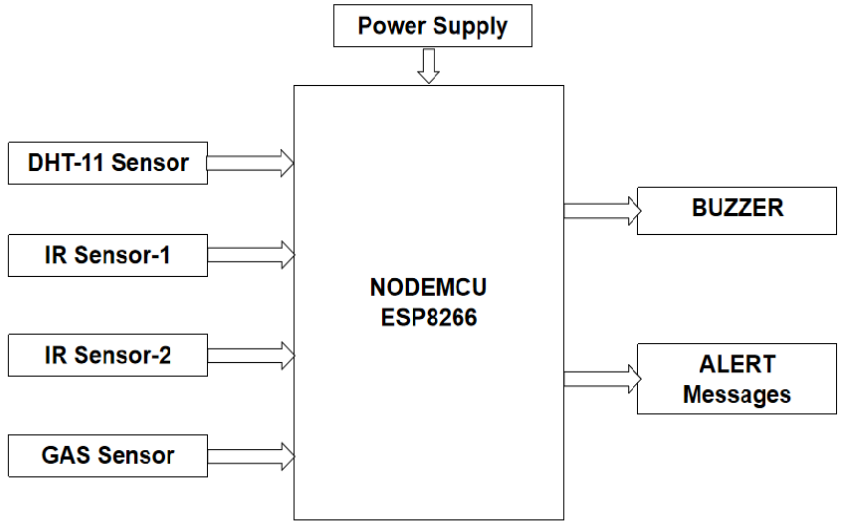

Fig.1(a):Block schematic of the suggested Approach

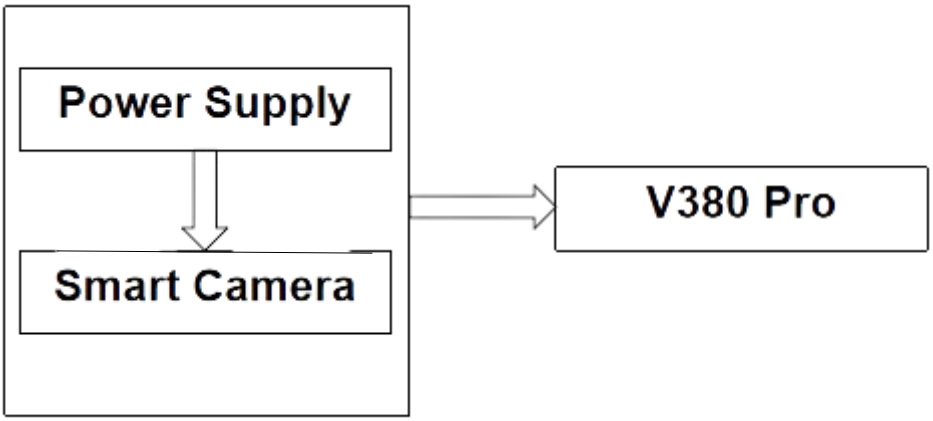

Fig.1(b): Connections for Smart Camera

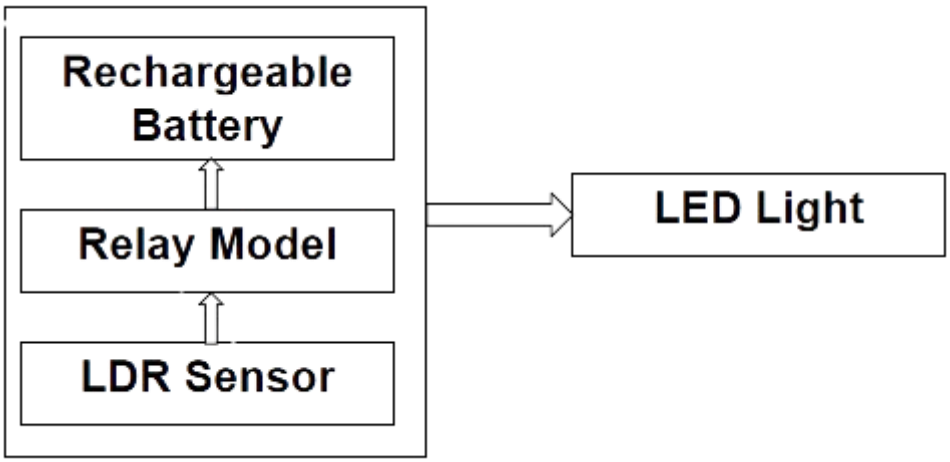

Fig.1(c): Connections for Torch

IX. PROJECT ARCHITECTURE

Fig.2:Architecture of Smart Helmet

X. RESULT ANALYSIS

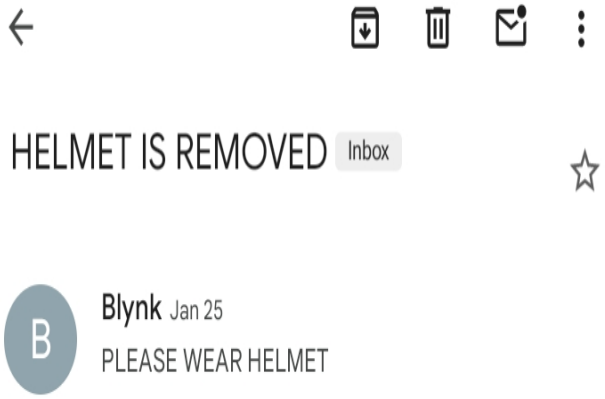

Fig.3: Helmet Removal Alert using IR Sensor

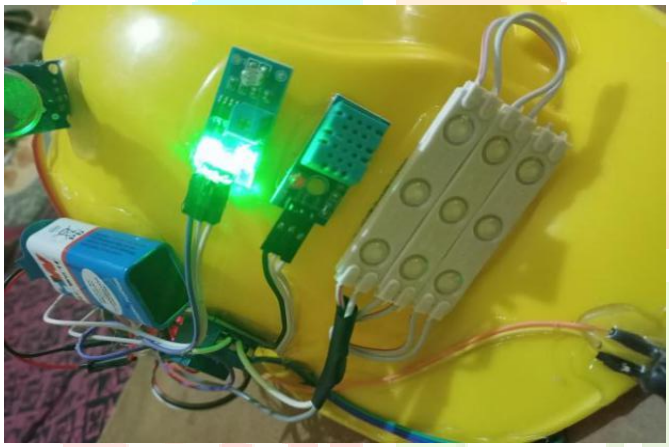

Fig.4: Working of LDR Sensor & ON mode of TORCH

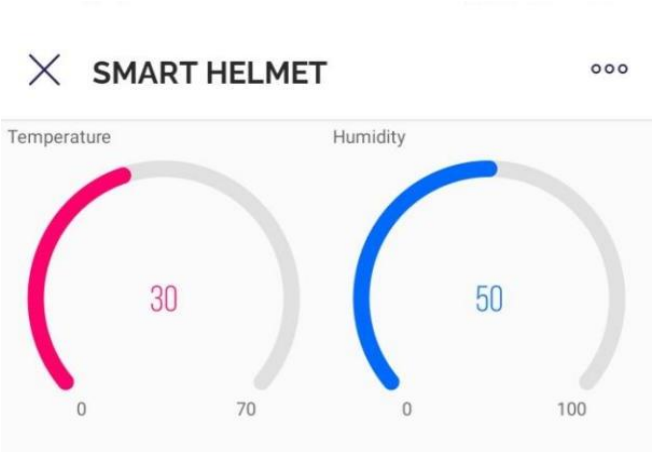

Fig.5: Working of DHT-11 Sensor & Values in Blynk

Fig.6: Pictures by Smart Camera

Fig.7: Smart Camera in Night Vision Mode

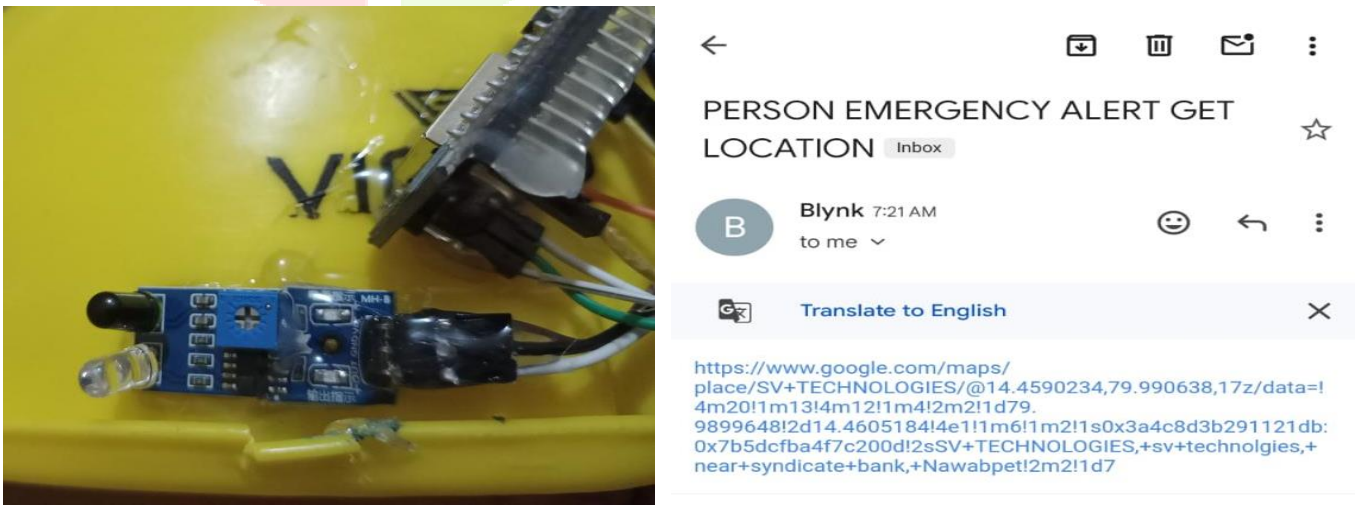

Fig.8: Emergency Alert using IR Sensor

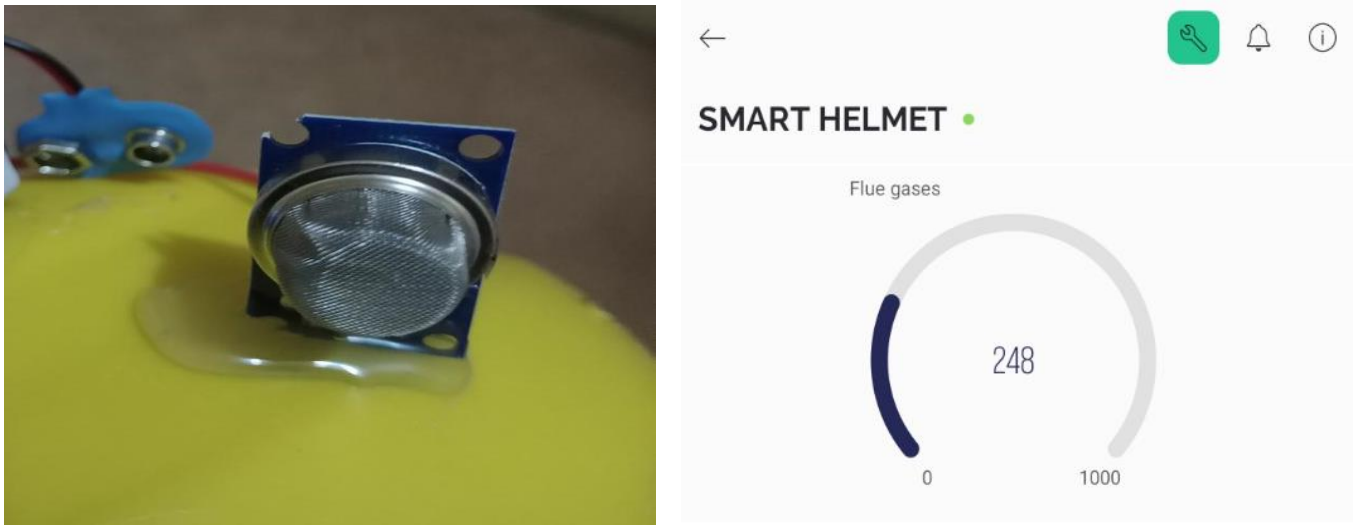

Fig.9: Concentration of Poisonous gases by MQ4 Sensor

XI. APPLICATIONS

1. Used in coal mines
2. For worker's safety
3. Used in Industries

XII. CONCLUSION & FUTURE SCOPE

Consequently, a brilliant head protector for unsafe occasion discovery, observing the encompassing ecological circumstances, and refreshing data like GPS area and sensor information to the focal control center for simple following and giving oxygen enhancements to stay away from the inward breath of noxious gases is planned. The Web of Things (WOT) implementation might also lead to further evolution of the framework. It is possible to create a data set that continuously screens the sensor modules.

XIII. REFERENCES

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