Design of Intelligent Health And Smart Tracking System For Soldier Using Internet of Things

E.Boopathirajan[1], Dr.V.Anitha[2]
[2]Vice principal & Professor, HOD, Dept of electrical & electronics engineering
[1, 2] Sri Muthukumaran Institute Of Technology,
Mangadu Rd, Chikkarayapuram, Chennai, Tamil Nadu 600069.

Abstract*- The goal of this project is to reduce the time, effort, and cost of the army control unit's search and rescue operations. This technology is extremely valuable to military troops during wartime since it may be utilised in the field without any network restrictions. This project is a location tracking health and monitoring system for troops based on the Internet of Things (IOT). This suggested device, which uses GPS to track the soldier's health and current location, may be put on the soldier's body. GPS is used to log longitude and latitude so that direction may be easily determined. We use the breathing rate to determine the soldier's health state. A sensor is used to monitor abdominal or theoretical breathing, as well as a cardiac sensor to detect the soldier's pulse rate. This data will be transferred to the control room through IoT. IoT is the connection of the internet and physical things in a network of limitless possibilities utilising microcontrollers, Arduino, and so on. As a result, it is conceivable to develop a low-cost system to safeguard valued human life on the battlefield using the proposed technology.*

Keywords- IOT, Health monitoring, Tracking, Soldier safety system.

I. INTRODUCTION

We are only able to sleep peacefully in our beds at night because harsh guys are willing to commit violence on our behalf. They are military personnel. We frequently witness troops risking their lives without being able to accurately convey their location and health condition till the very end[15]. This Soldier may require wireless networks to communicate not just with the control unit, but also with armed ground troops. Aside from national security, the soldier must be protected by improved armament, and the army control unit must keep track of the soldier's health [14].

Smart biosensor-based body sensor network systems offer a wide range of healthcare services, including even health alerts, remote health tracking and medical monitoring to doctors via the SMS or web at regular intervals, and they are more cost-effective in terms of cost, accuracy and response time. Patients who utilise biosensor-based health monitoring systems are not only not confined to their beds. Nowadays, smart care medical monitoring systems have evolved into truly automated and compact sensor healthcare kits, allowing patients' health monitoring to take place wherever without disruptions, and are so compact that even laypeople can operate them with such accuracy that nearly 95% of doctors worldwide begin the initial treatment of their patients [6].

In order to send and receive information to/from the control unit, the soldier must be connected to current GPS, and data communications. Wireless networks may be required not just for communication with the control unit, but also for communication with military forces on the ground. Aside from national security, the soldier must protect himself with superior weaponry. To achieve this goal, biomedical sensors and monitoring equipment are paired with troops in this investigation. The integrated components must be a small package that achieves the intended outcome without consuming a lot of energy. Soldiers' incapacity to communicate with the command and control unit is one of the most crucial issues in military operations. Furthermore, good navigation amongst soldiers is critical for meticulous planning and coordination. [7].

Surveillance of human beings is a critical concern, particularly for government agencies and human rights organisations. An application is required to track human actions as they commute between their residences and local locations. Fortunately, RFID technology is used in a wide range of applications, such as tracking people in indoor environments, such as children's safety while commuting to school and play areas, caring for the elderly, providing navigational assistance to the visually impaired, and caring for severe symptomatic patients. Those applications were all based on RFID, and some of them were integrated in technologies and other technologies such as GPS or Bluetooth. Furthermore, RFID allows objects to be taken together with their utilised or implanted tags. The techniques employed in the RFID archives to embed RFID tags with participants were not advantageous, and potential limitations, such as embedded-tags, student bags, cards, bracelets, and keychains, were documented. [11]

This project describes an intelligent tracking and health monitoring system for troops based on the IoT. This suggested device, that also utilises Gps devices the soldier's health by tracking and whereabouts, might be worn by the soldier. IoT will be used to send this data to the control room. Small wearable physiological devices, sensors, and transmission modules make up this system. The IoT is the joining of the internet and physical devices in a network of limitless possibilities utilising microcontrollers, such as Arduino. IoT enables physical things to connect wirelessly through networks. IoT also needs an internet connection through the ESP8266 WiFi Module.

II. LITERATURE SURVEY

Brijesh Iyer et al (2018) reported a military-grade IoT enabled tracking and monitoring sensor. The proposed method is tailored to meet the soldier’s safety during war. The sensor supplied a precise location of the human subject in terms of latitude and longitude of place using GPS-based location monitoring. Furthermore, the proposed sensor provided an accurate reading of the subject's body temperature. For military applications, this sensor provides a low-cost, portable, and dependable solution [8].

Yedla Vineetha et al (2020) centred on tracking soldier location, allowing the control room unit to recognise the exact position of the soldier and direct them accordingly. The strategy requires soldiers to seek assistance from the army control centre system from other soldiers in a panic situation. It is extremely useful for armed forces during conflicts and rescue operations because it may be utilised without a network. ZigBee and LoRaWAN compatibility and capabilities. The approach will ensure the security and safety of our troops. [9].

Jassas. M et al. (2015) demonstrated the integration of an intelligent networked e-health system. The architecture of this system is based on medical sensors that use wireless sensor networks to examine the biological features of patients (WSNs). Through a wireless network, these sensors transmit data from patients' bodies to the cloud. As a result, patients will receive high-quality care since the e-health smart system assists medical workers by gathering real-time data, reducing manual data collection, and enabling the monitoring of large groups of patients. [1].

Lounis, A et al. (2022) Reduced data handling complexity in wireless sensor networks for patient monitoring We suggested a secure and scalable architecture that uses cloud computing technologies to dynamically increase storage capacity through on-demand provisioning. We created attributes-based encryption with symmetric cryptography to deliver the sophisticated and dynamic security restrictions required for medical applications. According to our early performance investigation, this combination saves administrative cost as well as encryption/decryption time. In the future, we plan to use distributed attribute-based encryption to allow many healthcare authorities to collaborate. In addition, we want to carry out more extensive research. [2].

Pallavi Kulkarni et al.(2019) reported on an IoT-based tracking system and health monitoring for troops (IOT). The soldier might wear the proposed device, which uses GPS to track his or her health and current location. These data will be sent to the control room via the Internet of Things. Small wearable physiological devices, sensors, and communication modules make up the proposed system. As a result, using the proposed technology, a low-cost gadget to safeguard valued human life on the battlefield might be built. It also discusses the use of cryptographic techniques to secure troop data on the cloud. [10].

Rolim, C. O et al,(2010) suggest a method for automating this procedure by attaching "sensors" to current medical equipment that is interconnected to exchange service. The method is based on wireless sensor networks and utility computing ideas. The data is stored in the "cloud," and analysed by expert systems and/or made available to medical professionals. They integrates commodity computers into traditional medical devices, ensuring cost effectiveness and integration ease. [3].

Pranav Sailesh et al. (2014) The creation of a system for remotely monitoring a soldier's health data as well as communicating with the access point computer was discussed. In addition, the device should accurately determine vital signs and send an alert to the access point, including the Gps coordinates, so that a search team can be summoned. The system includes a GPS module, a biosensor, an LCD and a keyboard. [12].

Fortino et al.(2012) BodyCloud is a Cloud Computing-based system architecture for managing and monitoring body sensor data streams. The system serves as a foundation for developing and deploying body sensor network-based applications. System features include resource scalability and flexibility, the ability to handle sensor heterogeneity, and the dynamic deployment of user and community applications. The installation and testing of the system are now the primary focus of current effort [4].

AfefMdhaffar et al. (2017) introduced a unique IoT-based health monitoring solution in which medical sensor data is sent to an analysis module through LoRaWAN network architecture's channels. In remote places where cellular network service is either non-existent or data transfer is prohibited, we normally monitor blood pressure, glucose levels, and temperature. The major goal is to lessen the strain of long visits to healthcare facilities for individuals living in these locations, while also decreasing communication costs. Several studies were carried out to assess the LoRa network's coverage area as well as our system's power consumption. The typical area covered when the LoRa Gateway is put outside is roughly 33 km 2. The typical area covered when the LoRa Gateway is placed outside at a height of 12 metres is roughly 33 km 2. Furthermore, our monitoring system uses ten times less energy than competing long-distance cellular systems like GPRS/3G/4G [5].

Literature Summary:

- Loss of coverage - this is frequently the result of letting the battery to discharge. Maintain a full charge at all times. To ensure performance, batteries should be replaced every 12-18 months. Poorly charged batteries might result in various issues such as frequent radio beeping or poor performance.
- Excessive background noise makes it difficult to hear a discussion — try utilising a walkie-talkie with noise-cancelling capabilities.
- There's no privacy. Two-way radios are not the most discreet means of communication, and others can hear your talks; for privacy, try utilising an earpiece.
- Excessive static during transmission - this might be caused by a filthy antenna, therefore use a pencil eraser to wipe the antenna connections.

III. METHODOLOGY

In recent decades, the most often utilised approaches for tracking troops' lives on the battlefield have been cable-based systems, RF transceivers, Zig-Bee, walkie-talkie and GSM-based tracking systems. However, each of these systems had at least one flaw: high installation costs, signal loss, excessive noise, and bulkiness. As a result, safeguarding the safety of soldiers on the battlefield requires low-cost tracking, wireless, a portable system with high dependability.

We designed a new system based on the IOT to address the current device problem. The proposed system will aid in the constantly monitoring of troop position and health indicators in real time. The proposed system not only checks troops' health, but it also tracks them using IoT. The control room may use GPS data to establish the soldier's position and orientation. Even if the soldier loses their bearings, it is the GPS's responsibility to guide them in the right direction. Because the soldier's numerous tracking parameters are communicated via Wi-Fi module, The base station can use IOT to get information about the soldier's present status. This data will be saved in the cloud and will be available for download on the control room's PC as needed. Based on this information, authorities can take immediate action by assigning a medical team, a rescue team, or any other backup force to assist. Various biological sensors are used to monitor a soldier's health characteristics as well as the status of the surrounding environment.

The suggested system is separated into two units: soldier and control room. The LM35 temperature sensor, Heart Beat Sensor, and Respiratory Sensor are all utilised to constantly check the soldier's health. Gas sensors respond spontaneously to the presence of gas, informing the system of any changes in the concentration of molecules in the gaseous state. A steel exoskeleton houses a sensing element in the gas sensor module. The Global Positioning System (GPS) is used in real time to determine orientation and position. The Arduino (ATmega328P) processor is used to process and gather data from sensors and GPS receivers. The Arduino board was chosen as the processor because, It is a low-cost, generally accessible board with a variety of interface capabilities when compared to the other data possessors utilised in the current system. As a result, the ATmega328P performs better than other CPUs.

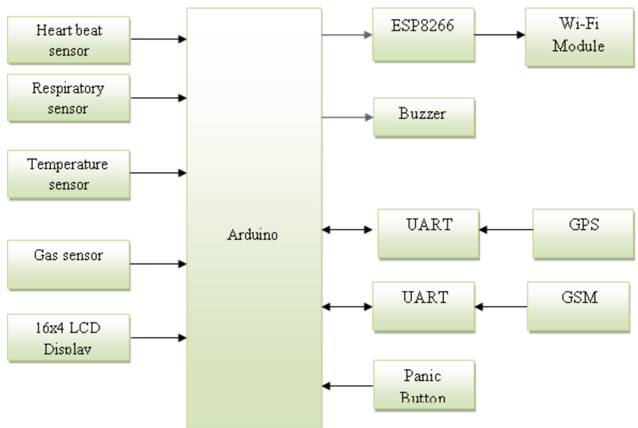

Figure 1. Block diagram

The strategy proposed is employed in conjunction with the soldier's equipment. The unit's brain will be the ATmega328P processor. An LM35 temperature sensor, a heart rate sensor, a gas sensor, a respiration sensor, a 16*4 LCD display, an Arduino, a buzzer, a panic button, and GPS receiver, a Nodemcu ESP8266 Wi-Fi module comprise the soldier unit (NodemcuESP8266). Based on the surrounding environment and the subject being tested, the required parameter's threshold values are defined and preprogrammed in the Arduino. Body temperature was taken into account in the suggested experiment for verification purposes. The system creates an alarm and conveys the information to the control room via a buzzer sound when the temperature deviates from the predefined threshold value.

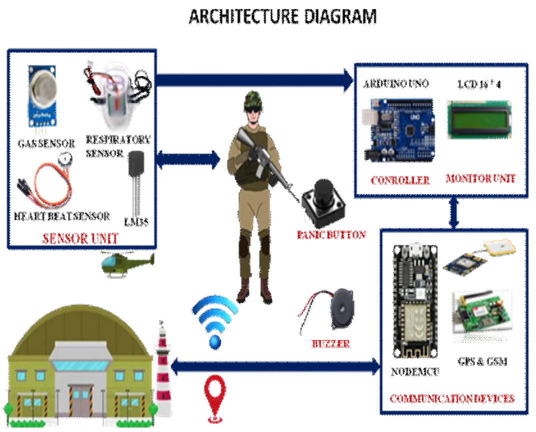

Figure 2. Architecture of entire system

The above figure2. Shows the entire architecture of the proposed system. Using a GPS receiver, track the soldier's exact location and communicate it to the control centre, where it is also shown on an LCD. Using an LM35 temperature sensor, determine the soldier's body temperature. The system will alert and notify the control room when the value exceeds the threshold, as well as display the value on the LCD. The technology will warn and notify the control room if the heart rate reaches a specified level. The desired information is also displayed on the LCD. Gas Sensor - This device measures the amount of oxygen in the atmosphere. If the environmental status changes, the system will alert and notify the base station. In an catastrophe circumstance, soldiers will benefit from the Panic Button.

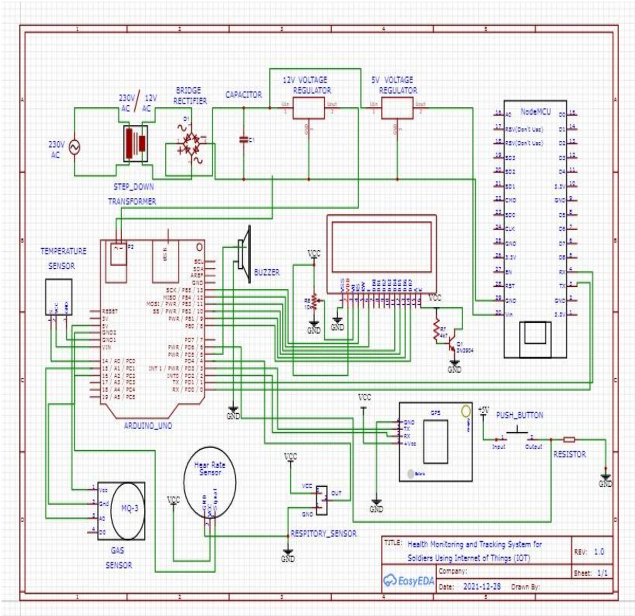

Figure3. Schematic diagram of the proposed system

The suggested system is depicted schematically in Figure 3. The soldier might wear the proposed device, which uses GPS to track his or her current location and health. This data will be sent to the control room via the Internet of Things. Small wearable physiological devices, sensors, and communication modules make up the proposed system. As a result, using the proposed technology, a low-cost gadget to safeguard valued human life on the battlefield might be built.

IV. RESULT AND DISCUSSION

Capture Proteus ISIS Schematic, From the left Toolbar, select Component Mode. Add all of the essential components by clicking on P (Pick from Libraries). Arrange the components on the workbench. Connect the circuit. To begin the simulation, click the Play Button on the bottom left.

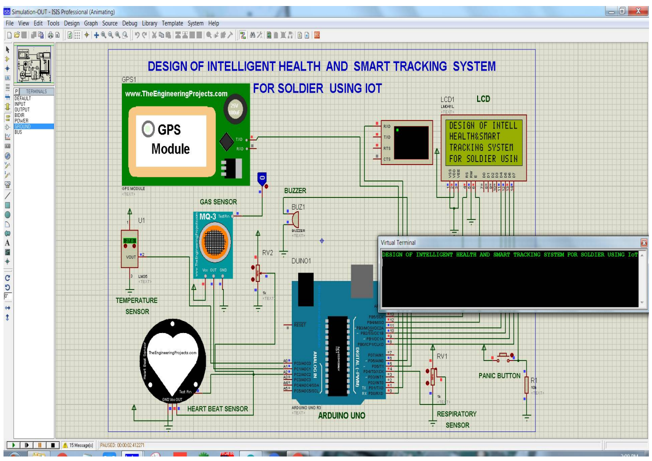

Figure 4. Simulation output

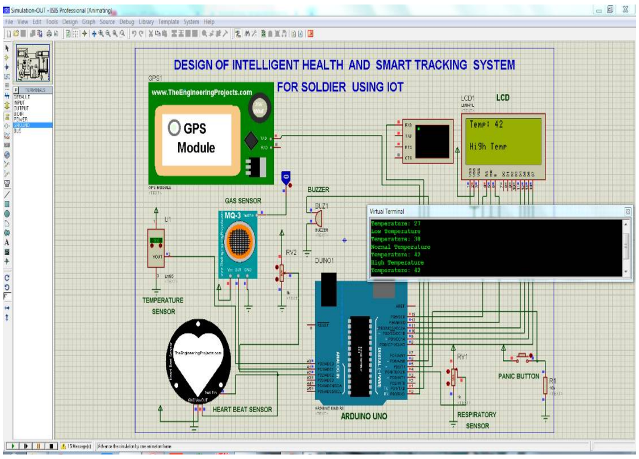

Figure 5. Result for soldier temperature detection

In these simulations, as seen in fig.5. We may modify the temperature value in the Temperature Sensor (LM35) by using the in-build increment and decrement buttons; the normal human temperature is (35-37 C). So, in the Arduino IDE, I set the condition to a temperature range of 30 to 38 degrees Celsius. If the temperature falls within these ranges (30 – 38 C), the statements "Normal Temperature" and "High Temperature" are shown on the Serial Monitor and LCD. If the temperature is less than 30 degrees Celsius, the statements "Low Temperature" and "Low Temp" are printed in the Serial Monitor and LCD. If the temperature exceeds (38 C), the statements "High Temperature" and "High Temp" are printed on the Serial Monitor and LCD.

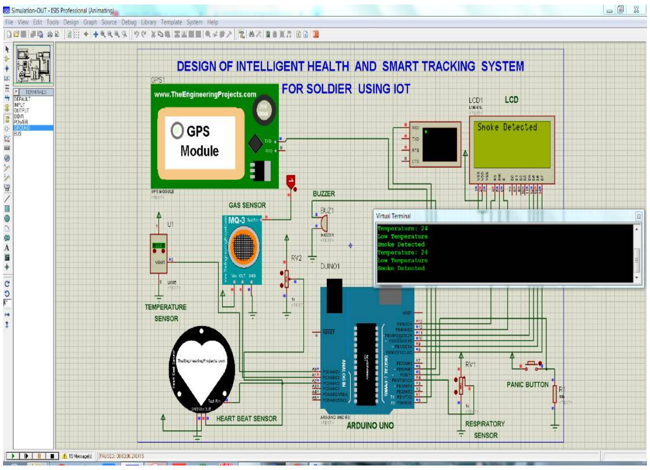

Figure 6. Result for smoke detection

In these simulations, we may modify the gas value in the Smoke Sensor (MQ-3) using the Logic Toggle and the breath rate value in the Respiration Sensor using the Potentiometer, as shown in fig.6. If the Logic Toggle value is "1," the message "Smoke Detected" is shown on the Serial Monitor and LCD. If the Logic Toggle value is "0," the message "NO Smoke Detected" is shown on the Serial Monitor and LCD. If the Breath rate level falls within these values (60 – 80), the message "NORMAL RESPIRATION RATE" & NORMAL RESP RATE is shown on the Serial Monitor and LCD. If the Breath rate level is less than (60), the statements "LOW RESPIRATION RATE" and "LOW RESP RATE" are shown on the Serial Monitor and LCD. If the Breath rate level exceeds (80), the statements "HIGH RESPIRATION RATE" and "HIGH RESP RATE" are shown on the Serial Monitor and LCD.

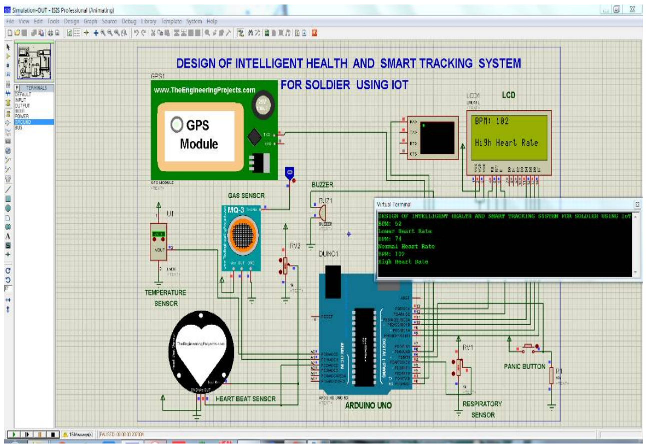

Fig 7. Result for soldier heart rate detection

We may modify the heart rate value in the Heart Beat Sensor in these simulations by using the potentiometer displayed in fig.7. The normal heart rate is (60 – 100 BPM). So I set the condition in the Arduino IDE to a heart rate range of (60 – 100 BPM). If the heart rate level falls between these limits (60 – 100 BPM), the statements "Normal Heart Rate" and "Normal Rate" are shown on the Serial Monitor and LCD. If the temperature falls below (60 BPM), the statements "Low Heart Rate" and "Low Rate" are shown on the Serial Monitor and LCD. If the temperature is higher than (100BPM), the statements "High Heart Rate" and "High Rate" are shown on the Serial Monitor and LCD.

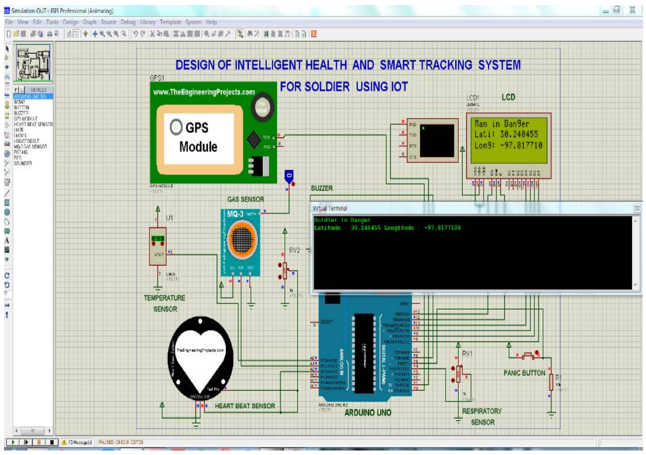

Figure 8. Result for soldier location detection

We utilised a push button in these simulations. When the Push button is hit, the statements "Soldier in Danger" and "Man in Danger," as well as the GPS position, are shown on the Serial Monitor and LCD. Otherwise, no statement is printed in the serial monitor and LCD, as illustrated in fig.8.

V. CONCLUSION

This project report is about a secure troop monitoring system that makes use of the Internet of Things (IOT). Because it is a minimal solution for the necessary function, the Arduino is used. Biomedical sensors communicate each soldier's heart rate, body temperature, and ambient information to the command center. This method could help find a seriously injured lost soldier and counteract the disadvantage of soldiers dead or missing. In an emergency, the addressing system is very important for improving communication amongst soldiers and giving exact direction to the command center. As a result, we can expect this technology to save the lives of army men all across the world. The suggested system was discovered to be low-cost, dependable, and easily trackable for rapid and successful rescue operations via direct connection with the control centre.

In the future, a portable handheld sensor gadget with more sensing choices could be developed to aid warriors.

Future Scope

In the future, the project kit will be transformed into readily worn devices such as a watch and a jacket. We propose an IOT-based AI welfare monitoring system for troops in this study (IOT). GSM-based monitoring methods have been the most often utilised processes for tracking troops' lives on the frontlines in the last decade. There are two parts: the hardware unit and the software unit. Only software is used in these project-based projects. Following that, the hardware unit will implement the sensors and interfacing displays, power supply, and microcontroller, while the software unit will include the Internet, web server, hardware programming, and server side scripting, as well as a database for storing information about soldiers' health.

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