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SOLAR AND IOT BASED HEALTH MONITORING AND POSITION TRACKING FOR SOLDIERS

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Abstract - *This paper presents a solar and IoT-based health monitoring and position tracking system for soldiers, which utilizes solar energy to power the system and IoT technology to monitor and track the soldier's health and position in real-time. The proposed system comprises a wearable device, a solar panel, and an IoT-based platform. The wearable device is equipped with sensors to monitor the soldier's health parameters, including heart rate, blood oxygen and body temperature. The solar panel provides a sustainable and reliable power source for the wearable device, ensuring continuous operation in the field. The IoT-based platform receives data from the wearable device. Additionally, the platform provides real-time tracking of soldier's positions using GPS technology, enabling commanders to monitor the soldier's movements and make informed decisions based on their current location. The proposed system has the potential to enhance soldier's safety and well-being, as well as improve their overall performance in the field.*

***Key Words*: Solar Power, Internet of Things (IOT), Health Monitoring, Position Tracking, Biometric sensors, GPS Tracking**

1. INTRODUCTION

Soldiers play a vital role in safeguarding a country's security. However, they operate under challenging conditions that can have detrimental effects on their health and well being. Hence, it is essential to ensure that soldiers' health is continuously monitored, and their positions tracked to ensure their safety. With the advancements in technology, the integration of the Internet of Things (IoT) and solar power can provide an efficient, cost-effective and sustainable solution to this challenge. This paper discusses the concept of a solar and IoT-based health monitoring and position tracking system for soldiers.

This project has associate implementation of tracking the soldier and to navigate between soldiers like obtaining their rapidity, distance, their health status throughout the fighting that permits the military decision makers to set up the war strategies. Base unit acquires location of soldier with the help of GPS. The responsibility of base station operators is to help the soldiers in choosing right path, if there is a threat of missing of soldiers. The base unit will contact this standing of the soldier that is exhibited on the computer. Hence, they can yield instant action by directing assistance for the soldier requested by soldiers having soldier unit. By the use of number of biometric sensors, health constraints of soldiers are monitored, the location and placement of soldier is confined by the use of GPS module.

2. OBJECTIVE

The main objective of this project is to improve the overall health, safety, and effectiveness of soldiers in the field. The system would use solar power to operate, making it self-sufficient and sustainable, while IoT sensors would provide real-time data on the soldier's health and location.

Specifically, the system would aim to achieve the following objectives:

1. **Monitor soldier's vital signs:** The IoT sensors would monitor soldier's vital signs, such as heart rate, blood oxygen, and body temperature, to detect any health issues early on and provide timely medical assistance.

2. **Track soldier's location:** The system would track the location of soldiers, ensuring that commanders have a real-time view of where their troops are located. This information would be valuable in emergency situations, such as combat or natural disasters.

3. **Enhance situational awareness:** The system would provide commanders with a better understanding of the health and location of their troops, which would help them make informed decisions during operations.

4. **Improve response times:** By providing real-time data, the system would help medical personnel respond quickly to health emergencies.

3. PROPOSED SYSTEM

The proposed method consists of Hardware Section & Software Section in which hardware section is divided into sensors, interfacing, display, power supply and Arduino UNO

microcontroller whereas software section consists of internet, web server, hardware programming, and server-side scripting & database for storage information of Soldier's Health. In this project, the solar array of rating 8V mono crystalline type solar panel is used to generate electricity or be stored in batteries.

When the soldier carries the device, then GPS module, IoT module, heartbeat and temperature sensors get activated and monitors the location, heart rate and body temperature of the respective soldier. If the heart rate increases or decreases than the normal heart rate of the human being or if the body temperature increases or decreases than the normal body temperature of the human beings or if the heart rate and body temperature is in normal condition but the soldier is in abnormal condition i.e; if the soldier has been captured by the enemies or he dislocated in the enemies base camp then he will press the danger switch then the indication goes to the base camp via alarm or any indicator then the officials take necessary action to safeguard them.

4. SENSORS USED

4.1 HEART RATE SENSOR

Fig -1: Heart Rate Sensor

The MAX30100 is a compact, integrated pulse oximetry and heart-rate sensor module. It uses two LEDs (one red and one

infrared) and a photodetector to noninvasively measure the oxygen saturation level (SpO2) and heart rate of a person's blood. The MAX30100 sensor module is designed to be low power, making it suitable for wearable fitness and medical devices. The sensor module communicates with a microcontroller over an I2C interface and can be configured to operate in various modes, including single LED, dual LED, and sample averaging modes. It also includes an ambient light cancellation feature to help eliminate external light interference. The MAX30100 sensor module is widely used in a variety of applications, such as fitness trackers, smart watches, and medical devices for monitoring oxygen saturation and heart rate.

4.2 TEMPERATURE SENSOR

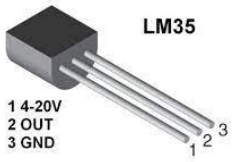


Fig -2: Temperature Sensor

LM35 is a temperature sensor that can measure temperatures in the range of -55°C to 150°C with an accuracy of +/-0.5°C at room temperature. It is a small and inexpensive device that can be easily interfaced with microcontrollers, such as Arduino, Raspberry Pi, and other embedded systems. The LM35 sensor outputs an analog voltage proportional to the temperature, with a sensitivity of 10mV/°C. For example, if the temperature is 25°C, the output voltage of the sensor will be 250mV. The LM35 has a low output impedance, which makes it easy to use in many applications.

4.3 GPS MODULE

Fig -3: GPS module

A GPS (Global Positioning System) module is an electronic device that receives signals from GPS satellites and provides precise location and time information. The GPS system consists of a network of satellites that orbit the Earth and transmit signals containing location and time information. A GPS receiver module receives these signals and uses them to determine its own position and time. GPS modules are commonly used in navigation systems, tracking devices, and other applications that require accurate location information.

They are available in various form factors, including modules that can be integrated into other devices and standalone units with built-in displays. The most common type of GPS module is a UART (Universal Asynchronous Receiver/Transmitter) module that communicates with a microcontroller or other host device through a serial interface. UART GPS modules usually have a small form factor and low power consumption, making them ideal for use in portable or battery-powered devices.

5. BLOCK DIAGRAM

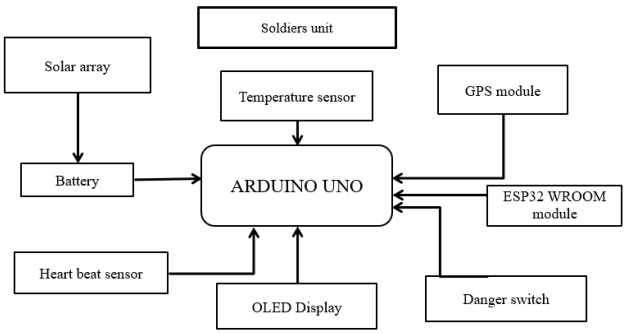


Fig -4: Interfacing diagram

The block diagram represents the components used in the device. The battery is charged with the solar array that supply the power for the working of the device. The heart beat and temperature sensors are used to monitor the heart beat and body temperature of the respective soldiers. IoT module is used for the data transfer between soldiers and the base unit. GPS module is used to identify the location of the respective soldier. Danger switch is used in case of emergency situations, if any abnormal situation happens around the war field then danger switch can be used manually for the soldier. Battery, heart beat sensor, temperature sensor, IoT module, GPS module and danger switch are connected to Arduino UNO microcontroller.

6. METHODOLOGY

The methodology of Solar and IoT based health monitoring and position tracking system for soldiers involves several stages, starting with requirements gathering, where the parameters to be monitored, sensors required, location tracking mechanism, power source, and communication protocol are identified. This is followed by system design, where the hardware and software components of the system are designed, and a prototype is developed. The prototype is then tested and evaluated to ensure that it meets the requirements and performs as expected. After testing, the system is deployed in the field, and its performance is monitored using cloud-based dashboards. The methodology

ensures that the system provides real-time health monitoring and position tracking of soldiers, thereby ensuring their well-being and safety during military operations.

7. WORKING MODEL

The working model of this project is for soldiers involves several interconnected components. The system comprises biometric sensors that collect health data such as heart rate, blood pressure, and temperature from soldiers. The GPS module collects location data, which is transmitted along with the health data to a microcontroller. The microcontroller processes this data and transmits it wirelessly to a cloud-based platform using wireless communication devices. The cloud-based platform stores and analyzes the data, and provides real-time monitoring and alerts to military personnel. The power management unit ensures that the system runs continuously by charging the battery using solar panels. The entire system is designed to be compact, rugged, and lightweight to ensure ease of use and minimal intrusion to soldiers during military operations. Overall, the working model of Solar and IoT based health monitoring and position tracking system for soldiers is a sophisticated and reliable system that can provide critical health and location data in real-time, enabling prompt action and ensuring the safety of soldiers in the field.

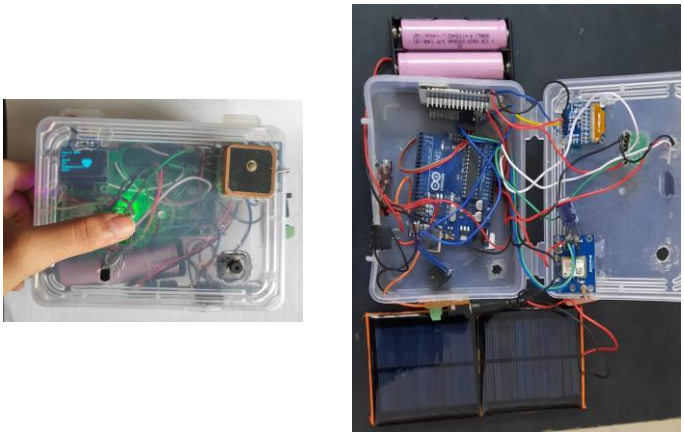


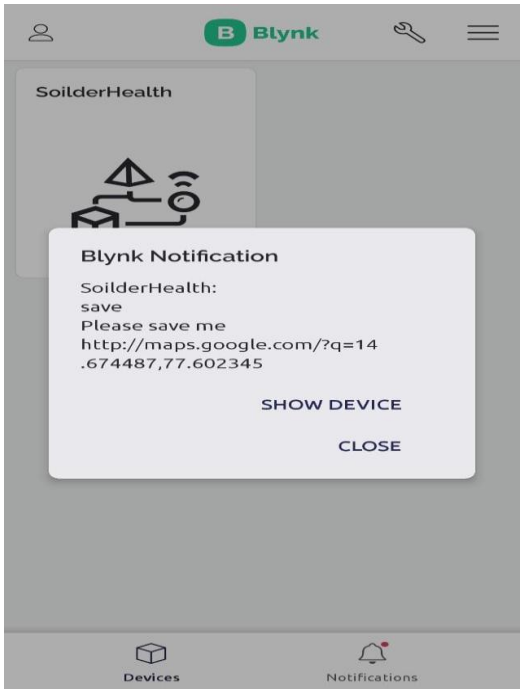
Fig -5: Working model

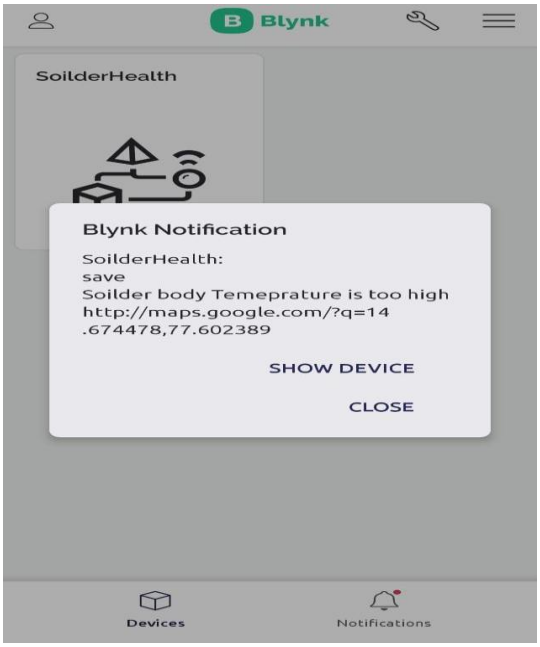
The device is provided with a 3.7V battery that can be boosted up to 5V with the boost regulator provided that is required for the working of sensors and other components in the device. The battery can be rechargeable by using the solar panels provided. The device would be switched ON when the soldier is present in the field, then the device monitors the heart rate and temperature continuously and the data should transfer through cloud to the base station. There would be a panic button on the device. When the soldier presses the button then the location of the soldier could be detected. This would be done by the GPS module.

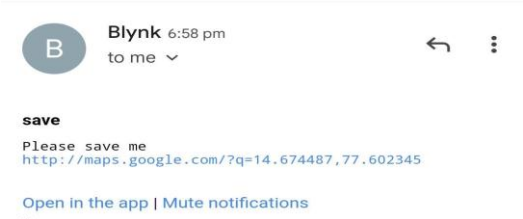
When the heart rate or body temperature fluctuates than the normal values then the message would be transferred to the base station. Then officials will take certain measures for protecting the soldiers.

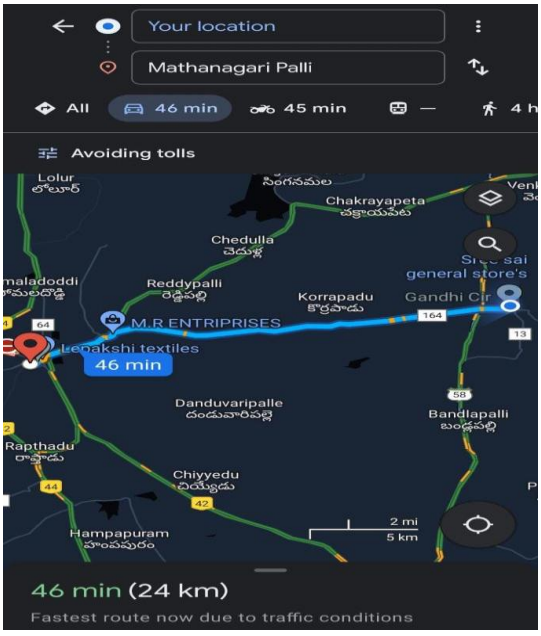
8. RESULTS

At location – 1:

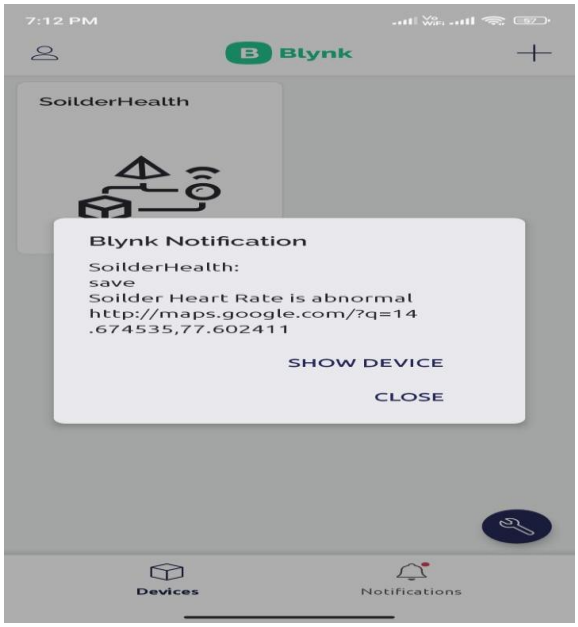


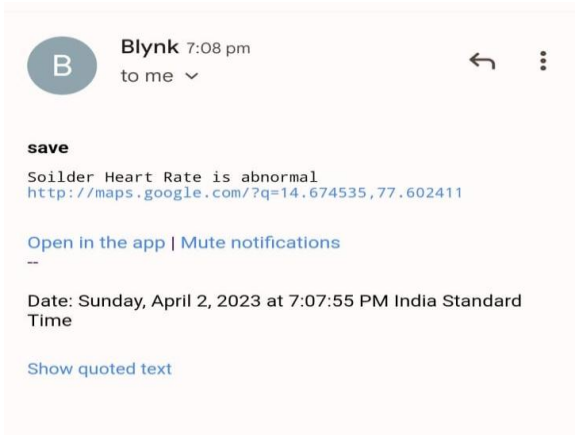


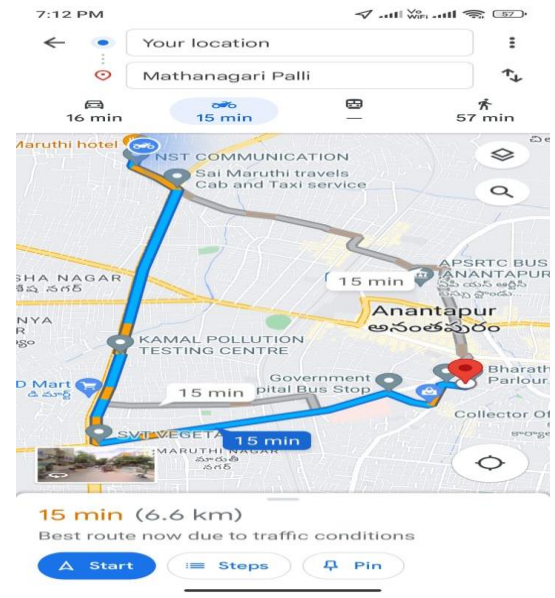




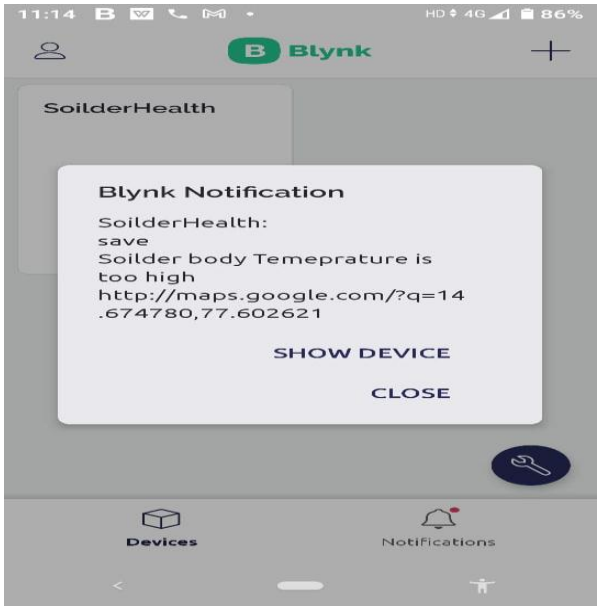
At location – 2:

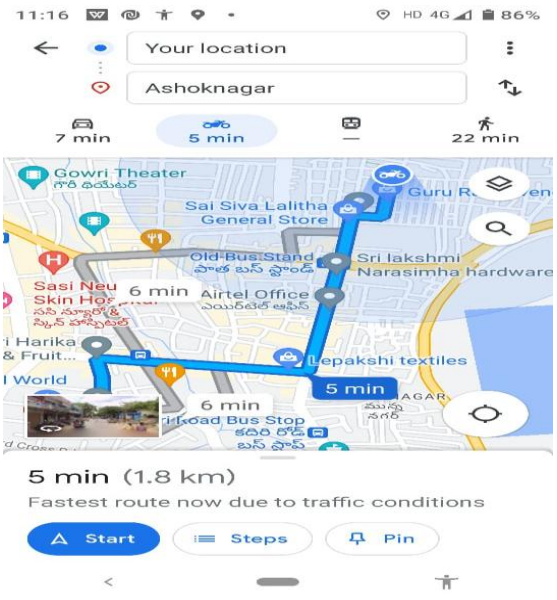






At location – 3:





9. CONCLUSION

The integration of solar power and IoT technology can provide a robust solution to health monitoring and position tracking for soldiers. The system can enhance soldier's safety and well being, and provide medical personnel with real-time information to the base station. The use of wearable devices and GPS tracking technology can ensure that soldier's health and location are monitored continuously, even in remote areas without access to medical facilities or electricity. This device can also help to provide proper medical assistance when the soldier's health is abnormal and helps by sending additional force when they are in danger condition in the field. As technology continues to evolve, the implementation of innovative solutions such as monitoring health parameters and tracking position can help address the challenges that soldiers face in their line of duty.

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