International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 04 | April - 2023 Impact Factor: 8.176 ISSN: 2582-3930

IOT-BASED SOLDIER HEALTH MONITORING E-JACKET

Ms. Dnyanada Meshram [1], Rahul Dange [2], Mrunali Pandao [3], Sakshi Gabhane [4], Vaishnavi Wakde [5]

*[1]Assistant Professor, Department Of Computer Science And Engineering, Priyadarshini JL College Of Engineering, Nagpur Maharashtra, India.

*[2,3,4,5]Researchers In Department Of Computer Science And Engineering, Priyadarshini JL College Of Engineering, Nagpur, Maharashtra, India.

Abstract - A country's arm forces consist of three professional uniformed services: the army, the navy, and the air force. Soldiers being the backbone of any armed force usually lose their lives due to lack of medical help when in an emergency, also soldiers who are involved in missions or in special operations get straggled on war fields and lose contact with the authorities. In a dangerous region, troops must not only manage the physical hazard but also endure strain and fatigue caused by continuous operations. To overcome these challenges, our team proposes to execute a jacket for soldier performance and health monitoring remotely. We have described how to use GPS to track the soldier's location in this project and we will also be able to keep an eye on vital signs like a heartbeat, pulse rate, and body temperature. To find out the soldier's status, the measured parameters will be transferred to the concentrate with the aid of a GSM module. we can also locate the injured soldiers and deliver the necessary medical care. The suggested system will include wearable physiological equipment, sensors, and transmission modules put within the jacket for communication between the soldier and the base station or between the soldier and the soldier. Consequently, a low-cost system to safeguard precious human life on the battlefield can be implemented.

Keywords: Arduino Microcontroller, GPS, Temperature Sensor, Heartbeat Sensor, Battery.

1. INTRODUCTION

This IoT-based soldier health monitoring jacket is a wearable device designed to monitor the health and well-being of soldiers on the battlefield. It is equipped with sensors and other electronic components that collect various physiological data, such as heart rate and body temperature, and it also captures the current location of the soldier along with the multi-Ip cameras to monitor based on the use of client/server technology to distribute video signals and send them to a central server via wireless communication. The device can be used to detect early signs of fatigue, stress, and other health issues, enabling commanders to take proactive measures to prevent injury and improve performance. In addition, the data collected by the device can be used to analyze trends and patterns, helping to identify risk factors and optimize training programs. The IoT-based soldier health monitoring jacket is an example of how the Internet of Things (IoT) is being used to transform various industries, including healthcare and defense. By leveraging the power of connected devices, we can collect data in real time and use it to make informed decisions that improve outcomes and enhance the quality of life. To send and receive data to and from the control unit, the soldier must be connected with cutting-edge healthcare monitoring, real-time GPS (Global Positioning System), and data communications. That soldier might need wireless networks not only to communicate with the control unit but also with side-by-side military personnel. Apart from the nation's security, the soldier must ensure his own safety by protecting himself with advanced weapons, and it is also necessary for the army control unit to monitor the soldier's health status. In order to achieve this, biological sensors and monitoring tools are combined with the soldiers in this research. The integrated components must be in a light package and provide the desired result without requiring much power. One of the fundamental challenges in military operations is that the soldiers are not able to communicate with the control unit. In addition, proper navigation between soldiers plays an important role in careful planning and coordination. As a result, the planned work focuses on tracking the whereabouts of soldiers, which is useful for the control room station to know exactly where soldiers are and to advise them accordingly. The control unit gets the location of the soldier using GPS. If a soldier gets lost on the battlefield, the base station must direct him on the right course. This paper will be useful for soldiers who are involved in special operations or missions. Soldiers' jackets are equipped with intelligent biological sensors, such as temperature and heartbeat monitors. These are implanted in the soldier for complete mobility. This system will offer wireless connectivity to the server located at the base station.

2. LITERATURE REVIEW

A soldier health monitoring system has been proposed using a number of current systems. The study proposes that utilizing cloud computing and machine learning with the Internet of Things (IoT) offers a method to calibrate real-time systems when the scenario does not have enough data. This might improve the accuracy of such a system. After examining several methods, a hardware-based strategy is suggested in which the body temperature and the soldier's present location are tracked by sensors and information is sent over the cloud.

The paper by P. S. Kurhe et. al [1] proposes continuous communication. Because troops can communicate from anywhere, they can always get in touch with fellow soldiers. The peripherals utilized are lightweight and compact, so they may be securely taken about.

The methodology followed by Hanifa Zakir et. al [2] Wearable physiological equipment, sensors, and transmission modules are all part of the suggested architecture and may be installed on the warrior's body to track their whereabouts and overall well-being.

Niket Patil et. al proposed [3] technology that may be used to monitor a soldier's health and be put on his body. IoT will be used to provide this data to the control panel. No software systems are used; only a hardware approach is used. didn't make as much use of cloud processing.

Nirmal Kumar S. Benni et. al proposed [4] When a fall or collapse is detected, the sensor system wirelessly communicates the information to the caretaker's mobile device, which receives it. The sensor is a wearable tri-axial accelerometer and gyroscope in the form of a belt. This posture is classified using these sensors. as well as the user's dynamics. The project's main objective is to develop efficient algorithms that can utilize these sensors to identify falls and distinguish them from other forms of movement.

Hock Beng Lim et.al propound [5] Described many wearable, portable, lightweight, and compact sensors that have been designed to monitor human physiological data. Blood pressure sensors, electrocardiogram (ECG) sensors, and other physiological and biomedical sensors make up the Body Sensor Network (BSN). EDA sensors, which may be applied to the human body, allow for real-time monitoring of health.

Shruti Nikam et.al contrive [6] The use of sensors to keep an eye on troops' health and the ammunition they are carrying was suggested as a way to ensure their safety. For wireless communications between troops, RF and GPS modules have been employed for high-speed, short-range data transfer. This will enable control units to receive information on the location and health of the soldiers.

Prof. Pravin Wararkar et.al [7][8][9] suggested deploying sensors to keep an eye on troops' health and the ammunition they were carrying to ensure their safety. Wireless communications between soldiers that will enable position monitoring using GPS and high-speed, short-range data transmission using RF, assist in giving the command unit information on the location and health of soldiers. In the paper [10] the author offered a plan for developing a BSN-based system for real-time soldier health monitoring.

Akshita V. Armarkar et.al [11] have suggested integrating barometric pressure sensors, GPS, GSM, and WBASNs to create an "Army Health and Location Monitoring System" (heartbeat sensor, temperature sensor). They utilized the ATmega328p microcontroller for their prototype. Without using any machines, straightforward conditional statements have been used to determine the soldier's health, training, or education.

3. METHODOLOGY

The proposed system is on a vest, which consists of various health monitoring parameters. The health monitoring parameters include sensors such as temperature sensors (for both body and environmental temperature measurement), pulse rate motion sensors, and proximity sensors like ultrasonic sensors (for object detection), a camera to capture real-time videos, and GPS sensors are receivers with antennas that use a satellite-based navigation system. All the sensor data along with the real-time data captured by the camera will be processed and transmitted through GSM (Global System for Mobiles), where it will transmit all the values in the LCD screen as output and video at the server side. Due to this, the limitations of the battery power consumed on the client side will be reduced. An efficient algorithm is developed and threshold values are set based on the requirements.

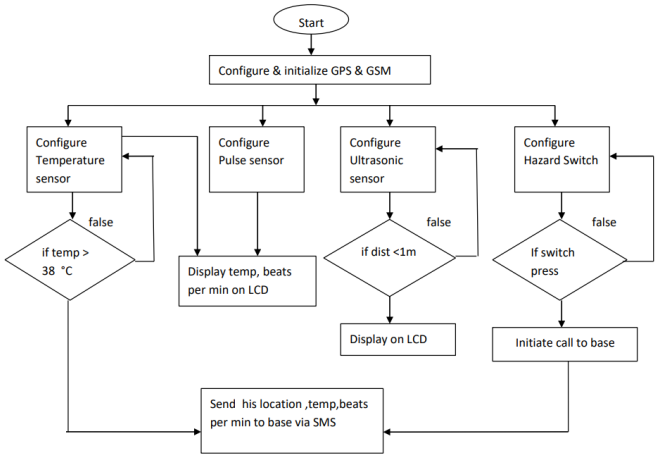

Figure-1 Data Flow Diagram

In the above flowchart, Firstly, we initialize the GPS and GSM modules, then we initialize sensors like the temperature sensor, pulse sensor, ultrasonic sensor, and hazardous switch. The temperature sensor is used to calculate the temperature of soldiers. If the temperature exceeds 38°C, it will send the temperature and beats per minute to the base station via SMS. If the temperature is below 38 °C, then it will again start to configure the temperature. The pulse sensor displays the number of beats per minute on the LCD. Ultrasonic sensors can find things that can't be seen with the naked eye. If the distance is less than 1 meter, it will detect an object and display that "someone is there" on the LCD screen. If the distance is more than 1 m, then it will not detect an object and again start configuring. When there is an emergency, the soldier will press the Hazard switch, then call and send an SMS to the base station with relevant information like temperature, bpm, latitude, and longitude.

4. CIRCUIT DIAGRAM

Fig.2 shows the circuit diagram below:

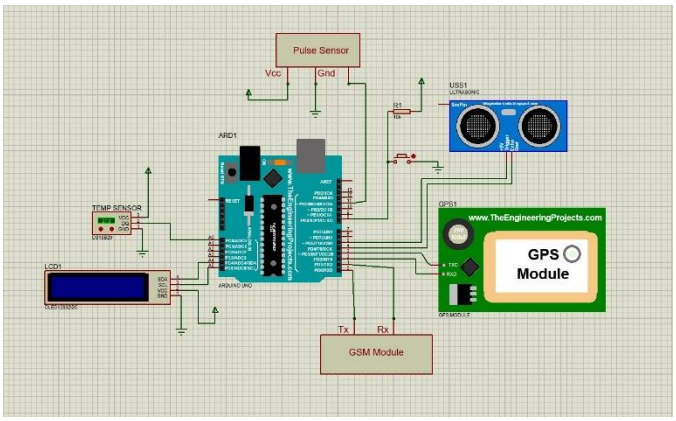

Figure-2 circuit diagram

The circuit diagram contains an Arduino Uno a popular open-source microcontroller board based on the ATmega328P microcontroller. The board has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. Temperature Sensor, Pulse Sensor, Ultrasonic Sensor, GSM, GPS, and LCD are connected to Arduino UNO Board.

5. HARDWARE ASPECTS

In our project, we're using an Arduino UNO board and an ATmega328P-based microcontroller board. It contains 6 analog inputs, a 16 MHz ceramic resonator, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It comes with everything needed to support the microcontroller; to get started, just plug in a USB cable, an AC-to-DC adapter, or a battery. You can experiment with your UNO without being overly concerned that you'll make a mistake; in the worst case, you can replace the chip for a few dollars and start over. The system's brain will be the microcontroller.

The other sensors are:-

1)**DS18B20 temperature sensor** - The DS18B20 temperature sensor, which provides temperature data in the 9- to 12-bit range, is one sort of temperature sensor. These numbers display the device's temperature.

This sensor can connect with an internal CPU using a one-wire bus protocol, which uses a single data line.

2) **Ultrasonic Sensor** - An ultrasonic sensor is an electronic device that emits ultrasonic sound waves in order to determine the distance of a target item, and then transforms the sound that is reflected back into an electrical signal. The speed of audible sound is greater than the speed of ultrasonic waves. (i.e. the sound that humans can hear).

3**) Pulse sensor** - Heartbeat sensor or heart rate sensor is another term for the pulse sensor. Connecting this sensor from the human ear or fingertip to an Arduino board will enable it to function. such that it is simple to compute heart rate. A 24-inch color coding wire, an ear clip, Velcro Dots 2, transparent stickers 3, etc. are all included with the pulse sensor. Protective coatings called transparent strikers are utilized to shield the sensor from perspiring fingers and earlobes. This sensor has three holes towards its outer border so that accessories can be connected to it with ease.

4.1. The list of sensors, components used, and their functionalities are listed below:

S.no.	Biometric sensors and components	Specification	Functionalities
1	IoT module(Arduino)	node mc module	To send data to the cloud server
2	GPS module	Ublox NEO 6M	Calculates latitude and longitude
3	Ultrasonic Sensor	HC-SR04	Detect objects can't be seen by naked eye
4	Heartbeat sensor	LM358	Calculates heartbeat by measuring pulse
5	LCD display	16x2	Displays heartbeat, temperature, and GPS Location
6	Temperature sensor	LM35	Senses surrounding temperature
7	Hazard button	Push buttons	Emergency communication buttons
8	Camera	8MP	Capture the images

Fig -3: Figure of hardware components

6. COMMUNICATION

GSM module (GSM SIM 900A) - SIM900A will be used for communication between the soldier and base station. The smallest and least expensive module for GPRS/GSM communication is the GSM Module. In the majority of embedded applications, Arduino and microcontrollers are ubiquitous. The module provides GPRS/GSM technology for use in mobile SIM-based communication. Users can send and receive SMS and mobile calls using the 900 and 1800MHz frequency bands. The keypad and display interface enable the creation of specialized applications by the developers. Additionally, it has data mode and command mode. Different GPRS/GSM protocols and operating frequencies are used in every nation. The developers can modify the default setting to meet their needs with the aid of command mode.

In our project, we use the NEO6 GPS Module to transmit our current GPS location to the base. The NEO-6M GPS module is a capable full GPS receiver with an integrated 25 x 25 x 4mm ceramic antenna that offers a powerful satellite search capability. The power and signal indicators let you keep an eye on the module's condition. When the main power source is unintentionally turned off, the module can still save the data because of the data backup battery. Its 3mm mounting holes may guarantee simple installation on your aircraft, enabling it to fly steadily in a fixed place, automatically return to Home, and fly to waypoints, among other things. You might even use it to automate returning on your intelligent robot automobile.

7. SOFTWARE ASPECTS

In our project, we use the Arduino IDE software for programming, which is an open-source integrated development environment that simplifies the process of creating software for the Arduino microcontroller. The programming language used is C++, which is a widely used high-level programming language known for its efficiency and versatility. Additionally, we have incorporated a real-time video feature, which can be accessed through a URL. This allows us to monitor the progress of the soldier and make necessary adjustments in real-time. Overall, the combination of the Arduino IDE software, C++ language, and real-time video feature has enabled us to develop a sophisticated and efficient system that meets our project's requirements.

8. ADVANTAGES

A soldier health monitoring jacket can offer several advantages, including:

1) Early detection of health issues: The jacket can monitor various vital signs of a soldier, such as heart rate, body temperature, and respiration rate, allowing for the early detection of health issues. This can help prevent serious health problems from developing and allow for timely medical intervention.
2) Real-time monitoring: The jacket can provide real-time monitoring of a soldier's health status, allowing for immediate action to be taken in case of any emergency.
3) Enhanced safety: The jacket can improve the safety of soldiers by providing alerts to commanders or medical personnel when vital signs fall outside the normal range, allowing for quick medical attention.
4) Improved operational efficiency: By providing real-time health information, the jacket can help optimize operational efficiency by enabling commanders to make informed decisions about the deployment of soldiers in the field.
5) Remote monitoring: The jacket can be equipped with wireless communication technology, allowing for remote monitoring of a soldier's health status.

Overall, a soldier health monitoring jacket can provide several benefits, including improved health outcomes, increased safety, and enhanced operational efficiency.

9. RESULT

The project's prototype has been created and put through testing, it performs as intended with pleasing outcomes. The sensors function effectively and produce precise outputs as intended.

I. SYSTEM JACKET

Fig -4: System jacket image

The jacket will be worn by the soldier and contains all the sensors mounted in the box to increase durability.

II. SMS MESSAGE RECEIVED

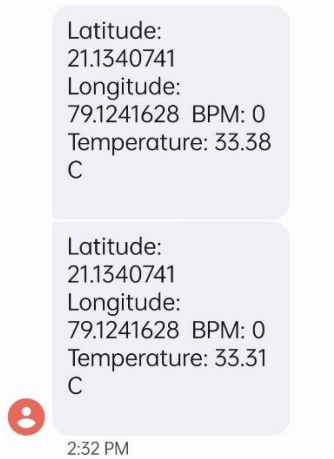

Fig -5: SMS message image

Location coordinates along with temperature and BPM received on base station through SMS.

III. REAL TIME VIDEO

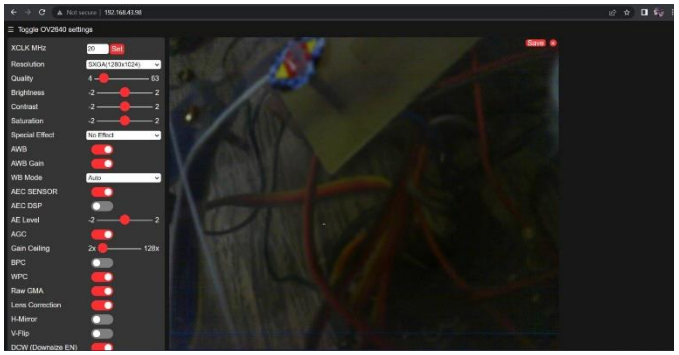

Fig -6: realtime url image

Real time video can be monitored by the base station by using the URL.

The following results are observed:

1) Successfully kept track of the soldier's temperature and blood pressure.
2) When the hazard switch was pressed, the base station unit will receive hazard notifications through call and SMS.
3) Location coordinates sent via SMS to the base.

10. CONCLUSION

The result of using an IoT-based soldier health monitoring e-jacket is improved situational awareness and a faster response to health emergencies. By continuously monitoring the health parameters of soldiers, commanders can identify potential health issues before they become critical and take appropriate action to prevent them. In case of a health emergency, the e-jacket can quickly alert the medical team, enabling them to provide timely medical assistance.

Overall, an IoT-based soldier health monitoring e-jacket can help improve the health and safety of soldiers on the battlefield and provide commanders with valuable insights into the health status of their troops.

ACKNOWLEDGEMENT

First and foremost, we would like to express our sincere gratitude to Er. Dnyanada Meshram. of Priyadarshini J L College of Engineering for their excellent guidance and valuable suggestions that helped us throughout this project. The team members would like to thank the Department of Computer Science and Engineering of Priyadarshini JL College of Engineering for providing the necessary support and resources.

REFERENCES

[1]. Thanga Dharsni, Hanifa Zakir, Pradeep Naik, Mallikarjuna, Raghu," Soldier Security and Health Monitoring". 2018.

[2]. Health Monitoring and Tracking System For Soldiers Using Internet of Things(IoT) Niket Patil 2017.

[3]. Wireless detection system for Health and military application Yallalinga, Nirmalkumar S. Benni 2017.

[4]. Akshita V. Armarkar, Deepika J. Punekar, Mrunali V. Kapse, Sweta Kumari, Jayshree A. Shelke (2017) "Soldier Health and Position Tracking System" IJESC, 7(3).

[5]. Palve Pramod, "GPS Based Advanced Soldier Tracking With Emergency Messages & Communication System" (2014) International Journal of Advance Research in Computer Science and Management Studies, 2(6), pp: (25-32).

[6]. M. Pranav Sailesh, C. Vimal Kumar, B. Cecil, B. M. Mangal Deep, P. Sivraj (2014) "Smart Soldier Assistance using WSN" International Conference on Embedded Systems - (ICES 2014), IEEE, pp: (244- 249).

[7]. "P. S. Kurhe, S. S. Agrawal, "Real Time Tracking & Health Monitoring System of Remote Soldier Using Arm7" International Journal of Engineering Trends and Technology Volume 4 Issue 3-2013.

[8]. Hock Beng Lim, Di Ma, Bang Wang, Zbigniew Kalbarczyk, Ravishankar K. Iyer, Kenneth L. Watkin (2010) "A Soldier Health Monitoring System for Military Applications" International Conference on Body Sensor Networks, pp: (246-249).

[9]. Shruti Nikam, Supriya Patil, Prajkta Powar, V. S. Bendre (2013) "GPS Based Soldier Tracking and Health Indication System" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, 2(3), pp: (1082-1088).

[10]. Prof. Pravin Wararkar, Sawan Mahajan, Ashu Mahajan, Arijit Banerjee, Anchal Madankar, Ashish Sontakke (2013) "Soldier Tracking and Health Monitoring System" The International Journal of Computer Science & Applications, 2(02), pp: (81-86).

[11]. Govindaraj A., Dr. S. Sindhuja Banu (2013) "GPS Based Soldier Tracking and Health Indication System with Environmental Analysis", International Journal of Enhanced Research in Science Technology & Engineering, 2(12), pp: (46-52).