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PROJECT REPORT

On

24X7 LIFELINE CHIP FOR MILITANTS

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CHAPTER 1

INTRODUCTION

1.1 Introduction to the Project

"A soldier lives by chance, loves by choice and kills by profession."The infantry soldier of tomorrow promises to be one of the most technologically advanced modern warfare has ever seen. Alongside vast improvements in protective and weaponry Sub systems, another major aspect of this technology will be the ability to provide information superiority at the operational edge of military networks by equipping the dismounted soldier with advanced visual, voice, and data communications. Helmet-mounted visors, capable of displaying maps and real-time video from other squad members, ranges of physiological sensors monitoring heart rate, core body temperature etc. These devices will improve situational awareness, not only for the host, but also for collocated military personnel who will exchange information using wireless networks. The challenge was to integrate these piecemeal components into a lightweight package that could achieve the desired result without being too bulky and cumbersome or requiring too much power. One of the fundamental challenges in military operations lays that the soldiers are not able to communicate with control room station. In addition, the proper navigation between soldier’s organizations plays important role for careful planning and co-ordination. So in this paper we focus on tracking the location of soldier from GPS, which is useful for control room station to know the exact location of soldier and accordingly they will guide them. Also High speed, short-range, soldier-to-soldier wireless communications to relay information on situational awareness.

1.2 Background and Motivations

India today faces the most complex threats and challenges that range from nuclear to sub-conventional spectrum of conflict. Issues such as the unresolved territorial disputes with China and Pakistan, the insurgency in Jammu and Kashmir (J&K) and the North-Eastern states, the growing menace of left-wing extremism and the rising threat of urban terrorism has further exacerbated India’s security environment. In the regional security milieu, it has clearly emerged that China poses the most potent military threat to India—given the advantages it has over India in nuclear, missile and military hardware. Moreover, the China-

Pakistan nexus and increased strategic engagements between the two have increased the probability that India might face a two-front war in the future.

Therefore, the need for augmenting defense capabilities, i.e., land, air and sea capabilities, is being largely reflected in the Indian policy towards defense modernization today (initiatives such as ‘Make in India’) to meet the challenges that emanate from both traditional and non-traditional threats that pose severe threats to India’s national security.

India’s defense industry, however, has failed to manage India’s defense requirements as of today. India is one of the largest arms importers in the world as the indigenous production of technology is one area where India continues to struggle. India’s defense preparedness, therefore, remains a question as some of the most crucial requirements in various services of the Armed Forces have not been fulfilled because of severe deficiencies in the defense industry. India’s land forces lack sophisticated weapons and armory, the navy’s submarine fleet has dwindled down to 40 percent of the minimum requirements and the fighter squadrons are at the level of 60 percent of the mandatory need which, indeed, is a cause for concern considering the slow pace of India’s defense modernization.

On the basis of recent incident, **“Lance Naik Hanumantappa Koppad”** ***was buried under the ice boulders up to 35 feet down due to unfavored weather*****.** And his existence was known after five and half hours through radio set, but they were unable to track his location. Fortunately, rescuers were able to access the telephone cable which could lead them to the location where the soldiers were buried. But it was not easy and couldn’t help. So the team eventually kept digging with basic tools. Finally, after digging vigorously for six days, he was found. This incident inspired us to create or work on the device which would overcome all the drawbacks of present military system.

1.3 Scope of the project

The infantry soldier of tomorrow promises to be one of the most technologically advanced modern warfare has ever seen. Around the world, various research programs are currently being conducted, such as the United States’ Future Force Warrior (FFW) and the United Kingdom’s Future Infantry Soldier Technology (FIST), with the aim of creating fully integrated combat systems. Alongside vast improvements in protective and weaponry subsystems, another major aspect of this technology will be the ability to provide information superiority at the operational edge of military networks by equipping the dismounted soldier with advanced visual, voice, and data communications. Helmet mounted visors, capable of displaying maps and real-time video from other squad members, ranges of physiological sensors monitoring heart rate, core body temperature etc. These devices will improve situational awareness, not only for the host, but also for collocated military personnel who will exchange information using wireless networks. The challenge was to integrate these piecemeal components into a lightweight package that could achieve the desired result without being too bulky and cumbersome or requiring too much power.

1.4 Objectives

i. Our proposed system gives an ability to track the location of the soldiers in real time with the help of GPS who are lost and get injured in the battlefield.

ii. This system enables to monitor the health of soldiers using area sensor networks (WBASNs), such as temperature sensor, heart beat sensor.

iii. It helps to minimize the time, search and rescue operation efforts of army control unit.

iv. Communication is enabled using GSM.

1.5 Literature Survey

During, wars and military search operations, soldiers get injured and sometimes become lost. To find soldiers and provide health monitoring, army base stations need GPS device for locating soldiers, WBASNs to sense health related parameters of soldiers and a wireless transceiver to transmit the data wirelessly.

Hock Beng Lim, Di Ma, Bang Wang, Zbigniew Kalbarczyk, Ravishankar K. Iyer, Kenneth L. Watkin had discussed on recent advances in growing technology, and on various wearable, portable, light weighted and small sized sensors that have been developed for monitoring of the human physiological parameters. The Body Sensor Network (BSN) consists of many biomedical and physiological sensors such as blood pressure sensor, electrocardiogram (ECG) sensor, electro dermal activity (EDA) sensor which can be placed on human body for health monitoring in real time. In this paper, we describe an idea to develop a system for real time health monitoring of soldiers, consisting of interconnectedBSNs. We describe the basic prototype of the system and present a blast source localization application. In this paper, we have completed only an initial design of individual sensor nodes and developed a basic prototype of the system to collect the sensed data. In future, we will try to develop an integrated data management system and a web portal which will enable users to have easy access of data.

P.S. Kurhe, S.S. Agrawal had introduced a system that gives ability to track the soldiers at any moment. Additionally, the soldiers will be able to communicate with control room using GPS coordinate information in their distress. The location tracking has great importance since World War II, when military forces realized its usefulness for navigation, positioning, targeting and fleet management. This system is reliable, energy efficient for remote soldier health monitoring and their location tracking. It is able to send the sensed and processed parameters of soldier in real time. It enables to army control room to monitor health parameters of soldiers like heartbeat, body temperature, etc. using body sensor networks. The parameters of soldiers are measured continuously and wirelessly transmitted using GSM. In this paper, it is possible to transmit the data which is sensed from remote soldier to the base station's PC by using wireless transmission device like GSM. The accuracy of this system may affected by some factors such as weather, environmental conditions around the soldier's unit and GPS receiver. The future works in this system may include the optimization of the hardware components, by choosing a suitable and more accurate GPS receiver. By improving the routing algorithm can be make this system more powerful and energy efficient. Upgrading this system is easy which makes it open to an advanced future.

ShrutiNikam, SupriyaPatil, PrajktaPowar, V. S. Bendrehad presented an idea for the safety of soldiers. There are many instruments which can be used to view the health status of soldiers as well as ammunitions on them. The Bio sensor which consists of various types of small physiological sensors, transmission modules have great processing capabilities and can facilitates the low-cost wearable solutions for health monitoring. GPS module can be used to log the longitude and the latitude by which directions and location can be traceable easily. RF module can be used for high speed, short-range data transmission, for wireless communications between soldier-to-soldier that will help to provide soldiers health status and location data to control room. So by using these devices and modules, we are trying to implement the basic health observing system for soldier in low cost with high efficiency and high reliability. The GPS module tracks the position of soldiers anywhere on the globe and the bio-sensors monitor the vital health parameters of soldiers that provide safety and security to soldiers. By the use of ARM processor and low power hardware peripherals, overall power consumption of system will get reduced. And due to use of small sized modules, the system will be lightweight and can be carried out anywhere.

Prof.PravinWorarkar, Sawan Mahajan, Ashu Mahajan, Arijit Banerjee, AnchalMadankar, Ashish Sontakkehad proposed an idea of tracking the position of soldier as well as to give the health status of the soldier, which enables the army base station to plan the strategies according to current situation during war. Use of GPS tracking device and RF transceiver module provide the wireless system to monitor the health parameters and location tracking of soldiers. By using this system, the army base station will come to know the position of soldier and the health parameters such as body temperature and blood pressure of soldiers.The health monitoring and tracking system can be implemented by using RF module and GPS tracking system. By GPS device, we will able to give proper location of soldier and also can monitor the heath parameters by temperature sensor and heart beat sensor. Thus, we can help the soldiers in panic condition from army control room by communicating with them during war.

Rubina.A.Shaikhhad investigated for the care of critically ill patients. Considering in India, everyday many people get affected by heart attack, and many of them become more serious, because they did not get proper and timely help of doctors. This paper is based on monitoring the health of remote patients, when they get discharged from hospital. I have tried to design and develop an energy efficient and reliable health monitoring system which is able to send the parameters of patients in real time because of the use of ARM 7 microprocessor. This system enables the doctors to monitor health parameters like body temperature, heartbeat and ECG of patients from their clinic or hospital. The health parameters of patient are measured continuously and transmitted wirelessly through ZigBeetransceiver. In this project, we will able to transmit and display the health data which is sensed from remote patients, on the doctor's PC, using ZigBee module as a wireless transmission device.Additionally, if doctor will not present in clinic or hospital, then too, they will able to receive SMS on their mobile phone, in case of any health parameter increases beyond the normal range using GSM technology. But, to get the more accurate and correct ECG readings, the leads of the ECG sensor should be stick properly on the body of patient, fails to do so; ECG readings will not be accurate.

CHAPTER 2

ANALYSIS

2.1 Problem Statement

In military operations, one of the fundamental challenges is that the soldiers are not able to communicate with control room and sometimes not even with the other fellow soldiers. Once a troop or a soldier become lost during fight in battlefield due to some unfavourable environment or adverse fight conditions, then it becomes more difficult to search them and bring back to the army base station. In addition, every defence organization needs to design and develop some advance, small, portable and robust system to provide safety measures to their soldiers. There are many problems which are faced by soldiers during wars in battlefield, like:

i. Sometimes soldiers want to know their location when they become lost but they are not able to do so.
ii. Sometimes soldiers need some help during panic situations but they are not able to ask for help.
iii. Sometimes soldiers are not able to get help when they get injured during war.

2.2 Functional Requirements

Functional requirements may be calculations, technical details, data manipulation and processing and other specific functionality that define what a system is supposed to accomplish. Behavioral requirements describing all the cases where the system uses the functional requirements are captured in use cases. Functional requirements are supported by non-functional requirements, which impose constraints on the design or implementation. Generally, functional requirements are expressed in the form system must do, while non-functional requirements are system shall be. The plan for implementing functional requirements is detailed in the system design. The plan for implementing non-functional requirements is detailed in the system architecture.

As defined in requirements engineering, functional requirements specify particular results of a system. This should be contrasted with non-functional requirements which specify overall characteristics such as cost and reliability. Functional requirements drive the application architecture of a system, while non-functional requirements drive the technical architecture of a system.

In some cases a requirements analyst generates use cases after gathering and validating a set of functional requirements. The hierarchy of functional requirements is: user/stakeholder request → feature → use case → business rule. Each use case illustrates behavioral scenarios through one or more functional requirements. Often, though, an analyst will begin by eliciting a set of use cases, from which the analyst can derive the functional requirements that must be implemented to allow a user to perform each use case. This information is used to help the reader understand why the requirement is needed, and to track the requirement through the development of the system.

With recent advances in technology, various Bio-sensors have been developed for the monitoring of human physiological parameters. The various sensing technologies are available, which can be integrated as a part of health monitoring system, along with their corresponding measured physiological signal. The measurement of these vital bio-signal and their subsequent processing for feature extraction, lead to collection of real time gathered physiological parameter which can give an overall estimation of health condition at any real time There are a number of medical parameters of soldier that can be monitored, like ECG, EEG, Brain Mapping, etc. But these require complex circuitry and advanced medical facilities and hence they cannot be carried around by the soldier. The entire system would become bulky for the soldier. We therefore use two simple parameters temperature of the soldier and Blood Pressure of the soldier, which does not require too complex circuits and can be easily fitted into a small device that can be carried by the soldier. We are using LM35 as it is a low cost temperature sensor and it does not require signal conditioning. Pulse rate sensor is used or pulse rate measurement it works on the principle of light modulation by blood flow through finger at each pulse.

2.3 Non Functional Requirements

Non-functional requirements include specifications that are not related to the basic operational behavior of the system such as reliability, availability, security, maintainability, portability and performance.

- **Reliability**

Ability of the system to perform its required function under stated condition and time is depending on the efficiency of the code. It is a standalone application with higher reliability. It can be used by a single user at a time. In computer networking, a reliable protocol provides reliability properties with respect to the delivery of data to the intended recipient, as opposed to an unreliable protocol, which does not provide notifications to the sender as to the delivery of transmitted data.

- **Availability**

The system runs only infrequently on-demand. Availability of a system is typically measured as a factor of its reliability – as reliability increases, so does availability. Availability of a system may also be increased by the strategy of focusing on increasing testability, diagnostics and maintainability and not on reliability. Improving maintainability during the early design phase is generally easier than reliability. Maintainability estimates are also generally more accurate. However, because the uncertainties in the reliability estimates are in most cases very large, it is likely to dominate the availability problem, even while maintainability levels are very high.

- **Maintainability**

This covers a wide range of activities including correcting code and design errors. To reduce the need for maintenance in the long run, we have more accurately defined the user's requirements during the process of system development. Depending on the requirements, this system has been developed to satisfy the needs to the largest possible extent. With development in technology, it may be possible to add many more features based on the requirements in future. The coding and designing is simple and easy to understand which will make maintenance easier.

- **Portability**

The system can be portable from one machine to another provided the machine is able to run Eclipse and it has been installed within the machine. The project should be exported by Eclipse and can be imported to Eclipse of another machine.

- **Performance**

Performance encompasses the set of roles, skills, activities, practices, tools, and deliverables applied at every phase of the systems development life cycle which ensures that a solution will be designed, implemented, and operationally supported to meet the non-functional requirements. It encompasses more than just the software and supporting infrastructure, and as such the term performance engineering is preferable from a macro view. Adherence to the non-functional requirements is also validated post-deployment by monitoring the production systems.

2.4 Requirement Specification

2.4.1 Hardware Requirements:

Micro Controller

GPS RX – L80

GSM – SIM 800

Temperature sensor – LM35

Heart Beat Sensor

2.4.2 Software Requirements

Mikroc pro for AVR-compiler

Eagle- Layout

Orcad’s capture-circuit design

CHAPTER 3

SYSTEM DESIGN

3.1 System Architecture

The figure 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 ATmega8 microcontroller, heart beat sensor, temperature sensor, GPS receiver, GSM transmitter and toggle switch.

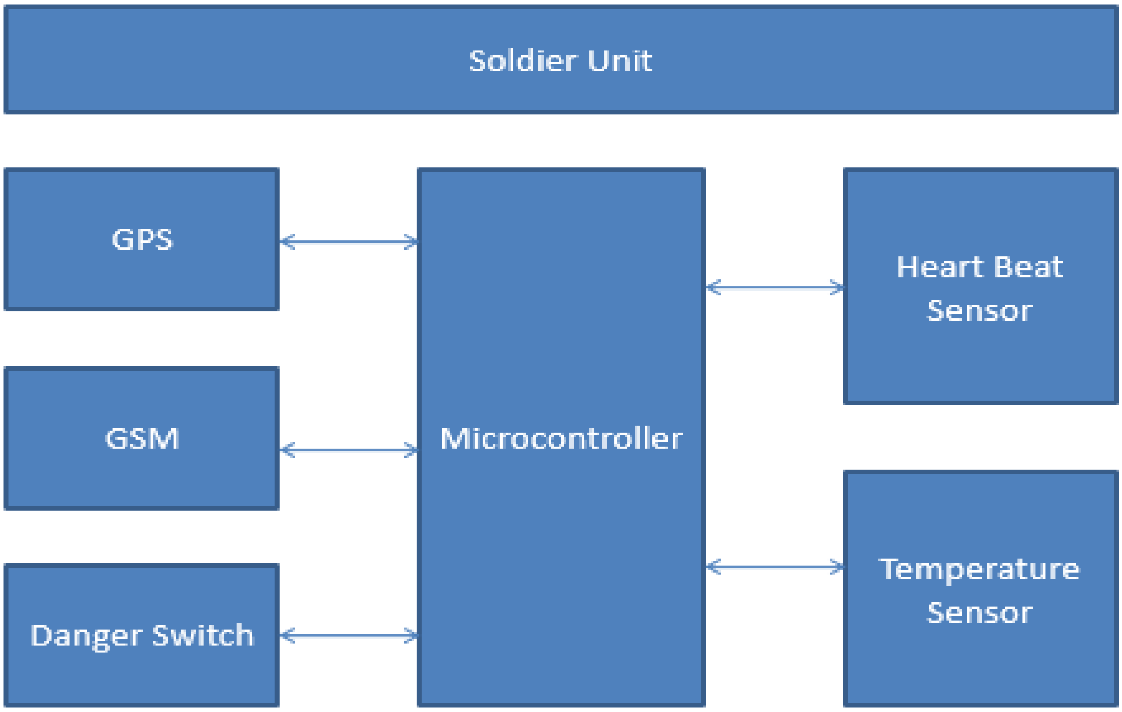

Fig 3.1: System unit

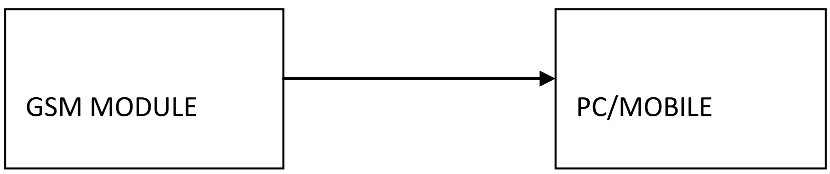

Fig3.2: Base unit

3.2 Defining the components

1) MICROCONTROLER - ATmega8: ATmega8 microcontroller has 23 programmable input/output (I/O) pins which can be used for interfacing with external world. It is possible to configure them as input or output by setting a particular register value through programming. Microcontroller are involve in embedded applications & automatically controlled devices like medical devices, remote control devices, control systems, office machines, power tools, electronic devices, etc.

Fig3.3: Microcontroller

What Is An Avr Atmega8 Microcontroller?

In 1996, AVR Microcontroller was produced by the "Atmel Corporation". The Microcontroller includes the Harvard architecture that works rapidly with the RISC. The features of this Microcontroller include different features compared with other like sleep modes-6, inbuilt ADC (analog to digital converter), internal oscillator and serial data communication, performs the instructions in a single execution cycle. These Microcontroller were very fast and they utilize low power to work in different power saving modes. There are different configurations of AVR microcontrollers are available to perform various operations like 8-bit, 16-bit, and 32-bit. AVR microcontrollers are available in three different categories such as TinyAVR, Mega AVR, and XmegaAVR. The Tiny AVR microcontroller is very small in size and used in many simple applications. Mega AVR microcontroller is very famous due to a large number of integrated components, good memory, and used in modern to multiple applications. The Xmega AVR microcontroller is applied in difficult applications, which require high speed and huge program memory.

Atmega8 Microcontroller Pin Description

The main feature of Atmega8 Microcontroller is that, all the pins of the Microcontroller support two signals except 5-pins. The Atmega8 microcontroller consists of 28 pins where pins 9,10,14,15,16,17,18,19 are used for port B, Pins 23,24,25,26,27,28 and 1 are used for port C and pins 2,3,4,5,6,11,12 are used for port D.

Architecture of Atmega8 Microcontroller

Memory: It has 1Kbyte Internal SRAM, 8 Kb of Flash program memory and 512 Bytes of EEPROM.

I/O Ports: It has three ports, namely port-B, port-C and port-D and 23 I/O line can be attained from these ports.

Interrupts: The two Exterior Interrupt sources are located at port D. Nineteen dissimilar interrupts vectors supporting nineteen events produced by interior peripherals.

Timer/Counter: There are 3-Internal Timers are accessible, 8 bit-2, 16 bit-1, presenting numerous operating modes & supporting internal/external clocking.

Serial Peripheral Interface (SPI): ATmega8 microcontroller holds three integrated communication devices. One of them is an SPI, 4-pins are allocated to the Microcontroller to implement this system of communication.

USART: USART is one of the most powerful communication solutions. Microcontroller ATmega8 supports both synchronous & asynchronous data transmission schemes. It has three pins allocated for that. In many communication projects, USART module is widely used for communication with PC-Microcontroller.

Two Wire Interface (TWI): TWI is another communication device which is present in ATmega8 microcontroller. It permits designers to set up a communication b/n two devices using two wires along with a mutual GND connection, As the o/p of the TWI is made by means of open collector o/ps, therefore external pull-up resistors are compulsory to make the circuit.

Analog Comparator: This module is incorporated in the integrated circuit that offers contrast facility between two voltages linked to the two inputs of the comparator through External pins associated with the Microcontroller.

ADC: Inbuilt ADC (analog to digital converter) can alter an analogi/p signal into digital data of the 10-bit resolution. For a maximum of the low-end application, this much resolution is sufficient.

Atmega8 Microcontroller Applications

The Atmega8 microcontroller is used to build various electrical and electronic projects. Some of the AVR atmega8 Microcontroller projects are listed below:

i. AVR Microcontroller based LED Matrix Interfacing.
ii. UART communication between Arduino Uno and ATmega8.
iii. Interfacing of Optocoupler with ATmega8 Microcontroller.
iv. AVR Microcontroller based Fire Alarm System.
v. Measurement of Light Intensity using AVR Microcontroller and LDR.
vi. AVR Microcontroller based 100mA Ammeter.
vii. ATmega8 Microcontroller based Anti-Theft Alarm System.
viii. AVR Microcontroller based Interfacing of Joystick.
ix. AVR Microcontroller based Interfacing of Flex Sensor.
x. Stepper Motor Control using AVR Microcontroller.

2) GPS RX – L80:L80 is an ultra-compact GPS POT (Patch on Top) module with an embedded 15.0 × 15.0 ×4.0mm patch antenna. This space-saving design makes L80 the perfect module for the miniature devices. Adopted by LCC package and integrated with patch antenna, L80 has exceptional performance both in acquisition and tracking.

Fig3.4: GPS

3) GSM – SIM 800:SIM800 GSM modules have an inbuilt Bluetooth stack compliant with 3.0+EDR & FM radio support, and the interface is accessible using AT commands. SIM800C GSM module is comes in a very compact ***size*** of 17.6*15.7*2.3 mm dimensions compared to SIM900/SIM900 which come in 24*24*3mm package. GSM networks operate in a number of different carrier frequency ranges (separated into GSM frequency rangesfor 2G and UMTS frequency bandsfor 3G), with most 2GGSM networks operating in the 900MHz or 1800MHz bands.

Fig3.5: GSM

4) Graphical LCD: The Graphical LCDsare used to display customized characters and images. The Graphical LCDs used in many applications; they are used in video games, mobile phones, lifts etc. as display units. This LCD has a display format of **128x64 dots** and has yellow-green colour backlight. Here it is used to display all details of soldier such as speed, distance height and also their health parameter's.

Fig3.6: LCD Display

5) Biosensors: To find the health status of soldier we are measuring body temperature, pulse rate using sensors. We are using LM35 as it is a low cost temperature sensor and it does not require signal conditioning. Pulse rate sensor is used or pulse rate measurement.

- **Temperature Sensor LM 35:** It isa precision integrated circuit temperature sensor whose output voltage is linearly proportional to temperature.

Fig3.7: LM35

Features of LM35:

i. Calibrated directly in degree celsius(centigrade).
ii. Linear +10.0 mV/ degree Celsius.

iii. 0.5 degree celsius accuracy guarantee able (at +25degree celsius).
iv. Rated for full -55 to +150 degree celsius range.
v. Suitable for remote applications.
vi. Low cost due to wafer-level trimming.
vii. Operates from 4 to 30 volts.
viii. Less than 60 Micro ampere current drain.
ix. Low self-heating, 0.08 degree celsius in still air.
x. Nonlinearity only +/- 1/4 degree celsius typical.
xi. Low impedance output, 0.1 Ohm for 1mA load.

- **Heart Beat Sensor:** It gives digital output of heart beat when finger is placed on it. it works on the principle of light modulation by blood flow through finger at each pulse.

Fig3.8: Heart Beat Sensor

The heartbeat sensor is based on the principle of photo phlethysmography. 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.

There are two types of photophlethysmography:

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.

Working of a Heartbeat Sensor

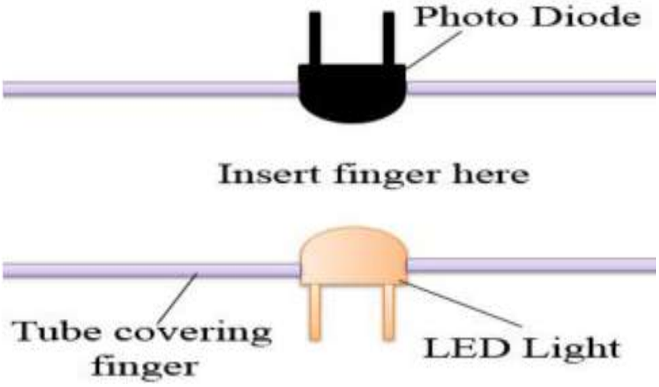

Fig 3.9: Heart Beat Sensor Components

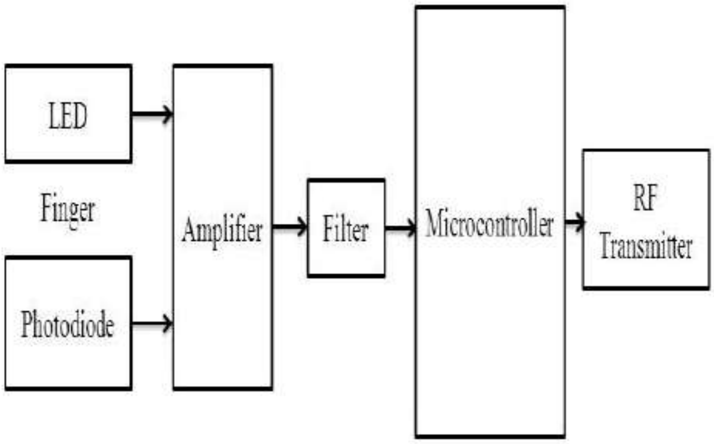

Fig 3.10: Block Diagram of Heart Beat Sensor

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. This signal is actually a DC signal relating to the tissues and the blood volume and the AC component synchronous with the heart beat and caused by pulsatile changes in arterial blood volume is superimposed on the DC signal.

6) Danger Switch (Slide Switch): Danger Switch is also called as slide switch or toggle switch. It gives the indication of danger.

Fig3.11: Toggle Switch

3.3 Algorithm

1. Power on
2. Initialize serial communication
3. Initialize LCD and display the message
5. Read data from GPS receiver and display on LCD
6. Read soldier body temperature status
7. Read soldier heart rate
8. Send GPS location, temperature status and heart rate to base station using GSM communication.
9. Receive data from sim800.

CHAPTER 4

IMPLEMENTATION

4.1 Interfacing GPS with Microcontroller

LCD (Liquid crystal display) data pins are connected to PORT2 of the controller and control pins RS, RW and EN are connected to the P1.0, P1.1 and P1.2 respectively. The latitude and longitude values of the location are displayed on LCD. Here pot RV1 is used to adjust the contrast of LCD. The receiver pin of GPS module is connected to the 13^{th} pin of max232 IC and GND pin is connected to ground. Controller RXD pin is connected to the 12^{th} pin of max232. Here max232 IC is used for level conversion.

The GPS receiver continuously transmits the data as per the NMEA standards using RS232 protocol. In this NMEA format, the LATITUDE and LONGITUDE values of location are available in GPRMC sentence. In this project LATITUDE and LONGITUDE values are extracted from NMEA format and displayed on LCD.

We have to receive the data to the controller form GPS module serially using UART protocol and now extract the latitude and longitude values from the received messages and display them on LCD.

Range of GPS

The approximate range for working of GPS is bout 4 -5 Km over which it can give accurate results. These signals, travelling at the speed of light, are intercepted by your GPS receiver, which calculates how far away each satellite is based on how long it took for the messages to arrive. . These signals, travelling at the speed of light, are intercepted by your GPS receiver and transmitted to base station. . These signals, travelling at the speed of light, are intercepted by your GPS receiver. The range of GPS is about Ten meters which can be increased according to applications. This GPS works on trilateration method which is described later on in this paper. The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions.

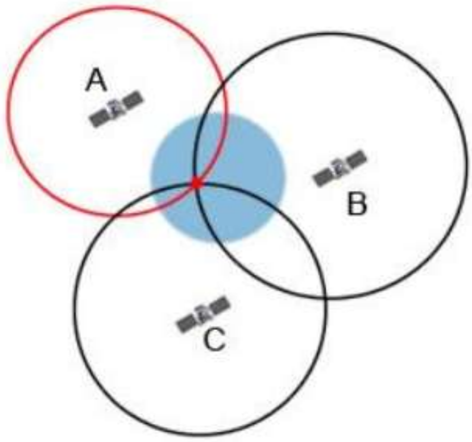

Fig 4.1: Satellite Communication using GPS

If you do the same for satellites B and C, you can work out your location by seeing where the three circles intersect. This is just what your GPS receiver does, although it uses overlapping spheres rather than circles. The more satellites there are above the horizon the more accurately your GPS unit can determine where you are at exact location on the earth.

How Position Is Determined?

A GPS receiver "knows" the location of the satellites because that information is included in the transmitted Ephemeris data. By estimating how far away a satellite is, the receiver also "knows" it is located somewhere on the surface of an imaginary sphere centered at the satellite. It then determines the sizes of several spheres, one for each satellite and therefore knows the receiver is located where these spheres intersect.

How Is The Signal Timed?

All GPS satellites have several atomic clocks. The signal that is sent out is a random sequence, each part of which is different from every other, called pseudo-random code. This random sequence is repeated continuously. All GPS receivers know this sequence and repeat it internally. Therefore, satellites and the receivers must be in synch. The receiver picks up the satellite's transmission and compares the incoming signal to its own internal signal. By comparing how much the satellite signal is lagging, the travel time becomes known.

What Does The Signal Consist Of?

The navigational signals transmitted by GPS satellites encode a variety of information including satellite positions, the state of the internal clocks, and the health of the network. These signals are transmitted on two separate carrier frequencies thatare common to all satellites in the network. Two different encodings are used: a public encoding that enables lower resolution navigation, and an encrypted encoding used by the U.S. military.GPS satellites transmit two radio signals. These are designated as L1 and L2. A Civilian GPS uses the L1 signal frequency (1575.42 MHz) in the UHF band. The signals travel by line of sight, meaning they will pass through clouds, glass, plastic etc. but will not travel through solid objects such as buildings and mountains.The GPS signal contains three different bits of information —a pseudo random code, almanac data and ephemeris data.GSM (Global System For Mobile Communication i.e. Group Special Mobile)It is a standard set developed by the European Telecommunications Standards Institute(ETSI) to describe protocols for second generation (2G) digital cellular networks used by mobile phones.

4.2 Interfacing with Temperature Sensor

Temperature is an analog quantity, but digital systems often use temperature to implement measurement, control, and protection functions. If you apply the right techniques and components, the necessary conversion of analog temperature to digital information won't be difficult. This application note discusses thermal comparators, PWM-output temperature sensors, and remote diode (or thermal diode) temperature sensors. Temperature is an analog quantity, but digital systems often use temperature to implement measurement, control, and protection functions. If you apply the right techniques and components, the necessary conversion of analog temperature to digital information won't be difficult.

Reading temperature with a microcontroller (µC) is simple in concept. The µC reads the output code of an analog-to-digital converter (ADC) driven by a thermistor-resistor voltage divider, analog-output temperature sensor, or other analog temperature sensor. The ADC built into some controllers can simplify this design. ADCs require a reference voltage, which can be generated by an external device. For example, the reference voltage for a thermistor sensor is usually the same as that applied to the top of the resistor-thermistor voltage divider. However, the following complications can arise in these systems:

- **The sensor's output-voltage range is significantly smaller than the ADC's input-voltage range.** A typical ADC for this purpose might have 8-bit resolution and a 2.5V reference voltage, which is normally equivalent to the input-voltage range. If the sensor's maximum output for the temperature range of interest is only 1.25V, the effective resolution drops to 7 bits. To achieve 8-bit resolution, either add gain via an external op amp or lower the ADC's reference voltage (which may reduce the accuracy of some ADCs).

- **The error budget is tight.** Combining the error from the thermistor-resistor combination or analog-sensor device with those contributed by the ADC, the amplifier offset voltage, the tolerance of gain-setting resistors, and the voltage reference error may be more error than your system can tolerate.

- **You want a linear temperature-to-code transfer function and you're using a thermistor.** The transfer function for thermistors is very nonlinear, but it may be sufficiently linear over the narrow temperature range required in many applications. You can compensate for the nonlinearity with a look-up table, but this approach requires resources that may not be available.

- **ADC inputs are limited.** If the number of temperatures you want to measure exceeds the number of ADC inputs available, you may need to add a multiplexer, which will increase the cost and development time.

- **The number of µC I/O pins is limited.** This won't be an issue for an internal ADC, but an external serial ADC will require two to four I/O pins as an interface to the µC.

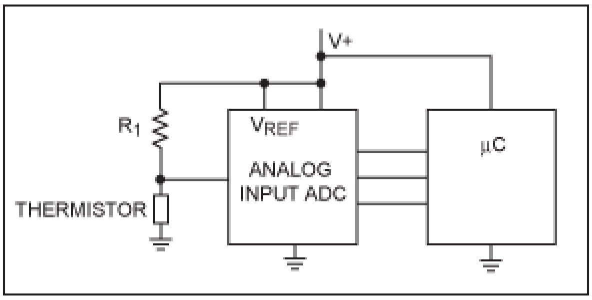

Fig 4.2: Circuit diagram of LM35

In this simple interface, the ADC's reference voltage is derived from the power-supply voltage. An analog temperature sensor can replace the thermistor-resistor voltage divider. In that case, the ADC (which can be internal to the µC) requires a reasonably accurate voltage reference.

The design problems are simplified if you use a temperature sensor with a digital interface. Similarly, temperature sensors with time- or frequency-based outputs can alleviate the measurement problem when ADC inputs and µC I/O pins are in short supply. The MAX6576 temperature sensor, for example, produces an output square wave whose period is proportional to absolute temperature. It comes in a 6-pin SOT23 package that requires very little board space. A single I/O pin interfaces this device to a µC; after its internal counter measures the period, the µC calculates the temperature.

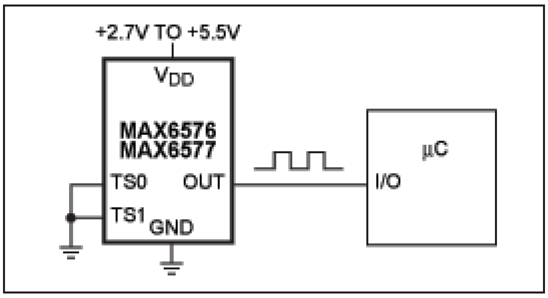

Fig 4.3: Pinout diagram of LM35

The MAX6576 produces a square wave with period proportional to absolute temperature; the MAX6577 produces an output frequency proportional to temperature. The resulting proportionality constant is set to one of four values by the TS0 and TS1 pins. No external components are necessary.Applying either ground or the positive supply voltage to each of two logic inputs selects one of four period/ temperature proportionality constants between 10µs/°K and 640µs/°K. A related temperature sensor (MAX6577) generates an output square wave whose frequency/temperature factor is programmable between 0.0675Hz/°K and 4Hz/°K. Both devices simplify temperature acquisition by reducing the required PC board real estate, component count, and analog/digital I/O resources. They transmit temperature data to the µC through a single digital I/O pin, and the addition of a single optical isolator makes them ideal for applications that require electrical isolation between the sensor and the CPU.

4.3 GSM interfacing with Microcontroller circuit principle:

The main principle of this circuit is to interface a GSM modem with the microcontroller. The microcontroller used is ATMEGA8 microcontroller. To communicate with GSM modem, AT commands are required. Microcontroller sends these commands to the GSM modem, which is then activated to perform the required operation.

The following AT commands are frequently used to control the operations of GSM modem.

Command – Operation

AT+CSMS – Select message service.

AT+CMGF – Message format.

AT+CMGL – List messages.

AT+CMGR – Read message.

AT+CMGS – Send message.

AT+CMGD – Delete message.

ATA – Answer a call.

ATD – Dial a number.

ATDL – Dial the last outgoing number.

ATH – Hang up the call.

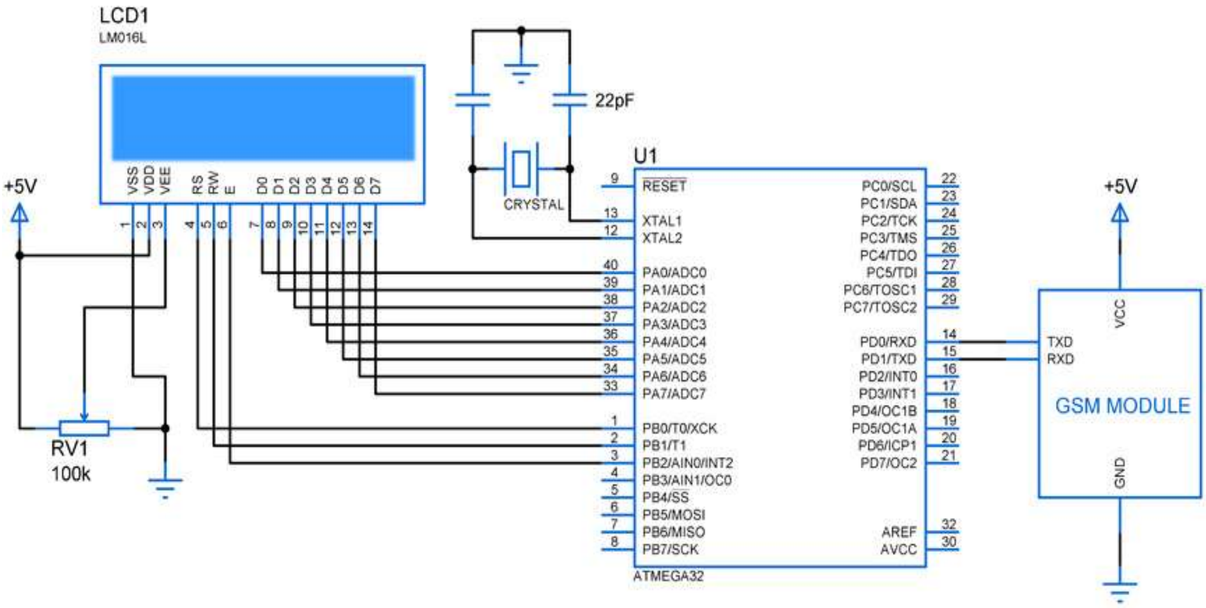

Fig 4.4: Interfacing GSM with Microcontroller

The circuit of interfacing GSM to AT89C51 microcontroller mainly consists of GSM modem and 8051 family microcontroller. GSM has RS232 interface for serial communication. In between the GSM module and the microcontroller MAX232 IC is connected.

MAX232 IC is used for converting the logic levels. RS232 logic levels of GSM are converted to the TTL logic levels of the microcontroller using this MAX232 IC. MAX232 IC has 16 pins. This is a dual driver IC as it has two transmitters and receivers. Interfacing of GSM to AT89C51 microcontroller uses only one transmitter and receiver.

The transmitter pin T1IN of max232 is connected to the transmitter pin of the microcontroller. The receiver pin R1out of the max232 is connected to the receiver pin of the microcontroller. The T1out pin of the IC is connected to the transmitter pin of the GSM modem.

The R1IN pin of the IC is connected to the receiver pin of the GSM modem. Two 0.1 micro farad capacitors are connected to the pins of 1, 2 and 4 , 5. Another 1uf capacitor is grounded from pin6 and another capacitor is connected to the supply of 5v from the through the 2nd pin of the IC.

GSM modem used here has sim300 module. These wireless modems communicate with the microcontrollers and other devices. This has 4 pins compatible to TTL logic. These can be directly connected to the microcontroller as it has max232 or use the DB9 connector to connect to the controller.

4.4 PROGRAM

```
unsignedinti,j;
unsigned char temp[]="     ",txt[]="     ";
unsigned adc_data1,adc_data2;
unsigned char gps_data[301],gp1[]="1234.1234",gp2[]="1234.1234";

sbitigni at PORTB4_bit;
sbitignid at DDB4_bit;
// LCD module connections
sbit LCD_RS at PORTD6_bit;
sbit LCD_EN at PORTD7_bit;
```

```
sbit LCD_D4 at PORTB0_bit;
sbit LCD_D5 at PORTB1_bit;
sbit LCD_D6 at PORTB2_bit;
sbit LCD_D7 at PORTB3_bit;

sbitLCD_RS_Direction at DDD6_bit;
sbitLCD_EN_Direction at DDD7_bit;
sbit LCD_D4_Direction at DDB0_bit;
sbit LCD_D5_Direction at DDB1_bit;
sbit LCD_D6_Direction at DDB2_bit;
sbit LCD_D7_Direction at DDB3_bit;

voidgps()
        {            for(i=0;i<300;i++)
                      {
while (UART1_Data_Ready() != 1);
                       {
gps_data[i]=Uart1_Read();
                        }
                      }
for(i=0;i<300;i++)
                         {
if(gps_data[i]=='$')
                         {
if(gps_data[i+1]=='G' &&gps_data[i+2]=='P' &&gps_data[i+3]=='R')
          {
          i=i--;
          i=i+21;//CHNGED

          for(j=0;j<9;j++)
          gp1[j]=gps_data[i+j];


 Uart1_Write_Text("\r\n");
```

```
                    Delay_ms(2000);
i=i+13;     //CHENGD

                    for(j=0;j<9;j++)
gp2[j]=gps_data[i+j];
    }
                     }
}



                    Uart1_Write_Text("AT\r\n");
delay_ms(2000); // 2 sec delay
                    Uart1_Write_Text("ATE0\r\n");
delay_ms(2000);
                    Uart1_Write_Text("AT+CMGF=1\r\n");
delay_ms(2000);
                    Uart1_Write_Text("AT+CMGS=\"+918880750868\"\r\n");
delay_ms(2000); // 2 sec delay
                    Uart1_Write_Text("Solder Found @");
Delay_ms(20);
Lcd_Cmd(_LCD_CLEAR);
                    UART1_Write_Text("Lattitude:");
                    UART1_Write_Text(gp1);
Delay_ms(20);
                    UART1_Write_Text("\nLongitude");
                    UART1_Write_Text(gp2);
Lcd_Out(1,1,gp1);              // Write text in first row
Lcd_Out(2,1,gp2);
                    UART1_Write_Text("\nBody Temp:");
                    UART1_Write_Text(temp);
                    UART1_Write_Text("\nHeart Rate:");
                    UART1_Write_Text(txt);
Delay_ms(2000);
                     Uart1_Write(26);
```

```
Lcd_Out(1,1,"Message Sent    ");
                    //  Lcd_Out(2,1,"                ");

Delay_ms(5000);


                     }

void main()
{
ignid=1;
igni=1;
Lcd_Init();                    // Initialize LCD
Lcd_Cmd(_LCD_CLEAR);               // Clear display
Lcd_Cmd(_LCD_CURSOR_OFF);          // Cursor off



Uart1_Init(9600);
ADC_Init();
while(1)
      {

     adc_data1=ADC_Read(0);
     adc_data1=adc_data1/2.049;//calibrate in degcel
temp[0]=(adc_data1/1000);
     adc_data1=adc_data1-(temp[0]*1000);
temp[1]=(adc_data1/100);
     adc_data1=adc_data1-(temp[1]*100);
temp[2]=(adc_data1/10);
temp[3]=(adc_data1%10);

temp[0]=temp[0]+48;
temp[1]=temp[1]+48;
temp[2]=temp[2]+48;
temp[3]=temp[3]+48;
```

```
Lcd_Cmd(_LCD_CLEAR);
Lcd_Out(1,1,"Body Temp in Deg");
Lcd_Out(2,1,temp);
Delay_ms(2000);
Lcd_Cmd(_LCD_CLEAR);

Lcd_Out(1,1,"Place Your Fingr");
Lcd_Out(2,1,"for HearBeat    ");



    adc_data1=ADC_Read(1);
while(adc_data1<512)
adc_data1=ADC_Read(1);

Delay_ms(2000);
    adc_data1=ADC_Read(1);
    adc_data1=(adc_data1/20)+40;

txt[0]=(adc_data1/10)+48;
txt[1]=(adc_data1%10)+48;
Lcd_Cmd(_LCD_CLEAR);
Lcd_Out(1,1,"Heart Beat      ");
Lcd_Out(2,1,txt);
Delay_ms(2000);
Lcd_Cmd(_LCD_CLEAR);
gps();

     adc_data1=ADC_Read(2);
if(adc_data1>512)
       {
for(i=0;i<300;i++)
                {
while (UART1_Data_Ready() != 1);
                 {
```

```
gps_data[i]=Uart1_Read();
                        }
        }

for(i=0;i<300;i++)
{
if(gps_data[i]=='$')
                        {
if(gps_data[i+1]=='G' &&gps_data[i+2]=='P' &&gps_data[i+3]=='R' )

          {
                    i=i--;
          i=i+21;//CHNGED
                    for(j=0;j<9;j++)
gp1[j]=gps_data[i+j];

                              Uart1_Write_Text("\r\n");
          Delay_ms(2000);
i=i+13;      //CHENGD
for(j=0;j<9;j++)
gp2[j]=gps_data[i+j];
                    }
 }
}
                    Uart1_Write_Text("AT\r\n");
delay_ms(2000); // 2 sec delay
                    Uart1_Write_Text("ATE0\r\n");
delay_ms(2000);
                    Uart1_Write_Text("AT+CMGF=1\r\n");
delay_ms(2000);
                    Uart1_Write_Text("AT+CMGS=\"+918880750868\"\r\n");
delay_ms(2000); // 2 sec delay
                    Uart1_Write_Text("Solder Found in Danger");
Delay_ms(20);
```

```
Lcd_Cmd(_LCD_CLEAR);
            UART1_Write_Text("Lattitude:");
            UART1_Write_Text(gp1);
Delay_ms(20);
            UART1_Write_Text("\nLongitude");
            UART1_Write_Text(gp2);
Lcd_Out(1,1,gp1);          // Write text in first row
Lcd_Out(2,1,gp2);
Lcd_Out(1,1,"Message Sent    ");
Lcd_Out(2,1,"                ");
            Uart1_Write(26);
Delay_ms(5000);

            //while(1);
            }
 }
}
```

CHAPTER 5

TESTING

5.1 Unit Testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.Field testing will be performed manually and functional tests will be written in detail.

In unit testing different are modules are tested against the specifications produced during the design for the modules. Unit testing is essential for verification of the code produced during the coding phase, and hence the goals to test the internal logic of the modules. Using the detailed design description as a guide, important Conrail paths are tested to uncover errors within the boundary of the modules. This testing is carried out during the programming stage itself. In this type of testing step, each module was found to be working satisfactorily as regards to the expected output from the module.

Test objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, messages and responses must not be delayed.

Features to be tested

- Verify that the entries are of the correct format
- No duplicate entries should be allowed

- All links should take the user to the correct page.

5.2 Integration Testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

5.3 Acceptance Testing

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.User Acceptance of a system is the key factor for the success of any system. The system under consideration is tested for user acceptance by constantly keeping in touch with the prospective system users at the time of developing and making changes wherever required. The system developed provides a friendly user interface that can easily be understood even by a person who is new to the system.

5.4Output Testing

After performing the validation testing, the next step is output testing of the proposed system, since no system could be useful if it does not produce the required output in the specified format. Asking the users about the format required by them tests the outputs generated or displayed by the system under consideration. Hence the output format is considered in 2 ways – one is on screen and another in printed format.

5.5 System Testing

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.Software once validated must be combined with other system elements (e.g. Hardware, people, and database). System testing verifies that all the elements are proper and that overall system function performance is achieved. It also tests to find discrepancies between the system and its original objective, current specifications and system documentation.

5.5.1 White Box Testing

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

5.5.2 Black Box Testing

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box .you cannot "see" into it. The test provides inputs and responds to outputs without considering how the software works.

CHAPTER 6

ADVANTAGES

- It will provide high level safety to Soldiers life.
- This system will be suitable for all environmental conditions.
- Continuous data logging can provide the analysis for different soldiers.
- It is low cost, compact and less complex system which can be easily adopted by any military force.
- Due to use of advanced technology and advanced equipment's, this system will fulfill all the requirements of growing technologies.

CHAPTER 7

APPLICATIONS

- GPS Tracking of Soldiers
- Health Monitoring
- Higher reliability
- Fast and efficient
- It can also be implemented in RAW agencies, Naval bases, Air force and many security based Agencies.

CHAPTER 8

CONCLUSION

These devices will improve situational awareness, not only for the host, but also for collocated military personnel who will exchange information using wireless networks. The outcome is the integration of piecemeal components into a lightweight package that leads to desired result without being too bulky and requiring too much power.One of the fundamental challenges in military operations lies that the soldiers are not able to communicate with control room station. With our proposed device, this is made possible.In addition, the proper navigation between soldier’s organizations plays important role for careful planning and co-ordination.Biosensors help us to notify active soldiers.

CHAPTER 9

FUTURE ENHANCEMENT

i. Collocated communication can be made possible between soldier to soldier. Thus keeping track of all the soldiers in the battle field.
ii. Oxygen sensor can be deployed.
iii. Bomb detector can also be added to the system.

SNAPSHOTS

Fig 1: Initial Setup

Fig 2: Initialization

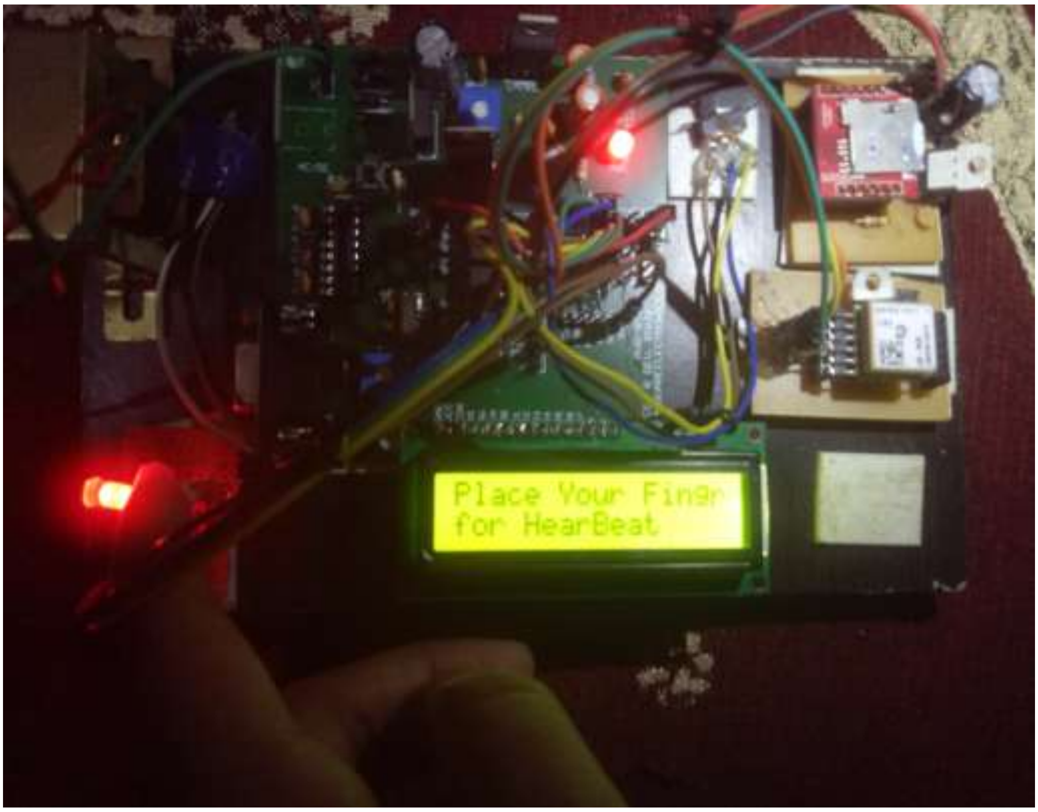

Fig 3: When finger is placed for sensing

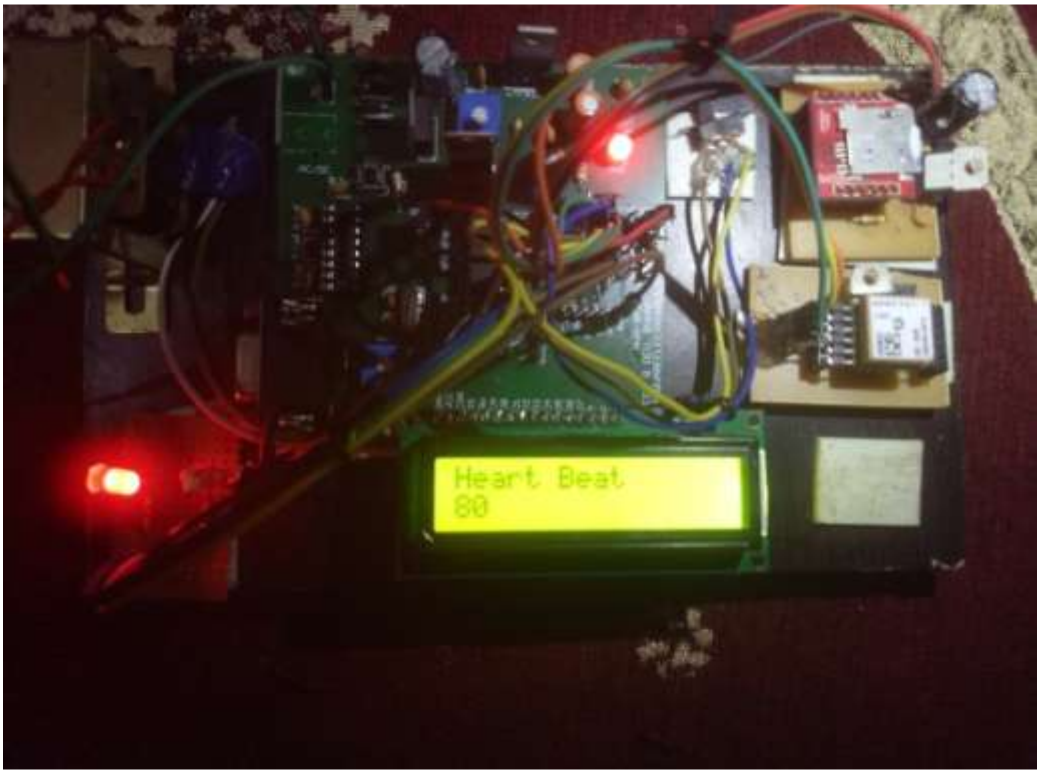

Fig 4: Heartbeat reading

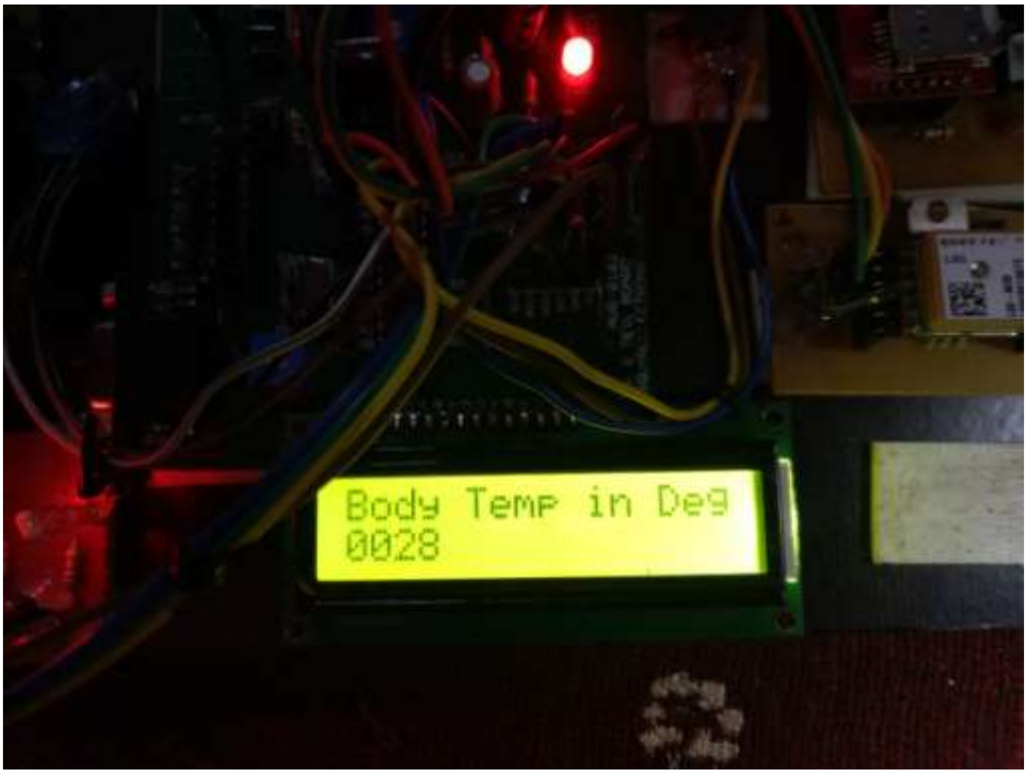

Fig 5: Temperature reading

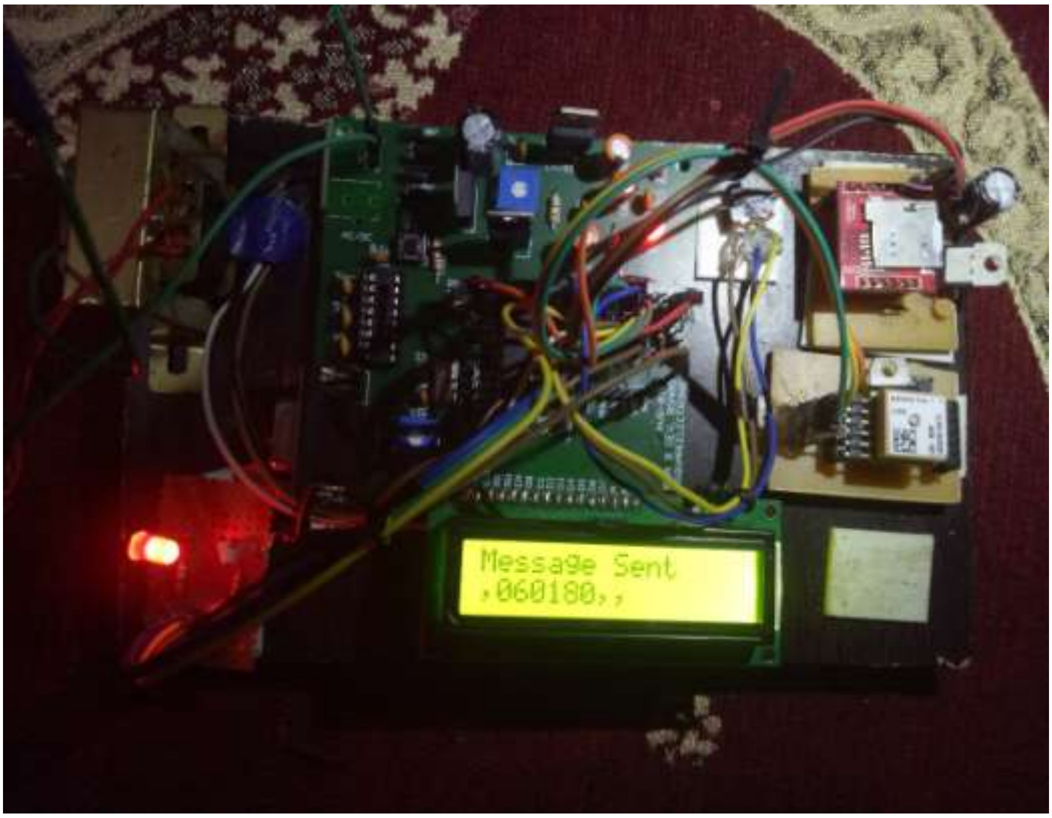

Fig 6: Message sent to base station

Fig 7: Message received from soldier unit

ANNEXTURE

WSN -Wireless Sensor Network: A sensor network is an infrastructure comprised of sensing, computing, and communication elements that gives an administrator the ability to instrument, observe, and react to events and phenomena in a specified environment.

IDE-Integrated Development Environment:An IDE is a software application that provides comprehensive facilities to computer programmers for software development. An IDE normally consists of a source code editor, build automation tools and a debugger.

LED-Light Emitting Diode :A light-emitting diode is a semiconductor light source. LEDs are used as indicator lamps in many devices, and are increasingly used for lighting.

UART-Universal Asynchronous Receiver/Transmitter :I t is an integrated circuit designed for implementing the interface for serial communications.

GPIO-General-Purpose Input/Output : It is a generic pin on an integrated circuit or computer board whose behavior—including whether it is an input or output pin—is controllable by the user at run time

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