IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 4, April 2024

DOI: 10.17148/IJARCCE.2024.134123

IMPLEMENTATION OF SOLAR BASED E-UNIFORM FOR SOLDIERS

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Abstract: The Soldier Health Monitoring System (SHMS) is a comprehensive solution designed to ensure the well-being of military personnel by continuously monitoring vital health parameters. This system incorporates a range of sensors, including a Heartbeat sensor, Temperature Sensor, Vibration Sensor, and GPS, interfaced with an Arduino microcontroller and Nodemcu for real-time data acquisition and analysis. The system provides valuable insights into a soldier's health status, allowing for timely intervention in case of anomalies. The core components of the system include a Heartbeat sensor for monitoring pulse rate, a Temperature Sensor for body temperature measurement, and a Vibration Sensor to detect external impacts or abnormal movements. These sensors are connected to an Arduino microcontroller, which processes the data and displays it on an LCD screen. Additionally, a GPS module is integrated to track the soldier's location, enhancing situational awareness. The Soldier Health Monitoring System features a relay and a Peltier device to regulate body temperature. In extreme environmental conditions, the Peltier device can be activated to either cool or heat the soldier's body, ensuring optimal physiological conditions. The relay also enables the triggering of alerts or alarms in emergency situations. To enhance communication and situational awareness, the system utilizes a Nodemcu module for wireless connectivity. In the event of abnormal health parameters or critical situations, the Soldier Health Monitoring System is programmed to send instant notifications to designated recipients through various communication channels, such as SMS or email. The combination of real-time health monitoring, environmental adaptation, and intelligent alert mechanisms makes the Soldier Health Monitoring System an effective tool for safeguarding the well-being of military personnel. This technology not only ensures prompt medical attention in emergencies but also facilitates proactive measures to optimize soldier performance and mission success.

Keywords: Microcontroller ATmega16a, solar panel, rechargeable battery, temperature sensor , heartbeat sensor, Peltier plate, GSM, GPS.

1. INTRODUCTION

In today's world, warfare is an important factor in any nation's security. One of the important and vital roles is played by the army soldiers. There are many concerns regarding the safety of soldiers. So for their security purpose, many instruments are mounted on them to view their health status as well as their real time location. One of the effective device which can be implemented to get the health status and location is, soldier's health monitoring and position tracking system. This system basically focuses on soldier's health in terms of body temperature and heart beat using sensor. If soldier gets injured and becomes unconscious by gunshot or due to any other reason, then heart beats start increasing or decreasing gradually. In this type of situation where the information about current heart beat rate becomes the indispensable part of soldier, this project emerges out as best to acknowledge at server site with the correct and information. If heart beat either increases above critical level or decreases below the critical level, a message is sent to the base station with relevant information and exact location. The message is containing heart beat rate, body temperature, longitude and latitude, it will be automatically sent to base station with the help of Nodemcu modem.

The armed forces of tomorrow swear to the newest technology in the modern world which we have ever observed. The Military Services are fastly moving and approaching new inventions with more development now-a-days. The most crucial and necessary character is played mostly by the army forces in war. Soldier physical health is one of the most important one because they are the protectors who protect our country from enemies. Many things are there to do in order to safeguard our soldier life. Knowing the exact spot of the soldier where he is and also the physical movement of them is very important for the base station to secure them. This project, we have arised with an idea of following the exact spot

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of the army member and also the physical health condition of the soldier in between the fight, which will entitle the persons in the base station to design the war plan accordingly. So, our paper here fully focuses on tracking and following the exact spot of the army members with the help of GPS, which is meant to be very useful for the base camp to know the correct spot of the army member where he is.

In this technological era, every domain is trying to improve in their respective fields and military forces are no exception for it .To protect any nation the infantry soldiers of future will be one of the most technologically advance forces in the world. All over the world a lot of research is going on to develop the technologies for the soldiers safety and nations security is prioritize. The soldier has to face many challenges like loss in war, low ammunition, health issues, crossing borders, travelling in the remote areas etc. So in these situations to get help soldier has to communicate with base station or there should be some facility to guide him. To overcome these difficulties GPS can be used to get the location of the soldier and bio-sensors can be used to get the information about his health. This information will be sent to base station. Base station will be able to provide necessary help to soldier. In addition to this fixed question keys can be provided to the soldier which will allow him to send message to the base station. Here google map can be used to display the locations of soldiers. With the help of google map it is possible to know the current location of each soldier which is displayed on single screen.

In the ever-evolving landscape of military operations, the health and well-being of soldiers remain paramount for mission success. To address this critical aspect, a Soldier Health Monitoring System (SHMS) has been developed, employing advanced technologies such as Arduino microcontroller, LCD display, Heartbeat sensor, Temperature Sensor, Vibration Sensor, Relay, Peltier device, GPS, Emergency Switch, and Nodemcu for comprehensive health monitoring and timely response. The SHMS is a multifaceted solution designed to provide real-time insights into the physiological well-being of military personnel during missions. In dynamic and unpredictable environments, monitoring vital health parameters is essential to ensure the immediate detection of anomalies and the prompt implementation of necessary interventions.

The system incorporates a Heartbeat sensor and Temperature Sensor to continuously monitor the soldier's pulse rate and body temperature. These sensors interface with an Arduino microcontroller, serving as the brain of the system, processing the data and presenting it on an LCD display in real-time. The Vibration Sensor adds an extra layer of safety by detecting external impacts or abnormal movements that may pose a threat to the soldier's health. Environmental adaptation is facilitated through the integration of a Peltier device and relay. The Peltier device regulates the soldier's body temperature, providing thermal comfort in extreme conditions. The relay, in conjunction with an Emergency Switch, enables the soldier to manually trigger emergency protocols, activating alarms and signaling the need for immediate attention. Location awareness is achieved through the incorporation of a GPS module, allowing for precise tracking of the soldier's position. This information is invaluable for mission commanders and rescue teams, enabling them to respond swiftly to emergencies or changes in the operational environment. The Nodemcu module establishes wireless connectivity, enabling the SHMS to transmit real-time health data and emergency alerts to designated recipients. In critical situations, the system is programmed to send notifications through SMS or email, ensuring that relevant parties are informed promptly. In summary, the Soldier Health Monitoring System represents a significant advancement in military healthcare technology. By amalgamating state-of-the-art sensors, adaptive systems, and wireless communication, the SHMS aims to safeguard the health and safety of soldiers, providing a comprehensive and responsive solution for modern military operations.

The mining industry is crucial for the global economy, providing essential resources for various sectors. However, it is also one of the most hazardous industries, with underground mining operations posing significant safety challenges. To mitigate these risks and enhance safety standards, innovative technologies are being developed to monitor and detect potential hazards in real-time. This introduction presents an advanced solution, the "Undermining Detection Robot," which leverages a range of cutting-edge technologies, including Arduino microcontrollers, a diverse set of sensors (metal, fire, gas, ultrasonic, moisture), a water pump, ESP32 CAM module, and real-time monitoring of personnel's health parameters like heartbeat, temperature, Spo2 levels. The system is further enhanced through the integration of an IoT platform, ThingSpeak, and the application of machine learning using Python. Mining operations are often carried out in harsh and unforgiving environments, with numerous safety concerns. Underground mines are particularly prone to hazards such as gas leaks, fires, collapsing structures, and unstable conditions. Detecting these hazards in a timely manner is essential to prevent accidents and protect the lives of the miners. The Undermining Detection Robot is designed to tackle these challenges comprehensively. It is equipped with a range of sensors, including metal sensors to identify potential obstructions or dangerous metallic objects, fire sensors to detect fires, gas sensors to monitor gas levels, humidity sensors to measure environmental moisture, and moisture sensors to address potential water-related issues. The integration of these sensors provides real-time data on the underground conditions, enabling quick responses to potential threats. In addition to environmental monitoring, the robot also considers the well-being of personnel working in these hazardous environments. It incorporates sensors for monitoring health parameters like heartbeat, temperature, and Spo2 levels. This not only ensures the safety of miners but also facilitates immediate responses in case of health emergencies. The Undermining Detection Robot is not just a data collection tool; it also embraces IoT technology through the ESP32 CAM module. This module allows the robot to capture images and stream video from the mining site, enabling remote monitoring and enhanced situational awareness for mine operators. The collected data, both from environmental sensors

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and the ESP32 CAM, is transmitted to the cloud-based IoT platform, ThingSpeak, for real-time data analysis and visualization. Furthermore, the system integrates machine learning using Python. This advanced technology processes the data collected from the sensors, applies predictive algorithms, and learns from historical data to identify potential safety hazards or health-related issues. These predictions are invaluable in ensuring that timely responses and appropriate actions are taken, thereby reducing accidents and improving overall safety standards in underground mining operations. In summary, the Undermining Detection Robot represents a significant leap forward in mining safety technology. By combining multiple sensors, IoT capabilities, and machine learning, this innovative system offers a proactive approach to hazard detection and worker health monitoring. Its potential to revolutionize safety standards in underground mining operations is promising, as it aims to reduce accidents and enhance the well-being of miners, ultimately making mining operations safer and more efficient.

A. PROBLEM STATEMENT

The objective of the system is to provide the real-time continuous monitoring of soldier's health parameters and location tracking using IOT and GSM and GPS module. In emergency situation it helps the solider by providing a panic button which sends and emergency message as well as he voice alert using which he can communicate with command officer and other soldiers. Depending on the message the control room takes the necessary action to save the life of the soldier.

B. OBJECTIVES

Real-time Health Monitoring: Continuously monitor vital health parameters, including heart rate and body temperature, in real-time. Provide immediate feedback on the soldier's physiological condition for proactive health management.

Abnormality Detection: Detect anomalies in health parameters, such as irregular heartbeats or abnormal body temperature, to enable early intervention in case of health issues.

Emergency Alert Mechanism: Integrate an Emergency Switch to allow soldiers to manually trigger emergency alerts in critical situations. Implement a relay system to activate predefined emergency protocols, ensuring rapid response to emergencies.

Environmental Adaptation: Utilize the Peltier device to regulate the soldier's body temperature, adapting to extreme environmental conditions for optimal performance and well-being.

Situational Awareness: Incorporate a GPS module for real-time tracking of the soldier's location during missions. Enhance situational awareness for mission commanders and rescue teams to respond promptly to changing operational scenarios.

Communication and Notification: Employ the Nodemcu module for establishing wireless connectivity. Implement a notification system to send instant alerts via SMS or email to designated recipients in the event of abnormal health parameters or emergency situations.

2. METHODOLOGY

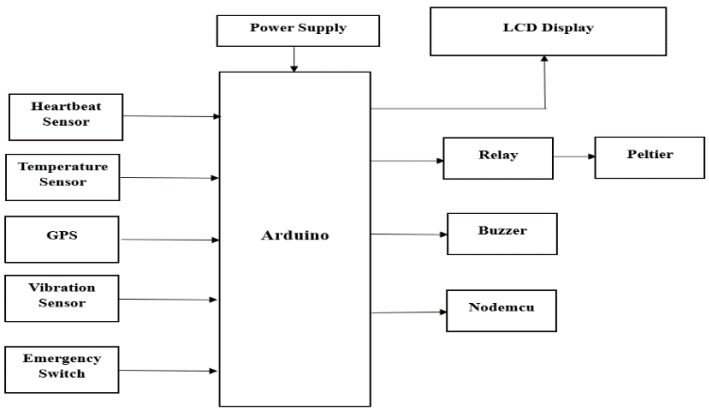

Fig 1. Block diagram

DOI: 10.17148/IJARCCE.2024.134123

The solider health monitoring and position tracking system retrieves the exact location and the health status of a soldier. The sensors collect all the health information such as heart rate, body temperature of the soldier. GPS module gets the exact location of the soldier in terms of latitude and longitude send it to the Arduino board. In order to detect the surrounding environment condition and presence of toxic gases, pressure sensor and gas sensor are implemented. These data will be fed to the Arduino, Arduino IDE code contains the base station number to which the message has to send, which is interfaced to a Nodemcu modem. The Nodemcu and GPS component is used to communicate with the base station regarding the health status and location of the soldier. The Arduino retrieves the exact location details from the GPS and sends an SMS to the concerned base station over Nodemcu modem. An LCD display is connected to the Arduino for displaying the data received before being sent over Nodemcu. This project will be very useful to army base station to keep track of their soldiers. The system is very helpful for getting health status information of soldier and providing them instant help.

1. System Architecture Design: Define the overall architecture of the Soldier Health Monitoring System, outlining the interconnections and functionalities of each component. Identify the communication protocols between sensors, Arduino, and Nodemcu for seamless data exchange.

2. Component Integration: Physically connect the Arduino microcontroller to the sensors (Heartbeat, Temperature, Vibration), LCD display, Peltier device, Relay, Emergency Switch, GPS module, and Nodemcu. Ensure proper wiring and power supply for each component.

3. Sensor Calibration: Calibrate the sensors (Heartbeat, Temperature, Vibration) to ensure accurate and reliable data readings. Establish threshold values for abnormal readings that trigger emergency alerts.

4. Arduino Programming: Develop Arduino code to read data from sensors, process the information, and display it on the LCD screen. Implement logic for anomaly detection and emergency alert triggers based on sensor readings.

5. Emergency Switch and Relay Integration: Configure the Emergency Switch to activate the relay in emergency situations. Program the relay to initiate predefined emergency protocols, such as sounding alarms or sending alerts.

6. Peltier Device Control: Write code to control the Peltier device based on temperature readings. Implement logic to adjust the Peltier device for heating or cooling based on environmental conditions.

7. GPS Integration: Interface the GPS module with the Arduino to obtain real-time location data. Incorporate GPS data into the system to enhance situational awareness.

8.Nodemcu Programming: Develop code for the Nodemcu module to establish wireless communication. Implement protocols for sending health data and emergency alerts to designated recipients via SMS or email.

1. *EXISTING SYSTEM*

- For a number of essential illnesses including the critical body condition of soldiers, existing research has already demonstrated the added usefulness og GPS and temperature based prediction using ML.
- The increased allowing quicker and more recise diagnostic decision – making will lessen the burden of severity.
- Prediction testing, any irregularity in the heart beat, temperature, blood pressure, ECG and oxygen rate of the soldier may result in finding severity.
- Symptoms include chest discomfort, shortness of breath, disorientation, and fainting.

2. *PROPOSED SYSTEM*

- The proposed system is based on IOT concept.
- The proposed system will be helpful in the real time continuous monitoring of soldiers health parameters and whether soldier's physical condition is normal or critical to predict the severity of the soldier by sending message to control room.
- There is continuous communication between the control room and the soldiers.
- Depending upon the climatic condition the proposed system will maintain the human body temperature by producing the heat to maintain the normal temperature of the human body.
- The proposed system will also allow the soldier's uniform to change the color according to the surrounding

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where it is useful when the intruders attack.

3. MOTIVATION

- To overcome the unpredictable climate conditions faced by military personnel, we are proposing solar based e – uniform.
- E – uniform project is a strategic investment, promising enhanced mission capabilities, reduced long term costs, and a positive global perception as we lead the way in green military innovation.

3. RESULTS

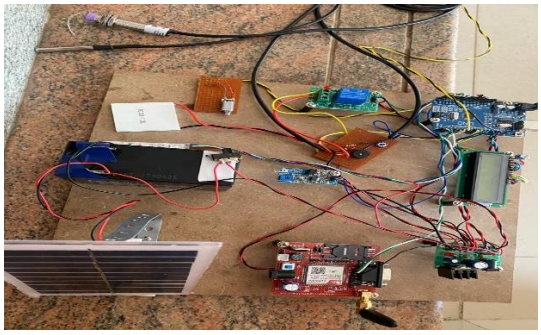

Fig 2. Prototype of the model

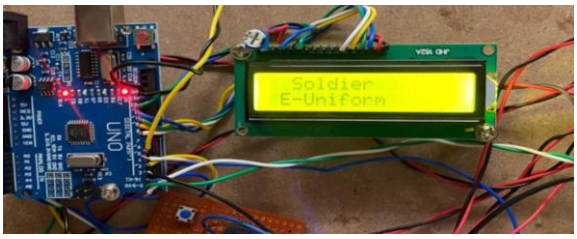

Fig 3. Display when system is turned ON

Fig 4. Temperature display

Fig 5. Pulse rate display

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Fig 6. Emergency display

4. ***Conclusion and future scope***

5. ADVANTAGES

1) Real-time Health Monitoring
2) Early Anomaly Detection
3) Emergency Response Mechanism
4) Environmental Adaptation
5) Situational Awareness
6) Customizable Alert Thresholds

6. APPLICATIONS

- Sleep Tracking
- Anxiety monitoring
- Remote patient monitoring/alarm system
- Health bands
- Advanced gaming consoles

7.CONCLUSION and FUTURE SCOPE

This system can provide more safety to soldiers by adding heart rate sensors, temperature sensors and Nodemcu and GPS modules for the purpose of communication and location of soldiers. By using this sensor base station can monitor physical status of soldier. And they can be given medical instruction to overcome the problems. We can add display section to this project. This will help to display digital map, which shows the position of all soldiers to the unit, which will help them to locate the target, and attacks can be avoided.

8. FUTURE SCOPE

1. Integrating solar panels into the uniform could power devices and equipment, reducing the need for heavy batteries and increasing soldier's mobility and endurance.

2. Uniforms could be adapted for various climates and environments, providing soldiers with reliable power sources even in remote or challenging locations.

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