SOLDIER HEALTH AND POSITION TRACKING SYSTEM

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ABSTRACT

In today's world, enemy warfare is an important factor in any nation's security. One of the important role is played by the army soldiers. In enemy territory soldiers not only have to deal with the physical threat, but also with stress and lethargy caused by prolonged operations or lack of sleep. Hence for the security purpose we need a tool to track the soldier's performance and health.

The aim of the project is to design a system that tracks the position and also monitors the health of the soldier. In this project the exact location and the health 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 reduces the rescue time and search operation effort of army rescue control unit. This system uses GPS module, Zigbee module and wireless body area sensor network to record all parameters in real time and send it to the control station. The different types of sensors used in this system are temperature sensor, air quality sensor, humidity sensor and heart-rate sensor which helps in deciding the health status of that particular soldier. GPS module used in the system helps in finding the position of the soldier. Hence with this system, it is possible to implement a low cost mechanism to protect the valuable human life on the battle field.

KEYWORDS: Arduino Mega, Zigbee, GPS, Soldier, Tracking, Heart- Rate Sensor, Temperature Sensor, Air Quality Sensor, Humidity Sensor.

INTRODUCTION

In today's world, the science and technology is growing rapidly with new inventions, innovations and with advance level of their implementations. These emerging advance technologies are firmly adapted by defense services to provide some safety systems to our soldiers. There are many parameters by which defense services can provide safety to the soldiers. The nation's security is monitored and kept by army, navy and air-force. The important and vital role is of soldiers who sacrifice their life for their country. There are several considerations concerning the security of those troopers. The future soldier should to be more advance technologically in every crucial situation like warfare or any secret mission. In entire world, numerous analysis platforms presently being arranged, like the United States' Future Force warrior (FFW) and also the United Kingdom's Future infantry Soldier Technology (FIST) and they have a plan of making totally modern fight methodology. Helmet attached screens, accomplished of presenting information from maps and video using varieties of physiological sensors. These devices have capability to improve wakefulness according to situation, not just for the soldier in battle field, however additionally for all the military personnel at base station and they can interchange data via wireless communication. The other concerns regarding the safety of the soldier are soldiers entering the enemy lines often lose their lives due to lack of connectivity, it is very vital for the army base station to know the location as well as health status of all soldiers. So many soldiers are 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 base stations. But the main concern was creation of a light weight system, which can get desired results. Motivated from these issues, a portable real-time tracking mechanism is proposed in this project. Hence designing a device that efficiently keeps a track on the health status of the soldier, and his precise location to equip him with necessary medical treatments as soon as possible is the solution to the problem. Soldier's tracking is done by using GPS and ZigBee module, which is used to provide wireless

communication system. For monitoring the health parameters of soldier we can use bio medical sensors such as temperature sensor, humidity sensor, air quality sensor and pulse rate sensor. The proposed system will be helpful in the real-time continuous monitoring of soldier's health parameters and location.

LITERATURE SURVEY

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

1. **Simon L. Cotton and William G. Scanlon** proposed a methodology on the topic Millimeter- wave soldier–to-soldier communications for covert battlefield operation. This paper had proposed secret communication between soldiers will required the development of an adapted directive medium access layer. The number of adjustments to an IEEE 802.11 distribution coordination function that will enable directional communication as suggested.
2. **H. Kedar, K. Patil and S. Bharti,** proposed a methodology on "Soldier Tracking and Health monitoring System". In this paper, a system is designed for tracking the soldier and navigation between soldier to soldier by knowing their speed, distance, and height as well as health status during the war, which enables the war personnel to plan the war strategies. Using various biomedical sensor health parameters of soldier's are observed, the position and orientation of soldier is trapped using GPS.
3. **J.Rantakokko,Joakimrydell,Peterstromb ack** proposed a methodology on Accurate and reliable soldier and first responder indoor positioning: Multisensor systems and cooperative localization In this paper ,it is proposed that inertial navigation with foot-mounted sensor is suitable as the core system in GPS denied environments, since it can yield meter–level accuracies for a few minutes. However, there is still a need for additional supporting sensors to keep the accuracy.
4. A real-time, ARM processor based approach for the monitoring and collection of temperature, heartbeat, ECG parameters of patients by **R. Shaikh *et.al*.**. ZigBee and GSM wireless technology were used to send current updates of patients to the doctor and then doctors can take immediate action against that patient. A wireless body area sensor networks (WBASNs) technology using ZigBee was reported in to continuously monitor the human health and its location.
5. **Vincent Pereira, A.Giremus, E.Grive** proposed a methodology on Modelling of multipath environment using copulas for particle filtering based GPS navigation. Another class of approaches deals with multipath effects directly at the level of the navigation algorithm which estimates the position from the satellite ranging measurements. They have the advantage of leaving the receiver architecture unchanged.

EXISTING METHODOLOGY

The different systems implemented for tracking the position of the soldier and his health status are:

A. GSM Based Tracking System

In this system, the tracking of soldier and navigation between soldier to soldier such as knowing their speed, distance, height as well as health status of them during the war is updated to the base station. The base station can access the current status of the soldier which is displayed on the phone with the help of gsm and hence appropriate actions can be taken.

B. IOT Based Tracking System

This system provides real time smart monitoring system that easy to carry light weight, allow the base Station to identify the soldier also locate its position and it's health condition continually, this allows the Base Station to collect and analyse those information to plan the tactics , also to provide an accurate, fast and efficient medical treatment. Soldier can ask for help or supplies through SOS and get commands displayed in the LCD with vibration to notice it.

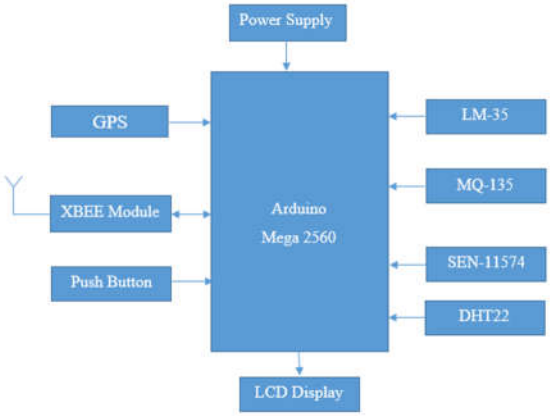
Proposed system:

Since is no active mobile networks available in the battlefield and the surroundings of the soldier's camp, we decided to design a system that can work

without any mobile network by creating a private network which enhances the safety and security of the soldiers and their valuable information. The proposed system uses zigbee network for creating a private network for the soldiers, and different biomedical sensors like pulse sensor, body temperature sensor, air quality sensor and humidity sensors are used for monitoring the health condition of the soldiers and a GPS is used to track the location of the soldier. The health parameters are automatically sent to the base station if the soldier's health is deteriorating. Soldiers can also communicate with each other with the help of the push buttons.

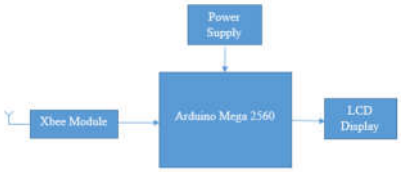
BLOCK DIAGRAM:

SOLDIER UNIT:



The soldier unit consists of biomedical sensors, GPS and Xbee for tracking health and position of the soldier. The biomedical sensors used in this project are LM35 for measuring temperature of the soldier's body, SEN11574 for measuring the pulse rate, MQ135 for measuring the air quality of surroundings and DHT22 for measuring the humidity in the surroundings. All these parameters are continuously monitored and once they cross the threshold, parameters are transmitted via xbee to base station and the location of the soldier tracked using GPS (NEO-6M) is also sent to the base station. These parameters can be manually set via push buttons. All the parameters are displayed through LCD display.

BASE STATION UNIT:



The base station unit consists of Xbee module and LCD display. The health parameters transmitted via soldier's xbee is received through receiver's xbee. These parameters are displayed through LCD.

COMPONENTS USED:

1. Arduino Mega 2560
2. LM35
3. DHT22
4. MQ135
5. SEN11574
6. GPS
7. XBEE S2C
8. LCD Display

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.

The Arduino Mega2560 can be powered via the USB connection or with an external power supply. 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 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).

Each of the 54 digital pins on the Mega can be used as an input or output, using **pinMode(), digitalWrite(), and digitalRead()** functions. They

operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms.

A SoftwareSerial library allows for serial communication on any of the Mega's digital pins. The ATmega2560 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus. To use the SPI communication, please see the ATmega2560 datasheet.

The Arduino mega can be programmed with the (Arduino Software (IDE)). Select "Arduino/Genuino Mega from the Tools > Board menu (according to the microcontroller on your board).

The Atmega2560 on the Arduino Mega comes preburned with a **bootloader** that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol.

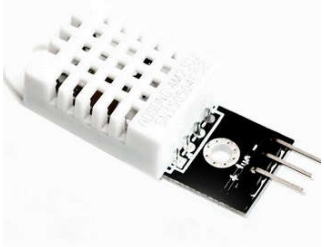
LM35:

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius temperature. The LM35 operates at -55˚C to +120˚C.It can measure temperature more correctly compare with a thermistor. This sensor generates a high output voltage than thermocouples and may not need that the output voltage is amplified. The scale factor is .01V/°C.

MQ135:

The gas sensor layer of the sensor unit is made up of tin dioxide (SnO2); it has lower conductivity compare to clean hair and due to air pollution the conductivity is increases. The air quality sensor detects ammonia, nitrogen oxide, smoke, CO2 and other harmful gases. The air quality sensor has a small potentiometer that permits the adjustment of the load resistance of the sensor circuit. The analog output is a concentration, i.e. increasing voltage is directly proportional to increasing concentration. The tested concentration range is 10 to 1000ppm.

DHT22:



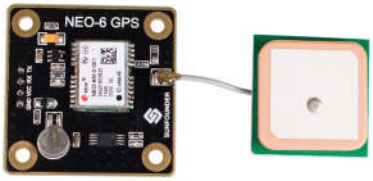
DHT22 consists of a humidity sensing component which has two electrodes with moisture holding substrate between them. So as the humidity changes, the conductivity of the substrate changes or the resistance between these electrodes changes. This change in resistance is measured and processed by the IC. For measuring temperature it uses a NTC temperature sensor or a thermistor. A thermistor is actually a variable resistor that changes its resistance with change of the temperature.

SEN11574:

When a heartbeat occurs blood is pumped through the human body and gets squeezed into the capillary tissues. The volume of these capillary tissues increases as a result of the heartbeat. But in between the heartbeats (the time between two consecutive heartbeats), this volume inside capillary tissues decreases. This change in volume between the heartbeats affects the amount of light that will transmit through these tissues. The pulse sensor module has a light which helps in measuring the pulse rate. When we place the finger on the pulse sensor, the light reflected will change based on the volume of blood inside the capillary blood vessels.

During a heartbeat, the volume inside the capillary blood vessels will be high. This affects the reflection of light and the light reflected at the time of a heartbeat will be less compared to that of the time during which there is no heartbeat (during the period of time when there is no heartbeat or the time period in between heartbeats, the volume inside the capillary vessels will be lesser. This will lead higher reflection of light). This variation in light transmission and reflection can be obtained as a pulse from the output of pulse sensor. This pulse can be then conditioned to measure heartbeat and then programmed accordingly to read as heartbeat count.

NEO-6M:



The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. The working of Global positioning system is based on the 'trilateration' mathematical principle. The position is determined from the distance measurements to satellites.

XBEE(S2C):

XBee S2C is a RF module designed for wireless communication or data exchange and it works on ZigBee mesh communication protocols that sit on top of IEEE 802.15.4 PHY. The module provides wireless connectivity to end-point devices in any ZigBee mesh networks including devices from other vendors. Please note that XBee is a module designed by 'DiGi' and ZigBee is the name of the protocol followed by XBee modules for establishing wireless communication. With a few of these modules the user can setup their own ZigBee network up-and-running in a matter of minutes. The XBee RF Module is compatible with other units that use ZigBee technology. These include other XBee modules, Connect ports gateways, XBee and XBee-PRO Adapters, XBee Sensors and other products that are designated with "ZB"product name.

EXPERIMENTAL RESULT:

The health parameters of the soldiers from the biomedical sensors like LM35, MQ135, DHT22, SEN11574 and gps module is shown below

Fig: Soldier's Parameters monitored in soldier's unit

The location status and health parameters of the soldier received via soldier's xbee module displayed on monitor of base station is shown below

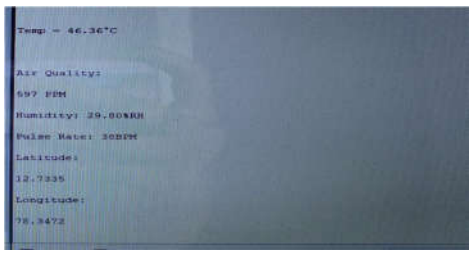


Fig: Parameters displayed on base station monitor

CONCLUSION:

From above proposed system, we can conclude that we are able to transmit data which is sensed from remote soldier to army control room using ZigBee transceiver as a wireless transmission technology. The system is completely integrated and can track the location of soldier at anytime from anywhere on the

earth using GPS receiver. This system helps to monitor health parameters of soldier using heart beat sensor to measure heart beats and temperature sensor to measure body temperature of soldier, humidity sensor to measure the humidity in the surroundings and the air quality sensor to measure the quality of the air. This system helps the soldier to get help from army base station and/or from another fellow soldier in panic situation. This system provides the location information and health parameters of soldier in real time to the army control room. This system is very useful to military forces during war as it can be used in battlefield without any network restriction. Thus, this system provides security and safety to our soldiers.

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