Smart Military Health and Tracking System

Akhilesh Paradhi[1], Mandar Nadkarni[2], Mayur Patil[3], Rajeev Puthran[4], J.R.Mahajan[5]

[1, 2, 3,4]Student, Dept. of EXTC Engineering, Rajiv Gandhi Inst. of Technology, Mumbai, Maharashtra

[5]Assistant Professor, Dept. of EXTC Engineering, Rajiv Gandhi Inst. of Technology, Mumbai, Maharashtra

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Abstract - *Although technology advances cannot help in preventive the dreadfulness of warfare, they can at least be deployed to reduce war effects and casualties. One way to help in this aim could be by tracking and monitoring the location and health situation of troops in the battle. The main objective of the work presented in this paper is to design and implement a whole tracking system that is composed of a miniature transportable server as a central unit hosted on a NODE MCU to read soldier's location, body temperature, and health information through wireless communication from a small monitoring unit that is attached to the soldier's arm. A set of test cases has been applied and the results achieved by our prototype have presented a likely exactness and efficiency when applying such a system.*

Key Words: NODE MCU, Wi-Fi, Heart rate, GPS, Temperature, Client, Server.

1. INTRODUCTION

The nation's safety is monitored and kept by army, navy and air-force. The dominant and vital role is of militaries who sacrifice their life for their nation. There are many worries regarding the safety of the soldier. Militaries entering the enemy lines often lose their lives due to lack of connectivity, it is very vital for the army base station to known the position as well as health status of all soldiers. India has already lost so many soldiers in war fields as there was no appropriate health backup and connectivity between the soldiers on the war-fields and the administrators at the army base stations. Soldiers are mainly known for their courage, in spite of rare ammunitions and safety measures, they have many triumphs to their credits. All must be really worried about the safety of the soldiers, so we have decided to build a project which will efficiently keep a check on the health status of the soldier, and his precise location to equip him with necessary medical treatments as soon as possible. Soldier's tracking is done using GPS and Wi-Fi is used to deliver wireless communication system. For monitoring the health parameters of soldier we are using bio medical sensors such as temperature sensor and heart beat sensor.

2. LITERATURE SURVEY

[1]Krutika Patil, etl. Have explained that their system "IOT Based Soldier Navigation and Health Monitoring System" uses GPS module and wireless body area sensor network to record all parameters in real time and send it to the base station. The different types of sensors used in this system are the humidity sensor, temperature sensor and pulse sensor which help in deciding the health status of that particular army official in the paper presented in IRD INDIA ISSN (Online): 2347-2820, Volume -5, Issue-1, 2017

[2]Niket Patil and Brijesh Iyer explains that the paper reports an Internet of Thing (IoT) based health monitoring and tracking system for soldiers. The proposed system can be mounted on the soldier's body to track their health status and current location using GPS in "Health Monitoring and Tracking System for Soldiers Using Internet of Things (IoT)" presented in ICCCA2017 ISBN: 978-1-5090-6471-7/17

[3]Ali Bazzi etl. explains that the main objective of the work presented in this paper is to design and implement a complete tracking system that is composed of a mini portable server as a central unit hosted on a Raspberry Pi to read soldier's location, state, and health information through wireless communication from a small monitoring unit that is attached to the soldier's arm in "Smart Military Healthcare Monitoring and Tracking System on Raspberry Pi and Arduino" presented in *GLOBAL HEALTH 2017 : The Sixth International Conference on Global Health Challenges* ISBN: 978-1-61208-604-0

[4]Monika V. Bhivarkar explains the exact location and health status parameter of soldier can be sent to be base station in real time so that the appropriate action can be taken in case of crisis. GPS is used to log the longitude and latitude so that direction can be known easily in "IOT and GPS Based Soldier Position Tracking and Health Monitoring System" presented in (IJETER) Volume 6, Issue 1, January (2018) ISSN: 2454-6410

3. PROPOSED METHODOLOGY

3.1 Monitoring unit implementation

In our system, the monitoring unit is composed of a microcontroller i.e. Node MCU connected to a heart pulse sensor, and body temperature sensor, serial GPS. The Node MCU is a small, complete, and breadboard friendly board. We connected the heart pulse sensor to an analog pin of the microcontroller. The pulse sensor reads a waveform and calculates the BPM (Beats per Minute), as well as the IBI (Inter Beat Interval), which is the time between beats. In addition, we used NEO-6M GPS Module to measure the speed of each soldier beside his location as latitude and longitude values. The serial GPS communicates serially with the microcontroller. This GPS Module uses the latest technology to give the best possible position information. Also, it comes with ceramic antenna. Finally, the microcontroller sends all measured values using serial communication to the Wi-Fi module which on chip in the Node MCU. The Wi-Fi Module (ESP8266) is programmed to get values from the microcontroller following a specific algorithm; then, it sends these values through WI-FI to the central unit where the leader monitors. The ESP8266-12 is a self-contained system on chip with integrated TCP/IP protocol stack that can give any microcontroller access to any WI-FI network. The ESP8266-12 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

3.2 Central unit implementation

Node MCU is used as the central unit. The leader track and monitor his soldiers. In addition, we added an i2c 16x2 LCD screen .The LCD will display the parameters received by the transmitter i.e. Temperature, heart pulse rate and location. There will be buzzer and an LED which will beep and glow w.r.t the heart pulses. The ESP8266 Wi-Fi module is used to receive all the data from the client (transmitter).
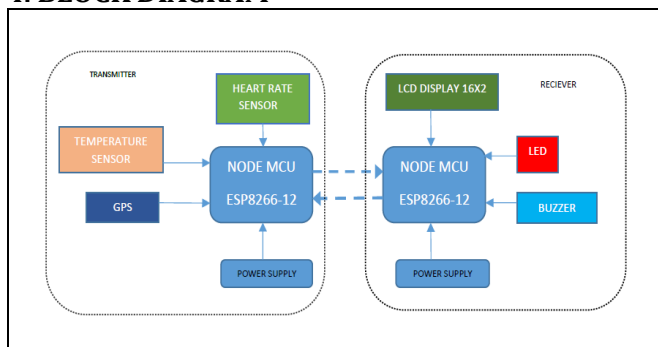
4. BLOCK DIAGRAM

Fig -1: Block Diagram

The Block Diagram consists of 2 sections viz. transmitter and receiver. The transmitter section consists of a NODE MCU ESP8266 Wi-Fi chip, Heart Rate Sensor, LM35-Tempreature sensor, GPS Module and Power Supply. The receiver section consists of an LCD, LED, Buzzer, Power Supply and another NODE MCU ESP8266 Wi-Fi chip.

NODE MCU kit/board consists of ESP8266 Wi-Fi enabled chip. It is a low-cost Wi-Fi chip developed with a TCP/IP protocol. It has ARDUINO like Analog (i.e A0) and Digital (D0-D8) pins on its board. It supports serial communication protocols i.e. UART, SPI, I2C etc.

Using such serial protocols we can connect it with Serial devices like I2C enabled LCD display, Magnetometer HMC5883, MPU-6050 Gyro meter + Accelerometer, RTC chips, GPS modules, touch screen displays, SD cards etc.

Another component is the LM35 temperature sensor. The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the centigrade temperature. The LM35 device has an advantage over linear temperature sensor calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient centigrade scaling. To find the health status of soldier base station should know the body temperature and pulse rate of the soldier. So we are using LM35 body biosensor as it is a low cost temperature sensor and it does not require signal conditioning. The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified. As the temperature increase above the specified value the GSM module will immediately alert the base station and thus will not wait for heart beats to go out of the normal range.

The heart rate sensor is completely different from the temperature sensor. The heartbeat sensor is based on the principle of photo plethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a vascular region). In case of applications where heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses. The basic heartbeat sensor consists of a light emitting diode and a detector like a light detecting resistor or a photodiode. The heart beat pulses causes a variation in the flow of blood to different regions of the body. When a tissue is illuminated with the light source, i.e. light emitted by the led, it either reflects (a finger tissue) or transmits the light (earlobe). Some of the light is absorbed by the blood and the transmitted or the reflected light is received by the light detector. The amount of light absorbed depends on the blood volume in that tissue. The detector output is in form of electrical signal and is proportional to the heart beat rate. GPS uses a lot of complex technology, but the concept is simple. The GPS receiver gets a signal from each GPS satellite. The satellites transmit the exact time the signals are sent. By subtracting the time the signal was transmitted from

the time it was received, the GPS can tell how far it is from each satellite. The GPS receiver also knows the exact position in the sky of the satellites, at the moment they sent their signals. So given the travel time of the GPS signals from three satellites and their exact position in the sky, the GPS receiver can determine your position in three dimensions - east, north and altitude.

The LCD 16 X 2 displays will tell us about the location and temperature of the soldier obtained through the sensor and GPS module. The buzzer and LED are for providing an indication that the soldier's heart beat is not normal.

5. WORKING

The circuit diagram consists of the client and server side which represents the soldier and the station monitoring the soldier's health respectively. The client side will consist of a wearable glove which will consist of the sensors to monitor the soldier's health as well as the NODE MCU and the power supply connected to it. The server side will consist of those components which will be used to know the condition of the soldier's temperature, heart rate and location of the solider on the buzzer, LED and LCD display along with another NODE MCU which will be used to receive the data from the client side.

The NODE MCU ESP8266 chip on the client side will collect data from the GPS module and the two sensors and then transmit it to the NODE MCU ESP8266 chip on the server side. The transmission and reception will take place through Wi-Fi.
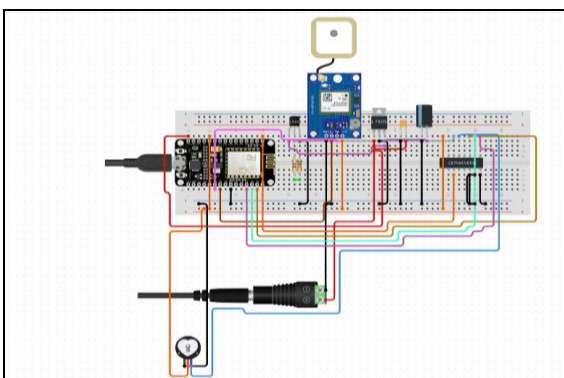
5.1 CLIENT SIDE
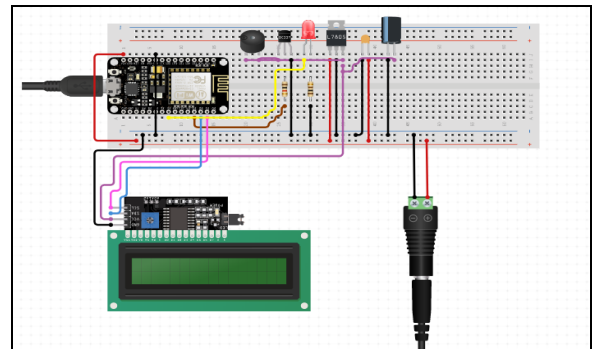

Fig -2: Client Side

5.2 SERVER SIDE

Fig – 3: Server Side

6. EXPERIMENTAL RESULTS

From the experimental results it can be observed that the data was transmitted from the soldier's side (client) after intervals of time which are 500ms in this case. This will be detected by the base station of the military camp (server) enabled by the Wi-Fi Technology. In this way the base station will always be aware of the condition their soldier in the battle is in. The sensors to monitor health and location will be completely integrated with the soldier with the help of a wearable glove so that it is possible to keep a close check on the soldier's health and position anytime and anywhere. It has real time capability.

Given below is the client side indicating that a connection has been established and the data can now be transmitted which is the objective of this project.
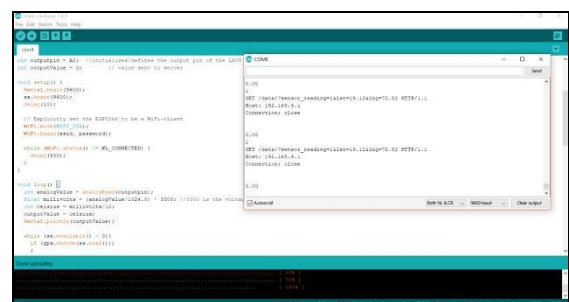

Fig -4: Connection established between client and server
The image below depicts the data being transmitted.
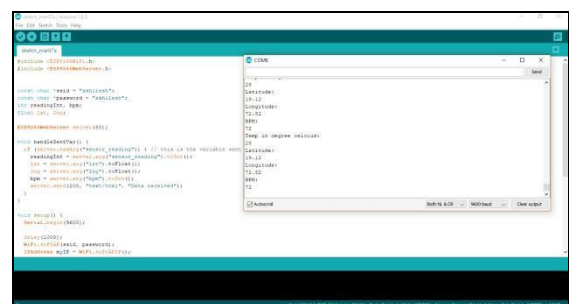

Fig – 5: Data transmitted from Client to Server

The temperature, heart rate and location of the soldier will be seen on the server side in this manner and the condition of the client can be monitored. The temperature and heart rate of a 22 year old human on an average ranges from 25-32 degree Celsius and 62-90 BPM. The co-ordinates below are those of Rajiv Gandhi Institute of Technology, Mumbai.

Fig – 6: Possible parameters of the client

7. CONCLUSIONS

The main objective of this paper was to design and implement a complete system for monitoring and tracking soldier's health information and location.
In a warzone. Our system provides a wearable device for each soldier and a portable device for the leader. This system has a humanitarian aim since it can decrease the effects of many issues in war including soldiers unaccounted for and the difficulty of health status monitoring. This system could be tested on real soldiers to prove its applicability. This system has many advantages such as large capability , multi-client and server handling capability , wide area range , low operation cost , effective , strong expandability and easy to use. Moreover the Wi-Fi signal range is limited to 100m, and is more efficient than GSM, ZigBee, raspberry pi technology as the range and signal availability is more. However, this system can be further tweaked to improve its performance. It can be improved by introducing a new communication system using microwave signals with frequencies lower than Wi-Fi band (around 2.4 GHz) which will be only available for military applications.

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BIOGRAPHIES

AKHILESH PARADHI

Pursuing Degree in Electronics and Telecommunication Engineering in Rajiv Gandhi Institute of Technology Engineering, Mumbai

MANDAR NADKARNI

Pursuing Degree in Electronics and Telecommunication Engineering in Rajiv Gandhi Institute of Technology Engineering, Mumbai

MAYUR PATIL

Pursuing Degree in Electronics and Telecommunication Engineering in Rajiv Gandhi Institute of Technology Engineering, Mumbai

RAJEEV PUTHRAN

Pursuing Degree in Electronics and Telecommunication Engineering in Rajiv Gandhi Institute of Technology Engineering, Mumbai