

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Smart Wearable for Mountaineers

Kinshuk Makhija¹, Ravi Prakash², Rishabh Pandey³, Sushma Kumari⁴, Navneet Kumar Pandey⁵

¹Department of Electronics and Communication Engineering, Babu Banarasi Das Institute of Technology and Management, Lucknow ²Department of Electronics and Communication Engineering, Babu Banarasi Das Institute of Technology and Management, Lucknow ³Department of Electronics and Communication Engineering, Babu Banarasi Das Institute of Technology and Management, Lucknow ⁴Department of Electronics and Communication Engineering, Babu Banarasi Das Institute of Technology and Management, Lucknow ⁵Assistant Professor, Department of Electronics and Communication Engineering, Babu Banarasi Das Institute of Technology and Management, Lucknow ⁵Lucknow

ABSTRACT

Mountain climbing in remote regions poses serious risks due to harsh environmental conditions and limited communication access. To address this, we propose a compact, wearable safety device designed to monitor external conditions and assist in emergencies. The system, built using two Arduino Uno boards, integrates ambient sensing and wireless communication to transmit alerts over long distances. It includes a DHT11 sensor for ambient temperature, BMP280 for pressure and altitude, MPU6050 for fall detection, and a NEO-7M GPS module for real-time location tracking. A 16x2 LCD provides live data feedback, while a panic button enables manual SOS transmission. Fall detection triggers automatic alerts, whereas manual intervention is also supported for distress signalling. Communication between the wearable and base station is handled via LoRa Ra-02 modules for reliable long-range data transfer. This low-cost, rugged solution is ideal for climbers, trekkers, and rescue teams, enhancing safety and enabling quicker response in isolated environments where time is critical.

Keywords: Arduino Uno , Lora RA02 , NEO 7M GPS , SOS ALERT

1. INTRODUCTION

Mountain climbing demands not only physical endurance but also readiness for sudden environmental changes and unpredictable accidents. Climbers often navigate remote terrains where temperature drops, low air pressure, and isolation can turn minor issues into life-threatening emergencies. Traditional wearables and mobile communication devices frequently fall short due to limited range, battery constraints, or fragile design. To address these challenges, this project presents a microcontroller-based wearable safety system tailored for mountain climbers and remote explorers. The system is lightweight, durable, and capable of monitoring critical ambient parameters while offering emergency communication capabilities. Built around two Arduino Uno boards—one on the wearable unit and one at the receiver end—it enables real-time sensing and long-distance communication using LoRa Ra-02 modules. The wearable monitors ambient temperature (DHT11), pressure and altitude (BMP280), and movement (MPU6050 for fall detection). A NEO-7M GPS module tracks the climber's location, while a 16x2 LCD displays live data. A panic button allows the user to send a manual SOS alert with GPS coordinates, while the MPU6050 can detect sudden falls and trigger automatic alerts.

This project aims to strike a balance between simplicity, reliability, and effectiveness—ensuring that even in disconnected, rugged regions, climbers have a safety net that communicates vital information when it matters most.

1.1 Components

Table 1 - Components

| S.NO | NAME | QUANTITY |
|------|-------------|----------|
| 1. | Arduino Uno | 2 |
| 2. | LORA RA02 | 2 |
| 3. | BMP280 | 1 |
| 4. | MPU6050 | 1 |
| 5. | NEO7M GPS | 1 |



1.2 Major Components

Arduino Uno

The Arduino Uno is the central microcontroller used in both the wearable (sender) and receiver units. Its simplicity, wide community support, and sufficient I/O pins make it ideal for integrating multiple sensors and modules. One Uno collects sensor data and sends alerts, while the other receives data and activates responses.

Fig. 1 - Arduino Uno

• LoRa Ra-02

LoRa Ra-02 modules enable long-range, low-power wireless communication between the sender and receiver. Operating at 433 MHz, LoRa can transmit signals over several kilometers in open areas—perfect for mountain or forest environments where mobile networks fail. It ensures reliable delivery of both routine data and SOS alerts.



Fig. 2-LORA RA-02

• NEO-7M GPS

The NEO-7M GPS module provides accurate geolocation with latitude and longitude coordinates. It continuously tracks the user's position, which is included in SOS transmissions triggered either by a fall or the panic button. Its high sensitivity and built-in EEPROM make it reliable for outdoor use.



Fig. 3- NEO7M GPS

• DHT11,BMP280,MPU6050 Sensors

DHT11 Monitors ambient temperature, BMP280 Measures pressure and calculates altitude and MPU6050 Detects sudden motion or falls through accelerometer and gyroscope data.

12946

1.3 Block Diagram



Fig. 1 - Block Diagram of smart wearable

2. Working

• Sensing

The wearable collects ambient temperature and humidity data using the DHT11 sensor and motion data via the MPU6050 accelerometer. GPS coordinates are captured using the NEO-7M module to track the wearer's real-time location.

• Check

The microcontroller checks for fall incidents using abrupt acceleration changes from the MPU6050. It also continuously listens for a manual SOS trigger via the panic button.

• Display

Current temperature, altitude, pressure and GPS location are displayed sequentially on the LCD screen. Automatically updated for real-time updates

• SOS

If a fall is detected or the panic button is pressed, an SOS signal is sent via the LoRa module. The receiver side triggers an LED and buzzer alert while displaying location details to aid rescue.

Power

Power to the circuit will be provided by a power bank which ensures reliable supply

3. Features

- Detects sudden falls or abnormal motion using the MPU6050 accelerometer, enabling automatic emergency response.
- Uses the NEO-7M GPS module to fetch and transmit real-time coordinates for easy location tracking during distress.
- Includes a dedicated panic button that the user can press to manually send an SOS alert with location data.
- Transmits data and alerts over long distances using LoRa modules, suitable for remote or mountainous regions with no cellular network.
- Built into a wearable arm/shoulder unit, it ensures hands-free operation and comfort over heavy mountain clothing. Scalable and flexible
 design leaving room for future upgrades

4. Result

This wearable safety system provides a reliable solution for monitoring and protecting mountain climbers in challenging environments. By integrating temperature sensing, fall detection, GPS tracking, and LoRa-based SOS alerting into a compact, wearable design, the project enhances real-time awareness and ensures quick response during emergencies. Its modular build and long-range communication capabilities make it a practical and life-saving tool for adventure, rescue, and remote operations. This device can potentially save lives by ensuring quick response during accidents, even in areas without mobile connectivity. Its hands-free operation and long-range alert system make it ideal for mountaineers, trekkers, and search-and-rescue personnel operating in rugged conditions.

References

[1] Smart Jacket for Health Monitoring of Climbers Using LoRaWAN Technology, Nirmaladevi P, Gandhirajan T, Dineshkumar R, Gobinath T,2024, ResearchGate

[2] Intelligent Safety Life Jacket Using WSN Technology, Dr. Neethu P S,2023 ResearchGate

[3] Wearable Technology in Jacket for Tracking Person, Rajkumar D Bhure, S Pavan, K Rakesh, 2021 IRJMETS

[4] Mountaineer Health and GPS Tracking Project, Smital Dhanraj Patil, Tejas Satish Patil, Janhavi Anil Mali, Gitai Girish Bhagwat, Shridhar Pandit Pawar, 2022 IJRPR

[5] Mountain Climber Monitoring System, Asarla Anusha, Kotha Ravi Teja, Suragani Srikanth, Muthyala.V. V Satya Chowdary, 2022 IJIRT

[6] LoRa-Based IoT System for Emergency Assistance and Safety in Mountaineering, Deeksha Rai Sharma, Rohini Ravindrasingh Raghuwanshi, Tanvi Chandak, Dipali Ramdasi, 2023 IIETA