Sewage workers health monitoring withalert system using android application

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***Abstract*— Every year, a large number of sanitation workers die as a result of erratic and inadequate equipment, as well as harmful toxic gases released while cleaning sewage. Real-time health monitoring systems for such workers will be useful in overcoming this problem. This real-time health tracking device can be used as a safety device in a sewer system. This project was created to keep track of the worker'shealth as well as the environment in which he or she works. The gas and temperature sensors are used to ensure the presence of contaminants in the air as well as the temperature. The worker's health is also tracked using the heartbeat sensor, and if there is any abnormality in the environment or in the worker's health, the data is sent to the microcontroller, where it can be viewed on the LCD or through the developed android application.**

Keywords—Android application, sewage, microcontroller, sensor,real time health monitoring, LCD.

I. INTRODUCTION

Annually, an increasing group of sanitation workers die from complications of irregular and deficient machinery, and even some poisonous fumes released during sewage clearing. These jobs are dangerous and hazardous to the people who clean the sewages, but they are obliged to do them in order to support their families. The concentration of gases present in sewer systems can be lethal at times. During the cleaning process, harmful gases such as methane (CH4), carbon monoxide (CO), and ammonia (NH3) are released. Methane displaces atmospheric gas quickly and forms quickly in wet environments with temperatures above room temperature. Methane is an asphyxiant, meaning it readily substitutes oxygen and can become trapped in tight spaces.

As a result, it is necessary to keep an eye on the sewage worker's health as well as the surroundings in which he or she works. Oxygen depletion, gas poisoning, asphyxiation from gases, and fumes inside the sewer are the primary issues for the workers. In all of the aforementioned issues, the issue of gases is usually neglected, creating a health risk or perhaps even death. During sewage work, a lot of toxic gases are released. This could put the workers' health in jeopardy. In the sewer, these gases are also accountable for foul odours and fire hazards.

These odours and foul smells are likely to kill the people working in the sewer tanks. In all of the aforementioned issues, the issue of gases is easily ignored, posing a health risk or even death. There isn't a variety of technologies that monitors the workers' health and the environment inside the sewer tanks. This project was created to keep track of the worker's health as well as the environment in which he or she works. It is used to ensurethe presence of pollutants in the air and the worker's health by using sensors, and if there is any abnormality in the environment or the worker's health, it can be viewed on the LCD or through the application created.

II. LITERATURE REVIEW

The health monitoring system for sewer workers had been the subject of several previous studies. Earlier researches on a health monitoring system for sewage workers has helped us generate more ideas and execute our prototype successfully. These are a few of the people who helped us come up with concepts for our current prototype. Aqueveque, Christopher Gutiérrez, Francisco Saavedra Rodríguez, Esteban J. Pino, Anibal S. Morales and Eduardo P. Wiechmann proposed syatem that at high altitudes it monitors and measures the physiological factors of miners. Physiological variables like electrocardiogram, breathing activity, and body temperature, as well as external conditions like ambient temperature and relative humidity, are all part of the system. To achieve a functional device and optimum comfort for users, the proposed system's safe and effective sensors are embedded in a T-shirt (first layerof protective clothing). The device can compute heart and respiration rates in real time and transmit data wirelessly to a monitoring center[1]. Valdo Henriques and Reza Malekian Mineproposed microcontroller as a primary processing unit in hardware that consists of electronic circuits. There is also a graphical user interface. A variety of qualifying tests are conducted. Temperature, humidity, airflow, and noise sensor readings are accurate ventilation switching and a noise protection scheme were introduced as two controlled outputs[2]. Navin G Haswani and Pramod J Deore proposed using wireless sensor network. It is made up of small data-gathering devices.

The term "node" refers to these sensing devices. The proposed system is a low-cost, low-maintenance, long-life, web-based real-time system that sends a text message to the municipal officer whenever a manhole reaches a threshold value. Thissystem has a direct effect on the residents' and workers' health when it comes to cleaning the underground drainage system[3]. Amira Zrelli and Tahar Ezzedine proposed to handle the sensor implementation in subway tunnels and its effects on the underground mining monitoring system in a real-time system based on optical sensors and WSN (UMMS). The difficulties of wireless and optical node deployment, as well as efficient coverage and sensing in deep mines. As a result, we're curious about the use of optical sensors in UMMS. Damages such as strain vibration, temperature, and humidity change can be detected and localised using the new architecture. The suggested optical sensors used here is UMMS[4]. Alvaro Romero Acero, Alejandro Marin Cano and Jovani Alberto Jimenez Builies proposed a wireless detection system based on the methods like triangle Coward and diagram Bureau of Mines. A wireless data acquisition system based on ZigBee performs mathematical analysis and measurements of the concentrations of combustion gases in the atmosphere, which is handled by a programming environment LabVIEW through a SCADA module[5]. Eleni S. Adamidi, Evangelos N. Gazis and Konstantina S. Nikita proposed a system containg data acquisition (DAQ) system, a control system (CS), and a remote monitoring system. The DAQ system collects data wirelessly from the user. The CS manages and generates alerts to alert the user in the event of an emergency. The MS was created to remotely monitor staff health and provide real-time guidance during the execution of complex tasks inside the ATLAS cavern[6]. Saadnoor Salehin, Syeda Sabrina Akter, Anika Ibnat, Tasmiah Tamzid Anannya, Nurun Nahar Liya, Manisha Paramita and Md Mahboob Karim proposed an automated manhole tracking system that detects hazardous substances and poisonous gases inside the manhole, as well as the absence ofthe manhole's lid, and issues an alert to passersby in that situation, as well as notifying the authorities about the system's status[7]. Rifat Shahriya, Md. Faizul Bari, Gourab Kundu, Sheikh Iqbal Ahamed and Md. Mostofa Akbar proposed system including Low cost, small, lightweight, and intelligent bio- sensor nodes have been designed using sensors, low-power integrated circuits, and wireless communications. These nodes can be seamlessly integrated into wireless personal or body areanetworks for mobile health monitoring, as they are capable of sensing, processing, and communicating one or more vital signs. Based on biomedical and environmental data gathered by sensor nodes, this system can provide medical feedback to patients through mobile devices[8].

In this paper, the system is made up of three main sensors that measure gas concentrations in the environment, as well as the pulse rate of the person using the device, as well as temperature and humidity. The Arduino is a microcontroller that serves as the device's brain, processing algorithms to determine the correct data values to be measured. Using the inter-integrated circuit protocol, each of the sensors can be called by a particulardigital address. Only the called sensor is activated after the address is called, and it begins sending data from its buffer. The microcontroller continually reads this data and processes it to determine the concentration of methane in the environment. A button is supplied that functions as an emergency switch and can be used by a human in distress.

III. PROPOSED SYSTEM MODEL

A. ARCHITECTURE OF PROPOSED SYSTEM

In this paper, we present the theory of sewage workers health monitoring system. The overall block diagram of the proposed method is explained. Every aspect of the system is explained in detail. In this proposed block diagram, the temperature sensor, gas sensor, and heartbeat sensor are all connected to the core controller. The core controller has access to the sensor values. . Below, Fig. 1 Specifies the architecture of the sewage workers health monitoring system using android application.

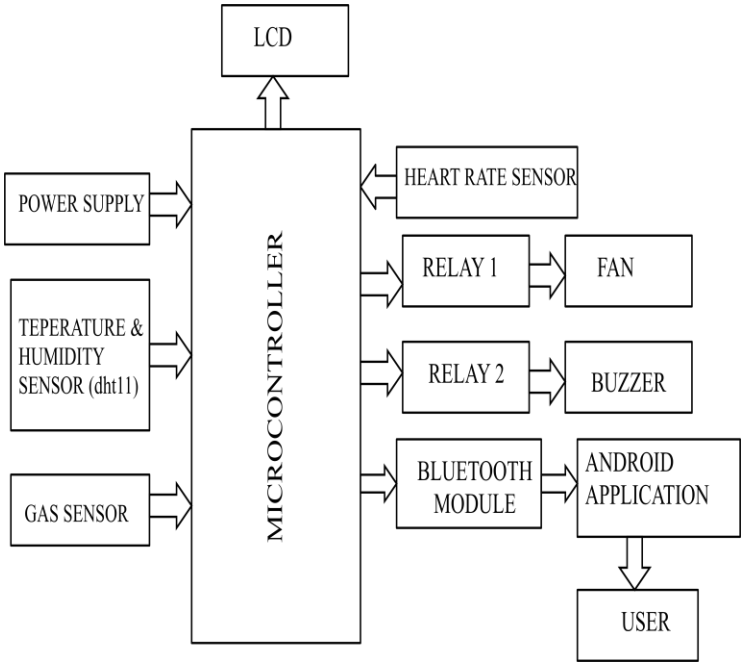

Fig. 1 Architecture of proposed system

The overall data received from the sensors are processed to determine the atmospheric temperature and humidity content and the number of pulses per minute. The temperature sensor used in this project is the dht11, which can also be used to measurehumidity and it also generates calibrated digital output. The mq4 sensor acts as an gas sensor to system which is used to measure methane gas levels in the sewer tank. The pulse per minute rate of heartbeat can be measured by the heartbeat sensor. The heartbeat sensor is powered by a 5V supply and includes an analogue to digital converter. The circuit's output is connected to the fan, buzzer, LCD, and Android application. The relay circuit, which is connected to the microcontroller unit, connects the fan and buzzer.

Only in emergency situations the LCD and buzzer activated. The LCD is a 16*2 LCD that is wired directly to the microcontroller unit. The Atmega 328p microcontroller provides the data to be displayed on the LCD. The bluetooth module connects the android application to the system. The Bluetoothmodule used here is the Hc05 module, which can send and receive data indefinitely. The data obtained from the microcontroller through Bluetooth is displayed on the android application's screen.

Switches which are provided in the android application are used to control the fan and buzzer. The user has the ability to turn it on and off.

B. CIRCUIT DIAGRAM OF PROPOSED SYSTEM

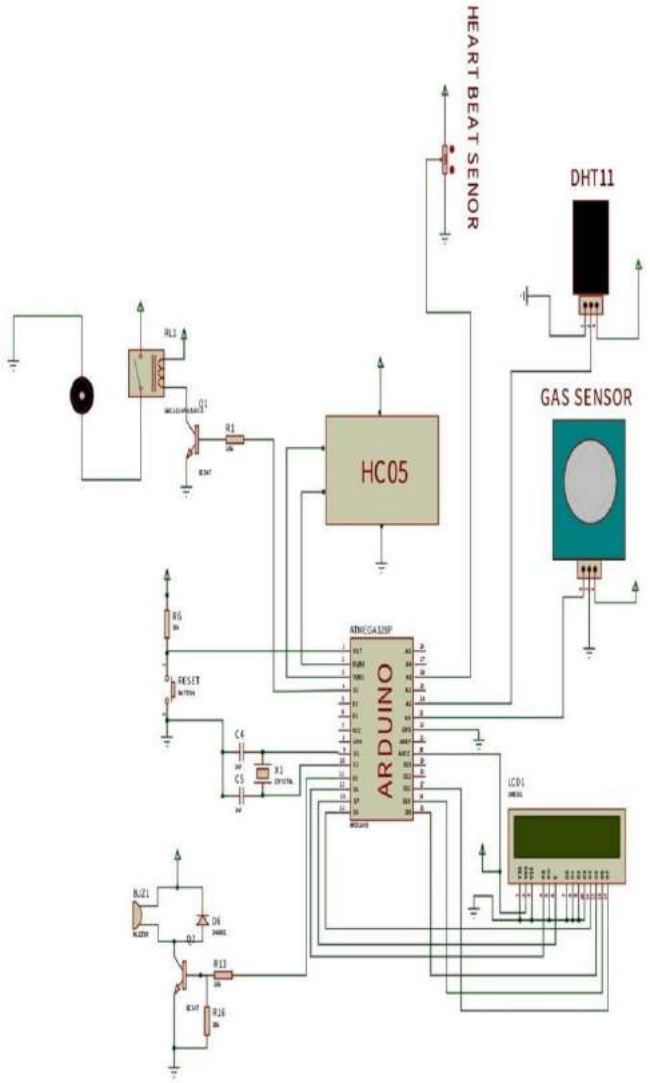

Fig. 2 Circuit Diagram of proposed system

In this circuit diagram, the Atmega328p serves as the central controller. It converts analogue values to digital equivalents. The controller receives data from the temperature, heartbeat, and gas sensors. The buzzer, fan, LCD, and android application are the circuit's output components. The sensors' signals are sent to the microcontroller, and the data from the microcontroller is presented as a result on the LCD and in the android application. The data is transferred to the android application using the Bluetooth module in the circuit.

The circuit consists of two relay one for the buzzer and the other for fan. The relay's mechanism is to close and open circuits both electronically and electromechanically. It regulates the opening and closing of an electronic circuit's contacts. Here the relay switch opening and closing is controlled using the android application.

When the command is sent using the Android application, the Bluetooth module connected to the

Atmega 328p microcontroller circuit receives it.So that the microcontroller receives the command from the android application and instructs the relay to turn on or off the device connected to it.

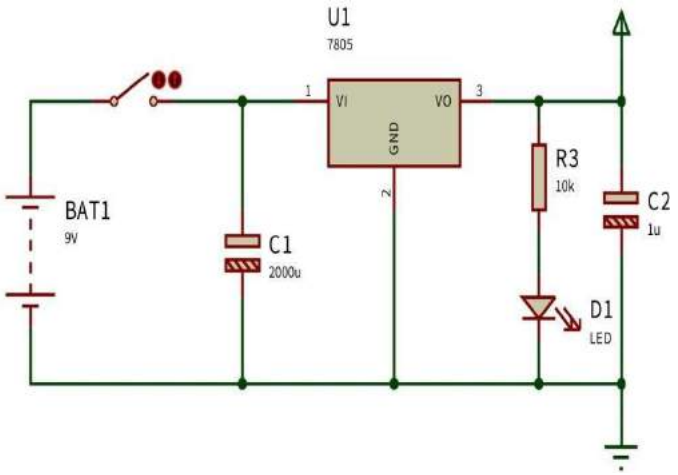

Fig. 3 Circuit diagram of the relay connection

The above Fig.3 specifies the circuit diagram of the relay connection which is connected to the Atmega 328p microcontroller unit.

C. WORKING PROCEDURE

The atmega 328p microcontroller is used to control the system. The gas sensor, temperature sensor, and heartbeat sensorall play a significant role in the device's output. The heartbeat sensor measures the pulse rate of the person working in the sewer tank, and the gas sensor measures the methane gas. The measured data is sent to the microcontroller, where it is further analysed before being displayed on the LCD and in the Android application. A fan and a buzzer are also included in this system. The fan and buzzer is receives their instruction from the atmega microcontroller.

The fan and buzzer are connected to a relay circuit ratherthan directly to the microcontroller. The relay circuit iscontrolled by the microcontroller. The buzzer is used to notify workers in an emergency situation, such as a gas leak in the area where sewer workers work. When poisonous gases are released, the fan can be used to provide some air. The android application can be used to turn on and off both the fan and the buzzer. The android application includes a monitor that displays the data variations detected by the sensor, as well as whether the datasent by each sensor is normal or abnormal.

The android application also includes switches forcontrolling the fan and buzzer. When the sensor level is abnormal, the fan and buzzer are only used in an emergency.The Hc05 module is used by the Android application to receive the data. The Hc05 module is a Bluetooth module for data transmission and reception. A reset button is also included in the system, which can be used to restart the overall structure.

IV. RESULT

B. ANDROID APPLICATION OUTPUT LCD OUTPUT

Table 1 LCD OUTPUT

FIELD	LCD OUTPUT
TEMPERATURE AND HUMIDITYVALUE	
GAS VALUE	
HEARTBEATVALUE	

In this study the sensor is used to measure the temperature, heartbeat, and gas value, and the output displayed by the LCDis described in the table above, and the data displayed by the LCD is provided by the Atmega 328p microcontroller unit. The output of the Android application is shown in Figure 4. The Hc05 bluetooth module is used to transmit the data displayed by the android application. The temperature sensor (dht11), gas sensor (mq4), and heartbeat sensor were used to obtain the values displayed in the LCD and the android application.

Fig 3 Android application's output

V. CONCLUSION

This project exemplifies the advancement of technology as well as society's needs. Workers at sewage treatment plants and underground mines would benefit greatly from this system. The data is collected by the gas, temperature, and humidity sensors and sent to the microcontroller, which analyses it before sending it to the android mobile application via the bluetooth module. The gathered data in the Android application can be used to monitor the sewage woker's health, and if there are any anomalies, the user can turn on/off the integrated buzzer and alarm system. The project can be upgraded in the future by integrating with a larger number of sensors to determine the presence of gases. Interfaces for GPS modules are also possible. The data can be saved on an SD card. It can be combined with air purifiers, which will be activated and begin working whenthe environment has a stronger odour.

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