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Physiological Monitoring Vest

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Abstract: A firefighter is a rescuer extensively trained in firefighting, primarily to extinguish hazardous fires that threaten life, property, and the environment as well as to rescue people and in some cases or jurisdictions also animals from dangerous situations. So the safety and health monitoring of firefighter should be on the top priority. As they work under extreme pressure conditions a proper system should be there which can do real time monitoring in order to keep them safe and improve their working efficiency.

Keywords: Microcontroller, Pulse Sensor, Temperature Sensor, Gas Sensor

I. INTRODUCTION

A firefighter is a rescuer extensively trained in firefighting, primarily to extinguish hazardous fires that threaten life, property, and the environment as well as to rescue people and in some cases or jurisdictions also animals from dangerous situations. So the safety and health monitoring of firefighter should be on the top priority. As they work under extreme pressure conditions a proper system should be there which can do real time monitoring in order to keep them safe and improve their working efficiency.

So we have come up with a system that can tackle problems mentioned above. Our main aim is to connect firefighter with new technology which will enable them to work more efficiently. The proposed system consists of three parts

1. **Data collection unit:** This unit consists of various sensors which will collect data of firefighter.
2. **Data transmission and storage:** The collected data is directly sent to the cloud platform with the help of wifi module. Using the IoT, their data can be transferred from one place to another over the network without the computer to computer and human to computer intervention.
3. **Data analysis:** The collected data is then analyzed as per the need of user or department.

The main purpose of our project is to ensure the safety of the life of the firefighter by monitoring physiological status of the firefighter and their location in order to locate them in situations like forest fire. Our project basically will alert the user about the explosive gases present nearby and will collect the real time data of the health status of the user and if there is any kind of complications it will inform the person monitoring data on local level about the person and its location in order to provide the reinforcement if needed.

II. Block Diagram Description:

1. NodeMCU

NodeMCU is an open-source LUA based firmware developed for the ESP8266 wifi chip. By exploring functionality with the ESP8266 chip, NodeMCU firmware comes with the ESP8266 Development board/kit i.e. NodeMCU Development board.

2. Temperature sensor

A Temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes. There are many different types of temperature sensors. Some temperature sensors require direct contact with the physical object that is being monitored (contact temperature sensors), while others indirectly measure the temperature of an object (non-contact temperature sensors). Non-contact temperature sensors are usually emitted by an object and send a signal to a calibrated electronic circuit that determines the object's temperature.

3. Gas Sensor:

Gas sensors (also known as gas detectors) are electronic devices that detect and identify different types of gasses. They are commonly used to detect toxic or explosive gasses and measure gas concentration. Gas sensors are employed in factories and manufacturing facilities to identify gas leaks, and to detect smoke and carbon monoxide in homes. Gas sensors vary widely in size (portable and fixed), range, and sensing ability.

4. Pulse Sensor:

The basic heartbeat sensor consists of a light-emitting diode and a detector like a light detecting resistor or a photodiode. The amount of light absorbed depends on the blood volume in that tissue. The detector output is in the form of the electrical signal and is proportional to the heartbeat rate.

5. Wifi Module:

WiFi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to Your WiFi network. The ESP8266 is capable of either hosting an application or offloading all WiFi networking functions from another application processor.

6. Cloud Server:

A cloud server is powerful physical or virtual infrastructure that performs application- and information-processing Storage. Cloud servers are created using virtualization software to divide a physical (bare metal) server into multiple virtual servers.

III. Block Diagram Implementation:

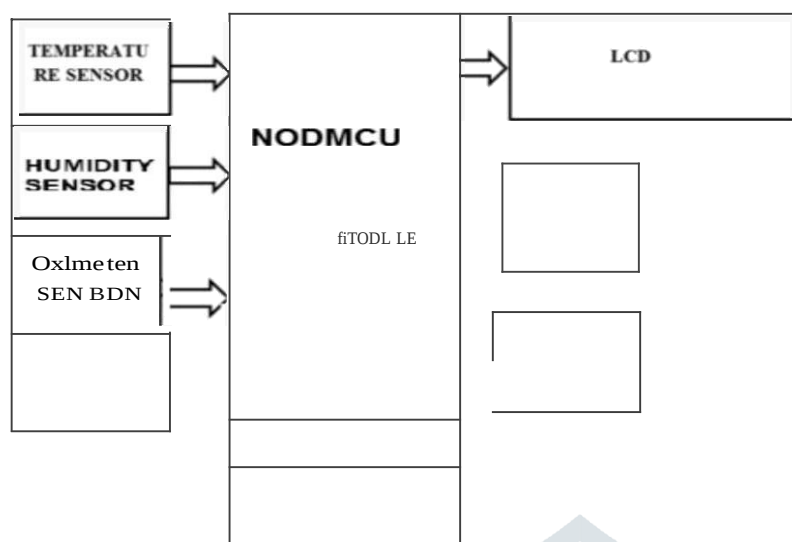


Fig 1.- Block Diagram of System

IV. Proposed Methodology:

The main purpose of our project is to ensure the safety of the life of the firefighter by monitoring physiological status of the firefighter and their location in order to locate them in situations like forest fire. Our project basically will alert the user about the explosive gases present nearby and will collect the real time data of the health status of the user and if there is any kind of complications it will inform the person monitoring data on local level about the person and its location in order to provide the reinforcement if needed. IoT will ensure automated and human less data transfer process. The temperature sensors will keep a continuous check of the body temperature and the accelerometer provides us with the body axial movement and the pulse sensor monitors the pulse rate of user. The gas sensor alerts the firefighters with the presence of any flammable gases nearby. On detecting the presence of any flammable gas a LED light will start blinking depicting the presence of fire is at a long range such as forest fire the GPS module helps to locate the firefighter in that area. All the real time data collected are sent to cloud with the help of wifi module (ESP8266). The whole system is being controlled by Arduino UNO.

I. RESULT, ANALYSIS AND DISCUSSION:

Since firefighters usually work in high risky working conditions, like high temperature, toxic gases, flames, explosion or collapse. It is extremely important to monitor their physiological states by analyzing in real time the firefighter's information on their health states. Moreover, it is certain that transmitting the firefighter's physiological information to the fire information center by wireless network is an important task for ensuring firefighter's safety. For this purpose, we propose a wearable system, permitting to estimate the physiological state of firefighters according to the data from the embedded physiological sensors and transmit the relevant information to the command center by wireless network.

The data collected through various sensors is analyzed on an average parameter which is set after a number of trials. The cut off values set through this process are the basic parameters which a firefighter should clear. Suppose a firefighter is not able to clear some of the parameters then he/she should be given valuable sessions which are specifically designed for their training

VI. Other specifications

1. Advantages

- a. Alerts in case of presence of combustible gases.
- b. Real-time monitoring of human body temperature and pulse rate
- c. Monitoring of body axial movements
- d. Real time monitoring
- e. Remotely accessible

2. Disadvantages

- a. Unavailability of continuous signal
- b. Extra trained workforce required
- c. Regular maintenance and proper handling is must

VII. APPLICATION

This has early flammable gas detection, which alerts the fighter about the leakage or presence of any flammable gases nearby.

This has a GPS module which provides the exact location of the firefighter so that to provide any medical help or reinforcement.

What if the fire fighter gets fainted and gets trapped in surrounding fire, who will alert about his condition This has an accelerometer which gives us the axialposition of the user.

This firefighter safety device are made to monitor the physical health status of the firefighters which can help us to provide us. With the data which will play a major role in the period of training new fighters and even modifying their technique if needed.

VII. Conclusion & Future Work:

The project entitled “**Physiological Monitoring Vest**” is an integrated wireless system that saves the life of firefighters during event site. The system consist the biometric sensors that monitors the body parameters offirefighter and a gas sensor detects the flammable gases near the surroundings. Thissystem also consist a GPS that helps to track the location of firefighter if event site is tall building or forest. It is easy to use and light weight.

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