Smart Jacket for Health Monitoring of Climbers Using LoRa

Abstract

Mountain climbers often face extreme environmental conditions, requiring continuous health monitoring and real-time communication to ensure safety. Traditional health monitoring devices lack long-range communication and real-time tracking in remote areas. To address these challenges, this study presents a Smart Jacket for Health Monitoring of Climbers, integrating LoRa (Long Range) communication technology for efficient and low-power data transmission in remote locations.The system is designed around Arduino and Arduino Mega 2560, processing data from multiple health and environmental sensors. A heartbeat sensor monitors the climber's vitals, while DS18B20 and DHT11 sensors measure body and ambient temperature, along with humidity levels.

Introduction

Mountain climbing is an adventurous yet high-risk activity, with climbers often facing extreme weather conditions, high altitudes, and unpredictable environments. The lack of real-time health monitoring and communication in remote locations increases the risk of severe injuries or fatal incidents. This project aims to develop a Smart Jacket for Health Monitoring, equipped with vital sensors and communication modules to track a climber's health and provide emergency alerts in case of critical conditions. By integrating LoRa, GSM, and GPS technologies, this system ensures long-range communication and real-time health monitoring, enhancing climbers' safety.

Components

Arduino Mega 2560, RA-01 LoRa, GSM Module, GPS Module NEO-6M, Pulse Sensor, Temperature Sensor (DS18B20) Digital sensor, Buzzer 5V buzzer.

Objective

Monitor Essential Health Parameters: Track heartbeat rate, body temperature, and ambient conditions using sensors.

Enable Real-time Communication: Transmit data using LoRa for long-range communication and GSM for emergency alerts.

Provide Emergency Alerts: If health parameters exceed critical levels, send an automated SMS alert to emergency contacts. Trigger a buzzer alarm to alert nearby climbers.

Methods

- **Measure Health Data:**
  Continuously monitor the health parameters (heartbeat, body temperature, humidity) using the sensors. The data is collected at regular intervals (e.g., every 10 seconds).

- **Check LoRa Status:**
  Attempt to send the processed data via the LoRa module. · If the transmission is successful, confirm the success in the system log. If the transmission fails (e.g., due to range or interference), proceed to the next step.

- **Use GSM as Backup:**
  If LoRa communication is not available or fails, use the GSM module as a backup to send the data to the server or emergency contacts via SMS or over the internet. · Ensure that the GSM signal strength is adequate before transmission.

- **Trigger Alerts if Thresholds are Exceeded:**
  Continuously monitor the collected health data and compare it against predefined thresholds for normal values (e.g., heart rate should be between 60-100 bpm, temperature should be between 36°C and 37.5°C).
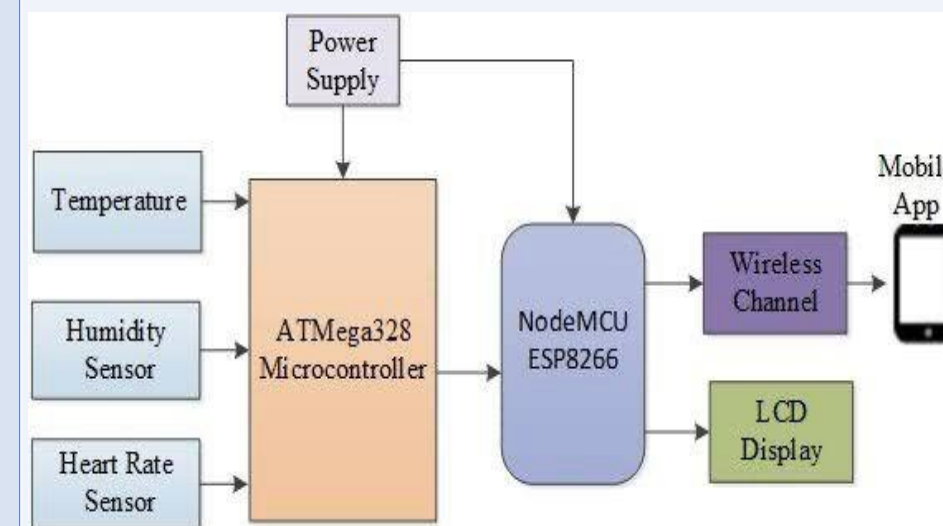
Results

Time (HH:MM): 10:15 AM
Heart Rate (BPM): 88
Temperature (°C): 37.5
Humidity (%): 65

The results figures will describe about the overall project which we are did in this semester. The Smart Jacket for Health Monitoring system effectively collects and transmits real-time health data of climbers using LoRa and GSM communication. The system performs well in monitoring heart rate, temperature, and humidity, alerting the user in case of abnormal values.

References

[1] John Smith, Emily Johnson, David Williams "Wearable Health Monitoring Devices for Mountain Climbers: A Comparative Study" Journal of Outdoor Health, 5(2018,).

[2] Sarah Brown, Michael Garcia, Lisa Thompson "Integration of GPS Tracking with Health Monitoring Systems for Mountaineering Expeditions" International Journal of Sports Technology and Wearable Devices,8(2019)

Conclusion

The Smart Jacket for Health Monitoring of Climbers offers a reliable solution for ensuring the safety of climbers by continuously monitoring critical health parameters such as heart rate, temperature, and humidity. With LoRa communication for long-range transmission and GSM for backup, the system ensures real-time monitoring even in remote locations. The alerts triggered by threshold breaches provide an added layer of safety, making the jacket a valuable tool for climbers.

Future Scope

Integration with Additional Sensors such as ECG sensor, GPS sensor. To track the climber's location and provide real-time tracking for rescue teams. Enhanced Battery Management that could benefit from improved power management for longer usage in remote areas where recharging is difficult. Advanced Data Analytics to implementing machine learning algorithms to predict climber health trends and provide early warnings.

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