iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** XII **Month of publication:** December 2018

DOI:

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue XII, Dec 2018- Available at www.ijraset.com

Smart Health Monitoring and Location Tracking System for Soldiers

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Abstract: This is an embedded based project. An embedded system is a fusion of software and hardware and perhaps other mechanical parts designed to perform a specific function. This system is a very essential to develop and implement in today's world for the safety of soldiers to ensure public safety too. The main aim of this project is to send soldier's location and health details like pulse rate, body temperature and electrocardiogram (EKG or ECG) in real time to base station for analyzing the crucial details and take the further steps into medication during combat. With these we would be able to approach quickly to right soldiers with right medic equipment necessary. To make our system more effective and user friendly, we have thought of using some latest technologies to transmit more crucial details fast and easily between the troops and the Base station
Keywords: Microcontroller ESP32, Temperature Sensor LM35, Heartbeat Sensor, ECG AD8232, GPS and GSM Module SIM808.

I. INTRODUCTION

In Defence sector, a smart system for health monitoring and tracking location is an essential device mostly in critical part of world where terrorism is growing. The warriors fighting reports the health details on radio and seek the medical help. However, due to some difficulties it may delay the message over radio for reasons like a team of many have limited radio device for long communication or it could be the case to neglect talking to fight at that moment [1]. This could delay the medical assistance. Every single second counts for a life.

Our project is implementation of smart system to send soldier's location and health details like pulse rate, body temperature, electrocardiogram (EKG or ECG) in real time to base station for analysing the crucial details and take the further steps into medication during combat [2 - 3].

Our project aims at interfacing microcontroller ESP32 to biosensors like ECG, GSR, temperature, pulse rate. This data would be used intelligently to assist medical needs to soldiers immediately and analyse their performance and track the real time location [4]. The data will also be stored in an online database through cloud computing technology where a database will be created and all information will be stored further performance analysis. A web application will also be provided for officers to remotely access all the information [5].

A security check is also provided by the system to ensure that only registered users are allowed access to the application. Also the database will store all the health details and other information for easier access later down the years [6].

II. HARDWARE AND SOFTWARE PLATFORMS

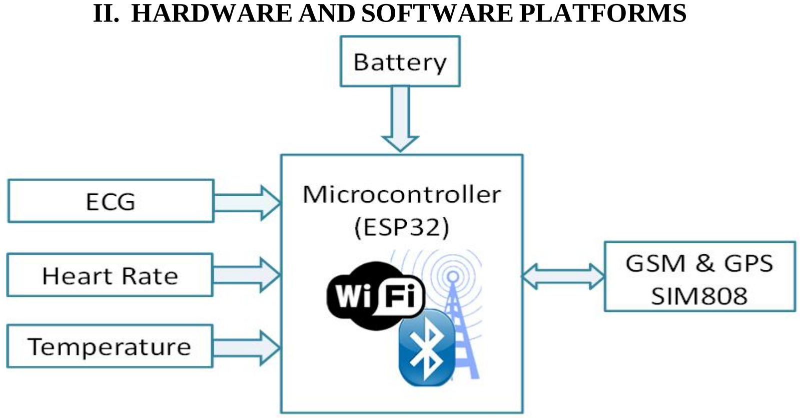

Fig. 1 General Block Diagram of Soldier Unit

Fig. 2-(a)
General
Block Diagram of
Base Station Unit
(During Training)

Fig. 2 General Block Diagram of Base Station Unit (During Training)

Fig. 2-(b)
General
Block Diagram of
Base Station Unit
(On Battlefield)

Fig. 3 General Block Diagram of Base Station Unit (On Battlefield)

The Figure 1-3 shows the complete working block diagram of the Soldier Health Monitoring and Location Tracking System. It has two main parts, a soldier unit and base unit. Soldier unit consists of a microcontroller ESP32, Heart beat sensor, Temperature sensor LM35, ECG AD8232 Sensor, GSM & GPS SIM808. During training Base unit includes a Bluetooth, Wi-Fi & PC, whereas on Battlefield Base unit includes GPRS, BLE, Cloud, Server and PC.

III.BLOCK DIAGRAM DESCRIPTION

A. Microcontroller ESP32

ESP32 is a series of low cost, low power system on chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The ESP32 series employs a Tensilica Xtensa LX6 microprocessor in both dual-core and single-core variations and includes in-built antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power management modules. ESP32 is created and developed by Espressif Systems, a Shanghai-based Chinese company, and is manufactured by TSMC using their 40 nm process. It is a successor to the ESP8266 microcontroller.

1) 32-bit microprocessor operating at 240MHz
2) Ultra Low power coprocessor
3) Wi-Fi: 802.11 b/g/n
4) 12bit ADC up to 18 channels

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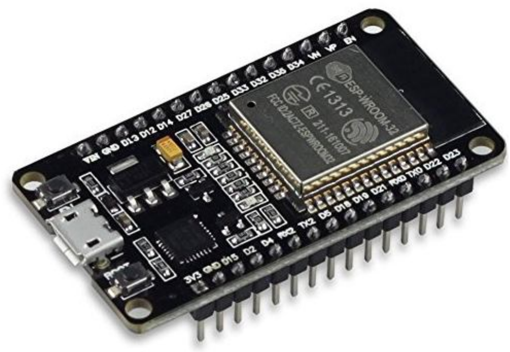

Fig. 4 ESP32 Microcontroller

B. Temperature Sensor LM35

The LM35 series are precision IC temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from its output to have handy Centigrade scaling. Low cost is guaranteed by trimming and calibration at the chip level. The LM35's low output impedance, linear output, and accurate inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. It has very low self-heating. The LM35 is rated to operate over a 55 to +150C temperature range. The LM35 series is available packaged in hermetic TO-46 transistor packages.

1) Calibrated directly in ˚ Celsius (Centigrade)
2) Rated for full −55˚ to +150˚C range
3) Suitable for remote applications
4) Low cost due to wafer-level trimming
5) Operates from 4 to 30 volts
6) Low self-heating

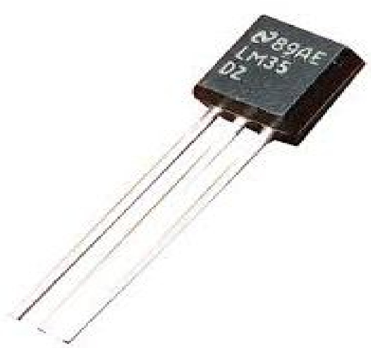

Fig. 5 LM35

C. Heartbeat Sensor

Heart beat sensor will be outlined to provide for advanced yield about heart beat the point when a finger will be set inside it. This advanced yield might be associated with arm straightforwardly to measure those beats for every moment (BPM) rate. It meets expectations on the guideline from claiming light regulation by blood stream through finger during each pulse. ICLM358 is utilized to heart beat sensor. Its double low force operational enhancer comprises of a super splendid red headed What's more light identifier. One will go about as amplifiers What's more in turn will a chance to be utilized Likewise comparator.

LED should be super splendid as the light should go through finger and distinguished at flip side. At the point when heart draws a beat of blood through veins, finger turns out to be marginally darker so less light came to at the indicator. With every heart heartbeat locator flag differs this variety is changed over to electrical heartbeat.

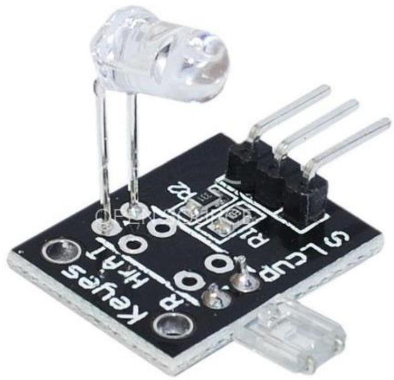

Fig. 6 Heartbeat sensor

D. ECG Sensor Ad8232

The AD8232 is a neat little chip used to measure the electrical activity of the heart. This electrical activity can be charted as an ECG or Electrocardiogram. Electrocardiography is used to help diagnose various heart conditions.

1) Operating Voltage - 3.3V
2) Analog Output
3) Leads-Off Detection
4) Shutdown Pin
5) LED Indicator
6) 3.5mm Jack for Biomedical Pad Connection

Fig.7 AD8232 ECG sensor with electrodes

E. GPS and GSM Module Sim808

SIM808 module is a GSM and GPS two-in-one function module. It is based on the latest GSM/GPS module SIM808 from SIMCOM, supports GSM/GPRS Quad-Band network and combines GPS technology for satellite navigation.

1) GPRS multi-slot class12 connectivity: max. 85.6kbps(down-load/up-load)
2) Controlled by AT Command
3) Supports charging control for Li-Ion battery
4) Supports Real Time Clock
5) Supply voltage range 3.4V ~ 4.4V
6) Integrated GPS/CNSS and supports A-GPS
7) Supports 3.0V to 5.0V logic level
8) Low power consumption, 1mA in sleep mode
9) Standard SIM Card support
10) Satellites there will be increase in the coverage of the system by decreasing the time gaps when a satellite is not in view of a given location. Some of the applications are:

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a) In military sector, providing robust and secure communications network
b) To provide communication when the terrestrial systems fail due to disaster and also to communicate family and friends during disaster.
c) World travellers can use a satellite phone to keep in touch with family without having to send loved ones a new telephone number for each destination.
d) Used by govt. and govt. agencies to transfer information before any disaster.

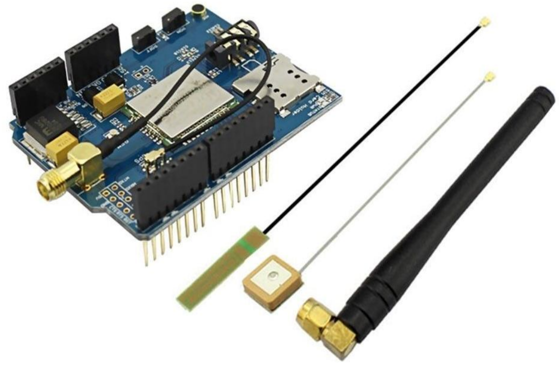

Fig.8 SIM808 chip mounted on board

IV. RESULTS

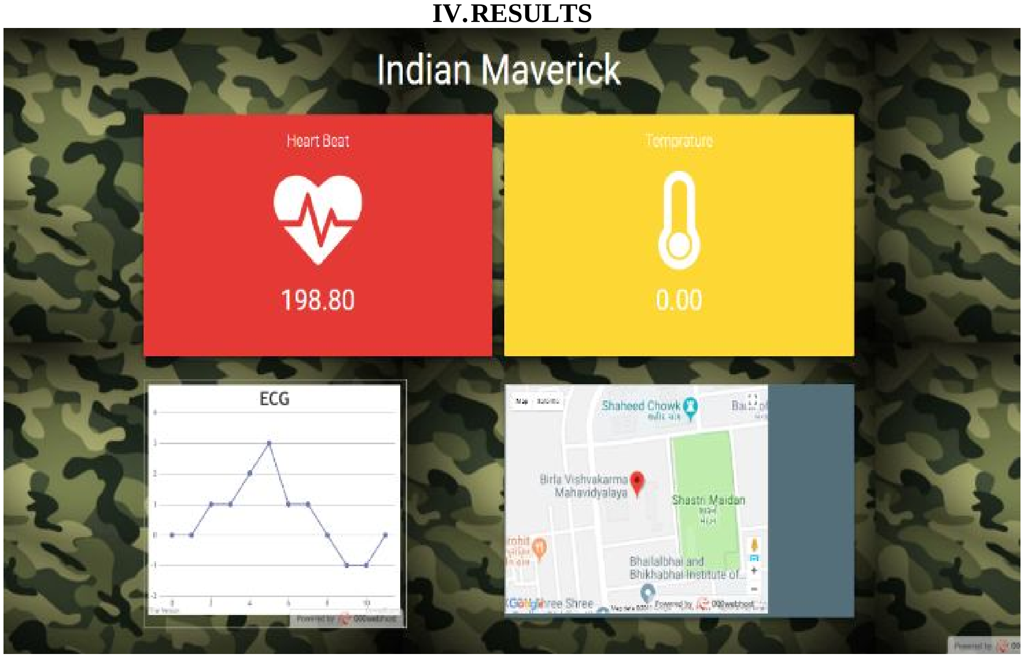

Fig. 9 Webpage view

V. CONCLUSION

The project entitled "Smart Health Monitoring And Locating System" is an effective health monitoring and locating system for a soldier which is made by integrating the advancements in wireless and embedded technology. It helps for a successful secret mission as well as on training field. This system can be used in critical conditions. It has real-time capability. The accuracy of system is affected by some factors such as weather, environment around the mobile soldier unit, GPS receiver. The future works include optimizing the hardware system, choosing a suitable GPS receiver and transfer speed for accurate ECG representation.

VI. FUTURE SCOPE

It has great scope in future by increasing transfer rate. Light weight and cheaper system can be made. Smaller and cheaper mobile terminals can be used. New techniques to reduce propagation delays can be found. Bluetooth mesh network can be used to connect all sensors on single master node to reduce wiring.

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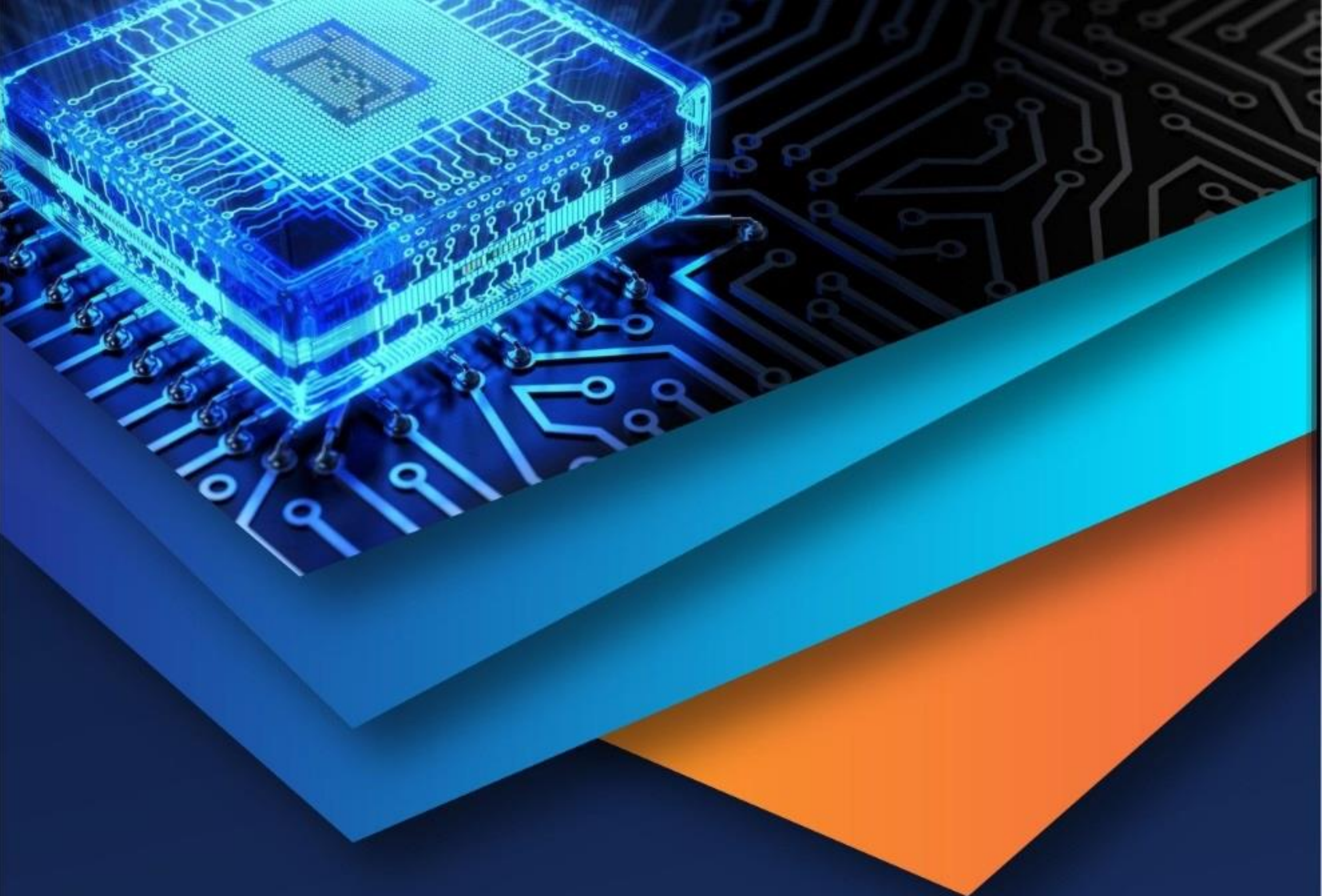

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