International Journal for Modern Trends in Science and Technology
Volume: 03, Issue No: 05, May 2017
ISSN: 2455-3778
http://www.ijmtst.com

Smart Controlled Landmines Detection System for Soldiers in the Battlefield Using GPS and Wireless Body Area Sensor Networks (WBASNS)

M.Siva Kumar[1] | E.Indhuja[2] | G.Kuzhalini[3] | M.Jenifer[4] | T.Infantasherly[5]

[1] Assistant Professor, Department of EEE, TRP Engineering College, Trichy, India.
[2,3,4,5] UG Scholar, Department of EEE, TRP Engineering College, Trichy, India.

To Cite this Article
M.Siva Kumar, E.Indhuja, G.Kuzhalini, M.Jenifer and T.Infantasherly, "Smart Controlled Landmines Detection System for Soldiers in the Battlefield Using GPS and Wireless Body Area Sensor Networks (WBASNS)", International Journal for Modern Trends in Science and Technology, Vol. 03, Issue 05, May 2017, pp. 232-237.

ABSTRACT

This Research paper describes the Land mines detection system for the Soldiers in the battle field using Global positioning system, the proposed system is to track the land mines in the battle field and alert the soldiers about landmines and safe the valuable life of the soldiers, The system monitors the health of the soldiers in real time who were lost or got injured in the battle fields or in forests the proposed system alerts helps the army squads to minimize the time for search and rescue operation efforts as quickly as possible. This proposed system enables the army squads to search the location of the injured soldiers using GPS module and Wireless Body Area Sensor Networks (WBASNs), such as Temperature sensor, Heart beat sensor, Pressure sensor and Metal detecting sensors,etc., The data obtained from the sensors using GPS receiver is transmitted through the wireless using zig-bee module,and in addition an Emergency switch is provided for the soldiers for seeking help from the control room and makes the rescue immediately to save the valuable soldiers life. In addition the support of Voice Playback device is included for the soldiers to warn about their body conditions, If any emergency take place the soldiers get cautioned to take first aid for rescue operation.

Keywords— *WBASNS, WLTS, GPS, Zig-bee, Blue tooth,PIC, RF modules, BPM, navigation, detection, Wireless, Voice play back, alert, memory, sensor.*

I. INTRODUCTION

In present scenario, the science and technology is growing rapidly with new inventions, innovations and with their advance level of their implementations. These emerging advance technologies are firmly adopted by defense services also to provide a safety systems to the battle field soldiers. In military operations, the soldiers find difficulties in detecting the land mines, in case of any emergency it is difficult to communicate with the Army control rooms during emergencies. once a troop or soldier get lost in battle field due to some unfavorable environment or adverse fight conditions, then it become more difficult to search them and bring back them to the army base station. The main aim of our research article is to improve the communication system between soldiers and army control room by using advance and highly efficient, power full system at low cost.The Research article proposed by us composed of two parts one is of portable unit for soldiers and other is of army control unit, the soldiers unit consists of a PIC 16F877A microcontroller, GPS tracking device, Zig- bee transceiver, Heart beat sensor, temperature

sensor, pressure sensor, proximity sensor and a small vibration motor. this project helps us to solve the above mentioned problems.

1.By using GPS device, it is possible to provide proper information about the location of soldiers when it is needed.

2.This will become possible to help the soldiers in panic situations when they are in a need by communicating with them using Zig-bee technology.

3.It will become very easy to provide medical assistance to soldiers when they got injured.

4.It will become possible to detect the land mines by the soldiers individually with the help of proximity sensor.

II.LAND MINES

The landmines are detected in the battle field by hand held detectors and only for a soldier may have that device and the fellow soldiers follows that soldier's information regarding the buried landmines.Landmines are very harmful, invisible bombing, and kills the soldier. Countries which are mine-affected, there is one child out of five landmine victims. Every year, around 15,000 to 20,000 people are died by land mines across the world.

TECHNOLOGY OVERVIEW:

Landmines Detection and Tracking Technology used for Detection of buried landmines and clearance is very difficult and dangerous task, however the efforts taken to develop a new technology with moderate cost and less risky for the detection of mines still continue.obivously there aremany efforts have been directed to develop new and improved landmine detection methods since the Second World War, however, the increased costs of improving these methods led to drive up their prices. The following points gives brief list of the recent landmine detection technologies.

i. Manual mines clearance.
ii. Sensing Technologies using Lasers.
iii. Sensing Technologies using Ground Penetrating Radar.
iv. Biological detection using Dogs, Rats, Honey bees, Plants and Bacteria's.
v. Mechanical Demining Machine.
vi. Robotization of Humanitarian Demining Robot.
vii. Unmanned Aerial vehicles (UAV) Helicopter plane.

The landmine detection techniques that are mentioned above are used to address the increasing complexity of landmines detection , however most of these techniques are extremely expensive and hard to be maintain for Army squads.

III.RELATED WORK

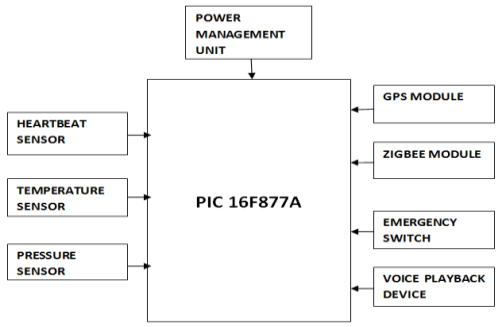
A study has been made in this article, PIC 16F877A microprocessor is used to process all the data in real time. To measure body temperature; pressure and heart beats of soldier, temperature; heart beat sensor and pressure sensor are used. Using signal conditioning processes, the analog output of sensors will be converted into strong electrical signal. As the processing is carried out on digital data, these analog data will be converted into digital data by using ADC which is inbuilt in PIC16F877A microcontroller. Therefore the output of the signal conditioning circuit will directly connected to the microcontroller. The Zigbee connected to the microcontroller transfers the data to the anotherzibgee which is placed in the receiving end.

IV.EXISTING SYSTEM

In army search operations and wars, soldiers become lost and get injured. There are many developments which give ability to track the location of soldier at any moment at any place. The main aim of the project is to provide medical monitoring for soldiers in real time .In these existing developments or systems, Bluetooth technology, Radio Frequency (RF) technology, GSM technology, etc. have been used for wireless transmission of position information and bio sensor's data of soldiers. Moreover the landmines are detected by handheld detectors and only a particular soldier may have that device and the fellow soldiers follow that particular soldier's information regarding the buried landmines.

V. PROPOSED SYSTEM

PIC Controller Controls the entire Tracking System. GPS is used to track the Latitude and longitude location of the soldier and update in the Control room. Health conditions of the soldiers are detected by temperature sensors, heartbeat sensors and pressure sensors are used to measure the temperature, heartbeat and blood pressure of the soldiers respectively. Mine sweeper detector is used to detect the metal. If any metal detected, the vibrator motor will alert the soldier using vibrator which will be placed in the soldier's leg.



A. Bluetooth and RF modules

In many of existing systems, Bluetooth devices and RF modules have been used to transmit the data wirelessly. But these devices and modules have certain limitations and drawbacks. They are not cost efficient, not energy efficient as they consume more power to operate, and have very short transmission and reception range.

To overcome these drawbacks and shortcomings of existing health monitoring and location tracking systems, we have proposed a new system which has capability to transmit the sensed data over a long distance wirelessly using ZigBee mesh technology. As the GSM technology is not useful according to security aspects, we will use ZigBee transceiver module for wireless data transmission and reception.

B. ZigBee module

A ZigBee module is a high level communication device use to create wireless personal area networks (WPANs) which is built from small and low power digital radios, and requires very low power to operate. ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate ZigBee devices to reach up to more distant ones. As ZigBee networks are secured by 128 bit symmetric encryption key.

The hacking of ZigBee modules are not possible for enemies and hackers as in GSM modules.In some Practical application, the keypads had been provided to input some numerical data by soldiers which are not so useful and make the system large in size. To overcome this part, we will use an Emergency Switch by which a soldier can request for help from control room. In our proposed system, Proximity sensors are being fixed inside the shoes of each and every soldiers individually .A small Vibration motor is also equipped with that Proximity sensor in order to alert the soldier whenever landmines are detected by the sensor.

VI.PROPOSED SYSTEM ARCHITECTURE

The Architecture of our proposed system is composed of two parts:

i. Soldier's Unit: The soldier's unit consists of Wireless Body Area Sensor Networks (WBASN's) such as Temperature sensor, Heart beat sensor, Pressure sensor. These sensors are used to sense the health parameters of soldiers. Temperature sensor and pressure sensor will sense the body temperature and pressure level of the soldier and give that sensed data to microcontroller. The Heart beat sensor will sense the pulse rate or heart beats of soldiers in beats per minute (BPM) and give it to microcontroller to process. The proximity sensor also called metal sensor is used to detect the land mines .The sensed analog signals will be converted into digital signals using analog to digital converter and then compared with the normal condition signals. And if any discrepancy occurs between sensed signals and defined normal signals, then it will be considered as an emergency. There will be a GPS modem is used to trace the location of soldiers at any moment from anywhere. The GPS receivers are space-based satellite navigation system s that provide location and time information in all weather conditions from anywhere on or near earth. The data coming from the GPS receiver will pass to microcontroller through ICMAX-232 which converts RS-232 voltage level data to TTL voltage level data and vice versa. The IC MAX-232 is a dual driver\receiver which converts typically .

ii. Rx,Tx,CTS,and RTS signals.

The microcontroller used is PIC16F877A.The program on the microcontroller, reads the value of temperature, pressure and heart beat. Then the processed output in digital form is sent to the PC through Zigbee transmission. The microcontroller programming is done using Embedded C, a middle level language for controller units. The PIC microcontroller PIC16F877A has an Operating Speed Max 20 MHz, Voltage-(2-5.5) v. Memory consists of Flash Program, RAM, EEPROM and Data Memory. It has 5 Ports for Internal and External usage. It has three on chip Timers and in built Analog to Digital Converter. It has serial as well as Parallel Communication facilities.

The program on the microcontroller is reads the value of temperature and heart beat the processed output in digital form is sent to the PC through Zigbee transmission.

iii. Zig-bee

A ZIGBEE transceiver is used to transmit the data, coming from sensors and GPS through microcontroller, to the army control room

wirelessly. It is low cost, low power; wireless mesh network standard especially designed and developed for long battery life devices in wireless controlling and monitoring applications. ZIGBEE has low latency which can further reduce the average current.

In addition to that emergency switch, voice play back device, vibration motor is also provided. A soldier can press the emergency switch for seeking any help during panic situation from army control room. If the predefined range of the health parameter exceeds, the voice play device alert the soldier about their health condition .vibrator motor alerts the soldier through a small vibration if any metal is detected.

iv. GPS Description

GSM/GPRS Modem-RS 232 is built with dual band GSM/GPRS engine-SIM 900A,works on frequencies 900/1800 MHz. The modem is coming with RS 232 interface which allows you connect PC as well as microcontroller with RS232 chip(MAX 232).The baud rate is configurable from 9600-115200 through AT command.The GSM/GPRS modem is having internal TCP/IP tack to enable you to connect with internet via GPRS.It is suitable for sms,voice as well as data transfer application in M2M interface.

v. Vibration motor

The primary function of the vibration motor is to alert the user to incoming calls. Vibration motors are normally classified into cylinder type and button type. Here, we will look at how the cylinder type works. A coreless motor is a DC motor with a rotor that does not have an iron core. Instead, it has a permanent magnet inside and a coil outside.

VII. SOLDIER'S PROTECTION

When the average person thinks about Soldier protection, body armor is one of the first things that come to mind. Yet, most people cannot imagine the challenges that come with making better, lighter, stronger body armor or the fact that there are several more pieces of equipment that have to be researched, tested and approved before they reach Soldiers' hands. The scientists and engineers at the Indian Army know these challenges all too well as they face them every day in their labs when testing and ultimately fielding individual Soldier protection equipment.

SOLDIERS PROTECTION SYSTEM

a. Control Room unit

The army base station consists of a *PC or a Laptop* and a Zigbee transceiver. The Zigbee module will be connected to PC with the help of PL-2303 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) codedusing visual basic language.

b. Emergency Switch

An Emergency Switch will be provided in this system, so that a soldier can request for his help in panic situation by pressing it. When a soldier press the emergency switch , he will be able to get help from the control unit.

VIII. SOFTWARE DESCRIPTION

Software is a basic building block for the every system which designs the processing and operations. Following are the software's used in designing of the proposed system,For programming of PIC16F877A microcontroller, embedded c language using MPLAB IDE software is used. The MPLAB IDE has been designed to enhance developer's productivity, also enabling faster and more efficient program development. MPLAB IDE introduces a flexible window management system, enables us to drag and drop individual windows anywhere on the visual surface including support for Multiple Monitors.

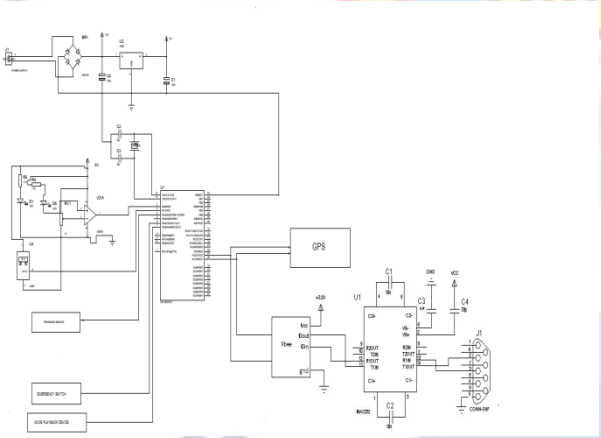
To display the data received by ZigBee on servers PC, a PL-2303driver for USB-to-Serial adapter has

installed on that PC. This driver helps to access the data on PC, through USB adapter of ZigBee transceiver. To designing the schematic circuit diagram and PCB Layout, Proteus 7 software is used. This software is less complex, easy to learn and helps to design circuit diagram in professional manner.

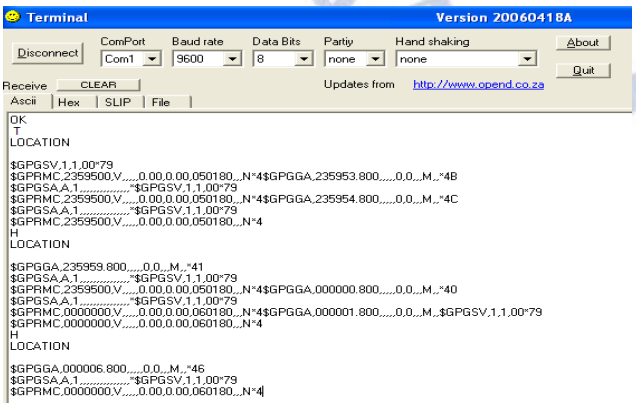
IX. ADVANTAGES OF THE PROPOSED SYSTEM

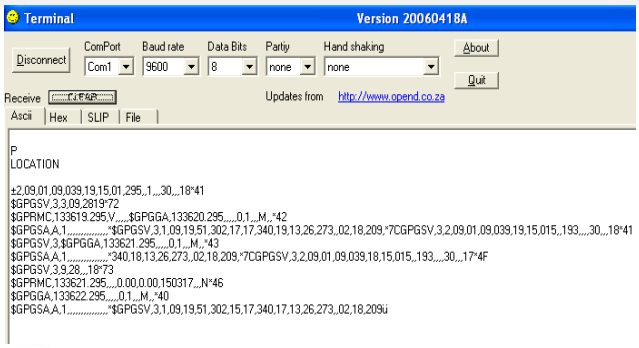
- It will provide high level safety to Soldiers life.
- This system will be suitable for all environmental conditions.
- Continuous data logging can provide the analysis for different soldiers.
- It is low cost, compact and less complex system which can be easily adopted by any military force.
- Due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

X.EXPERIMENTAL WORK

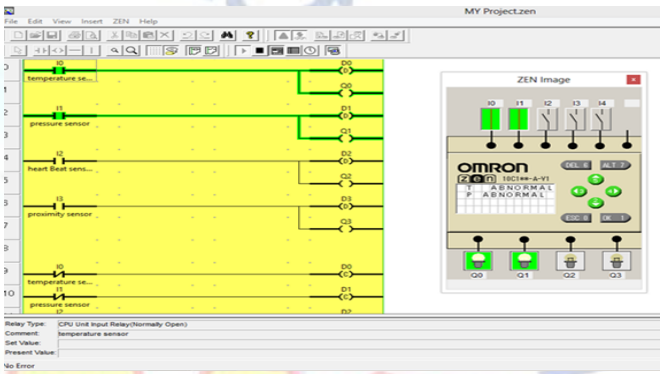


XI.TEST RESULTS





XII.SIMULATED OUTPUT



XIII. 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. 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. And the landmines can also be easily detected by the soldiers individually. 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.

REFERENCES

[1] American War and Military Operations Casualties: Lists and Statistics, Congressional Research Service [Online]Available:http://www.fas.org/sgp/crs/natsec/RL32492.pdf

[2] National/54-missing-defence-personnel-believed-to-be-in-pak-jails- Survey", IEEE Communications

Surveys & Tutorials, vol. 15, no. 1, 2013, pp. 101-120.

[3] H. Furtado and R. Trobec, "Applications of Wireless Sensors in Medicine," in Proc. MIPRO'11, 34th International Convention,Opatija, May 2011, pp.257-261.

[4] P. B. Crilly, E. T. Arakawa, D. L. Hedden, and T. L. Ferrell, "An Integrated Pulse Oximeter System for Telemedicine Applications," Proceedings of the IEEE Instrumentation and Measurements Conference, Ottawa, Canada, May 1997, pp. 102-104, vol. 1.

[5] Hyuntae Kim, Jingyu Do and Jangsik Park, "Wireless Structural Health Monitoring System Using ZigBee Network and FBG Sensor," in International Journal of Security and Its Applications, Vol. 7, No. 3, May 2013.

[6] N. Chadil, A. Russameesawang, and P. Keeratiwintakorn, "Real-Time Tracking Management System using GPS, GPRS and Google Earth," in Proc of the 5th ICoEETIT, Thailand, 2008, pp. 393-396.

[7] I.F. Akyilidiz, Weilian Su, Y. Sankarasubramaniam, E. Cayiric,"A Survey on Sensor Networks", IEEE Communications Magazine, Vol. 40, Issue 8, Aug 2002, pp. 102-114.

[8] N. M. Z. Hashim, N. A. Ali, A. Salleh, A. S. Ja'afar and N. A. Z.Abidin, "Development of Optimal Photosensors Based Heart Pulse Detector," in International Journal of Engineering and Technology (IJET), Vol 5 No 4, Aug-Sep 2013, pp. 3601-3607

[9] ICBL-CMC, "Landmine Monitor 2013", International campaign to ban landmines – cluster munition coalition, Nov. 2013, http://www.the-monitor.org/lm/2013/ resources /Landmine%20Monitor%202013.pdf

[10] D.J.Daniels, "Ground penetrating radar for buried landmine and IED Detection", in Unexploded Ordnance Detection and Mitigation NATO Science for Peace and Security, pp 89-111R, Series B: Physics and Biophysics, 2009

[11] Doheny, R. C. etal.,"Handheld standoff mine detection system (HSTAMIDS) field evaluation in Namibia," Proc. of the SPIE,

[12] D. Daniels, P. Curtis,"Minehound™ trials in Cambodia, Bosnia, and Angola," Proc. of the SPIE, 6217, 2006.

[13] M. Sato, Y. Yokota and K. Takahashi, "ALIS: GPR system for humanitarian demining and its deployment in Cambodia," Journal of the Korean Institute of Electromagnetic Engineering and Science, 12, 1,2012.