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Design and Implementation of Coal Mine Safety Monitoring and Alerting System Using IoT

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ABSTRACT

Minors security is being a foremost challenge in nowadays. Miner's fitness and existence is inclined to various necessary issues, that includes no longer solely the workplace, however additionally the consequences of this. To minimize the price of mining and to expand the productiveness alongside with contemplation of the protection of miners, an revolutionary strategy is necessary. Coal mine protection observing gadget primarily wi-fi sensor based community can well timed as well precisely replicate the dynamic scenario of workforce in the below ground areas to the cell unit and the floor pc machine. The coal mine's air pollution is in the main due to release of particulate count and gases consist of temperature sensor, carbon monoxide (CO), hydrogen sensor (NO2) etc. To display the awareness stage of released hazardous gases, semiconductor fuel sensors are used. This gadget additionally affords an early alert, which will be beneficial to all workers existing inside the mine to bring their lifestyles earlier than any disasters occurs. The device makes use of IOT science for exchanging of data. There is warning message and GPS location for catastrophe purpose. Exactly when an fundamental stipulations is diagnosed warnings are given by using the shape and comparative approximation is exceeded on to internet server by way of starting ESP8266 microchip problem to Wi-Fi resemblance. The identified assortments in properties are seemed to be on net server web page which makes much fewer asking for the below ground manage core to display the screen and make main speedy cross to the forestall authentic damage.

Index Term: Mine safety, Internet Of Things, Gas Sensor, Wireless Network.

I.INTRODUTION

IoT is nothing however the units speaking with every different by using the usage of the internet. IoT functions fluctuate on a massive scale. European Research Cluster on the Internet of Things classifies main IoT functions as clever buildings, clever transportation, Smart energy, clever industry, clever fitness and the clever town as fundamental areas. IoT is a trend-setting innovation in which all the facts from sensors is saved in the cloud the place it can be effortlessly accessed from the cloud. Sensors and actuators for gathering the records and sending throughout the web are additionally protected in this advancement. We use cloud now not solely to keep facts however additionally for facts analysis, gathering, visualization. In India, we have 493 coalmines present[13]. Coal is the most necessary asset in the world. These petroleum merchandise are herbal property of the earth which assist create strength and for some, purposes. Coal is a non-sustainable supply which cannot be supplanted regularly by means of humans, there are several coalmine mischance going on in the mines, and the miners are inserting their life in hazard via serving in the coal fields, even as soon as in a while they finish up dropping their

lives in the coalfield which is an unlucky part. For the most part these mishaps are taking place as a direct end result of the significant equipment and the wired systems, ensuing in the terminate mischance's, spillage of the noxious gases in the coalfields are imparting giant risks to the diggers internal the coal mines. They can not go away the mine if there is no official lighting fixtures which coming about them to damage the mineworker's imaginative and prescient due to the fact of working below low lights area. So to continue to be away from this problem we have structured the coalmine protection framework. In our work, we have tackled the troubles by using checking each one of the data gathered through the sensors which we have utilized and the watching is completed utilising the Thinker platform. Controlling is viable by means of each robotically and manually. The microcontroller right here in the work we have utilized is Node MCU. We found following the catastrophe in the same state we see that the loss of productivity increases the protection value by 2.51 times, use of published "Statistical life value" along with lesions cost estimations.[16]

II.LITERATURE REVIEW

[1] Dangeetal., proposed diagram which is constructed on MSP430, In these days due to world calefaction and local weather modifications there are some difficult conditions in discipline of coal fields. To reduce the fee and to show enhance in the productiveness alongside with output excellent the atomization in the subject of coal field is certainly essential, which may additionally minimize the mine people contributions. This paper comes up with a plan of wi-fi sensor community (WSN) and also with the assist of MSP430xx controller. The device which is in a position to estimate the humidity, temperature, fame of smoke and fuel in an underground mine field. This device additionally controls the air flow demands to mine employees relying on existing local weather stipulations inside the mine field. This device makes use of low power, a temperature sensor LM35, price superb microcontroller MSP430, smoke detector, gasoline sensor, humidity sensor SYSH220 for sensing the underground mine's local weather parameters together with a wi-fi Zigbee transceiver considering far flung write-down of records at primary vicinity to maintain those local weather nation with the assist of valve and motor manipulate circuitry

[2] Lihuietal., This paper representing a machine which monitors coal field protection depends totally on Zigbee wi-fi sensors network. This monitoring device collects humidity, methane and temperature values below ground of coal field through Zigbee sensor junction around the mine, along with device then transmits all the records to statistics preparing terminal based totally on ARM. This terminal sends the facts to the central administration through Ethernet, and then the observatory Centre display video with the units of the statistics and brings out them to the LAN for far off users to scrutinize. If the records exceeded the threshold record values, the device will send message (SMS) to the associated human resources of safety. The device has understood the concurrent monitoring of work surface.

[3] Kumar etal., Health monitoring systems come to be a warm subject matter and vital lookup subject today. Research on fitness monitoring have been developed for many purposes such as domestic care unit, military, sports activities, hospital, emergency monitoring system and education. In this work, a transportable real-time wi-fi fitness monitoring device is applied the usage of Programmable System on Chip (PSoC) and developed. The developed acquisition machine is used for faraway keep track of patients' heart rate, oxygen saturation in blood and temperature and temperature i.e. pulse oximetry, ECG, pH stage of blood. This gadget approves the medical doctor in a position to apprehend patient's situation on the laptop display with the aid of the wi-fi module. Here we using low cost, low electricity consumption and bendy community topology ZigBee wi-fi module to

experience the far flung affected person data. PSoC fashion designer device will be used for enforcing the utility and constructing the software.

[4] RajkumarBodduetal., developed a coal field security keep tracking system, In this work, the protected Coal field observing devices which replaces the usual coal field observing devices which have tendency to be circuited community systems. This device play an vital position in coal field to secure production. With perpetual amplifying of make the most of areas and add-on of depth in coal field, many below ground narrow passages come to be observing unsighted areas, the place has a lot of out of sight dangers. Furthermore, it is unfavourable to set down cables which are eat time and high priced. So as to achieve clear up the drawback, we have designed a coal field security observing machine primarily based upon wi-fi sensor network, this can show an enhancement in the stage of observing manufacturing security and minimizes disaster in the coal field. Zigbee technological know-how presents a course for technologist who carry out to clear up the security observing troubles of coal field. Reason for this learn about is to advocate an answer appropriate to coal field wi-fi conveyance, security observing, supply a evidence to the similar studies.

[5]Ashishetal., described a device that is primarily based on ARM controller and special sensors like temperature sensor, humidity sensor and the gasoline sensor. An IR sensor is positioned in the mine to test the conditions. The major motive was once to furnish an implementable diagram state of affairs for underground coal mines the use of wi-fi sensors networks (WSNs)[6]. The important purpose being that given the complexities in the bodily shape of a coal field, solely low electricity WSN junctions can produce correct monitoring and disasters detection data. The duty normally targeted on simulating and designing a number of different situations for a usual coal field and evaluating those based totally upon the got consequences to make an appearance at a closing representation. In the time of embedded automation, the Zigbee protocols were used in greater and extra applications. Since of the speedy improvement of microcontrollers, sensors and community methodology, a dependable Technologique situation occurs furnished for their automated synchronous observing of below ground coal field. The below-ground gadget gathers humidity, methane and temperature values of coal field through sensor junctions in the coal field. It additionally gathers the range of human resources interior the coal field with the assist of an IR sensor along with the device then transmits the statistics to data preparing terminal based totally on an ARM

III.EXISTING SYSTEM

It will use zig-bee software program and three sensors such as temperature, humidity and fuel sensor. Three sensors will detect the alternate in parameters of the surroundings and will give the facts to the microcontroller. Then the microcontroller can test these values up to the minute, if any of the values exceeds the permitted value, then it will warn all the miners via the buzzer. This statistic is handed via the ZigBee module to the central administration. Then the central administration department ought to take protected measures to shield the people who work in coal mining[7][9][11][15].

IV.PROPOSED SYSTEM

In this proposed device the coal mine protection structures are constant with fuel sensor modules, temperature sensor, hydrogen (H) sensor, Nitrogen Dioxide (NO2) sensor, Hydrogen Sulfide (H2S) sensor, carbon monoxide (CO) sensor, fireplace sensor, buzzer etc., We combine all the sensors to the Arduino Uno along with the use of Internet of Things (IoT). In this device we generally have observing and controlling structures observing gadget we reveal all the facts from distinctive sensor modules. The gas sensors detect the fuel components inside the coal field environment. If the detected fuel value exceeds the threshold value, then according to the situation the

buzzer receives excessive so that the mines will get notified. Those monitored sensor values are always used to upload to the cloud for estimation and additionally for in addition use. Then temperature values are additionally here monitored inside the below ground coal field. If in case any casualties occur, then without delay fireplace alert messages show on IoT page and LCD display along with the buzzer alert and motor used to spray water inside the field. Controlling device is totally finished the usage of IoT platform. In the Internet of Thing platform, we create widgets, by using the use of the widgets, we manage buzzer and water pump manually.

V.BLOCK DIAGRAM

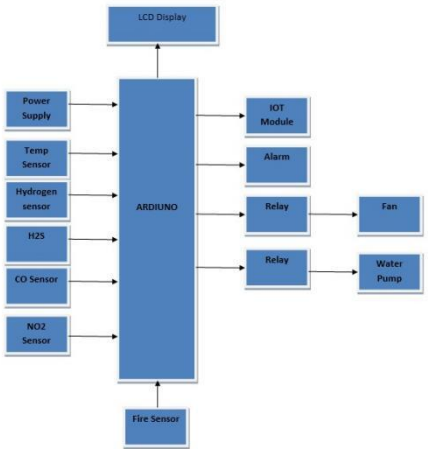


Fig 1:Block diagram of a System

1.GAS SENSORS

Fig 2:Gas sensor

The mine gases are tremendously centred and toxic, grow to be a danger to each miner's fitness and the surroundings and also restrict visibility. The fundamental factor of the flammable gases that leak from coal seams is methane. The sensor makes use of MID04 infra-red methane sensor. The attention sensing vary of 300 ppm to 10,000 ppm is appropriate for leak detection. The temperature vary of the sensor is from − 10o C to 50o C and it consumes strength much less than one hundred fifty mA at 5 V. The MG-811 is the carbon dioxide sensor. It is tremendously touchy to CO2 and much less touchy to alcohol and CO. It ought to be used in air satisfactory control, ferment process, indoor air monitoring application. The output voltage of the module falls as the attention of the CO2 will increase.

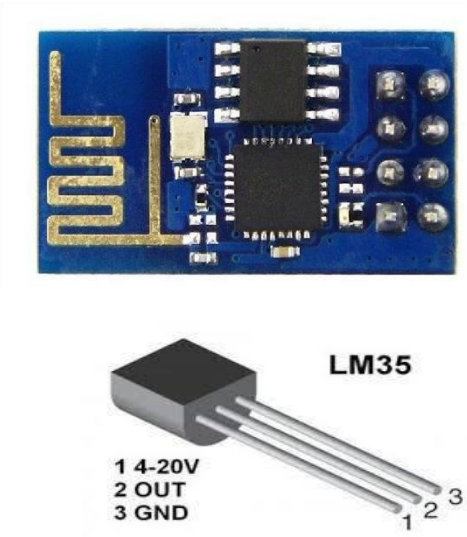
5.1. FIRE SENSOR

The flame sensor module is only sensitive to the flame. But also can detect ordinary light but it is designed to allow infrared only. Its detecting ranges lie over from 760nm-1100nm. Its operating voltage is 3.5V to 5V.it detection angle about 60 degrees. It is a three-pin sensor. That three pins are Vcc, gnd, and Digital out. The Dout pin is to microcontrollers input.

5.3. *TEMPERATURE SENSOR* (LM35)

Fig 3:Temperature sensor module

The sensor used in this prototype is called Lm35 which is an integrated circuit type temperature sensor. This sensor has three terminals two pins are used to give power supply and ground remaining one is an analog output pin to ADC of a microcontroller. The sensor is directly calibrated for centigrade. It can measure the temperature from -55°C to 150°C.In the basic centigrade configuration, it can measure temperature from 2°C to 150°C and in



full range configuration, it can measure temperature from -55°C to 150°C. Its operating voltage ranges over from 4V to 30V. it consumes only less than

Fig 4:LM35

60μA.in still air it self-heating is 0.08C. the output is linear with the increase in temperature. Every 1°C increase output voltage increases by 10mV.

V_{OUT} = 10 mv/°C × T

where T is temperature and V_{out} is the analog output of the sensor.

5. 4.ESP8266 WIFI MODULE

Esp 8266 is a Wi-Fi module that can be interfaced with microcontrollers to provide interconnect availability to achieve IoT. This board contains a 32-bit processor which runs at 80mhz. It is operating at +3.3V.

It consumes only 100mA. It has a deep sleep mode in which it only consumes less than 10µA A.it has a 4MB flash memory. this module is integrated with TCP/IP protocol. It has serial communication compatibility so the vast range of development modules can support this.

Fig 5:ESP8266

5.5. MICROCONTROLLER

The heart of this project is Arduino Uno. It is an opensource development board that is based on AVR microcontroller Atmega328p. It is an 8bit microcontroller. This development board consists of other components like crystal oscillator, Voltage regulator, serial communication. This can be easily programmed with a PC. This board also has a reset button.it has 14 input and output pins. out of 14 pins 6 can be used as PWM pins.it has 6 analog pins with a resolution of 10bit. The AVR microcontroller operates At 5V But the board can support voltage memory,2KB SRAM,1KB EEPROM. It runs at 16MHz clock frequency.

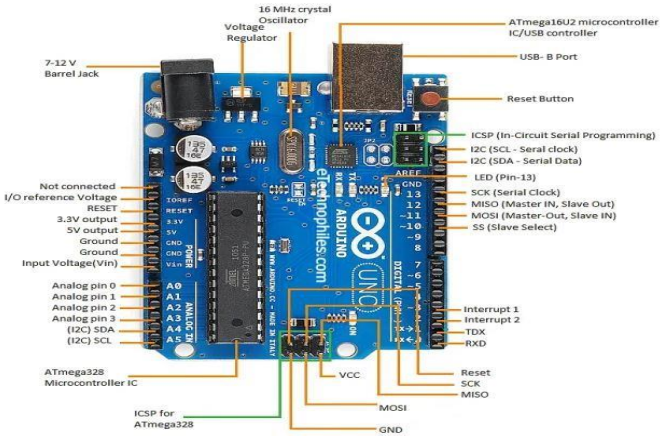


Fig 6:Arduino Pin diagram

5.6. CIRCUIT DIAGRAM

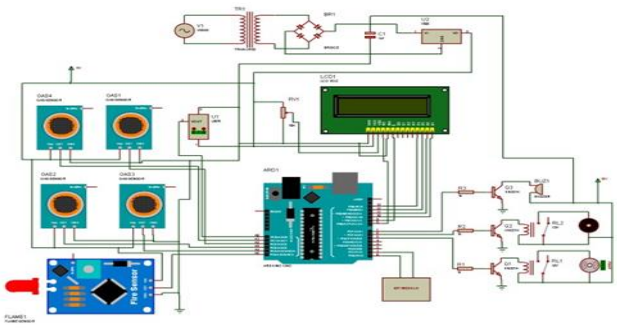


Fig 7:Circuit diagram

VI. RESULT

The hardware implementation of the IOT Based Coal Mining safety for Workers Using Arduino is shown below

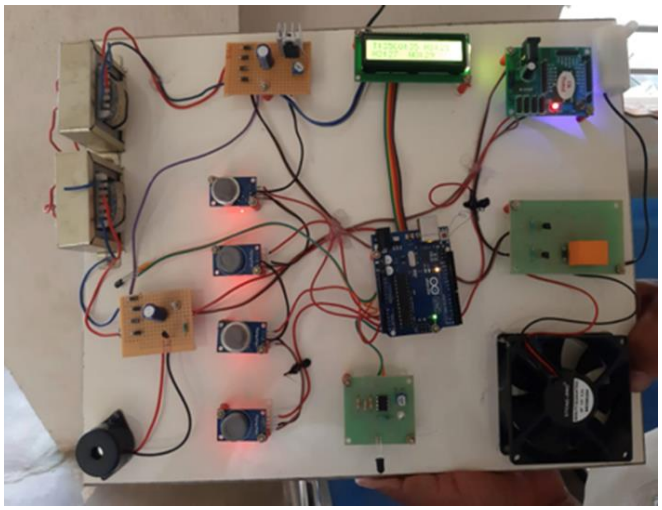


Fig 8:prototype

VII.CONCLUSION

The developed system using Arduino UNO, gas sensor, fire sensor, and temperature sensor measures the underground coal mine parameters accurately and provides those values to the cloud for continuous monitoring. if the hazardous parameters in the coalmine exceed the threshold value the system gives immediately alerts the miners and sends the value to the cloud. Through monitoring, the coal mine in the cloud can immediately commence the medical and rescue operations if needed.

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