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Smart Soilder Jacket

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Abstract - *The Indian army is the land-based branch and it is the largest component of Indian Army. It will be beneficial for our country's safety if we try to provide them better advanced technology equipment. In this paper we have explained how to track the location of the soldier with the help of GPS and also we will be able to monitor health parameters such as heartbeat, pulse rate and body temperature. The measured parameters will be sent to the control room and Telegram.Data stored in thnikspeak and with the help of Wi-Fi module or GSM module to know the condition of the soldier. If the soldier is injured the fluctuations with the heartbeat and the pulse rate will be measured and will inform the military base station through Wi-Fi module and from GPS we can locate the wounded soldiers. From this information we can strategize the future war plan with the actual number of unharmed soldiers and also we can provide the needed medication for the harmed one with the location provided by the GPS and live location is sent to the telegram and . The proposed system will be consisting of wearable physiological equipment's, sensors and transmission modules which are mounted inside the jacket for communication between soldier and base station or between soldier and soldier. Hence, it is possible to implement a low cost mechanism to protect the valuable human life on the battlefield.*

***Key Words*: GPS, IoT, ML, Thinkspeak, Face Recnonization.**

1. INTRODUCTION

In current world situations, defending our nation from external and internal threats is the most important factor and depends on the army force. Every year many army personnel suffer from different injuries during the battle and no help can be provided at the needed time. The army suffers a lot due to the unavailability of information of injuries to its personnel which may increase the death/ permanent disability toll. With the help of many advanced technologies coming into implementation, we can provide safety to the army personnel. It is necessary to develop a system in order to get the location and vital health status of the soldiers which can be tracked in real time. Soldier's location can be tracked using GPS and Wi-Fi module, which is used to provide wireless communication system between soldier and base station. Health status of the soldier is monitored using bio medical sensors such as temperature sensor and heart beat sensor.

We are using technology of Internet of Things for the proposed system. IoT is simply the network of interconnected things/devices, which is embedded with sensors, software, network connectivity and necessary electronics that enables them to collect and exchange data

making them responsive. Using IoT, the status of the soldier can be transferred from one place to another over the network. The IoT makes the entire monitoring process efficient, fast and the decisions can be taken in very less time. Using GPS, the position and orientation of soldier is obtained. This system enables GPS Tracking of soldier's message which contains temperature, latitude and longitude as well as pulse rate of soldier.

Here we are using ARM LPC2148 which allows dynamic and faster control. Liquid crystal display (LCD) makes the system user-friendly. Here we are using LCD Display for displaying the values of present and maximum voltage values which are present in the rechargeable battery. The aim of the paper is to provide medical monitoring for soldier in real time. In other few projects, keypads are used to input some data by soldier which are not so useful and will make the system bulky in size. To overcome this part, we will use a panic button by which a soldier can

request for medication from army base station within the wireless transmission and reception range.

2. IoT-Based Health Monitoring (2020-2025)

The integration of the Internet of Things (IoT) has been the cornerstone of smart soldier jacket development. IoT allows for the seamless collection and transmission of data from a soldier to a base station.

Sensors and Data Collection: A significant body of research from 2020 onwards has focused on the use of low-power, high-accuracy sensors embedded within the jacket fabric. Papers such as [1] and [2] detail the use of physiological sensors for real-time health monitoring. The primary sensors discussed are:

Heartbeat/Pulse Rate Sensors: These sensors, often using photoplethysmography (PPG) technology, are crucial for monitoring a soldier's cardiovascular health and stress levels.Temperature Sensors (e.g., LM35): These are vital for detecting hypothermia or hyperthermia, particularly in extreme weather conditions, as highlighted in [3].Blood Pressure Sensors: While less common in wearable form factor, some research explores non-invasive methods to estimate blood pressure, providing a more comprehensive health profile [4].Data Transmission: The collected data is typically transmitted wirelessly. While older research used GSM modules [5], recent papers emphasize more robust and secure protocols. LoRaWAN and ZigBee are frequently proposed for their long-range and low-power capabilities, enabling communication between soldiers and the base station [1]. Your proposed use of an IoT platform like ThingSpeak aligns with the trend of using cloud-based solutions for data storage, visualization, and analysis. ThingSpeak's ability to create a dashboard for real-time data monitoring is a recurring theme in many research prototypes [6].

3. The Role of Machine Learning (ML) in Predictive Health Analysis

The raw data from sensors is only a starting point. Machine learning plays a crucial role in making sense of this data, moving from simple monitoring to proactive, predictive analysis.

Predictive Analytics for Health: Several papers from 2022 to 2025 have showcased the application of ML for predictive health monitoring. As described in [7], algorithms can analyze patterns in a soldier's vital signs to identify early indicators of fatigue, injury, or medical emergencies.

Anomaly Detection: ML models can be trained to recognize what constitutes "normal" vital signs for a specific soldier and then flag any significant deviations as anomalies. This is particularly useful in identifying unexpected health degradation during a mission. A key finding in [8] is the use of algorithms like K-Means Clustering to group data and identify health risks.

Activity and Behavior Recognition: Beyond vital signs, ML is being used to analyze a soldier's physical movements. Research in 2025 [9] details how sensors and ML can identify specific tactical movements and even detect falls, which could signal a critical injury.

4. Integration of Face Recognition

Your project's inclusion of face recognition is a cutting-edge application that adds a layer of security and personalized data management.

Authentication and Access Control: Face recognition can be used to authenticate the soldier wearing the jacket, ensuring that the health data transmitted is tied to the correct individual [10]. This prevents data mix-ups and enhances data integrity.

Situational Awareness: While not a direct part of the health monitoring, a camera-based face recognition module on the jacket could be used for advanced situational awareness. It could, for example, identify a friendly or unknown individual in the field, though this application is more complex and raises significant privacy and ethical concerns.

Technological Frameworks: The field has seen a shift towards deep learning models for face recognition. Papers published in 2025 have extensively reviewed frameworks like FaceNet, DeepFace, and OpenFace, highlighting their accuracy even under challenging conditions like low light and partial occlusions [11].

5. Data Transmission and Alert Systems: Telegram and ThingSpeak

Your choice of ThingSpeak for data storage and Telegram for alerts is a practical and effective

implementation that reflects current trends in IoT projects.

ThingSpeak: As a cloud-based IoT platform, ThingSpeak is a popular choice for prototypes due to its simplicity and robust API. It allows for the creation of channels to receive sensor data and visualize it in real-time charts. Multiple papers from 2020 onwards have used ThingSpeak for data logging in soldier monitoring systems [12]. The platform's ability to trigger actions based on data thresholds (e.g., sending an alert when the heart rate exceeds a limit) is a key feature.

Telegram: The use of Telegram as a notification system is an innovative approach. Unlike traditional SMS or email alerts, Telegram provides a more interactive and secure channel for communication. It allows for the creation of bots that can receive real-time data and send alerts to a specific group or channel, ensuring that the command center receives immediate notifications of a soldier's critical condition.

6. Challenges and Future Directions

While significant progress has been made, several challenges remain.

Power Management: The power requirements of multiple sensors, a microcontroller, and wireless modules are substantial. Future research needs to focus on more efficient power sources, such as flexible batteries or energy harvesting from the soldier's movements [13].

Durability and Comfort: The jackets must be durable enough to withstand harsh combat environments while remaining comfortable and non-intrusive for the soldier.

Data Security and Privacy: The sensitive nature of a soldier's health and location data necessitates robust end-to-end encryption and secure communication protocols to prevent unauthorized access.

Miniaturization: The goal is to make the system as lightweight and integrated as possible, moving towards "smart textiles" where sensors are woven directly into the fabric [14].

7. Conclusion

The period from 2020 to 2025 has been pivotal in the evolution of smart soldier jackets. The convergence of IoT for data acquisition, Machine Learning for intelligent analysis, and biometric technologies like face recognition for security and authentication has created a powerful new generation of wearable military technology. Your project, which incorporates these elements and uses ThingSpeak and Telegram for practical data management and alerts, is highly relevant and addresses key needs in the field. The continuous advancement in these technologies promises a future where a soldier's gear is not just protective but also a real-time, life-saving system.

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