ISSN: 2278-4632
Vol-10 Issue-7 No. 11 July 2020

AN IOT BASED SOIDIER HEALTH AND POSITION TRACKING SYSTEM

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ABSTRACT

In today's world, warfare is an important factor in any nation's security. One of the important and vital roles is played by the army soldiers. There are many concerns regarding the safety of soldiers. So for their security purpose, many instruments are mounted on them to view their health status as well as their real time location. Bio-sensor systems comprise various types of small physiological sensors, transmission modules and processing capabilities, and can thus facilitate low-cost wearable unobtrusive solutions for health monitoring. This paper gives an ability to track the location and monitor health of the soldiers in real time who become lost and get injured in the battlefield. It helps to minimize the time, search and rescue operation efforts of army control unit.

INDEX TERMS :

GPS tracking, navigation, Arduino, Heart beat sensor, Temperature sensor, LCD Display, Power supply.

1. INTRODUCTION

The soldier must be integrated with advanced healthcare monitoring, real time GPS (Global Positioning System) and data communications to send and receive information to/from the control unit. For that Soldier might need wireless networks not only to communicate with control unit but also with side by side military personnel. Apart from the nation's security, the soldier must need safety by protecting himself with advanced weapons and also it is necessary for the army control unit to monitor the health status of the soldier. In this paper bio medical sensors and monitoring devices are integrated with the soldiers.. This paper will be useful for the soldiers, who involve in special operations or missions.

The authors[1][2][3] had discussed 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 realtime. In this paper, we propose a methodology to develop a system for real time health monitoring of soldiers, consisting of interconnected BSNs. The authors[4] had introduced a system that gives ability to track the soldiers at any moment. The soldiers will be able to communicate with control unit using GPS coordinate information in their distress. It is able to send the sensed and processed parameters of soldier in real time. It enables to army control unit to monitor health parameters of soldiers like heartbeat, body temperature, etc using body sensor networks. The parameters of soldiers are wirelessly transmitted using GSM. The authors [5][6][7][8] had presented an idea for the safety of soldiers using sensors to monitor the health status of soldiers as well as ammunitions on them. GPS module has been used for location tracking and RF module has been 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 unit[9][16]. The authors [10][15] had investigated for the care of critically ill patients. This paper is based on monitoring the health of remote patients, after they get discharged from hospital. This system enables the doctors to monitor health. The authors[20] have proposed a "Soldier Monitoring and Health Indication System" in which they have used GPS, Heart rate sensor, Temperature Sensor, Vibration sensor, Bomb Detector and a PIC16F877A Microcontroller for the prototype. This project uses polar heart rate transmitter and RMC01 receiver as a heartbeat sensor. This paper proposes the use of piezo disk vibration sensor using piezo-electric plate. Piezoelectric film is a lightweight, flexible, reliable, mobile and low cost alternative to expensive sensors.

II.PROPOSED METHODOLOGY:

REAL-TIME DATA SENSING IN THE WARZONE: Data collected from the war zone will be the indicator of soldier's health condition. so the data analytics performed using K-Means helps the control unit in mapping the conditions around the soldiers.

DATA TRANSMISSION: Data is transmitted from the soldier to the squadron leader using IOT. The squadron leader then collects this data and passes it to the control unit. Data can either be sent periodically after some fixed intervals or only when there is a significant change in the biomedical sensor readings of the soldier.

DATA ANALYSIS &PREDICTION: Instead of using simple conditional statements, K-Means Clustering algorithm has been proposed. Clustering is a type of unsupervised learning that can be used to visualize similar kinds of data and cluster them together. Due to the unavailability of real time soldier data, clustering has been proposed initially. K-Means Classification can be easily applied on the real time data that will be collected eventually.

CONTROL ROOM'S UNIT:The army base station unit or the control unit shall consist of a PC and a LoRaWAN transceiver module which will be connected with each other. The data coming from LoRaWAN module will be displayed on PC screen with the help of graphical user interface (GUI)

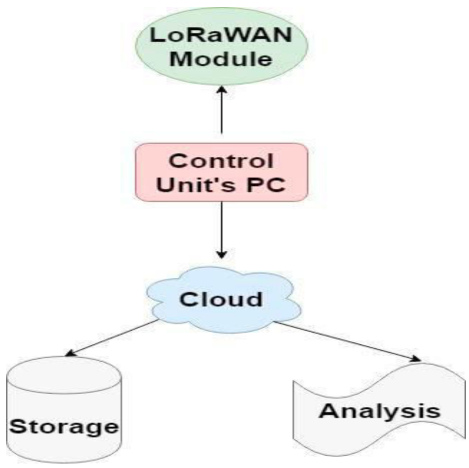

FIGURE 1: Control Room's Unit

The fig1 gives the brief description about the prototype. And also explain about the smart techniques that are used here.

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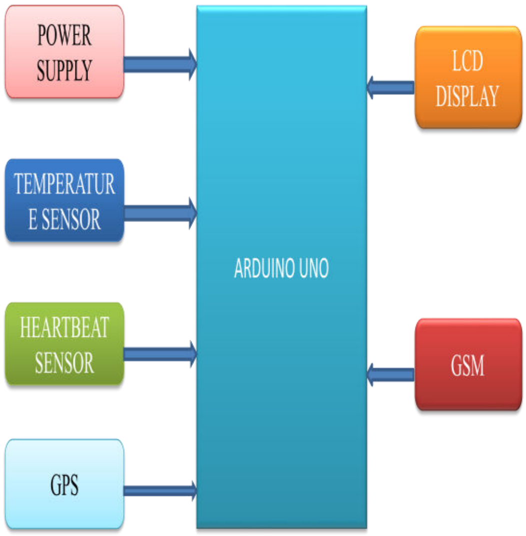

FIGURE 2: IOT Based Soldier health and Tracking System

OPERATIONS OF MODULES:

A. *ARDUINO:*

The ARDUINO UNO is an open-source micro control board based to he Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the ARDUINO IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20volts. It is also similar to the ARDUINO NANO and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution ShareAlike 2.5 license and is available on the ARDUINO website.

FIGURE 2(a): ARDUINO

B. *LM35 TEMPERATURE SENSOR:*

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in °C).It can measure temperature more accurately than a

ISSN: 2278-4632
Vol-10 Issue-7 No. 11 July 2020

using a thermistor. The sensor circuitry is sealed and not subject to oxidation. The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified. The LM35 has an output voltage that is proportional to the Celsius temperature. The scale factor is .01V/°C.

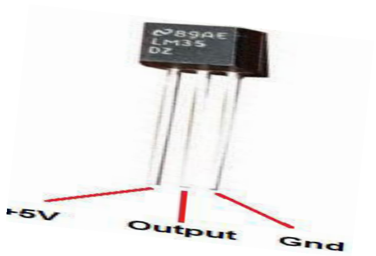

FIGURE 2(b): LM35 Temeprature sensor

C. GPS:

Global Positioning System (GPS) technology is changing the way we work and play. You can use GPS technology when you are driving, flying, fishing, sailing, hiking, running, biking, working, or exploring. With a GPS receiver, you have an amazing amount of information at your fingertips. Here are just a few examples of how you can use GPS technology.

FIGURE 2(c): GPS Modem

FIGURE 2(d): GPS sample module

D. GSM:

A GSM modem can be an external modem device, such as the Wavecom FASTRACK Modem. Insert a GSM SIM card into this modem, and connect the modem to an available serial port on your computer.A GSM modem can be a PC Card installed in a notebook computer, such as the Nokia Card Phone.

FIGURE 2(e): GSM smart modem

E.HEARTBEAT SENSOR:

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heartbeat. 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.

FIGURE 2(f): Pulse sensor

F. LCD:

The LCD can display a character successfully by placing the
1. Data in Data Register
2. Command in Command Register of LCD

Data corresponds to the ASCII value of the character to be printed. This can be done by placing the ASCII value on the LCD Data lines and selecting the Data Register of the LCD by selecting the RS (Register Select) pin.

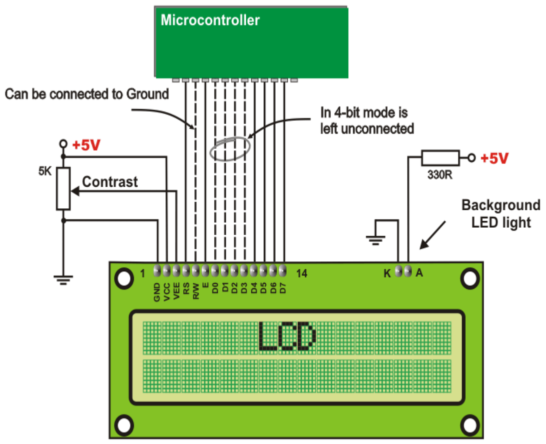

FIGURE 2(g): LCD Display

III. SYSTEM DESIGN SOFTWARE:

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.

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FLOWCHART:

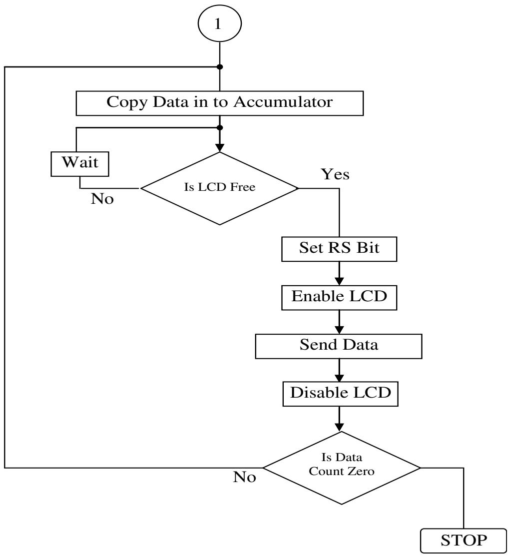

FIGURE 4: Flowchart

USES:

The LCDs used exclusively in watches, calculators and measuring instruments are the simple seven-segment displays, having a limited amount of numeric data. The recent advances in technology have resulted in better legibility, more information displaying capability and a wider temperature range. These have resulted in the LCDs being extensively used in telecommunications and entertainment electronics.

So in this project, the LCD is used to display the instantaneous information. The information may be prompting or alerting or instructing the user.

V. RESULT AND DISCUSSION:

The sensors were subjected to the real world and the semi/unstructured sensory output data were recorded. These data were then processed and converted to structured data to fit the K-Means model. A total of 2000 instances of data were collected from various sensors. It was then clustered using K-Means Clustering algorithm and the following clusters were observed for different activities performed: Fig

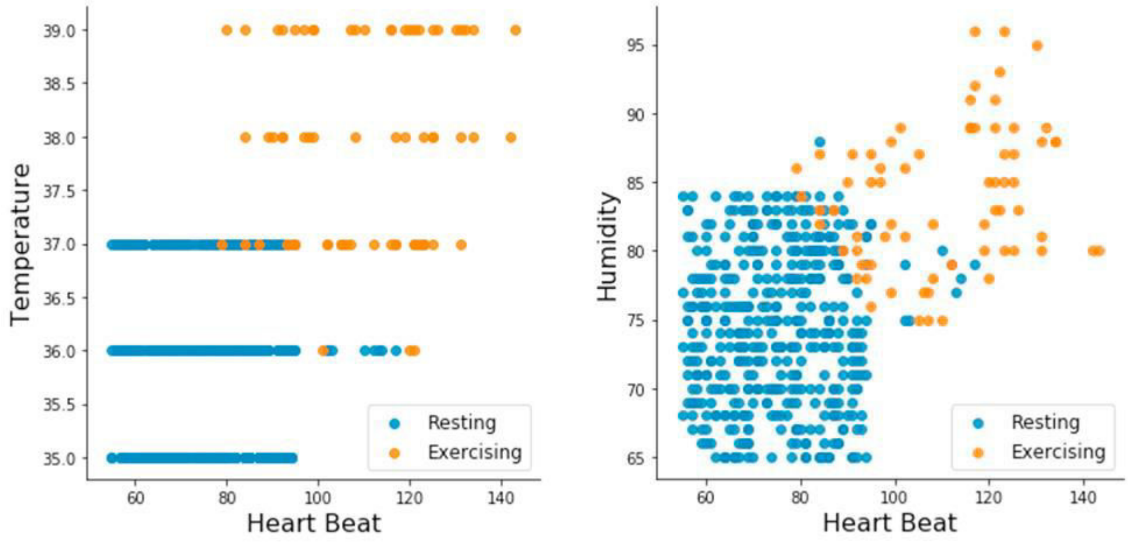

FIGURE 5(a):K-Means Clustering forming 2 clusters for Temperature Vs Heart Beat & Humidity Vs Heart Beat respectively

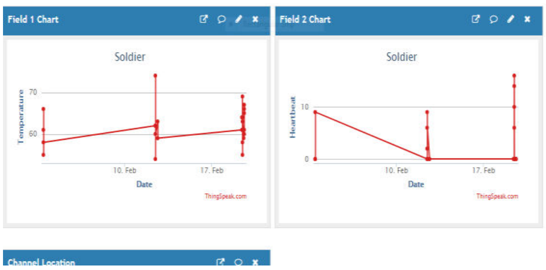

FIGURE 5(b): Soldier helath condition

VI. CONCLUSION:

We can conclude that we are able to transmit the data which is sensed from remote soldier to the squad leader and other soldiers using IOT transceiver and from the squad leader to the control unit using LoRaWAN as the wireless transmission technology. This system helps to monitor health parameters of soldier, track their position, detect nearby bombs and predict the warzone environment using various sensors and K-Means machine learning algorithm. The system helps the soldier to get help from army control unit and/or from another fellow soldiers in panic situation. It will prove to be very useful to military forces during war and rescue operations as it can be used without any network restriction combining the capabilities of IOT and LoRaWAN. Thus, this system provides security and safety to our soldiers.

VII. FUTURE SCOPE:

The proposed work can be expanded in the future in many directions. Gyroscope and Accelerometer can also be used together for human activity recognition using machine learning. Blood pressure sensor and electro dermal activity sensor can also be implemented together to classify if the soldier is calm or is in distress. A suitable and better routing algorithm can be used to make this system more reliable and energy efficient. Ubiquitous computing will surround all the soldier’s environment that merges physical and computational infrastructures forming a whole new integration. It will feature a proliferation of hundreds or thousands of computing devices and sensors that will provide new functionalities without being bulky. The selection of the squadron leader has been done statically in this paper while it can be done dynamically in the future using an appropriate and efficient cluster-head selection algorithm.

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