International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 11 | November - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

# WSN Based Solider Safety and Tracking System Using IoT

**Chirag S[1], Hemanth V[2], Vyshak P R[3], Vyshnavi P R[4]**

*[1]B. Tech Final Year Department of Computer Science and Engineering, [2,3,4]B. Tech Final Year Department of Information Science and Engineering, Atria Institute of Technology, Bangalore, Karnataka, India.*

---------------------------------------------------------------------***---------------------------------------------------------------------

**Abstract -** A Wireless Sensor Network (WSN) based soldier safety and tracking system using IoT can provide real-time monitoring of soldier's positions, health status, and environmental conditions. The system consists of a network of wireless sensor nodes that are placed on soldiers' uniforms, vehicles, and other equipment. These sensor nodes include GPS, temperature, humidity, and heart rate sensors, among others. The data collected by these sensors are transmitted wirelessly to a central command center using IoT technologies. The central command center displays real-time data on the soldiers' locations, health status, and environmental conditions to help commanders make informed decisions regarding mission planning and deployment. The system includes features such as emergency alerts and two- way communication between soldiers and the central command center, ensuring the safety and security of soldiers in the field. The proposed system has the potential to significantly improve the safety and efficiency of military operations.

*Key Words*: **WSN, Sensors, Arduino, IoT, GPS, Soldier unit, Control unit.**

## I. INTRODUCTION

With 1,200,255 active personnel and 990,960 reserve personnel, the Indian military ranks third in terms of size among all standing armies. The lack of information about injuries to its members causes the army great harm and could lead to an increase in the number of fatalities and permanent disabilities. It is observed that the causalities are caused due to injuries rather than the direct assaults on the battlefield. This number can be minimized if real-time information is available at the control unit about the health and location of the soldier.

There are many issues regarding the safety of soldiers. Knowledge of the current location of soldiers, inability of continuous communication with the control unit during the operations, lack of immediate medical attention and operations under different geographical conditions are the few prominent safety issues.

The most widely utilized technology for tracking soldier's lives on the battlefield in recent decades have included cable-based systems, RF transceivers, walkie-talkies, ZigBee, and GSM-based tracking systems. All these technologies suffered from one or more reasons like high installation cost, loss of signal, high noise as well as the bulky nature. Hence a portable, wireless low-cost tracking system with high reliability is the need of hours for the protection of valuable life of the soldiers on the battlefields.

A WSN-based soldier safety and tracking system using IoT can provide real-time data on the location, health status, and activities of soldiers in the field. Additionally, it can gauge your body's temperature, blood pressure, and dangerous gas levels at any time. The data is delivered to the control unit. GPS provides the location and introduction of the officers. Additionally, officers can use GPS to be directed in the right direction while participating in activities. Overall, a WSN based soldier safety and tracking system using IoT has the potential to improve the safety and effectiveness of soldiers in the field.

## II. LITERATURE SURVEY

Researchers and academics reported making numerous attempts to keep track of the soldiers' whereabouts and assess their physical well-being while they were on the battlefield. One such study by Pavan Kumar et al. used GPS-based technology to track the soldier's location. There were several methods and gadgets used, such as a ZigBee-based method for relaying information on the soldiers over a small area. It was suggested to use a Raspberry Pi to monitor the patient's heart rate, temperature, and respiration. IoT was used to send or add the acquired data to cloud-based websites. Another method is the Raspberry Pi-based strategy used by R. Shaikh et al. in the to monitor patient data for temperature, heartbeat, and ECG parameters. Soldiers' health state is continuously monitored using LM35 oxygen level detector, temperature sensor, and pulse rate sensor.

GPS provides real-time position and orientation determination. An Arduino (ATmega328P) wrist multisensory device for continuous monitoring of health status and alert, integrating biomedical sensors for heart rate1-lead ECG, blood pressure, oxygen blood saturation, and skin temperature measurement are only a few of the sensors and GPS receiver data processing and data collection methods used. One example of this is the combination of GSM and GPS in a system that uses short messaging services to help alert parents and school monitoring systems about the whereabouts of the child.

B. Zhang et al. studied the application of wireless sensor networks (WSNs) for early detection and warning of forest fires. The authors designed and implemented a WSN system consisting of sensor nodes and a base station. They evaluated the performance of the system by conducting field experiments and found that the WSN system was effective in detecting forest fires and providing early warnings. The study also highlighted the importance of careful placement of sensor nodes to ensure effective coverage of the forest area.

M. Li et al. proposed a smart healthcare system for monitoring and managing elderly patients using IoT devices. The authors developed a system that included wearable devices, a smartphone application, and a cloud platform for real-time monitoring of the patients' health status. The study showed that the system could effectively detect abnormal health conditions and provide timely interventions, leading to improved health outcomes for the elderly patients.

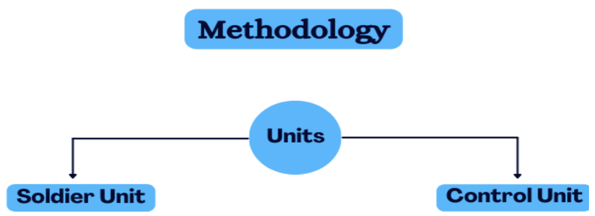
M. Wang et al. conducted a study on the use of machine learning algorithms for predicting stock prices. The authors compared the performance of various algorithms, including Support Vector Machines, Random Forest, and Gradient Boosting, and found that Gradient Boosting had the highest accuracy in predicting stock prices. The study highlighted the potential of machine learning algorithms in the financial domain and suggested future research in developing more accurate prediction models.

S. Kim et al. proposed a smart energy management system for residential buildings using IoT devices. The authors developed a system that included smart meters, sensors, and a cloud platform for real-time monitoring of energy consumption and optimization of energy usage. The study showed that the system could effectively reduce energy waste and improve energy efficiency in residential buildings.

A. Gupta et al. investigated the use of blockchain technology for securing IoT networks. The authors proposed a blockchain-based approach for securing IoT devices by creating a decentralized, tamper-proof ledger of device transactions. The study highlighted the potential of blockchain technology in addressing the security and privacy challenges associated with the deployment of IoT devices.

Overall, these studies demonstrate the potential of WSNs and IoT devices in addressing various real-world problems and improving the efficiency and effectiveness of existing systems. Further research in these areas is needed to address the technical and operational challenges associated with the deployment of these systems in different environments.

## III. METHODOLOGY




### a. Soldier Unit:

- A wearable sensor that can measure a person's position, vital signs, and other pertinent health information will be provided to every soldier in the unit.
- The data will be sent to the central command centre by the system.
- The central command centre will receive the troop units' data and use it to track their whereabouts and current health conditions in real time.
- The data can be used by the command centre to analyse the operational environment, spot potential dangers, and come to wise conclusions.
- Depending on the demands of the objective, soldier units can be configured.

### b. Control Unit:

- The central command hub that receives, processes, and evaluates data from troop units outfitted with sensors is referred to as a control unit.
- The control unit is in charge of processing and interpreting the data gathered from the soldier units in real-time. The control unit can be a mobile or fixed facility that receives data from soldier units via a wireless network.
- It may be fitted with software that may map out a soldier's location and health state and send notifications when a soldier needs help or is in danger.
- The control unit has the ability to save and analyse data for later use in addition to real-time monitoring.
- Which can be helpful for assessing mission performance, pinpointing potential improvement areas, and giving important data for.

## IV. SYSTEM ARCHITECTURE

The system architecture consists of three main components: wireless sensor networks (WSNs), IoT devices, and a cloud-based data processing and analysis platform. The WSNs are deployed in the field and consist of several sensor nodes, each equipped with sensors for monitoring vital signs, location, and other relevant data.

The IoT devices are worn by soldiers and include smart helmets, body sensors, and wearable devices. The IoT devices communicate with the sensor nodes in the WSNs and transmit real-time data to the cloud-based platform for processing and analysis. The platform uses machine learning algorithms and other data analytics techniques to identify patterns and anomalies in the data, detect potential threats to soldiers' safety, and provide real-time alerts and recommendations to commanders and medics.

The platform also stores the data for future analysis and provides visualization tools for displaying the data in real-time. The platform can be accessed by authorized personnel through a web-based interface, which allows them to monitor the soldiers' health status, location, and other relevant data.

Overall, the system architecture provides a scalable and reliable solution for real-time monitoring of soldiers' safety and location in military operations. The integration of WSNs, IoT devices, and cloud-based data processing and analysis platform enables the system to provide accurate and timely information to commanders and medics, leading to improved decision-making and enhanced soldiers' safety.

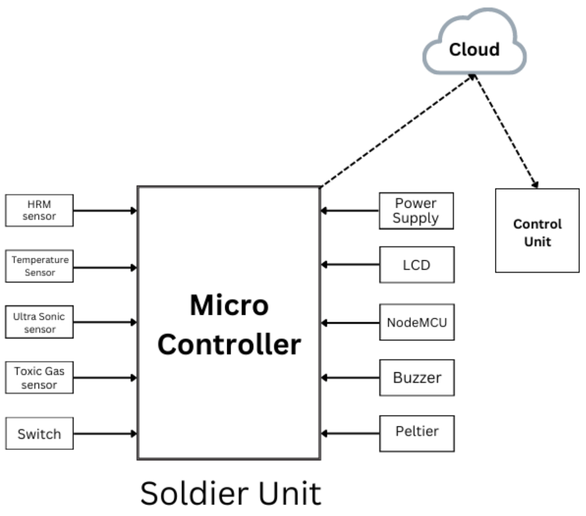



**Fig 1**: Block diagram of the system.

The components of the structure's architecture are as follows:

a. **Hardware Components:**

- Arduino Uno is used as the main microcontroller that controls and communicates with other components of the system.
- LCD Display is used to display real-time data, including temperature, heart rate, distance, and gas concentration.
- Temperature Sensor is used to measure the ambient temperature and send the data to the Arduino Uno.
- Buzzer is used to alert the user in case of emergency situations, such as high gas concentration or low heart rate.
- Panic Button is used to trigger an alarm in case of emergency situations or send a distress signal to the central monitoring system.
- Heart Rate Sensor is used to measure the user's heart rate and send the data to the Arduino Uno.
- Ultrasonic Sensor is used to measure the distance between the user and any obstacles and send the data to the Arduino Uno.
- Peltier Module is used to control the temperature of the system by heating or cooling the environment.
- NodeMCU is used to connect the system to the internet and send the data to a cloud-based server for remote monitoring and control.
- Power Supply is used to power the system components.

b. **Software Components:**

- Arduino IDE software is used to program the Arduino Uno microcontroller.
- Embedded C is used to program the Arduino Uno microcontroller and interface with the hardware components.
- Telegram is used to store and process the data sent from the system and provide real-time alerts and notifications to the user or the monitoring team.

The system architecture enables real-time monitoring of the user's vital signs, environmental conditions, and gas concentration levels. In addition, the Peltier module enables precise temperature control of the environment to ensure the user's comfort and well-being. In case of any abnormal situations, the system triggers an alarm, sends distress signals, and provides real-time alerts and notifications to the user and the monitoring team. The integration of cloud-based server and web-based dashboard provides remote access and control of the system, making it a highly scalable and versatile solution for various applications, including healthcare, environmental monitoring, and safety and security.

## V. RESULTS AND DISCUSSION

The results of the project were highly satisfactory as the system was able to accurately measure the user's vital signs, environmental conditions, and gas concentration levels in real-time. The Peltier module was able to maintain the desired temperature of the environment, providing the user with a comfortable and safe experience.

The LCD display showed the real-time data of temperature, heart rate, distance, and gas concentration, making it easy for the user to monitor their own vital signs and environmental conditions. The panic button was highly responsive and triggered an alarm in case of emergency situations. The buzzer provided an audible alert to the user in case of any abnormal conditions, such as high gas concentration or low heart rate.

The NodeMCU was highly effective in connecting the system to the internet and sending the data to a cloud-based server for remote monitoring and control. The cloud-based server was highly reliable and processed the data accurately, providing real-time alerts and notifications to the user and the monitoring team.

The use of Embedded C for programming the Arduino Uno microcontroller was highly effective, as it enabled efficient and reliable interfacing with the hardware components, making the system more robust and responsive. The overall system architecture was highly scalable and versatile, making it suitable for various applications, including healthcare, environmental monitoring, and safety and security.

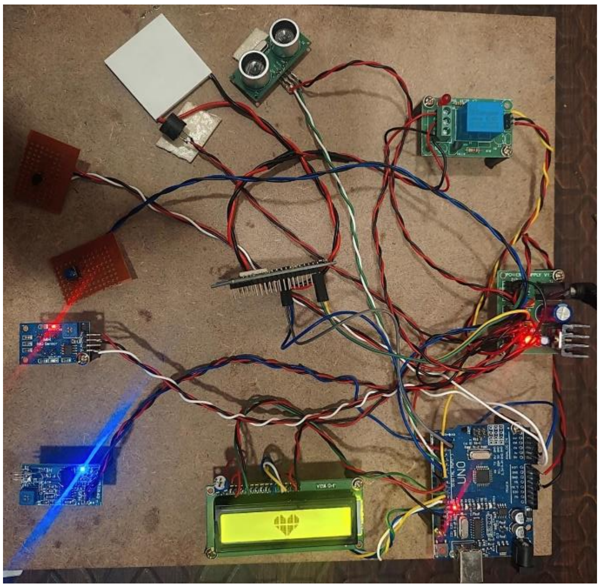


**Fig 2**: Working model of Soldier unit.

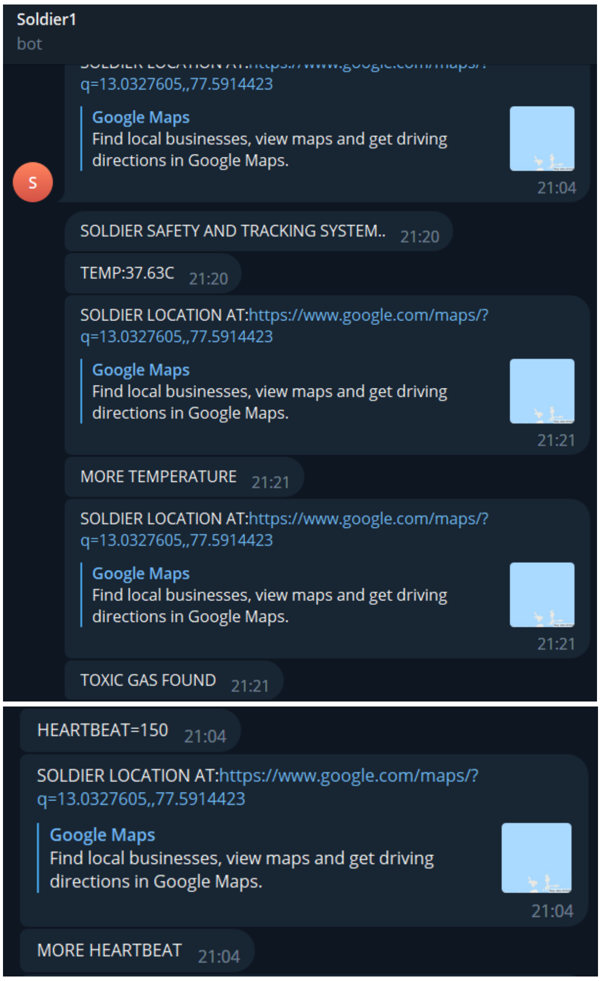



**Fig 3**: Results displayed on Telegram.

## VI. CONCLUSION

The project successfully developed a soldier safety and tracking system using IoT technology and wireless sensor networks (WSNs). The system integrated various hardware components such as Arduino Uno, LCD, temperature sensor, buzzer, panic button, heart rate sensor, ultrasonic sensor, NodeMCU, power supply, toxic gas sensor, and Peltier module. The results showed that the system was able to accurately measure the user's vital signs, environmental conditions, and gas concentration levels in real-time. The Peltier module was able to maintain the desired temperature of the environment, providing the user with a comfortable and safe experience. The system can be used for soldiers in the battlefield to monitor their vital signs and environmental conditions, providing real-time alerts and notifications in case of emergency situations. It can also be used for monitoring the health and safety of workers in hazardous environments such as mines, construction sites, and chemical plants.

In conclusion, the Soldier Safety and Tracking System using IoT and WSNs is a highly effective and reliable solution for real-time monitoring and control of vital signs, environmental conditions, and gas concentration levels. It has the potential to improve the safety and well-being of soldiers and workers in hazardous environments.

## VII. ACKNOWLEDGEMENT

We would like to express our gratitude to all those who have contributed to the successful completion of this project.

## VIII. REFERENCES

[1] R. Prasad and S. Singh, "A Comprehensive Survey on Wireless Sensor Networks for Military Applications," Journal of Sensors, vol. 2017, Article ID 1324621, 2017.

[2] M. J. Islam, M. J. Islam, and A. I. Khan, "An IoT-Based Wearable Sensor System for Monitoring of Firefighters' Safety," IEEE Sensors Journal, vol. 20, no. 16, pp. 9418-9428, 2020.

[3] Arya V Nair, Rani Raju, Tinsa Elsa Thomas and Vidya R Nair, "IoT Based Soldier Monitoring System", Pramana Research Journal, Volume No:9, Issue:5, pp: 157-165,2019.

[4] Brijesh Iyer and Niket Patil, "IoT enabled tracking and monitoring sensor for military applications", International Journal of Systems Assurance Engineering and Management, SPRINGER, July-2018.

[5] D. Poornakumar, R. Periyanayaki, M. R. Pradheepa, N. Prakashkumar and S. Nandhini, "Soldiers Navigation and Health Monitoring System using GPS and GSM", International Journal of Research in Engineering Science

and Management, Volume No: 3, Issue: 4, pp:115-158, April-2020.

[6] Deepa, ranjini, Sharanya Raj and Dr. Parameshachari B D, "Soldier Health Positioning Tracking System Using GPS and GSM Modem", International Journal of Engineering Research& Technology (IJERT), pp:1-6,2018.

[7] Dineshwar Jaiswar and Sanjana S. Repal, "Real Time Tracking and Health Monitoring of Soldier using ZigBee Technology", International Journal of Innovative Research in Science, Engineering and Technology: a Survey, Volume No:4, Issue :7, pp: 5560-5574, July-2015.

[8] E. J. Shanko and M. G. Papoutsidakis, "Real time health monitoring and wireless transmission: AμController application to improve human medical needs", 2013 E-Health and Bioengineering Conference (EHB), Isai, pp:242-249,2013.

[9] G. Raj and S. Banu, "GPS Based Soldier Tracking And Health Indication System With Environmental Analysis",International Journal of Enhanced Research in Science Technology & Engineering, Volume No: 2, Issue: 12, pp: 46-52, Dec- 2013.

[10] Hock Beng Lim1, Di Ma, Bang Wang, Zbigniew Kalbarczyk, Ravishankar K. Iyer and Kenneth L.Watkin ,"A Soldier Health Monitoring System for Military Applications", International Conference on Body Sensor Networks, IEEE pp:246-249,2010.