

Soldier Monitoring System Using Zigbee

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ABSTRACT

In 21st century, soldier technology growing faster with new inventions, innovation. The nation's Security depends on the military, Army, Air-force and navy. The soldier plays vital role for their country. The backbone of all forces are our soldier. There are many concerns regarding the safety and health of soldier. This project ability to monitoring the health and location of soldier in real time application. This system used GPS to tracking the location of soldier and various sensors to monitoring the health of soldier. The various sensor like Temperature sensor, Humidity sensor and Heart Beat Sensor. The control base station record all parameter of soldier and take appropriate actions in case of emergency and crisis at real time. The control base station watch the current status of soldier which is displayed on personal computer. The main purposed of system one soldier to another soldier communication and this communication can be done wireless networking using Zigbee. This project simple to operate technology which is the most important factor of this project.

Keywords : GPS, Tracking, Arduino Mega, Temperature Sensor, Humidity Sensor, Heart Beat Sensor, Zigbee

I. INTRODUCTION

The nation's security is kept eye by army, navy and air-force. The important role is of soldiers who sacrifice their life for their country. There are many concerns regarding the safety and health of soldier. The soldier lives and died for the nation. During wars, Military search operation, surgical strike and terrorist attacks operation soldier gets injured and sometime become losses. It is our responsibility to help and protected our soldier. Soldiers entering the enemy lines often lose their lives due to lack of connectivity, it is very vital for the army control base station to known the location as well as health status of all soldiers. So many soldiers lost 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 control base stations. All must be really concerned about the safety of the soldiers, so decided to build a project which will efficiently keep a check on the health status of the

soldier, and his precise location to equipment him with necessary medical treatments as soon as possible. Soldier's tracking is done by using GPS and Zigbee module which is used to provide wireless communication system. To monitoring the health parameters of soldier we are using sensors such as Temperature sensor, Humidity sensor and Heart Beat sensor. The Temperature sensor monitor the Temperature of soldier, Humidity sensor monitor humidity and Heart Beat sensor Monitor pulse rate of soldier.

This devices ability improve control current situation 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 components into a lightweight box that could achieve the desired result without being too bulky and requiring too less power. One of the fundamental challenges in military operations lies that the soldier's

are not able to communicate with control base station. The main proposed of system soldier-to-soldier communication and this communication can be done wireless networking using Zigbee. This project easy to understand, wearable and simple to operated technology which is the most important factor of this project.

II. RESEARCH METHODOLOGY

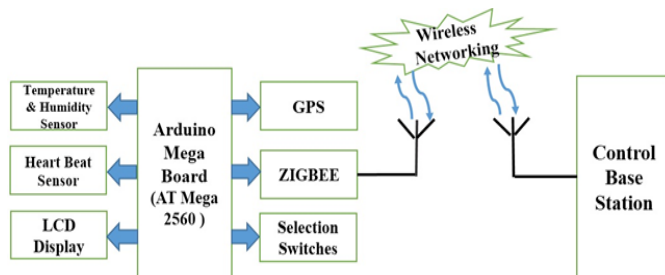


Figure 1. Block Diagram of the Soldier Monitoring System Using Zigbee

The general block diagram of the Soldier Monitoring System Using Zigbee is given in Figure1. The whole system is divided into two section that are Transmitter Section and Receiver Section.

In the Transmitter Section the Temperature Sensor, Humidity Sensor and Heart Beat Sensor to monitor the soldier health & GPS is for location Detector. Temperature Sensor, Humidity Sensor & heart Beat Sensor sense the variations then it these signal fed to the Arduino Mega. In the Arduino Mega it compares with predefined values. If any variation in Temperature Sensor, Humidity Sensor & Heart Beat Sensor and co-ordinates which is received from GPS it will send the to another receiving station through Zigbee which is in concern staff or Head office. Then signal is given to the output load for indication purpose. In this system provide predefined message selection switches. This message like Ammunition, Help, backup, etc.

The Receiver Section act Control Base Station. The Control Base Station unit consists of a PC and a Zigbee transceiver. The Zigbee module will be connected to PC with the help USB-to-Serial driver installed in that PC. The data coming from Zigbee module will be

displayed on PC screen with the help of graphical user interface (GUI) coded using visual basic language.

Hardware Description

The Hardware required for this system are as following.

1. Temperature and Humidity Sensor.
2. Heart Beat Sensor.
3. Zigbee Module.
4. LCD Display.
5. Switches.
6. Arduino Mega 2560.
7. GPS Module.

1. Temperature and Humidity Sensor.

DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness[13].

DHT11's power supply is 3-5.5V DC. When power is supplied to the sensor, do not send any instruction to the sensor in within one second in order to pass the unstable status. One capacitor valued 100nF can be added between VDD and GND for power filtering. Single-bus data format is used for communication and synchronization between MCU and DHT11 sensor. One communication process is about 4ms. Data consists of decimal and integral parts. A complete data transmission is 40bit, and the sensor sends higher data bit first[13].

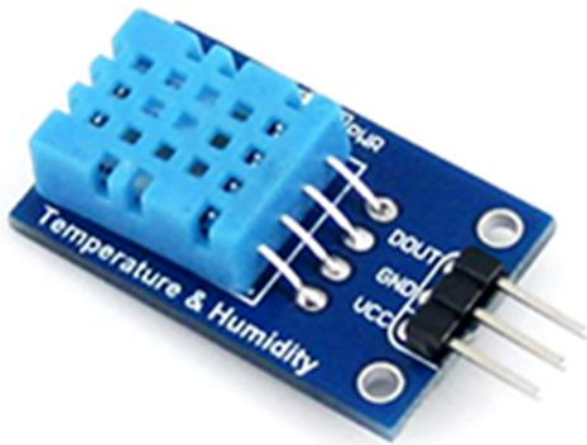


Figure 2. Temperature and Humidity Sensor

2. Heart Beat Sensor

Heart beat sensor is designed to give digital output of heart beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse. The target pulse rates for people aged between 20 and 70. The target range is the pulse rate needed in order to provide suitable exercise for the heart. For a 25-year old, this range is about 140-170 beats per minute while for a 60-year old it is typically between 115 and 140 beats per minute[14].

Features:

Heart beat indication by LED, Instant output digital signal for directly connecting to microcontroller, Compact Size, Working Voltage +5V DC[14].

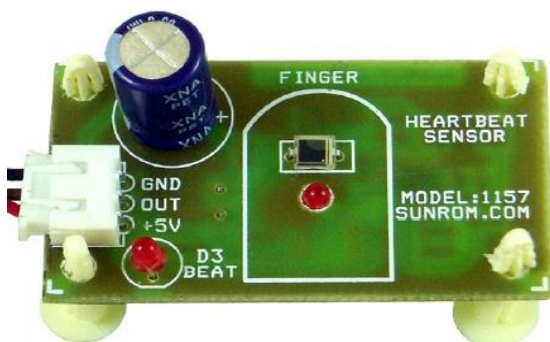


Figure 3. Heart Beat Sensor.

3. Zigbee Module

Zigbee is based on an IEEE 802.15.4 standard which is a packet-based radio protocol. It is used to provide the communication which needs wireless applications that have low data rates and requires low power consumption. Zigbee has a defined rate of 250 Kbit/s, which is best suited for intermittent data transmissions from a sensor or input device. This module has worldwide 2.4GHz ISM (The industrial, scientific and medical radio bands) bands and ultralow power operation. The Zigbee standard provides wireless networking, security, and application support services that operate on the basis of IEEE 802.15.4 Medium Access Control (MAC) and Physical Layer (PHY) wireless standard. It uses a suite of technologies which enable the self-organizing, self-healing and scalable networks that is efficient enough to manage various data traffic patterns.

Zigbee is a low-cost, low-power, and wireless mesh networking standard device. The low cost allows this technology to be widely accepted in wireless control and monitoring applications. The low power consumption provides longer life with smaller batteries and the mesh networking provides high reliability and larger range of data transmission. Zigbee technology has been developed to fulfill the need of advanced wireless networking between various low power devices, sensors and modules[15].

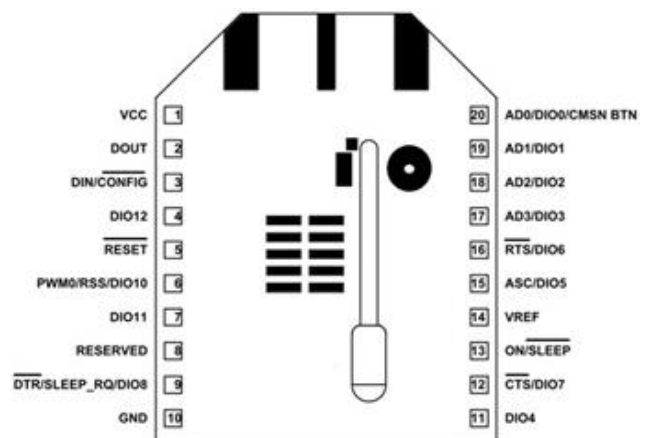


Figure 4. Zigbee Module

4. LCD Display.

Alphanumeric displays are used in a wide range of applications, including palmtop computers, word processors, photocopiers, point of sale terminals, medical instruments, cellular phones, calculators, etc. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. We are using this LCD to display the health parameters measured by different sensors used and location information given by GPS module.

FEATURE:

5 x 8 dots with cursor, Built-in controller (KS 0066 or Equivalent), + 5V power supply (Also available for + 3V), 1/16 duty cycle, B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED), N.V. optional for + 3V power supply



Figure 5. LCD Display

5. Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila.[12].

The Arduino Mega can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The Mega2560 differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.[12].

The ATmega2560 has 256 KB of flash memory for storing code (of which 8 KB is used for the boot loader), 8 KB of SRAM and 4 KB of EEPROM (which can be read and written with the EEPROM library).[12]

FEATURE:

High Performance, Low Power Atmel 8-Bit, Advanced RISC Architecture, High Endurance Non-volatile Memory Segments, JTAG (IEEE std. 1149.1 compliant) Interface, 8/16-channel, 10-bit ADC (ATmega2560), Temperature Range -40°C to 85°C, Operating Voltage 5V, ATmega2560 0 - 16MHz and 4.5V - 5.5V, Active Mode 1MHz, 1.8V at 500µA, Power-down Mode: 0.1µA at 1.8V [12].

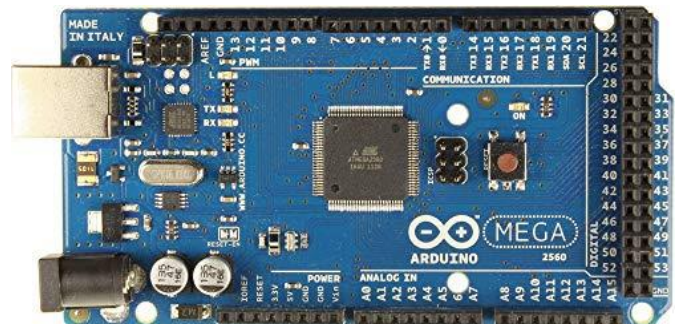


Figure 6. Arduino Mega 2560.

6. GPS Module.

The NEO-6 module series brings the high performance of the u-blox6 position engine to the miniature NEO form factor. u-blox6 has been designed with low power consumption and low costs in mind. Intelligent power management is a breakthrough for low-power applications. These receivers combine a high level of integration capability with flexible connectivity options in a small package. This makes them perfectly suited for mass-market end products with strict size and cost requirements. The DDC interface provides connectivity and enables synergies with u-blox LEON and LISA wireless modules. All NEO-6 modules are manufactured in ISO/TS 16949 certified sites. Each module is tested and inspected during production. The modules are qualified according to ISO 16750 - Environmental conditions and electrical testing for electrical and electronic equipment for road vehicles[11].

FEATURES:

Navigate down to -162 dBm and -148 dBm coldstart, Faster acquisition with AssistNow, Autonomous o Configurable power management o Hybrid GPS/SBAS engine (WAAS, EGNOS, MSAS) o Anti-jamming technology, Simple integration with u-blox wireless modules, A-GPS: AssistNow Online and AssistNow Offline services, OMA SUPL compliant, Backward compatible (hardware and firmware); easy migration from NEO-5 family or NEO-4S, Compatible with u-blox GPS Solution for Android, Based on GPS chips qualified according to AEC-Q100 Manufactured in ISO/TS 16949 certified production sites, Qualified according to ISO 16750[11]



Figure 7. GPS Module.

7. Switches

A switch will be providing in this system, so that a soldier can request for his help in panic and emergency situation by pressing it. As a soldier will press the button, of another fellow soldier's unit and he will able to get help of that fellow soldier which is present within the Zigbee range.



Figure 8. Switches.

Software Description:

The Software language required for this system are as following

1. Embedded C language
2. VB.net language

For programming of Arduino Mega 2560, embedded c language using Arduino software is used. The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them. For selecting a hardware programmer when programming a board or chip and not using the onboard USB-serial connection. Normally you won't need this, but if you're burning a bootloader to a new microcontroller, you will use this.

The Graphical user interface (GUI) coding needs VB.Net language. Visual Basic is a legacy third generation event

Driven programming language and integrated development environment (IDE) Microsoft. Microsoft intended Visual.

Basic to be relatively easy to learn and use. Visual Basic was derived from BASIC (Beginner's All-purpose Symbolic Instruction Code) and enables the rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using Data Access Objects, Remote Data Objects, or ActiveX Data Objects, and creation of ActiveX controls and objects.

To display the data received by Zigbee on servers PC, a driver for USB-to-Serial adapter has installed on that PC. This driver helps to access the data on PC, through USB adapter of Zigbee transceiver.

EXPERIMENTAL SETUP



Figure 9. Experimental Setup

III. CONCLUSION

From this project, It is concluded that the proposed system using Zigbee module as a main communication medium. So, we are using Zigbee not only for soldier-to-soldier communication take place but also work as a Wireless information transmission system. Soldier can communicate with each other in the range of 1 to 1.3 km using Zigbee module. We have used Arduino mega is the main control unit here since it has many input and output ports are available and it is very cheap than

any other available controllers. The main advantage of soldier-to-soldier communication is that it can communicate with nearest soldier. In this system, we have our control base station for receiving soldier information like Health as well as soldier monitoring. This system is also work as a transceiver. This project easy to understand, wearable and simple to operated technology which is the most important factor of this project.

IV. FUTURE SCOPE

There is always chance to improve any system as research and development is an endless process. The following details are as follows [5]:

1. I.E.D & Metal Detector system.
2. It can track the location of children.
3. A Camera can be fitted into the system.
4. Automatic Surveillance Robot.
5. Soldier Voice Recognition system.

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