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Monitoring and Safety Systems for Coalmine Using IOT

Pradeep R, Lalith Kishore J, Mohamed Jamsheedh S M., Nithishkumar V

Assistant Professor, Department of ECE, Sri Eshwar College of Engineering, Coimbatore, India

UG Student, Department of ECE, Sri Eshwar College of Engineering, Coimbatore, India

UG Student, Department of ECE, Sri Eshwar College of Engineering, Coimbatore, India

UG Student, Department of ECE, Sri Eshwar College of Engineering, Coimbatore, India

ABSTRACT: In this paper, a coalpit safety system is implemented employing a Ubidots explorer platform as a medium to transmit the info. The system is implemented to watch and control various parameters within the coal mines like light detection, leakage of gas, temperature and humidity conditions, Fire detection within the coalpit. These all sensors are together considered together unit and are placed within the coal mines. All the esteems of the sensors are continuously uploaded to the Ubidots explorer for analysis. Here the gas is continuously monitored if any uncertainties within the level of gas arise. then buzzer is employed to alert the workers. during this system LDR sensor is employed to detect the presence of sunshine. Automatically light gets one and may be controlled using the LED button. just in case if any fire occurs within the coal mine, then an alert notification is shipped to the mail of the authorized person. Temperature and humidity values also are continuously monitored and displayed on the serial monitor and also within the Ubidots explorer platform. The developed system is especially implemented to enhance the working condition inside the coal mines and also to make sure workers safety.

KEYWORDS: Cloud Server, Safety system, Sensors, Ubidots explorer

I. INTRODUCTION

Internet of Things (IoT) is nothing but the devices(things) communicating with one another by using the web [1,2,3]. IoT applications vary on an outsized scale. European Research Cluster on the web of Things classifies major IoT applications as smart buildings, smart transportation, Smart energy, smart industry, smart health and therefore the smart city as major areas. IoT may be a trend-setting innovation during which all the data from sensors is stored within the cloud where it is often easily accessed from the cloud. Sensors and actuators for gathering the info and sending across the web also are included during this advancement. We use cloud not only to store data but also for data analysis, gathering, visualization. Such an emerging technology are often utilized in various IoT applications like agriculture, health, smart home etc, to make the already existing systems more efficient. The key characteristics of the cloud include on-demand service provision, ubiquitous access, resource pooling and, elasticity. In India, we've 493 coalmines present. Coal is that the most vital asset within the world. These petroleum products are natural assets of the world which help create power and for some, purposes. Coal may be a non-sustainable source which can't be supplanted commonly by humans, there are numerous coalmine mischance's happening within the mines, and the diggers are putting their lives in hazard by working within the coal mines, even once during a while they finish up losing their lives within the coal mines which is an unfortunate part. Mainly these mishaps are happening as an immediate result of the old hardware and therefore the wired systems, leading to the terminate mischance's, spillage of the noxious gases within the coal mines are presenting immense dangers to the excavators inside the coalmines. within the underground coalmines light is an essential thing to convey their work, they cannot leave the mine if there's no legitimate lighting which happening them to harm the mineworker's vision due to working under low lighting area. So, to remain far away from this issue we have structured the coalmine security framework. In our work, we've tackled the problems by checking all of the information gathered by the sensors which we've utilized and therefore the observing is finished utilizing the Ubidots explorer platform. controlling is feasible by both automatically and manually. The microcontroller here within the work we've utilized is Node MCU.

II. LITERATURE REVIEW

Kumar et al [1] proposed plan which is based on MSP430, In the coal mineshaft different boundaries like Temperature, moistness, gas and smoke are checked. A Zigbee handset is set at the middle area and by utilizing the engine environment state is controlled.

Lihui et al [2] carried out a framework, where temperature, stickiness, methane estimations of the coal mineshaft are gathered by the sensor hubs and the data is gathered by ARM regulator for handling, for correspondence reason Zigbee is used. In the event that any regards go high, a SMS is shipped off keep up the wellbeing of the laborers.

Madhu et al[4] built up a coal mineshaft wellbeing checking framework by using Temperature, stickiness and the sum of carbon-dioxide present are checked. In the event that any questionable condition happen then message is sent with the assistance of GSM to the woods and local groups of fire-fighters

Ashish et al [5] portrayed a framework that depends on ARM regulator and various sensors like temperature sensor, dampness sensor and the gas sensor. An IR sensor is put in the mine to check the conditions.

Wakode et al[6] proposed a framework that fundamentally used to screen the centralization of hazardous gases in the coal

To provide safety the systems gives the alerts that will be helpful to the workers in the mine to save their lives. An alert switch is placed at the transceivers and receivers side for emergency purpose.

Aarti et al[7] developed a system that monitors temperature, humidity, methane values in the coal mine and all the values are sent to the ARM9 processor and a using a Wi-Fi module the values are continuously updated in the webpage.

Dheerajet al[8] suggested a framework that values of all the parameters that are monitored are stored and visualized in the cloud and those can be controlled using smart phone so that safety of the coal mine workers are maintained

Dong et al[9]proposed a coal Mine safety Monitoring framework dependent on Zigbee and GPRS remote transmission was established. With GPRS innovation, remote information transmission was accomplished and informed through the short message sent to his cell phone, which adds to the early ID of genuine mishaps and continuous treatment, subsequently expanding the security of coal mining.

COAL MINE SAFETY SYTEM

In this proposed system the coal mine safety systems are fixed with gas sensor modules, the light dependent resistor (LDR sensor), temperature/humidity sensor, fire sensor, buzzer and led. We integrate all the sensors to the

Node MCU. First, we need to create an account in the ubidots explorer platform. In this system we mainly have monitoring and controlling systems monitoring system we monitor all the data from different sensors. gas sensor detects the gas in the coal mine environment, if the gas level exceeds the normal level then the buzzer gets high so that the mine workers get notified. These sensor values are continuously uploaded to the cloud (Ubidots explorer) for analysis and also for further use. The temperature and humidity values are also he monitored inside the coalmine. LDR sensor is used to measure the intensity of the light by varying its resistance value. If there is an obstacle to the LDR sensor then led gets on automatically. If in case any fire accidents occur, then immediately fire alert messages are sent to the authorized persons mail and also the link of the location is shared. Controlling system is completely done using Ubidots explorer. In the Ubidots explorer, we create widgets by using the widgets we control buzzer and led manually.

Picking a sensor is a troublesome errand, as indicated by the application prerequisites we need to pick sensors, if the framework needs to support for long time sensors should work precisely, they ought to be dependable

Gas sensor:

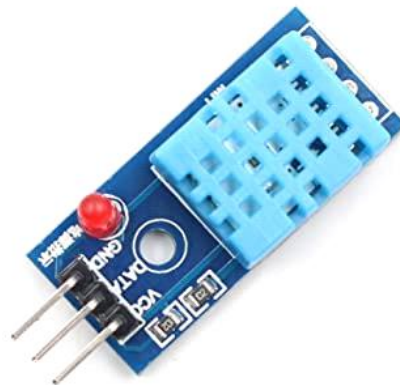


Here mq4 gas sensor is utilized, specifically in utilizing the mq2 sensor. It has a high affectability and a quick reaction rate. Gas sensor basically involves four pins, where three pins are utilized A0, GND, VCC, A0 is a simple pin that is associated to the simple pin of Node MCU, GND is associated with GND, VCC supply is 3.3v. This sensor adequately distinguishes gas spillage in businesses and distinguish burnable smoke and gases.

Fire Sensor:

Here Fire sensor is utilized to distinguish the fire in the coal mineshafts. Fire sensor essentially contains four pins, where three pins are utilized A0, GND, VCC, A0 is simple pin that is associated to simple pin of Node MCU, GND is associated with GND, VCC supply is 3.3v.

DHT11 Sensor:



DHT11 Sensor is utilized to check the temperature and dampness esteems inside the coalmines. DHT11 sensor comprises of three pins, power supply of dht11 is 3.3v, Ground pin is associated with GND pin of Node MCU, Digital pin of a dht11 sensor is associated with Digital pin of Node MCU.

Node MCU:

The Node Micro Controller Unit (Node MCU) is used as a gateway. It has inbuilt Wi-Fi module which is used to send the sensor data to cloud for storage and analysis. The main reason behind selecting Node MCU is that the sensors used in our project uses only digital pins and one analog pins are required.



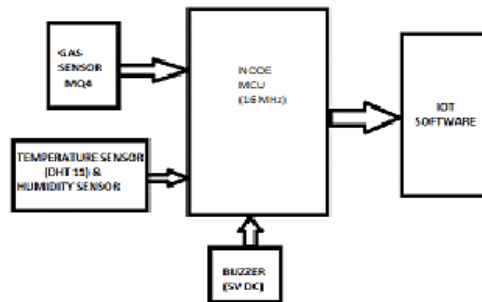
Also, it consumes less power (3.3v) and is of low cost when compared to other microcontrollers /processors like Arduino and Raspberry pi. Node MCU is connected to ultrasonic sensors, gas sensor, temperature sensor, IR sensor. All the values are connected and send to Cloud server.

The ESP8266 is designed and manufactured by Express if Systems. Node MCU contains all crucial elements of the modern computer: CPU, RAM, networking (Wi-Fi), and even a modern operating system and SDK. When purchased at bulk, the ESP8266 chip costs just \$2 USD a piece. The features like establishing a Wi-Fi connection with just a few lines of code, Plug and play mode, Programmable Wi-Fi module and Arduino like software and hardware I/O made Node MCU an IoT Tool that is best suitable for various applications based on IoT. It has a deep sleep mode which consumes 60mA is useful for the low power consumption of an application. Some more features of Node MCU are:

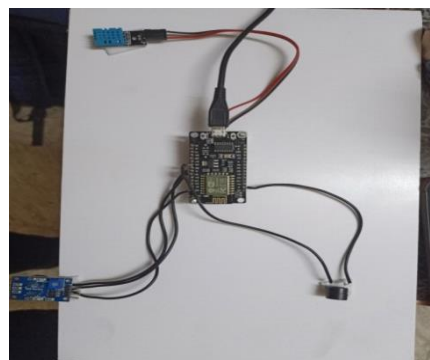
- Voltage:3.3V.
- Wi-Fi Direct (P2P), soft-AP.
- Operating current Average: 80mA
- Flash memory attachable: 16MB max (512K normal).
- Integrated TCP/IP protocol stack.
- Processor: Ten silica L106 32-bit.
- Processor speed: 80~160MHz.
- RAM: 32K + 80K.
- GPIOs: 17 (multiplexed with other functions).
- +19.5dBm output power in 802.11b mode
- 802.11 support: b/g/n.

III. RESULT AND DISCUSSION

Experimental Setup:

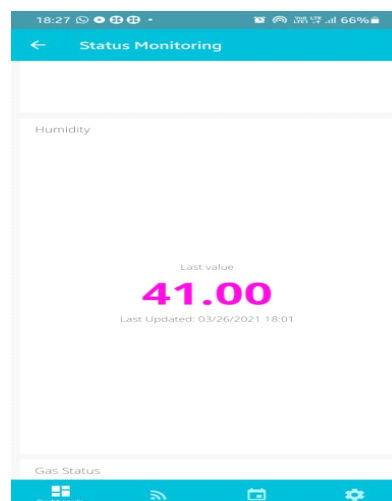


All the values of the sensors are collected by Node MCU and are sent to Thingier.io Design of IoT Based Coal Mine Safety System Using Node MCU The Temperature, Humidity and gas values are displayed on the serial monitor. We are controlling the buzzer with switch widgets created in the cloud platform. When the light is not detected in the coalmines then the yellow button represents the absence of light in the coal mine. If any uncertain conditions occur then notification is sent to the mail of the authorized person.



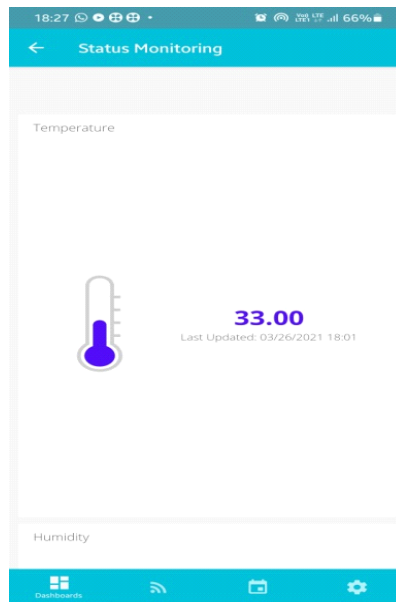
Output:

Each value which are taken by the humidity sensor are updated and displayed in the Ubidots explorer as a result, which is given below



Humidity sensor result

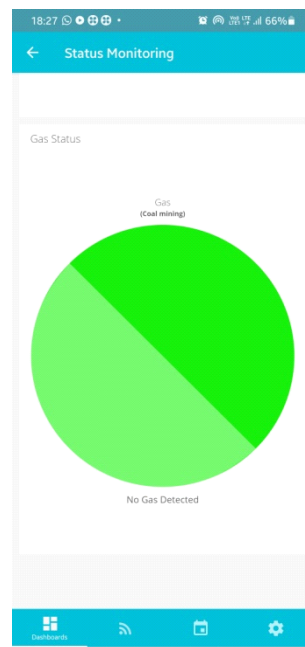
Output given from the temperature sensor is given below,



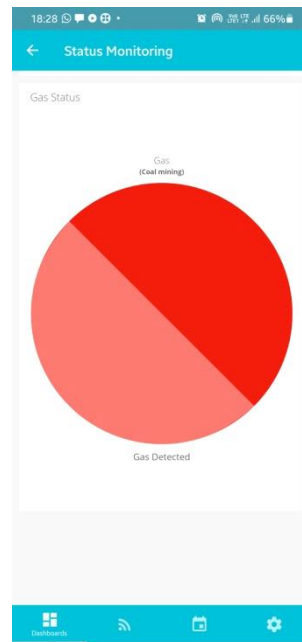
Temperature sensor result

Gas sensor result

Before gas detected:



After gas detected:



IV. CONCLUSION

Implementation of Coal mine safety system is implemented using Fire sensor, Gas sensor, LDR sensor, DHT11 sensor to increase the safety of the workers in the coal mine and to prevent them from danger, by using this system constant checking of the coalmine and alerting the worker is done by using Ubidots explorer. The system is cost-effective and efficient

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