IoT Based Soldier Monitoring System

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ABSTRACT

Nowadays, the security system of the nation depending upon the warfare and soldiers have important role in it. 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. Bio-sensor systems comprise various types of small physiological sensors, transmission modules and processing capabilities, and can thus facilitate low-cost wearable unobtrusive solutions for health monitoring. 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 atmospheric temperature sensor, heart beat sensor, humidity sensor, atmospheric pressure sensor etc. The data coming from sensors and GPS receiver will be transmitted wirelessly using ZigBee module to the base station. The collected data will be uploaded on the cloud for further data analysis at control unit and appropriate decisions are made.

***Keywords*: GPS Module, Zigbee, Sensors**

1. INTRODUCTION

The security and stability of a country depends on soldiers. Soldiers may has to withstand with different climatically conditions ranges from high temperature to high cold. The nation is also focusing on development of different devices for ensuring the soldier's safety. So the soldier must be accompanied with advanced systems for their safety such as real time GPS (Global Positioning System) and data communications to send and receive information to/from the control unit. In this paper biomedical sensors and monitoring devices are attached with the soldier's body and the used components are light weight. The proposed system focuses on tracking the health conditions and position of the soldiers, hence this system can be used for special mission. Smart biomedical sensors such as Temperature & Humidity sensor, Pressure & Altitude sensor, Heartbeat sensor and GPS module are attached to the hand of soldiers. These are implemented with the soldier for complete mobility. For data transmission

zigbee module is used at soldier unit and base station unit. The data collected at the base station is further analysed by thinspeak cloud platform. This may help the control station to know about the condition of the soldier.

The system has a soldier unit and control room unit. The soldier unit is attached to the hand of the soldier. It collect the details about conditions of the soldiers especially about their health conditions and atmospheric conditions. These data or signals are transmitted to the control room and there these data are analyzed in thinkspeak cloud platform, so that we can observe the data as graphical representation. According to the conclusion they decides that whether any operations are needed for the safety of the soldiers. Since GPS module placed at the soldier unit the control room gets the details about the current position of the soldier. Hence we can save the life of the soldiers in critical conditions and also we can monitor their positions.

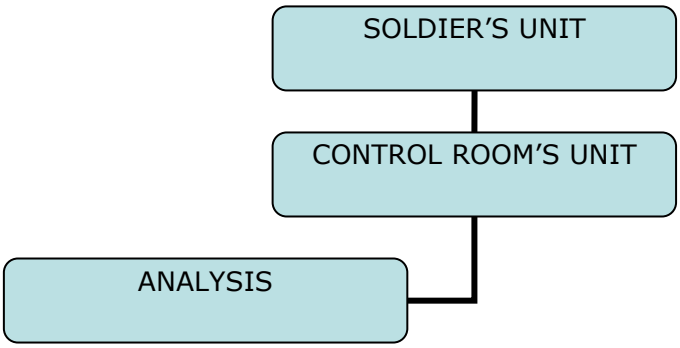

Figure 1.1 Flow chart of proposed system

2. LITERATURE SURVEY

A body sensor network consisting of physiological and biomedical sensor nodes placed on, near or within a human body can be used for real time health monitoring [1]. Remote monitoring systems allow the monitoring of persons outside of the doctor's office or hospital, thus giving a more accurate history of the person's status. A remote health monitoring system allows medical personnel to service a larger number of persons, reduce hospital visits, enable faster emergency notice, and hopefully reduce health care expenditures[2][3].

In soldiers security, bio-sensors systems gives different types of small physiological sensors, Barometric sensor and Oxygen analyzer sensor , transmission modules and processing capabilities, and can thus facilitate low-cost wearable unobtrusive solutions for health monitoring. GPS used to log the longitude and latitude so that direction can be known easily. These devices are being added to weapons, firearms, and militaries which are exploring the possibility of embedding GPS devices into soldiers vests and uniforms so that field commanders can track their soldier's movements in real time. The wireless Webcam can be used to watch the real time video. RF module can be used for effective range of high-speed transmission, short-range and soldier-to-soldier wireless communication[4][5][6].

The soldier can ask for directions to the army base unit in case he feels that he is

lost. By using the location sent by the GPS, the base station can guide soldier to safe area & GSM will help to communicate the Soldier unit with Base unit. By getting the exact location of soldiers it will help the Soldiers to discuss about their war strategies and take guidance from Base unit. The various Health Sensors such as Temperature sensor, Heart rate sensors, Humidity sensors, Gas detection sensors will help to decide the health status of that particular soldier. Continuous Communication is possible[7][8]. Use of ARM processor and low power requiring peripherals reduce overall power usage of system. Modules used are smaller in size and also lightweight so that they can be carried around[9].

The data coming from sensors and GPS receiver is transmitted wirelessly using ZigBee module. Also, a soldier can ask for help from control room and can communicate with other fellow soldier present within the wireless transmission and reception range[10][11][12]. An interactive intelligent healthcare and monitoring system (IIHMS) including body sensor network (BSN) and local sensor network. The wireless bio-signal acquisition System–on–Chip (WBSA-SoC) for BSN application is applied to acquire the real human body temperature, heart rate and ECG signal via IEEE 802.15.4 ZigBee network communication. The high integration WBSA-SoC including an ECG acquisition node, heartbeat and temperature sensor, a spirometer, a processor with ZigBee protocol, a mix-mode interface, and a RF trans-receiver have been designed[13][14].

The authors have proposed a “Soldier Health and Position Tracking System” using Barometric pressure sensor, GPS, GSM and WBASNs (heartbeat sensor, temperature sensor). Microcontroller ATmega328p has been used for their prototype. Simple conditional statements have been used to identify the health of the soldier without any machine learning or training. GSM has been used as the means of communication which will not be useful at places with high altitude where network connectivity would be a big challenge. A message is sent after regular intervals containing the health status of the soldier using GSM[15].

3. PROPOSED SYSTEM

The soldier monitoring and Position Tracking System allows military to track the current GPS position of soldier and also checks the status including movement and heartbeats of soldier. The proposed system consists of two sections, soldier unit and control unit. Soldier’s unit comprises of sensor network for health and environmental monitoring, GPS module for tracking the location and a zigbee module for wireless data transmission. The GPS modem sends the latitude and longitude position with link pattern with the help of that military can track the current position of the soldier. The system is very helpful for getting health status information of soldier and providing them instant helpThe proposed system not only performs the task of health monitoring but also does the tracking of soldiers using IoT. The control room can acquire the details about the position and orientation of soldier . At the receiver the zigbee transceiver will receive the data which is then stored and analyzed in thinkspeak cloud platform. Based on these information, the authorities can initiate immediate action by deploying a medical, rescue team or any backup force for their help. It has two units: Soldier unit & Control room unit.

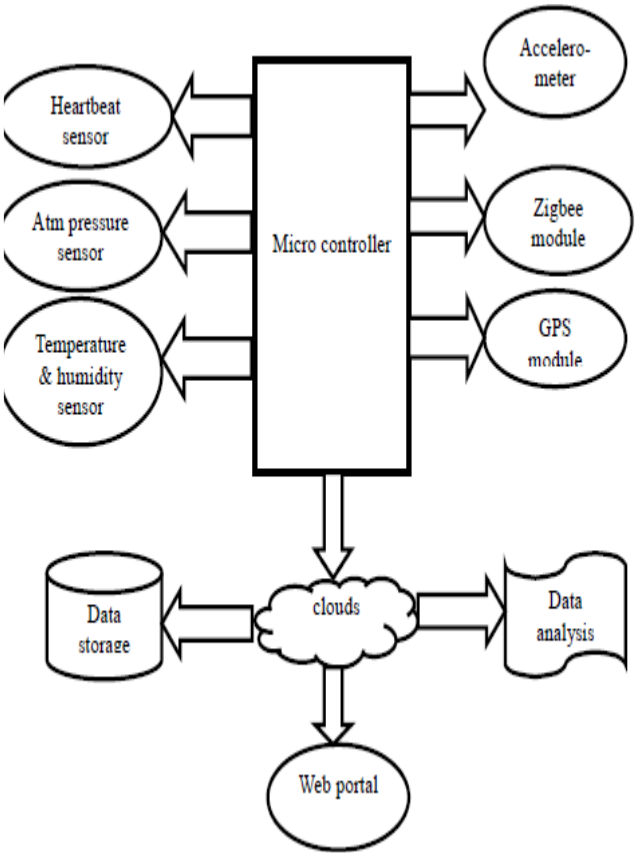

Figure 3.1 Block diagram of proposed system

3.1 PROPOSED SYSTEM ARCHITECTURE

3.1.1 Soldier's unit

This unit consists of body area sensor networks such as temperature and humidity sensor, GPS heart beat sensor, accelerometer , pressure and altitude sensor. These sensors are used to sense the health and environmental parameters of soldiers and tracking their location The sensed analog signals will be converted into digital signals using analog to digital converter and then compared with the normal conditional signals. If any discrepancy occurs between sensed heart beat signals and defined normal signals, then it will be considered as an emergency at receiver and an alarm gets on. A zigbee module will be used for communication between the soldier and the base station. The whole unit is attached to hand of soldier.

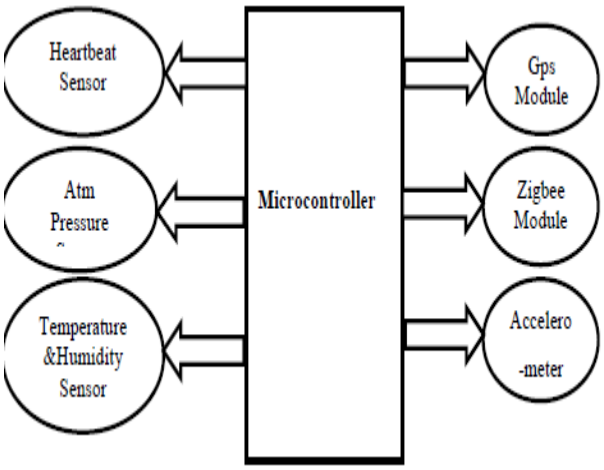

Figure 3.2 Soldier's Unit

3.1.2 Control Room's Unit

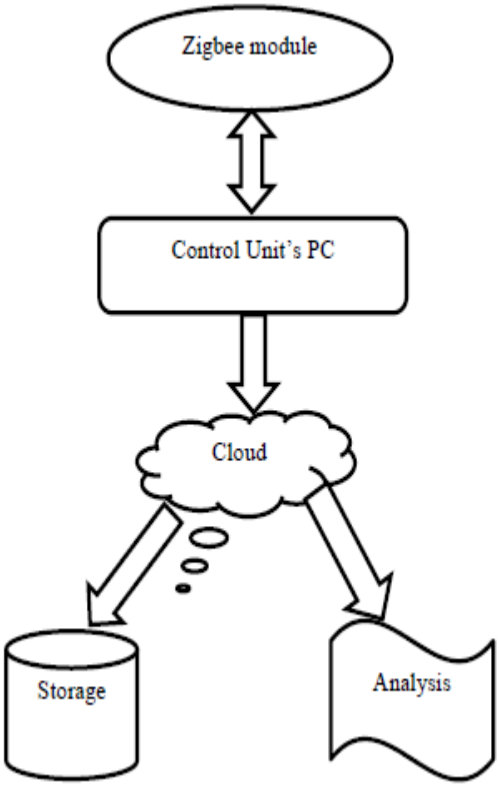

Figure 3.3 Control Room's Unit

The army base station unit or the control unit consists of a PC and a Zigbee transceiver module which will be connected with each other. The data coming from Zigbee module will be displayed on PC screen with the help of web portal or IoT cloud platform.

3.2 COMPONENTS SPECIFICATION

- Arduino MEGA 2560
- DHT11
- Accelerometer (adxl335)
- Digital barometric pressure altitude module (bmp180)
- Heart rate sensor
- GPS module (NEO-6M)
- Zigbee series 1

3.3 CIRCUIT DIAGRAM

The Arduino Mega board is connected to the sensors, particularly DHT11(humidity and temperature sensor) , SEN 11574 (pulse sensor),BMP180(pressure and altitude sensor),Adxl3359(accelerometer), and NEO6M(gps module) which are arduino compatible. Final important component interfaced with the Arduino Mega board is the Zigbee S1 transmitter module which is used for sending values to other Zigbee S1 receiver module at base station.

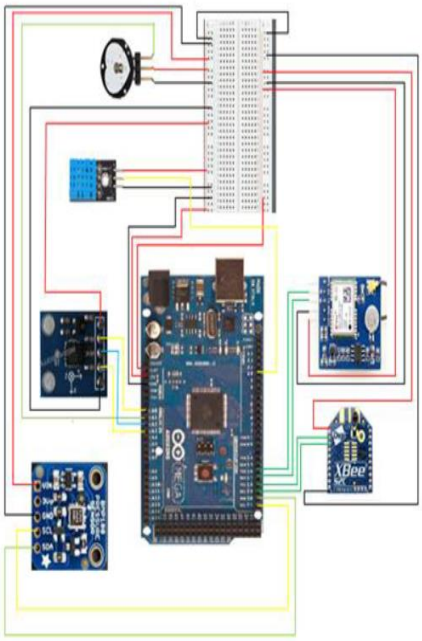

Figure3.4 Circuit Diagram

4. RESULT

The sensors were subjected to real world and the semi/unstructured data are recorded. These data are then processed at the receiver side and converted to structured data. It is then observed for different activities to be performed. A cloud platform named thingspeak is used for analyzing the data obtained as graph. The obtained graphs are:

- Atmospheric Pressure versus Time
- Atmospheric Temperature versus Time
- Altitude versus Time
- Movement versus Time
- Humidity versus Time
- Heartbeat versus Time
- Alert

The sample graphs are shown below.

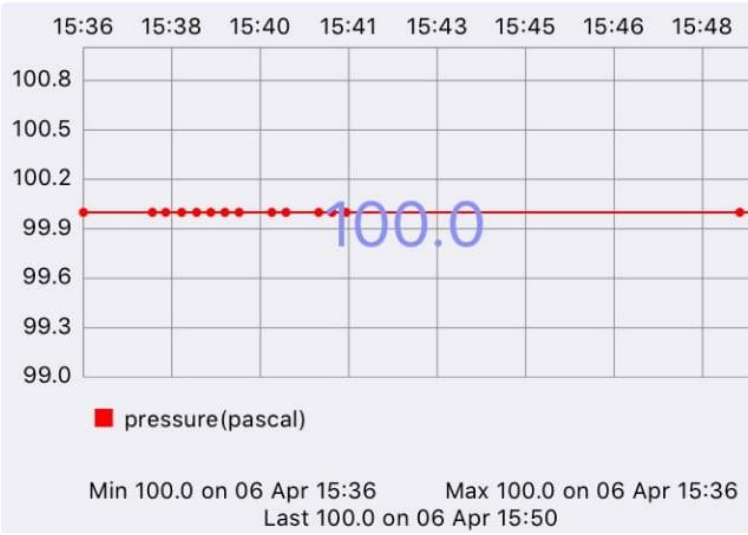

Figure 4.1 Atmospheric Pressure versus Time

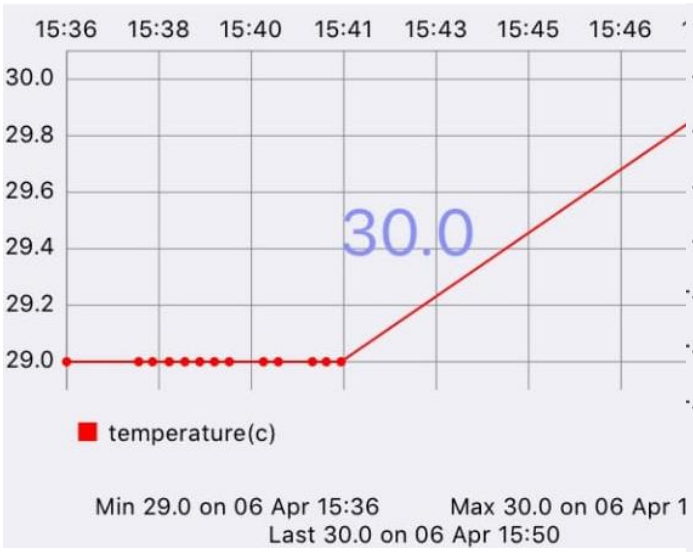

Figure 4.2 Atmospheric Temperature versus Time

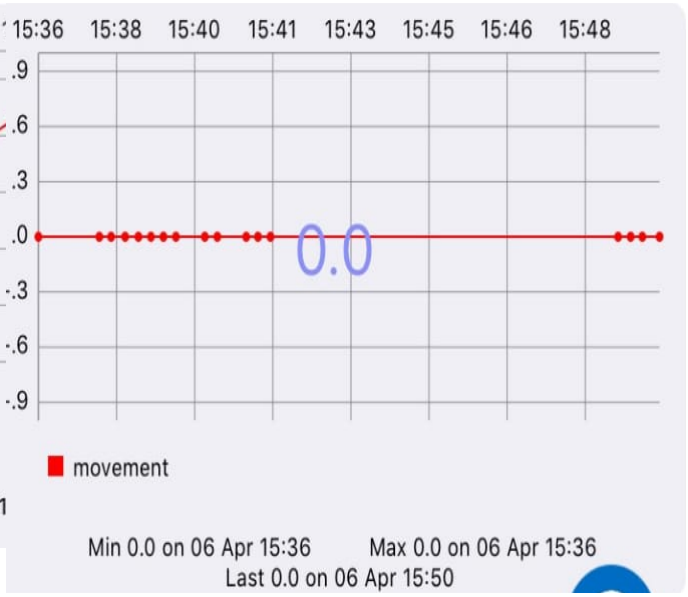

Figure 4. 4 Movement versus Time

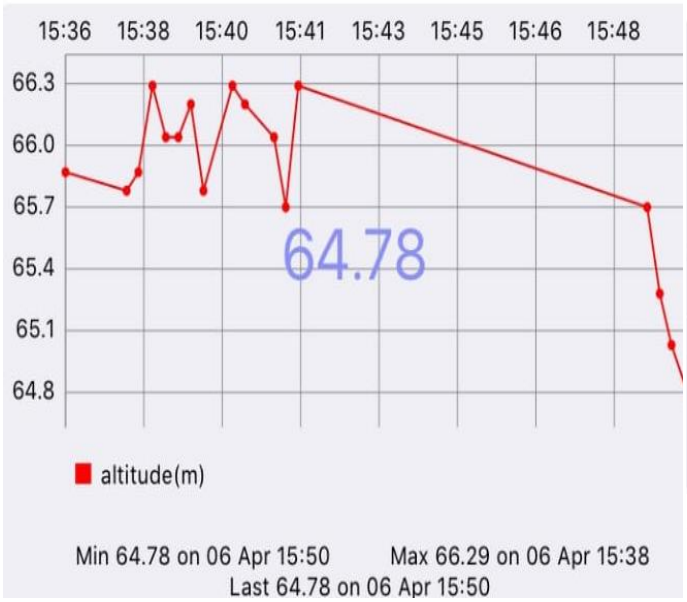

Figure 4. 3 Altitude versus Time

Figure 4. 5 Humidity versus Time

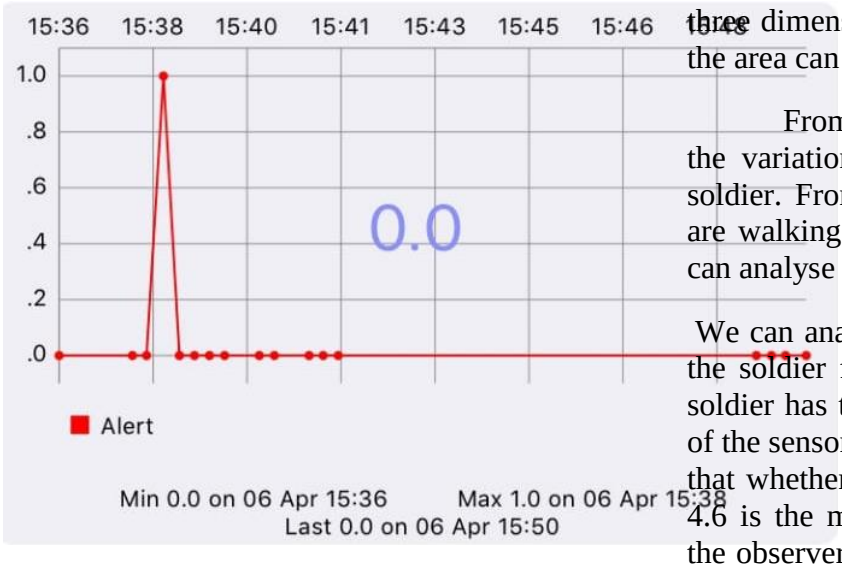

Figure 4. 6 Alert

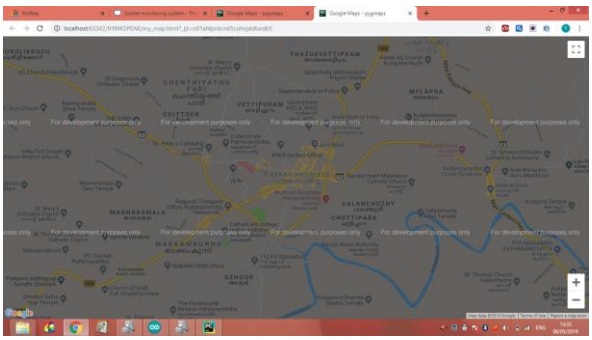

Figure 4.7 Location tracking via GPS

From the figure 4.1 we can analyse the variation in atmospheric temperature of the area where the soldier exists continuously. Change in the temperature may be due to many reasons. Then the observer concludes to one acceptable reason.

From the figure 4.2 we can analyse the variation in atmospheric pressure of the area where the soldier exists continuously. Change in the pressure may be due to many reasons. Then the observer concludes to one acceptable reason. Pressure variation may cause many health problems in soldiers. Then the team can plan for the rescue operation for the sake of the soldiers.From the figure 4.3 we can analyse the variation in position of the soldier continuously. For this we have a three dimensional analysis. Current height of the area can be obtained.

From the figure 4.4 we can analyse the variation in speed of movement of the soldier. From this we can identify that they are walking or running. From figure 4.5 we can analyse humidity of the area.

We can analyse the variation in heartbeat of the soldier from another graph. For this the soldier has to place his forefinger on the top of the sensor. Hence the observer can identify that whether he is healthy or not. The figure 4.6 is the modification of that graph that is the observer can focus on critical conditions. A buzzer is also connected for giving alarm on critical situations, if the heartbeat rate is below 60 or above120 beats per minute.

5.CONCLUSIONS & FUTURE SCOPE

From the proposed system we can conclude that transmission occurs at fixed interval of time and the readings are accurate. From the soldier unit the data is transmitted to the control room unit through zigbee transceiver. This system helps to monitor health parameters of the soldier, atmospheric conditions and their positions. The system helps the soldier to get help from the army control unit and or from another fellow soldier in panic situation. It will prove to be very useful to military forces during war and rescue operations as it can be used without any network restriction. Hence this system provides safety and security to soldiers. The design of the system is more effective. The componenents interfaces with each other matchly. The system is a reasonable one since it can be easily attached to the hand of the soldier.

A suitable and better routing algorithm can be used to make this system more reliable and energy efficiency. Improve

security of data by encryption and decryption techniques. Can use LoraWAN along with zigbee for increasing the range of data transmission.

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