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Soldier Health and Position Tracking System

Ashi Aggarwal[1], Vidit Kumar[2], Vasu Singhal[3], Ranjeeta Yadav[4]
[1,2,3,4]ABES Engineering College, Ghaziabad, Uttar Pradesh, India

***Abstract*--Utilizing GPS, Node MCU, sensors, and other tools, the Soldier Health and Position Tracking System (SHPTS) is designed to provide soldiers with enhanced safety and security on the battlefield. This IoT-enabled system is mounted on the soldier's body and wirelessly transmits vital information to a control room, such as the soldier's location, health status, and physiological indicators. The system utilizes GPS to accurately pinpoint the soldier's latitude and longitude, allowing for quick and easy location tracking. Furthermore, the system includes physiological sensors that the soldier can wear to monitor their body temperature, oxygen level, and heart rate.**

Keywords: **- NODEMCU (ESP8266), Temperature Sensor (DHT-11), Heartbeat Sensor, IR receiver, oximeter, GPS MODULE, SOS Switch (for the alert).**

I. Introduction

It is essential to prioritize the health and safety of soldiers who risk their lives to protect their nation. India is home to a variety of climates and temperatures, from the frigid mountains to the scorching deserts and the vast oceans. Temperatures range can be from an extreme low of -50°C to an extreme high.[1] To ensure the safety of these brave soldiers, a project has been proposed to monitor their health and location. This can be done with the help of various systems and technologies, such as a wearable device that tracks the soldiers' vital signs and location. This device can be linked to a central database that army base station officials can access. It can also be programmed to sound an alarm if the soldiers' vital signs fall below a certain threshold or if the device detects a sudden impact or fall that suggests an injury. Furthermore, the soldier can notify the base station of their presence. By analyzing the data from the device, officials at the army base station can gain insight into the soldiers' health and identify potential risks. With this information, they can respond to emergencies and take preventative measures to ensure the safety of these brave soldiers.

The proposed project could be a major step forward in improving the safety and well-being of soldiers. To effectively monitor their locations and health status in real-time, a combination of GPS, GSM, and biomedical sensors such as temperature and heart rate sensors could be utilized. This wearable technology would provide crucial information to the base station in the event of an emergency, allowing for rapid and appropriate action. The GPS-enabled device would also provide the soldiers with precise location data, making it easier for the base station to locate and rescue them in need. Furthermore, the device is capable of wirelessly transmitting data via GSM to the base station, enabling army officials to remotely monitor the health of soldiers and take any necessary preventative measures.

Moreover, the device could monitor vital health parameters such as temperature, heart rate, and other vital signs by incorporating biomedical sensors. This could help to prevent potential risks to health and detect health issues early on. With this real-time monitoring of health parameters, officials may be able to expedite rescue operations and provide immediate medical assistance.

II. Related Work

Fighter well-being monitoring and location tracking systems are designed to ensure the safety and well-being of soldiers in [2] combat situations by providing real-time data on their health status and location. These systems integrate a range of sensors and monitoring devices to collect data on physiological parameters such as heart rate, blood pressure, core temperature, and oxygen saturation levels, as well as location information using GPS or other tracking technologies.

One such system is the Soldier Health and Position Tracking System (SHoPTS) developed by the US Army. SHoPTS is designed to monitor the health status and location of soldiers in real-time and utilizes a range of sensors including physiological sensors, environmental sensors, and GPS for tracking.

Another system is the Wearable Integrated Physiological Monitoring System (WIPMS) developed by researchers at the Georgia Institute of Technology. In addition, researchers at the University of California, San Diego have developed

a Smart Health Monitoring and Warning Response Technology (Smart) system for monitoring the health status of soldiers.

These systems utilize a range of wearable sensors to monitor physiological parameters such as heart rate, respiration rate, and core temperature, as well as environmental parameters like temperature and humidity. This system is designed to provide real-time alerts to commanders and medical personnel in case of any health issues, allowing for quick and effective [3]responses.

Wearable sensors for soldier monitoring and health status prediction by Gao et al. (2018) have revolutionized the way military personnel are monitored in the field. This paper discusses the utilization of wearable sensors for soldier monitoring and health status prediction.

Kwon et al. (2015) developed a portable health monitoring system for military applications. This system includes a wearable device that monitors vital signs such as heart rate, blood pressure, and body temperature, and transmits the data to a central server. The system also includes a mobile application that allows military doctors to view the soldiers' data in real-time and provide remote medical assistance if necessary.

Hussain et al. (2019) designed and implemented real-time soldier health monitoring and GPS. This system integrates a range of sensors, including heart rate, blood pressure, and oxygen saturation sensors, as well as GPS and accelerometer sensors for position tracking. The system can provide real-time data on the soldiers' health status and location, which can be critical for ensuring their safety in the field.

Asokan et al. (2020) proposed the use of a sophisticated protective helmet for soldier health monitoring. This helmet is equipped with a range of sensors, including pulse, blood pressure, and temperature sensors, as well as a GPS sensor for location tracking.

Singh et al. (2016) developed a smart vest for vital sign monitoring of soldiers in combat operations. This vest is equipped with sensors for a pulse, respiratory rate, and body temperature, as well as a GPS sensor for location tracking.

These systems provide real-time location tracking to accurately monitor the locations and health of soldiers. This system enables military personnel to respond quickly to emergencies and ensure that soldiers are equipped with the right gear for the situation.

III. Proposed Work

The development of energy-saving technologies is a crucial step in the advancement of soldier health monitoring and position-tracking systems. One of the main obstacles to this progress is the issue of power consumption, as wearable sensors and GPS devices require a significant amount of energy to operate when soldiers are unable to access power sources. To overcome this, researchers are exploring the potential of alternative energy sources, energy-efficient processors, and low-power sensors to reduce power consumption.

Data security is also a major concern when developing these systems, so another area of work could be to develop new security measures to protect the data collected. This could include encryption methods, secure communication protocols, and secure data storage.

Finally, the development of new sensors that can monitor a wider range of physiological parameters is also necessary. Currently, most soldier health monitoring systems focus on basic vital signs such as temperature and heart rate, but it is important to keep an eye on a wider range of physiological parameters, such [4]as pressure, hydration, and glucose levels. This would provide a more comprehensive picture of the soldier's health and could help detect potential ailments and health risks earlier. The proposed method for tracking soldiers and navigating between them during this war takes into account their speed, distance, height, and health, allowing the armed forces to create more effective war plans. To monitor the health of the troopers, a variety of biomedical sensors are used in conjunction with GPS to record their location and orientation. In addition to the physical threats they face in hostile environments, soldiers must also contend with the mental and physical strain of long hours and lack of sleep. if any of these parameters exceed the set threshold, the Wi-Fi Module will update and the trooper can send an emergency response signal with their location to a GPS module. A soldier health monitoring and position tracking system, as illustrated in Fig. 1, would include the following components: Sensors, Data Collection, Coordinating and Communicating, and Output and Display.

The flowchart in Fig. 2 outlines the steps of the system: Collection of Data, Data Collection, Coordinating and Communicating, Energy Source, and Output and Display. The Collection of Data step involves the sensors gathering the soldiers' vital signs. The Data Collection step stores the data gathered by the sensors. The Coordinating and Communicating step allows medical personnel and command staff [5]to receive real-time information about each soldier's location and condition. The Energy Source step provides power to the system through batteries or other power sources. Finally, the Output and Display step allows the user to view and send data from the system to other systems.

IV. Mythology

The Soldier Health and Position Tracking System is a cutting-edge technology that utilizes biomedical sensors, oxygen level sensors, GPS, and GSM modules, and The GPS module records and tracks the soldier's location in real-time, while GSM provides wireless communication between the soldier and their team and superiors. Biomedical sensors, such as temperature and heart rate sensors, are used to detect any signs of stress or illness, and the data is sent in real-time, allowing medical personnel to provide the necessary assistance.

The oxygen level sensor is essential for soldiers operating in various climates, as it provides information on the amount of oxygen in the environment, allowing soldiers to be outfitted with the appropriate gear. Additionally, the Internet of Things-Based Soldier Navigation and Health Monitoring System utilizes GPS and wireless body area sensor networks to continuously track soldiers' locations and assess their health. Wearable technology outfitted with a variety of sensors, including those for temperature, humidity, and pulse, is used to provide precise information regarding the soldier's health. Finally, the GPS module is used to continuously monitor the soldier's movements and locations.

The size, complexity, and necessary infrastructure of the Soldier Health Monitoring and Position Tracking System (SHMPTS) all contribute to its cost. The system is likely to be expensive due to the sensors and other hardware components required. Basic sensors with limited capabilities will be less costly than high-end sensors with multiple measurement capabilities, and the cost of the infrastructure for data management and communication will also be a significant factor. Software development, testing, and deployment will also add to the overall cost, as will the time and effort required to create bespoke algorithms and software, as well as the cost of updating and maintaining the system over time. My project cost will be 3000-5000 which I have made.

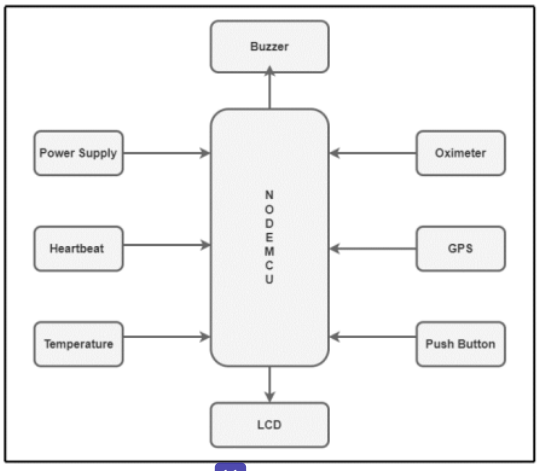

Fig.1 Block Diagram

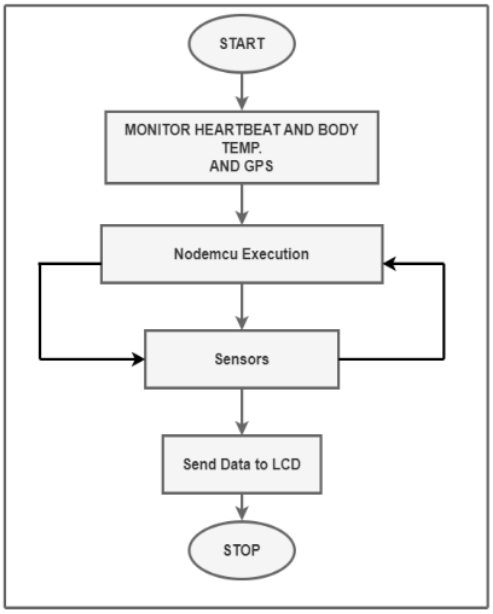

Fig.2 Flow Chart

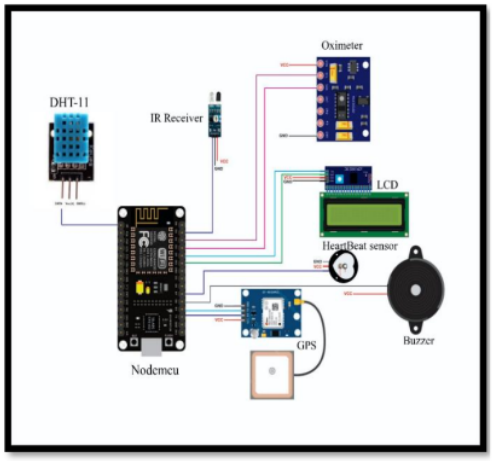

Fig.3 Circuit Diagram

V. Working

The Soldier Health and Position Tracking System (SHMPTS) [9] works by gathering data from various sensors and components, processing that data with the NodeMCU microcontroller, and displaying the results on an LCD.

- The heartbeat sensor detects the electrical signals produced by the heart as it beats and sends that data to the NodeMCU. The NodeMCU processes this data and displays the pulse rate on the LCD. If the pulse rate falls outside a predetermined range, the NodeMCU triggers an alarm to alert the officer and other personnel.
- The DHT11 temperature and humidity sensor detects changes in the electrical resistance of a thermistor as the temperature and humidity around it change and sends that data to the NodeMCU. The NodeMCU processes this data and displays the temperature and humidity levels on the LCD.
- The pulse oximeter measures an officer's oxygen levels by shining a light through the skin and measuring how much light is absorbed by the blood. This data is sent to the NodeMCU, which processes it and displays the oxygen levels on the LCD.
- The GPS module receives signals from GPS satellites and uses that data to determine the officer's exact location. This data is transmitted wirelessly to the NodeMCU, which processes it and displays the officer's location on the LCD.
- The SOS button is a switch that the officer can press to send an emergency message to other personnel. When the button is pressed, it sends a message to the NodeMCU, which can activate the bell and display a warning on the LCD.

Overall, the SHMPTS system is designed to provide continuous monitoring of an officer's vital bodily functions and location, allowing military personnel to respond to emergencies or other events in the field quickly and efficiently.

VI. Results

Soldiers' well-being and position-tracking systems are invaluable for their ability to provide real-time data to medical personnel and other care staff. This can help to quickly identify potential medical issues or injuries, allowing for faster and more effective treatment. Additionally, these systems can be used to monitor the location of troopers at all times, which can be especially beneficial in combat situations where soldiers may become separated from their unit or lost. This feature can also be important for strategic purposes, such as in the case of supply or evacuation missions.

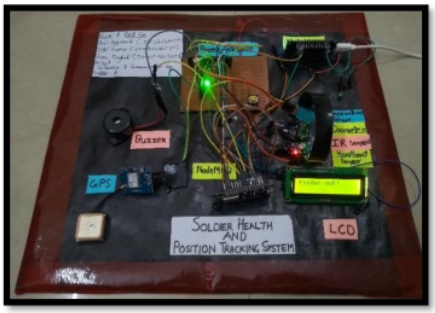

Fig. 4 Hardware

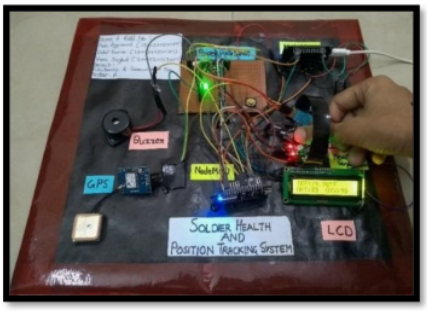

Fig. 5 Testing Sensor

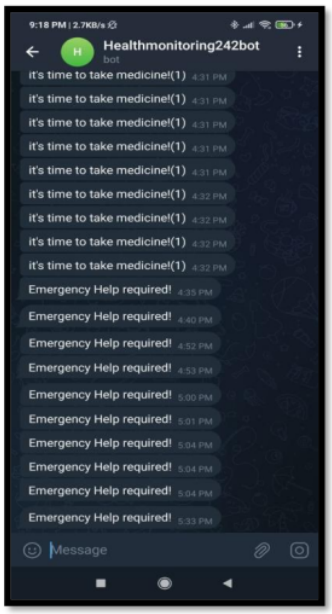

Fig.6&7 Web page & Telegram Message

VII. Conclusion

This project presents an IoT-based circuit that utilizes an Arduino board and biomedical sensors to monitor the health and track the location of soldiers. The system provides real-time data on the soldiers' heart rate, body temperature, and environmental conditions, which is transmitted to a control center for analysis.

One of the key advantages of this project [12] is its low cost, as the components are an affordable solution for data processing and storage. The system can also be used to locate missing soldiers in hazardous conditions, which can be especially critical in situations where troops may become separated from their unit. The monitoring system also helps to further enhance communication between soldiers in emergencies and provides a way for soldiers to navigate to the control room. Ultimately, it has the potential to act as a lifesaver for military personnel around the world.

In the future, it is suggested that a portable handheld sensor device with additional sensing options could be developed to further enhance the effectiveness of the system. This would provide even more comprehensive monitoring of soldiers' health and environmental conditions, boosting the efficacy of the system even further.

VIII. Future Scope

There are a plethora of potential applications and enhancements for the Soldier Health Monitoring and Position Tracking System (SHMPTS) that could [14] revolutionize the way soldiers monitor their health and safety in the field. These include:

- Integrating Machine Learning (ML) and Artificial Intelligence (AI) algorithms to analyze the data from the various sensors and provide a soldier's health status with greater accuracy and sophistication.
- Incorporating cutting-edge wearable technologies such as smartwatches, fitness trackers, and biometric sensors to give a soldier's health status a more comprehensive and precise picture.
- Utilizing drones or unmanned aerial vehicles (UAVs) to provide soldiers in the field, even in remote or difficult-to-reach locations, with real-time location tracking and monitoring.
- Integrating wireless communication technologies like Bluetooth and Wi-Fi enables data to be sent to central command centers or medical facilities in real-time so that they can respond immediately in the event of an emergency.

- Develop a mobile application that will make it possible for soldiers to access their health data and keep track of their vital signs in real time on their own devices.

Overall, the SHMPTS system has immense potential for improvement and application in the future, and could drastically improve soldiers' health and safety in the field.

IX. References

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