# Health Monitoring and Tracking System for Soldiers Using Internet of Things (IoT)

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## Abstract

*The paper reports a health monitoring and tracking system for soldiers based on internet of things (IoT). The proposed system can be mounted on the soldier's body to track the health status and current location of the soldiers using GPS. The information obtained will be transmitted to the control room through IoT. The proposed system consists of tiny wearable physiological equipment's, sensors, transmission modules. Hence, with the use of the proposed equipment, it is possible to implement a low-cost mechanism to protect the soldier's life on the battlefield. During wars and military search operations, soldiers gets injured and sometimes the connection will be lost. To find the soldiers and to provide the information about health of the soldier's army base station need Global Position System (GSM) device for locating soldiers, and a wireless transceiver to transmit the data wirelessly. Upon losing the connection in the battlefield it is necessary for the base station to guide the solider. The base station can obtain the current status of the soldier which is displayed on the Personal Computer. The proposed system can be firmly fixed on the soldier's body to track their health status and current location using Global Positioning System (GPS). This information will be sent to the control room through Internet of Things.*


**Keywords:** *Arduino board, biomedical sensors, GPS, GSM, IoT, gas sensor, vibration sensor, Remote health monitoring, Tracking*

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## 1. INTRODUCTION:

Indian crowd are the third largest drove in the world with 1,200,255 active troops and 990,960 reserve troops. The soldiers will suffer a lot due to the unavailability of information of injuries to its personnel which increases death count. It is observed that the causalities are caused due to injuries rather than the direct assaults in the battlefield. The number can be minimized if the control room gets the real-time information about the health and location of the soldier. There are some issues regarding the safety of the soldiers. Knowledge of current location of soldiers, lack of continuous communication with the control room during the operations, lack of immediate medical attention and operations under different geographical conditions are the few safety issues. There is a necessity to develop a wearable technology which is less in size and dissipates very little power in the defense sector so that the location and the health parameters of the soldiers can be tracked in real time. By using this navigation system, the base station can guide the soldier to reach the desired destination. This device will improve awareness not only for the host but also for collocated military personnel who will exchange information using wireless networks.

The proposed system is based on IoT concept and will be helpful in the real-time continuous monitoring of soldier's health parameters and location. Pulse rate, humidity with body temperature, and oxygen level in an environment can also be monitored along with the location of the soldiers. During last decades, technologies like RF transceiver, cable-based systems, walkie-talkie, Zig Bee and GSM based tracking systems were most commonly used methodologies for the tracking of soldier's life during war. However, all these technologies suffered from one or more reasons like high installation cost, high noise, loss of signal, as well as the bulky nature. Hence, a wireless low cost and portable tracking system with high reliability is needed for the protection of valuable life of the soldiers in the battle field.

These parameters are transmitted to the control room by using IoT. The control room receives the position and orientation of soldier from GPS.  Hence, soldiers are guided for the correct directions during the operations using GPS.


## 2. LITERATURE SURVEY

Kumar et al [1] they found their idea from the mountaineers as mountaineers uses wrist watch for tracking their position, to know the temperature of their surroundings and to know the direction. The idea of this paper was taken from the wristwatch used by mountaineers. The watch displays position, direction, surrounding temperature, and it also acts as altimeter. Soldiers carry walkie-talkies, which are bulky and it is also used for the trekking purpose to know the direction to the people. So it is been developing an alternative system using sensor system which will save the soldier during danger**.**

Pramod [2] has focused on integrating the bulky components into lightweight package which could acquire more power without using large power source. Global Positioning System (GPS) is used to guide the soldiers in the war field when they get lost and also to guide them to find the safe place whenever needed. Because many soldiers lost their lives when they entered in the enemy region without even knowing so this will help to guide them towards the right path. Temperature sensor and heart beat sensor will help to check their health status. Fundamentally it is meant for establishing communication between the soldier and the base.

Madhyan and Kadam [3] have proposed a Zig-Bee transceiver is used to transmit the data, coming from sensors and Global Positioning System (GPS) receiver through microcontroller, to the army control room wirelessly a Zig-Bee is low cost, low power, wireless mesh network standard especially designed and developed for long battery life devices in wireless controlling and monitoring applications. Zig-Bee devices have low latency which can further reduce the average current. Additionally, an alphanumeric Liquid Crystal Display (LCD) display is used to display the health parameters (i.e. body temperature and heart beats) and location information of soldier. Also a buzzer and a panic switch are provided. A soldier can press the panic switch to ask for help in panic situation from army control room and from another fellow soldier within the wireless range. The buzzer of other fellow soldier will sound when panic button is pressed by the soldier in panic condition.

Nikam et al [4] have presented an idea for the safety of soldiers. There are many instruments which can be used to view the health status of soldiers as well as ammunitions on them. The biosensor which consists of various types of small physiological sensors, transmission modules have great processing capabilities and can facilitates the low-Cost wearable solutions for health monitoring. The biosensor reader device with the associated electronics or signal processors that are primarily responsible for the display of the results in a user-friendly way. This sometimes accounts for the most expensive part of the sensor device, however it is possible to generate a user friendly display that includes transducer and sensitive element. The readers are usually custom designed and manufactured to suit the different working principles of biosensors.

Srijani et al [5] have proposed "Patient Health Management System". This system is based on smart devices and wireless sensor networks for real time analysis of various parameters of patients. This system is aimed at developing a set of modules which can facilitate the diagnosis for the doctors through tele-monitoring of patients. It also facilitates continuous investigation of the patient for emergencies looked over by attendees and caregivers. A set of medical and environmental sensors is used to monitor the health, as well as the surroundings, of the patient. This sensor data is then relayed to the server using a smart device or a base station. Each of the systems discussed above provides a feature needed before, during and after a combat. Multichannel Television Sound (MTS) provides continuous tracking of soldiers' movements, but their health statuses are missing, "Smart real-time healthcare monitoring" system provides health statuses tracing, but not continuously, "Patient Health Management System" provides health monitoring using smartphone over the Internet or using servers to extract information.

Limbu and Kale [6] have introduced a system that gives ability to track the soldiers at any moment. The soldiers will be able to communicate with control unit using Global Positioning System (GPS) coordinate information in their distress. It is able to send the sensed and processed parameters of soldier in real time. It enables to army control unit to monitor health parameters of soldiers like heartbeat, body temperature, etc. using body sensor networks. The

parameters of soldiers are wirelessly transmitted using Global System for Mobiles (GSM). They had presented an idea for the safety of soldiers using sensors to monitor the health status of soldiers as well as ammunitions on them. Global Positioning System (GPS) module has been used for location tracking and Radio Frequency (RF) module has been used for high speed, short-range data transmission, for wireless communications between soldier-to soldier that will help to provide soldiers health status and location data to control unit.

Archana and Indira [7] they had given stress on the protection of soldier itself especially of those who go on special tasks or missions because if a soldier is safe then our nation is safe. For this Global Positioning System (GPS) for tracking their position and different biomedical sensors are used for checking their health in a definite interval of time and also to monitor their movement. They focused on using light weight sensors and a power source which give more than sufficient power to these components. In this paper they have focused on helping the soldiers by providing medical assistance at the battlefield.

## 3. METHODOLOGY

### 3.1 Real-time Data Sensing in the Warzone:

Data which is collected from the war zone will be the measure of soldier's health condition. Appropriate sensors are used for deployment so the data analytics performed using K-Means helps the control unit in mapping the conditions around the soldiers.

### 3.2 Data Transmission:

Data is transmitted from the soldier to the squad leader using wifi module. The squad leader then collects this data and passes it to the control unit using LoRaWAN (Long Range Wide Area Network). Data can either be sent periodically after some fixed intervals of time or only when there is a significant change in the biomedical sensor readings of the soldier.

### 3.3 Data Analysis & Prediction:

Instead of using simple conditional statements, K-Means Clustering algorithm has been used. Clustering is the assignment of a set of observations into subsets (called clusters) so that observations in the same cluster are similar in some sense. Clustering is a method of unsupervised learning, and a common technique for statistical data analysis used in many fields. Due to the unavailability of real time soldier data, clustering has been proposed initially. K-Means Classification can be easily applied on the real time data that will be collected eventually. The difference in sensor values will help us in clustering the data into clusters such as healthy, ill, abnormal and dead. Once the data has been collected and clustered, these clusters can be visualized for more instinctive summaries at the control unit.

## 4. CONCLUSION

In military operations, one of the fundamental challenges is that the soldiers will not be able to communicate with control room as well as other soldiers. The protection of the country is primary mission for soldiers. Hence, concern regarding the safety of the soldiers is taken care of. The paper reports an IoT based system for the health monitoring and tracking of the soldiers. Here we are using Arduino board which is low cost for the possessing purpose. And use of biomedical sensors provides body temperature, heartbeat, and the environmental parameters of every soldier to control room. This technology will be helpful to provide the accurate location of the missing soldier in critical condition and overcome the drawback of soldiers missing in action. The addressing system is also helpful to improve the communication between soldier to soldier when there is any emergency situation and will provide proper navigation to control room. Thus we can conclude that this system will act as a lifeguard to the army personnel of all over the globe. In future, a portable handheld sensor device with more sensing options may be developed to aid the soldiers.

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