A Smart Health Care Monitor for Fire Fighters and Sewage Cleaners using IoT

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***Abstract*:- The safety of the people is the chief precedence so it's necessary to apply a good care taking system in places of work. Poisonous backwaters are more frequently released from sewage and fire fighter's areas which cannot be fluently detected by mortal senses. A familiarity of making them preventative and bettering seamsters and fire fighter's safety is lacking largely. It's concentrated on designing an embedded system with IoT to track down backwaters and induce alert signals through a wireless network. The dangerous feasts like ammonia, methane, and alcohol turn out from sewage and fire fighter area are tasted by gas detectors every moment, and their health parameters similar as heart rate, body temperature, respiration rate and also streamlined to the customer when they surpass the normal grade using internet of effects with GPS position. The advantage of this smart system is its quick response time and accurate discovery in extremity cases with evidence of safety.**

Keywords: IOT, Health monitor, PIC16F877A, buzzer system

1.INTRODUCTION:

To improve the safety, coordination and efficiency of rescue personnel, the European program ProeTEX aims to develop new equipment for rescue personnel [8]. Based on microtechnology and nanotechnology, the device consists of intelligent sensors integrated into the textile, monitoring physiological parameters, the rescuer's environment, but also the detection and communication modules [8]. Thermal parameters are basically important. Indoor temperature, outdoor temperature, and heat flux are related parameters to prevent heat stroke in firefighters when exposed to intense fire [8]. These parameters are recorded during exposure to fire, emphasizing that on the one hand the outerwear of the firefighting equipment isolates the firefighters from the external environment and on the other hand thermal monitoring is involved [8].

Wearable health monitoring is a new information technology that can support the early detection of abnormal conditions and the prevention of their serious consequences [9]. It is useful in areas such as lifestyle, life support, sports, firefighter lung toxicity levels, and radiation exposure in war zones. [9] Real-time stress monitoring of fighter pilots with wearable wireless sensors in body area networks is an important topic for researchers gaining potential knowledge through data mining of all collected information. [9] This paper proposes a viable concept to provide some valuable insights into human behavior under high Dasiagpsila conditions [9]. The proposed system can synergize information from multiple sensors to alert users in emergencies and provide feedback during monitored recovery or normal activity [9].

Intelligent Stress Monitoring Assistant (SMA)-Next Generation Stress Detector. SMA is intended for the first responders and professionals to deal with extreme physical and psychological stress. Firefighters, military combat personnel, explosives disposal personnel, law enforcement officers, paramedics and paramedics. Stress affects human behavior and decision making and can spread among team members. [10] SMA is an integral part of the decision support system and is a component of the decision support recognition-behavior cycle. Model this cycle as a cognitive dynamic system. The intelligent parts of SMA are designed using a) residual time convolutional networks to learn data from sensors and detect stress characteristics, and b) inference mechanisms based on multi-level fusion causal networks. increase. [Ten] Sewer blockage is one of the major problems leading to sanitary sewer overflow (SSO), causing serious environmental and property damage. [10] This existing work showed how to detect and monitor pipe blockages based on acoustic analysis to determine the degree of blockages that can reduce the risk of pipe blockages and SSO problems. [10] The existing technique is to attach a vibrating speaker to the tube as a sound source. [10] Clogging due to clogging is detected by reading the change in the resonance frequency of the pipe through a microphone installed on the opposite side of the pipe. The resonant frequency of the measured signal was characterized by the Fast Fourier Transform (FFT) [10].

Since sensors to monitor the surface moisture status of concrete sewers are not available, water operators use surrogate measurements such as relative humidity to observe the model. [10] Therefore, prediction of corrosion is often difficult and is associated with prediction uncertainty. [10]

In April 2010, the last generation of ProeTEX prototypes was delivered: it is comprised of two sets of sensorized clothing designed to track the health of emergency personnel. This latest edition of garments is marked by a significant specialisation to the needs imposed by the various groups of end-users (Firefighters, Civil Protection rescuers) addressed by the project [7]. Each ProeTEX prototype comes with a communication infrastructure that allows for the real-time remote transmission of data collected by wearable sensors, as well as the presentation of that data to potential users. managers supervising the activities of the first line responders [7]. After the delivery of the prototypes, an intense validation of the garments is being carried out both in laboratories, specialized in physiological measures, and in simulated fire-fighting scenarios [7]. In such a context, this paper presents the main features characterizing the final ProeTEX prototypes and preliminary results of their laboratory assessment [7].

The workmen must eliminate the clog in the drainage system. If there is any leakage in the pipe, the harmful gases will come out due to excess wastage disposal [7]. The current clothing edition is distinguished by a major specificity to the needs imposed by the project's several end-user groups (Firefighters, Civil Protection rescuers) [7]. Different sensors are used to check the degree of wastage, a gas sensor is used to identify dangerous substances, a pulse sensor, a heartbeat sensor, buzzer, fan, and Arduino. When it crosses the threshold value, the buzzer will be alerted and its data will be displayed on the IoT webpage [7].

The European programme ProeTEX intends to create new equipment for the intervention personnel in order to increase rescuer safety, coordination, and efficiency [8]. This apparatus is based on micro and nanotechnologies and consists of a smart textile integrated sensor that monitors physiological factors and the rescuer's environment, as well as an acquisition and communication module [8]. Thermodynamic parameters are of primary importance. Internal temperature, external temperature, and heat flux are important characteristics to keep in mind when preventing heat stroke in firefighters [8]. These measurements were taken during a fire exposition and show, on the one hand, that the outer garment of a firefighter's kit protects them from the elements, and on the other hand, that thermal monitoring is important [8]. Wearable health monitoring is novel information technology that will be able to support early detection of abnormal conditions and prevention of its serious consequences [9]. It is useful in areas like lifestyle, assisted living, sports, toxic levels in the lungs of a fire-fighter, radiation exposure in war zones etc.[9] Real time stress monitoring of fighter pilots through wearable wireless

Previous publications have shown the development and successful evaluation of a electrical resistance-based sensor suite for estimating the surface moisture status of concrete ducts. The sensor was installed in a municipal sewer pipe in Sydney, Australia and measured on-site. [10]

2.LITERATURE REVIEW

sensors in body area network are the vital issue for researchers to acquire potential knowledge through data mining of all gathered information.[9] This paper proposes the workable concept to provide some valuable insights of human behavior under high dasiagpsila conditions[9]. The proposed system can synergize the information from multiple sensors, warn the user in the case of emergencies, and provide feedback during supervised recovery or normal activity [9].

The next generation of stress detectors is an intelligent Stress Monitoring Assistant (SMA). First responders and professions dealing with high physical and psychological pressures, such as firefighters, combat military troops, explosive ordnance disposal operatives, law enforcement officials, emergency medical technicians, and paramedics, should use the SMA. Stress has an impact on human behaviour and decision-making, and it can spread across team members. [10] The SMA is a component of the decision support perception-action cycle and is a vital feature of the Decision Support System. This cycle is modelled as a cognitive dynamic system. The intelligent element of the SMA is built around a) a residual-temporal convolution network for learning data from sensors and detecting stress factors, and b) a causal network-based reasoning mechanism for fusion at various levels. [10] Clogged sewer pipelines are one of the main problems that cause Sanitary Sewer Overflow (SSO) which leads to serious environmental issues and property damage.[10] blocked pipe detection and monitoring solutions based on acoustic analysis to identify pipe clogging occurrence and degree of blockage that can be used to mitigate the hazards associated with SSO issues [10] The current situation technique is to attached with the vibration speaker on the pipe as an acoustic source. [10] The clogged by blockage will be detected by reading the change in the pipe resonance frequency via the microphone installed on the other side of the pipeline. The resonance frequency of the measured signals was characterized by Fast Fourier Transforms (FFT) [10].

Water utilities employ surrogate measurements such as relative humidity of the air as an observation for the model due to the lack of sensors to monitor concrete sewer surface moisture levels. [10] As a result, corrosion predictions are frequently impeded and linked with uncertainty. [10] An electrical resistivity-based sensor suite for measuring the surface moisture conditions of concrete sewer pipes was developed and successfully evaluated in a previous publication. To conduct field measurements, the sensor was installed inside a municipal wastewater pipe in Sydney, Australia. [10]

3.EXISTING SYSTEM:

Intelligent hazardous gas detection system with emergency alert when LPG and flammable gas are detected. It is monitored by the PIC microcontroller. A signal is generated and a message is sent to the licensed user as a warning system to mitigate critical situations more quickly. Indeed, this system only detects two gases. You need to know the trap level for each gas. This system is only useful in-home residential areas.

4.PROPOSED SYSTEM:

A well-functioning sewage system is essential for the protection of people's health and the environment in any country. People's health and hygiene are critical factors in determining a nation's and its citizens' growth and development. Most countries have begun to provide sewage services in order to maintain the environment and keep the population healthy. Until recently, sewage cleaning services were performed manually. Despite the fact that manual scavenging and sewage cleaning have been prohibited in India since 1993, the duty is nevertheless carried out manually to some extent, and statistics clearly show that sewage worker deaths are on the rise due to poor worker knowledge and non-compliance with safety regulations.

1.POWER SUPPLY:

The operation of power circuits built with filters, rectifiers, and voltage regulators. [12]

A diode rectifier that provides a full-wave rectifier voltage, first filtered with a simple capacitor filter to produce a DC voltage. [12]

The stabilizing circuit uses these DC inputs not only to have a much lower ripple voltage, but also if the input DC voltage fluctuates slightly or the DC voltage sent to the output loads it. It can provide a DC voltage that maintains the same DC value. Voltage regulation changes are usually obtained with one of several common voltage regulation IC devices. [12].

2.PIC MICROCONTROLLER:

PIC16F877A PIC microcontroller is one of the most famous microcontrollers in the industry. [12] This microcontroller is very easy to use and it's easy to code and program. [12] One of its main advantages is that it uses flash memory technology so you can write as many times as you can.

Total 40 pins, 33 pins for input and output. [12] The PIC16F877A also has many uses in digital electronic circuits. In our project, we can use the heartbeat sensor, carbon monoxide sensor, hydrogen gas sensor, methane/smoke sensor, alcohol sensor, respiration sensor, and temperature sensor.[12]

The sensors are fixed on the sweeper's body to monitor the sweeper's heartbeat level sensor value is sent to the Microcontroller using the digital pin (RB4).The carbon monoxide sensor is connected to the digital pin (RB0) of the controller. [12] The hydrogen gas sensor is connected to the digital pin (RB1) controller. [12] The methane sensor is connected to the digital pin (RB2). An alcohol sensor is connected to the analog pin (RB5). [12]

Focus on surveillance system. When a suspicious leak occurs, sensors in the system detect the 400-600 ppm leak, send an alert message to the end user, activate the alarm and provide a protection circuit.

It controls the knob of the cylinder with the help of a relay DC motor. When the minimum weight of 500g is reached, the demand for bottles is automatically registered. This system focuses only on household gas detection

Sewage gas is a very effective greenhouse gas and contributes significantly to climate change. Detection and regulation of trench gas based on the ppm level of hazardous gas.

The toxic gases like methane, ammonia and alcohol with including this parameter we are measuring employee heart rate, body temperature, and respiration rate are monitored by using IoT module in the remote location.

When the gas exceeds the normal ppm level, the data is sent to the receiver via cloud communication. This system is very reliable, accurate and inexpensive.

5.COMPONENTS

FIG 2: PIC micro controller

3.METHANE (CH4):

Gas is a colourless, odourless, toxic gas produced when the carbon in the fuel is not completely burned. [13] This semiconductor gas sensor detects the presence of methane gas (CNG) at concentrations of 300ppm to 10,000ppm. This is a good range for detecting sewage leaks. The sensor's simple analog voltage interface requires only one analog input pin from the microcontroller. [13]

It is a by-product of sewer / sewer exhaust and accounts for about 60 percent of all harmful emissions nationwide. [13] This is an easy-to-use sewage gas sensor suitable for measuring gas concentration in the air. [13]

4.RESPIRATION SENSOR

The respiration sensor is a sensitive girth sensor worn using easy fitting high durability woven elastic band fixed with a length adjustable webbing belt.[13] It detects chest or abdominal expansion/contraction and outputs the respiration waveform. A stretch sensitive device is strapped to the torso to measure the relative amount of expansion that occurs during respiration (breathing).

It detects chest or abdominal expansion/contraction and outputs the respiration waveform.[13]

we have used to respiration sensor is the breathing level monitoring to sweepers, it has been connected to the pic controller of a digital pin.[13]

5.ALCOHOL SENSOR

The alcohol sensor detects the presence of alcohol gas in the air and outputs an analog voltage. [13]

The sensor can be activated at temperatures in the range of 10-50 ° C with a power supply of less than 150 Ma to 5 V. The measuring range is 0.04 mg / l to 4 mg / l, which is suitable for breather risers. [13]

It is a metal oxide semiconductor (MOS) type sensor. Metal oxide sensors are also known as chemical resistors because they rely on changes in the resistance of the sensor material when exposed to alcohol.

Therefore, by placing it in a simple voltage divider network, alcohol levels can be detected. [13] The MQ3 alcohol sensor operates at 5VDC and consumes approximately give digital output heartbeat when a finger is placed on it. [14]

When the heartbeat detector starts working, the light-emitting detector (LED)blinks simultaneously for every heartbeat.

The sensor unit consists of an infrared light-emitting-diode (IR LED) and a photodiode, placed side by side, and the fingertip is placed over the sensor assembly.[14]

The IR LED transmits an infrared light into the fingertip, a part of which is reflected from the blood inside the finger arteries. The photodiode senses the portion of the light that is reflected.

The intensity of reflected light depends upon the blood volume inside the fingertip.[14]So, every time the heart beats the amount of reflected infrared light changes, which can be detected by the photodiode. [14]

6.HEARTBEAT SENSO

The heartbeat sensor is designed to emit a digital heartbeat when you place your finger on it. [14] When the heart rate detector begins to function, the light emitting detector (LED) flashes simultaneously with each heart rate. The sensor assembly places the infrared light emitting diode (IR-LED) and photodiode side by side, with your fingertips on top of the sensor assembly as shown below. [14]

IR LEDs emit infrared light to the fingertips, some of which is reflected by the blood in the arteries of the fingers. The photodiode captures the reflected light component. The intensity of the reflected light depends on the blood volume at the fingertips. [14]

Each time the heart beats, the amount of infrared light reflected changes. This can be detected with a photodiode. [14]

FIG 3 HEART BEAT SENSOR

7. BUZZER

The buzzer can be mechanical, electronic, electromechanical, and piezoelectric in nature. Generally, we use the electronic ones in ovens, game shows, appliances etc. [14] These buzzers have an internal circuit. The sound produced is because of the movement of a disk. The disk is ferromagnetic in nature. It is a current driven device that has a voltage source as an input to it. Considering the safety of the people we have added one more gas sensor that is abnormal to alert the buzzer sound.[14]The buzzer will be connected to microcontroller of digital pin (RC0).

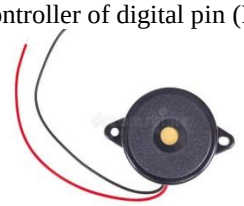


FIG 4 BUZZER

8.LCD DISPLAY

Liquid crystal displays (LCDs) are used in similar applications where LEDs are used.[14]These applications are a display of numeric and alphanumeric characters in dot matrix and segmental displays.

The liquid crystal material may be one of the several components, which exhibit optical properties of a crystal though they remain in liquid form.[14]

Liquid crystal is layered between glass sheets with transparent electrodes deposited on the inside faces but the good news is that not all these pins are necessary for us to connect to the pic microcontroller.

- 16x2 character LCD is connected across PIC16F877A microcontroller, in which RB0, RB1, RB2 is connected respectively to the LCD pin which is RS, R/W, and E. RB4, RB5, RB6, and RB7 are connected across LCD's 4 pin D4, D5, D6, D7.[14]

FIG 5 LCD display

9.IoT MODULE (ESP 8266 – 12E NODE MCU)

NodeMCU is an open-source IoT platform.

It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware that is based on the ESP-12 module.By default, the term "node MCU" refers to the firmware, not the development kit. [15]The firmware uses the Lua scripting language. It is based on the eLua project and built on the Espressif Non-OS SDK for ESP8266. Here we use the NodeMCUE SP8266

manufactured by Espressif. NodeMCU is an open-source platform.

10.GPS MODULE

Global Positioning System & # 40; GPS & # 41; is a satellite-based navigation system that provides position and time information.This system has a GPS receiver and is freely accessible to anyone who has an unobstructed line of sight to at least four GPS satellites. GPS receivers calculate position by accurately timing the signals transmitted by GPS satellites. The GPS is now widely used and you can't imagine a smartphone without it.

11. TEMPERATURE SENSOR (LM35):

There is an output voltage that is proportional to the temperature in degrees Celsius. The scaling factor is 0.01V / oC. Another important feature of the LM35DZ is that it can only draw 60 microamps from the power supply and has a low self-heating capacity. Due to the self-heating of the sensor, the temperature rise of the static air will be less than 0.1oC. [15]

The LM35 series are high-precision integrated circuit temperature sensors whose output voltage is linearly proportional to the temperature in degrees Celsius. [15] Therefore, the LM35 is superior to the ° Kelvin calibrated linear temperature sensor in that the user does not have to subtract a large constant voltage from the output to obtain convenient scaling in degrees Celsius. [15]

12.AMMONIA MQ - 3

In current technology scenario, monitoring of gases produced is very important.[16] From home appliances such as air conditioners to electric chimneys and safety systems at industries monitoring of gases is very crucial. Gas sensors spontaneously react to the gas present, thus keeping the system updated about any alterations that occur in the concentration of molecules at gaseous state.[16] The gas sensor module consists of a steel exoskeleton under which a sensing element is housed. This sensing element is subjected to current through connecting leads.[16] This current is known as heating current through it, the gases coming close to the sensing element get ionized and are absorbed by the sensing element. This changes the resistance of the sensing element which alters the value of the current going out of it. The connecting leads of the sensor are thick so that sensor can be connected firmly to the circuit and sufficient amount of heat gets conducted to the inside part. They are cast from copper and tinned. [16]

MPLAB IDE SOFTWARE

INTRODUCTION

Microchip Technology's MPLAB is a proprietary freeware integrated development environment for developing embedded programmes on PIC and dsPIC microcontrollers. [17] MPLAB X is the most recent version of MPLAB, built on the Net Beans platform. Microchip 8-bit, 16-bit, and 32-bit PIC microcontrollers are supported by MPLAB and MPLAB X for project management, code editing, debugging, and programming. [17] For programming and debugging PIC microcontrollers using a personal computer, MPLAB is meant to work with MPLAB-certified devices such as the MPLAB ICD 3 and MPLAB REAL ICE. [17] MPLAB also works with PIC Kit programmers. MPLAB 8.X is the final version of Microchip Technology's historical MPLAB IDE technology, which was custom created in Microsoft Visual C++. Project administration, editing, debugging, and programming are all supported by MPLAB.

6.OUTPUT:

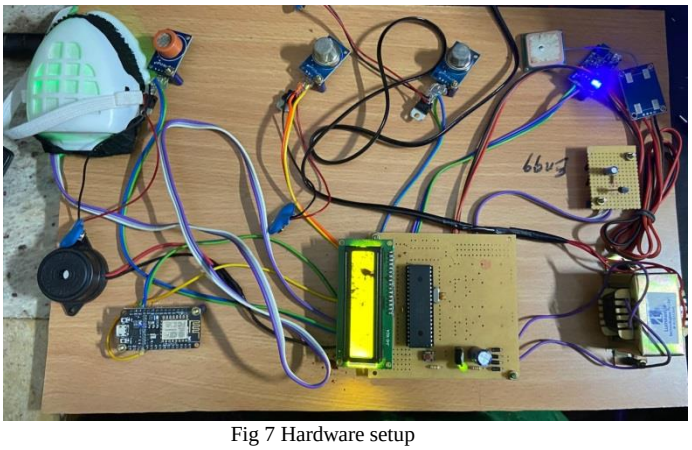
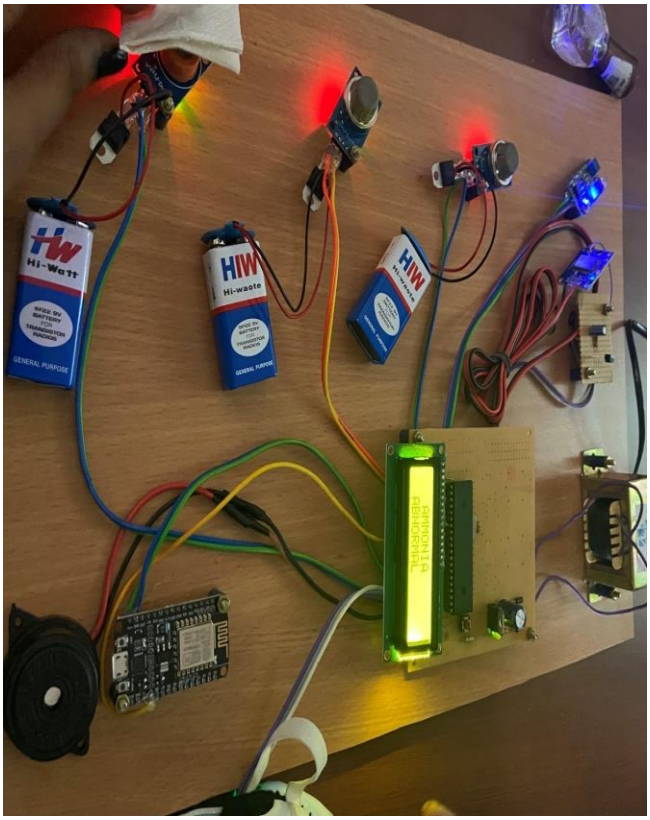


Fig 7 Hardware setup

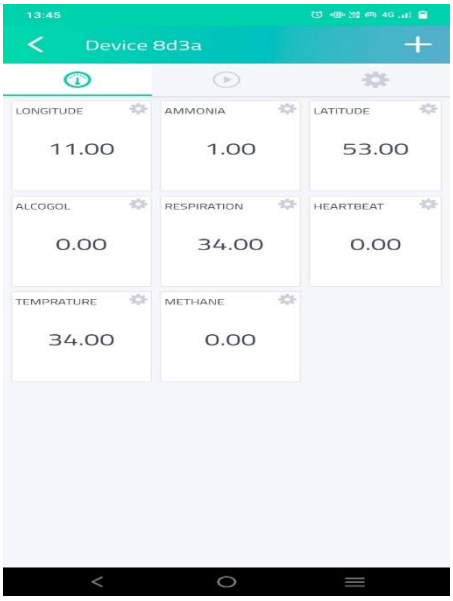
This project monitor health care of the fire fighters, the above fig 9 is the basic setup of the kit. This monitor show the environmental values like temperature,alcohol, methane, ammonia present in the atmosphere and physical values like heartbeat, respiration rate.

This monitor setup gives an alert when the range of the parameters exceeds and presence of harmful gas in atmosphere.

Respirational rate – 12 to 18 breaths per minute
Heartbeat – 60 – 100 beats per minute
Temperature – Room temperature
Buzzer alert sound will be given if it exceeds the normal range and presence of harmfull gases.



Hardware displaying



ammonia presence

When there is a presence of ammonia in the atmosphere it is detected and alert with a buzzer. Then through the cayenne app the ammonia presence is shown as 1 to the authority and it also shows the latitude and longitude using GPS and room temperature.

CONCLUSION:

Innovative surveillance systems based on an embedded sensor platform are designed to detect hazardous gases present in the environment and measure health parameters. The system records the accurate gas load and is used for precautionary measures. The main innovations are a fully automated end-to-end monitoring solution and a self-locating strategy for energy savings with GPS tracking. Manual scavengers are exposed to harmful environments. Our

system helps you collect and detect heart rate, body temperature, and harmful gases and send information. Authorized persons with a valid username and password can view and analyze the collected data. In such cases, if the threshold is exceeded, authorized persons will be notified immediately via the IOT module. For this project, the results will be displayed in the cloud and can be viewed in the mobile app.

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