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**ECE 1901**

**TECHNICAL ANSWERS FOR REAL WORLD PROBLEMS**

# IOT BASED SOLDIER HEALTH MONITORING AND TRACKING SYSTEM

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VIT VELLORE

# DECLARATION

We hereby declare that the project entitled " Soldier Health Monitoring And Tracking System" submitted for the completion of course ECE 1901 Technical Answers For Real World Problem to VIT is a record of bonafide work carried out by me under the supervision of Prof.Kalavani S.

We further declare that the work reported in this thesis has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

**Place** : Vellore
**Date**: 23.08.22

**Signature of Candidate**
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# CERTIFICATE

This is to certify that the thesis entitled " Soldier Health Monitoring And Tracking System" submitted by SARNITHA G U (**19BEC0575**), DIPANJAN ACHARYA(**19BML0040**), SOUMYA KUMAR(**19BML0069**) from SENSE SCHOOL, VIT UNIVERSITY, for the award of the degree of Bachelor of Technology in Programme in the course ECE 1901 Technical Answers For Real World Problem , is a record of bonafide work carried out by them under my supervision during the period 12.07.2022 to 23.08.2022, as per the VIT code of academics and research ethics.

The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university. The thesis fulfils the requirements and regulations of the University and in my opinion meets the necessary standards for submission.

**Place**: Vellore
**Date**: 23.08.22

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## CONTENTS

## EXECUTIVE SUMMARY - Abstract

Tracking the soldiers is a pivotal function to carry out in the military. This will increase the efficiency and provide aid to the soldiers whose health conditions are sensed to be abnormal. At present only through communication can the authorities obtain information about the condition of their soldiers.

In this project we try to understand and implement the Soldier Health Monitoring System Using IBM Cloud and additional health parameters are modelled using Proteus Simulation. The Soldier Health monitoring system will serve two primary functions. Firstly, it will help keep track of the soldier's locations and secondly monitor his vital parameters.

We have obtained a random location of the soldiers and their health conditions which includes temperature, pulse rate and blood pressure using python code and sent it to the cloud. We have used Node-RED to configure the flow to receive the data. Cloudant DB nodes are used to store the received data in the Cloudant DB. The data is published in the web application.The health parameter and their modelling is done using Proteus.

The purpose of this project is to track the location of the soldiers in a certain range and to check if their health condition is normal or abnormal. If the soldier is out of range, then a notification is sent to the authorities. If the received data of the health conditions of the soldiers is not normal then a corresponding notification is sent to the authorities as well. This is a highly useful application as we can track and analyse the condition and the location of the soldier without direct communication.

In today's modern times, health monitoring systems for soldier's will greatly strengthen a nation's military power and improve their efficiency.

# INTRODUCTION

A crucial task for the military to perform is tracking the soldiers. This will improve effectiveness and help the warriors whose health is thought to be aberrant. Currently, the only way for the authorities to learn about the state of their soldiers is through communication.

Therefore to solve this problem we have proposed a solution.By accessing the soldiers' sensor data and examining their position and state of health, we suggest that this problem be resolved. The information will be presented visually in the web application, and if any of the parameters—such as temperature, pulse, or blood pressure—are outside of what is considered normal for a healthy person, the appropriate message is immediately sent to the appropriate authorities. Additionally, the sensor data is kept in the Cloudant DB.

Dataflow :
To acquire random sensor data for location (latitude and longitude), body temperature, pulse rate, and blood pressure, we create a Python method.

The code is integrated with IBM Cloudant, and the data received is saved in IBM Database.We build a Node-RED user interface that presents the sensor data using dashboard nodes.When a soldier's health falls outside of the normal range, the appropriate alarm notification is transmitted to the authorities.

The troop data was generated using Python code that was written utilising built-in packages and functions.
Node-RED dashboards were researched and set up to plot the soldier's location.
To compare the data from the soldiers with the typical range of body temperature, heart rate, and blood pressure.
The user interface uses appropriate charts to display the facts in a way that makes it easy to grasp.

# LITERATURE SURVEY

| S.No | Title, Author and Name of the journal | Year of publication | Methodology |
|---|---|---|---|
| Base Paper | Aashay Gondalia, Dhruv Dixit, Shubham Parashar, Vijayanand Raghava, Animesh Sengupta, Vergin Raja Sarobin, IoT-based Healthcare Monitoring System for War Soldiers using Machine Learning, Procedia Computer Science, Volume 133, 2018, Pages 1005-1013, ISSN 1877-0509, https://doi.org/10.1016/j.procs.2018.07.075. | 2018 | In today's world there are many concerns regarding the safety of soldiers. So for their security purpose, many instruments are mounted on them to view their health status as well as their real time location. This paper gives an ability to track the location and monitor health of the soldiers in real time who become lost and get injured in the battlefield. It helps to minimize the time, search and rescue operation efforts of army control unit. This system enables to army control unit to track the location and monitor health of soldiers using GPS module and wireless body area sensor networks (WBASNs), such as temperature sensor, heart beat sensor, etc. The data coming from sensors and GPS receiver will be transmitted wirelessly using ZigBee module among the fellow soldiers. Furthermore, LoRaWAN network infrastructure has been proposed to be used between the squadron leader and the control unit in high altitude warzones where cellular network coverage is either absent or does not allow data transmission. The collected data will be uploaded on the cloud for further data analysis and predictions using K-Means Clustering algorithm. |

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| 1. | Jayshree Palkar; Nikhil N Chauhan. "IoT based Soldier Health Monitoring and Tracking System." Volume. Volume. 7 Issue. 5, May - 2022 , International Journal of Innovative Science and Research Technology (IJISRT), www.ijisrt.com.https://doi.org/10.5281/zenodo.6609343 | 2022 | Soldiers play a key role in the security system of the country. So, it's a prime responsibility to provide security to a soldier also. This proposed project uses a health monitoring and tracking system to check health by records & track the location of the soldier by Longitude and Latitude details. The sensors are fitted on soldier's body, and with the help of a GPS tracker, thorough IOT, the data will be transmitted to the control room. The project is to contrivance a mechanism to protect valuable human life on the battlefield. |
| 2. | M. R. Ruman, A. Barua, W. Rahman, K. R. Jahan, M. Jamil Roni and M. F. Rahman, "IoT Based Emergency Health Monitoring System," 2020 International Conference on Industry 4.0 Technology (I4Tech), 2020, pp. 159-162, doi: 10.1109/I4Tech48345.2020.9102647. | 2020 | This paper represents the system for monitoring the patient's body 24/7 by using IoT. This system is responsible for collecting pulse, body temperature and heart beat from the patient's body and send the data into the IoT Cloud platform by using WIFI-Module and health condition of the patient stored in the cloud. Hence, the professional and family member can monitor their patient from a remote location at any time. |
| 3. | A. H. Alquhali, M. Roslee, M. Y. Alias and K. S. Mohamed, "IOT Based Real-Time Vehicle Tracking System," | 2019 | A real-time vehicle tracking and monitoring device has been proposed in this paper. Additionally, a system using Arduino Uno R3 has been developed by the team. Global system for mobile (GSM) device, and global positioning system (GPS) to track the |

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| | 2019 IEEE Conference on Sustainable Utilization and Development in Engineering and Technologies (CSUDET), 2019, pp. 265-270, doi: 10.1109/CSUDET47057.2019.9214633. | | exact and accurate position of the vehicle at any location. The device is also equipped with a display to show the information on the current location of the vehicle to the user. Results show that users can easily track their vehicle location via their mobile phone through the internet. |
| 4. | S. Sharma, S. Kumar, A. Keshari, S. Ahmed, S. Gupta and A. Suri, "A Real Time Autonomous Soldier Health Monitoring and Reporting System Using COTS Available Entities," 2015 Second International Conference on Advances in Computing and Communication Engineering, 2015, pp. 683-687, doi: 10.1109/ICACCE.2015.84. | 2015 | The proposed system enables to detect the pulse (heartbeat rate) and position of the army personnel whenever required, thus vouching that timely support is provided to the needy ones. The transmitter equipped with pulse sensor and GPS Module is programmed with certain conditions to examine the healthiness of the soldier and accordingly to communicate with the receiver at some remote location. This paper presents framework of the design by utilizing the IEEE 802.15.4 standard and multifarious wireless sensor networks |
| 5. | Dr. Shantanu K. Dixit, Miss. Ashwini A. Joshi,"A Review Paper on Design of GPS and GSM Based Intelligent Ambulance Monitoring,". Joshi et al Int. Journal of Engineering Research and Applications, ISSN : 2248-9622, Vol. 4, | 2014 | An integrated GPS-GSM system is proposed to monitor ambulances using Google Earth application. At receiver side GPS accept data coming through SMS and process date using 89C51. After data processing, Google Earth application is used to view the current location and status of each ambulance. The front end application at the monitoring system is developed using visual basic software in Personal Computers. The system was found to be very useful for emergency patient |

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| | Issue 7( Version 6), July 2014, pp.101-103 | | transportation. |
| 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). | 2014 | The paper presents the development of a system which will help wirelessly monitor the health parameters of a soldier and also send and receive messages wirelessly from the base station computer. The system must also detect reduced vitals and alert the base station along with the GPS location so that a rescue team can be sent. The system also broadcasts messages wirelessly via the EZ430-RF2500 wireless module. These messages are sent to all the EZ430-RF2500 modules in the locality. |
| 7. | Govindaraj, A., and Dr S. Sindhuja Banu. "GPS based soldier tracking and health indication system with environmental analysis." *International journal of enhanced research in Science Technology & Engineering* 2.12 (2013): 46-52. | 2013 | Care of critically ill patient, requires spontaneous & accurate decisions so that life-protecting & lifesaving therapy can be properly applied. Statistics reveal that every minute a human is losing his/her life across the globe. More close in India, everyday many lives are affected by heart attacks and more importantly because the patients did not get timely and proper help .This paper is based on monitoring of remote patients, after he is discharged from hospital. It is able to send parameters of patient in real time. It enables the doctors to monitor patient's parameters (temp, heartbeat, ECG) in real time. Here the parameters of patient are measured continuously (temp, heartbeat, ECG) and wirelessly transmitted using Zigbee. |
| 8. | A. Chandra, S. Jain and M. A. Qadeer, "GPS Locator: An Application for Location Tracking and Sharing Using GPS for Java Enabled Handhelds," | 2011 | A J2ME mobile application based on providing Location Based Service using Global Positioning System (GPS) as a location provider is presented. The application informs the user with his current location coordinates and shows it on Google Maps. The application is also implemented as a client server |

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| | 2011 International Conference on Computational Intelligence and Communication Networks, 2011, pp. 406-410, doi: 10.1109/CICN.2011.85. | | system that helps users to locate their friends or anyone with whom he wants to share his location. The location average accuracy using this system is believed to be within a couple of meters. The application works in open space areas only since it relies on GPS. |
| 9. | Lim, H. B., Ma, D., Wang, B., Kalbarczyk, Z., Iyer, R. K., & Watkin, K. L. (2010, June). A soldier health monitoring system for military applications. In 2010 International Conference on Body Sensor Networks (pp. 246-249). IEEE. | 2010 | With recent advances in technology, various wearable sensors have been developed for the monitoring of human physiological parameters. A Body Sensor Network (BSN) consisting of such physiological and biomedical sensor nodes placed on, near or within a human body can be used for real-time health monitoring. In this paper, we describe an on-going effort to develop a system consisting of interconnected BSNs for real-time health monitoring of soldiers. We discuss the background and an application scenario for this project. We describe the preliminary prototype of the system and present a blast source localization application. |
| 10. | Walker, W., Aroul, A. P., & Bhatia, D. (2009, September). Mobile health monitoring systems. In 2009 Annual International Conference of the IEEE Engineering in Medicine and Biology Society (pp. 5199-5202). IEEE. | 2009 | Advancements are being made towards a cheap and effective means for health monitoring. A mobile monitoring system is proposed for monitoring a bicycle rider using light weight, low power wireless sensors. Biometric and environmental information pertaining to the bicycle rider is captured, transmitted to, and stored in a remote database with little user interaction required. Remote users have real time access to the captured information through a web application. Possible applications for this system include the monitoring of a soldier in the battlefield and the monitoring of a patient during an ambulance ride. |

## METHODOLOGY

We propose to solve this issue by obtaining the sensor data of the soldiers and analyse their health condition and location. The data will be displayed in the form of visual representation in the web application and if the parameters such as temperature, pulse and blood pressure are not within the normal range of a healthy person then the authorities are promptly notified with the corresponding message. The sensor data is also stored in the Cloudant DB.

We have obtained a random location of the soldiers and their health conditions which includes temperature, pulse rate and blood pressure using python code and sent it to the cloud. We have used Node-RED to configure the flow to receive the data. Cloudant DB nodes are used to store the received data in the Cloudant DB. The data is published in the web application.

## TECHNOLOGY USED

- **IBM WATSON** -
  IBM Watson's cognitive and analytical capabilities enable it to respond to human speech, process vast stores of data, and return answers to questions that companies could never solve before. As new data is entered into Watson's data repository, it uses machine learning that is the product of the processing it performs during analytics to continue to increase its knowledge of subject areas, and the insight it is capable of delivering to users.
  In our project we use IBM Watson to store and manage the data of the soldiers. All the input data be it temperature parameters or any other physical parameter, all these are stored and implemented using IBM Watson.

- **NODE RED** -
  Node-RED is a flow-based development tool for visual programming developed originally by IBM for wiring together hardware devices, APIs and online services as part of the Internet of Things.Node-RED provides a web browser-based flow editor, which can be used to create JavaScript functions. Elements of applications can be saved or shared for re-use.

| | |
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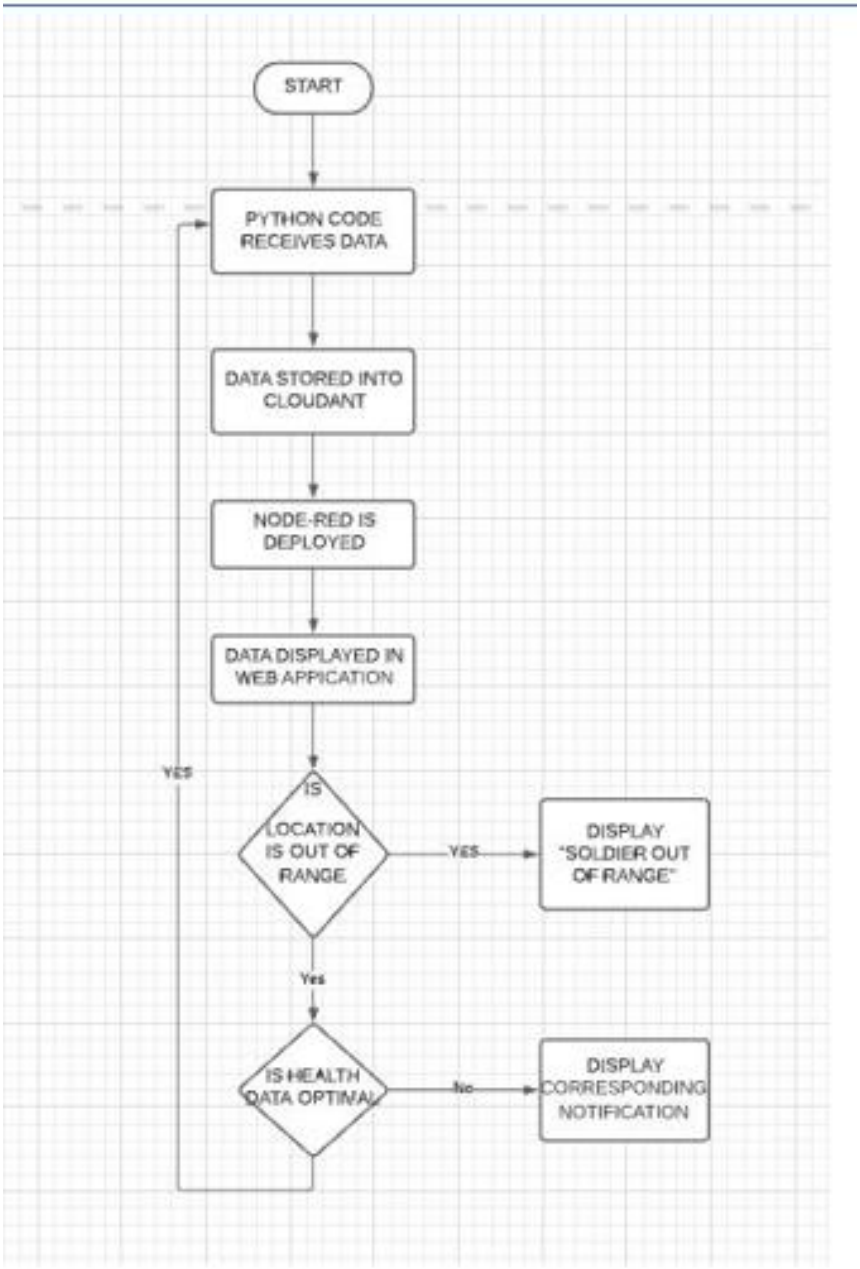
| Node-RED | A visual tool for wiring the Internet of Things |
| Node-RED Dashboard | A dashboard UI for Node-RED |

- **Proteus**
  The **Proteus** is an electronic circuit design software which includes a schematic capture, simulation and PCB ( Printed Circuit Board) Layout modules. But generally nowadays.
  Proteus is ahead in simulating the circuits containing the micro controllers where we can simulate the circuit by uploading the hex code to the Microcontroller whereas Multisim can’t do this.

## FLOW CHART




## PROCESS FLOW EXPLANATION

We develop a python code to obtain random sensor data for location (latitude and longitude), body temperature, pulse rate and blood pressure.We integrate the code with IBM Cloudant and store the received data in IBM Database.

Using dashboard nodes, we create a User Interface in Node-RED which displays the sensor data.When the health conditions of the soldier are out of normal range, suitable alert notification is sent to the authorities.

## MODELLING

Using dashboard nodes in IBM cloud, we create a User Interface in Node-RED which displays the sensor data. The python code is then integrated with the Node-RED.

The python code analyses the data from the soldier and shows results and takes actions accordingly. We load the ideal health condition and location of the soldier.

The system compares the obtained data from the soldier with the value preloaded by us in the system. The data collected by our system is the soldier's Temperature, Blood pressure, pulse rate and their location are monitored periodically.

Whenever the health conditions of the soldier are non-ideal or if the soldier is out of range, alert notification is sent to the respective authorities.

## MEASURES TO VALIDATE IMPLEMENTATION

After completing the implementation we compared our results with our on going progress.

From the proposed system above, we conclude that transmission happens at fixed intervals of time and the readings are accurate. From the soldier unit the data is transmitted to the base camp unit and if any abnormalities are notified in the health conditions, the officials in the base station are immediately notified about it. This would really help in early tracking of danger and immediate actions can be taken to save lives of soldiers. This system helps in monitoring the health parameters of the soldier, atmospheric conditions and their locations.

The system also assists the soldier in getting help from the army base camp and or from another fellow soldier in situations of emergency. This would be very useful to military forces during war and rescue operations since the system can be used without any network restriction. Hence this system provides safety and protection to soldiers. The system has a very effective modelling design. The system is a reasonable one as it can be easily attached to the hand of the soldier.

For any system, there is always scope for improvement with development in technology in upcoming times. With regard to the soldier health and location monitoring system, a compatible and better routing algorithm can be utilized to make this system much more reliable and efficient in terms of energy. New technologies can be incorporated in order to expand the capacity of data

transmission. Methods to increase the number of health parameters being measured can be taken.

Additional features such as the attachment of a microphone can be done to the system in order to record external voices and also directly communicate with the soldier. A camera can also be added to take pictures of the location of the soldier so that tracking can be made easier in times of emergency. The range of communication of the system can also be expanded in order to expand the area of coverage and to ensure that data transmission is not stopped due to the increase in distance between the base station and the present location of the soldier.

File Edit Format Run Options Window Help

```
import wiotp.sdk.device
import time
import json
import random
import geocoder

myConfig = {
    "identity": {
        "orgId": "x012hb",
        "typeId": "VITDevice",
        "deviceId":"500062"
    },
    "auth": {
        "token": "12345678"
    }
}

def myCommandCallback(cmd):
    print("Message received from IBM IoT Platform: %s" % cmd.data['command'])
    m=cmd.data['command']

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

while True:
    t=random.randint(90,110) #Body temperature in Fahrenheit
    p=random.randint(40,120) #Pulse rate in beats per minute
    #Blood pressure(systolic(s) & diastolic(d))-measured in mm Hg:
    d=random.randint(80,140)
    s1=random.randint(60,80) #systolic range for low Blood Pressure
    s2=random.randint(80,90) #systolic range for high Blood Pressure

    if (d<=120):
        s=s1
    if(d>=120):
        s=s2
    b = str(d) + "/" + str(s)
    #Tracking current location (latitude & longitude) using geocoder:
    soldier=random.randint(1,10) #Just a random number for Soldier
    #g = geocoder.ip('me') #Location of the soldier when's he witihn the required area
    g = geocoder.ip('199.7.157.0') #Random location to consider Soldier is not in the required area
    name="Soldier" + str(soldier)
    la=(g.latlng[0]) #Latitude of soldier location
    lo=(g.latlng[1]) #Longitude of soldier location

    myData={'name':name,'temperature':t, 'pulserate':p,'bloodpressure':b ,'systolic':s,'diastolic':d, 'lat':la, 'lon':lo }
    client.publishEvent(eventId="status", msgFormat="json", data=myData, qos=0, onPublish=None)
    print("Published data Successfully: %s", myData)
    client.commandCallback = myCommandCallback
    time.sleep(6)
client.disconnect()
```

Fig. *Python code*

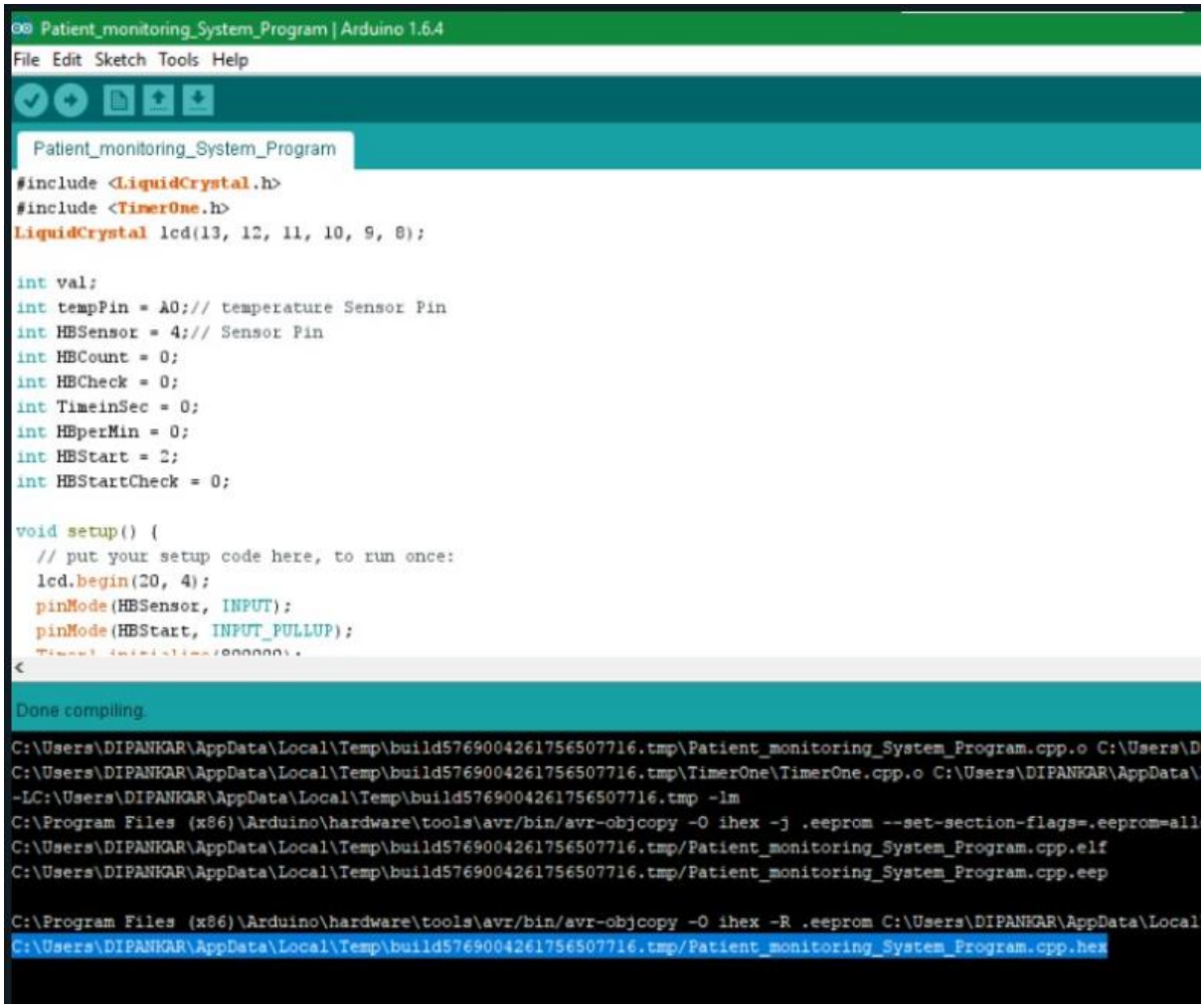


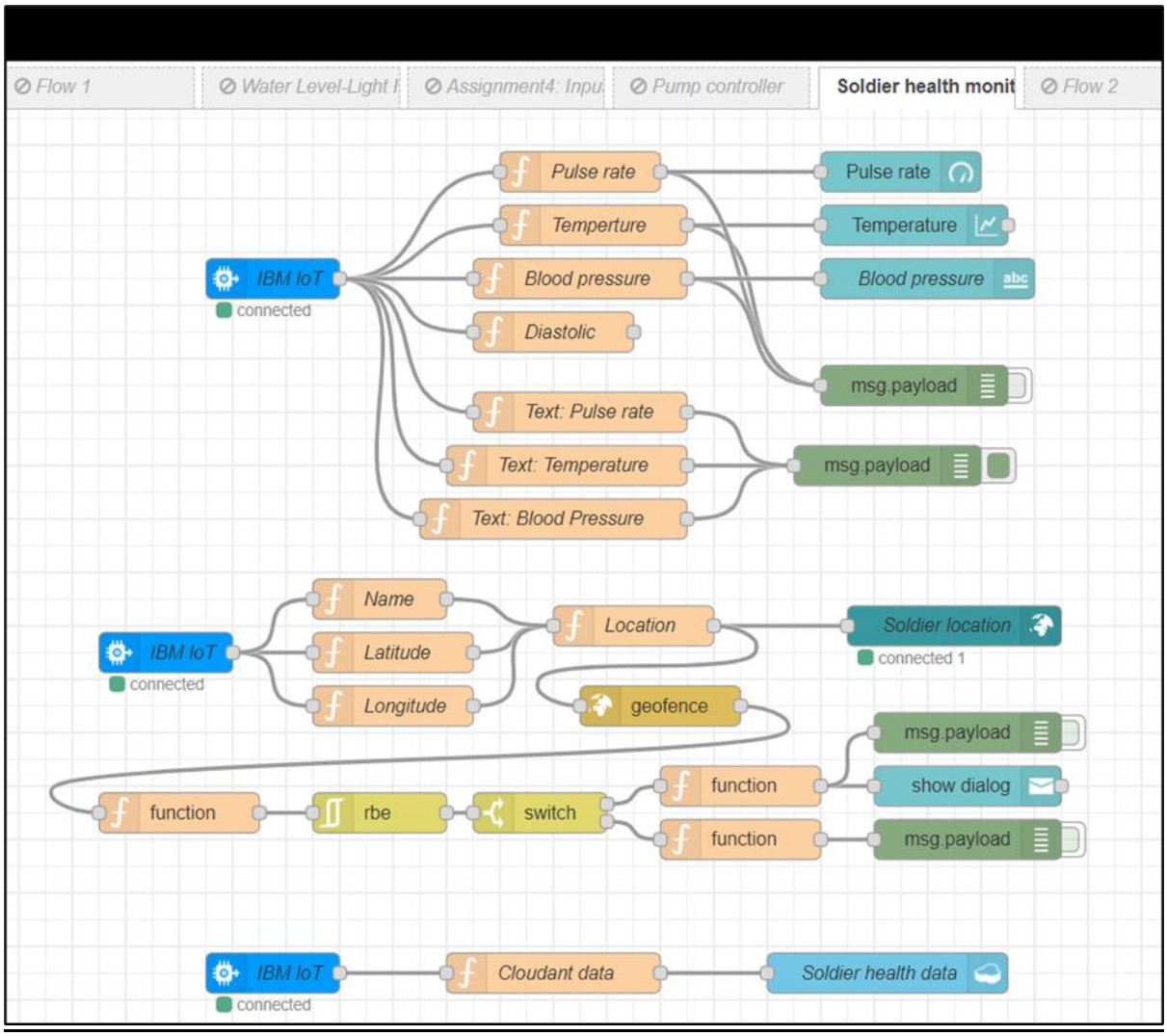

Fig. *Arduino code for Proteus Simulation*

## RESULTS VALIDATION

The main aim of our project is to continuously monitor the health condition and the location of the soldier and send alerts or notifications to the appropriate authorities.

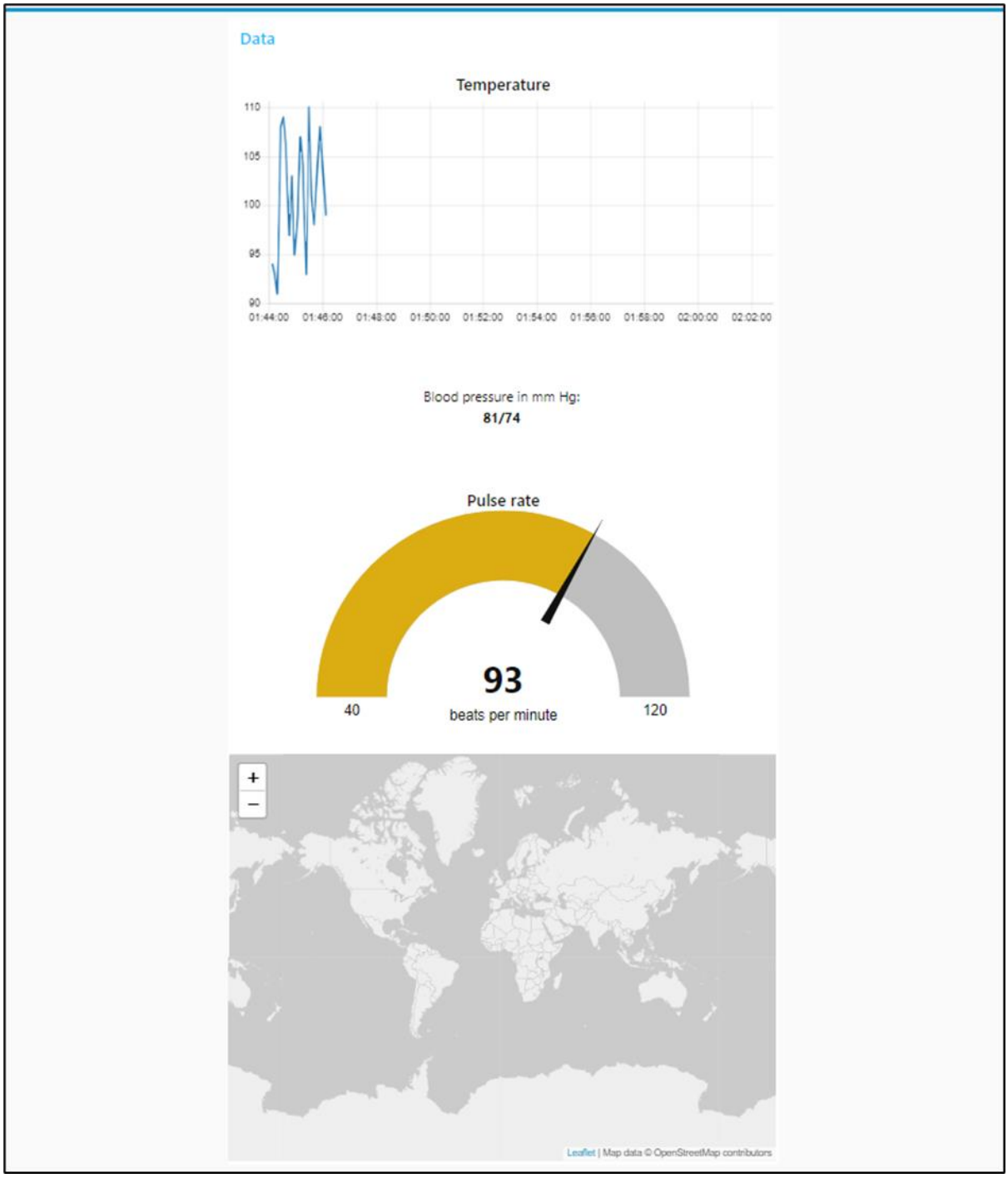
So, the system is pre-loaded with the normal health conditions and the location range where the soldier must be present. If the soldier's health is abnormal or if the soldier is out of range, the system must immediately report or alert the authorities.

Node-red flow

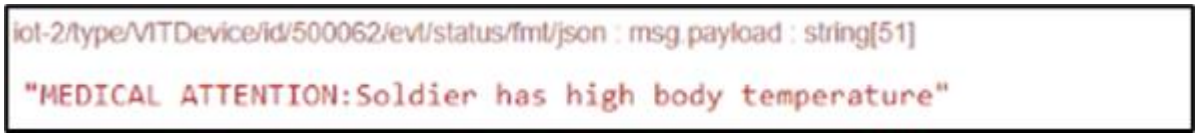



This figure shows the flow of the system using node-red. Here the IBM acts as a IoT device which continuously gives input to the system to analyze and take actions accordingly.

Using Node-red dashboard flow the pulse rate, Temperature and blood pressure of the soldier can be visualised. And using geofence, we could visualise the location of the soldier.




In case the soldier has high body temperature



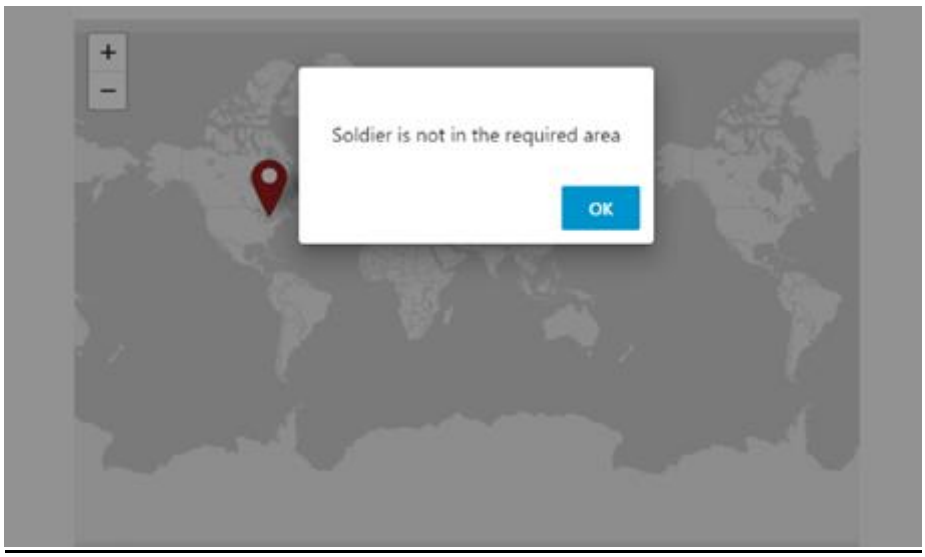

This figure shows that the notification “Soldier has high body temperature” and action can be taken at the latest.

Similarly, all the abnormalities in the soldier's health can be sent as alert to the authorities.

```
iot-2/type/VITDevice/id/500062/evt/status/fmt/json : msg.payload : string[50]
"MEDICAL ATTENTION:Soldier has low body temperature"
```

```
iot-2/type/VITDevice/id/500062/evt/status/fmt/json : msg.payload : string[49]
"MEDICAL ATTENTION:Soldier has high blood pressure"
```

If the soldier's location is sensed out of the range then,




Proteus Simulation

Inference from the data in relation to health care problems

- Hypothermia, defined as a core temperature of <35.0°C, may present with shivering, respiratory depression, cardiac dysrhythmias, impaired mental function, mydriasis, hypotension, and muscle dysfunction, which can progress to cardiac arrest or coma.
- Hyperthermia, defined as a core temperature of >40.5°C, may present with sweating, flushing, tachycardia, fatigue, light headedness, headache, and paresthesia.
- Disorders resulting from abnormally high or low body temperature result in neurologic dysfunction and pose a threat to life.
- Identification of bradycardia and tachycardia  The presence of tachycardia in critically ill patients is frequently used as an indication of severity of illness and

to guide treatment decisions but can be influenced by body temperature, thus confounding its interpretation.

- Increase in body temperature is associated with a linear increase in heart rate of 9.46 beats/min/°C in female and 7.24 beats/min/°C in male patients.

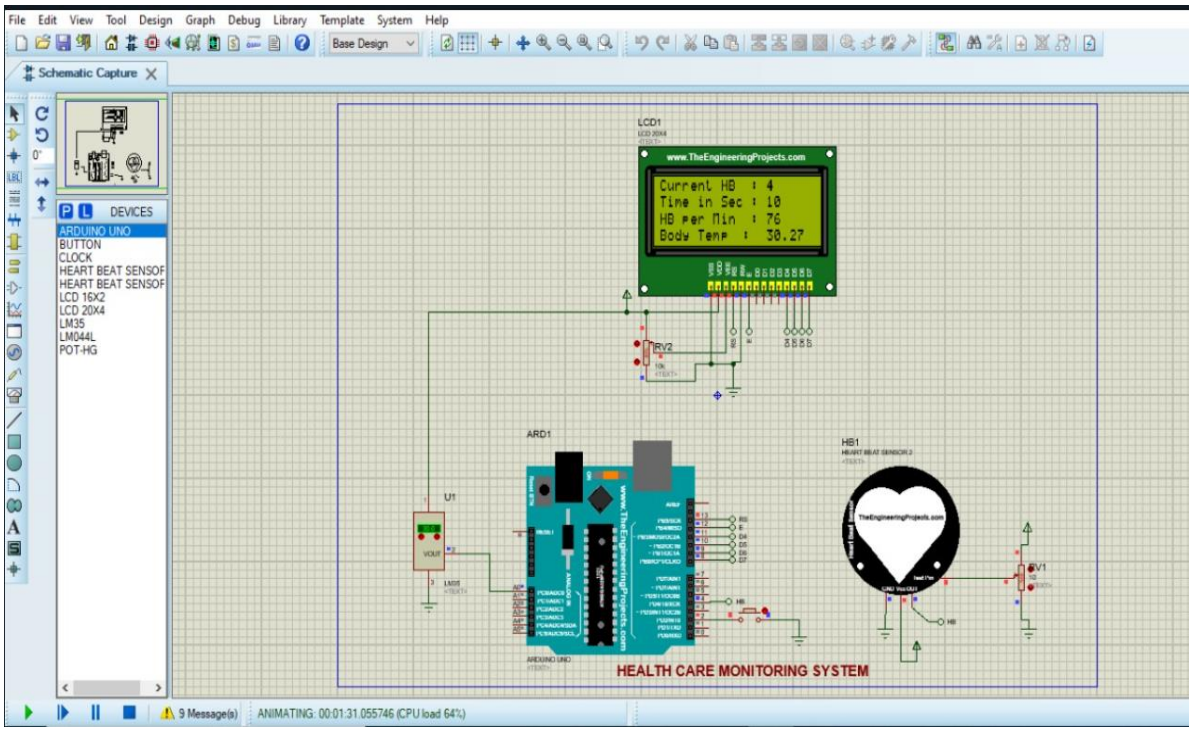



Fig: *Display of Health parameters by Proteus Simulation*

## DISCUSSION AND ANALYSIS

Advantages or benefits of the system include :

The body temperature, blood pressure, and pulse rate of a soldier can be tracked using an IoT-based military health monitoring system. Additionally, it enables us to track the soldier's location, which is very helpful in emergency situations. Real-time transmission of the precise position and health status to the base station enables the base station to take the necessary steps. It is a very efficient and trustworthy method. Because IoT is incorporated, it operates quickly and transfers data more quickly.

Some disadvantages of the system include:

The system's limited range is one of its main shortcomings. When the soldier is far from the base station, accurate data transmission may be challenging. Weather conditions and network problems might also have an impact on data delivery. Additionally to this Systems based on wifi are frequently vulnerable to hackers who could tamper with the data provided to the bases.

## CONCLUSION

We were able to successfully simulate the iot based soldier health care monitoring system. From the proposed system above, we conclude that transmission happens at fixed intervals of time and the readings are accurate. From the soldier unit the data is transmitted to the base camp unit and if any abnormalities are notified in the health conditions, the officials in the base station are immediately notified about it. This would really help in early tracking of danger and immediate actions can be taken to save lives of soldiers. This system helps in monitoring the health parameters of the soldier, atmospheric conditions and their locations.

The system also assists the soldier in getting help from the army base camp and or from another fellow soldier in situations of emergency. This would be very useful to military forces during war and rescue operations since the system can be used without any network restriction. Hence this system provides safety and protection to soldiers. The system has a very effective modelling design. The system is a reasonable one as it can be easily attached to the hand of the soldier.

## FUTURE SCOPE

For any system, there is always scope for improvement with development in technology in upcoming times. With regard to the soldier health and location monitoring system, a compatible and better routing algorithm can be utilized to make this system much more reliable and efficient in terms of energy. New technologies can be incorporated in order to expand the capacity of data transmission. Methods to increase the number of health parameters being measured can be taken.

Additional features such as the attachment of a microphone can be done to the system in order to record external voices and also directly communicate with the soldier. A camera can also be added to take pictures of the location of the soldier so that tracking can be made easier in times of emergency. The range of communication of the system can also be expanded in order to expand the area of coverage and to ensure that data transmission is not stopped due to the increase in distance between the base station and the present location of the soldier.

## LINK TO THE VIDEO DEMONSTRATION OF PROJECT

https://drive.google.com/file/d/1BVHUR16OJFdN1uAxi8e7zXMtSzF4P9SV/view?usp=sharing