Project Report on

Quick Rescue Operation In War Field: Using IoT Wearable

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Certificate

This is to certify that, this is a Bonafide Project report, titled "**Quick Rescue Operation In War Field: Using IoT Wearable**", done satisfactorily by Amarjit Pradhan(1901229022), Chandan Kumar Sahu (1901229040), Merry Manasi(1901229065) in partial fulfillment of requirements for the degree of B.Tech. in Computer Science & Engineering under Biju Patnaik University of Technology (BPUT).

This Project report on the above mentioned topic has not been submitted for any other examination earlier before in this institution and does not form part of any other course undergone by the candidate.

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ABSTRACT

War rescue operation plays a vital role which will help in dominating the war. A major problem related to borders or war-field is that it is quite impossible to reach every injured soldier at any time. Manual monitoring is relatively difficult in case of borders or the war field where the area is too big; specifically, during the night the majority of the attacks are executed by the rivals. Thus, in the war field, it is difficult to find out the status of every individual. Therefore, an intelligent system needs to be developed which will automatically identify the survival of our army in any circumstances may it be day or night.

We put forward an intelligent quick rescue operation system which consists of an ATmega328P processor and different types of sensors like ultrasonic sensors, pulse sensors, and GPS which will help the rescue team to find the exact location of the soldiers and their status. The internet of things is used to inform the concerned authority about the live data for efficient monitoring of the soldiers which will enable them to find their live status so that their information will be updated in the system from time to time. This system will help the patrolling team to reach the exact place where the soldiers are there and rescue them quickly.

Key Words: Rescue operation, ATmega328P, ultrasonic sensor, pulse sensor, and GPS.

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CHAPTER 1

1.1 INTRODUCTION

A quick rescue operation system is a tracking model device connected to the internet system that notifies the prior authority about the live status and therefore location of the injured soldier. When something happens to the soldier the device is going to be activated and can send the data to the authority wirelessly. The quick rescue operation system enables one to know the information regarding the live status of the person and their exact location. This system will help the rescue team to successfully reach the injured soldiers and save their life on time. The objective of this project is to develop a rescue operation system which enables us to check the condition of a soldier. During war times it is difficult to check whether the soldier is dead or alive. The main objective of the project is to detect human and send the message whether the person is authorized or unauthorized. The prior objective of this system is that it will help to save the lives of the soldier. Many a time soldiers die because they are unable to get the proper treatment on time. Sometimes many army soldiers are declared missing because the rescue team is unable to reach out to them and know their location. Thus, an intelligent quick rescue operation system will help to resolve all these kinds of problems and will help to save the lives of many on time.

1.2 MOTIVATION FOR WORK

In the military, sustaining innovations reinforce the existing way of wars. I n general, wars tend to accelerate technological development to adopt tools for the purpose of solving specific military needs.

Now-a-days with the help of AI there are multiple Robots that are being used in the war field but they have limited features as they cannot be there with the soldiers all the time.

Real-time identification of health is also possible through wrist so that plays an important role. Using IoT, it helps improving efficiency, reduction of actual cost and many more.

1.3 OBJECTIVES OF THE PROJECT

The main objective of this paper is to propose a system which can effectively help in preventing any kind of mishaps and if such conditions occur then how it detects and informs the concerned authorities and people, so that the situation can be taken care of immediately

1. The main objective of the project is to detect injured soldier in war.
2. To provide instance back support or force if necessary.
3. To detect exact location or position of soldier during extreme condition.

CHAPTER 2

2.1 LITERATURE SURVEY

[1] Karl E. Friedl et al. purposed a "Wearable physiological monitoring" that can provide predictions about an individual's health and performance from their real-time physiological state. This precision medicine approach offers major improvements over population-based predictions derived from ambient conditions and the general context of a mission. Physiological sensors will have useful military applications if they are soldier-acceptable and provide important actionable information. One of the most promising and still least developed part of performance monitoring is to use measurements of human physiological and behavioral signals to detect neurophysiological status, particularly in predicting individuals reaching stress limits and with impending degraded performance.

[2] Mr. Sourabh Kulkarni et al. purposed a "War-field Soldier tracking and Health Monitoring System". The author proposed a system can be mounted on the soldier's body to track their health status and current location using GPS. This information will be transmitted to the control room through GSM. The proposed system comprises 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 valuable human life on the battlefield.

[3] Deepika J et al. purposed a "Alive Human being Detector in War Field". The objective of this project is to develop a motion sensor alarm based on a Passive Infra-Red (PIR) sensor module. The purpose of the proposed system is to provide a cost-effective system for rescue of human beings in war fields. The proposed system uses a low-cost sensor which is easily available. It is impossible for an individual to visit the war fields. So, in such situations, the proposed system can be useful.

[4] Rushikesh Uphad et al. purposed a "Secure Bomb Defusal Spy Robot Controlled Using Android App". The author presents a system of wireless bomb disposal robot which will help to improve the defence of our nation from terrorist, suicide bombers and other such activities. The proposed system of the bomb-disposing robot will be very useful in the area of security and spying of enemies as well as the areas where human beings cannot reach the robot will do that bomb-disposing work this robot is also remotely operated through the internet so there is no harm to human lives.

[5] Miss. Krashna V. Panpaliya et al. purposed a "Detection of Alive Human body in Military Area". The author proposed a robotic system can be design to detect alive human body in Military area which is useful for rescue operation. The propose robotic system detect alive human body in military area. These system uses a specific set of sensors and a wireless camera. There are two modes where robotic system is working manually operate mode and user controllable mode.

[6] Kunal Deo et al. purposed a "Human Intrusion and Motion Detection System". This system can detect the presence of a human being using sensors. It is meant to provide a versatile framework using which a security system can be set up according to the need and situation. It is more affordable than existing security systems and modifiable.

[7] Chaitra R L et al. purposed a "Soldier Health Status Detection and Location Tracking System using Internet of Things". According to this, the author proposed a system which can

conclude that the various biomedical sensors sense the body parameters in real time and transmit the data to the control room, there by tracking the current location of the soldier using GSM and GPS technology and even the bomb near the surrounding of the soldier. It also provides the spontaneous communication with control room and other fellow soldier in a panic situation to get help.

[8] Hemantha v et al. purposed a "Live human detection robot". The main objective of the project is to detect human and send the message whether the person is authorized or unauthorized. It can also be used as surveillance robot in disaster areas. This proposed model is very much useful for rescue team, at military base and disaster affected areas in the disaster environment.

[9] Aashay Gondalia et al. purposed a "IoT-based Healthcare Monitoring System for War Soldiers using Machine Learning". 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.

[10] Asst Prof. Rajagopalan Nadathur et al. purposed a "IOT based War Robot". The robot model can be controlled from a far distance and overcomes the limitations of the other robots that uses Bluetooth technology. The wireless night sensor camera issued to live stream the video and can be viewed on the hyper terminal on our devices. The metal detector sensor used in the robot senses the metal components and mines present in the fields. The robot proposed can reduce the loss of the lives on the border areas and also helps in performing patrolling duty and record any unexplored areas.

[11] Deepak Kumar Panda et al. purposed a "Motion Detection, Object Classification and Tracking for Visual Surveillance Application". In this thesis, the authors have presented the methods for visual surveillance and have carried out the work on motion detection, object classification, single camera object tracking and multiple camera object tracking in non-overlapping.

[12] Rachana.S. Iyengar et al. purposed a "Multifunctional War Field Robot using IOT". In this project, the author has created a model of robot which can be described to build a robot with night vision wireless camera run by android application and the people can learn about developing android application in order to control the robot through wireless application. The robot has reduced the human effort. The robot is designed with high accuracy in movement section. All the objectives of the project were accomplished with high accuracy, camera result was complimentary in that respect is always a way for betterment in any task.

[13] Sheng-Chang Dou et al. purposed a "Systematic Analysis of a Military Wearable Device". In this paper, a multi-level fusion framework based on heterogeneous sensor networks is proposed by the authors. The framework is divided into three levels, including original information collected by densely deployed sensing modules, cross-fused independent systems, and emergencies as determined from multi-dimensional evidence. The proposed framework covers information on soldiers in multiple respects, including motion, physiology, emotion, fatigue, environment, and location, and allows for the addition of other types of sensors and systems.

[14] Dr. Parameshachari B D et al. purposed “Soldier Health and Position Tracking System using GPS and GSM Modem.” The authors after proper considering the above technologies the tracking of soldier a navigation between soldier to soldier such as knowing their speed, distance, height as well as health status of them during the war, which enables the army personal to plan the war strategies. Base station gets location of soldier from GPS. 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 found

2.2 PROBLEM STATEMENT

To develop a system i.e., "Quick Rescue Operation in War Field: using IoT wearable” which automatically displays the detail of the health information and location of the soldiers. This sends the information regarding the status of every soldier to the base camp and the rescue team will reach to them as soon as possible.

2.3 SOLUTION APPROACH

According the functionalities, this project is based on the safety tracking device which is basically designed to track the injured soldiers by exact location in the extreme situation and send proper treatment at right time. This device gives the result as we able to save many lives of the soldiers those who are died because of not getting proper treatment at right time.

CHAPTER-3

3.1. INTERNET OF THINGS

Internet of Things (IoT) refers to a network of things. These things could be any object that we see in our daily life. These objects are not limited to electronic devices or some high-end technology products but could include objects that we won't normally think of them as electronic like dustbins, chairs, clothes etc. It's a network of smart objects in which the objects are capable of sharing resources and data with other objects. The data collected from the objects is further analyzed to extract the useful information. The smart objects are equipped with some sort of sensors, processing powers and an ability to communicate to other objects. IoT has provided many benefits to improve the quality of life, where smart objects are used to simply our daily errands.

3.2 INTERNET OF THINGS CHARACTERISTICS

There are the following characteristics of IoT as follows. Let's discuss it one by one:

3.2.1 INTER CONNECTIVITY AND SERVICES

As long as IoT is concerned, IoT devices can be inter-linked with the worldwide information and communication foundation. Things-related services such as privacy protection, semantic consistency between physical things and their virtual interlinked items within the constraints of objects are offered by IoT. Technologies continue to develop both in the real world and in the information world to provide things-related services.

3.2.2 HETEROGENEITY

The IoT devices are heterogeneous in nature. Various devices can communicate with each other due to this property. The devices that make use of different hardware platforms, networks, technologies can communicate with each other due to this feature. IoT system includes connectivity of various devices, platforms and operating systems interlinked by different protocols. IoT provides connectivity between different devices which have different power constraints, vendors and are designed for different purposes. The goal of IoT is to provide seamless machine to machine, machine to human and human to human connectivity, so it must be able to connect different things and networks.

3.2.3 ENORMOUS SCALE

The number of devices that are inter connected and need to be tracked and handled would be at least an order of magnitude greater than the internet devices currently connected. It'll become even more complex to manage the massive amount of data produced by these devices and using this data and its interpretation for different application purposes.

3.2.4 DYNAMIC CHANGES

The IoT devices are dynamic i.e., rapidly changing in nature. The state of devices varies with time. For example, the devices may be in sleep/wake state, connected/ disconnected. The number of devices at a time can also change. Some new devices can be added in the network, while other might leave the network. IoT devices are able to adapt to the changing needs. For instance, security cameras can adapt their modes according to the time of the day. The device's connectivity with other devices may vary during different time intervals such that it's connected to one set of devices at one instance, and to another set at another instance, so to ensure security, efficient cryptography systems and good security protocols are needed.

3.2.5 SAFETY

While we avail numerous benefits from IoT, an important concern 'safety' should also be considered. Whether we are creators or receivers of IoT, we must ensure safety. It includes the safety of our physical well-being as well as our private data. This also includes ensuring the safety of communication endpoints, networks, data being communicated across the paths, thus creating a security standard that will be able to scale.

3.2.6 CONNECTIVITY

Connectivity entitles attainability and compatibility. Network availability refers to be able to receive on the network and compatibility refers to be able to use and produce data. New possibilities for IoT can be generated by bringing together the routine objects and connecting the smart gadgets and applications

3.3 IOT APPLICATIONS

IoT has numerous and diverse applications which cover almost all areas in our day-to-day tasks. It covers many domains such as transportation, agriculture, healthcare, waste management, supply chain, environment and energy as shown in Figure 2. Some of the applications of IoT are as follow:

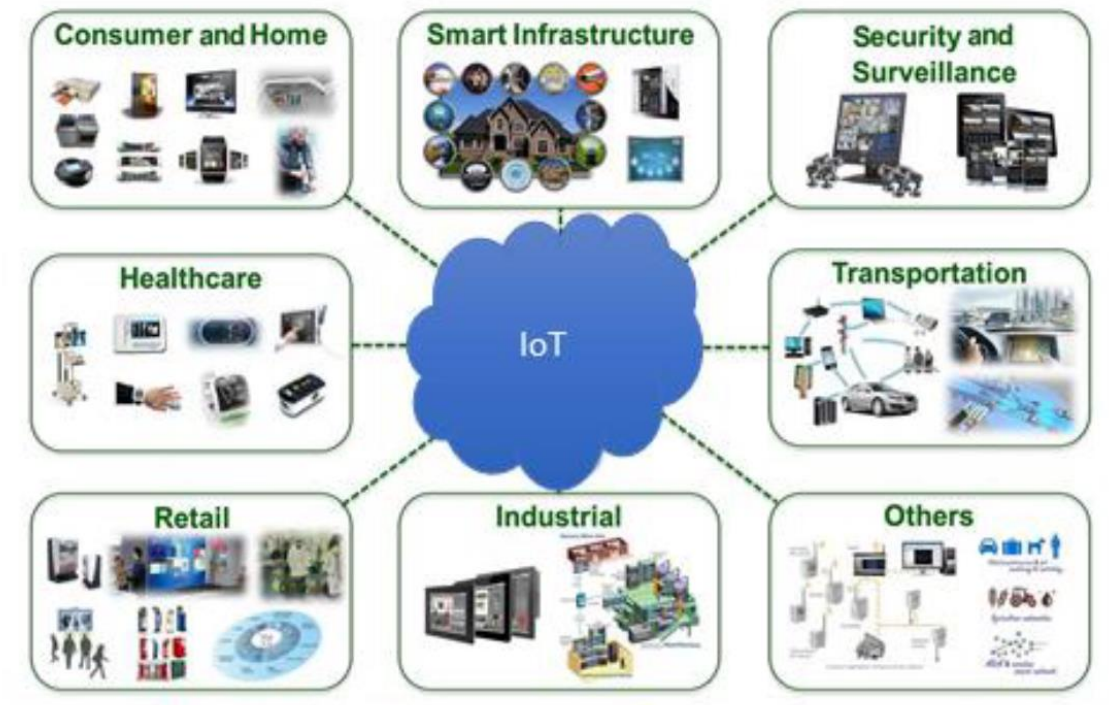

Fig-1: Application of IoT

3.3.1 IOT IN HEALTHCARE

IoT has numerous applications in healthcare. It can be used to monitor and indicate various health indicators.

Patient Monitoring – Patients can be monitored for various conditions like heart rate, blood pressure, glucose level etc. inside hospitals.

Medical Cold Storage – Various medicines, vaccines could be stored and their conditions can be monitored, like when they'll expire etc.

Fall Detection – Assistance could be provided for elderly or handicapped people if they fall, timely assistance could be provided to them.
Dental – Toothbrush connected by means of Bluetooth to a Smartphone app can analyse brushing habits.
Physical Activity Monitoring – Sensors placed on some gadget like watch, that a person could wear, it can monitor how many steps he walked, heart rate etc.

3.3.2 IOT IN SMART ENVIRONMENT

Weather monitoring – Climate changes such as humidity, pressure, temperature and rain can be monitored.
Water Quality Monitoring – Quality of water can be monitored, that is, whether it's safe for humans to consume it.
Prevention of Natural Disasters – River levels could be monitored for early flood detection, similarly landslides and other natural disasters could be predicted.
Air Quality Monitoring – Quality of air can be monitored and measures could be taken to control the emission of CO2 and other toxic gases by vehicles, factories and industries.
Forest Fire Detection – Different fire conditions such as combustion gases can be monitored to generate an early alert.

Protecting Wildlife – Wild animals can be traced and their location can be determined through tracking collars, which use GPS to track location and GSM for communication.

3.3.3 ROLE OF IOT IN INDUSTRIES

Explosive and Dangerous Gases – IoT can be utilized to detect gas leakages in manufacturing areas, in the vicinity of chemical plants and indoor mines. Harmful gases and oxygen levels in chemical plants can be monitored and controlled to ensure safety for both workers and products.
Water, Oil and Gas levels Monitoring – The levels of oxygen, water and oil can be monitored in storage tanks and containers.
Maintenance and Repair – Early predictions can be made for component malfunctions and maintenance service can be set automatically before the actual component failure.
Managing fleet of cars – The fleet of cars can be monitored for any corporation. It can monitor its performance and can process the data to choose the one that needs maintenance.
Temperature Monitoring – The temperature inside industries, mines and other work places can be monitored to generate an alert, if the temperature exceeds to ensure the overall safety of workers and workplace.
Ozone Detection – The presence of ozone levels could be detected in food industries during the process of drying meat.
Indoor Air Quality Surveillance – The quality of air can be monitored inside workplaces to ensure general safety of workers and goods.
Rescue Operations – Factory workers who may have been stuck in underground units due to natural disasters such as earthquake, landslides, explosion or some other natural calamity may be saved, thorough deployment of IoT resources that can accurately track their location.

3.3.4 IOT IN AGRICULTURE

IoT has vast applications in agriculture, some of them are as follows:

Green House Monitoring – The climate conditions can be monitored and controlled for green house to maximize the production of vegetables and fruits, and their quality can also be monitored by providing favourable environmental conditions.
Animal Tracking – Animals grazing in open fields and pastures can be identified and located.
Air Quality Monitoring – The quality of air can be monitored to detect any harmful or toxic gases that may emit from waste material

Field Monitoring – The condition of fields can be monitored via different sensors, the data can then be processed, and the farmer could be informed that a particular piece of land requires special care.
Pest Control – Different mechanisms can be incorporated to control the pests in crops, to ensure quality of crops.
Water Management – The water can be managed efficiently to minimize water wastage by making use of different sensors.
Soil Management – The condition of soil can be monitored such as measuring the PH levels, salinity, moisture content etc. so that the farmer sow the seeds according to the soil level.
RFID tags and Sensors – Using RFID (Radio-Frequency Identification) tags and sensors will help identifying and recognizing the diseases that occurred in plants or crops. The farmer can access the information from a remote location and can take the necessary actions, to save the crops.

3.4 IOT ON WARFIELD

3.4.1 STATISTICS WARFARE:

Though data from a variety of platforms, compiled by the military, allow each army division to identify its critical pitfalls quickly and accurately, the service is most benefited by data from a large array of sensors, aircraft, and other parameters. These strengths can enable the service to determine crippling weaknesses rapidly.

3.4.2 SMART BASES:

At the moment, incorporation IoT technology into army bases will have many high-quality results. Next controls and security precautions, for example, cause discomfit and lower force while benefitting safety. A network of military safety cameras tied to the particular terrain utilizing sensors and a applicable network will cease to act pitfalls and peel the also well-being of all ones in base. The advanced latent control of funding energy and water benefits the implicit concern of coverage bases while stopping that the spirits of all beings in the enclosure are an asset.

3.4.3 TRANSPORTATION:

Obtaining the supply of items, the best way to augment a company's forces so that it may perform in tip-top shape inside an efficient manner while reducing accidents and the number of business actors that needs to be contacted. Employed transport motorcar and smart detectors could be utilized to screen temperature, context and the need for airfare to assist the car recognize the best path it may take because well-being and safety of the specific goods. Smart associated devices and smart software program might be utilized to make statistics that can aid the driver use the vehicle in a reliable manner. The probability and scope of IoT in other use areas, specifically transport, can be extremely extensive in the next number of a few.

3.4.4 USE OF IOT & SENSORS IN ARMY:

Collect Battleground mindfulness in Advance Surveying the battleground the use of unmanned upstanding drones with attached cameras and detectors to collude the outlook and positions of the adversaries and transport the data to a command center. These records can help the officers in taking strategic opinions. Those drones can also be used for tone- reliant patrolling close to the borders and to warn the military labor force in case of a breach or a capability change. This

nullifies any labor force loss as they're unmanned and pose no fresh peril as they can be operated ever.

3.4.5 REAL- TIME MONITORING OF FIGHTER'S FITNESS:

Monitoring a fighter's fitness at the same time as on the battleground could be veritably elaborate. A wide variety of detectors like heart rate detector, PH detectors, strain detectors on Kevlar suite to assess the damage may be connected to the squaddies vest that can song, feel and transport pointers roughly their converting clinical condition to the command center where every fighter may be centrally covered and in mischievous situations can be pulled off from the sector or be administered clinical salutary supplements grounded completely on need.

3.4.6 TRAINING SIMULATION VIA AUGMENTED REALITY:

There may be a flight simulator for aviators who can check and get the near fleshly experience of flying the aeroplane before the use of a flight simulator. aviators need to carry out multitudinous pushes to dodge an adversary trail or break out a monitoring bullet. fleshly education for similar eventualities can be high priced to arrange and on occasion can affect in deadly injuries. Simulation is the applicable desire for training aviators in similar eventualities.

3.4.7 TARGET RECOGNITION AND AUTONOMOUS SURVEILLANCE:

AI ways are being evolved to bedeck the delicacy of thing fashion ability in complicated fight surroundings. Those strategies permit defense forces to profit from in- depth know- style of implicit operation areas by studying reports, documents, news feeds, and different types of unshaped data. also, AI in thing fashion ability systems improves the capability of these structures to come apprehensive of the placement in their pretensions. capacities of ai- enabled thing recognition structures include occasion- grounded total vaticinations of adversary conduct, aggregation of rainfall and environmental conditions, expectation and flagging of capability force line backups or vulnerabilities, examinations of charge procedures, and advised mitigation strategies. contrivance gaining knowledge is likewise used to learn, music, and discover objects from the records acquired.

- Presently, what the defence system need is high connectivity, getting real-time information and knowing situational awareness.
- As the technological capabilities of allies and adversaries advance, more pressure is put on military commanders to anticipate, assess, and act in increasingly pressurized environments and restricted timeframes.
- By integrating systems of sensors, actuators, and control systems into existing military infrastructures, the military can become more efficient and effective.
- The effect of IoT on logistics and supply chain management has been huge.
- In terms of military application, the connected sensors and digital analytics that IoT technology offers can be used to track supplies and equipment from their source to where they are needed on the battlefield.
- Automated security screening, for example, increases safety while decreasing manpower, and a network of security cameras connected to their environment via sensors will minimize security risks.
- Smart management of resources - electricity and water for example - will increase the capacity and output of military bases.
- By collecting data from a wide range of military platforms the military can increase the effectiveness of their intelligence and surveillance.
- This wealth of information will allow the armed forces to identify key threats faster and with more accuracy.
- Surveying the battlefield in advance would help the officers in taking apt decisions at right time.
- This is possible via vehicles where attached sensors sense the data and send it to the command center in real-time.

- The network-centric warfare using IoT transform the communication gateways and connected battlefield assets back to headquarters this way instant decision could be taken as easy better by officers.
- Regular maintenance of military vehicles is very important and that's done at regular intervals.
- The onboard sensors in vehicles that constantly measure and monitor engine performance.
- When any fluctuation is sensed by the sensors in engine the maintenance staff was reported.
- Best healthcare facilities are offered in the military forces, but administering soldier's health status when they are fighting on the battlefield is tricky.
- A wide range of sensors attached to soldiers clothes or wear a variable could sense the data and alert them any changes in medical condition.
- Shoot houses having cameras, motion sensors, and acoustic sensors monitor the soldiers during training exercises and send the same data to the coaches who train the soldiers.
- The data sent is kept in the form of video to view their performances.
- With Multiple Integrated Laser Engagement System (MILES) is also possible where soldiers are provided lasers mounted on the weapons.
- If laser signal touches the sensors attached on soldier's clothing and equipment, then a beeping noise is heard indicating the soldier has been "killed."
- Optimum investment is made by the military in the utilization and managements of fleets.
- Adopting IoT technologies, vehicles embedded with sensors would allow real-time GPS tracking, exhibit speed and engine status, total engine hours, fuel efficiency, and pretty more.
- According to the department of defense, Real-Time Fleet Management would reduce the fuel costs by 25 percent.
- Weapons are shipped with a great security, but manual management and update of these items into inventory is complex and less efficient.
- With every equipment, a RFID tracker is attached that alerts the concerned team on mobile that whether the item is shipped, transferred, deployed or consumed.

Extending the real time visibility would help the military to predict which items are in demand and which are in the excess.

3.5 IOT CHALLENGES

IoT improves the quality of our life, due to its numerous applications. However due to its security and privacy issues, it’s likely that it’ll be less adopted by the users. IoT has vast uses and benefits in different sectors and solves many problems, but still, it has various challenges and limitations. One of the main challenges faced by IoT is maintaining privacy and security of user’s data. IoT is a large-scale network, which includes many manufacturers, industries, and it may vary in different applications according to the user’s need. Such large-scale deployment of service, needs to be in the boundaries of a certain standard. IoT will be developed in a step-by-step procedure. Various challenges faced by IoT need to be addressed. These challenges may include power consumption, architecture challenge, heterogeneity, mobility, interoperability etc. Some of the challenges of IoT are discussed below:

3.5.1 MOBILITY

One of the major issues to implement IoT is mobility, because IoT is expected to offer services to the mobile users as well. It continuously needs to connect the users, in order to provide better services. It is unable to provide the services to the mobile users when it needs to transfer from

one gate to another. Mobility is one of the prominent characteristics of IoT devices, thus the devices need to join the nearby networks without any previous configuration. Thus, good security mechanisms need to be implemented to make the IoT devices compatible with mobility.

3.5.2 POWER CONSUMPTION

Power drainage of devices is one important challenge in IoT. IoT is concerned with how it can interlink things in a compatible fashion, while watching out for the energy constraints because communication is one of the most power consuming task. Computing is involved in every aspect of human lives, so power consumption becomes an unavoidable issue. Some mechanisms should be introduced to have IoT devices which consume less energy. In order to use the IoT devices, it's need of time that problem of storing power in devices should be solved. The energy capacity of IoT devices is limited and they have to be replaced after some time, however some devices consume a lot of power and they can't be recharged. Low bandwidth connections should be used, in order to extend the battery life.

3.5.3 SECURITY AND PRIVACY

To provide and avail services throughout the day in an IoT environment, the things and people are connected with each other. However, the communication over internet is prone to security breaches, since the devices are not equipped with good security mechanisms. Different devices are connected with each other and data is shared among them instantly, thus a mechanism is needed to ensure data integrity and confidentiality. The network of IoT not only consists of things, but also crucial data and high value gadgets which further creates hurdles to ensure security. The main issues arise due to implementation through remote clouds which are connected with other interlinked systems, user's personal data etc. In order to make IoT more usable in real world it's security issues must be solved. The IoT network is estimated to deal with a exponentially growing number of inter-connected devices. These objects will exchange information; thus, their interactions must be secure to ensure data integrity. The heterogeneous nature of IoT, where different types of devices, located at different places will interact, further makes it complex for the deployment of an efficient and scalable security algorithm

CHAPTER-4

4.1. PROPOSED SYSTEM ARCHITECTURE

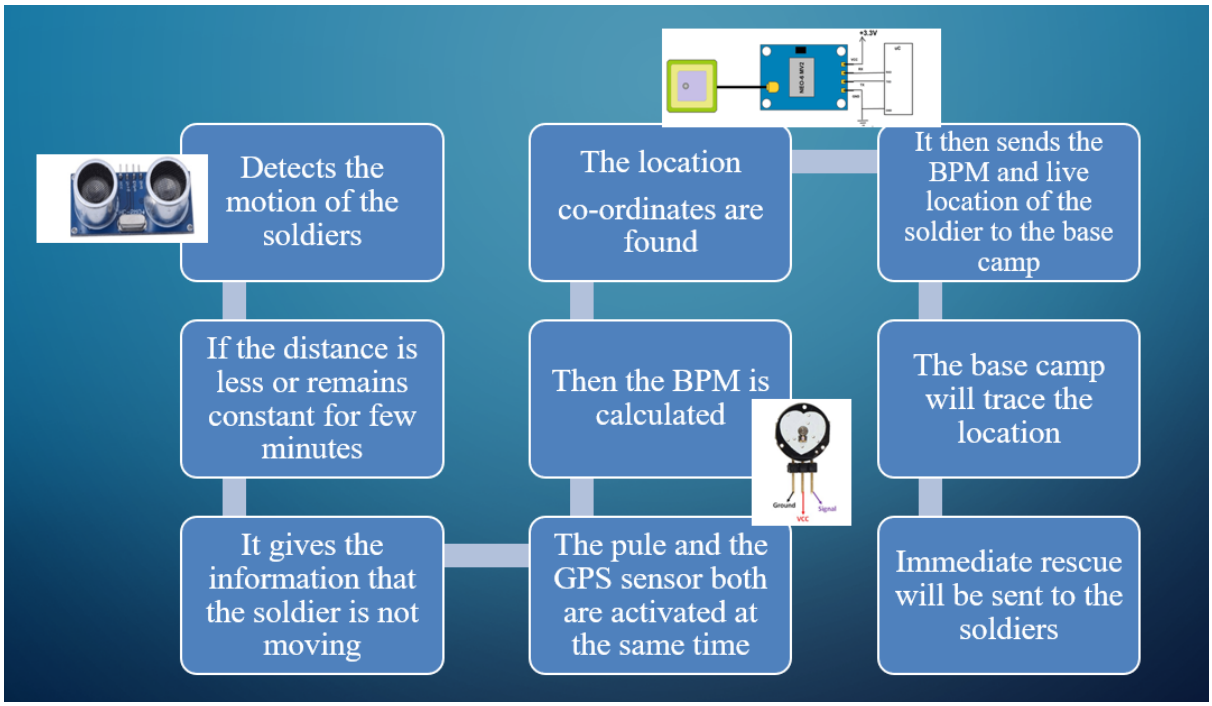

Fig-2: Proposed System Architecture

The system architecture describes how the whole mechanism works, i.e. how the device operates and show the accurate output automatically.

At first, the ultrasonic sensor activates always and measures the distance between the device and surface. While the distance measures less than 20cm, the microcontroller decides that the body has no movement, then only the whole device (the pulse sensor and the GPS module) will be activated.

Now the GPS module will determine the proper location (i.e. Latitude*Longitude) and at the same time the pulse sensor will detect the BPM (Beats per Minute) of that body. And all data will be shown in the LCD display. Finally, the operator at the base camp will be able to take appropriate decision by evaluating these data.

4.2. MODULES CLASSIFICATION

4.2.1. Arduino UNO R3

The Arduino Uno is an open-source microcontroller board based on the 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 I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available

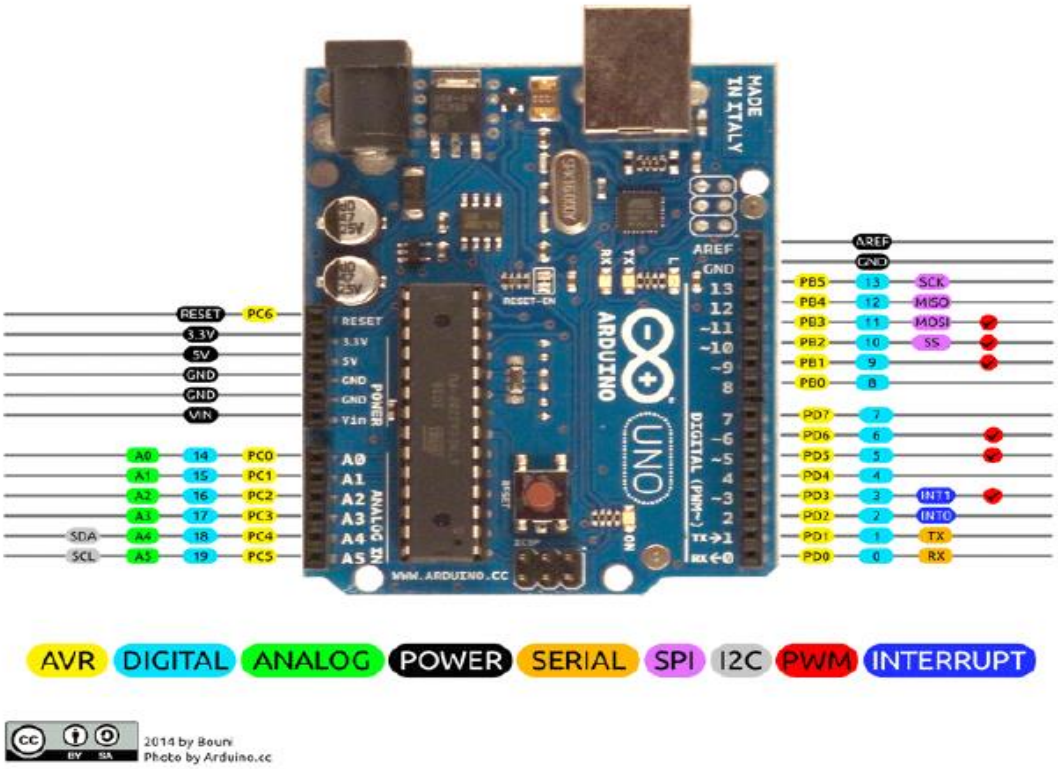

Fig-3: Arduino UNO R3

The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes pre-programmed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.
While the Uno communicates using the original STK500 protocol, it differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter

GENERAL PIN FUNCTION

- • **LED**: There is a built-in LED driven by digital pin 13. When the pin is high value, the LED is on, when the pin is low, it is off.

- • **VIN**: The input voltage to the Arduino/Genuino board when it is using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- • **5V**: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- • **3V3**: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- • GND: Ground pins.
- • **IOREF**: This pin on the Arduino/Genuine board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source, or enable voltage translators on the outputs to work with the 5V or 3.3V.
- **Reset**: Typically used to add a reset button to shields that block the one on the board

4.2.2. ULTRASONIC SENSOR

Knowing the specifications of an ultrasonic sensor helps in understanding the reliable approximations of distance measurements.

- The sensing range lies between 40 cm to 300 cm.
- The response time is between 50 milliseconds to 200 milliseconds.
- The Beam angle is around $5^{0.}$
- It operates within the voltage range of 20 VDC to 30 VDC
- Preciseness is ±5%
- The frequency of the ultrasound wave is 120 kHz
- Resolution is 1mm
- The voltage of sensor output is between 0 VDC – 10 VDC
- The ultrasonic sensor weight nearly 150 grams
- Ambient temperature is -25^0C to $+70^0$C
- The target dimensions to measure maximum distance is 5 cm × 5 cm

Fig-4: Ultrasonic Sensor

Pin Description:

Vcc – This pin has to be connected to a power supply +5V.

TRIG – This pin is used to receive controlling signals from the Arduino board. This is the triggering input pin of the sensor

ECHO – This pin is used for sending signals to the Arduino board where the Arduino calculates the pulse duration to know the distance. This pin is the ECHO output of the sensor.

GND – This pin has to be connected to the ground.

Ultrasonic Sensor working principle:

As shown above the **HC-SR04 Ultrasonic (US) sensor** is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

Distance = Speed × Time

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture below

Now, to calculate the distance using the above formulae, we should know the Speed and time. Since we are using the Ultrasonic wave we know the universal speed of US wave at room conditions which is 330m/s. The circuitry inbuilt on the module will calculate the time taken for the US wave to come back and turns on the echo pin high for that same particular amount of time, this way we can also know the time taken. Now simply calculate the distance using a microcontroller or microprocessor.

Application:

- Used to avoid and detect obstacles with robots like biped robot, obstacle avoider robot, path finding robot etc.
- Used to measure the distance within a wide range of 2cm to 400cm
- Can be used to map the objects surrounding the sensor by rotating it
- Depth of certain places like wells, pits etc can be measured since the waves can penetrate through water

4.2.3. PLUSE SENSOR

Pulse Sensor Features and Specifications

- Biometric Pulse Rate or Heart Rate detecting sensor
- Plug and Play type sensor
- Operating Voltage: +5V or +3.3V
- Current Consumption: 4mA
- Inbuilt Amplification and Noise cancellation circuit.

- Diameter: 0.625”
- Thickness: 0.125” Thick

Warning: This sensor is not medical or FDA approved. It is purely intended for hobby projects/demos and should not be use for health critical applications.

Fig-5: Pulse Sensor

PULSE CONFIGURATION

Pin Number	Pin Name	Wire Colour	Description
1	Ground	Black	Connected to the ground of the system
2	Vcc	Red	Connect to +5V or +3.3V supply voltage
3	Signal	Purple	Pulsating output signal.

Note: Complete technical details can be found in the **Pulse Sensor Datasheet** linked at the bottom of this page.

Pulse Sensor Working principle

The working of the **Pulse/Heart beat sensor** is very simple. The sensor has two sides, on one side the LED is placed along with an ambient light sensor and on the other side we have some circuitry. This circuitry is responsible for the amplification and noise cancellation work. The LED on the front side of the sensor is placed over a vein in our human body. This can either be your Finger tip or you ear tips, but it should be placed directly on top of a vein.

Now the LED emits light which will fall on the vein directly. The veins will have blood flow inside them only when the heart is pumping, so if we monitor the flow of blood we can monitor the heart beats as well. If the flow of blood is detected then the ambient light sensor will pick up more light since they will be reflect ted by the blood, this minor change in received light is analysed over time to determine our heart beats.

Applications

- Sleep Tracking
- Anxiety monitoring
- Remote patient monitoring/alarm system
- Health bands
- Advanced gaming consoles

4.2.4. GPS MODULE

The **NEO-6MV2** is a **GPS** (Global Positioning System) module and is used for navigation. The module simply checks its location on earth and provides output data which is longitude and latitude of its position. It is from a family of stand-alone GPS receivers featuring the high-performance u-blox 6 positioning engines. These flexible and cost-effective receivers offer numerous connectivity options in a miniature (16 x 12.2 x 2.4 mm) package. The compact architecture, power and memory options make **NEO-6 modules** ideal for **battery operated mobile devices** with very strict cost and space constraints. Its Innovative design gives **NEO-6MV2** excellent navigation performance even in the most challenging environments

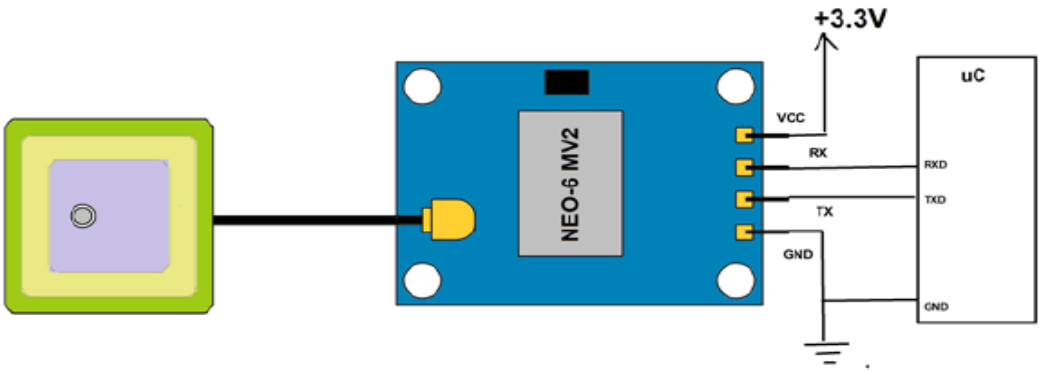

Fig-6: GPS Module

NEO-6MV2 GPS Module Pin Configuration

The module has four output pins and we will describe the function each pin of them below. The powering of module and communication interface is done through these four pins.

Pin Name	Description
VCC	Positive power pin
RX	UART receive pin
TX	UART transmit pin
GND	Ground

4.2.5. LCD DISPLAY

An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various

devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.
Command registers stores various commands given to the display. Data register stores data to be displayed. The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register. In your Arduino project Liquid Crystal Library simplifies this for you so you don't need to know the low-level instructions. Contrast of the display can be adjusted by adjusting the potentiometer to be connected across VEE pin

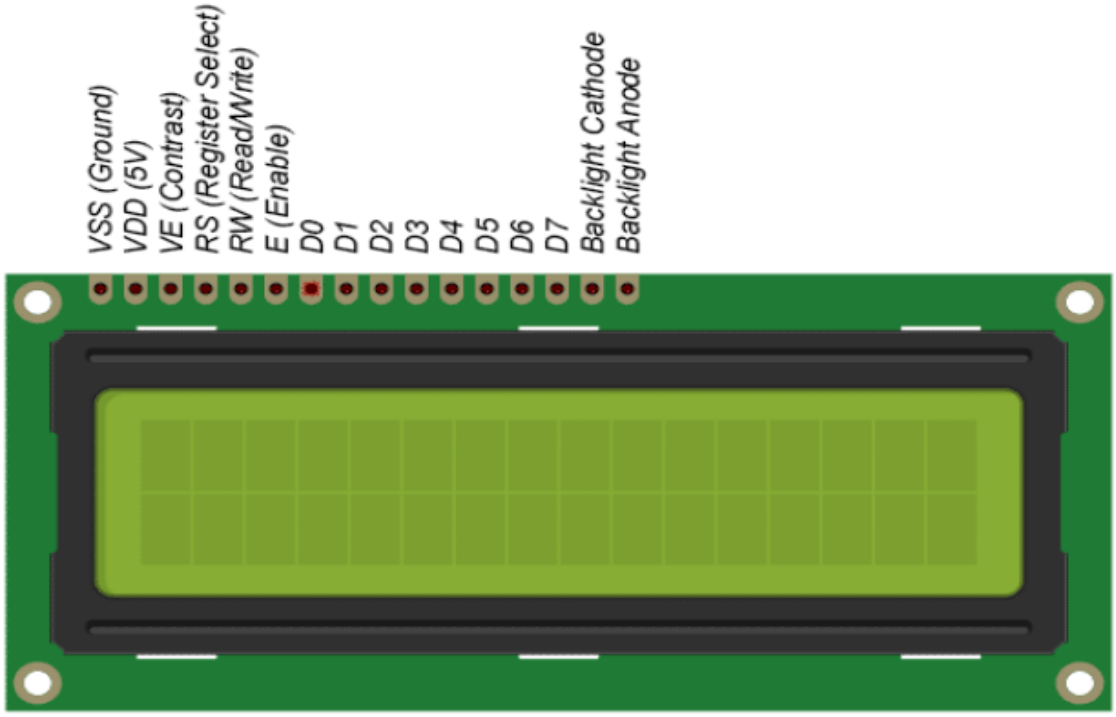

Fig-7: LCD Display

4.2.6. BREADBOARD

A **breadboard**, or protoboard, is a construction base for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used when slicing bread.[1] In the 1970s the **solderless breadboard** (a.k.a. **plugboard**, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these images. Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education. Older breadboard types did not have this property. A stripboard (Veroboard) and similar prototyping printed circuit boards, which are used to build semi-permanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs).

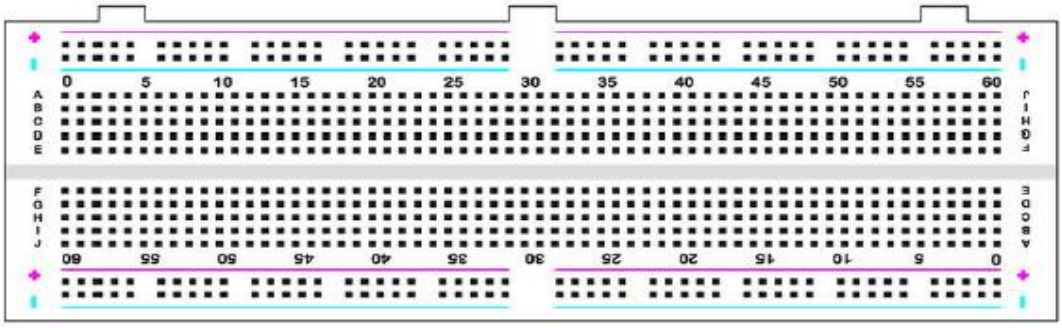

Fig-8: Breadboard

Compared to more permanent circuit connection methods, modern breadboards have high parasitic capacitance, relatively high resistance, and less reliable connections, which are subject to jostle and physical degradation. Signaling is limited to about 10 MHz, and not everything works properly even well below that frequency.

A common use in the system on a chip (SoC) era is to obtain an microcontroller (MCU) on a pre-assembled printed circuit board (PCB) which exposes an array of input/output (IO) pins in a header suitable to plug into a breadboard, and then to prototype a circuit which exploits one or more of the MCU's peripherals, such as general-purpose input/output (GPIO), UART/USART serial transceivers, analog-to-digital converter (ADC), digital-to-analog converter (DAC), pulse-width modulation (PWM; used in motor control), Serial Peripheral Interface (SPI), or I²C. Firmware is then developed for the MCU to test, debug, and interact with the circuit prototype. High frequency operation is then largely confined to the SoC's PCB. In the case of high-speed interconnects such as SPI and I²C, these can be debugged at a lower speed and later rewired using a different circuit assembly methodology to exploit full-speed operation.

4.2.7 JUMPER WIRES

A jumper wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Fig-9: Jumper Wires

Individual jumper wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment

CHAPTER-5

5.1. WORKING PRICIPLE

- In the war field it is difficult to find out the status of every individual, as it is not possible to reach each one of them.
- As what the defence system need is high connectivity, getting real-time information and knowing situational awareness will help in saving many lives if rescue is provided at the proper time.

This IoT device will be installed in the band of every soldiers so that their information will be updated in the system from time-to-time.

5.2. FLOW CHART

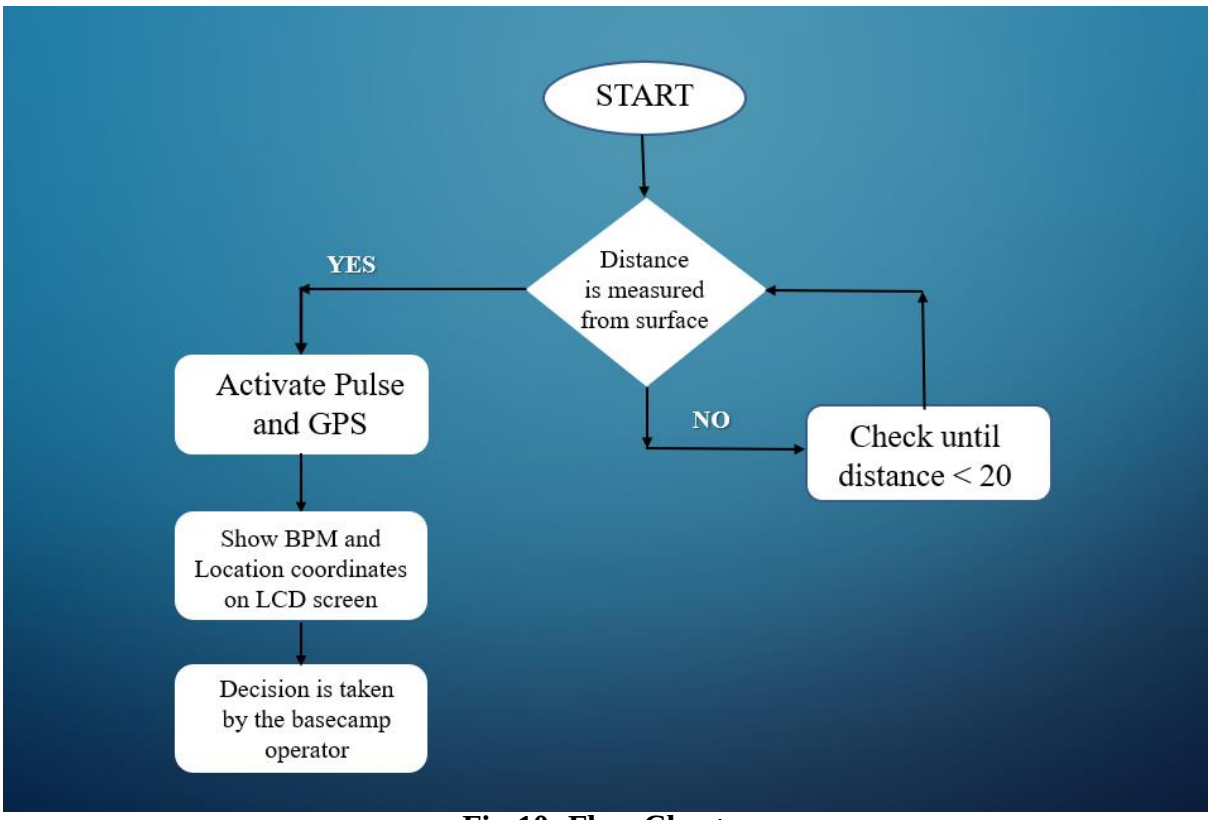

Fig-10: Flow Chart

5.3. SOFTWARE USED:

5.3.1 ARDUINO IDE

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.

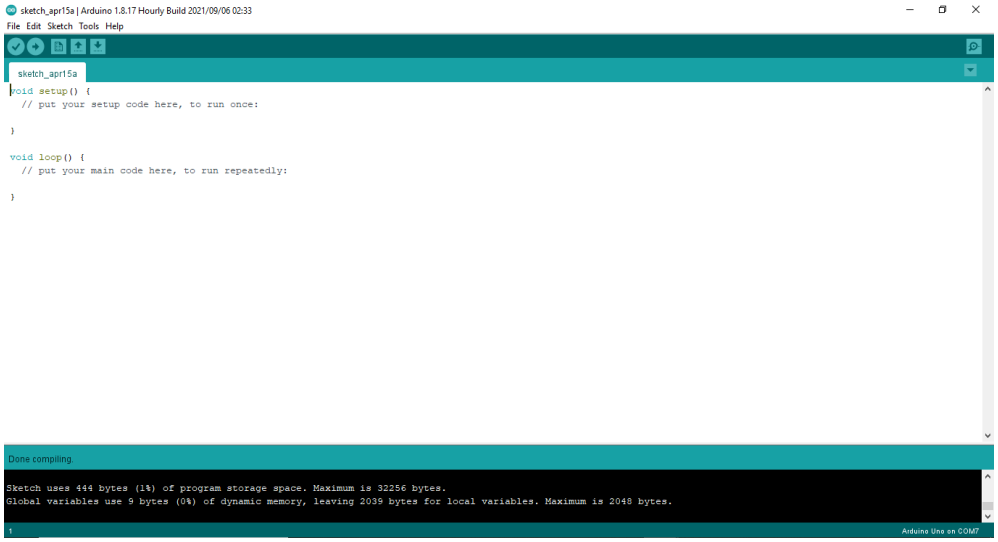

Fig-11: Arduino IDE

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.

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

5.3.2 PROTEUS SOFTWARE

Proteus is a simulation software used to simulate components and is capable of drawing desired circuit. It is being used for fast checkup of code you have written for microcontrollers. Proteus have huge list of components and many libraries available which can be added to include more components.

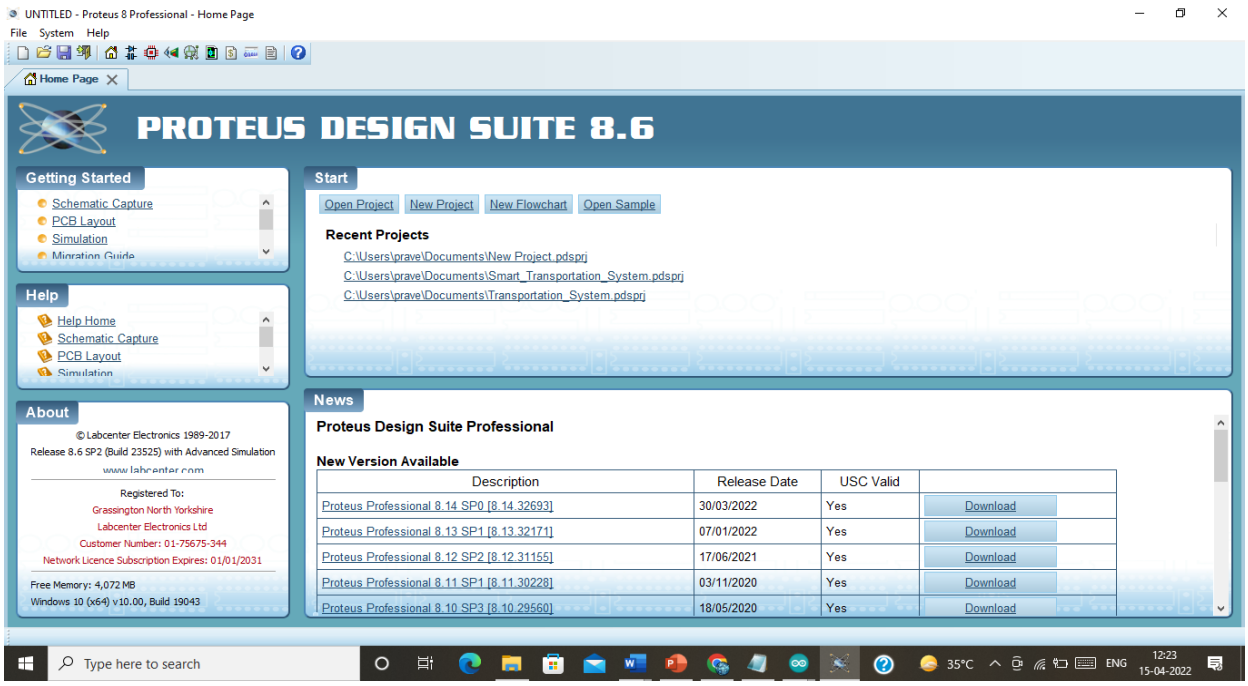

FIG-12.: Proteus Software

5.4. CIRCUIT DIAGRAM

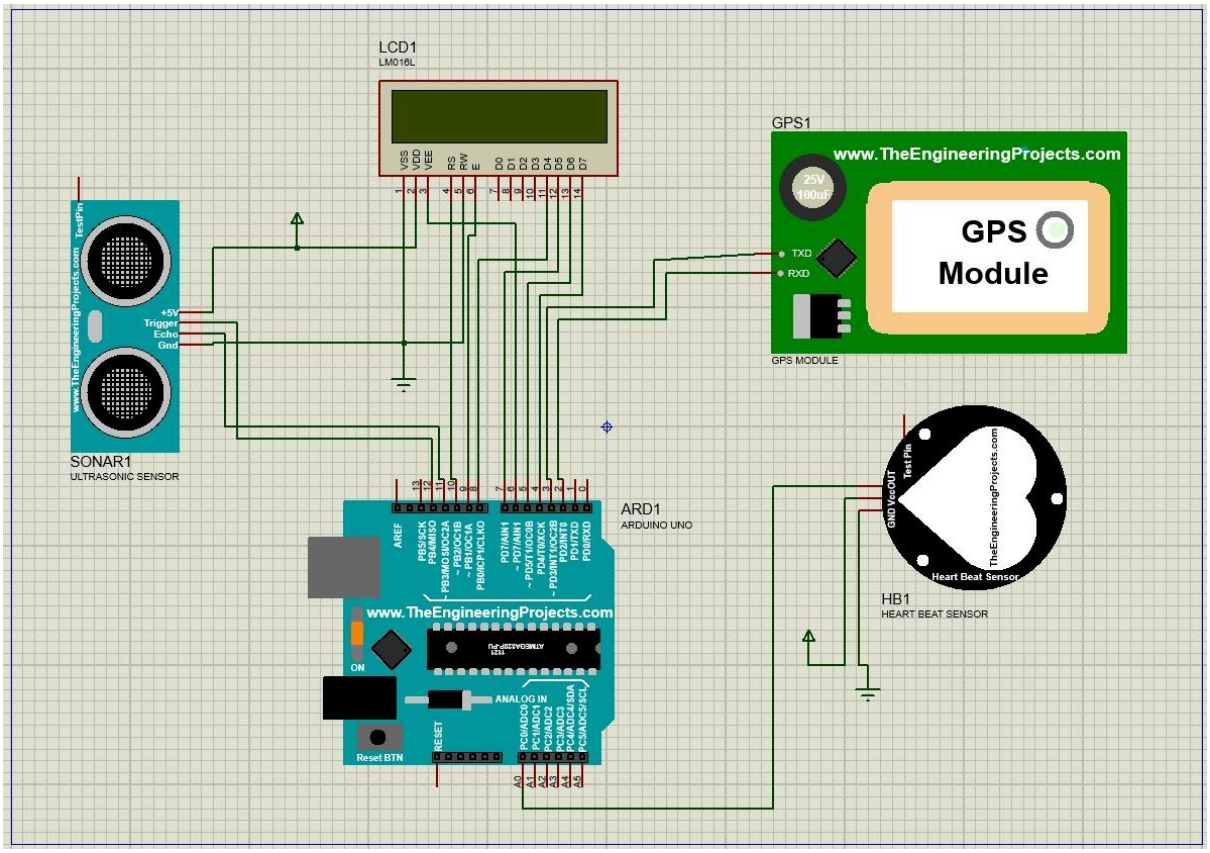

Fig-13: -Circuit Diagram

5.5. SOURCE CODE

```
#define USE_ARDUINO_INTERRUPTS true  // Set-up low-level interrupts for most acurate BPM math.
#include    <PulseSensorPlayground.h>          //    Includes    the PulseSensorPlayground Library.
#include <TinyGPS++.h>
#include <SoftwareSerial.h>
#include <LiquidCrystal.h>

LiquidCrystal lcd(10, 9, 8, 7, 5, 4);  // Declare digital-pins for LCD display
const int PulseWire = 0;                 // PulseSensor PURPLE WIRE connected to ANALOG PIN 0
const int LED13 = 13;                   // The on-board Arduino LED, close to PIN 13.
int RXPin = 2;
int TXPin = 3;                          // 2 & 3 pins are connected to RX & TX of NEO-6M module respectively

SoftwareSerial gpsSerial(RXPin, TXPin);   // Create a software serial port called "gpsSerial"
PulseSensorPlayground pulseSensor;  // Creates an instance of the PulseSensorPlayground object called "pulseSensor"
TinyGPSPlus gps;                    // Create a TinyGPS++ object
int Threshold = 550;                    // Determine which Signal to "count as a beat" and which to ignore.
                                        // Use the "Gettting Started Project" to fine-tune Threshold Value beyond default setting. Otherwise leave the default "550" value.
int dist = 0;  // dist hold the distance value measured by Ultrasonic Sensor

void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
  gpsSerial.begin(9600);
  lcd.begin(16, 2);
  analogWrite(6, 80);
  // Configure the PulseSensor object, by assigning our variables to it.
  pulseSensor.analogInput(PulseWire);
  pulseSensor.blinkOnPulse(LED13);  //auto-magically blink Arduino's LED with heartbeat.
  pulseSensor.setThreshold(Threshold);
}
void loop() {
  dist = 0.01723 * readUltrasonicDistance(12, 11);
  if (dist < 20) {
```

```
    if (pulseSensor.sawStartOfBeat()) {            // Constantly test
to see if "a beat happened".
      int myBPM = pulseSensor.getBeatsPerMinute();  // Calls function
on our pulseSensor object that returns BPM as an "int".
                                                    // "myBPM" hold
this BPM value now.
      lcd.setCursor(0, 0);
      lcd.print("BPM: ");  // Print phrase "BPM: "
      lcd.setCursor(6, 0);
      lcd.print(myBPM);  // Print the value inside of myBPM.
    }
    else{
      // lcd.setCursor(0, 0);
      // lcd.print("No Pulse");
    }
    // This sketch displays information every time a new sentence is
correctly encoded.
    while (gpsSerial.available() > 0)
      if (gps.encode(gpsSerial.read()))
        displayInfo();

    // If 5000 milliseconds pass and there are no characters coming
in
    // over the software serial port, show a "No GPS detected" error
    if (millis() > 5000 && gps.charsProcessed() < 10) {
      lcd.setCursor(0, 1);
      lcd.print("No GPS detected");
      while (true)
        ;
    }
  }
   delay(1000);   //  Delay  a  little  bit  to  improve  simulation
performance
}

long readUltrasonicDistance(int triggerPin, int echoPin) {
  pinMode(triggerPin, OUTPUT);  // Clear the trigger
  digitalWrite(triggerPin, LOW);
  delayMicroseconds(2);
  // Sets the trigger pin to HIGH state for 10 microseconds
  digitalWrite(triggerPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(triggerPin, LOW);
  pinMode(echoPin, INPUT);
  // Reads the echo pin, and returns the sound wave travel time in
microseconds
  return pulseIn(echoPin, HIGH);
}
```

```
void displayInfo() {
  if (gps.location.isValid()) {
    lcd.setCursor(0, 1);
    lcd.print(gps.location.lat(), 6);
    lcd.setCursor(6, 0);
    lcd.print("x");
    lcd.setCursor(7, 1);
    lcd.print(gps.location.lng(), 6);
  }
}
```

5.6 CODE EXPLANATION

Here we are going to explain about the functionality of the project, how it works by code to execute the function of The Quick Rescue Operation in War-Field using IoT Wearable.

The sketch begins by including the TinyGPS++ library, the SoftwareSerial library, PulseSensorPlaygroound library and LiquidCrystal library to support the sensors and actuator used here.

```
#include <PulseSensorPlayground.h>
#include <TinyGPS++.h>
#include <SoftwareSerial.h>
#include<LiquidCrystal.h>
```

Then mentioned digital pins and analog pins are alerted to the respective sensor and LCD display.

```
LiquidCrystal lcd(10, 9, 8, 7, 5, 4);
const int PulseWire = 0;
const int LED13 = 13;
int RXPin = 2;
int TXPin = 3;
```

To use these libraries, we create objects like “gps” for TinyGPSPlus library and “pulsesSensor” for PulseSensorPlayground.

```
PulseSensorPlayground pulseSensor;
TinyGPSPlus gps;
```

In the setup function, we initiate the serial communication with microcontroller as well as with the NEO-6M module and Pulse Sensor.

```
void setup() {
  Serial.begin(9600);
  gpsSerial.begin(9600);
  lcd.begin(16, 2);
  analogWrite(6, 5);
  pulseSensor.analogInput(PulseWire);
  pulseSensor.blinkOnPulse(LED13);
  pulseSensor.setThreshold(Threshold);
}
```

In the loop function, the `readUltrasonicDistance(12, 11)` function which measures the distance between the device and surface. While the distance is less than 20cm, then `pulseSensor.getBeatsPerMinute()` function evaluate the BPM (Beats per Minute) value and the `displayInfo()` function gives the live location information (latitude and longitude) by using two relevant functions such as `gps.location.lat()` and `gps.location.lng()`. These two data are shown in the used LCD display.

```
void loop() {
  dist = 0.01723 * readUltrasonicDistance(12, 11);
  if (dist < 20) {
    if (pulseSensor.sawStartOfBeat()) {
      int myBPM = pulseSensor.getBeatsPerMinute();
      lcd.setCursor(0, 0);
      lcd.print("BPM: ");
      lcd.setCursor(6, 0);
      lcd.print(myBPM);
      delay(200);
    }
    while (gpsSerial.available() > 0)
      if (gps.encode(gpsSerial.read()))
        displayInfo();
  }
  delay(1000);
}
```

It's all about the working principle of the present project mechanism.

CHAPTER-6

6.1. RESULTS AND DISCUSSION

Sr.No.	Movement	BPM	GPS CO-ORDINATES	ACTION REQUIRED
1.	Happen	-	-	NO
2.	Not Happen	238	20.5506x85.9977	YES
3.	Not Happen	30	20.5506x85.9978	YES
4.	Happen	-	-	NO
5.	Not Happen	82	20.5507x85.9978	YES
6.	Not Happen	43	20.5508x85.9981	YES

Fig-14: Results Table

6.2. MODEL SNAPSOT

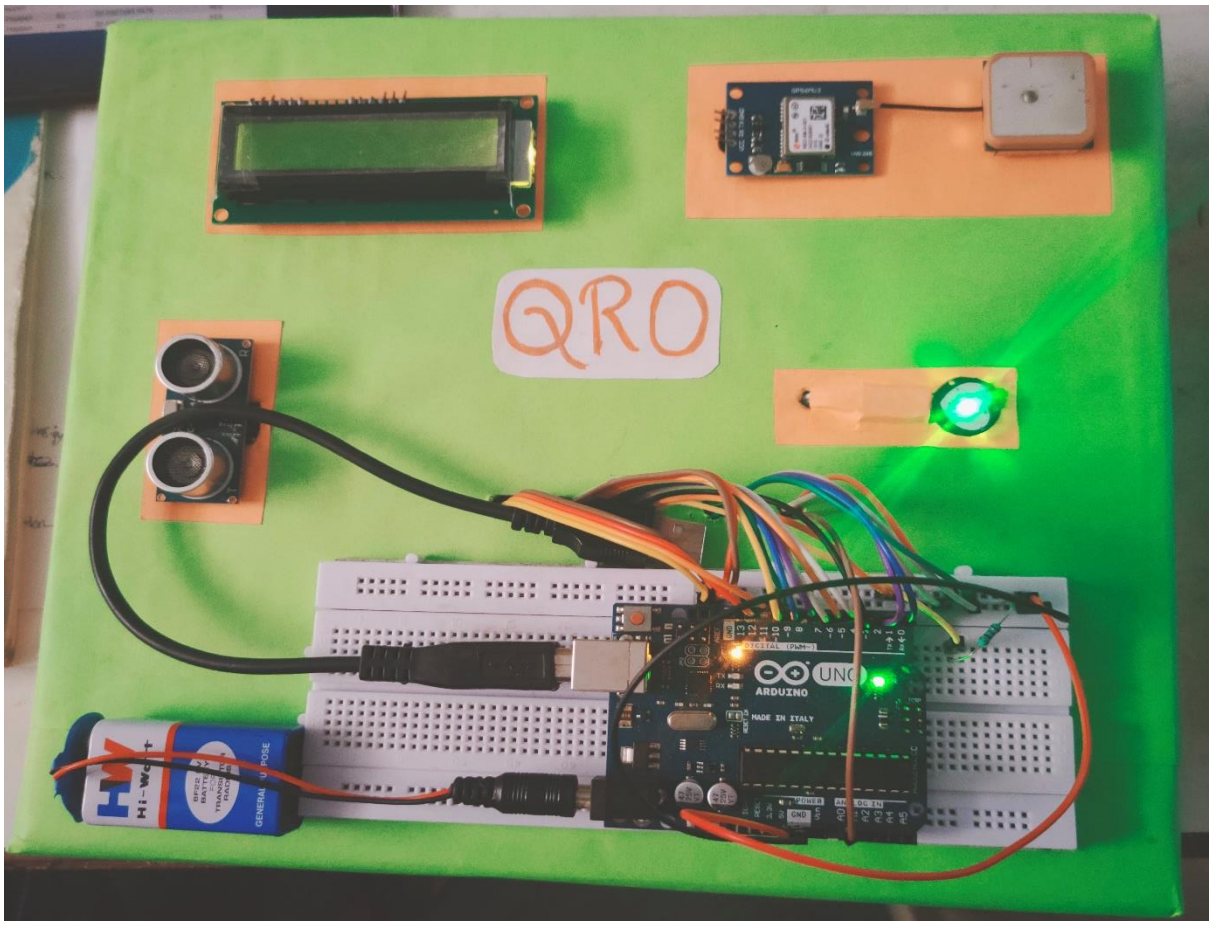

Fig-15: Working Model

6.3. ADVANTAGES:

This new IoT technology is similar to other advance system. This is designed for invasion warhead to do tackle the people.
First of all, it more helpful to the Army defense to track the allies and get the details.
This Model contains GPS module, which helps to find the exact location of a person.
Model also contains pulse sensor which helps to check the heartbeat of the person which will trigger the GPS sensor.
It is specially recommended to the mountain climber to locating their position.
If a person stuck in a avalanche then we can easily rescue them.
In case of war like situation, this device will help to find the injured or dead soldier.
It's just easy to wear like watch.

6.4. DISADVANTAGES:

We designed a prototype model which is experimental. It hasn't yet tested for the real-world implementation. There is some several problems occur in the design. Let's see this problem.
While the GPS module will connect to the network, weather should be clean. Otherwise, the gps module is not able connect to the satellite and we don't get any information about person who carry it.
The Ultrasonic sensor is the 1st important role which triggered all the part of the device. If the accurate value will not give or infinite value (distance from the ground), then the next functionality will not triggered. But somehow the GPS sensor will available every time.
Model should be designed proper way that the ultrasonic sensor will triggered at exact point.
Pulse sensor may or may not work properly if position is not at exact point where we can get the pulse rate.

CONCLUSION AND FUTURE SCOPE

This project aims on the use of Ultrasonic sensor, Pulse sensor and GPS module by connected to the Arduino UNO R3 board and the data from the sensors further provided to the LCD screen as well as detecting the movement and the pulse rate of the body of the subject to decide requirement of any rescue operation for the subject. The GPS module further helps to reach the exact location of the subject. Finally, we conclude that this project is contribute towards the safety and security of our incredible army soldiers at any type of war or extreme situation.
This project is the basic mechanism for this problem-solving statement. We have more scope to improve or enhance this project by attaching some extra functionalities discussing below:

- One is Gyroscope sensor; it is a device that is used to maintain the angular velocity of an object. We use it to overcome the problem when distance is going to starvation.
- A CAM module and a Thermopile IR Temperature sensor will be appending to detect the living objects near to the subject.
- And finally, a database or cloud will used to store and maintain all the data send by the device. It also helps for future investigation on those data.

This device is not only for the soldiers but also for any alternatives such as the mountain climbers, etc.

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