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Smart Safety Jacket for Tracking and Healthcare with Optimal Temperature Control in Extreme Weather

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ABSTRACT

The environment is periodically impacted by changing climatic conditions. Extreme temperatures are extremely harmful to one's health. Heating stroke is the most dangerous issue in an extremely hot setting. The risk of hypothermia or harmful overcooling of the body is the most serious issue when it is really cold outside. Sometimes, these unusual climate variations can tragically result in fatalities. Therefore, in order to provide better protection for those who live in harsh weather conditions, we devised a jacket that goes by the name of "Smart Safety Jacket". The ideal temperature is maintained within this jacket. Particularly for our soldiers who operate in harsh weather conditions, the Smart-Jacket is highly useful. This jacket keeps the interior at the desired temperature. The Smart- Jacket is highly beneficial, especially for our soldiers who must work in inclement weather. The purpose of the smart army jacket is to accurately track a soldier's whereabouts and check their health. A few climatic circumstances are caused. Unfortunate military deaths. Using temperature sensors, this jacket can automatically determine the temperature inside and outside. Coils are used for heating, and the temperature of the coil is influenced by the outside temperature. The models utilized for communication include GPS and GSM. Therefore, sensors have been put in the jacket in order to monitor the soldier's heart rate and overall health.

INDEX TERMS: Body temperature control, health monitoring, tracking, toxic gas detection, GSM and GPS module, Alert notifications.

1. Introduction

In current world situations, defending our nation from external and internal threats is the most important factor and depends on the army force. Every year many army personnel suffer from different injuries during the battle and no help can be provided at the needed time. The army suffers a lot due to the unavailability of information of injuries to its personnel which may increase the death or permanent disability toll. With the help of many advanced technologies coming into implementation, we can provide safety to the army personnel.

Extreme climatic circumstances have increased significantly in recent years, posing serious health hazards to anybody who are exposed to them. Extreme temperatures, whether sweltering heat or icy cold, can harm a person's body and frequently lead to potentially fatal disorders like heat stroke or hypothermia. Ensuring people's safety and wellbeing is of utmost importance, especially for those operating in harsh and unpredictable weather conditions, such as military personnel. The "Smart Safety Jacket" has been envisioned as a breakthrough piece of clothing to address this pressing issue. This cutting-edge wearable technology is made to keep the body at the appropriate temperature inside the garment, providing an essential layer of protection for people enduring hazardous weather conditions.

Figure 1: Soldiers Safety Parameters

It is necessary to develop a system in order to get the location and vital health status of the soldiers which can be tracked in real time. Soldier's location can be tracked using GPS which is used to provide communication system between soldier and base station. Health status of the soldier is monitored using bio medical sensors such as temperature sensor and heart beat sensor. Jacket will maintain body temperature to 37 degrees irrespective of atmospheric temperature so that solider can survive at minus degree temperature also.

Using GPS, the position and orientation of solders is obtained. This system enables GPS tracking of solders message which contains temperature, latitude and longitude as well as pulse rate of soldier. Here we are using ATMEGA328p-pu which allows dynamic and faster control. Liquid crystal display (LCD) makes the system user-friendly. Here we are using LCD display for displaying the value of present and maximum voltage values which are present in the rechargeable battery. The aim of the project is to provide medical monitoring for solder in real time.

The remaining section of this paper is organized as follows:

Review of the Literature is addressed in Section II. The technique of the suggested task is described in Section III. Section IV provides the hardware implementation of the proposed model, while Section V analyzes the effectiveness of the suggested tactic. The paper is finally concluded in Section VI.

Problem statement

Numerous alternative jackets on the market today can offer both cooling and heated services in addition to the jacket. The various climatic extremes, including extremely cold and extremely hot temperatures, may be harmful to health. The risk of hypothermia or dangerous overcooling of the body is the major concern in extremely cold conditions. Since soldiers are crucial to defending our nation in extremely cold weather, we have created an appropriate army jacket as a valuable resource for the soldiers. The smart safety jacket is designed to be able to track the soldier's health, internal temperature, and provide short message service alerts in case of an emergency.

Objectives

- Semi-automatic temperature control jacket.
- Heartbeat and blood pressure monitoring.
- Wireless jacket status monitoring.
- Track the solders' exact location by using GPS.
- GSM are used for communication purpose.
- Toxic gas detection through gas sensor.

II. Literature review

[1] Soldier Security and Health Monitoring Thanga Dharsni, Hanifa Zakir, Pradeep Naik, Mallikarjuna, Raghu.2018, the proposed framework can be mounted on the warrior's body to track their wellbeing status and current area utilizing GPS. These data will be transmitted to the control room through distributed computing. The proposed frame work involves small wearable physiological equipment's, sensors, transmission modules. Consequently, with the utilization of the proposed hardware, it is conceivable to execute a minimal effort component to ensure the important human life on the war zone GSM is used which is irrelevant and excessive use of sensors unnecessarily.

[2] Health Monitoring and Tracking System For Soldiers Using Internet of Things (IoT) Niket Patil 2017, the paper reports an Internet of Thing (IoT) based health monitoring and tracking system for soldiers. The proposed system can be mounted on the soldier's body to track their health status and current location using GPS. This information will be transmitted to the control room through IoT. The proposed system comprises of tiny

wearable physiological equipment's, sensors, transmission modules Only hardware approach and no use of software systems. Didn't utilized cloud processing as well.

[3] Wearable Systems for Monitoring the Health Condition of Soldiers: Review and Application Patrik Kutilek, Petr Volf, Slavka Viteckova, Pavel Smrcka 2017, systems for measuring of physical and medical data for the diagnostics of physical and psychological state have significantly spread. This study, however, examines the current technologies and usage of the wearable monitoring systems in military. The article can serve as a guide for choosing suitable and affordable systems of quantitative evaluation of physical and psychological conditions of soldier's Wearable system but with higher cost. High end simulation software required.

[4] Wireless detection system for Health and military application Yallalinga, Nirmalkumar S. Benni 2017, upon detection of fall/collapse the sensor system transmits the information wirelessly, which will be received by the care-taker's mobile. The sensor is a belt shaped wearable device consisting of accelerometer (tri-axial) and gyroscope. These sensors are used to classify the posture and dynamics of the user. The main aim of the project is to develop efficient algorithms to detect falls and distinguish between falls and non-falls using these sensors. GSM is outdated. Zigbee is used for wireless communication and it has many limitations such as range and obstacles in communication channel

[5] Monitoring of Soldier's Health and Transmission of Secret Codes Zeeshan Raza, Kamran Liaquat 2016, in this paper we are going to design a smart device for soldier using modern technologies and techniques. This device would be carried by soldier in warfare. The device will be able to sense heart beat and body temperature of soldier and transmit the reading on base station where the cumulative data will be displayed. A small database is organized for storage of readings. Solder can also sent a secret massage on base station. In order to make the reading accurate and precise a formula is designed which is a correlation of body temperature and heartbeat. Hardware approach, LCD is not necessary to use if we use software interfaces. No cloud processing. Secret codes are already implemented.

[6] Heart Rate, Skin Temperature and Skin Humidity and their Relationship to Accumulated Fatigue Decho Surangsrirat, Songphon Dumnin and Supat Samphanyuth 2016, the objective of this study is to monitor the heart rate, skin temperature and skin humidity of the new recruited soldiers during the last week of multiple weeks training period in high temperature where accumulated fatigue is expected. The measurements are collected during their sleep. Experimental results show an increasing trend of the average resting heart rate in multiple participants. There is an increasing trend of skin temperature in one participant, the data also show consistently high skin humidity for this participant. However, there are two participants with decreasing trend of skin temperature. Average skin humidity measurements are mostly stable for all of the participants. Deals with the frustration of soldiers and not actually with health and no tracking is present.

III. Proposed methodology

- **Block Diagram**

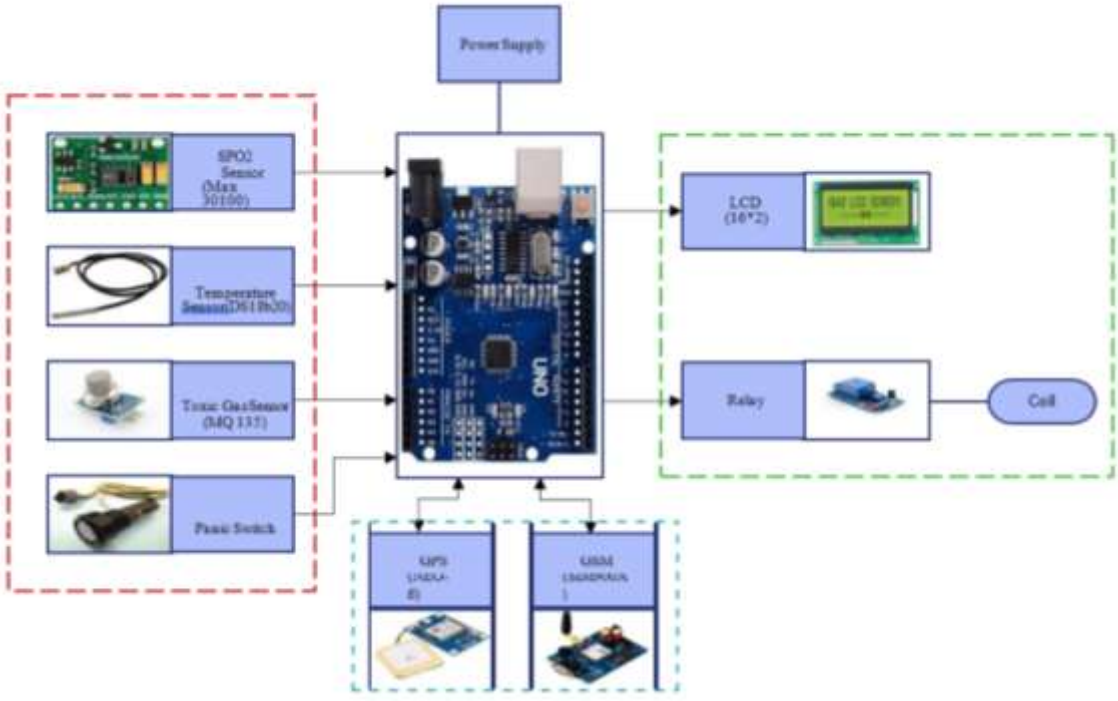


Figure 2: Block Diagram

- In accordance with our methodology, the block diagram is separated into three sections: input, control, and output.
- There are certain sensors that are built into the model in the input portion. We made use of sensors such those for temperature, hazardous gas, heart rate and oxygen saturation, GSM, and GPS.
- The controlling portion, which includes Arduino control, comes next. As the values are sensed, the sensors will output them to the Arduino. The Arduino will instruct the other controlling components, including the LCD and relay coil, in accordance with that output.
- The Arduino regulates the relay coil that heats the jacket. All system notifications that will display on the LCD are done so using the LCD.
- Here, we use an alert system that sends notifications of any changes in body temperature and other metrics that the sensors will detect.
- The output comes next. Following control via the Arduino, we receive output in the form of notice and relay coil control.
- In terms of output, we are able to manage the soldier's body temperature, regularly track their whereabouts, and detect harmful gas.

Assembly of Sensors

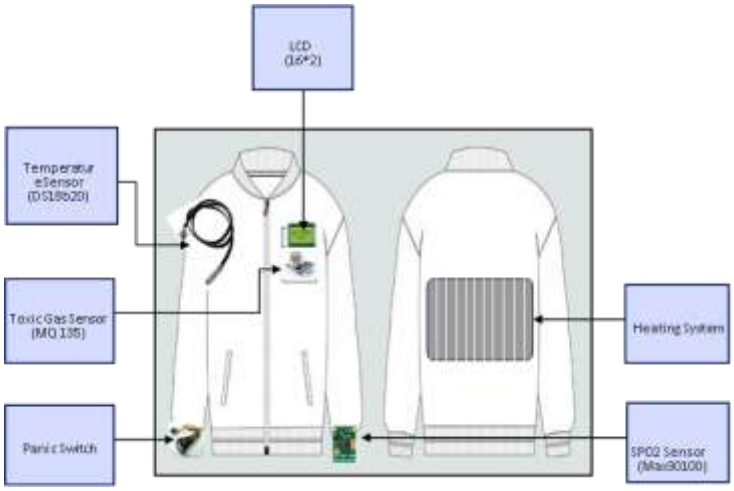


Figure 3: Assembly of sensor

- By using the diagram above, which shows how our jacket is put together.
- In that, we displayed the layout of the control module and several sensors in the jacket.
- The BPM, SpO2, and panic switch are situated close to the hands.
- The temperature sensor is positioned close to the soldier's arms to measure body temperature.
- To detect any hazardous or fire mishap, the poisonous gas sensor is placed outdoors and close to the soldier's pocket.
- In order to readily display all messages and alarms, an LCD display is also located outside and next to the packet.
- As can be seen, the soldier's body temperature is maintained by the heating system, which is located on the back of the jacket.

Assembly of Sensors inside the jacket

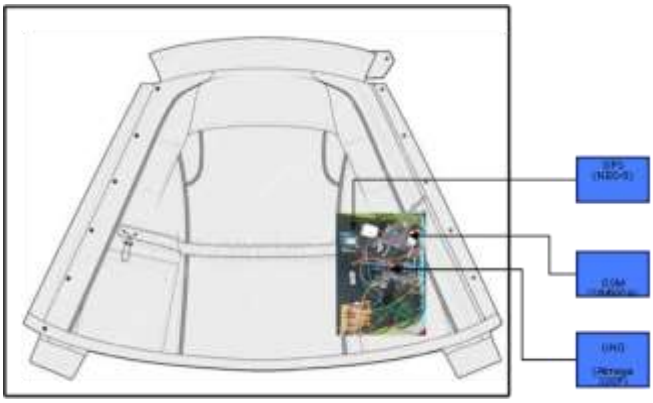


Figure 4: Assembly inside the Jacket

- The Arduino controller and GSM-GPS module circuit are shown in the above diagram.
- Only a portion of the circuit or module remains after all the sensors have been placed at their desired locations. In a single module, we combined the Arduino controller, GSM, and GPS devices.
- The Arduino controller receives input from additional sensors and outputs in response to control parameters.
- The GSM and GPS module are essential. The module works and keeps track of the soldier's precise location in any situation.
- Through the GSM module, the soldier's information is tracked, and safety measures are sent to the military base.

IV. Hardware implementation of proposed model

Figure 5: Hardware Implementation model

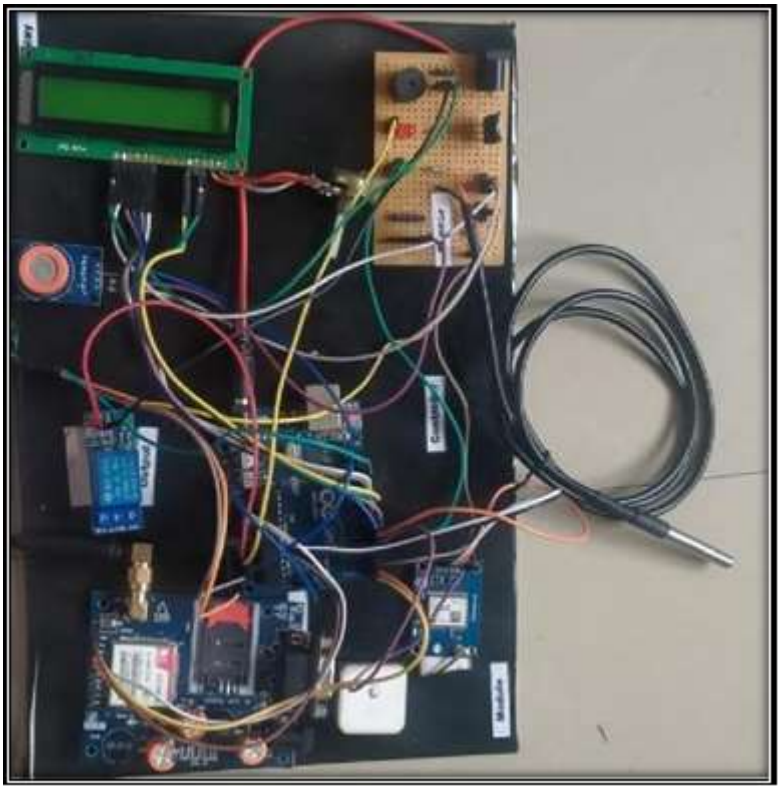


Figure 6: Hardware Implementation model

The project's hardware implementation is shown in the above photograph, where we demonstrate the Arduino, GSM, GPS, and voltage regulator circuit with relay channel along with other sensors.

As shown in the illustration, a relay channel uses heating pads to regulate a temperature management system.

The output of the regulator 7805, which is used to provide continuous power, is +5V constant DC. The several sensors described above receive their electrical power from this regulator.

Only the BPM sensor needs 3.3 V supply, and this supply is provided by an Arduino pin. All other sensors, such as GSM, GPS, Arduino, and relay channels, require 5V supply for operation. The hardware requirements consist of:

1. Power Supply (Battery)
2. LCD Display
3. Temperature Sensor
4. BPM and SpO2Sensor (MAX 300)
5. GSM Sensor
6. GPS Sensor
7. Toxic gas Sensor
8. Arduino (ATMEGA 328P)
9. Adapter
10. Relay coil
11. Panic Switch

Flow of Hardware Model

- After selecting the topic, we started collect information regarding the components.
- After collecting the components, we searched for the circuit connections of all components.
- Before going toward hardware, we tried for simulation modulation of all projects.

- We use proteus software because of Arduino and try to collect all parts which is required for our project from software of proteus.
- We did perfectly our simulation module with all our sensing results and simultaneously start to our model also.
- We connect all the components like Arduino ATmega328P, LCD, temperature sensor, GPS, GSM, BPM and SPO2 monitoring, gas detector, relay coil.
- In the hardware we built the circuit of components according to our circuit. We connect all the components and sensors with Arduino for controlling purpose.
- After completion of connection, we put the program in the Arduino and start for testing the results. We get desired results like notification on the LCD for Alert and location tracking and all.
- In order to safeguard the circuit from external hazards and stresses that could lead to circuit failure, we placed it in a safe box.
- We included heating pads in the jacket portion to keep the soldier's body temperature stable in cold weather.

5. Results and discussion

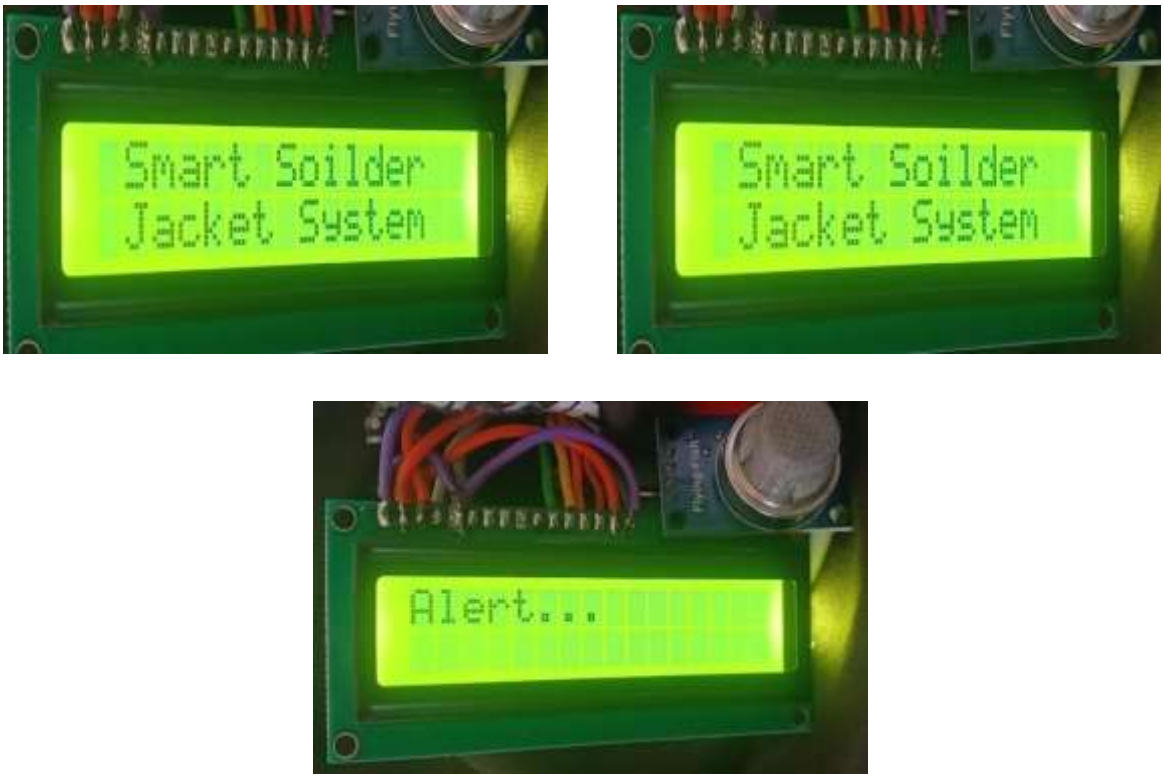


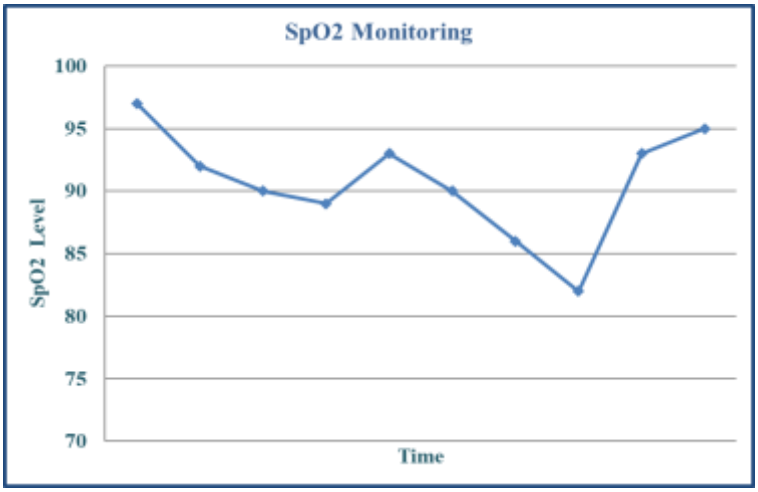
Figure 7: Results of Hardware

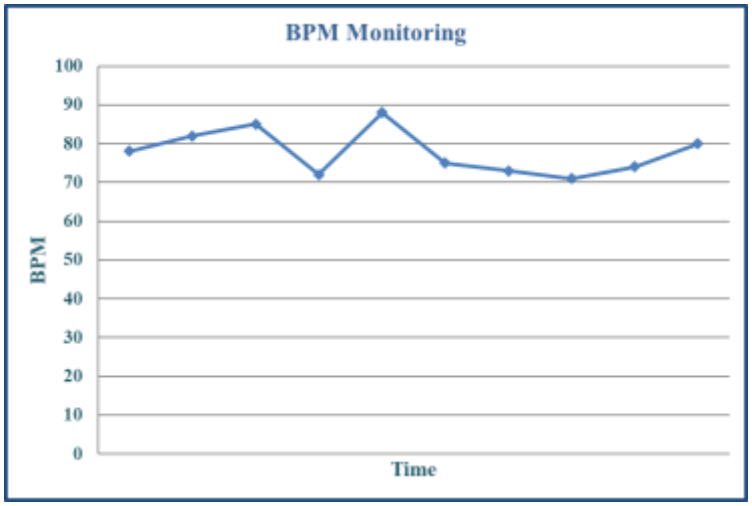
Sr. No.	Body Temperature	SpO2	BPM	Smoke
1	35.08	97	78	45
2	36.00	92	82	47
3	36.38	90	85	48
4	35.50	89	72	50
5	35.06	93	88	55
6	37.02	90	75	74
7	34.09	86	73	81
8	34.5	82	71	92
9	35.44	93	74	104
10	37.28	95	80	107

The corresponding visualization provides a general sense of the project's outcomes. These exhibit the project's initial stages. We begin by stating the name of our project's title as well as the mentor we are working with.

The application for which we are utilizing the safety jacket will determine whether we notice the notification when we start in normal circumstances.

Figure 8: Results of BPM and SpO2 sensor





The results are presented on the LCD screen and the BPM and SpO2 measures of the heartbeat are shown in figure 8 above. Under typical working conditions, it demonstrates how the outcome depends on the environment.

In terms of heartbeat and oxygen level, we present the range for the BPM and SpO2 sensor. BPM should be between 60 and 100 beats per minute, and oxygen levels should be between 80 and 100. When a soldier's health varies, we will see the outcomes depicted in the aforementioned figure. It will alert you to changes in oxygen level and heartbeat values.

Figure 9: Results of Temperature sensor and status of relay channel

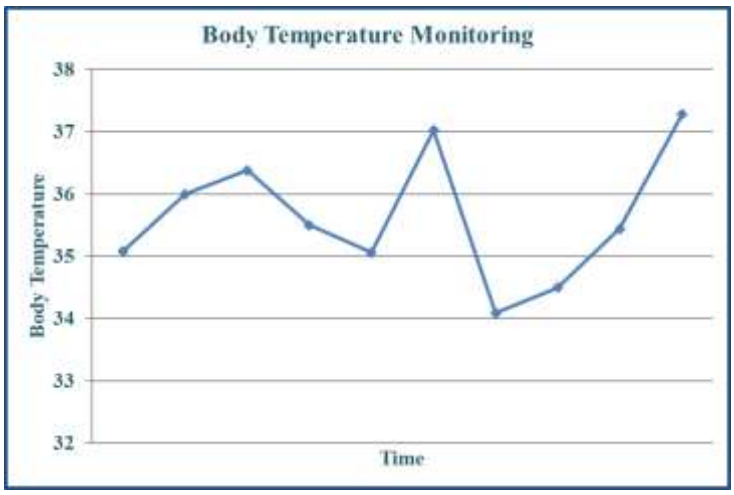


Figure 9 above indicates how different body temperatures are presented on the LCD panel using a temperature sensor. The temperature sensor detects changes in the soldier's body temperature and notifies the user of those data.

The temperature sensor's operating range is 35 to 37 ^{0}C, as provided. We receive an alarm notification when the temperature goes above or below the specified parameters.

The data listed above are considered in light of the various atmospheric conditions. When the ambient temperature changes, the body temperature also changes, which can lead to health problems. In order to lessen that, we receive alert alerts on changes to our findings.

Figure 10: Results of Gas sensor

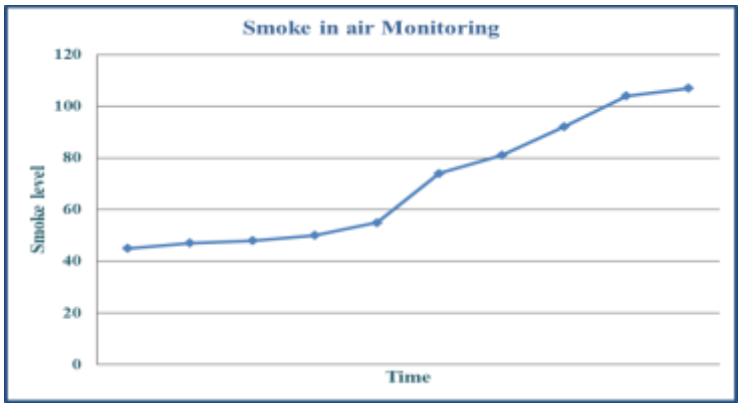


Figure 10 above demonstrates how a gas sensor is used to detect smoke in an atmosphere and how the results are then shown on an LCD screen.

We gave the gas sensor a range that ranges from 35 to 40% of atmospheric air condition. When it crosses that, we receive an alert notification.

The aforementioned findings relate to the various testing scenarios. We created some conditions for exceeding air and checked the aforementioned parameter, and the results showed the level of smoke on LCD.

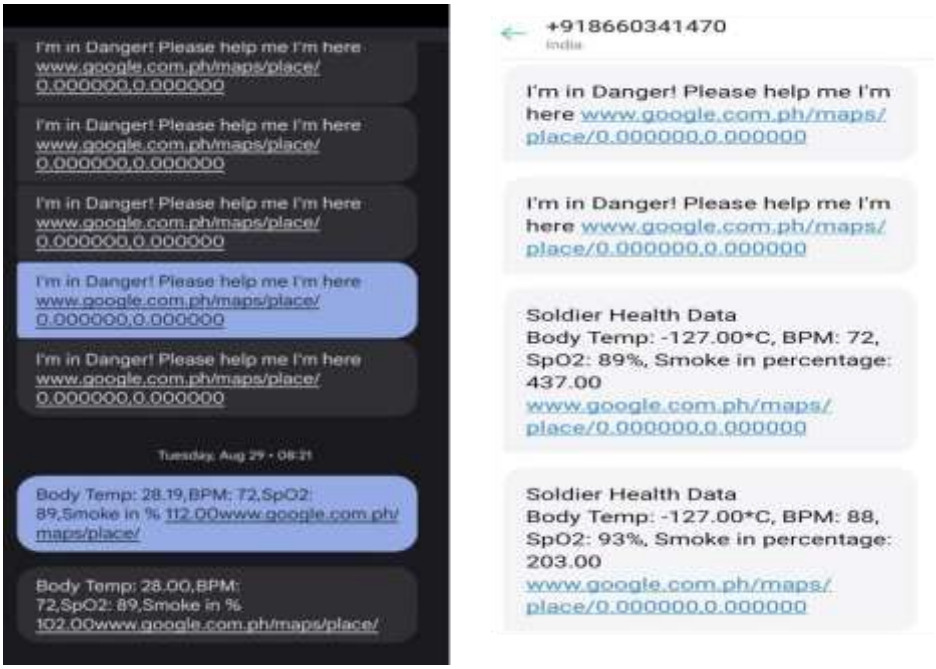


Figure 11: Results of GPS and GSM module

Figure 11 above depicts the messages that the GSM module provides during an emergency. When there is a dangerous situation, we will be notified about the soldiers' whereabouts.

Under typical situations, the message system notifies us of every parameter that has been measured. We will be able to find the exact location of the soldiers using a google map in an emergency if the soldiers' health deteriorates, as evidenced by the results above.

If the soldier activates the panic switch at that moment, the precise location will be visible through a Google link. Clicking that link will open Google Map, where you may view the location as it has changed.

6. Conclusion

Soldiers are one of the important factors in a country. Because they are the forces who protect our country day and night living behind sleep and rest. Therefore, it is our responsibility to protect them. Same is the significance of this project. If this system may fail GPS will find out the position of soldiers and send messages via GSM to the control station. This project has a significant role in our day-to-day life. Also, it can be used in various streams of industrial applications The specially designed E-uniforms are very much useful for military applications especially, in unlike climatic conditions for soldiers and other civilian people.

7. References

[7] Soldier Security and Health Monitoring Thanga Dharsni, Hanifa Zakir, Pradeep Naik, Mallikarjuna, Raghu.2018 https://ieeexplore.ieee.org/document/8437084

[8] Health monitoring and tracking system for soldiers using Internet of Things(IoT), Niket Patil, 2017 https://ieeexplore.ieee.org/document/8230007/authors#authors

[9] Wearable Systems for Monitoring the Health Condition of Soldiers: Review and Application Patrik Kutilek, Petr Volf, Slavka Viteckova, Pavel Smrcka 2017. https://ieeexplore.ieee.org/document/7988856

[10] Wireless detection system for Health and military application Yallalinga, Nirmalkumar S. Benni 2017. https://ieeexplore.ieee.org/document/7976779

[11] Monitoring of Soldier's Health and Transmission of Secret Codes Zeeshan Raza, Kamran Liaquat 2016. https://ieeexplore.ieee.org/abstract/document/7845019

[12] Heart Rate, Skin Temperature and Skin Humidity and their Relationship to Accumulated Fatigue Decho Surangsrirat,Songphon Dumnin and Supat Samphanyuth, 2016 https://www.semanticscholar.org/paper/Heart-Rate%2C-Skin-Temperature-and- SkinHumidity-and-Surangsrirat-Dumnin/2049e009685f9bb37eae14ce3662506489b3c7f3