SOLDIER TRACKING AND HEALTH MONITORING SYSTEM USING AN ARDUINO

Mr. B. NAVEEN KUMAR [a], E. SANDEEP [b], B. RACHANA [c], N. RAKSHITHA [d], P. MEGHANA [e], A. MANIKUMAR [f]

[a] Assistant Professor, Department of Electronics & Communication Engineering, Balaji Institute of Technology & Science, Warangal.
[b] Student, Department of Electronics & Communication Engineering, Balaji Institute of Technology & Science, Warangal.
[c] Student, Department of Electronics & Communication Engineering, Balaji Institute of Technology & Science, Warangal.
[d] Student, Department of Electronics & Communication Engineering, Balaji Institute of Technology & Science, Warangal.
[e] Student, Department of Electronics & Communication Engineering, Balaji Institute of Technology & Science, Warangal.
[f] Student, Department of Electronics & Communication Engineering, Balaji Institute of Technology & Science, Warangal.

Abstract: In today's era enemy warfare is an important factor in any nation's security. In this system, smart sensors are attached to the body of soldiers. This is implemented with a personal server for complete mobility. This personal server will provide the connectivity to the server at the base station using a wireless connection. Each soldier also has a GSM module which enables the communication with the base station in case of injuries. Real-time GPS tracking allows for precise location data, crucial for situational awareness and rapid response in emergency situations. Simultaneously, wearable sensors provide continuous monitoring of vital signs, including heart rate, body temperature, and stress levels, offering insights into soldiers' health and readiness. This integrated system combines GPS tracking and wearable sensors to comprehensively monitor and enhance the well-being and operational effectiveness of soldiers. Real-time GPS tracking allows for precise location data, crucial for situational awareness and rapid response in emergency situations. Simultaneously, wearable sensors provide continuous monitoring of vital signs, including heart rate, body temperature, and stress levels, offering insights into soldiers' health and readiness. The system's sophisticated data analytics capabilities facilitate in-depth assessment of soldiers' overall health and readiness, optimizing their performance in diverse and demanding environments. In our project we have come up with an idea of tracking soldier as well as to give status of the soldier during the war. This is not just a technology but a vital asset in ensuring the safety, well-being, and operational efficiency of military personnel.

Keywords: Arduino Uno R3, R1 NTC Temperature Sensor, MAX30100 Heart Beat Sensor, GSM-SIM 900A Module, GPS – 6MV2 Module, 16X2 LCD Display, Danger Switch Button

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1. Introduction

The project aims to revolutionise soldier monitoring and enhance battlefield safety through an innovative based system. By integrating advanced technologies such as Arduino Uno, GSM and GPS modules, emergency switches, biometric sensors, and LCD displays, the system offers comprehensive tracking and health monitoring capabilities for soldiers in the field. Through continuous monitoring of vital signs like heart rate and body temperature,

the system ensures timely detection of any abnormalities that may indicate health issues or distress. Additionally, the inclusion of a GPS module enables accurate real-time tracking of soldiers' locations, allowing commanders to maintain situational awareness and coordinate operations effectively Through continuous monitoring of vital signs like heart rate and body temperature, the system ensures timely detection of any abnormalities that may indicate health issues or distress. Additionally, the inclusion of a GPS module enables accurate real-time tracking of soldiers' locations, allowing commanders to maintain situational awareness and coordinate operations effectively. In the event of critical health parameters exceeding predefined thresholds, such as a heart rate above 95 beats per minute or a temperature exceeding 38 degrees Celsius, the system automatically triggers alert messages. These alerts promptly notify the control room, enabling swift response and intervention to ensure the well-being of soldiers in distress. By providing instant access to crucial health and location data, this project significantly enhances operational efficiency and reduces response times during emergencies. It empowers military personnel with actionable insights, enabling them to make informed decisions and deploy resources more effectively in dynamic battlefield scenarios. Overall, this project represents a significant advancement in soldier monitoring technology, offering unparalleled capabilities to safeguard the lives and well-being of military personnel in high-risk environments.

2. Significance of The Study

Studying soldier tracking and health monitoring systems is significant for enhancing military effectiveness and ensuring the well-being of personnel. These systems can improve situational awareness, streamline operations, and enable timely medical interventions, ultimately enhancing mission success and saving lives. Additionally, understanding the technological advancements in this field can lead to innovations with broader applications in healthcare and emergency response.

The problem statement revolves around addressing the challenges faced by military forces.

- Lack of real-time information: The absence of timely data on soldiers' health conditions and locations hampers the ability of commanders to make informed decisions and respond effectively to emergencies on the battlefield.

- Inadequate monitoring systems: Existing monitoring systems suffer from limitations such as high installation costs, bulky equipment, and unreliable communication channels, making them unsuitable for use in dynamic and hostile environments.

- Safety concerns: Soldiers face risks due to injuries, health emergencies, and getting lost or disoriented in unfamiliar terrain, highlighting the need for robust monitoring and tracking mechanisms to ensure their safety and well-being.

The goal of the project is to develop an innovative IoT-based solution that overcomes these challenges by providing continuous health monitoring and accurate location tracking

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of soldiers in real-time. This solution aims to enhance the safety and effectiveness of military operations by enabling commanders to monitor soldiers' health status, track their movements, and respond swiftly to emergencies on the battlefield.

3. Objective of The Study

Objective of this project is to develop a robust Internet of Things (IoT) based system for monitoring the health and tracking the location of soldiers in battlefield environments. By integrating wearable devices with sensors capable of measuring vital health parameters such as heart rate, body temperature, and oxygen levels, along with GPS technology for real-time location tracking, the system aims to provide comprehensive situational awareness to military commanders. Through communication modules, health data and location information will be transmitted to a centralized control room, enabling timely decision-making and rapid response in case of emergencies. The system will be designed to be lightweight, portable, and durable, ensuring its suitability for use in harsh battlefield conditions. Field trials and performance evaluations will be conducted to validate the system's effectiveness and reliability, with the ultimate goal of enhancing soldier safety and operational efficiency at a reasonable cost.

4. Proposed Method

Our proposed system is an Internet of Things (IoT)-based health monitoring and tracking system designed specifically for soldiers in battlefield scenarios. This system integrates various components including Arduino boards, biomedical sensors, GPS modules, and communication modules to provide real-time monitoring of soldiers' health status and location. The system is compact, portable, and equipped with tiny wearable physiological equipment and sensors, making it suitable for deployment in challenging environments. Soldiers wear the monitoring device, which continuously collects data on vital signs such as pulse rate, body temperature, and oxygen levels. The GPS module tracks the soldier's location, and all this information is transmitted to a control room through IoT connectivity. In case of any abnormalities detected in the soldier's health parameters or if the soldier is in distress, the system triggers alerts to notify the control room. Additionally, soldiers can use the emergency switch to send immediate distress signals if needed. The control room receives and processes the data sent by the soldier's device, enabling real-time monitoring of their health status and location. Authorized personnel can access this information through a graphical user interface (GUI) and take necessary actions, such as deploying medical teams or providing assistance, based on the situation. Overall, our proposed system offers a comprehensive solution for enhancing the safety and well-being of soldiers in combat situations. By leveraging IoT technology and integrating various sensors and communication modules, it enables effective monitoring and timely intervention, ultimately contributing to the protection of soldiers' lives on the battlefield.
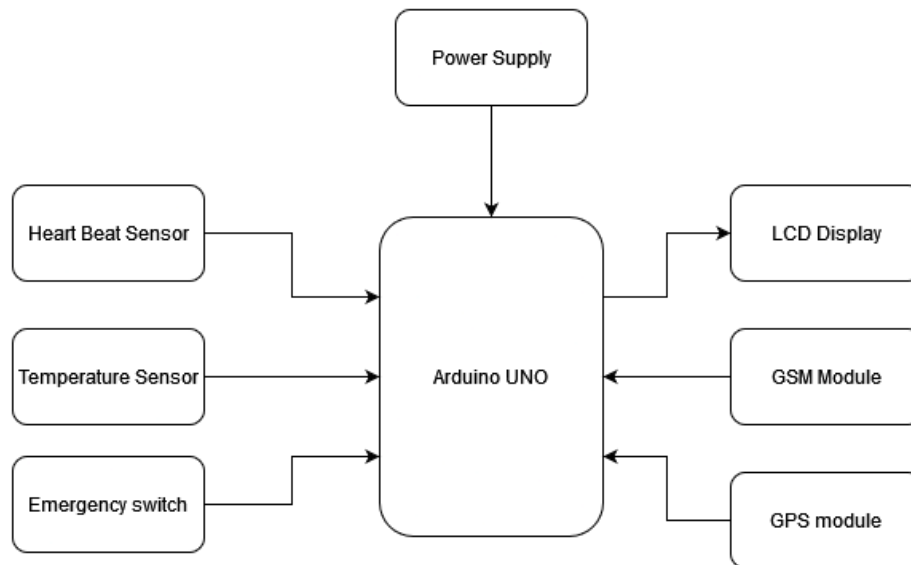
5. Block Diagram

Fig 1: Block diagram of soldier tracking and health monitoring system

6. Working Principle

The soldier tracking and health monitoring system operates on a principle that integrates various components, each with a specific function, to ensure the safety and efficiency of military personnel. At the heart of the system is the Arduino Uno, which acts as the central processing unit, coordinating the operations of other modules and processing the data from sensors. It connects with different sensors and modules using its digital and analog pins and is programmed to perform tasks such as reading sensor data, managing GSM and GPS modules, displaying information on the LCD, and responding to emergency switches. The GSM module is crucial for communication, linking the soldier's device with the control center through the GSM network. It enables soldiers to send emergency alerts and allows the control center to send back commands or instructions for remote monitoring. The GPS module is responsible for location tracking, using satellite signals to determine the soldier's precise geographic position and updating the control center in real-time, which is essential for monitoring and rescue operations. An emergency switch provides a direct line to the control center in critical situations, triggering an alert that prompts immediate action, such as deploying rescue teams or providing instructions. The LCD display serves as a visual interface for soldiers, presenting important information like GPS coordinates, vital signs, or status messages, and allowing them to monitor their health and environment. The heartbeat sensor measures the soldier's heart rate by detecting blood flow through the fingertips, providing real-time health status and enabling early detection of medical emergencies.

Lastly, the power supply module is the backbone of the system, supplying electricity to all components, ensuring continuous operation, and including portable power sources for autonomy in various conditions.
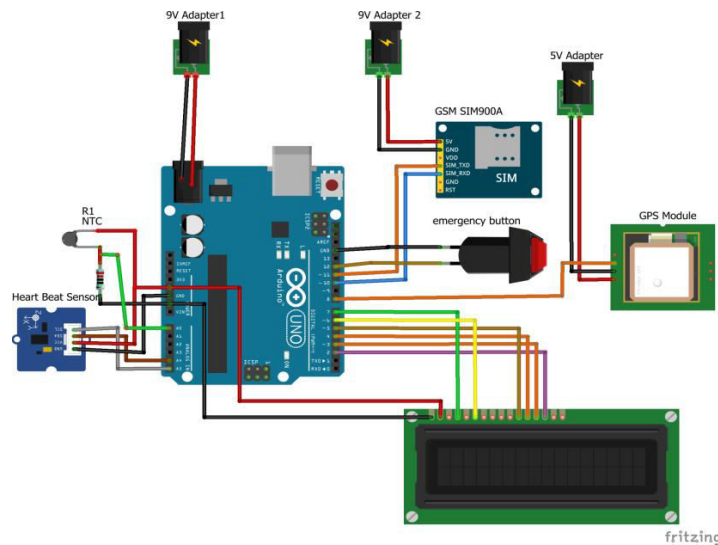
7. Schematic Diagram

Fig 2: Schematic Diagram of Soldier Tracking and Health Monitoring System

8. Implementation

Connecting the modules in the soldier tracking and health monitoring system involves establishing physical and electrical connections between each component to ensure proper communication and functionality. Here's how each module is connected within the system:

1. **Arduino Uno**: As the central processing unit, the Arduino Uno serves as the hub for connecting all other modules. It provides input/output pins (digital and analog) and communication interfaces (such as UART, I2C, and SPI) to interface with sensors and communication modules.
2. **GSM Module**: The GSM module is typically connected to the Arduino Uno via UART serial communication. It uses Tx (transmit) and Rx (receive) pins on the Arduino to send and receive data. The module may require additional connections for power (Vcc) and ground (GND).
3. **GPS Module**: Similar to the GSM module, the GPS module communicates with the Arduino Uno using UART serial communication. It typically connects to the Tx and Rx pins on the Arduino for data transmission. Additionally, the module may require connections for power and ground.
4. **Emergency Switch**: The emergency switch is connected to one of the digital input pins (e.g., D2) on the Arduino Uno. When pressed, it sends a digital signal (HIGH or LOW) to the Arduino, indicating the activation of the emergency protocol.
5. **LCD Display**: The LCD display is connected to the Arduino Uno using a parallel or serial interface, depending on the type of display module used. It requires

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connections for data lines (e.g., D4-D7), control lines (e.g., RS, EN), power (Vcc), and ground (GND).

6. **Heart Rate Sensor**: The heart rate sensor is typically connected to one of the analog input pins (e.g., A0) on the Arduino Uno. It outputs an analog voltage signal proportional to the detected heart rate, which is read by the Arduino for processing.

7. **Power Supply**: The power supply module provides electrical power to the Arduino Uno and other connected components. It may connect to the Arduino's power input pin (e.g., Vin or Vcc) and ground pin (GND), ensuring stable voltage and current supply.
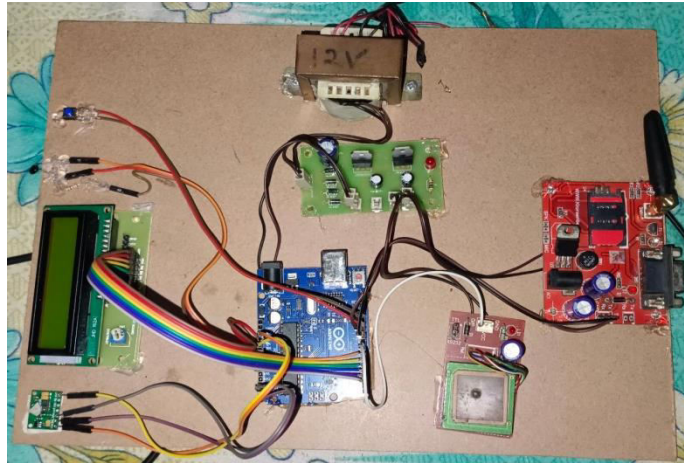
9. Results

Fig 3: This Above image Shows Final assembled Circuit as per circuit diagram
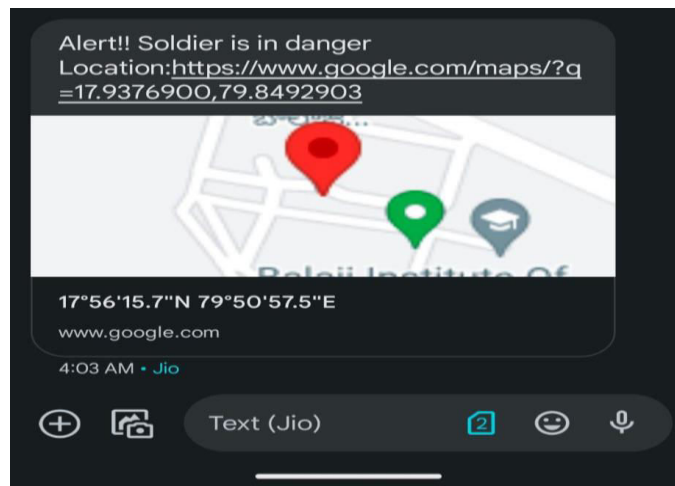

Fig 4: Above image shows sms alert received when soldier heart rate is above 95 BPM
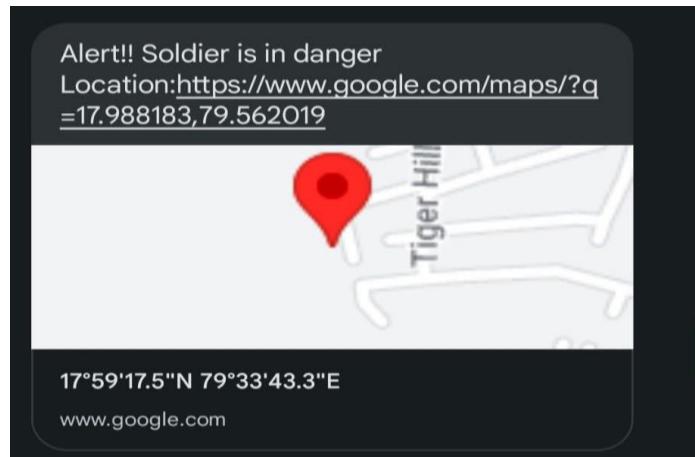
Fig 5: Above image shows sms alert received when soldier presses Danger Button

10. Conclusion:

One of the key advantages of this system is its portability and ease of deployment, making it suitable for use in various military operations, search and rescue missions, border patrol activities, and peacekeeping operations. Furthermore, the system's ability to generate alerts based on predefined thresholds for heart rate and temperature adds an extra layer of safety by proactively notifying authorities of potential health risks. Overall, the soldier tracking and health monitoring system offers a comprehensive solution for enhancing the safety and effectiveness of military personnel in challenging and dynamic environments. With further refinement and integration of advanced technologies, such as artificial intelligence and data analytics, this system holds great promise for improving the health, security, and operational capabilities of armed forces worldwide.

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