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Health Monitoring and Tracking Systems for Soldiers Using IoT

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ABSTRACT

Soldier safety is a primary concern in the modern world since military tactics play a significant role in national security. Hazardous gases, snow slides, severe weather, and unexpected health problems like heart difficulties or body temperature fluctuations are just a few of the many risks that soldiers encounter in combat zones. The inability to efficiently communicate with the control room in an emergency is one of the main obstacles. To track the soldier's precise location and critical health data, this idea suggests a real-time monitoring system. By doing this, quick steps may be taken to protect them, enhance communication, and speed up reaction times in dire circumstances—all of which can eventually save lives on the battlefield.

Keywords: *Health Monitoring and Tracking System, Global system for mobile communications, global positioning system, Electrocardiogram, Electromyogram, Light Emitting Diode, Transmission Control Protocol / Internet Protocol, Artificial Intelligence*

1. INTRODUCTION

In this project, an IoT-based Health Monitoring and Tracking System (HMTS) for troops is designed and put into use. It tackles important problems like casualties from injuries, a lack of up-to-date location and health information, and poor communication during operations. Wearable sensors are integrated into the system to track vital signs like body temperature and heart rate. Real-time data is sent to a centralized command center over secure IoT networks. It uses the GSM module to communicate and GPS to track location of its whereabouts. The HMTS helps soldiers in emergency situations, improves situational awareness, and facilitates quick medical intervention. For defence applications, embedded systems offer a versatile, low-power option. Additionally, the system uses machine learning and predictive analytics to identify health irregularities and boost operational effectiveness. Soldiers receive proactive care by gaining information about their health through tailored dashboards. All things considered, HMTS uses IoT to revolutionize health management in contemporary warfare by enhancing troop safety, lowering casualties, and boosting mission readiness.

2. LITERATURE REVIEW

A literature review aids in understanding current research, encouraging creativity, and building a strong project foundation. N. Swetha et al. (2023) suggested a LoRa WAN-based system in tracking the positional status and health of soldiers that uses STM32 and Proteus. WBASN methods utilizing Arduino, GSM, GPS, and sensors for real-time monitoring were examined by Swarupan et al. in 2023. GPS and MAX30102 were used by Dr. Basavaraj et al. (2023) to track oxygen and heart rate.

Using the Blynk IoT platform, Abhishek Kadam et al. (2023) combined with the metal detection, biosensors, GPS location tracker, and GSM module. IoT and AI-enabled wearable technology for remote and real-time troop monitoring, enhancing situational awareness, prompt alarms, and effective health management were the main topics of Bhatia & Goyal (2023) and Singh & Sharma (2024).

3. PROBLEM STATEMENT

One major problem is the absence of real-time health and location tracking of soldiers on the battlefield, which raises the danger of injury or death and delays medical response. Since soldiers frequently serve in remote or tough locations with few means of communication, it can be challenging to keep an eye on their wellbeing. Soldiers are left vulnerable in emergency situations since traditional methods are inadequate for monitoring vital indications like heart rate, body temperature, and oxygen levels. To give the command center precise, current health and position data, a solution is desperately needed. Enhancing situational awareness might allow for prompt reactions to medical crises, possibly saving lives. To guarantee that it doesn't impair a soldier's effectiveness, the system needs to be portable, dependable, energy-efficient, and simple to incorporate into already-existing military gear. In the end, real-time monitoring would increase operational efficiency and soldier safety in critical situations by improving the mission outcomes, enhancing coordination, and ensuring the rapid medical intervention with the use of the wearable sensors, GPS tracking systems, and cloud-based data processing.

4. EXISTING SYSTEM

Despite their adaptability and capacity for well-informed decision-making, human military surveillance systems have many drawbacks. Operators may ignore hazards or make inaccurate assessments due to weariness, human error, and cognitive bias. Physical and mental constraints limit their capacity to digest complicated data and continuously monitor large areas. Maintaining a human surveillance crew is also expensive because it requires specialized equipment, hefty operating costs, and extensive training. The efficiency of human personnel in dangerous circumstances is further compromised by the possibility of their capture, harm, or psychological stress.

The necessity for automated surveillance systems that can offer more dependable, scalable, and effective solutions is highlighted by these difficulties. These technologies can increase operational performance by decreasing human error and improving data processing capabilities, guaranteeing accurate, ongoing monitoring in high-risk areas. Automated systems meet the changing needs of contemporary warfare by providing a safer and more sustainable substitute for human observation.

5. PROPOSED STATEMENT

The Soldiers' Health Tracking and Monitoring System By using wearable sensors to continuously monitor vital signals like heart rate, body temperature, and activity, the Internet of Things improves soldier safety. For analysis, this data is sent in real time to a command center or central cloud platform. Automatic notifications are set off in the event that abnormal health indicators are found, enabling timely medical intervention. The system guarantees quick emergency response, enhances resource allocation, and promotes proactive health management. It improves situational awareness and operational performance by providing real-time health and location tracking, which eventually boosts mission success and guarantees the welfare of soldiers in the field.

6. PROJECT OBJECTIVE

This project's goal is to use IoT technology to create a reliable, low-power health monitoring and tracking system for soldiers. By using wearable sensors to record vital signals like body temperature and heart rate, the system seeks to track soldiers' health in real time. Using a GPS receiver, it will precisely locate the soldier and send the data to the army control center. The technology will automatically notify command staff by sending alert messages in urgent situations. In order to facilitate prompt decision-making, the project also aims to create an intuitive user interface for effective and transparent data visualization.

7. METHODOLOGY

The IoT-based Health Monitoring and Tracking System for Soldiers is intended to provide real-time location and health tracking. The system tracks health markers like body temperature, heart rate, and ECG using a variety of sensors. The ESP32 microcontroller, which serves as the central processing unit, continuously gathers and processes these vital indicators. By collecting signals from satellites in orbit, a GPS receiver is incorporated to pinpoint the soldier's exact location. The army base station receives and stores this geographic data as well as health measures. The soldier has the option to hit an emergency (EMG) button in case of an emergency, which will instantly notify the control center. The TCP/IP protocol is used to send all collected data to the cloud platform, giving the control room access to real-time data. The solution also facilitates mobile viewing via the Telegram App, which improves monitoring and communication. Integrated software at the base station shows the soldier's location and health status. Additionally, there is an LCD screen that provides the soldier with real-time position and health information. This IoT-based solution guarantees better care for soldiers in the field, improves situational awareness, and significantly speeds up response times.

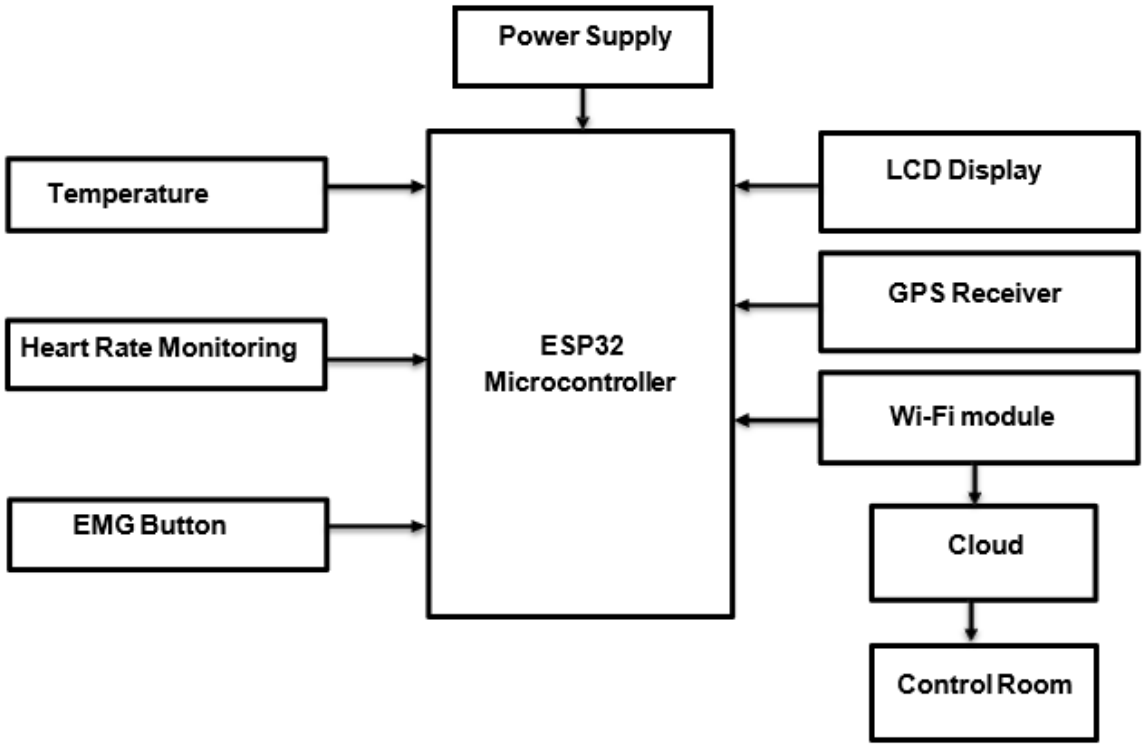

FIGURE-1: Block Diagram

8. IMPLEMENTATION

Wearable sensors, cloud computing, and real-time data processing are all combined in the IoT-based Health Monitoring and Tracking System for Soldiers to protect military personnel's health and safety in challenging situations. Soldiers have access to a variety of wearable sensors, including as GPS trackers, temperature sensors, heart rate monitors, and SpO2 (blood oxygen) sensors. Critical health data is continuously collected by these devices and sent to a central gateway for prompt processing. This data is sent by the gateway to a cloud-based platform for safe storage and analysis. An high heart rate, low oxygen saturation, or abnormal body temperature are examples of anomalies in the data that are detected by machine learning algorithms. These anomalies may suggest potential health hazards like heatstroke, exhaustion, or cardiac problems. Commanders and medical staff receive alerts instantly when the system identifies alarming health metrics, guaranteeing timely action.

By integrating GPS tracking, it is possible to follow the soldier's exact location and quickly deliver aid in an emergency. Additionally, commanders can use a smartphone app to receive real-time health data and unit position information, enabling them to make more informed decisions. By encouraging proactive health management, speeding up response times during medical emergencies, and enhancing situational awareness on the battlefield, this method dramatically improves operational performance. In the end, military units have a strong instrument for enhancing troop safety, raising mission success, and guaranteeing efficient coordination in the face of various and difficult operational circumstances thanks to the Internet of Things-based Health Monitoring and Tracking System.

9. SNAP SHOTS

FIGURE-2: Implementation of Health Monitoring and tracking System for Soldiers Using IoT

FIGURE-3: Detection and Display of More Heart Rate

FIGURE-4: Detection and Display of temperature

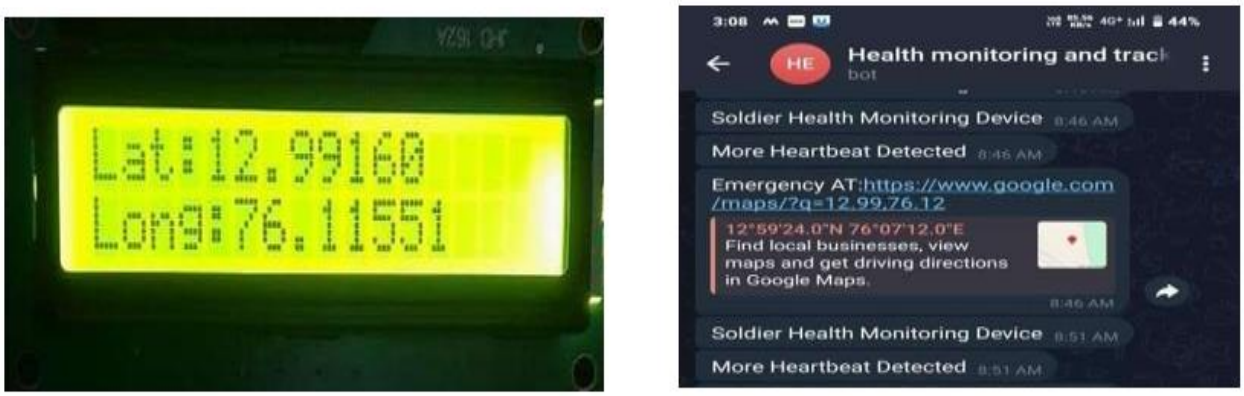

FIGURE-5: Detection and Display of Longitude and Latitude, Data (longitude and latitude) sent to the Telegram App

10. RESULT AND DISCUSSION

The IoT-based Health Monitoring and Tracking System for Soldiers successfully illustrated position tracking and real-time vital sign monitoring utilizing wearable sensors and GPS. The ESP32 microcontroller does precisely records and process the data, including geographic coordinates, body temperature, heart rate, and ECG. The solution ensured smooth communication with the control room by displaying real-time health parameters on an LCD and sending the data via TCP/IP to the cloud. The system's potential in dire circumstances was demonstrated by the fast receipt of alerts prompted by the emergency button. Remote monitoring was improved with mobile access made possible by the integration with the Telegram app. Testing verified the system's suitability for remote and high-risk military locations, despite the fact that data transmission dependability was dependent on environmental factors and network strength. Longer battery life and greater sensor integration would improve performance for longer missions and more demanding situations, but the system works well for low-power, real-time health tracking.

11. CONCLUSION

Using embedded technology and the Internet of Things, the soldier tracking and health monitoring system provides a reliable way to improve military safety. It incorporates temperature and pulse sensors, a GPS module, and an emergency button using the ESP32 microcontroller to track location and health in real time. Through cloud platforms like ThingSpeak and the Telegram app, data is wirelessly sent to a command center and seen on an LCD. This creates the situational awareness, quick notifications, and improve remote monitoring. The technology shows great promise for future integration of sophisticated algorithms for health diagnostics and accurate position monitoring, and it guarantees continuous operation with a dependable power source.

12. FUTURE SCOPE

With the potential for major improvements, the Health Monitoring and Tracking System for Soldiers Using IoT has a very bright future. Future iterations may incorporate cutting-edge sensors to track fatigue, hydration, and mental wellness, offering a comprehensive health picture. By integrating AI-driven analytics, predictive capacities will be enhanced, allowing for the early identification of health issues and increasing military productivity. Data transfer will become more dependable as 5G and satellite communications advance, even in isolated or dangerous locations. By improving real-time surveillance, information collection, and operational assistance in demanding military conditions, these advances will strengthen the system.

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