Development And Fabrication Of Solar Based E-Uniform Kit For Soldiers

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***Abstract*— This project's purpose is to provide low-cost, low-power, dependable, non-intrusive, and non-invasive health status indicators. Longitudes and latitudes are used to track the soldier's whereabouts. This project's methodology is to employ non-invasive sensors to monitor heart rate and body temperature while maintaining a comfortable temperature. Signal conditioning circuits filter and amplify signals in order to produce the desired output. The circuit's components are all low-power and low-cost. The data is collected in real time and delivered to the microcontroller. This project is beneficial not only to warriors, but also to trekkers who are in a similar situation.**

I. INTRODUCTION

1.1 Motivation

Encourage the introduction of IoT in Soldiers and military operation and to track and health monitoring of soldiers using solar power.

1.2 Aim and Objective

The objective of this work is to design and fabricate a corpse locating submarine to find submerged corpse in muddy water. This aim is achieved through following objectives:

1. To perform conventional designing task of the jacket keeping in mind the positioning and structure so that the components can be installed easily.
2. To calculate and finalize the size, structure and cost of the actual jacket as per the parameters considered in conventional design.
3. To test the components so as to check whether it works or not and to detect flaws in it.
4. To reconstruct the flaw making parameter and develop the project.
5. To check the feasibility of developed solar based jacket for health monitoring, tracking and temperature control.

1.3 Problem Definition

A Solar based Jacket with systems embedded in it will be precise for location tracking nad health monitoring. But the systems required such as GPS tracker, Heart beat sensor, Temperature sensor, heating and cooling system etc.. are high in cost. The tracking watch giving a perfect location tracking and health monitoring costs between Rs25000 to 40000. The heating and cooling system for temperature control will cost more than Rs10000. This shortcoming was taken into consideration and a prototype was developed involving the cheapest equipment available as per the constrained budget. The prototype was installed with GPS sensor, Peltier plate, a temperature sensor and a buzzer . The main field of application are for soldier in battlefields i.e. around the borders where soldiers are stationed and also for trekkers climbing long isolated mountains. The limitation would be that it cannot function in excessive heat as heat dissipation is not proper.

1.4 Features Of E-Jacket

With this in mind, the project's focus is on a solar-powered E-jacket that can aid soldiers in tracking, health monitoring, and temperature control. The suggested E-jacket will be solar powered and will assist in tracking, health monitoring, and temperature control through the use of accessories such as GPS, a heart rate sensor, a temperature sensor, and a micro-controller. The soldier's whereabouts will be determined thanks to the GPS system that has been installed. Temperature data will be provided via the temperature sensor. The soldier's heart beat data will be collected using a heartbeat sensor. This information will be passed to the micro controller. The data will be collected by the micro controller and sent

to the base through WIFI. The Peltier plate will aid in the jacket's heating and cooling. The emergency button will send data to the base for assistance. The data will be displayed on the LCD. The microprocessor and other components are powered by a solar panel.

1.5 Report Summary

The main aim of the project is to develop a jacket which is less in weight, has low cost and easily mobile. Taking this into consideration designing was proceeded. This report mainly focuses on the development of our project. This is main reason for our project to come into existence. It also emphasize the main motivation, objectives of our project. We also recites all the previous information of the project. It also provides information about the details and properties of components and consideration taken for manufacturing the submarine. This tells about IoT and Blynk. Block diagram shows the designing and aspect of calculations for the submarine in 3D model. This paper explains the fabrication of Jacket and review the results obtained at various aspects. It indicates the development that can be done on E-Jacket and future scope of the submarine developed and discusses the conclusion and future scope of the project.

II. LITERATURE SURVEY

A. Background

Jasvinder Singh, et al., [1] proposed Global Positioning System (GPS) and Internet of Things (IoT) based soldier positioning and health signal system in 2019. Nonstop communication is possible. soldiers can communicate anywhere, which can help soldier to communicate among their other soldier whenever in need. Simple circuit and less power needed, use of low power needing peripherals and ARM processor lower the total power usage of module. Peripherals used are smaller size and also has low weight so that can be carried around safety and security for soldiers. GPS trace location of soldier anywhere on globe also health system monitors so soldiers important health parameters which gives safety and security for soldiers.

In 2018, Niket Patil et al. [2] proposed a health monitoring and tracking system for soldiers. The system is based on IoT technology and involves a module that can be attached to a soldier's body to monitor their health status and track their location using GPS. The collected data is transmitted to the base station through IoT. This module enables the development of a low-cost circuit to safeguard the lives of soldiers on the battlefield.

In 2018, William Walker A. L. et al. [3] proposed a mobile health monitoring system for soldiers. The authors discussed various wearable biosensors that have been developed for monitoring soldiers' health status. These sensors, including heart rate, temperature, and gas sensors, are portable, lightweight, and small in size, making them suitable for real-time health condition monitoring. The authors suggest a methodology for developing a system for real-time health monitoring of soldiers, which involves interconnected body sensor networks (BSNs).

In 2018, Akshay Gondalic et al. [4] developed an IoT-based healthcare monitoring system using machine learning for war soldiers. This system allows the army base station to monitor soldiers' medical conditions and track their location using sensors such as GPS, temperature, and heart rate sensors. The sensor and GPS data are wirelessly transmitted using the ZigBee system to other soldiers, while a LoRaWAN network system is recommended for communication between the leader and the base station in war zones where cellular network coverage is limited. The collected data is then uploaded to the cloud for further analysis and prediction using the K-means clustering algorithm.

In 2017, Afef Mdhaffar et al. [5] proposed a work on IoT-based health monitoring using LoRaWAN. The collected biosensor data is transmitted to an analysis module through low-cost, low-power, and secure communication using the LoRaWAN network framework. This system measures heart rate, temperature, and glucose levels in rural areas where cellular network coverage is either absent or does not allow data transmission. The LoRaWAN network framework is claimed to cover an average area of around 33km when the LoRaWAN gateway is placed outdoors at a height of 12 meters. .

III. BLOCK DIAGRAM

The NodeMCU, a microcontroller board, receives voltage input from a regulator connected to a 12V lead acid battery. The NodeMCU is used to interface with sensors while the Peltier plate, a type of thermoelectric cooler, is directly connected to the battery. An Emergency Key is also linked to the NodeMCU for additional control or functionality.

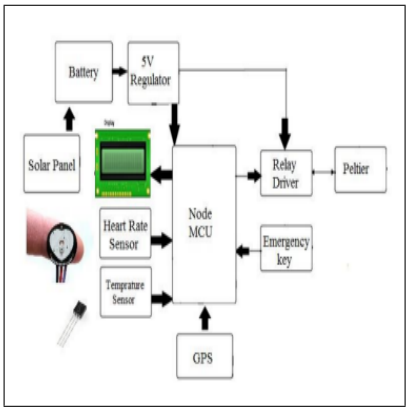

Fig. 1. Block Diagram

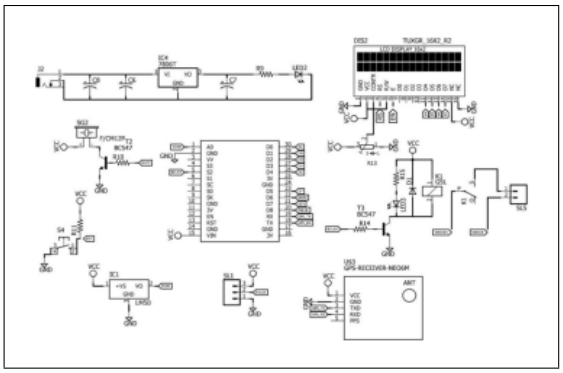

Fig. 2. Circuit Diagram

IV. SYSTEM IMPLEMENTATION

A. Neo GPS

GPS receivers use trilateration to determine their location on Earth by calculating their distance from multiple GPS satellites. The GPS system consists of a network of satellites that transmit information about their position and the current time via radio signals towards the Earth. GPS receivers are pre-programmed to know the location of the GPS satellites at any given time. The GPS receiver then uses the information from the satellites to calculate its distance from each of them by measuring how long it took for the signals to arrive. By combining the distance information from at least three satellites and their positions in space, the receiver can determine its exact location on Earth. This process of using distance information from multiple satellites to determine a location is called trilateration. GPS receivers can also use this information to calculate other variables such as speed and direction of travel.

B. Peltier plate

Thermoelectric coolers utilize the Peltier effect to create a temperature differential by transferring heat between two electrical junctions. An electric current is generated by applying a voltage across the joined conductors. As the current flows through the junctions of the two conductors, one junction removes heat, resulting in cooling, while the other junction deposits heat. Heat absorption: Cooling occurs when a current passes through one or more pairs of elements from nto p-type; there is a decrease in temperature at the junction (“cold side”), resulting in the absorption of heat from the environment. The heat is carried along the elements by electron transport and released on the opposite (“hot”) side as the electrons move from a high- to low-energy state.

C. Heart beat sensor

An optical heart rate sensor utilizes the PPG (photoplethysmography) technique to detect changes in the volume of a blood vessel caused by the heart pumping blood. It consists of an optical sensor and a green LED that emits light through a tissue, such as a finger or earlobe. The amount of light absorbed by the blood depends on the blood volume in that tissue, and the transmitted or reflected light is received by the sensor. An optical filter optimized for pulse wave detection minimizes the effects of ambient light. The sensor output is an electrical signal proportional to the heartbeat rate.

D. Blynk

Blynk is a platform that enables users to create interfaces for controlling and monitoring hardware projects from their iOS or Android device. The Blynk app can be used to create a dashboard and add various widgets such as buttons, sliders, and graphs. These widgets can be used to turn pins on and off or display data from sensors. Blynk is specifically designed for the Internet of Things and can control hardware remotely, store and visualize data, and perform other functions. The platform is made up of three major components:
1. Blynk App - Allows to you create amazing interfaces for your projects using various widgets we provide.
2. Blynk Server - Responsible for all the communications between the smartphone and hardware. User can use Blynk Cloud or run private Blynk server locally. It’s open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.
3. Blynk Libraries - For all the popular hardware platforms - enable communication with the server and process all the incoming and outcoming commands.

V. PROBLEM DEFINATION AND METHODOLOGY

A Solar based Jacket with systems embedded in it will be precise for location tracking nad health monitoring. But the systems required such as GPS tracker, Heart beat sensor, Temperature sensor, heating and cooling system etc.. are high in cost. The tracking watch giving a perfect location tracking and health monitoring costs between Rs25000 to 40000. The heating and cooling system for temperature control will cost more than Rs10000. This shortcoming was taken into consideration and a prototype was developed involving the cheapest equipment available as per the constrained budget. The prototype was installed with GPS sensor, Peltier plate, a temperature sensor and a buzzer . The main field of application are for soldier in battlefields i.e. around the borders where soldiers are stationed and also for trekkers climbing long isolated mountains. The limitation would be that it cannot function in excessive heat as heat dissipation is not proper.

Flow diagram of Methodology followed throughout the project is presented in following.

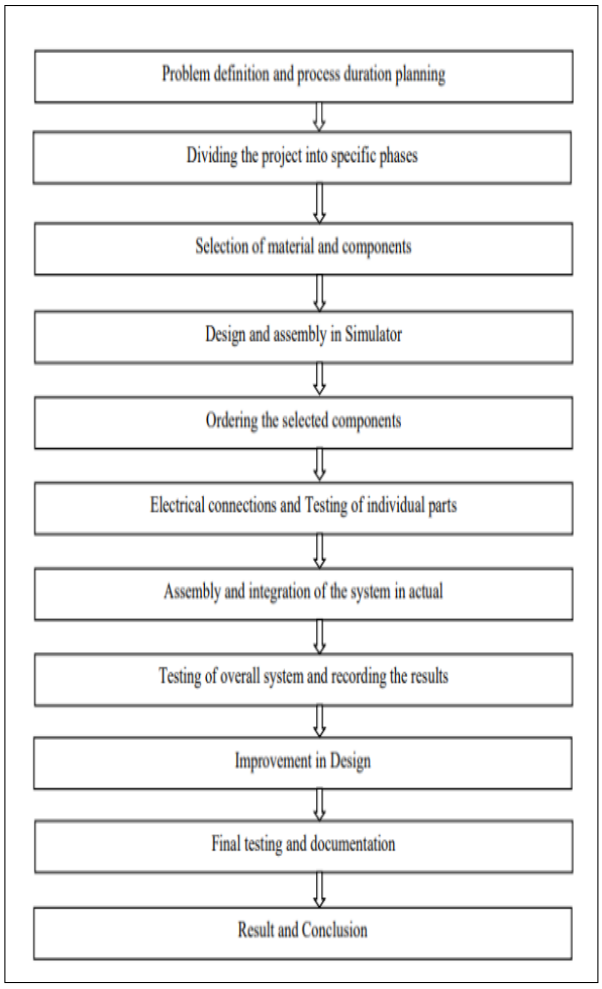

Fig. 3. Methodology

VI. RESULT AND ANALYSIS

1. The functioning of circuit was proper and the output received was satisfactory. The power switch turned on circuit fail without any fail. Voltage regulator provided suitable voltage output to the NodeMCU.
2. The electrical connection perfectly executed the working of E-Jacket. The circuit operated two Peltier plate without any fail.
3. The heating received from the Peltier plate was satisfactory but cooling was not desirable.
4. The data from the sensor(GPS, heartbeat, Temperature) are successfully collected and transferred to microcontroller. The programme of NodeMCU is successfully executed.
5. The data from the sensors are displayed on the LCD without any issue. The buzzer sound is also activated at proper time.
6. The working of Blynk app is proper and the communication of NodeMCU with the server is also working properly. The values of the sensor are sent to the email-id without any issue.
7. The emergency button provided also sends the required data to the email-id on being pressed.
8. The charging of the battery with solar plate is also working properly. The circuit is fixed on to the board.

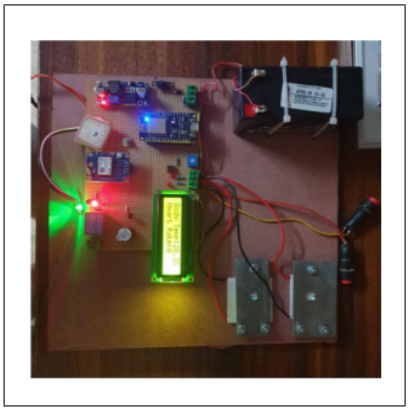

Fig. 4. Working Circurt

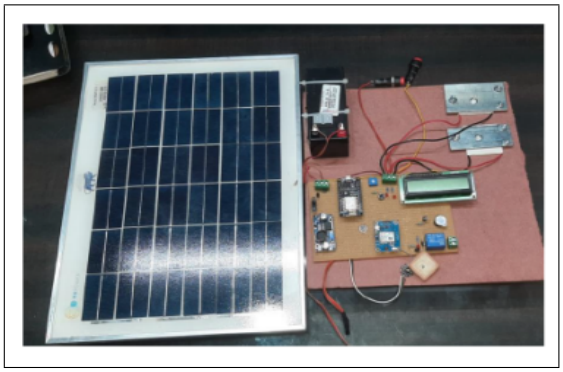

Fig. 5. Circuit Design

VII. CONCLUSIONS

The objective of this project was to create a solar-powered E-jacket from scratch. To achieve this goal, the appropriate parts and components had to be sourced and correctly assembled. This aspect of the project required significant time and effort. While there were some issues that arose during the development process, most of them were resolved.

However, there is still room for further improvements to be made. Despite not having all of the intended features, the E-Jacket is currently operational. As a result, the primary aim of constructing and controlling the E-Jacket can be regarded as successful. The first thing that was carried out for completion of the project was to study of various sensor and communication of the sensor data with base was studied and how can the jacket be heated and cooled to maintain desirable temperature. A detailed study led to the conclusion that IoT can be used for sensor and communication and Peltier plate for heating and cooling.

The first order of installing those Sensor was to install the NodeMCU. The various sensor connected to the microcontroller provide various real time data of soldier

and surrounding . It will help the base for locating and help him in any emergency . But the installed sensors is not so sensitive and can take a lot of time to read data. This can be further improved by adding high quality sensors. There is also space for any mechanism that can be attached to the jacket in future.

The sensor used in the E-Jacket are of lowest price available the market. The scope of the E-jacket to collect data can be improved by installing high end sensors available that gives real time imaging of reservoir bed, the only drawback would be the price of such sensors.

During the development it was found out that it can also be used by trekkers who also remain to some extent in same condition in as that of soldiers. These E-jacket can help them to send their data to respective base camps during trek and can help them in maintaining desirable temperature inside. The main advantage of this E-Jacket is it is solar powered which can help trekkers.

Fig. 6. Working Jacket

Fig. 7. Blynk APP

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