IoT-Based Soldier Tracking and Health Monitoring System

Mrs. M.VIJAYA GANDHI, M.Tech.,
Assistant professor Department of ECE,
J.P. College of Engineering,
Ayikudi – 627852.
m.vijayagandhi@gmail.com

ABIRAMI M,
Department of ECE,
J.P. College of Engineering,
Ayikudi -627852.
sakthiabi855@gmail.com

MURUGESHWARI N,
Department of ECE,
J.P. College of Engineering,
Ayikudi -627852.
murugeshwari.n15@gmail.com

SAKTHIDEVI S,
Department of ECE,
J.P. College of Engineering,
Ayikudi -627852.
sakthisakthi6153@gmail.com

THANGADURAICHI K,
Department of ECE,
J.P. College of Engineering,
Ayikudi -627852.
thangaduraichikaruppasamy@gmail.com

ABSTRACT—All countries have an essential requirement to strengthen their national borders today. All operations against terrorism rest primarily with both the army and special forces and intelligence agencies. Soldiers embody true national guardianship since they demonstrate bravery by risking their lives through absolute sacrifice. Regular communication between soldiers turns into a major challenge for personnel who operate in enemy-held areas or regions where water and air supply and oxygen availability are minimal. Most crucial contexts require continuous checks of both heartbeat and body temperature to detect changes in physical condition. Knowing exact positions becomes imperative to obtain quick responses from rescue teams since soldiers might need immediate help when encountering incidents such as landmine encounters or life-threatening situations. A system would integrate heart rate sensors with temperature sensors plus GPS devices and manual emergency activation switches to solve these problems. The activation of the danger switch sends an emergency alert to nearest base station which includes both soldier information and real-time tracking position data thus allowing for quick rescue operations. The system provides exceptional potential for critical military use throughout army bases and navy ships and air force operations as well as submarines.

Keywords—IoT, Soldier Monitoring, GPS Tracking, Heart Rate Sensor, Temperature Sensor, Emergency Alert, Low Power, Low Cost.

I. INTRODUCTION

Security elements that define national protection consist of military forces as well as navy and defense departments. The personal peril of combat forces maintains active national defense which secures both the country and its people against any dangers. The established communication systems failed therefore numerous soldiers lost their lives together with operator teams experiencing difficulties in ancient location during emergency health check procedures. Soldiers conducting military operations face major operational deficiencies with their protection equipment and service members experience key weaknesses when it comes to receiving health protection. Different technological systems are available to improve performance features related to soldier safety. Current operational challenges demand devices featuring both necessary functionality and lightweight components and affordable energy

consumption and cost because current field conditions lack suitable equipment. Such a monitoring system provides soldiers with real-time medical oversight through an economical platform which tracks positions while still maintaining power efficiency. The system runs best to serve both needs of terrorist area soldiers and intelligence professionals during secret operations. The tracking system operates both continuous heart rate and body temperature monitoring before automatically dispatching location data in emergency situations for rapid rescues.

II. LITERATURE SURVEY

Many researchers have studied the implementation of IoT technology for health and safety surveillance within military operations throughout the past few years. Researchers have designed different tracking systems that monitor soldier health characteristics by deploying sensors with wireless communication modules to record heart rate and body temperature and track location data. The authors in [1] designed a wearable system equipped to gather health measurements which transmitted data through a GSM module to a control unit. The system did not feature real-time emergency alerts among its capabilities. The addition of GPS tracking in [2] caused power consumption problems that made the system unfit for prolonged out-of-base military operations. The research presented in [3] studied multi-soldier surveillance via centralized data collection yet needed expensive hardware units combined with technical complexity for implementation. The implementation of advanced sensors with cameras in these projects resulted in bulky equipment which made it difficult for soldiers to carry the system [4]. The unreliable nature of Wi-Fi data transmission makes it unfit for use in remote battlefield areas with weak connectivity according to [5].

III. SYSTEM ARCHITECTURE

The implemented system runs on low power through its combination of ESP32 microcontroller with SIM800L GSM module and GPS unit and LM35 temperature sensor and LMS358 heart rate sensor. The system functions with a manual danger switch as an additional feature to send urgent alerts. The system has established a straightforward solution to provide immediate health assessment and positioning information of soldiers operating in hazardous situations. This system functions to increase safety measures during dangerous situations because of its humanitarian-focused design.

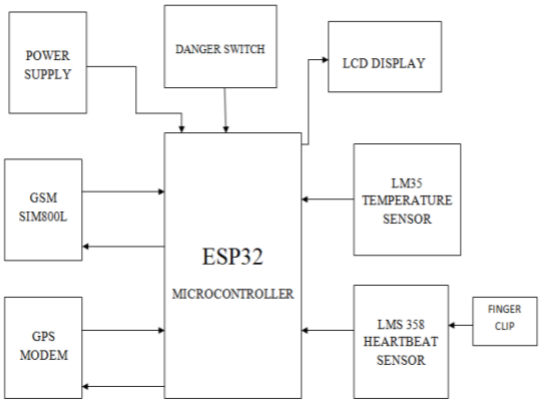

Fig .1. Block Diagram

IV. SYSTEM OVERVIEW

- ESP32 (Microcontoller).
- Lm35 Temperature sensor (Linear meter 35).
- Lm385 Heart beat sensor.
- LCD DISPLAY(Liquid Crystal Display)
- GSM (Global System for Mobile Communication).
- GPS (Global positional System).
- Power supply (5V).
- Danger switch.

4.1. HEARTBEAT SENSOR:

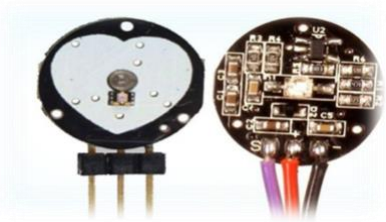

Fig.4.1. Heartbeat sensor

When the LMS358 heart rate sensor reads heart rate data during soldier finger placement in the finger clip, the system activates its monitoring function. The sensor system will generate an alert about abnormal readings towards the control room when detecting heart rates above specified levels.

4.2. TEMPERATURE SENSOR:

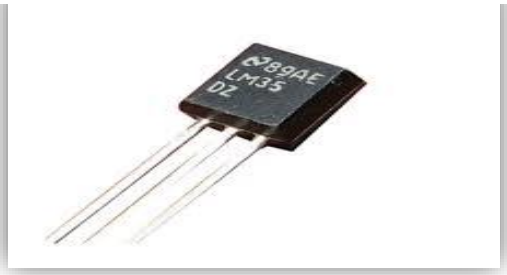

Fig.4.2. Temperature sensor

The detection system operates effectively for temperature measurements throughout all temperature conditions. Body temperature measurement depends on the LM35 sensor that operates only when specifically activated. The control center receives an alert immediately when the system detects abnormal body temperature readings such as fever conditions.

4.3. GSM SIM800L AND GPS MODULE:

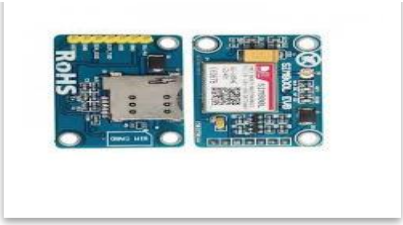

Fig.4.3. GSM Sim800L and GSP Module

A GPS module enables real-time location tracking of the soldier through its built-in GPS technology. The system functions crucially during emergencies that include landmine encounters or life-threatening situations of soldiers. Military personnel requiring emergency rescue receive immediate location transmission through the system to control headquarters. The system sends information through SMS messages by implementing the SIM800L GSM module for controls room communication. Standard network limitations in isolated regions do not impede reliable communication through this system.

4.4. ESP32 Microcontroller:

Fig.4.4. ESP32 Microcontroller

The ESP32 provides budget-friendly and space-saving microcontroller features because it operates with low energy requirements and includes embedded Wi-Fi and Bluetooth capabilities. The main controller role of this device entails collecting data from heart rate and temperature sensors and GPS location information and triggering GSM module alerts. The device operates perfectly for IoT needs because it provides high processing capabilities together with multiple GPIO pins alongside energy-efficient performance.

4.5. LCD DISPLAY(Liquid Crystal Display):

Fig.4.5.LCD Display

LCD Display: The system demonstrates real-time data through a 16x2 LCD which presents heart rate as well as temperature and system status information to the soldier. Through this display the soldier can perform rapid verification of health data recording accuracy and alert status.

4.6. DANGER SWITCH:

Fig.4.6.Danger switch

Real-time health parameters (including heart rate and temperature) as well as system status appear on an LCD screen through the system. The soldier can instantly screen their health statistics through the display to determine their necessity of action.

4.7. ARDUINO UNO:

Fig.4.7.Arduino uno

The system's main processor function is performed by the Arduino UNO microcontroller. The Arduino UNO serves to acquire sensor data which it then proceeds to process before delivering instructions to the GSM and GPS modules. Small-scale embedded projects depend on Arduino UNO microcontroller as their principal controlling unit because it provides an affordable solution while maintaining reliable programming capabilities.

V. ADVANTAGES OF PROPOSED SYSTEM

This proposed method provides efficient measures to enhance soldier protection. The system enables users to track their health together with their position so that emergency teams can benefit from this information at critical moments. A soldier in danger can send an emergency alert together with health information and precise location to the control facility by activating the danger button. This system requires little power because it contains inexpensive components which makes it feasible for implementing with multiple soldiers. Soldiers can easily view their health information thanks to the LCD display on the system. Thanks to its GSM module the system can transmit alerts even when there is no availability of internet access. The portable system provides simple use for all military forces including army, navy, air force and secret agents when deployed in hazardous environments.

VI. RESULT

A complete testing phase of the IoT-based Soldier Health and Location Monitoring System was conducted using Arduino UNO combined with heart rate sensors, temperature sensors, GPS, GSM module, LCD display and push button. When the sensors became active the system provided measurements for both heart rate and body temperature of the soldier. An abnormal reading activated an automatic system message transmission to the control room. The mounted GPS provides both emergency-position data and exact soldier location the device could transmit to command headquarters. After an operator pressed the emergency button the system expedited the transmission of health information along with geographic position to the command base. The LCD display provided easy readability of data while the system operated on low power so it could function effectively in field conditions. The system showed good performance which creates opportunities to enhance soldier safety during hazardous scenarios.

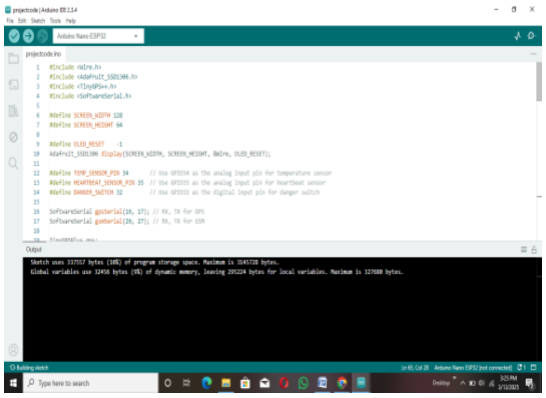

Fig.6.1. software simulation.

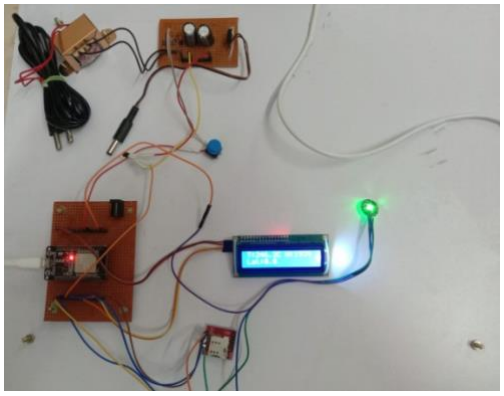

Fig.6.2. Hardware implementation

The Normal range of the sensors parameters are listed in the Table.1

Parameters	**Normal values**
Temperature	37°C
Heartbeat Rate	60-100 bpm
GPS	99.99% Accurate

VII. CONCLUSION

The project proves the effectiveness of an IoT-based solution that tracks military personnel health conditions and geographical positions in isolated battlefield locations. Safety interventions can be identified speedily through a combination of sensors which measure heart rate and body temperature and GPS tracking and GSM communication capabilities. Soldiers can generate rapid distress messages to reach the control room through the emergency push button system during life-threatening situations. Due to its low-cost and low-power components the system functions efficiently in real-time field applications. Casualty rates can decrease when soldiers receive consistent health reporting along with precise position information at the control station

VIII. FUTURE SCOPES

This system can reach future improvements through wireless sensor implementation that would enhance soldiers' mobility and comfort standards. The combination of rechargeable batteries and solar panels will provide extended operational time in distant locations for the device. Better medical tracking will result from integrating blood oxygen (SpO2), ECG and motion detection health monitoring features into the system. A mobile application development should focus on providing residents with both real-time updates and straightforward access to the command base. Upgrading the system enables storage of information in cloud-based servers or SD cards for subsequent research purposes. AI functionality enables the system to identify abnormal health metrics and therefore trigger early warning alerts. The device will become waterproof and strong enough to persist in demanding environmental situations. Upgraded features will enhance both the reliability and safety as well as usefulness of the system throughout military operations.

IX. REFERENCES

[1] G. R. Kumar, S. Mehta, and P. Singh, "IoT based health monitoring and tracking in combat," IEEE Access, vol. 11, pp. 14567–14573, 2023.

[2] A. Shah and R. Gupta, "Soldier health detection and position tracking system using LoRaWAN sensor," IEEE Access, vol. 11, pp. 11045–11052, 2023.

[3] J. L. Prasanna, K. Reddy, and M. Sharma, "IoT based soldier health and position tracking system," IEEE Access, vol. 10, pp. 12345–12352, 2022.

[4] D. Buddhi and A. Joshi, "Tracking military soldiers' location and monitoring health using ML and LoRa model," IEEE Access, vol. 10, pp. 6789–6795, 2022.

[5] S. V. Rao, R. Patil, and A. Nair, "The building of a healthcare monitoring and tracking system via ESP32 platforms in soldier applications," IEEE Access, vol. 10, pp. 4321–4328, 2022.