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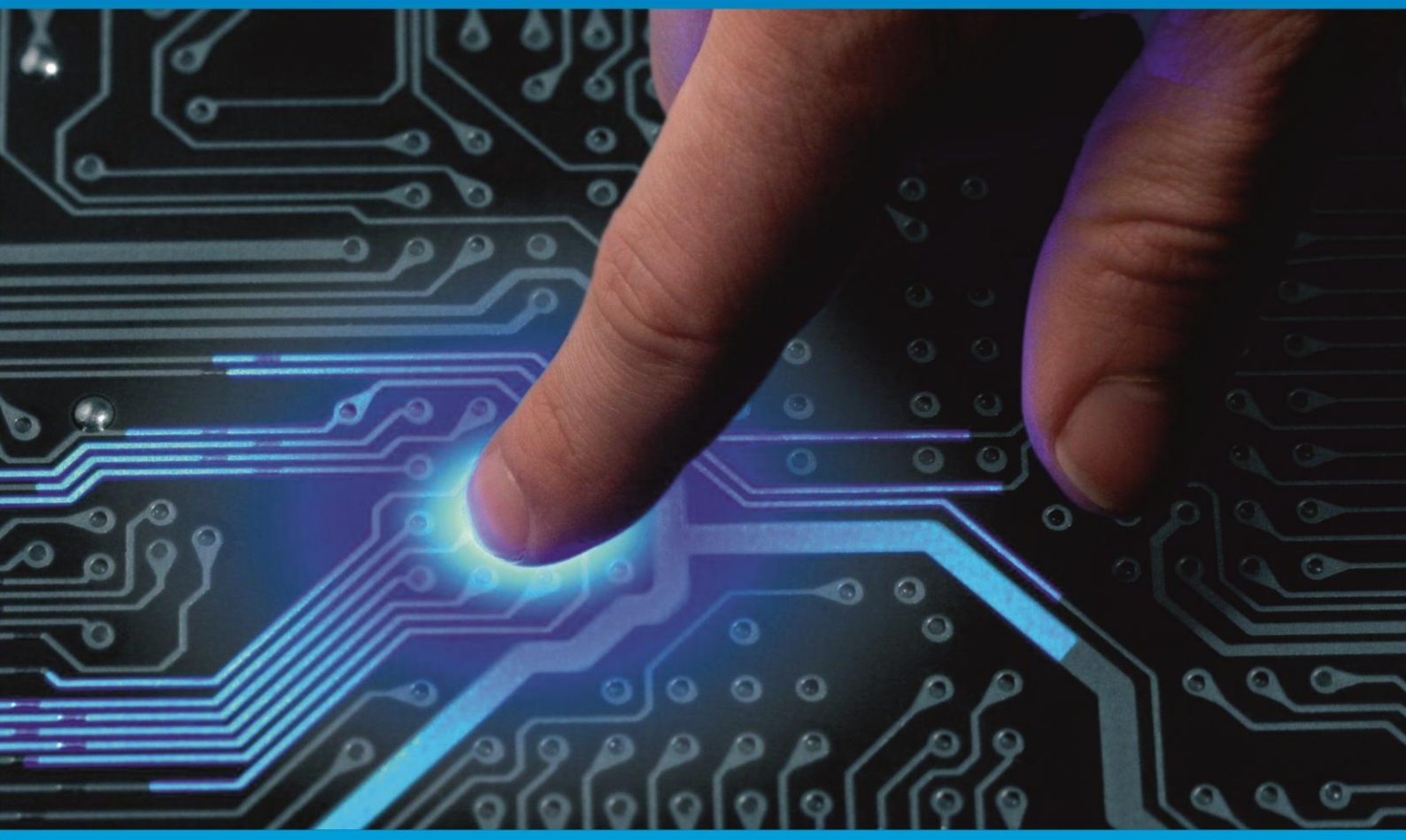

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An IoT Based Real Time Autonomous Soldier Health Monitoring and Reporting System

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ABSTRACT: The security system of a nation depends upon how a country's soldier handles enemy's war tactics and hence their security is considered as an important role in it. Concerning the safety of the soldiers, there are numerous tools to observe the health condition of the soldiers. The proposed system uses GPS to trace the direction of the soldier within the sort of latitude and longitude values. So that direction can be found easily. The proposed module can be mounted on the soldier's body to track their health status and current location using GPS. These information will be transmitted to the control area through IoT. The proposed framework involves minuscule wearable physiological equipment's, sensors, transmission modules. Hence, with the utilization of the proposed equipment, it's possible to implement a low-cost mechanism to guard the precious human life on the battlefield. Designing of this system using GPS gives a wireless system for tracking the location and observe the health parameters of a soldier.

KEYWORDS: Soldier health, GPS, Node MCU, AES, IoT

I.INTRODUCTION

There are many concerns to discuss about the safety of soldiers. Soldiers who enter enemy lines often lose their lives due to lack of connectivity, it is very vital for the army base station to known the location as well as health status of all soldiers. India has already lost many of its soldiers in war fields as there was no proper health backup and connectivity between the soldiers on the war-fields and the officials at the army base stations, so we have decided to build a project which will efficiently keep a check on the health status of the soldier, and his/her precise location to equip him with necessary medical treatments as soon as possible.

Soldier's tracking is done using GPS to provide wireless communication system. For monitoring the health parameters of soldier, we are using bio medical sensors such as temperature sensor, heart beat sensor, respiratory sensor as it is essential for the control station to determine the precise location and the health status of the soldier. Hence more emphasis should be given to navigation and health monitoring technology for the soldiers in the war-torn zone. In this project a more accurate location and the health status parameters of the soldier can be sent to the base station in real time so that the appropriate actions can be taken in case of crisis. This technology helps to minimize the rescue time and search operation effort invested by the army rescue control unit. Wearable technology is the highlighting factor of this project.

II.RELATED WORKS

In [1] authors used Improved Bayesian Convolution Network (IBCN) is used in the proposed model which is used by wearable sensors of different kinds of uncertainty for human activity. The device includes a wearable sensor and Deep Learning technology to provide information about a variety of behaviors that are aimed at deducting activity that may arise suspicion. Through analysis, the method proposed is differentiated between data- dependency and model dependent in certainty. Estimation of different types of uncertainties is necessary to design active learning pattern and novelty detection and to detect errors and fusion of data that are all relevant to the development of successful and customized recognition systems for functioning. The system architecture includes Wi-Fi and Cloud onboard applications so that they can be upgraded.

In [2] clinical research, wound assessment techniques usually focus on physical appearance of wound for example, wound size, wound color, wound shape etc. However other factors also play significant role in healing process. Hence, they may need to measure for wound assessment. These factors included atmosphere in which the wound is formed, temperature of wound and amount of oxygen supplied to wound site. These factors can not only influence wound healing but they also showed association with other wound characteristic as well i.e., air humidity correlation with air temperature which in turn effect wound temperature, similarly oxygen levels correlated with wound hydration level and

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vice versa. In second module an entropy-based decision tree is used for efficient decision making of wound assessment status.

In [3] authors used real time pulse sensing and position detection system is developed in an attempt to save the soldiers who are placed at warfronts and suffer martyrdom. The situation becomes more regretful when the rescue team is inadequate to trace the soldiers just because the instantaneous geographical location of the soldiers is unbeknownst to them. This system ensures that any casualty in battlefield is brought to the attention of the authorities at the earliest. It will also help in tracing missing soldiers. This system consists of a transmitter (including GPS Module and Pulse Sensor) and a receiver at some remote location. This system uses the main parameter as heartbeat rate for the healthiness of soldiers. In this module, the system employs Wasp mote for both transmitter and receiver.

In [4] The advanced technology for patient monitoring those who are suffered from heart diseases & physical disorder. Hence, heart rate sensor and temperature sensor are used for patient monitoring. Sensors gives accurate output thus scores off the use of traditional medical instruments such as thermometer and other devices. For continuously transmission of message from patient's location to medical advisory GSM modem used. This module provides relief to medical advisory for patient monitoring and also to patients for providing them freedom of movement. Then heart rate sensor and temperature sensor measures heart rate and body temperature accordingly and both outputs are given to a PIC controller.

III.EXISTING SYSTEM

In the last few decades, technologies such as cable-based systems, RF transceiver, walkie- talkie, Zig-Bee, GSM based tracking systems so on and so forth were the most dominantly used methodologies for keeping tracking of soldiers' survival on the battlefield. However, all these technologies suffered from one or more reasons like high installation cost, loss of signal, high noise as well as the bulky nature. Hence, a low-cost wireless and portable tracking system with high reliability is needed for the protection of valuable life of the soldiers on the battlefields.

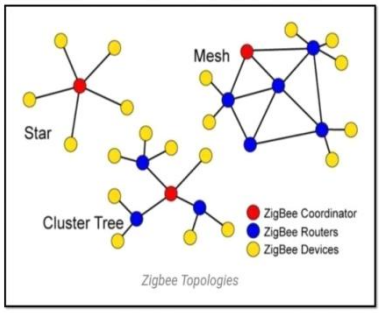

Fig 3.1. Zigbee Technologies [2]

In the versatile entryway plan, underscored flexibility and conveyablity is used. Thus, the framework can be adjusted to any ZigBee-based remote sensor organization. Figure represents specialized plan of the framework including modules and associations between the modules. The door was executed in Java and it can possibly run on any Java- empowered cell phone, yet a few changes may be needed to UI as per the objective gadget's abilities.

Graphical UI of the model passage is worked with the Standard Gadget Library (SWT) from the Shroud project. Far off data set is executed with MySQL. However, it is amazing and flexible enough for our motivation. It has, among different highlights, a huge screen with 800x480 goal, actual QWERTY console, GPS beneficiary, camera, WLAN and Bluetooth. The U- Medical services passage on a cell phone utilizes two kinds of associations: Bluetooth and Web (e.g., 4G, 3G, WLAN).

We use Bluetooth for correspondence between the cell phone and a ZigBee sensor hub which goes about as the sink hub of Boycott. The sink hub has an exceptional Bluetooth module joined which empowers correspondence with another Bluetooth gadget. The sink hub sends caught information over Bluetooth to the versatile passage, and the portable entryway thusly sends control messages to the sink hub when vital. Bluetooth correspondence is clarified in detail in the accompanying segment.

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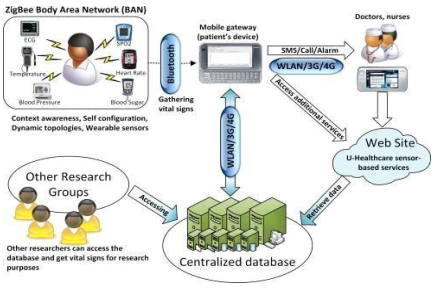

Fig 2. Flow diagram for Mobile Gateway Concept [3]

IV.PROPOSED SYSTEM

To overcome on existing system problem, we came out with an idea which is based on IOT concept. The proposed system is going to be helpful within the real-time continuous monitoring of soldier's health parameters and site. The proposed system performs both health monitoring and tracking of soldiers using IoT. The control room can acquire the details about the location of a soldier using GPS. Even just in case of losing their direction, it's the responsibility of the GPS to guide the soldier in correct direction. Since the different tracking parameters of the soldier are transmitted via Wi-Fi module, the base station may access the current status of the soldier using IOT.

These information can be stored on cloud storage and it can be extracted later on control's room pc. Based on these information, the authorities can initiate immediate action to overcome on existing system problem we are come with our proposed system which is based on IOT concept. The proposed system is going to be helpful within the real-time continuous monitoring of soldier's health parameters and site

Thus, proposed system performs both health monitoring and tracking of soldiers using IoT.The control room can acquire the small print about the position and orientation of soldier from GPS. Even just in case of losing their direction, it's the responsibility of the GPS to guide the soldier in correct direction by deploying a medical, rescue team or any backup force for their help. Using various biomedical sensors, health parameters of a soldier is observed alongside its surrounding environment condition observed.

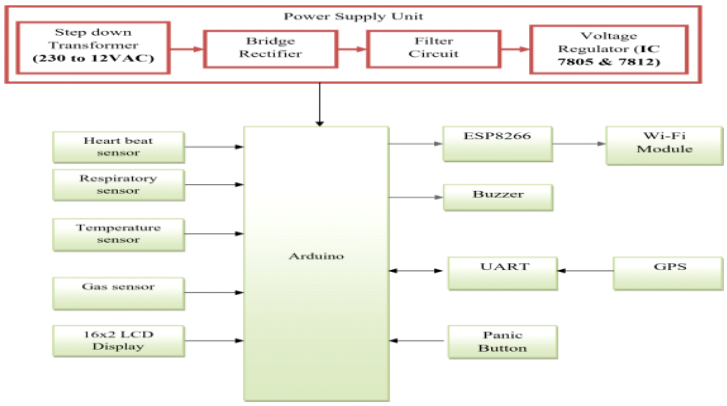

Fig 4.1. Block Diagram for IoT based Real time Autonomous Soldier Health Monitoring and Reporting System.

V.METHODS

Different sensors like Heartbeat, and Vibration are connected to the soldier's body at appropriate positions to collect real time data about his health. These data are then compared to standard threshold values to check if the soldier is in normal condition. Accordingly, the information about the soldier is updated. In case of any emergency condition, an alarm is also sent to the Head of the Army's mobile in the form of a alert through IoT modem and as well as corresponding LEDs ON.

If a particular soldier's health parameter falls below the threshold value, an automated updating is sent which is interfaced to the Arduino. In case of death of the soldier, the processor detects the change in pulse rate of the soldier and notes their location. Their location is tracked by the GPS module, then it is communicated to the military base station by the use of IoT. This system enables the army base station to track the location and health condition of soldiers using GPS module and wireless sensor networks.

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- **GPS**

The working of Global positioning system is mainly based on the 'trilateration' mathematical principle. The position of the object is determined from the distance measurements to satellites. There are four satellites used to determine the position of the receiver on the earth. The target location of the object is established by the 4th satellite. The other three satellites are used to trace the location place. The global positioning system is made up of a satellite, control station, monitor station, and receiver. The GPS receiver gets hold of the information from satellite and uses the method of triangulation to determine a user's exact location.

GPS is used in several instances, such as:

- To determine locations; for example, when we need to inform a helicopter pilot the coordinates of our position location so that the pilot can gather us.
- To lay the course from one location to another; for example, when we need to travel from our home to a famous mall.
- To create digitized maps for better visuals; for example, plotting fire perimeter and hot spots.
- To determine the distance between two points so that it can be used to calculate the time required to reach from one place to another.

- **Temperature Sensor – LM35**

LM35 is a commonly used temperature sensor, which can be used to measure temperature and produce an electrical output comparative to the temperature in °C(Celsius). It measures temperature in a better way than a thermistor. LM35 is mainly used in industries and commercial buildings where high accuracy of temperature readings are more crucial. The scale factor of temperature sensor is .01 V/°C. One of the most important characteristic of temperature sensor is that it draws only 60 micro-amps from its supply and achieves a low self-heating capacity.

The most commonly used combinations for LM35 temperature sensor T0-46 metal transistor-like package, TO- 92 plastic transistor-like package, 8-lead surface mount SO-8 small outline package, etc. In this module we have used TO-92 plastic transistor-like package. LM35 temperature sensor has three pinouts. They are given as: **PIN 1:** Vcc, Input voltage pin. **PIN 2:** V0, Output voltage pin. **PIN 3:** GND, Ground pin. LM35 is used for measuring accurate centigrade temperature. The output voltages of these sensors are linearly comparative with respect to the Celsius temperature.

- **Heart beat Sensor**

The principle of heartbeat sensor is photoplethysmography. It detects and measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (avascular region). In the case of applications where the 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 the blood, the signal pulses are equivalent to the heartbeat pulses. There are two types of photoplethysmograph

Transmission: Light emitted from the light-emitting device is transmitted through any vascular region of the body like earlobe and received by the detector.

Reflection: Light emitted from the light-emitting device is reflected by the regions.

- **Respiratory Sensor**

The respiration sensor may be a sensitive girth sensor worn using a simple fitting high durability woven rubber band fixed with a length adjustable webbing belt. It senses chest or abdominal expansion/contraction and produces a waveform of breathing. The sensor is latex-free, magnet-free, and Velcro-free, and may be worn over clothing. Since respiration sensors are frequently used with any rate, they are frequently connected to any encoder input. However, it's connected to an input with a lower rate.

The respiration sensor is sensitive to stretch. When strapped around a client's chest or abdomen, it'll convert the expansion and contraction of the skeletal structure or abdominal area, to an increase and fall of the signal on the screen. As the abdomen expands during breathing, the elastic band section stretches for the soldier's comfort. For most applications, placing one sensor round the abdomen is required. Optionally, you'll place a second respiration sensor round the chest.

- **LoRa Module**

LoRa (which stands for Long Range) may be a patented wireless communication technology which mixes ultra-low power consumption with an efficient long range. Although range varies greatly depending on the environment and potential obstructions (LOS or N-LOS), LoRa usually has a range of 13- 15 kilometers, implying that a single LoRa gateway can cover an entire city, and with a few more, an entire country.

A LoRa radio comprise of a couple of features which help it achieve long-range effective power and Low cost. Some of these features include

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- Modulation Technique
- Frequency
- Adaptive Data Rates
- Adaptive Power Levels

- **THRESHOLD LEVEL**

Parameter	Reading
Gas sensor	0 to 200
Temperature	96-99 degree
Heart rate	65-85
Respiratory sensor	16-19

VI.RESULTS

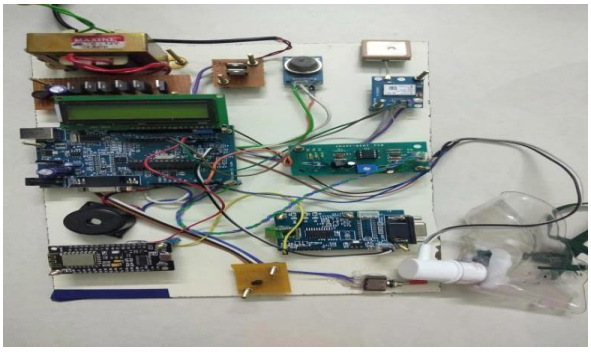

Fig7.1 Hardware module

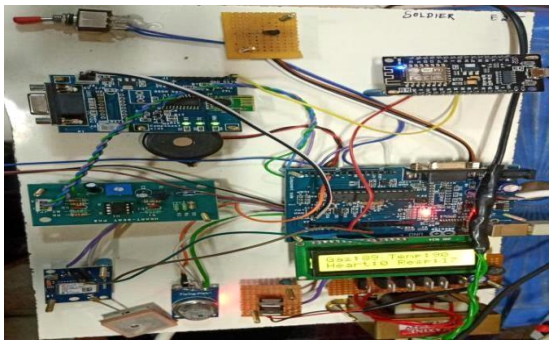

Fig 7.2 Hardware output

Fig 7.3 LCD display output

Fig 7.4 Location

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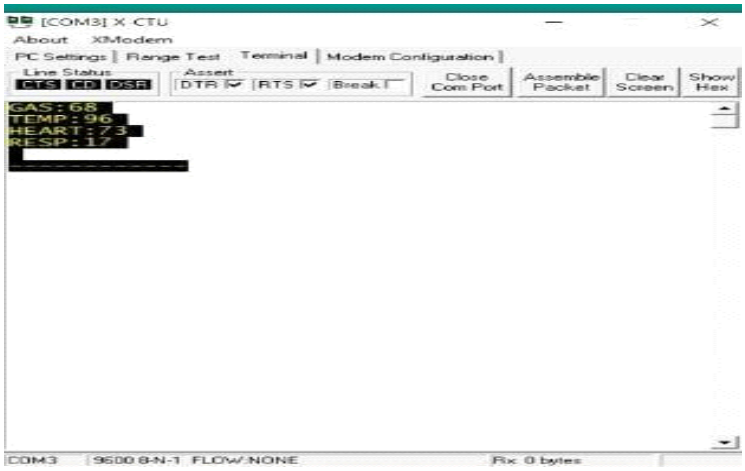

Fig 7.5 x-CTU Terminal

VII.FUTURE SCOPE

To aid soldiers in the future, a portable handheld sensor system with more sensing options could be created. The proposed work is often extended in several ways in the future Machine learning can also be used to recognize human movement using a gyroscope and an accelerometer. A blood pressure sensor and an electro dermal activity sensor may also be used together to determine whether a soldier is calm or distressed. A more appropriate and effective routing algorithm is often used to improve the system's reliability and energy efficiency. Ubiquitous computing can encompass all aspects of a soldier's world, combining physical and computational infrastructures to create a new level of integration.

VIII.CONCLUSION

The paper describes an IoT-based framework for soldiers' health monitoring and tracking. The possessing function is served by an Arduino board, which is a low-cost solution. Heartbeat and body temperature are provided by biomedical sensors and report soldier's health parameters to control room. The LoRa module can be used to periodically update data in the control room. When there is an internet outage, LoRa can be a useful tool. If there is a normal internet connection, the WiFi module will send data to the doctor monitoring unit on a continuous basis. This technology may be useful in providing the precise position of a missing soldier in critical condition and overcoming the disadvantage of soldiers going missing in action. Also useful is the addressing scheme. To boost soldier-to-soldier contact in an emergency situation and provide adequate navigation to the control room. In future, a portable handheld sensor device with more sensing options could also be developed to assist the soldiers.

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