Smart Soldier Health Monitoring and Tracking System with Temperature

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***Abstract* - The mining and defence sectors are among the most hazardous working environments, where ensuring worker and soldier safety is a critical challenge. This project proposes the development of Smart IoT Clothing, a wearable system integrated with advanced sensors to continuously monitor both environmental and physiological conditions. The system is designed to collect data such as heart rate, body temperature, presence of hazardous gases, humidity, and surrounding temperature, transmitting this information securely and in real time to a centralized monitoring system.**

Keywords: Smart IoT Clothing, Wearable Technology, Sensor Networks, Worker Safety, Hazard Detection, Location Tracking, Mining Industry, Soldier Health Monitoring, Internet of Things (IoT), Real-Time Data Transmission

I. INTRODUCTION

In recent years, advancements in Internet of Things technology have significantly transformed the healthcare sector. Traditional patient monitoring systems rely heavily on manual observation and periodic health check-ups, which may lead to delayed medical responses during emergencies. This challenge becomes more critical in the case of elderly patients, soldiers, and individuals requiring continuous supervision of vital health parameters. The proposed IoT-based health monitoring system aims to provide continuous and real-time monitoring of patient health conditions using multiple sensors integrated with a microcontroller.

The proposed IoT-based health monitoring system aims to provide continuous and real-time monitoring of patient health conditions using multiple sensors integrated with a microcontroller. Sensors such as temperature, pulse, gas, and smoke sensors are used to collect physiological and environmental data. In addition, GPS technology is incorporated to track the location of the user, enabling timely assistance during emergencies.

II. LITERATURE SURVEY

1. IoT-Based Real-Time Health Monitoring System Using Wearable Sensors: The IoT-Based Real-Time Health Monitoring System Using Wearable Sensors that A. Kumar and S. Verma indicated, (2021) employs a threshold-based analysis technique and MySQL as the database. The system can monitor body temperature and heart rate via wearable sensors and doctors get real-time access. Nevertheless, it is limited in the number of parameters it can monitor, and it lacks location tracking support.

2. Healthcare Monitoring System Using IoT and Cloud Computing: Implemented by J. Lee and H. Park (2021) utilized a decision tree approach and a MongoDB database. This system combines IoT sensors with cloud services to allow 24/7 patient monitoring. Although it has many merits, the system is very reliant on the internet and there are issues related to the security of data.

Paper Name	Author Name	Year	Algorithm	Database	Observation	Drawbacks
IoT-Based Real-Time Health Monitoring System Using Wearable Sensors	A. Kumar, S. Verma	2021	Threshold-Based Analysis	MySQL	Monitors body temperature and heart rate using wearable sensors and provides real-time access to doctors.	Limited parameters and no location tracking.
Smart Healthcare	J. Lee, H. Park	2021	Decision Tree	MongoDB	Integrates IoT sensors	Internet dependency
Monitoring System Using IoT and Cloud Computing					with cloud services for continuous patient monitoring.	and data security concerns.
IoT-Based Patient Health Monitoring with GPS Tracking	R. Sharma, P. Gupta	2022	Threshold Logic	Firebase	Combines health monitoring with GPS tracking and emergency alerts.	Poor indoor GPS accuracy and high battery usage.
Wearable IoT Health Monitoring System for Emergency Alerting	S. Patil, K. Kulkarni	2022	Event-Driven Algorithm	Cloud Database	Triggers emergency alerts when abnormal health conditions are detected.	False alerts due to sensor fluctuations.
Intelligent Health Monitoring System Using IoT and Machine Learning	L. Chen, X. Wang	2023	Support Vector Machine	NoSQL	Uses machine learning to predict abnormal health patterns.	Requires large datasets and high computation.

3. Based Patient Health Monitoring with GPS Tracking: R. Sharma and P. Gupta (2022) have developed the IoT-Based Patient Health Monitoring with GPS Tracking, which is mainly based on threshold logic and makes use of Firebase. This system is a great combination of health monitoring, GPS tracking, and emergency alerts, which can essentially help in remote patient supervision. Unfortunately, their system is still experiencing time inaccuracies with indoor GPS and power-hungry operation.

4. Wearable IoT Health Monitoring System for Emergency Alerting: Emergency Alerting by S. Patil and K. Kulkarni (2022) implements an event-driven algorithm that saves data in the cloud. It sets off emergency alerts whenever it detects abnormal health condition so that response time can be shortened. The biggest disadvantage is the risk of false alarms resulting from the sensor noise.

5.Intelligent Health Monitoring System Using IoT and Machine Learning: L. Chen and X. Wang (2023) utilize a Support Vector Machine along with a NoSQL database. The system is based on machine learning to forecast abnormal health conditions in a way that makes it smarter and more anticipative. On the other hand, it needs huge datasets and powerful computational resources, thus leading to a more complicated system.

III. EXISTING SYSTEM

In the existing safety monitoring systems used in mining and defence sectors, most operations rely heavily on manual supervision, periodic inspections, and basic protective equipment**.** Traditional safety systems include tools such as helmets, gas detectors, and handheld communication devices, which provide only limited and localized data. In many cases, separate devices are used for different parameters, and there is no centralized system for continuous real-time monitoring of a worker's health and environmental conditions.

In the mining industry, for example, gas sensors and ventilation alarms are often installed at specific points within the mine rather than being worn by each individual worker. This means hazardous changes in temperature, humidity, or toxic gas levels may go unnoticed until it is too late. Similarly, in defence environments, soldiers depend mainly on manual status reporting or radio communication, which can be unreliable in remote or combat situations.

The existing systems also lack integration between human health monitoring and environmental sensing**,** as well as automatic alert mechanisms and location tracking features. Moreover, there is no IoT-based framework for securely transmitting data to a central monitoring platform for real-time analysis. These limitations make it difficult to ensure immediate response in emergencies, increasing the risk of injuries, fatalities, and loss of operational efficiency.

IV. METHODOLOGY

Health and environmental sensors such as temperature, pulse, gas, and smoke sensors are connected to the Arduino microcontroller to collect real-time data. The Arduino continuously reads sensor values and performs basic processing to identify abnormal or unsafe conditions. GPS module is used to track the real-time location of the user for safety and emergency response purposes. The processed sensor data is transmitted to the backend server using a communication module. The backend system is developed using web technologies and stores data in a database for real-time monitoring and historical analysis. A web-based application allows doctors and authorized users to view patient sensor data and location information. Automatic alerts are generated and displayed when sensor readings exceed predefined thresholds, enabling timely medical or safety intervention.

1. Soldiers: Primary users of the system whose health, load, and location data are continuously monitored to ensure safety and well-being during missions

2. Commanding Officers/Military Supervisors: Responsible for monitoring real-time data through the Android application to make quick and informed decisions in emergencies.

3. Medical Team/Field Doctors: Utilize the health data to provide immediate medical support or evacuation assistance when abnormal readings are detected.

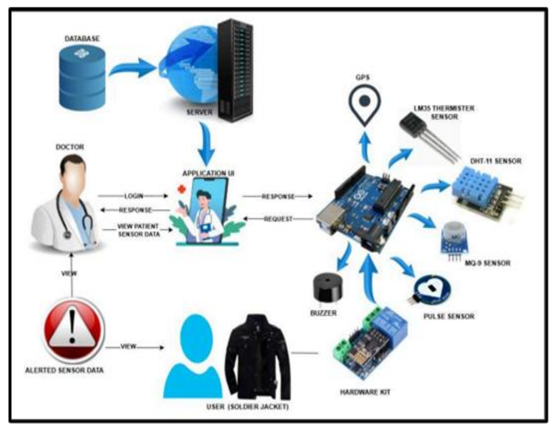
4. System Developers/Engineers: Involved in designing, programming, and maintaining the hardware and software components of the monitoring system.

5. Defence Organizations/Military Authorities: Oversee deployment, data security, and operational efficiency of the system within defence networks.

6. Research Institutions/Technical Experts: Contribute to improving system accuracy, reliability, and sensor integration through innovation and testing.

7. Government and Defence Ministry: Provide funding, policy guidelines, and authorization for implementation in real-world defence operations.

System Architecture



Advantages of the Proposed System:
1. To design and integrate multiple sensors (temperature, heart rate, gas, humidity, and motion) into wearable clothing for real-time data acquisition.
2. To monitor necessary health parameters such as heart rate, body temperature, and physical activity level of the wearer.
3. To detect and alert hazardous environmental conditions like high temperature, toxic gases or lack of oxygen in mining areas.
4. To real-time positioning and quick rescue operations in case of emergencies.

V. CONCLUSION

The proposed Smart IoT Clothing for Miners and Soldiers with Location Tracking provides an innovative and practical solution to address the safety challenges faced in hazardous working environments. By integrating advanced sensors, IoT communication, and GPS technology, the system enables continuous monitoring of health parameters and environmental conditions in real time. This ensures early detection of potential dangers such as toxic gas exposure, abnormal temperature, or health irregularities, thereby reducing the risk of accidents and improving emergency response times. In conclusion, this project demonstrates how the convergence of IoT, wearable technology, and real-time analytics can significantly enhance personal safety, operational efficiency, and proactive hazard prevention. The system can also be expanded in the future with AI-based predictive models, long-range communication modules, and advanced biometric sensors to create a fully intelligent and autonomous safety network for diverse industrial and defence applications.

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