

IoT-based Healthcare Monitoring System for Soldiers

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Abstract—Enemy warfare is an important factor in any nation's security. There are many concerns regarding the safety of these soldiers. The defense department of country must be effective for the security of that country. This system will be useful for soldiers, who involve in missions or in special operations. 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. This paper based on IOT technology and Arduino kit is used in this system for tracking the soldiers.

Keywords— Soldiers, Security, Arduino kit, IOT, Healthcare

1. INTRODUCTION

The Internet of Things (IoT) is the network of physical objects—devices, vehicles, buildings and other items embedded with electronics, software, sensors, and network connectivity—that enables these objects to collect and exchange data. Various names for IOT, which contain one concept: M2M (Machine to Machine), "Internet of Everything" (Cisco Systems), "World Size Web" (Bruce Schneier), "Skynet" (Terminator movie) [1].

Arduino kit is a very useful device that comes with a wide range of applications and covers less space as compared to other Arduino board. Breadboard friendly nature makes it stand out from other board. Following are the main applications of the board:

Arduino Metal Detector, Medical Instruments, Industrial Automation, Android Applications, GSM Based Projects, Automation and Robotics, Home Automation and Defense Systems, Virtual Reality Applications [2].

Solar Panels:

Solar Panels to power up the internal circuitry of the E-uniform. A 12 V DC lead acid rechargeable

battery is used for storing the energy. We are using conventional battery charging unit also for giving supply to the circuitry. Solar panels are devices that convert light into electricity. They are called "solar" panels because most of the time, the most powerful source of light available is the Sun, called Sol by astronomers.

Embedded System technology very much used in this paper. Embedded System used in many ways. Nearly 99 per cent of the processors manufactured end up in embedded systems [3]. The embedded system market is one of the highest growth areas as these systems are used in very market segment- consumer electronics, office automation, industrial automation, biomedical engineering, wireless communication, data communication, tele-communications, transportation, military and so on.

One of the most important tasks in military processes is that the Soldier, not able to interconnect with control room administrator. In addition, every organization wants to apply for certain work when they communicate over the n/w owned and worked with other organizations. Therefore, without cautious planning and coordination, one group cannot interconnect with the other groups. Present a problem faced by the soldiers are; Soldier wants to identify the location. They will not get assistance during terror situation and soldiers are not trackable.

The organisation of the paper is as follows: Section 2 describes the literature review. Section 3 describes the proposed approach. Section 4 explains the methods used in proposed approach. Section 5 describes the experimentation results and Section 6 concludes the paper and provides the direction for future work.

2. RELATED WORK

In [4], author designed smart monitoring system for soldiers who protecting the homeland so, it is necessary to help them by using smart monitoring

system to avoid any terrorist attack or know their places when the abduction of any one of these soldiers. Supply soldier with modern technological devices makes it easy for us to know the health status and their location and this makes the control rooms in the military full-time to monitor the enemy rather than preoccupation with monitoring soldiers. Wireless communications devices play an important role in monitoring the soldiers through the use of the devices Global Positioning System (GPS) system, and also SOS messages that help the soldier to adapt with different situation. All the data collected from the sensors and send to the web server to make analysis also statistics depending on these information Base Stations can make the right decision and send it to the soldier to follow thanks to this smart control system.

Today's world, enemy 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 ammunitions present with them. 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. GPS used to log the longitude and latitude so that direction can be known easily. These devices are being added to weapons and firearms, and some militaries such as the Israeli Army which are exploring the possibility of embedding GPS devices into soldiers vests and uniforms so that field commanders can track their soldier's movements in real time. RF module can be used for High-speed, short-range, soldier-to-soldier wireless communications that will be required to relay information on situational awareness, tactical instructions, and covert surveillance related data during special operations reconnaissance and other missions. So by using these equipments we are trying to implement the basic life-guarding system for soldier in low cost and high reliability [5, 6].

Soldiers are very essential part of any nation's security system. During, wars and search operations soldiers get injured and many of them become lost. As, soldiers health is important because they are the savior of our country who protects us from enemy attacks, terrorist activities

and from many suspicious activities which can harm us as well as our nation too. In this paper, we have proposed an approach 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. This system enables to army base station to track the location and monitor health of soldiers using GPS module and wireless body area sensor networks (WBASNs), such as temperature sensor, heart beat sensor, etc.. The data coming from sensors and GPS receiver is transmitted wirelessly using Zig Bee module. Also, a soldier can ask for help from control room and can communicate with other fellow soldier present within the wireless transmission and reception range [7].

In military operations, one of the challenges is that the soldiers are not able to communicate with the control room or army base station. Once a troop become injured or need some help during the panic situations in the battlefield then it becomes more difficult to monitor them and bring back to the base station. It is necessary for the army base station to guide the soldiers in such cases. In this paper we have used a wireless embedded system by which the health status of the troopers who get injured can be monitored by the army control unit. This system facilitates continuous investigation of the trooper for emergency looked over by attendees. The doctors and caregivers monitor the trooper in real time through the data received through the internet. This system consists of temperature sensor, ECG sensor and camera interface. The data value measured by the sensors and the image captured by the camera are transmitted wirelessly using the internet. Also, a soldier can ask for help from the control room when they need help in critical situation [8].

The soldier plays a vital role in nations security. Many times the soldiers become lost or injured. So it is important to make a system which will help in such situation. This approach gives the ability to track the current position and gives the current health status of the soldier using GPS and biosensors. So that the rescue operation become easier. With the alert feature to give instructions becomes easier. The camera features adds the advantage of real time video of the site, so the analysis of the site at base station becomes more convenient. In this work, continuously monitors the health status (body temperature and heart rate)

of the soldier and transfer the data wirelessly at base station server using zigbee technology. The GPS sensor gives the latitude and longitude so to find the direction becomes easier. The voice instruction module and wireless camera helps the soldier in warfare. So by using this system we are trying to improve the security of soldier and giving additional equipment's to the soldiers increasing their power in war [9].

The country security mainly depends on Army for ground, Navy for sea, Air-force for air. 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 ammunitions present with them [10].

This work gives the ability to track where soldiers are at any given moment. 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. GPS used to log the longitude and latitude so that direction can be known easily. These devices are being added to weapons and firearms, and some militaries such as the Israeli Army which are exploring the possibility of embedding GPS devices into soldiers vests and uniforms so that field commanders can track their soldier's movements in real time. RF module can be used for High-speed, short-range, soldier-to-soldier wireless communications that will be required to relay information on situational awareness, tactical instructions, and covert surveillance related data during special operations reconnaissance and other missions. So by using these equipment's we are trying to implement the basic life-guarding system for soldier in low cost and high reliability [11].

In today's world a nation power is recognized by its economy, military power and political relations with other countries especially with neighbor countries. But in the present time having strong military power is also vital because no one can predict when our ally becomes our enemy. For having strong military a nation need advanced technology for its soldiers like advance weapons, advance gadgets and many more. This proposed work will be very useful for our soldiers in many conditions like Surgical Strike. Each soldier will have a GPS and GSM module and heart beat and

temperature sensor which will tell the base headquarter about their position, pulse rate and temperature of the body [12].

Nowadays Defense services are rapidly growing towards new innovation with advance implementation. Soldier's health is more important because they are the defenders who protect our country. Every year some Soldiers have lost or injured. There are many concerns regarding the safety of these soldiers. This approach gives an idea of tracking the location of soldier as well as health status of them during the war, which enables the army personnel to plan the war strategies. It is necessary for the base station to guide the soldier on correct path if he lost in the battlefield. The GPS receiver is used to log the longitude and latitude of soldier, which is stored in microcontroller memory. GPS Receiver receives and compares the signal from orbiting GPS satellite to determine geographic position. At Army Base station unit it gets the location of soldier through GSM.

During wars and military search operations, soldiers gets injured and sometime becomes losses. To find soldiers and provide health monitoring, army base station and need Global Position System device for locating soldiers, wireless base station to sense health related parameters of soldiers and a wireless transceiver to transmit the data wirelessly. Upon losing in the battlefield it is necessary for the base station to guide the soldier. The base station can access the current status of the soldier which is displayed on the Personal Computer. The proposed system can be mounted on the soldier's body to track their health status and current location using Global Positioning System. These information will be transmitted to the control room through Internet of Things. The proposed system comprise of tiny wearable physiological devices, sensors, transmission modules. Hence, with the use of the proposed system, it is possible to implement a low cost mechanism to protect the valuable human life on the battlefield [13].

This paper reports health monitoring and tracking system for soldiers using live track application. The proposed system can be mounted on the soldier's body to track their health status and current location using GPS. These information will be transmitted to the control room through live track application. The proposed system comprise of tiny wearable physiological equipment's, sensors,

transmission modules. So by using these equipment's we are trying to implement the basic life guard for soldiers in low cost and high reliability.

In today's world the security of the nation is depends up on the enemies' warfare and so the safety of the soldiers is considered as vital role in it. Concerning the soldiers safety there are many instruments to view their health status as well as ammunitions on the soldiers. In soldiers security, bio-sensors systems gives different types of small physiological sensors, Biomedical sensor, transmission modules and processing capabilities, and can thus facilitate low-cost wearable unobtrusive solutions for health monitoring. GPS used to log the longitude and latitude so that direction can be known easily. These devices are being added to weapons, firearms, and militaries such as the Israeli an Army which are exploring the possibility of embedding GPS devices into soldiers vests and uniforms so that field commanders can track their soldier's movements in real time. GSM module can be used for effective range of high-speed transmission, short-range and soldier-to-soldier wireless communications that will be required to relay information on situational awareness, tactical instructions, and covert surveillance related data during special operations reconnaissance and other missions .So by using these equipment's we are trying to implement the basic lifeguarding system for soldier in low cost and high reliability [14].

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The wireless Webcam can be used to watch the real time video. RF module can be used for effective range of high-speed transmission, short-range and soldier-to-soldier wireless communications that will be required to relay information on situational awareness, tactical instructions, and covert surveillance related data during special operations reconnaissance and other missions. So by using these equipment's we are trying to implement the basic life-guarding system for soldier in low cost and high reliability.

The paper reports a health monitoring and tracking system for soldiers based on internet of things (IoT). The proposed system can be mounted on the soldier's body to track the health status and current location of the soldiers using GPS. The information obtained will be transmitted to the control room through IoT. The proposed system consists of tiny wearable physiological equipment's, sensors, transmission modules. Hence, with the use of the proposed equipment, it is possible to implement a low-cost mechanism to protect the soldier's life on the battlefield. During wars and military search operations, soldiers gets injured and sometimes the connection will be lost. To find the soldiers and to provide the information about health of the soldier's army base station need Global Position System (GSM) device for locating soldiers, and a wireless transceiver to transmit the data wirelessly. Upon losing the connection in the battlefield it is necessary for the base station to guide the soldier. The base station can obtain the current status of the soldier which is displayed on the Personal Computer. The proposed system can be firmly fixed on the soldier's body to track their health status and current location using Global Positioning System (GPS). This information will be sent to the control room through Internet of Things.

In today's world a nation power is recognized by its economy, military power and political relations with other countries especially with neighbor countries. But in the present time having strong military power is also vital because no one can predict when our ally becomes our enemy. For having strong military a nation need advanced technology for its soldiers like advance weapons, advance gadgets and many more. This approach will be very useful for our soldiers in many conditions like Surgical Strike. Each soldier will have a GPS and GSM module and heart beat and temperature sensor which will tell the base

headquarter about their position, pulse rate and temperature of the body.

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. This system enables to army control unit to track the location and monitor health of soldiers using GPS module and wireless body area sensor networks (WBASNs), such as temperature sensor, heart beat sensor, etc. The data coming from sensors and GPS receiver will be transmitted wirelessly using ZigBee module among the fellow soldiers [7]. Furthermore, Lora WAN network infrastructure has been proposed to be used between the squadron leader and the control unit in high altitude warzones where cellular network coverage is either absent or does not allow data transmission. The collected data will be uploaded on the cloud for further data analysis and predictions using K-Means Clustering algorithm [9].

3. PROPOSED SYSTEM

In the existing system there is no feature of finding the exact health condition and the location of the soldier. If any sudden health drop is detected in soldier the officials cannot know the information immediately. It does not have any login page and we cannot get the information whenever we want. Main disadvantages of existing systems are no continuous monitoring, no immediate response [10].

The purpose of this approach is to design and construct automatic health detection of the soldier in the field work and immediately inform the nearest military base. This system continuously tracks the health, temperature, heart beat of the

soldier along with this it can also have the GPS tracker. This system is designed to detect the entire body control of the soldier.

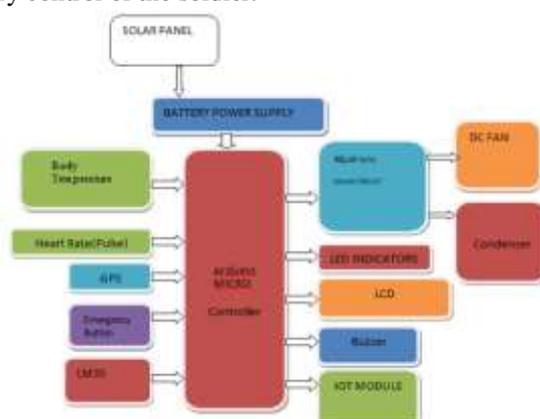


Fig 1: Block diagram of Arduino Micro controller

The main advantages of the proposed system is monitoring the moving target, works in any critical conditions, automatic alerting mechanism, there is no manual work required [11].

4. METHODS AND MATERIALS

In this paper, Arduino Micro controller method is used for execution, which is showing in Figure 1. The Power Supply Section is the Section which Provide +5v for the Components to work. IC LM78 is Used for Providing a Constant power of +5V, showing in Figure 2.



Fig 2: Block diagram of Power Supply

Light Emitting Diode (led):

LED is abbreviation of Light Emitting Diode. It's nothing, but just a combination of semiconductors which emits light when current pass through it. Over the years, semiconductor technology has advanced to bigger heights, Light Emitting Devices have also been a part of this revolution and as a result, now we have LED's which give better illumination with low power consumption.

5. IMPLEMENTATION RESULTS

Implementation of microcontroller kit and pin results are showing in Figure 3 and 4.

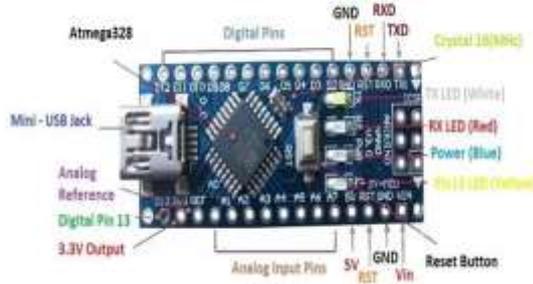


Fig 3: Microcontroller KIT

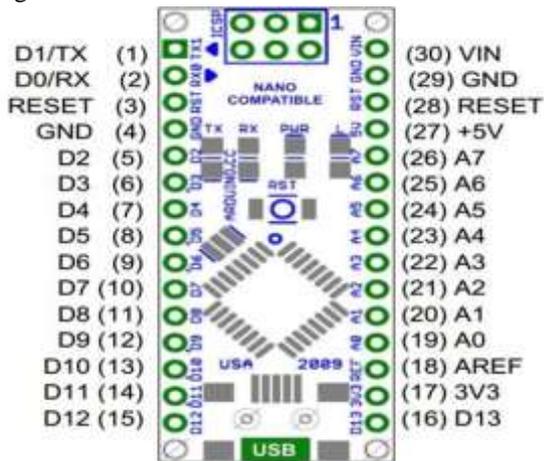


Fig 4: PIN DIAGRAM

FEW PIN DESCRIPTION:

VCC: Digital supply voltage.
GND: Ground.

1. Arduino Nano Pin out contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins.
2. Each of these Digital & Analog Pins are assigned with multiple functions but their main function is to be configured as input or output.
3. They are acted as input pins when they are interfaced with sensors, but if you are driving some load then use them as output.
4. Functions like pin Mode () and digital Write() are used to control the operations of digital pins while analog Read() is used to control analog pins.
5. The analog pins come with a total resolution of 10bits which measure the value from zero to 5V.
6. Arduino Nano comes with a crystal oscillator of frequency 16 MHz. It is used to produce a clock of precise frequency using constant voltage.
7. There is one limitation using Arduino Nano i.e. it doesn't come with DC power jack, means you cannot supply external power source through a battery.

8. This board doesn't use standard USB for connection with a computer, instead, it comes with Mini USB support.

9. Tiny size and breadboard friendly nature make this device an ideal choice for most of the applications where a size of the electronic components are of great concern.

10. Flash memory is 16KB or 32KB that all depends on the at mega board i.e Atmega168 comes with 16KB of flash memory while Atmega328 comes with a flash memory of 32KB. Flash memory is used for storing code. The 2KB of memory out of total flash memory is used for a boot loader.

11. The SRAM can vary from 1KB or 2KB and EEPROM is 512 bytes or 1KB for Atmega168 and Atmega328 respectively.

12. This board is quite similar to other Arduino boards available in the market, but the small size makes this board stand out from others.

13. It is programmed using Arduino IDE which is an Integrated Development Environment that runs both offline and online.

14. No prior arrangements are required to run the board. All you need is board, mini USB cable and Arduino IDE software installed on the computer. USB cable is used to transfer the program from computer to the board.

15. No separate burner is required to compile and burn the program as this board comes with a built-in boot-loader.

16. Each pin on the Nano board comes with a specific function associated with it.

17. We can see the analog pins that can be used as an analog to digital converter where A4 and A5 pins can also be used for I2C communication. Similarly, there are 14 digital pins, out of which 6 pins are used for generating PWM.

18. Vin. It is input power supply voltage to the board when using an external power source of 7 to 12 V.

19. 5V. It is a regulated power supply voltage of the board that is used to power the controller and other components placed on the board.

20. 3.3V. This is a minimum voltage generated by the voltage regulator on the board.

21. GND. These are the ground pins on the board. There are multiple ground pins on the board that can be interfaced accordingly when more than one ground pin is required.

22. Reset. Reset pin is added on the board that resets the board. It is very helpful when running

program goes too complex and hangs up the board. LOW value to the reset pin will reset the controller.

23. Analog Pins. There are 8 analog pins on the board marked as A0 – A7. These pins are used to measure the analog voltage ranging between 0 to 5V.

24. Rx, Tx. These pins are used for serial communication where Tx represents the transmission of data while Rx represents the data receiver.

25. 13. This pin is used to turn on the built-in LED.

26. AREF. This pin is used as a reference voltage for the input voltage.

27. PWM. Six pins 3, 5, 6, 9, 10, 11 can be used for providing 8-bit PWM (Pulse Width Modulation) output. It is a method used for getting analog results with digital sources.

28. SPI. Four pins 10(SS), 11(MOSI), 12(MISO), 13(SCK) are used for SPI (Serial Peripheral Interface). SPI is an interface bus and mainly used to transfer data between microcontrollers and other peripherals like sensors, registers, and SD card.

29. External Interrupts. Pin 2 and 3 are used as external interrupts which are used in case of emergency when we need to stop the main program and call important instructions at that point. The main program resumes once interrupt instruction is called and executed [12].

30. I2C. I2C communication is developed using A4 and A5 pins where A4 represents the serial data line (SDA) which carries the data and A5 represents the serial clock line (SCL) which is a clock signal, generated by the master device, used for data synchronization between the devices on an I2C bus. These PINs are showing in Figure 4.

6. CONCLUSION AND FUTURE WORK

The main aim of this paper is to provide the continuous surveillance at the border areas even in the day and night, also in any type of weather condition. In this approach also added with the gas leakage and PIR sensors which will be used to detect any bombs or gas leakage and send the message to the central army board. As we are using the IoT module it will activate using the wifi and also it is attached with the server and everything is stored in server and displayed on the LCD screen and also in the web page. This system is implemented to find an effective solution for the problems faced by soldiers.

In future we are going to extend our work by using the drones and the night vision cameras where even the picture of the person is also clicked and sent to the board.

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