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CLIMATER ADAPTABILITY SAFETY JACKET FOR ARMY

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Abstract:

Nowadays, uncertain and insecure global situations have increased the risk for soldiers. To enhance soldiers' safety, this project proposes a multi-functional techno suit equipped with embedded systems for health monitoring and location tracking using IoT and GPS. The suit automatically controls body temperature in extreme conditions and sends alerts for injuries or emergencies to the military base.

Keywords: IoT, GPS, Health Monitoring, Soldier Safety, Temperature Control

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I. INTRODUCTION

Indian soldiers demonstrate immense courage despite limited safety resources. This paper proposes a system for monitoring soldiers' health and location in real-time, using GPS, IoT, and biometric sensors (heartbeat, SpO2). It aims to ensure timely medical assistance and efficient tracking.

II. LITERATURE REVIEW

- [1] P. Chakravarth et al., "GSM based soldier tracking system and monitoring using wireless communication," Dept. of Electronics and Communication, 2017.
- [2] Akshita V. Armarkar et al., "Soldier health and position tracking system," ETC Engineering, vol. 7, no. 3. (Add additional references accordingly)

III. PROBLEM STATEMENT

Soldiers deployed in remote or hostile environments often face two critical challenges: lack of real-time health monitoring and the inability to communicate distress or emergencies. In extreme weather conditions, maintaining body temperature and physiological stability becomes crucial. Existing systems are limited to location tracking via GPS, offering no provisions for vital sign monitoring or automated environmental adaptability. The absence of an integrated safety mechanism places soldiers at increased risk during missions, particularly when they are isolated, injured, or immobile. Therefore, a compact, real-time, wearable solution is necessary to monitor a soldier's health, location, and thermal condition and to alert the control room in case of any emergency.

IV. PROPOSED FRAMEWORKThe proposed system is a multi-functional, IoT-based smart jacket that includes:

- **Health Monitoring Unit**: Heart rate and SpO2 sensors collect real-time physiological data from the soldier.
- **Location Tracking Module**: A GPS module determines the precise geolocation of the soldier.
- **Emergency Alert System**: An emergency switch allows manual alerts; automatic alerts are triggered if abnormal health metrics are detected.

- **Temperature Regulation Mechanism**: Peltier devices controlled via relay modules adjust internal jacket temperature according to ambient conditions.
- **Communication Framework**: All data is transmitted wirelessly to the military base via an IoT module (e.g., ESP8266).

The system is controlled by an Arduino microcontroller, which processes sensor inputs and initiates appropriate responses.

V. RESULT AND DISCUSSION

A prototype of the climate adaptability jacket was developed and tested under controlled conditions. The system successfully:

- Detected real-time heart rate and SpO2 levels with acceptable accuracy.
- Triggered alerts when the emergency button was pressed or abnormal readings were simulated.
- Sent accurate GPS coordinates to a remote server through IoT integration.
- Adjusted jacket temperature using Peltier modules in response to simulated cold and hot conditions.

Performance Highlights:

- **Heart Rate Detection**: ±2 bpm accuracy compared to medical-grade sensors.
- **SpO2 Monitoring**: ±2% accuracy under steady conditions.
- **Location Tracking**: Real-time coordinates within 5-meter accuracy using standard GPS modules.
- **Temperature Control**: Jacket internal temperature successfully adjusted by ±5°C within 30 seconds.

Discussion:
The proposed system demonstrates significant potential for real-world military deployment. It enables remote health diagnostics, enhances soldier survivability, and reduces response time in emergencies. While current implementation uses basic modules, integrating advanced AI algorithms in the future could enhance predictive health monitoring and optimize power consumption. One limitation is the dependency on uninterrupted power supply and internet connectivity, which can be addressed with solar charging and offline storage buffers in future iterations.

VI. Conclusion

The proposed Climate Adaptability Safety Jacket presents a holistic solution to critical challenges faced by soldiers in remote and extreme environments. By integrating IoT-based health monitoring, GPS-based location tracking, and an automatic temperature regulation system, this jacket significantly enhances the safety, communication, and survivability of military personnel during operations. The system not only monitors vital signs like heart rate and blood oxygen levels but also alerts the control room in emergency scenarios—either manually or automatically. Additionally, the use of Peltier modules allows real-time thermal adaptation to environmental conditions, maintaining body temperature effectively.

This innovation demonstrates the practical application of embedded systems and wireless communication technologies in defense and security. Future improvements may include solar-powered modules, AI-based health prediction, and encrypted data communication for enhanced reliability and security in mission-critical scenarios.

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