Detection and Automation System in Fire Work Factories using IOT

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ABSTRACT

The accidents in fire work places are increased day by day. There are numerous life losses ofmany skilled workers and laborers. There is no advent precaution measure to detect the alarming cause of the fire work place accidents and provide an alert system. Occupational accidents and occupational diseases are common in the mining. The most common causes of accidents in coal mining are firedamp and dust explosions, landslips, mine fires, and technical failures related to transport and mechanization. An analysis of occupational accidents in the consideration of social and economic factors reports that the real causes behind these accidents, which are said to happen inevitably due to technical deficiencies or failures. Thus, an automated alarming fire work accident detection system is employed to rescue and protect the workers from the hazards. This system incorporates the combined action of the temperature, pressure and gas sensor and IOT module to detect the temperature, pressure and atmosphere in the work place and log every data onto the cloud using datalogging. Then these data are accepted by an admin controlled sever page through data acquisition. The data processing takes place at a server page and the alert is send to the device to glow the alarm and to the concerned officials and rescue stations for taking the prevention measures.

Keywords- **Temperature sensor, pressure sensor, gas sensor, IOT module, Cloud, datalogging, data acquisition and data processing.**

I. INTRODUCTION

The accident is any uncertain activity due to unavoidable circumstances and carelessness of some people. This incident is happening continuously all around the world. A large number of workers (approximately 2.3 million) die each year worldwide, 350,000 because of occupational accidents and approximately 2 million because of occupational diseases. Occupational health is defined as an area of application in which the effects of work life on health are investigated. A public health approach, using the notion of occupational health represents a partial understanding of health, that leads to defining workplace and work life as outside of public health. The reasons for that are that citizens are seen not as workers but as consumers and that work life is moved out of the healthcare field. This causes occupational health to detach from public health when organizing healthcare services. The basic area that problems arise in terms of worker's health and safety is the production activities phase. Production activities consist of main activities such as excavation, ground support, and haulage as well as activities such as electricity maintenance, establishing and managing pressurized room networks, communication and signalization systems, and maintenance and repair of various machines and equipment. Accidents in fire work related to collapses, pit fires, firedamp and fire dust explosions, haulage, and mechanization frequently occur in underground pits. Thus, they end up with many complications physically.

II. PROBLEM STATEMENT

The major problem identified is that there are numerous accidents occurring in the fire work places due to improper maintenance and inadequate monitoring of the mining activities. These led to numerous life losses and immeasurable resource loss. There is no proper early detection of the uncertainty in the fire work places. Fire works manufacturing has been a very dangerous activity. Fire work hazards include suffocation, gas poisoning, roof collapse and gas explosions. Chronic lung diseases, such as pneumoconiosis (black lung) were once common in workers, leading to reduced life expectancy. Many workers continue to die annually, either through direct accidents in fire work places or through adverse health consequences from working under poor conditions.

III. LITERATURE SURVEY

In the hazardous environment, industrialized accident occurs. Due to which consequence may be very serious and it causes loss of environment, property and life. For moral, legal,& financial reasons hazardous environmental safety & security is more important wireless sensor network in industrial site, the deployment of distributed point source where the dangerous parameters used, produced and stored is described seven characteristics, fundamental aspects for estimating and mission method were identified. For measurement of temperature using Virtual Instrumentation is by Automatic Process Control in many industries. Some project sources in WSN systems that monitors fire work places are as follows:

- Zigbee Based Intelligent Helmet For Coal Miners

- Design of Coal Mine Intelligent Monitoring System based on ZigBee Wireless Sensor Network, 2016
- An Event Reporting and Early-Warning Safety System Based on the Internet of Things for Underground Coal Mines: A Case Study, 2017
- Application of WSN Fire Monitoring System in Coal Mining, 2017
- Design of Underground Coal Mine Monitoring System, 2013

IV. EXISTING SYSTEMS

There are existing fire work place alert systems that is built using sensors and WSN.The fire work place intelligent monitoring system, through ZigBee nodes collect a variety of wireless data. The systemsets up a backup control and monitoring stations. The data is transmitted using Ethernet connection. It includes wireless data acquisition subsystem based on ZigBee network, industrial Ethernet transmission subsystem and remote monitoring system.

Fire work place safety systems based onIoT seamlessly integrate gas sensing monitoring, miner tracking, and cloud computing to create an intelligent loop of safety through analytics. IoT utilizes BLE for transmitting data fromArduino modular sensors. The cloud is helpful for determining the service state of the fire work place and forsharing information. The fire monitoring system is based on Zig-bee technology and discusses the network data transmission process in the system. When the system is applied to an actual fire work place, it achieves a sound fire monitoring effect. The wireless sensor network (WSN) fire monitoring system consists of three subsystems as data acquisition subsystem, control center subsystem and emergency response subsystem. With sensor nodes as the basic unit, the WSN is divided into five parts: sensor module, treatment module, wirelesscommunication module, location module and power supply module. The systemcan monitor the air temperature, humidity and smoke concentration of fire in thework place and provide effective basis for monitoring department to make decisions on fire prevention and control measures. These basic systems don'trely on cloud for entire data logging, data acquisition and data processing. They completely depend on the WSN that transmits data to nodal points not the cloud. This may make the system unreliable at emergencysituations. The data rate transmission and governing these data is done at the faster rate during emergencysituations.

V. PROPOSED SYSTEM

The proposed system consists of the sensor modules that senses all the data around the fire work environment and logs the data onto the cloud-controlled server page using IOT module. The server page is maintained using the Java Servlet Package. The logged data is processed into the average values for each entry on an interval basis. These values are automatically processed using a predefined value maintained by the server page. When there is any arbitrary change in the values of the sensed data an alert is send to the IOT MODULE and the concerned authorities. The IOT module detects the alert signal and glows the inbuilt alarm system and alert message to the authorities may take precautions steps. The main advantage of this project is that IoT detects the uncertainty in the environment beforehand using data analysis reports. The system also considers the emergency situations in hand to alert the workersas quickly as possible. This project serves the aspect of "Prevention is Better than Cure".

VI. ARCHITECTURE

The architecture consists of twomodules such as asensor Moduleand Cloud data storing and processing using JSP Module. The sensor modules include the CO and CG sensors, Methane sensor, smoke sensor, SO2 sensor Temperature and Humidity, Pressure sensor which are interfaced using an AVRcontroller (AtMega32) for collecting the data. IOT module to transmit data to the cloud. The JSP page acquisite data and process data to reliable units for data comparison and exchange.

6.1. Sensorsmodule

This module consists of all the sensor setup along with the ARM microcontroller and IOT module, Alarm and LEDs. The live data from each sensor is obtained as an analog signal and is sent to the AVR controller. The controller is programmed in such a way that it converts the input AC signals into measurable units and these values are then sent to the cloud. Once

The AVR controller processes the signals based on environment into processable units and sends the information to the cloud. After receiving an alert form the cloud due to some uncertain changes in the environment the Alarm and the LED is made to function by changing their signal inputs from LOW to HIGH

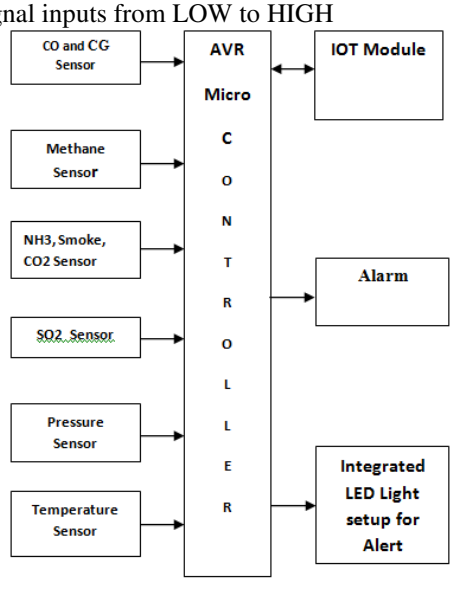

Fig 1. Architecture of the system

6.2. Cloud data storing and processing using JSP Module

The data from the IOT module reaches the cloud storage and is obtained by the server page maintained at the cloud.

The server pages check for the deviation, ambiguity, and relational operations of the data logged by processing it and returns the alert signals if it identifies any changes. This module is designed in such a way that its records preconditions, current conditions and post conditions of the work place and alerts the workersbeforehand. The categories that falls under alerts are as follows: minimal risk, risk and emergency. The minimal risk includes low alteration levels. Th risk level includes definite alteration levels and the emergency level includes high alteration levels of data found. The system is designed in such way that it responds to risk levels and alert the workers and the authorities before the situation becomes worse. The system acts as a predictable unit in the risk factors considered above.

VII. COMPONENTS

7.1. Hardware

AtMega32- The high-performance, low-power Microchip 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 54/69 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for boundary-scan and on-chip debugging/programming, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a universal serial interface (USI) with start condition detector, an 8-channel 10-bit A/D converter, programmable watchdog timer with internal oscillator, SPI serial port, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

7.2. Sensors

A sensor is a device, module, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor. A sensor is always used with other electronics, whether as simple as a light or as complex as a computer. Sensors are usually designed to have a small effect on what is measured; making the sensor smaller often improves this and may introduce other advantages.Technological progress allows more and more sensors to be manufactured on a microscopic scale as microsensors using MEMS technology. In most cases, a microsensor reaches a significantly higher speed and sensitivity compared with macroscopic approaches.

Table 1. Sensor Details and Specifications

Specification	MQ-9	MQ-4	MQ-135	ME4-SO2	BMP180	DTH11
Voltage	5.0 V	5.0 V	5.0 V	5. 0 V	3.3V	3.5 V
Detection	CO and CG	Methane	NH3, smoke, CO2	So2	Pressure	Temperature and Humidity
Measurement Range	10–1000 ppm (CO), 100–10,000 ppm (CG)	200–1000 ppm	10–300 ppm NH3	0-20 ppm Max-220ppm	300-1100 hPa (9000 m to -500m above sea level)	20–90% RH , 0–50 _C
Sensitive Material	SnO2	SnO2	SnO2	-	-	-
Configuration	3 pin	4 pin	4 pin	2 pin	4 pin	4 pin
Digital/Analog	Analog	Both	Both	Analog	Analog	Digital

7.3. IOT module

The Internet of Things (IoT) is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these things to connect and exchange data,[1][2][3][4][5] creating opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits, and reduced human exertions. IoT involves extending internet connectivity beyond standard devices, such as desktops, laptops, smartphones and tablets, to any range of traditionally dumb or non-internet-enabled physical devices and everyday objects. Embedded with technology, these devices can communicate and interact over the internet, and they can be remotely monitored and controlled.

7.4. ESP8266

The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer Systems. The chip first came to the attention of western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at the time there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the

Chinese documentation. TheESP8285 is an ESP8266 with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi.

7.5. Software

The Microcontroller is programmed to accept all the data by using the Arduino IDE and the hard code embedded C Program is burnt into the AVR microcontroller. The Server-side Scripting is done using JSP to accept and process data.

VIII. WORKING

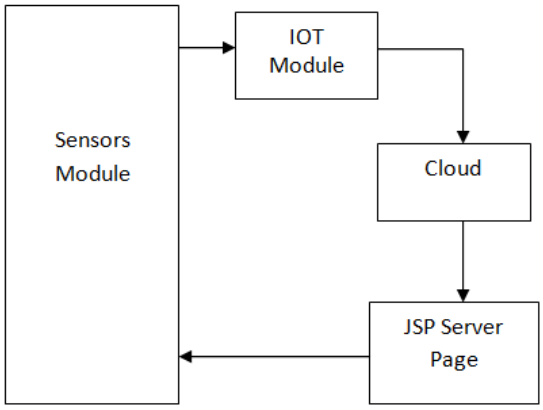

Fig 2. Working of the Coal Mine Accident Detection and Automation System

The Cloud data storing and processing using JSP Module. The Sensor Module consists of the entire hardware interfaces. The sensors are interfaced with the AVR microcontroller and they are programmed in such a way that they continuously log data onto the microcontroller. The data received from the sensors are then processed by the micro controller to the measurable units. These data are then logged into the cloud using the IOT module. The cloud data are acquisited using the cloud maintained JSP page that processes the data to the validate the responses that must be sent to the terminals to alert the workers and the other authorities. The normal, risk and emergency ranges are sorted and analyzed to send the alert as quickly as possible. This method proves to be the fastest and accurate way of data transmission.

IX. CONCLUSION

The above paper proposes the basic idea for the lifesavingmeasures for the fire work place workers and the concerned authorities and the cost their total resource cost.The sensors used for demonstration of concept are general. The MQ-7 gas sensor is more sensitive to carbon monoxide but can sense methane, butane, LPG, hydrogen, smoke, etc. We found more heating of sensor if operated for long time. It is noise free and has low power platform. More advanced version of controller like Cortex-M3 can be used for more speed of execution and extreme low power consumption. With use of sophisticated sensors, the system can work with more accuracy in real time. It can be modified in industrial monitoring as well. A real time monitoring system is developed to provide clearer and more point to point perspective of the fire work environment. This system is displaying the parameters on the monitoring unit; it will be helpful to all workers present in the factory to save their life before any casualty occurs. Alarm triggers when sensor values cross the threshold level. This system also stores all the data in the computer for future inspection.

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