

Wearable Health Monitor for Soldier

M.Tech. Scholar Pamba Anjanamma, M.Tech Scholar Gunde Harish

Department of ECE,
JNTUH College of Engineering,
Hyderabad, India

Abstract- The nation depends upon the enemies' warfare and so the safety of the soldiers is considered as vital role in it. Many times soldiers become lost or injured. This project gives the ability to track the current location and gives the current health status of the soldier and also concerning the soldiers' safety, there are many instruments to view their health. In soldier's health monitoring, bio-sensors systems such as temperature sensor and heart rate sensor give the result of abnormal condition when the level goes low or high. The GPS sensor gives the latitude and longitude to find the direction becomes easier. GSM module can be used for effective range of high-speed transmission, short-range and soldier-to-soldier wireless communications that will be required to relay information on critical situation awareness so that the rescue operation become easier. Both GPS and GSM devices are being added to weapons and firearms, and some militaries such as the Israeli Army which are exploring the possibility of embedding the devices into soldiers' vests and uniforms. Through this project, we continuously monitor the health status (body temperature and heart rate) of the soldier and transfer the data wirelessly to the website using mobile as a server through IOT. So by using these equipments, we are trying to implement the basic lifeguarding system for soldier in low cost and high reliability.

Keywords- Arduino MEGA 2560, Heartbeat Sensor, Temperature Sensor and Humidity Sensor.

I. INTRODUCTION

The infantry soldier of tomorrow promises to be one of the most technologically advanced modern warfare has ever seen. So, this paper focus on tracking the location of soldier from GPS, with High-speed, also detect the health and monitor abnormal condition using Bio sensors.

The Bio Sensor consists of the Temperature sensor & Heart Rate Sensor. In brief to explain, Soldier is always facing death. He never shirks responsibility.

He fights in most difficult terrains, on hills and mountain, in plains and forest. It is our responsibility to help our soldiers. That's why we are introducing this project which will be very useful for providing health status of the soldiers and provide medical help to them at critical situation in battlefield. In our system we are basically focusing on Soldier's health in terms of his heartbeats and his body temperature. If soldier gets injured and becomes unconscious by gunshot or due to any other reason, then his heart beats start increasing or decreasing gradually.

In this type of situation where the information about current heart rate becomes the indispensable part of soldier, this project emerges out as best to acknowledge the doctors at server site with the correct and fast information. If heart beat either increases above critical level or decreases below the critical level, a message is automatically sent to server with the help of GSM modem. GPS tracker will give the current location of the soldier

which will be useful for locating soldier's location and providing medical help as early as possible.



(a)



(b)

Fig 1. BASE UNIT and soldier unit of wearable health monitor for soldier.

Base unit acquires the location of soldiers with the help of GPS. The responsibility of base station operators is to help the soldiers in choosing right path, if there is a threat of missing of soldiers.

- The base unit will contact the standing of the soldier that is exhibited on the computer. Hence, they can yield instant action by directing assistance for the soldier requested by the soldiers having soldier unit.
- By the use of number of biomedical sensors, health constraints of soldiers are monitored, the location and placement of soldier is confined by the use of GPS module.

II. LITERATURE REVIEW

Many efforts were reported by different academicians and researchers to track the location of the soldiers' along with their health condition on the battlefield.

Pavan Kumar et.al. Reported a GPS based technology to monitor the soldier health parameters and location tracking using GPS. AT89C51 microcontroller was used to collect health parameters and then these parameters are transferred through GSM to the base unit [3]. A ZigBee based approach was proposed in [4]. A Raspberry Pi based approach was proposed in [5] to monitor the body temperature, respiration, movements and heartbeat of the patient. The collected information was then added to the cloud-based websites with the help of IoT.

A real-time, ARM processor based approach for the monitoring and collection of temperature, heartbeat, ECG parameters of patients by **R. Shaikh et. al.** [6].

ZigBee and GSM wireless technology were used to send current updates of patients to the doctor and then doctors can take immediate action against that patient. A wireless body area sensor networks (WBASNs) technology using ZigBee was reported in [7] to continuously monitor the human health and its location. RF based module to gather the live information of soldiers on the battlefield was proposed by **G. Raj et. al.** in [8].

Further, a one-time password (OTP) based system was proposed in [9] to secure and authenticate the data processing. **Jassaset. al.** proposed an idea of integration of wireless sensor network and cloud computing for the information processing in real-time and speedy manner [10] to track the location of the soldiers.

However, all these systems are stuck-up by one or more reasons like costly implementation, delay in response and bulky nature. Hence, a portable wireless real-time system based on IoT concept is developed and proposed in this paper which will be an effective alternative to the existing technologies in the area of soldiers' health and location tracking on the battlefields. Table 1 provides the state-of-the-art soldiers health and location monitoring system.

III. PROPOSED SYSTEM

We use two units namely Soldier and Base Unit. Soldier Unit contains a microcontroller (AT Mega), heart beat sensor (Easy Pulse v1.1) is used to calculate the pulse rate of soldier, temperature calculation sensor (DHT11) used to calculate the body hotness of the soldier, GPS receiver (SKM53) is used for tracking purpose, a Keypad is used for secret code input, GSM Module (SIM900D) is used to send all the input data to base station and LCD is used to display this data.

A Power bank is used to power the circuit. Base Unit includes a Cell Phone working as GSM connected with PC, which shows data consisting messages as threads on Moborobo android pc suit and save messages as well in .xls format. By the use of this system, the soldier can send feedback to his concerning base station. The project is mainly divided into four sections 1. Input section 2 Output section 3 Circuit section 4 Sensor section.

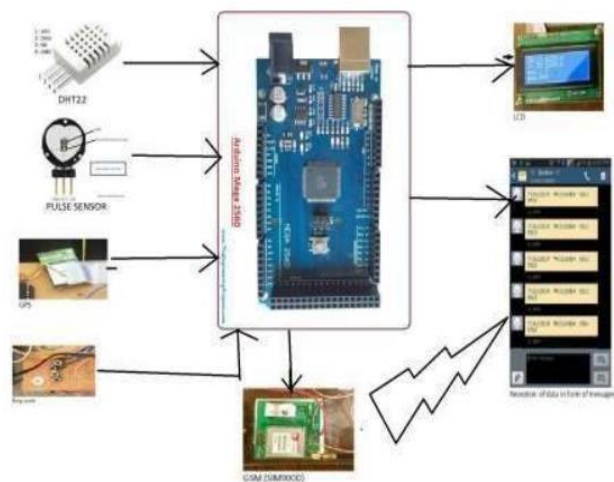


Fig 2. Proposed System.

1. Input Section:

The Input Section takes the input from soldier. It consists of the following components: GPS (SKM53) Keypad.

2. Output Section:

The Output Section gives the output in form of display and to transmit data. It consists of following components. LCD, GSM (SIM900D).

3. Circuit Section:

The Circuit Portion is one of the main and important sections of the project. It mainly consists of all the circuits which are processing the instructions that are received from sensor and input sections. After processing the instructions, this section sends the instructions to the output section which then produce the respective output. The circuits which are involved in this section for processing are as follows: Main controlling circuit, Sensor circuit, Power regulator circuit.

4. Sensor Section:

The Sensor Section includes the health monitoring sensors. This provides body temperature and pulse rate status to circuit section. It consists of Temperature sensor (DHT11), Heart beat sensor, Accelerometer (ADX311).

IV. BLOCK DIAGRAM

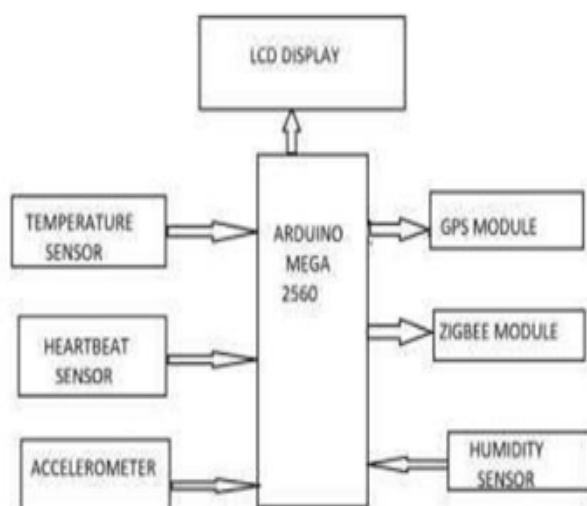


Fig 3. Block Diagram.

The above figures show the complete working block diagram. It consists of two main units: Soldier Unit and Base Unit. A Soldier Unit consists of a microcontroller (MEGA), heart beat sensor, temperature sensor (DHT11), GPS receiver (SKM53), GSM Module (SIM900D), a Keypad, LCD and a Power bank. Base Unit includes a Cell Phone working as GSM connected with PC, which shows data consisting messages as threads on Motorboat android pc suit and save messages as well in .xlsformat.

The circuit and hardware and software design of the project is explained with different sections. All the hardware is enclosed in small bag that soldier can easily carry with him. Sensors are placed on body parts where they can give a better performance. The project has a weight less than 1kg so it can be easily carried by a soldier. We designed a better software design to get the better performance and focus on the problem of processing capability of microcontroller.

Our project is mainly divided into three parts: On finger, on arm, on the bag.1.In the Bag: The whole circuit is enclosed in a box and the box is to be placed in bag, which will be on soldier's back. The bag carries the following circuits: o Main circuit o

Heart beat sensor circuit o GPS Module o GSM Module o LCD The box in the bag also contains battery to power up the circuit.2 On arm: The temperature sensor is to be placed in shoulder for proper working.3 On finger: The finger contains the finger part of heart beat sensor.



Fig 4. Breakdown structure of our project.

1. Hardware Description:

1.1 Arduino Mega 2560: Arduino Mega 2560 is a Microcontroller board based on Atmega2560. It comes with more memory space and I/O pins as compared to other boards available in the market. There are 54 digital I/O pins and 16 analog pins incorporated on the board that make this device unique and stand out from others. Out of 54 digital I/O, 15 are used for PWM (pulse width modulation). A crystal oscillator of 16MHz frequency is added on the board.



Fig 5. Arduino Mega 2560.

1.2 Heartbeat Sensor: Heartbeat Sensor is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Monitoring body temperature, heart rate and blood pressure are the basic things that we do in order to keep us healthy. In order to measure the body temperature; we use thermometers and a sphygmomanometer to monitor the Arterial Pressure or Blood Pressure. In this project, we have designed a Heart Rate Monitor System using Arduino and Heartbeat Sensor.

You can find the Principle of Heartbeat Sensor; working of the Heartbeat Sensor and Arduino based Heart Rate Monitoring System using a practical heartbeat Sensor. Monitoring heart rate is very important for athletes,

patients as it determines the condition of the heart (just heart rate). There are many ways to measure heart rate and the most precise one is using an Electrocardiography, but the easier way to monitor the heart rate is to use a Heartbeat Sensor. It comes in different shapes and sizes and allows an instant way to measure heartbeat.

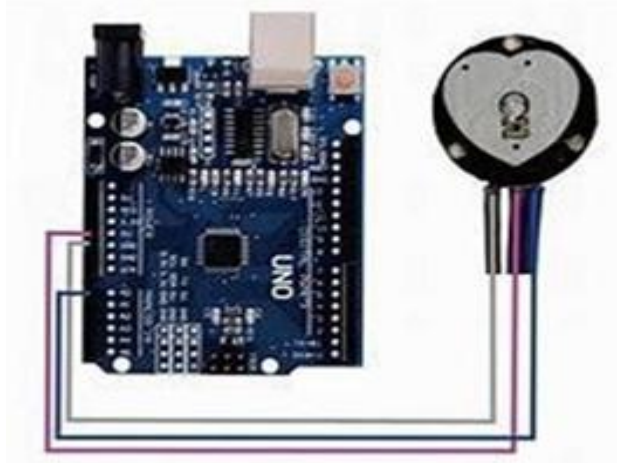


Fig 6. Heartbeat sensor.

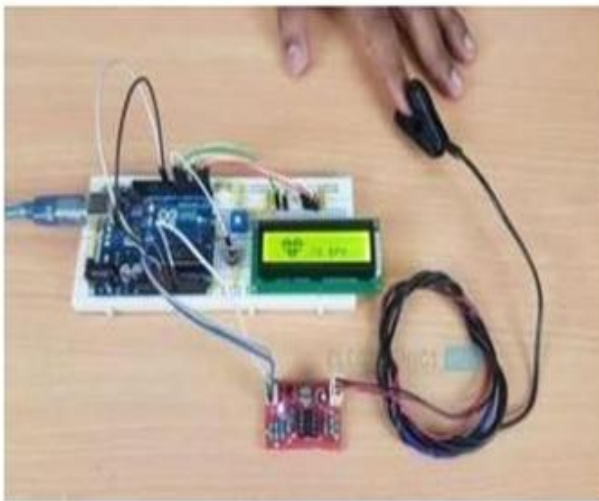


Fig 7. Working of heartbeat sensor with arduino.

1.3 Temperature and Humidity Sensor (DHT22): TDHT22 is Humidity and Temperature Sensor, which generates calibrated digital output. DHT22, can be interface with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low cost humidity and temperature sensor which provides high reliability and long term stability.

For adults 18 and older, a normal resting heart rate is between 60 and 100 beats per minute (bpm), depending on the person's physical condition and age. Hence, the measurement threshold is set from 60 to 100 bpm. Whenever heartbeat of soldier will deviate from the threshold value, the system will transmit information to base station.



Fig 8. Temperature sensor and humidity sensor.

1.4 Accelerometer: ADXL335 is a small, thin, low power, complete 3- axis accelero-meter with signal conditioned voltage outputs. The product measures acceleration with a minimum full- scale range of ± 3 g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.



Fig 9. ADXL335 Accelerometer.

2. Global Positioning System (GPS):

The GPS unit is installed in addressing system so that base camp can track their movements and real time information in all weather, at all times from anywhere on globe. The Global Positioning System (GPS) is radio location using navigation satellites. These systems provide round the clock information on the three dimensional position, velocity and time for users with the appropriate equipment and are at or near the earth's surface (and sometimes outside it).

Applications include portable guidance on the location, trajectory tracking of ships, as well as the system of driving wireless communication devices, which are designed for the car, the driver provides a personalized and promotional information, receive messages, and use the specific local conditions of travel information and services Security.

GPS technology is used in a large number of applications, including maritime, environmental, navigational applications for tracing and monitoring.

2.1 Global System For Mobile Communications (GSM):

GSM (Global System for Mobile communications) is the most general standard for mobile telephony system in the world. Everywhere it achieved international nomadic preparations between mobile phone operatives, allowing subscribers to use their phones everywhere in the world. Global System for Mobile Communication differs from its prototype in that both signaling and speech channels are digital technologies.

So GSM is 2nd generation (2G) mobile phone system, which facilitates the utilization and application of a widespread range of data communications applications in the system. It was everywhere in the implementation of the GSM standard feature for both customers, who may take advantage from the skill to travel and change carriers without changing phones and network operatives as well.



Fig 10. Sim900D gsm module

2.2 LCD Display:

16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. But the most used one is the 16×2 LCD, hence we are using it here.

V. RESULT AND DISCUSSION

The expected results of project are described here. However the main focus is on base station which tells that how these results are used to the health status and location of the soldier as well.

1. Base Station Results:

At base station, Android smartphone (Samsung Galaxy S4 mini-i9192) is used, working as GSM and connected with laptop via data cable. Moborobo for android is used to display results on laptop. There is an option to export all messages record in laptop in .xls and .txt format.



Fig 11. Soldier details in the base station.

VI. CONCLUSION

By the use of this system, we can condense casualties of battle. It assists to give critical information's and cautions to soldiers so that they can survive for long and aim of war or secret. Operation can be obtained.

This system gives strength to the defense system of country. So, we can accomplish that these types of strategies are very supportive for certifying security of the soldiers.

VII. ACKNOWLEDGEMENT

We would like to thank JNTUH College Of Engineering, Hyderabad for motivating us to do research and development works. We are thankful to the faculty members of ECE department for support.

REFERENCES

- [1] Shruti Nikam, Supriya Patil, Prajka Powar, V.S. Bendre- "GPS Based Soldier Tracking and Health Indication System", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 2, Issue 3, March 2013.
- [2] M.V.N.R. Pavan Kumar, Ghadge Rasika Vijay, Patil Vidya Adhikrao, Bobade Sonali Vijaykumar- "Health Monitoring and Tracking of Soldier Using GPS", International Journal of Research in Advent Technology, Vol. 2, No. 4, April 2014 E- ISSN: 2321-9637.
- [3] The Clock Generator [Online], Internet: <http://c-hipmk.ru/index.php/2014-08-10-05-51-44/41-sam-ouchitelpic18-asm-2-chast/187-taktoviy-generator>. [June 9, 2015]
- [4] Hock Beinge Limn "A Soldier Health Monitoring System for Military Applications" 2010 International

- Conference on Body Sensor Networks (BSN). [June 18, 2015].
- [5] D. Kumar and S.Repal, "Real Time Tracking and Health Monitoring of Soldiers using ZigBee Technology: a Survey," International Journal of Innovative Research in Science, Engineering and Technology, vol. 4, no.7, pp. 5561-5574, Jul. 2015.
- [6] 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, vol. 2, no. 12, pp. 46-52, Dec. 2013.
- [7] V. Ashok, T. Priyadarshini, and S.Sanjana, "A Secure Freight Tracking System in Rails Using GPS Technology" Second International Conference on Science Technology Engineering and Management (ICONSTEM), Chennai, India Mar. 2016, pp. 47- 50.
- [8] M.Jassas, A . Abdullah.and H. Mahmoud, "A Smart System Connecting e- Health Sensors and the Cloud" IEEE 28th Canadian Conference on Electrical and Computer Engineering Halifax, Canada, May 2015, pp.712-716.
- [9] S. Dixit and A. Joshi, "A Review Paper on Design of GPS and GSM Based Intelligent Ambulance Monitoring" International Journal of Engineering Research and Applications, vol. 4, no. 7, pp.101-103, Jul. 2014.
- [10] H. Kedar, K. Patil and S. Bharti, "Soldier Tracking and Health monitoring System", vol. 2m, no.17, pp., Mar. 2015. [13] H. Furtado and R. Trobec, "Applications of wireless sensors in medicine", MIPRO, 2011 Proceedings of the 34th International Convention, Opatija-Croatia, pp. 257- 261, Jul. 2011.