Automatic Safety and Monitoring System Using ESP 8266 with Cloud Platform

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Abstract. Ensuring the well-being of workers, particularly at the production line level, is a top priority for organizations across all industries. This concern is crucial not only for the workers' prosperity but also for the organization's overall success. In environments where working conditions are harsh, and employees face significant risks while performing their tasks, accidents are unfortunately common occurrences. To address this issue effectively, we propose implementing a monitoring system in factories. This system will allow us to closely observe key safety parameters in the workplace, providing valuable insights into the likelihood of accidents. Our solution involves utilizing the ESP8266 Wi-Fi chip-enabled microcontroller NodeMCU. The safety system design incorporates three essential sensors: a DHT sensor to monitor temperature and humidity, an ultrasonic sensor (HC-04), and a smoke sensor (MQ2). These sensors continuously monitor the work environment's conditions and transmit the data to the IoT platform, a powerful cloud-based solution that facilitates real-time data monitoring from anywhere in the world.

Keywords: Node MCU · HC-04MQ2 sensor · ESP 8266 · Ultrasonic sensor · Cloud

1 Introduction

In today's climate, a security system must be supplied for any system or device. This security system may be used to provide an alarm system or a signal that the system is being used that can alert working men in real time. Home automation security systems provide for the control of household appliances, the protection of valuables, and the theft detection. Safety monitoring systems are one of the other categories of monitoring system. India's economy is now expanding, but the nation is also seeing an increase in accidents rate resulting in losses of life's, and property. One of the largest problems that is challenging to eradicate is sudden blasts in coal mines, which is the primary concern. In the event of an emergency, the traveler can be traced and safeguarded. However, safety has also emerged as a crucial concern because accidents are happening more frequently every day. With the fast modern turn of events, there has been increasing number of plants all over India. With this turn of events, the eruption of manufacturing plants have

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tragically not been joined by the required and directed wellbeing principles set by the Public Strategy on Security, There are a lot of issues that plague the specialists working in production lines with unsafe conditions. The fundamental issues that influence the laborers in a regular production line are the natural circumstances, specifically, temperature and mugginess, the presence of possibly hurting and risky gear utilized in the plant, and chance of a fire itself in the production line. So for enhancing the security there is the requirement for a framework which can consistently screen what is going on in the manufacturing plant and send the information in an smart way to the concerned specialists so they can screen it and take necessary action when there is any incident away or when there is the chance of a mishap and caution the concerned individuals to forestall it. The Web of Things acts as a critical technology here with us having the option to screen the climate with a few sensors furthermore, transfer the information. Temperature and mugginess are two of the most essential parameters. The vast majority feel good in the temperature range of 20 to 27 °C and a mugginess in the range of 35–60%. Commonly high degrees of temperature an mugginess make laborer's suffocate and reduce their efficiency. A portion of the issues caused incorporate muscle cramps, exhaustion, bothering and migraine. So there is a need to continually screen these parameters. One more primary driver for industrial facility mishaps is the way that workers will generally stroll into regions where there are mechanized apparatus. This prompts mishaps where the laborers stray into high temperatures which can lead to fire and suffocation. In the existing System the patrolling by individuals cannot precisely find the accident site under the current technique. Often people choose to ignore such alarms, the alarm siren may not always even get the attention of the majority of the public. The following factors make the current security mechanism ineffective: The siren cannot be heard from a great distance away. The majority of vehicles use the same siren sound and inability to be heard inside buildings; Inability to pinpoint the precise site of an accident while it is happening.

Lot of efforts were made in the past to design security module to safeguard people working in extreme conditions like coal mines, under ocean for oil extraction and exploration. People working in mines face many hazards which are life threatening. The mining protection gadget guarantees that the walking environment is free of hazards. More effort should be directed to prevent mining injuries and create suitable working conditions. In many reports proposed in the past Arduino Uno is used for extended reliability in the IOT-based totally mine safety gadget, which has more than one sensor for several features. This machine is used inside the mining agency, and all sensors are considered as one unit sensors screen a spread of characteristics from the working location at the side of temperature and humidity, light intensity, dangerous gasoline ranges within the air, and flame hint [1, 2]. Safety is the most essential element of any industry. Safety and protection are extremely essential within the mining business. To avoid mishaps, the mining region takes several fundamental safeguards. Temperature increases, and methane fuel leaks causes accidents in underground mines. It ensures employee protection here. Whilst a worker is in risk, it is able to use the panic button to alert safety. To improve underground mine protection, a dependable verbal exchange device between subterranean mine workers and the fixed ground mining system has been proposed. The communication network cannot be disrupted at any time or underneath any events. Few

research work proposes a Zigbee-based absolutely wi-fi mine surveillance device with early-warning intelligence. The reputation of personnel can be tracked through IOT [2, 3]. Many coal miners are worried as poor ventilation in subterranean mines exposes humans to toxics gases, heat, and dust, which could cause illness, harm, and even loss of life. Few research work offers a concept for a web of factors wi-fi sensor network that monitors temperature, humidity, and fuel in an underground mine with the use of an ATmega controller. Tt is a powerful technology for underground environment, and it's far referred to as Zigbee. While it being an occasional pressure and being a easy process, its significance is greater. Due to the wide range of programs, the expense is trying to be reduced in recent times. The Zigbee module will pass information to the microcontroller. The microcontroller will then check for any extreme values that have extended beyond threshold value, to produce a caution by way of sounding the buzzer. This information has been transmitted to the base station to the ZigBee module. The base station department takes practical steps to guard all those who help supply coal mining.

2 Proposed Security System Using ESP 8266 and Cloud Platform

The research proposal answers for these issues, and screens the different boundaries to alert potential mishaps or accidents in the industrial facility and totals this information for additional assessment and handling to arrive at savvy choices. The information is transferred on one of the most remarkable and most well-known cloud platform enabling individuals to monitor security features at home or office. The sensors that are used in proposed security device are DHT11, Gas sensor, LDR sensor, along with ESP 32 camera. Buzzer is used to alert officials for possible mishap. LCD provides display for various sensor readings. The paper is organized as follows. Section 1 deals with introduction and literature review, Sect. 2 provides brief description of proposed security system and sensor used. Section 3 explains architecture and working of proposed security system. Section 4 illustrates results and analysis and finally conclusion is provided in Sect. 5.

3 Basic Architecture and Working of Security System

The different sensors continuously send information to the NodeMCU which stores them briefly. Then, at that point, it transfers all this information to the Losant IoT stage by distributing the information through MQTT. The equipment arrangement comprises of the fundamental microcontroller, the NodeMCU, to which every other sensor is connected. The DHT sensor has a solitary computerized yield which can be associated with any computerized GPIO of the NodeMCU. It can be installed in the production line with no adjustment required, due to the presence of installed handling accessibility on the DHT sensor. The ultrasonic sensor has two pins, the trigger pin (Trig) furthermore, the reverberation pin (Reverberation) which is associated with two advanced GPIOs of the NodeMCU. On Losant, we make a record and We can add another Application and afterward set the characteristics which are only the sensor information being gathered by the gadget through the different sensors associated with it. Then we make another

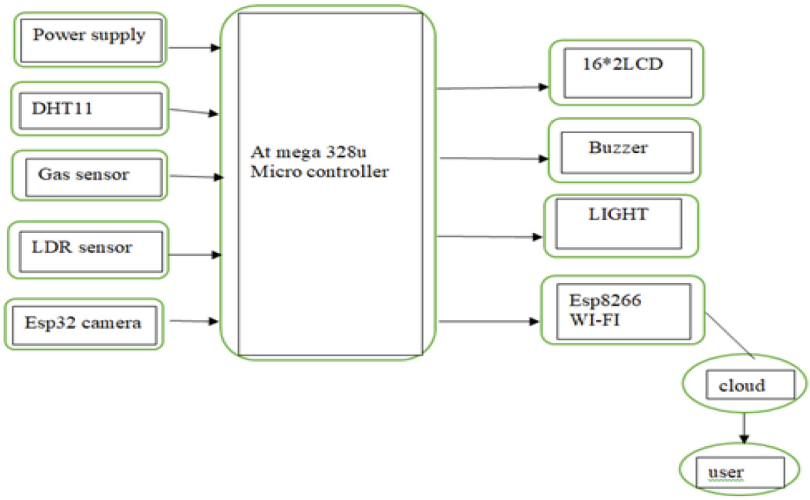

Fig. 1. Block diagram of the implemented algorithm

Dashboard on the stage under the Application and redo it to suit our information assortment necessities. This Dashboard is an ideal spot to observe all the information from various sources on one display. The architecture of proposed security system is shown in Fig. 1.

3.1 Arduino Uno (Atmega 328P Microcontroller)

A microcontroller board called the Arduino Uno utilizes the ATmega328. This board has six essential ports, a 16 MHz mechanized oscilloscope, a USB association, a power connector, an ICSP header, and a restart button notwithstanding 14 high level information/yield pins, six of which may be utilized as PWM yields [4, 5]. It accompanies all that you really want to make the microcontroller ready; essentially, interface it to a PC by means of USB, power it with an air conditioner to-DC converter or utilize a battery. Since it doesn't utilize the Arduino ide USB-to-persistent driver chip seen in before sheets, the Uno is one of a kind. No doubt, it involves an Atmega8U2 that has been modified to work as a USB-to-ongoing connector. The Italian word "uno," and that signifies "one," is the wellspring of the name "Uno." It was chosen to recognize Regulator 1.0's inescapable appearance.

Arduino is an actual handling stage that is open-source and in view of a microcontroller board with an underlying improvement climate. Few information sources, such switches or sensors, are gotten by Arduino, and it deals with few results, similar to lights, engines, and different contraptions. The Arduino application can run on Windows, Mac, and Linux working frameworks, not at all like most microcontroller systems (operating system). Programming for Arduino is easy to learn and use for novices and fledglings. Arduino is an instrument for building a PC that can perform more control, cooperation, and detecting errands than a normal workstation. An actual handling stage is open-source

and based on a fundamental microcontroller board, alongside an improvement climate. Arduino might be utilized to make intelligent gadgets that can work different lights, motors, and other actual results utilizing input from a great many switches or sensors. Exercises with an Arduino board can be finished freely or as a team with PC programs (for example Glimmer, Handling and Maxmsp.) The open-source IDE is allowed to download, and the board can be gathered the hard way or bought currently finished. The Handling media programming climate fills in as the establishment for the Arduino programming language, which is an execution of Wiring, a connected actual registering stage.

3.2 LCD

Liquid Crystal Display (LCD) is a term used to describe a display that specifically contains liquid. It is a sort of photoelectric display that can be found in a wide range of devices, including mobile phones, calculators, calculating's, and station sets [6, 7]. Liquid crystals are principally used in the operation of the LCD (Liquid Crystal Display) kind of flat panel display. LEDs have a wide range of uses for both consumers and businesses because they are frequently utilized in telephones, televisions, computers, and instrument panels. In these displays, multisector light-diffusing diodes and seven pieces are most frequently used. The primary advantages of using this item are the low cost, simplicity of registration, animations, and the fact that there are no restrictions on the use of unique figures, distinctive animations, and even animations by professional users. LCDs offered a substantial improvement over the technologies they superseded, such as light-emitting diode (LED) and gas-plasma displays. LCDs function on the principle of blocking light rather than emitting it, which results in a significant reduction in power usage compared to LED and gas display displays. Although other display technologies are already catching up to LCDs, LCDs are still used today. OLEDs, or organic light-emitting diodes, are steadily displacing LCDs. OLED screens, like plasma-based displays, can experience burn-in but are typically more expensive. To interface LCD with arduino we need to put LCD in our code so that relevant data can be sent to LCD. On many occasions, LCD requirements can be omitted as output can be seen in serial monitors also. However, for standalone projects without laptop or displays LCD is suitable as it makes the overall project more compact.

The above function basically draws a rectangle in the image to point out the corresponding corner points. The rest of the parameters are to illustrate the colour and thickness and type of lines in the rectangle and visualize the coordinates.

3.3 Gas Sensor

A fuel sensor is a tool that detects the presence or attention of gases within the surroundings. Based totally on the eye of the gas the sensor produces corresponding capacity difference through converting the resistance of the fabric in the sensor, which can be measured as output voltage. Based totally in this voltage cost the sort and interest of the fuel maybe predicted. The form of fuel the sensor may additionally want to hit

upon is predicated upon on the sensing cloth gift within the sensor. Commonly those sensors are to be had as modules with comparators as shown above. The ones comparators may be set for a particular threshold charge of gas awareness. When the eye of the gas exceeds this threshold the digital pin is going immoderate. The analog pin can be used to measure the attention of the gasoline.

3.4 DHT 11 Sensor

DHT11 sensor is versatile compact and frequently used sensor for measuring temperature and humidity. DHT11 operates from voltage ranging from 3.5 V to 5 V. The humidity range of this sensor ranges from 20% to 90%. This sensor does not require any calibration and therefore it is very simple to use. Sensor can measure temperature ranging from 20% to 90%. Accuracy level of temperature measurement is 1degree Centigrade high or low. There are inbuilt libraries available that user has to install before installing code in arduino. This sensor is most commonly used sensor as it is robust and takes very less time to give the output. The size of this sensor is less than 2 cm which makes it useful for project which needs to be compact.

3.5 LDR Sensor

LDR sensor consist of LDR whose resistance decreases when light falls on resistor. LDR is usually connected using very popular voltage divider circuit. LDR resembles as variable resistance in voltage divider circuit. As resistance of LDR decreases, voltage drops on other resistor increases. Arduino will sense voltage drop and when voltage drop crosses a particular threshold, it will make LED either glow or off depending upon the project. They are employed in several patron merchandises to gauge light depth. Other names for an LDR, also known as a photoresistor, photocell, or photoconductor. The resistance varies as mild moves the resistor. These resistors are often used to locate the presence of mild. There are numerous uses and resistances for these resistors.

3.6 Buzzer

A buzzer is a device which will send audio signal to alert user. It can be used in fire alarm, water indicator. A buzzer can be mechanical or piezo electric. It has one positive and negative terminal. Buzzer is basically a transducer that converts electrical signal to sound signal. It usually requires DC voltage to operate. Positive terminal of buzzer is usually kept longer as compared to negative terminal for identification. The negative terminal of the buzzer is usually connected to ground. It is usually available in black colour with operating temperature from – 20 °C to +60 °C [8, 9] and [10]. The supply current is around 10mA. Piezo electric buzzer is most commonly used buzzer and is based on piezoelectric effect. Pulse current causes metal plate to vibrate which generates sound.

3.7 ESP 8266 WiFi Module

ESP8266 has Wifi interfacing capability and equipped with built-in TCP/IP networking software. This chip is usually of low cost equipped with TCP/IP stack. The ESP8266 is able to both host software or offload all the networking functions from every other application processor. Each ESP8266 module comes pre-programmed with an AT command setwirelessrmware, the buzzer can be connected directly with Arduino. Negative terminal of the buzzer is usually connected to ground. It is usually available in black colour with operating temperature from – 20 °C to +60 °C [8, 9] and [10]. The supply current is around 10mA. Piezo electric buzzer is most commonly used buzzer and is based on piezoelectric effect. Pulse current causes metal plate to vibrate which generates sound.

4 Result and Analysis

After the installation of code, output may be visible on serial reveal of Arduino IDE. It shows various sensor This assists us with breaking down how the utility is working and allows us to correctly regulate our cod.

Next, the output can be seen in Losant IoT Stage which has inbuilt feature to name axes. In the dashboard user can see all data sent from different sensors on one stage as shown in Fig. 2. So it is simple for us to assemble this information into one spot and observe it. This coordinating of gadgets with the Web of Things makes observing simple and more effective. As shown in Fig. 2, temperature and humidity can be observed clearly. The bottom display represent gas reading. Gas sensor reading should not go beyond 65. In the Fig. 2, gas sensor reading is 32 showing ideal conditions. Gas sensor can detect gases such as Liquefied petroleum gas (LPG), Methane, Carbon Monoxide (CO), Alcohol, Carbon dioxide. LDR reading is shown in Fig. 3. Various parameters of ESP 32 can be controlled as shown in Fig. 4. These features are clock frequency, resolution, contrast brightness etc. The photograph of the prototype of this project is shown in Fig. 5. Temperature should not rise above 50° and humidity should be not go beyond 95%. If the reading crosses threshold value, an alarm (buzzer) will ring indicating inappropriate working conditions. Workers working in coal mines where security system is installed can observe various reading on LCD which is incorporated with other sensors.

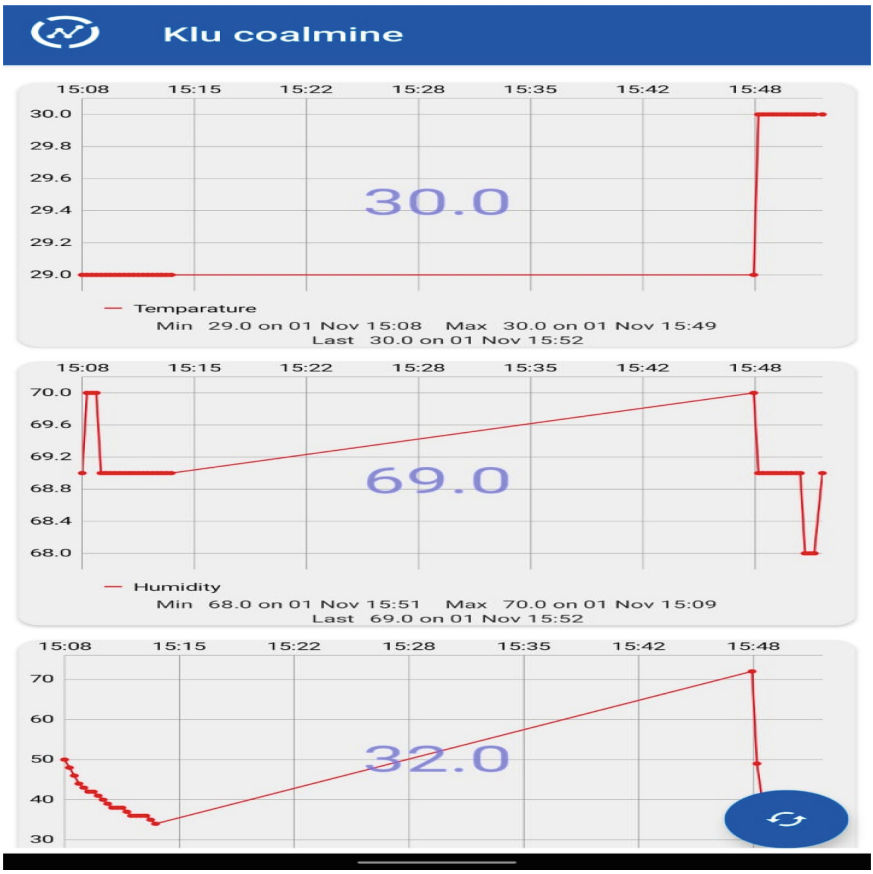

Fig. 2. Block diagram of the implemented algorithm

Fig. 3. LDR Output Plot

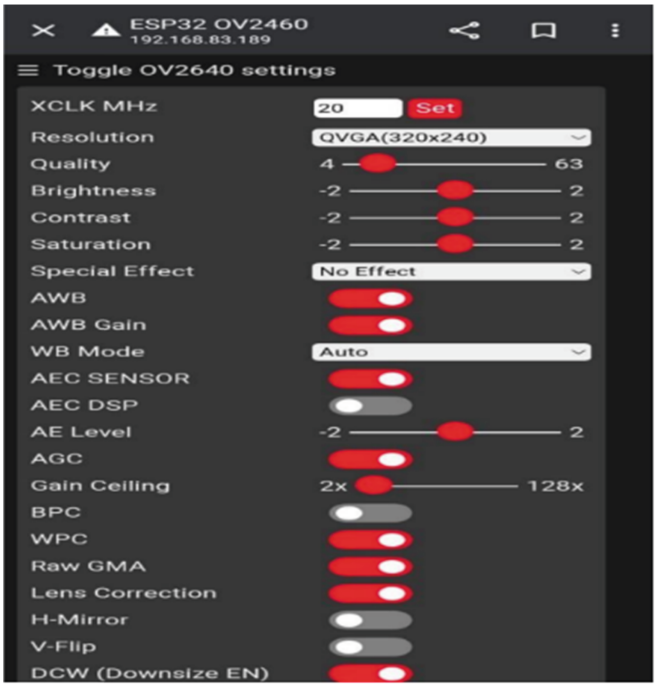

Fig. 4. ESP 32 Controller Interface

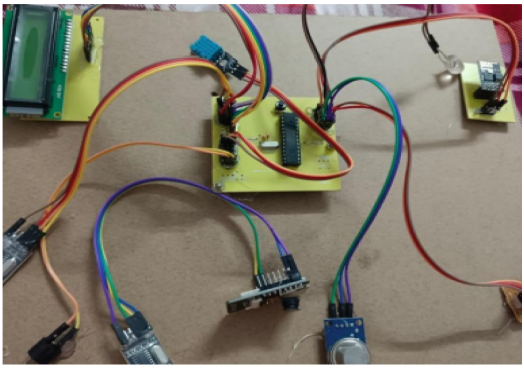

Fig. 5. ESP 32 Controller Interface

5 Conclusion and Future Scope

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