STM JOURNALS

Journal of
Communication Engineering & Systems

ISSN: 2249-8613 (Online)
ISSN: 2321-5151 (Print)
Volume 13, Issue 1, 2023
DOI (Journal): 10.37591/JoCES

http://computerjournals.stmjournals.in/index.php/JoCES/index

Review JoCES

Mountaineer's Health and GPS Tracking System

Krutika Bhagane[1], Nikhil Bhosale[1], Abhishek Gambre[1], Shrutika Khobragade[2,*]

Abstract

Mountaineering is always a fun and adventurous activity. But mountaineering comes with a lot of risks. Mountain climbers have heavy chances of mishaps. Search and rescue efforts frequently fail when a similar tragedy takes place in a rural area or at a high elevation. As a result, the search and rescue team is ignorant of the accident's location or whether or not the individual is alive and, if so, what condition he is in. The real-time monitoring of mountaineers' vital signs and the IoT tracking of their whereabouts are both made possible by this project. This entails live heartbeat monitoring, GPS location tracking, an altimeter, fall detection, and a barometer sensor to assess a mountaineer's health. This information is transmitted via the IoT for live monitoring in the form of SMS to the mountaineer's device using their configured or saved contact number.

Keywords: IOT, heartbeat sensor, GPS tracking, fall detection

INTRODUCTION

Mountaineering has continuously been an adventurous and growing activity. However, with a journey comes risk. Mountain climbers square continuously measure risks about getting injured or accidents. When such an incident occurs at a high altitude or in a remote area, search and rescue operations are not always successful because the rescue team may not receive accident information for hours or even days, they cannot identify the scene of the accident, they cannot determine whether the person involved is alive or dead, and if they are still alive, they cannot tell how they are faring. The sensible adventurer permits groups to trace organs of climbers in real time as to keep track of their location with the help of IOT [1].

Teams can track climbers' vitals and track their whereabouts using IOT thanks to the smart mountain climber. A heartbeat and temperature sensor, a mega controller, a Wi-Fi module, an LCD display, and a GSM module are all used in the system's construction. The pulse sensor is used to track and transmit the user's heart rate to the controller [2, 3].

***Author for Correspondence**
Shrutika Khobragade
E-mail: shrutikak@mes.ac.in

[1]Student, Department, of Computer Engineering, Pillai HOC College of Engineering and Technology, Rasayani, Maharashtra, India
[2]Assistant Professor, Department, of Computer Engineering, Pillai HOC College of Engineering and Technology, Rasayani, Maharashtra, India

Received Date: April 17, 2023
Accepted Date: May 19, 2023
Published Date: June 01, 2023

Citation: Krutika Bhagane, Nikhil Bhosale, Abhishek Gambre, Shrutika Khobragade. Mountaineer's Health and GPS Tracking System. Journal of Communication Engineering & Systems. 2023; 13(1): 25–32p.

The GPS tracking aspect of the system typically involves using a GPS device or smartphone app to track the climber's location in real-time. This information can be displayed on a map, allowing friends, family, or rescue teams to keep track of the climber's progress and ensure their safety.

The health monitoring aspect of the system may include wearable devices such as fitness trackers or smartwatches that monitor a climber's heart rate, blood oxygen levels, and other vital signs. This information can be used to alert the climber or rescue teams if the climber's health is in danger, such as if their heart rate suddenly increases or their blood oxygen levels drop.

It is necessary to note that while these systems can provide necessary information, they should not be relied upon solely for safety during mountain climbing. Climbers should always have a comprehensive understanding of the risks associated with their activity and take appropriate safety precautions. Additionally, these systems can sometimes be limited by poor or absent GPS or cellular coverage in remote areas, so it is always wise to carry backup navigation and safety equipment.

LITERATURE SURVEY

This project uses a heartbeat sensor and GPS to monitor the health and position of a mountain climber. The heartbeat sensor measures the speed of the heartbeat and provides an economical alternative to more expensive methods like electro-cardiograms. GPS tracking helps us monitor the climber's position in real-time, ensuring their safety. The Global Positioning System (GPS) is a satellite-based navigation system that transmits data regarding the numbers, positions, and times of the satellites. The GPS receiver utilizes this data to calculate the separations between the GPS satellites. This project combines these two technologies to create a valuable tool for monitoring the health and safety of mountain climbers.

This project focuses on health monitoring and position tracking using two primary components: a heart pulse sensor and GPS. Our team has developed an Arduino-based Heart Rate Monitor System that utilizes a practical heartbeat sensor to measure the speed of the heartbeat. While electro-cardiograms (ECGs) are commonly used to measure heart rates, they can be costly. Additionally, other devices like wrist watches that measure heart rates exist, but they may not be cost-effective. For temperature measurement, thermometers are commonly used, and for blood pressure monitoring, sphygmomanometers are employed. These devices are accurate but can be expensive. Therefore, our proposed heart rate monitor with a heartbeat sensor is a valuable tool for monitoring the pulse and temperature of a mountain climber.

In addition to the heartbeat sensor, we use GPS to track the position of the climber. GPS is a navigation system, and it consists of a total of 24 satellites that orbit the Earth. Each satellite transmits its own number, where it is in space, and the time when the information was sent. These signals are captured by the GPS receiver, which measures the distance between itself and the GPS satellites. This allows us to track the position of the mountain climber in real-time, making it easier to ensure their safety.

EXISTING SYSTEM

For monitoring the actual condition of a climber and tracking its position we require certain gadgets. Gadgets like Smart watch offer features through sensors like pulse heart rate sensor, calorie counter, GPS tracking, temperature sensors and others. Gadget like GPS mobile phones which are specially built to track the exact location of a person are shown in Figure 1.

The following are some benefits and features of certain devices:

- Live Heartbeat Monitoring Sensor.
- Upper and Lower Limit Settings.
- IOT Live Vitals Display.
- GPS Location Tracking.
- Live monitoring results are displayed.

As per the given existing system, gadgets like Smart watch provide features of heart pulse monitoring and GPS tracking; also, a dedicated GPS mobile device/gadget which keeps an accurate live tracking on the movements of a person/climber. But the major drawback is the pricing at which an individual device provides the feature respectively. For example, a single GPS tracking gadget provides greater features of tracking a person's position but it will cost around Rs. 6000 to 8000 in INR.

Figure 1. Available gadgets.

SURVEY TABLE

The description, as shown in Table 1, has been compiled with the assistance of various authors.

Table 1. Different authors' descriptions.

S. No.	Author	Title	Description
1.	Patil and lyer [4]	Monitoring the health and Position Tracking 2017	The paper describes a health tracking and monitoring system powered by the Internet of Things (IoT).
2.	Thananant *et al.* [5]	Development of IoT Heartbeat and Body Temperature Monitoring System 2020	Both the body temperature and the heart rate can be determined by the portable measurement gadget. The invention makes use of an Arduino board that is wired up to a temperature and cardiac sensor.
3.	Zhihua *et al.* [6]	Design of Portable Barometric Altimeter System 2022	This work completes the design and implementation of the air pressure height detection system based on the air pressure sensor SCP1000-D01, improving the detection accuracy and sensitivity of the air pressure height.
4.	Gupta *et al.* [7]	IoT Based Fall Detection Monitoring and Alarm System 2020	A complete algorithm has been designed for the detection of genuine fall.

PROPOSED SYSTEM

GPS tracking and a heartbeat sensor are used in an Arduino-based heart rate monitor. We are employing a variety of sensors in our project, including heart rate sensors, body temperature sensors, barometer sensors, altimeter sensors, and accelerometer sensors. We are using a GSM module to track our position and an LCD×2 display to show the sensor data. The Arduino Mega 2560 is concurrently connected to all of these [8].

With the use of LEDs, a photodetector, specifically created optics, and sophisticated low-noise analogue signal processing, the heart sensor can precisely measure pulse oximetry and heart rate. Consequently, the sensor is configured and ready to use to track heart rate. For non-contact temperature measurements, an infrared thermometer is connected to a body temperature sensor. Additionally, a barometer and altimeter sensor, which is excellent for all types of weather sensing, are employed for fall detection purpose.

A handy tool that measures heart rate using an electrical Heartbeat Sensor is the Heart Rate Monitor System with Arduino. When compared to conventional techniques like the sometimes-expensive

Electro-cardiogram (ECG), the device is made to be more effective and efficient. By placing the Heartbeat Sensor on the subject, the sensor detects the pulsation and calculates the heart rate [9].

The proposed heart rate monitor can also measure body temperature using a thermometer and arterial pressure using a sphygmomanometer, making it a useful instrument for mountain climbers. The device also includes other sensors such as an Accelerometer, Barometer, and Altimeter Sensors, which are commonly used in electronic devices, smartphones, and wearable devices to measure acceleration, atmospheric pressure, and altitude.

In addition, the device uses the Global Positioning System also known as GPS to measure the distance between the GPS receiver and the GPS satellites, which is useful for navigation purposes. The GPS system consists of 24 orbiting satellites which transmit three bits of information: satellite number, location in space, and time of transmission. This data is used by the GPS receiver to calculate its distance from the GPS satellites.

Overall, the Heart Rate Monitor System, which uses an Arduino board and a heartbeat sensor, is an economical and effective tool for measuring heart rate, body temperature, and arterial pressure. It employs GPS for navigation and has other sensors such an accelerometer, barometer, and altimeter. Here, the accelerometer serves as a sensor for detecting falls. A barometric pressure sensor measures air pressure; as a result, it can be used to track an object's precise location and to keep track of the weather. When calculating altitude, or the height of a spot above sea level, an altimeter is utilized [10].

METHODOLOGY

As shown in Figure 2 is the given circuit diagram.

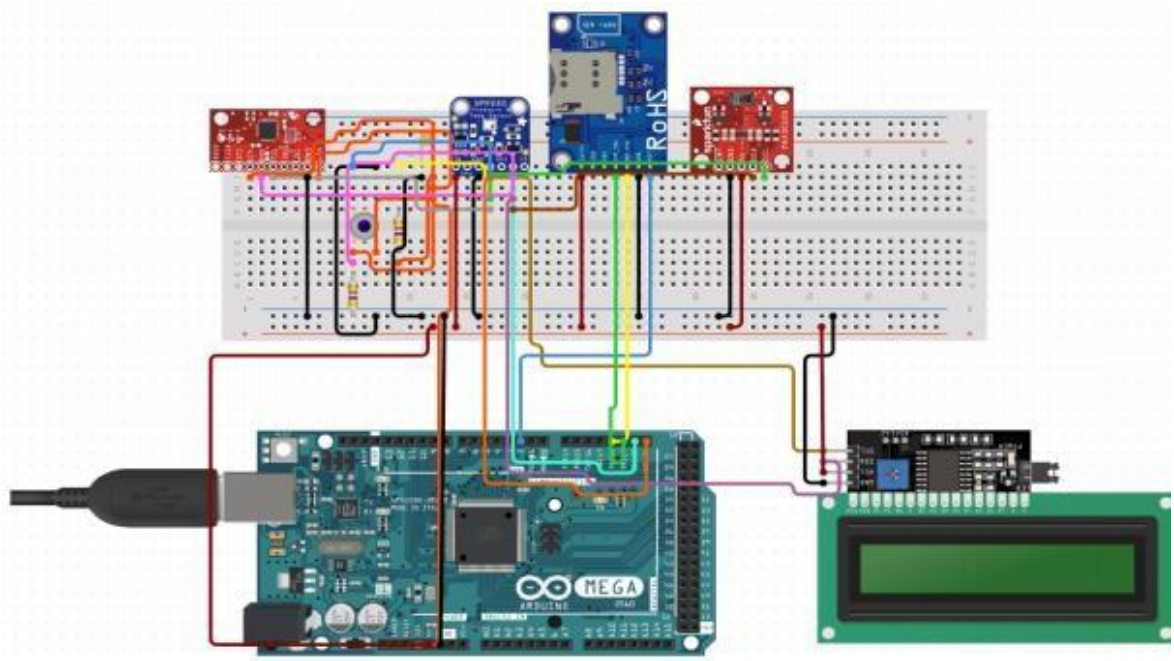

Figure 2. Circuit diagram.

Arduino Mega 2560

A microcontroller board called the Arduino Mega 2560 is based on the ATmega2560 microcontroller. It is a larger and more powerful version of the popular Arduino Uno board, with more input/output pins, more flash memory, and more RAM. The board has 16 analogue inputs, 54 digital input/output pins, including 15 that can be used as PWM (pulse width modulation) outputs, 4 UART power jacks, a reset button, and a USB port for programming and computer communication. Applications for the Arduino

Mega 2560 board span from straightforward LED blinking and sensor reading to more intricate projects requiring numerous sensors, communication interfaces, and high-speed data processing. It is widely used in robotics, automation, and IoT (Internet of Things) projects, and is compatible with a large number of shields and libraries that can be used to extend its functionality [11].

Pulse Sensor

A sensor is a tool that generates a signal corresponding to the quality being measured. The physical characteristic being monitored is converted by the sensor into a signal that can be electronically measured. A sensor is often used with other electronics but can also be a mechanical sensor. There are large sensors available for various applications. In this project, we use Biomedical sensors.

Connections

Connect the + and - pins to the 5 V and GND pins on the Arduino, respectively.

Connect the analog output pin to any analog input pin on the Arduino, for example, A0.

Temperature Sensor (MLX90614)

An object's temperature can be determined by a temperature sensor without touching it. It functions by meeting the thermal radiation that the object emits and converting it into a temperature reading. With a resolution of 0.02°C, the sensor can calculate temperatures between –70 and +380°C. It is frequently utilized in sectors like industrial or healthcare when contact temperature measurement is neither feasible or practical.

Connections

SDA and SCL pins on the sensor should be connected to the corresponding SDA and SCL pins on the Arduino. Connect the sensor's VIN and GND pins to the Arduino's 5 V and GND pins, respectively.

Accelerometer Sensor (MPU 6050)

Popular MEMS (microelectromechanical system) accelerometer and gyroscope sensor modules like the MPU-6050 have both components. It is used to measure rotational motion in three dimensions and acceleration in three axes (x, y, and z), (Pitch, roll, and yaw). Numerous applications, including robots, drones, gaming, and motion tracking, can make use of the MPU-6050. To offer a complete set of data for motion analysis and control, it is frequently used in conjunction with other sensors, such as magnetometers and barometers.

Connections

Connect the 5 V and GND pins of the Arduino to the VCC and GND pins of the MPU 6050, respectively. Connect the sensor's SDA and SCL pins to the appropriate SDA and SCL pins on the Arduino.

Barometer, Altimeter sensor (BMP280)

Serial communication ports

Additionally, it contains an instrument used to gauge atmospheric pressure which is a barometer. An altimeter is a type of instrument that is used to measure altitude, and the height above a reference point, such as above sea level. The BMP280 is a sensor module that contains a MEMS barometer and thermometer, which can be used to measure atmospheric pressure and temperature. The BMP280 can also be used as an altimeter by measuring the changes in pressure as the altitude changes. The sensor is excellent for a variety of applications, including weather monitoring, height sensing, and drone navigation, due to its high accuracy rate and large measurement range. It is easily interfaced with microcontrollers like Arduino and communicates with them using the I2C protocol.

Connections

Connect the 5 V and GND pins on the Arduino to the BMP280's VIN and GND pins, respectively. Connect the sensor's SDA and SCL pins, respectively, to the SDA and SCL pins of the Arduino.

GSM Module (Sim900L)

The Global System for Mobile Communications (GSM) standard is used by a GSM module, such as the SIM900L, to link a microcontroller or computer to a mobile network and send and receive data through the network. The SIM900L module, which has a tiny form factor, is a whole Quad-band GSM/GPRS solution with low power requirements and high sensitivity rates. It includes a SIM card slot, an antenna connector, and several interface ports for interacting with the microcontroller, including UART, SPI, and I2C. Applications for the module include remote monitoring, data logging, and Internet of Things (IoT) devices that require mobile network communication.

The SIM900L module can be controlled using AT commands, which are sent over the UART interface. These commands can be used to make and receive phone calls, send and receive SMS messages, and establish a GPRS connection to the Internet.

Connections

Connect the TX pin of the module to the RX pin of the Arduino (pin 0).
Connect the RX pin of the module to the TX pin of the Arduino (pin 1).
Connect the GND pin of the module to the GND pin on the Arduino.
Connect the Arduino's 5 V pin to the VCC pin of the module.

LCD 16×2 Screen

A form of display known as an LCD (Liquid Crystal Display) 16×2 screen has two rows of 16 characters each, for a total of 32 characters. The screen is based on the HD44780 controller, which allows the microcontroller to display characters and graphics on the screen by sending commands and data over a parallel or serial interface.

In context of IoT also called Internet of Things, an LCD 16×2 screen can be used to display information and feedback from the sensors and actuators that connected to the microcontroller.

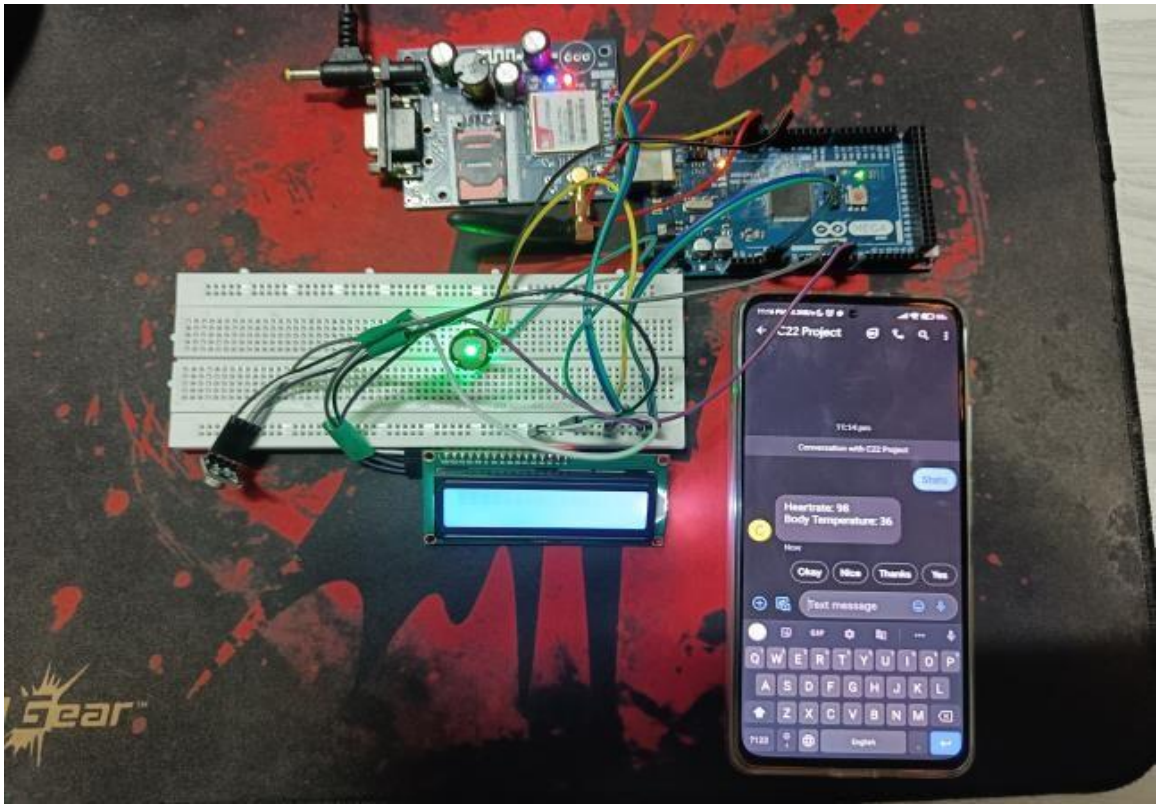

Figure 3. Project review.

Connections

Connect the Arduino's 5 V and GND pins to the VCC and GND pins of the LCD, respectively.

Connect the SDA and SCL pins on the LCD to the corresponding SDA and SCL pins on the Arduino as shown in Figure 3.

RESULT

The system utilizes advanced technologies such as a heartbeat and temperature sensor, an Arduino Mega 2560 microcontroller, an LCD display, and a GSM module (sim900L). The user's heart rate is determined by the pulse sensor, which then sends that information to the microcontroller. To monitor the gadget in real-time, the microcontroller then transmits the heart rate data over the IoT and displays it on an LCD display. The user can also set the system up to send SMS notifications to a specified contact number when the heart rate's upper and lower limits are reached as shown in Figure 4. The microcontroller continuously checks the pulse rates, and if either the pulse rate or temperature rises above the set thresholds, it generates an alert on the IoT display device and sends a message alert with GPS coordinators, which can then be accessed via a link to send a rescue team to the scene right away. The crew can still retrieve the last recorded location via IoT to narrow down the mountaineer's search area even if the climber wanders beyond the network region. For safeguarding the security of hikers and other people in isolated areas, this technology is a practical answer.

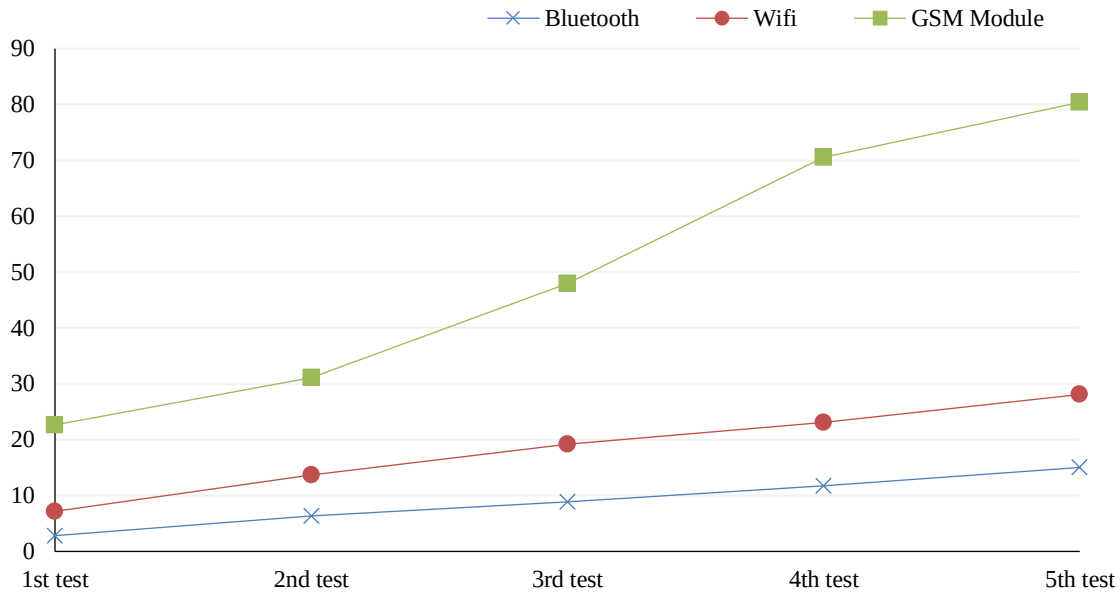

Figure 4. Accuracy graph.

CONCLUSION

The proposed device could assist mountaineering guides in immediately and effectively managing their teams and facilitate improving safety in mountaineering by such IOT based devices. The primary goal of this project is to track the whereabouts and physical well-being of the mountain climber while they are trekking. Successfully analyzing the parts and planning to construct a prototype also allows guides to accurately track a mountain climber's physiological condition and issue prompt commands, giving guides a quick and efficient way to help.

REFERENCES

1. Arora J, Gagandeep, Singh A, Singh NP, Rawat SSS, Singh G. Heartbeat rate monitoring system by pulse technique using HB sensor. International Conference on Information Communication and Embedded Systems (ICICES2014). 2014; 1–5. doi: 10.1109/ICICES.2014.7033986.

2. Nookhao S, Thananant V, Khunkhao T. Development of IoT Heartbeat and Body Temperature Monitoring System for Community Health Volunteer. 2020 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering (ECTI DAMT & NCON). 2020; 106–109. doi: 10.1109/ECTIDAMTNCON48261.2020.9090692.
3. Nevon Projects. (2021). Mountain Climber Health & GPS Tracker. [online] Nevon Projects. Available from: https://nevonprojects.com/mountain-climber-health-gps-tracker/
4. Patii N, Iyer B. Health monitoring and tracking system for soldiers using Internet of Things (IoT). In 2017 IEEE international conference on computing, communication and automation (ICCCA). 2017 May 5; 1347–1352.
5. Nookhao S, Thananant V, Khunkhao T. Development of IoT heartbeat and body temperature monitoring system for community health volunteer. In 2020 IEEE Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering (ECTI DAMT & NCON). 2020 Mar 11; 106–109.
6. Zhihua S, Lihong Y, Min L, Xiangdong Z. Design of Portable Barometric Altimeter System Based on SCP1000-D01. 2022 14th International Conference on Measuring Technology and Mechatronics Automation (ICMTMA). 2022; 512–514. doi: 10.1109/ICMTMA54903.2022.00108.
7. Gupta A, Srivastava R, Gupta H, Kumar B. IoT Based Fall Detection Monitoring and Alarm System for Elderly. 2020 IEEE 7th Uttar Pradesh Section International Conference on Electrical, Electronics and Computer Engineering (UPCON). 2020; 1–5. doi: 10.1109/UPCON50219.2020.9376569.
8. Abdallah Dafallah HA. Design and implementation of an accurate real time GPS tracking system. The 3rd International Conference on e-Technologies and Networks for Development (ICeND2014). 2014; 183–188. doi: 10.1109/ICeND.2014.6991376.
9. Kusriyanto M, Putra BD. Smart home using local area network (LAN) based arduino mega 2560. 2016 2nd International Conference on Wireless and Telematics (ICWT). 2016; 127–131. doi: 10.1109/ICWT.2016.7870866.
10. Lu W, Wang C, Stevens MC, Redmond SJ, Lovell NH. Low-power operation of a barometric pressure sensor for use in an automatic fall detector. 2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC). 2016; 2010–2013. doi: 10.1109/EMBC.2016.7591120.
11. Awasthi S, Joshi A. MEMS accelerometer based system for motion analysis. 2015 2nd International Conference on Electronics and Communication Systems (ICECS). 2015; 762–767. doi: 10.1109/ECS.2015.7125014.

