Implementation of Zigbee Based Coalmine Parameters Monitoring System

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ABSTRACT-
The proposed work is to screen the underground coal mining gas spillage framework utilizing zigbee module. This framework gathers the underground mine parameters, for example, carbon mono-oxide, methane gasses and temperature, stickiness estimation of coal mine through zigbee. In the current framework, at whatever point the limit values increments over the edge esteem, then a message will be sent through base station unit for the approved client. In the proposed framework the data send from the principle server to all specialists, if the conditions get to be unfavourable in the working place, diggers will be alarmed to leave the spot, through which the coal mine mishaps can be stayed away from. So the profitability can be expanded and wellbeing to the coal mining procedure.

KEY WORDS: PIC16F877, Mine Safety, ZigBee, LCD, RFID, Temperature Sensor, Humidity, Threshold value.

1. INTRODUCTION

Safety and security is a vital component of all in the mining industries. All mining industry takes after some essential protection to stay away from any sorts of undesirable frequencies. Correspondence is the most vital effect today, is to screen distinctive parameters, for example, temperature, expanding dampness, and carbon monoxide, methane gas, and so forth., consistently utilizing sensors, for example, LM35, water level pointer and carbon monoxide gas sensor MQ4 and to stay away from any sorts of dangers identified with security utilizing signal fundamental moves are made. Most dependable correspondence framework must be utilized in the underground to upgrade security in the underground mines. That is it must be set up between workers, who are moving in the mine, and a settled base station. The correspondence system must not be sporadic at any minute and at any condition.

The wired correspondence system framework is not all that dynamic in the Inside underground mines. Inside the underground mines, because of uncomfortable condition the establishment cost and in addition support expense is high for wired correspondence systems. For the fruitful remote information transmission, in the mine work the zigbee plan is utilized in switches. A practical zigbee based remote mine managing framework with ahead of schedule cautioning knowledge on carbon monoxide, methane, temperature, expanding stickiness and number of persons in the mining region is proposed in (Zhang, 2001; Qiang, 2009; Wei, 2009; Dai Wei Chen Jianhong, 2011).

Objective:

- Monitoring: To monitor the parameters like carbon monoxide (co), temperature and humidity level detection.
- Communication: Monitored data will transmit toward pc side (receiver unit) through zigbee wireless communication. Zigbee can be used inside mines at routers.
- Rescue method: Whenever the information or data from the sensor exceeds the specified threshold (preset) value of temperature, carbon monoxide and water level, the zigbee module at remote monitoring site will transmit alert signal to local site by blowing buzzer continuously and temperature, gas, humidity and number of persons will be displayed on LED segment according to the emerging situation.
- Protection: Due to the zigbee wireless communication system, employees who are working in the coal mine environment will be alert earlier. So rapid action will be taken and the chances of accidents will be reduced due to the information from the underground mines environmental factors (LI Yao-bin ZHAO Da-peng, 2011; Philomina, 2014; Karthik, 2013; Jasmin, 2015).

Existing System: Underground mining is naturally unsafe and its security checking is an intricate movement. The current framework has absence of checking in the most danger working range. Because of homogeneity, a few hubs are getting over loaded. The information will be send only to the authorized user through modem. Highly efficient nodes are wasted in low level applications. In the existing system, continuous data collection from the fixed node to sink node, this will result in energy wastage as well as false detection (Karthik, 2014; Saravanan, 2014, Gopalakrishnan, 2014).

Proposed System: It meets the prerequisites of completely and dependable scope on the underground mining passages. It gives a higher capacity to recuperate from blunders. The systems are exceedingly effective, with most noteworthy QoS (Quality of Service). The event detection is the major application over existing system, this will cause energy consumption. While using continuous data collection it will result in data congestion, data losses. It will be reduced in proposed system. The information will be send to all workers about the environmental factors, which may help the workers to avoid the accidents (Vijayaragavan, 2014, Saravanan, 2014; Gopalakrishnan, 2014).

Description: Three parts available in this system. Those are monitoring unit, sensing unit and person availability checking unit. The block diagrams of each unit are as shown in the following figure. Each unit has one

microcontroller. Monitoring unit will receive a data from the sensing unit whereas sensing unit is continuously monitoring the above mentioned data's.

The methane concentration, temperature level and the moisture level has been sensed and send to the monitoring unit simultaneously. Another unit is a person availability checking unit. Every employee has this unit to check their presence. It is also will send to the monitoring unit. So the monitoring unit will monitor the sensing data as well as the availability of the employees.

- Fixed Nodes-collects the local data from the environment and transmits the information or data to sink node
- Sink Node-receives the information or data from fixed node and communicate the same to the server, and also communicates the commands from PC to Fixed nodes.
- Mobile Nodes-transmits the unique employee id and also receives warning messages from fixed nodes. They are carried by the mine workers.
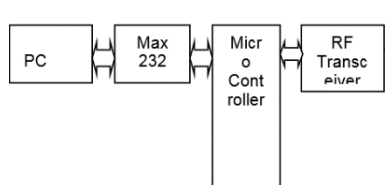- The nodes are communicating with each other and forms a wireless network.
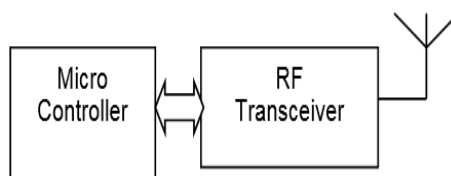

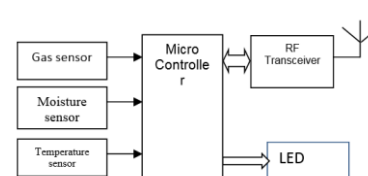**Figure.1. sink node**   **Figure.2. mobile node**   **Figure.3. fixed node**

Hardware Design: There are various hardware equipment's, which are utilized to implement the coal mine system are briefly defined as follows:

Microcontroller: The microcontroller used here in this project is "PIC16F877A". A PIC microcontroller is a processor with an inbuilt memory and RAM and you can use it to control the levels of your projects. So it saves you constructing a circuit that has separate external RAM, ROM and peripheral chips. It includes EEPROM, timer, analog comparator, UART. It is an 8-bit architecture and it is said to be RISC processor. It can support I2C, SPI protocols. It is a 40 pin package. External crystal can go up to 20MHz
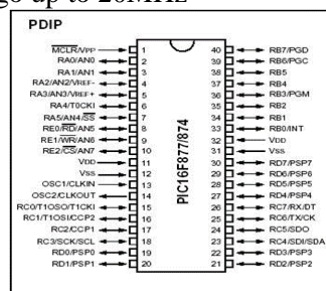

Gas Sensor: This sensor is used to sense the leakage of this stated gas. In normal conditions the output of this sensor is 'low' and it goes 'high', when the specified gas sensed. The output of the sensor goes LOW as hurriedly as the gas sensor senses any gas leakage from that storage. This is detected by the microcontroller and the buzzer is turned ON. After the interruption of few milliseconds, the exhaust fan is also turned ON for propelling the gas out. The output of sensor is connected to the PIC microcontroller (port A or E).

Temperature Sensor: In the proposed framework thermistor is utilized as temperature sensor. The word thermistor is an acronym for warm resistor (temperature touchy resistor). It identifies little changes in temperature. Here we utilized LM35 temperature sensor.it is utilized when we have to figure out the temperature of specific environment. The yield of the temperature sensor is simple in nature. This sensor yields a voltage which is identified with the outright temperature scale by an element of 10 mV for every degree Kelvin. It can hold temperature up to 150 degree Celsius.
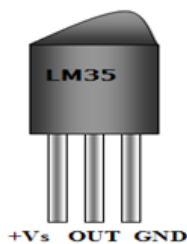
Humidity Sensor: Stickiness is the measure of water vapor noticeable all around. In day by day dialect the expression "moistness" is regularly taken to mean relative mugginess which is characterized as the proportion of the incomplete weight of water vapor in a package of air to the soaked vapor weight of water vapor at an endorsed temperature. The moistness sensor which senses the moisture is of resistive sort.
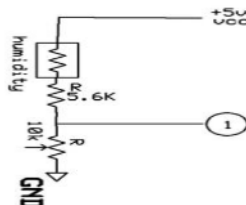
Humidity sensor circuit

ZigBee Communication: ZIGBEE is another remote innovation coordinated by the standard of IEEE 802.15.4 individual range systems. It is by and large utilized for the uses of far reaching robotization. It in the blink of an eye works in the 868MHz band with an information or data rate of 20Kbps in Europe, 914MHz band at an information or data rate of 40Kbps in US, and the 2.4GHz ISM groups Worldwide at a greatest information or data rate of 250Kbps. The ZIGBEE determination is a blend of Home RF Lite and the 802.15.4specification. This detail works in the 2.4GHz (ISM) radio band - the same band as 802.11b standard, Bluetooth and microwaves. It is having limit of uniting 255 gadgets for each system. The handset module scope can be 30-70m in urban zones and 1-1.5km in outside (LOS). The handset has an on-chip wire receiving wire and it works at a recurrence of2.4GHz. The information got from the microcontroller is sorted out in light of the ZIGBEE convention principles and afterward balanced. The detail underpins information transmission or data rates of up to 250 Kbps at a scope of up to 30meters.This ZIGBEE's innovation is slower than 802.11b (11 Mbps)and Bluetooth (1 Mbps) yet it devours essentially less power. Here a couple of Zigbee modules is utilized one to transmit the information or data from underground area and another to get this information or data at ground or observing segment.

Max232: Max 232 is utilized as a level interpreter in the middle of microcontroller and RS232. The Max 232 is a double RS-232 collector/transmitter takes +5V power supply from the force supply unit. It has four level interpreters, the two of which are RS232 transmitters that change over TTL/CMOS info levels into + 9V RS232 yields. The other two level interpreters are the RS232 collectors, they change over RS232 inputs to 5V TTL/CMOS yield level.

RS-232: MAX-232 proselytes the TTL rationale voltage to RS-232 rationale, and it is utilized for serial correspondence. The Character organization and the transmission bit rate are all controlled by the serial port equipment, regularly a solitary coordinated circuit called a UART that changes over information from parallel to offbeat begin stop serial information structure. Subtle elements of voltage levels, slew rate, and cut off are actually controlled by a line-driver, which changes over from the UART's rationale levels to RS-232 perfect sign levels and a beneficiary that changes over from RS-232 good flag levels to the UART's rationale signal levels.

Display Unit: It is said to be liquid crystal display and is used to display the content from the microcontroller. Here we use 2x16alpha-numeric LCD. It has two line and we can display maximum of 16 characters on each line.

Power supply unit: The power supply unit consists with four units. To begin with the information AC supply 230v is bolstered into the progression down transformer. It smothered the given AC information and the voltage in the scope of (0-15) V is acquired. To change over the AC to DC the yield is bolstered into the scaffold rectifier. To uproot the music we utilized capacitor lastly the yield is nourished into the voltage controller. It will create the consistent DC voltage relies on upon the voltage controller IC's.

RF Encoder: RF Encoder (HT12E) is utilized to transmit advanced information, it works in Radio Frequency. Information to be transmitted are encoded with 8-bit or 4-bit information and it is sent to the RF transmitter. Signs through RF can go through bigger partitions making it suitable for long range applications.

RF Decoder: RF Decoder (HT12D) is used to decode the data transmitted by the transmitter. The transmission of information or data occurs at the rate of 1Kbps - 10Kbps.The transmitted data or information is received by an RF receiver operating at the same frequency as that of the transmitter.

Software Design:

MPLAB -IDE: It gives another Call Graph to exploring complex code. It bolsters Multiple Configurations inside of your activities. It supports different versions of the same compiler. It supports different Debug Tools of the same sort. It Supports Live Parsing. It Import existing MPLAB® 8 IDE activities and utilize either IDE for the same source. It Supports hyperlinks for quick route to presentations and incorporates. It Supports Live Code Templates. It supports the capability to enter File Code Templates with permit headers or layout cod

CCS Compiler: It can without much of a stretch relocate between all Microchip PIC® MCUs gadgets. It Minimize advancement time with: fringe drivers and standard C builds C++ style information/yield streams with full information organizing to any gadget or for strings. It Use CCS libraries and article code sovereignty free Convenient capacities like #bit and #byte permit C variables to be put at outright addresses. The fundamental one-piece sort (Short Int) grants the compiler to produce extremely proficient. It gives Bit-arranged code. It can easily characterize, set-up and oversee interferes (Kanniga, 2011).

Proteus: The full usefulness of the recreation center and the components in the Basic Simulation Package. It is aGraph based recreation of all the previously stated examinations sorts. Charts show simple, advanced and transport information. The Frequency plots show pick up and stage in dB or straight estimations. The Audio Analysis processes a waveform and plays it to your sound-card. The Results can be sent out as a *.wav document (and later transported in by means of the sound generator if required). The Interactive Analysis runs an intelligent recreation and catches the outcomes onto a chart. The Digital Conformance investigation - see underneath for points of interest of this capable Quality Assurance apparatus. The Probe expressions permit plotting of numerical capacities got from measured voltage and streams. We can take exact estimations utilizing diagram cursors.
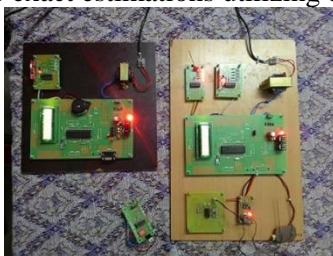
4. CONCLUSION

The conventional mine security framework can be adequately supplanted by discovering the quantity of persons and additionally coalmine parameter (temperature, gas, dampness) values and cautioning them is proposed in the paper. The framework is dependable, bona fide, continuous, sparing and easy to use. This framework will utilize occasion recognition strategy for vitality utilization. The framework consolidated the Zigbee based high recurrence remote information transmission innovation. By method for giving the data to the faculty with respect to the measures to be taken if there should arise an occurrence of a threat, it will be gainful for them to spare their life. Legitimate checking and correspondence is conceivable between the workers and the observing site which can take suitable activities all the more quickly and shrewdly.

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