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SMART BATTLEFIELD GUARDIAN: REAL-TIME SOLDIER TRACKING AND HEALTH MONITORING SYSTEM

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ABSTRACT

The Indian Army, as the land-based branch and largest component of the country's defense forces, plays a crucial role in national security. Enhancing their capabilities with advanced technology can significantly improve safety and efficiency. This project focuses on tracking soldiers' locations using GPS and monitoring vital health parameters such as pulse rate and body temperature. The collected data is transmitted to the control room via a GSM module, allowing real-time assessment of a soldier's condition. Implemented using an Arduino microcontroller, the system detects fluctuations in temperature, panic levels, heartbeat, and pulse rate, triggering alerts to the military base if a soldier is injured. Through GPS, the precise location of wounded soldiers is identified, enabling timely medical assistance and facilitating strategic planning by assessing the number of active personnel. The system comprises wearable physiological monitoring equipment and transmission modules integrated into a soldier's jacket, ensuring seamless communication between soldiers and the base station. This cost-effective mechanism enhances battlefield safety by enabling efficient medical response and troop management, ultimately safeguarding valuable human lives.**Keywords:** Advanced Soldier Security System, Real-Time Position Tracking, GPS Tracking, Health Monitoring, Injured Soldier Detection, Military Base Station, War Strategy

1.INTRODUCTION

An embedded system is a special-purpose computer system designed to perform one or a few dedicated functions, sometimes with realtime computing constraints. It is usually embedded as part of a complete device including hardware and mechanical parts. In contrast, a generalpurpose computer, such as a personal computer, can do many different tasks depending on programming. Embedded systems have become very important today asthey control many of the common devices we use. Since the embedded system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product, or increasing the reliability and performance. Some embedded systems are massproduced, benefiting from economies of scale. Physically embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis orenclosure. In general, "embedded system" is not an exactly defined term, as many systems have some element of programmability. For example, Handheld computers share some elements with embedded systems — such as the operating systems and microprocessors which power them — but are not truly embedded systems, because they allow different applications to be load and peripherals to be connected. An embedded system is some combination of computer hardware and software, either fixed in capability or programmable, that is specifically designed for a particular kind of application device. Industrial machines, automobiles, medical equipment, cameras, household appliances, airplanes, vending machines, and toys (as well as the more obvious cellular phone and PDA) are among the myriad possible hosts of an embedded system. Embedded systems that are programmable are provided with a programming interface, and embedded systems programming is a specialized occupation. Certain

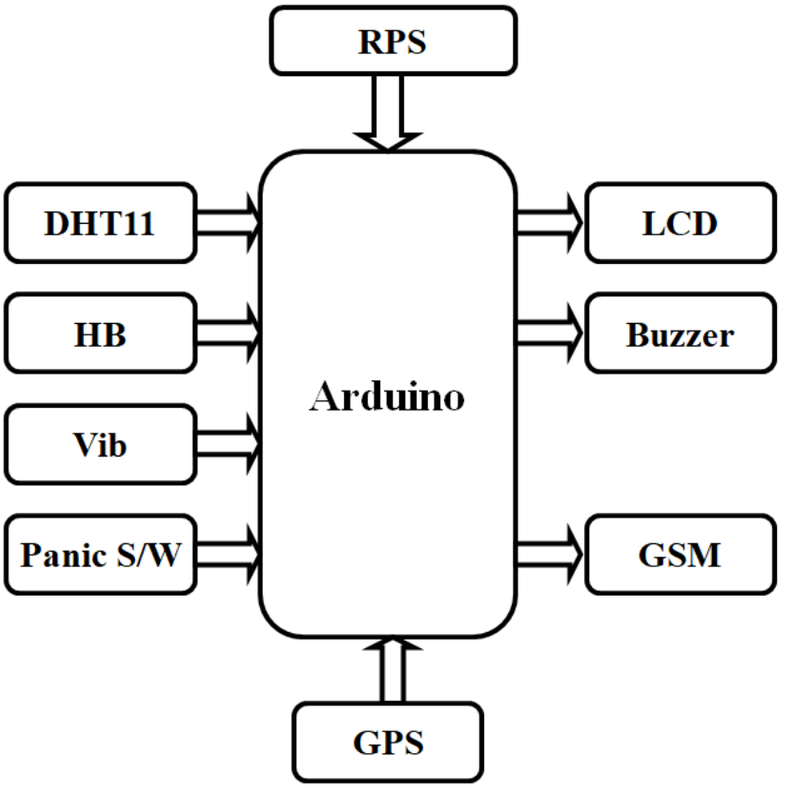
operating systems or language platforms are tailored for the embedded market, such as Embedded Java and Windows XP Embedded. However, some low-end consumer products use very inexpensive.

2.LITERATURE REVIEW

Our objective was to establish a cost-effective and consistent project that would aid the base unit in terms of soldier health and security during wartime special operations. Furthermore, soldiers can submit requests for assistance to the base Station. At first obtaining the physical parameters like body temperature, heartrate and oxygen level of the soldier's body[1]. Then Tracking the location of the soldier through GPS. After that obtaining the environmental factors of soldier like atmospheric temperature and atmospheric pressure. Data obtained in these cases is processed through the blynk server and displaying the information in the blynk app. If any abnormalities found in the data obtained from the soldier the soldier, Alerting the soldier and authority in emergency[2]. During the conflict, this project has an associated implementation of tracking the soldier and navigating between soldiers, such as getting their speed, distance, and health state, which allows military decision makers to put up war strategies. As a result, they can take immediate action by directing help to soldiers who have requested it. Soldiers' health constraints are monitored using a variety of biological sensors, and their location and placement are restricted using a GPS module[3]. ZigBee and GSM wireless technology were used to send current updates of patients to the doctor and then doctors can take immediate action against that patient. So ATmega328P better than other processors. Data originating from sensors and GPS receiver is processed and collected using Arduino (ATmega328P) processor. AT89C51 microcontroller was used to collect health parameters and then these parameters are transferred through GSM to the base unit. LM35 temperature sensor, Pulse Rate sensor and oxygen level detector sensor for continuously monitoring health status of soldier[4]. Many efforts were reported by different academicians and researchers to track the location of the soldiers' along with their health condition on the battlefield Pavan Kumar et.al.The base station can access the current status of the soldier using IOT as the different tracking parameters of the soldier get transmitted via Wi-Fi module. reporteda GPS based technology to monitor the soldier health parameters and location tracking using GPS. Jassaz al .proposed an idea of integration of wireless sensor network and cloud computing for the information processing in real-time and speedy manner. A ZigBee based approach was proposed in the collected information were then added to the cloud-based websites with the help of IoT[5]. A wireless body area sensor networks (WBASNs)technology using ZigBee was reported in to continuously monitor the human health and its location. A real-time, ARM processor based approach for the monitoring and collection of temperature, heartbeat, ECG parameters of patients by GPS is used to determine realtime position and orientation[6]. A Google map based approach was proposed in to track the location of the soldiers. These information will be stored on the Cloud and can be extracted on the PC of control room, as and when extracted. Using various biomedical sensors, health parameters of a soldier is observed along with its surrounding environment condition observed [7] .The proposed system is divided into two unit i.e. of the GPS to guide the soldier in correct direction. Based on these information, the authorities can initiate immediate action by deploying a medical, rescue team or any backup force for their help. RF based module to gather the live information of soldiers on the battlefield was proposed by [8]G. Shaikh.

3.PROPOSED SYSTEM

The block diagram of GPS based soldier tracking and health indication system is shown in fig. it consist of two units soldier unit and base station unit. As it requires high speed communication it is intended to use Arduino controller which is based on with real-time emulation and embedded trace support, that combines the 2GB of embedded high speed Flash memory. Biosensors such as Body temperature and pulse rate are integrated to Raspberry Pi processor to monitor the health status. The GPS receiver is used to log the longitude and latitude of soldier, which is stored in microcontroller memory. GPS Receiver receives and compares the signal from orbiting GPS satellite to determine geographic position.

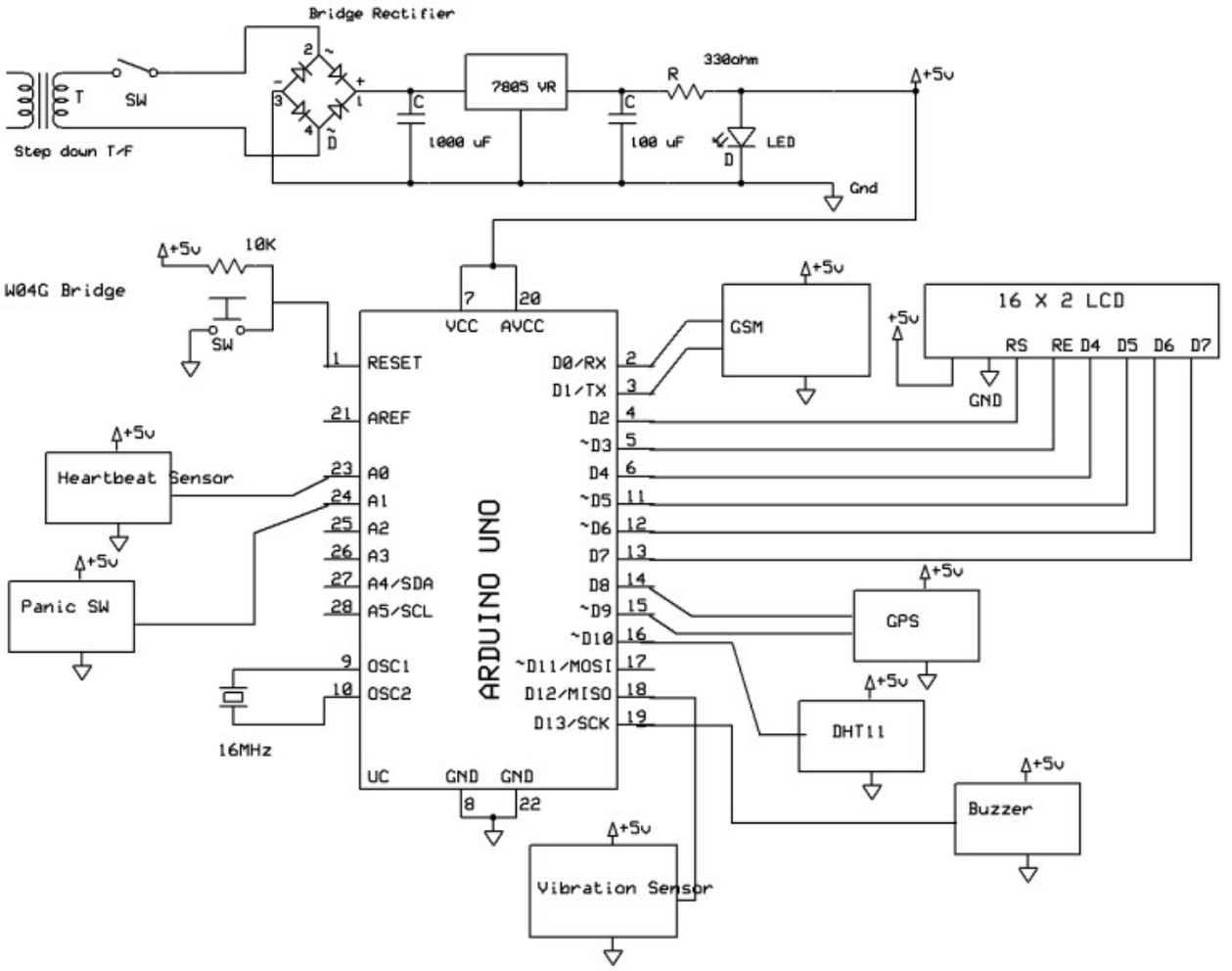


Block diagram description:

This is a block diagram referring soldier security using embeddedelectronics.Ourproject is characterized as five sections,which are RPS section, input section, output section, microprocessor section and programming section. A regulated power supply (RPS) is an embedded circuit, used to convert unregulated alternating current into a stable direct current by using a rectifier. The main function of this is to supply a constant voltage to a circuit that should be functioned in a particular power supply limit.Inour project we are supplying 5V to the raspberry pi board.

The input equipment of our project are temperature sensor which is DHT11. The DHT-11 Digital Temperature and Humidity Sensor is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin (no analog input pins needed). The input section also consists of heart beat sensor.Heartbeat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heartbeat. This digital output can be connected to raspberry pie directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.Theinputs temperature and heart beat are sent to the processor section. Our project output consists of LCD display which shows the latitude and longitude of a soldier's region which captured by the GPS receiver.The temperature and heartbeat are displayed on the LCD display in Celsius and heart beat per minute(bpm). The temperature, heartbeat and location of soldier is sent to the defense system through SMS. In this way live location, health of soldier is monitored. If the higher or lower temperature,heart beat is detected the buzzer is automatically activated. In this project we are using Raspberry Pi for processing the input and output. All the sensors(DHT11,heartbeat sensor), GSM module and GPS module ,driver boards are connected to the Raspberry Pi. As we are using RaspberryPi we selected the embedded python as programming language. Generally embedded python consists several libraries which are useful for easy coding.

Schematic Pin Diagram:



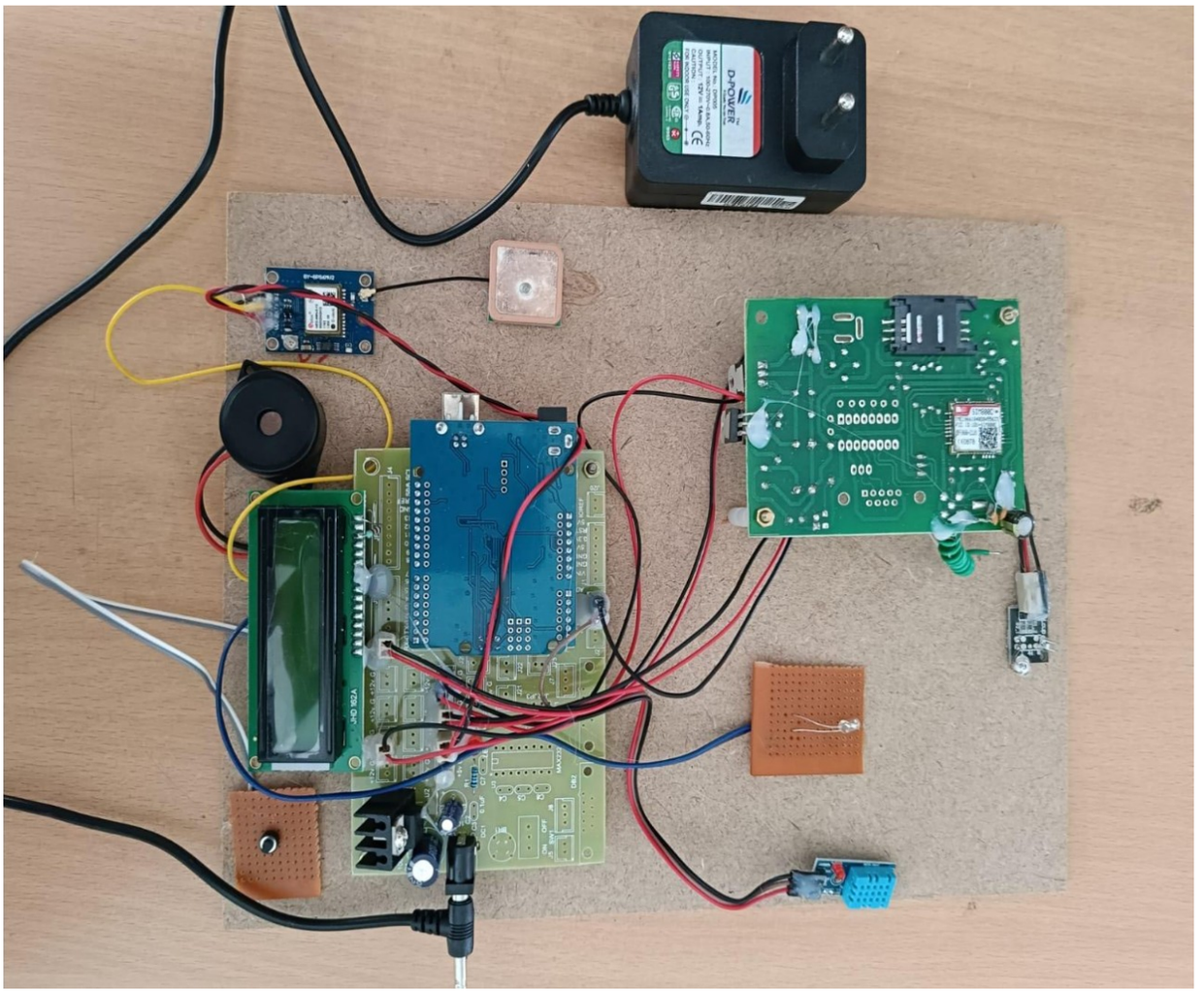
The hardware components are connected to Arduino board. The General purpose I/O pins are connected to buzzer, LCD Display, GSM module, Temperature and humidity sensor,heart beat sensor and GPS modules. 5V RPS is connected to the raspberry pi. The RPS circuit diagram consists of stepdown transformer,bridge rectifier for AC to DC conversion. voltage regulator 7805 for supplying 5V voltage to the Arduino.

Hardware connected to the Raspberry pi:

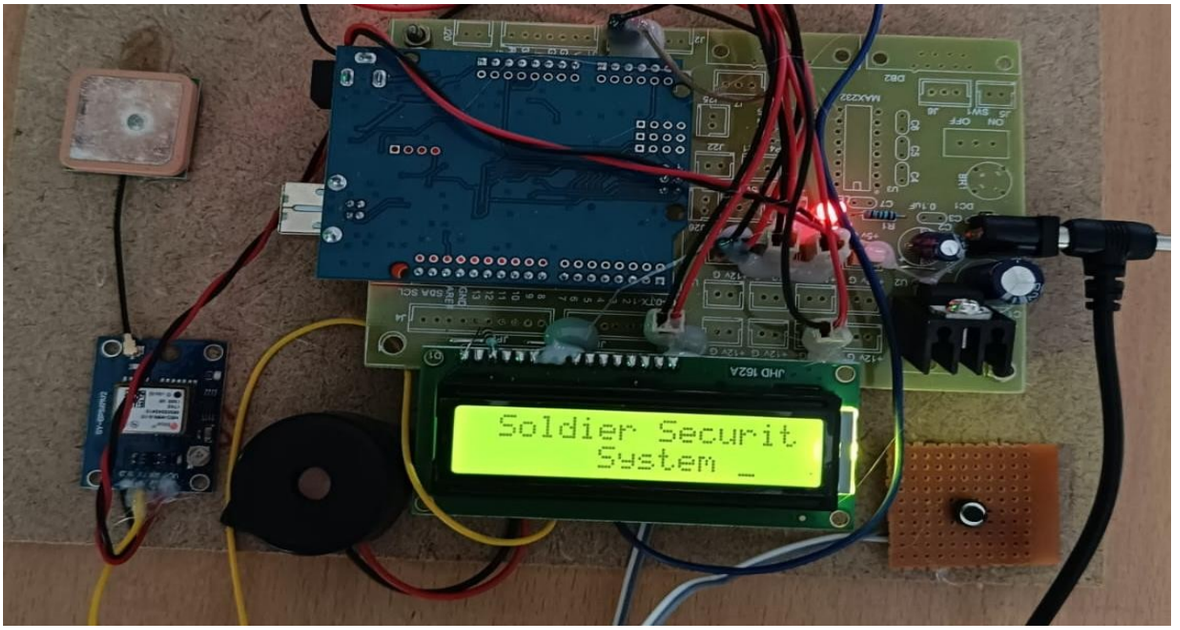
- GSM module is connected to the 5V supply TX,RX of Arduino.
- D7,D6, D5, D4, RE, RS of LCD Display are connected to the D2 –D7.
- GPS module is connected to 8,9th pin.
- DHT11 sensor is connected to the 10th pin.
- Buzzer is connected to the 13th pin.
- Heartbeat sensor is connected to the A0.

4.RESULTS

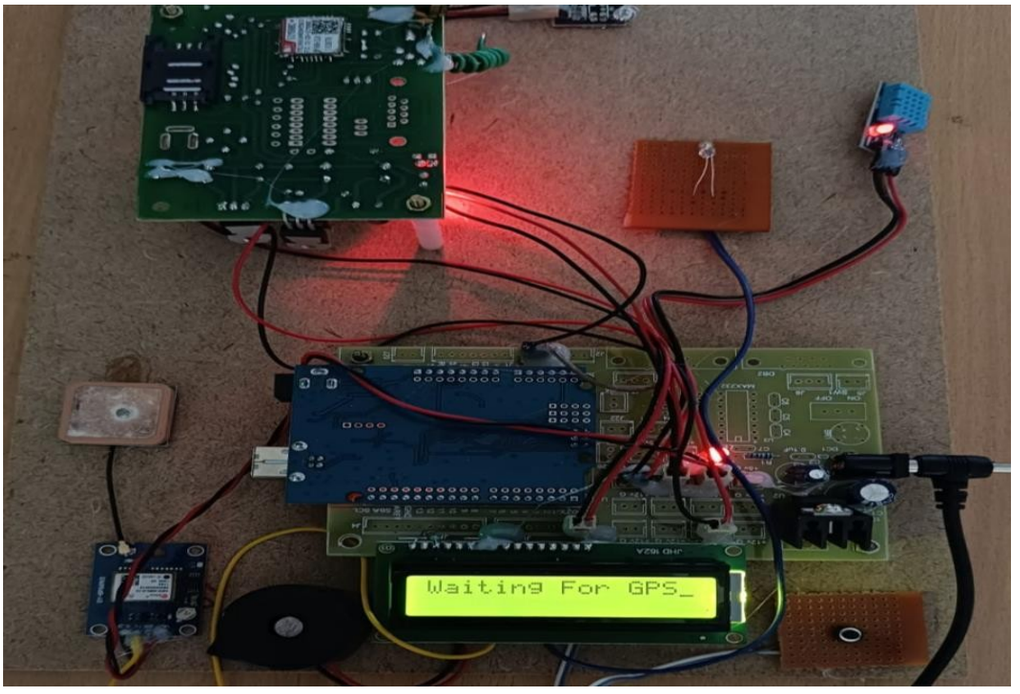
The final results of project are described here. However the main focus is on base Solider condition that how these results are used to the health status and location of the soldier as well. The Below Figure shows the Circuit Components that are used in this project.



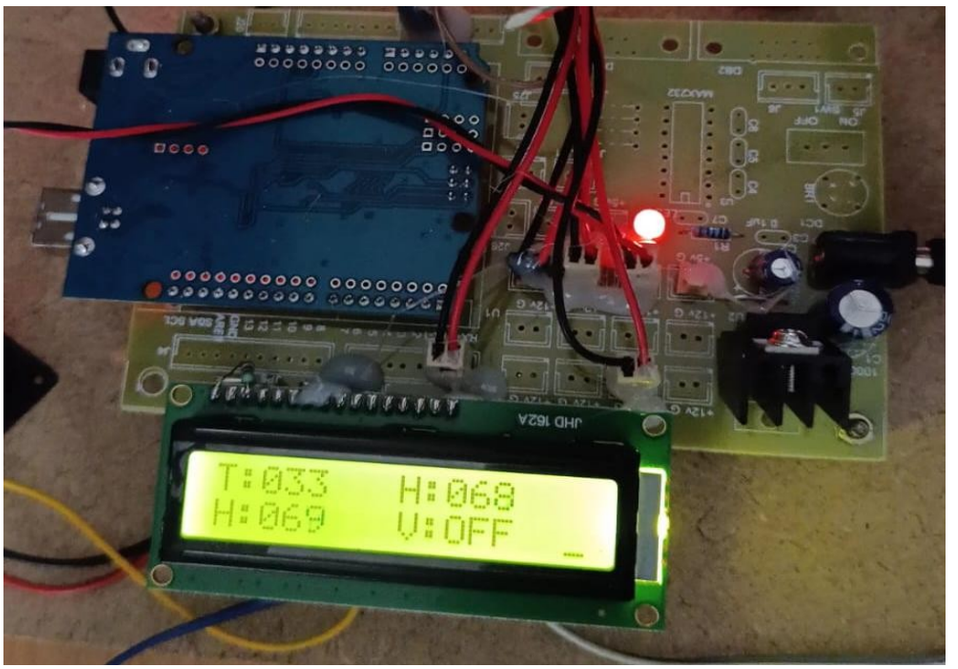
The above image shows the hardware equipment of the project. The kit is turned ON by giving the regulated power supply of 12v which is then converted to 5v dc current. The LED is the indication for 5v current so, if there is 5v current then automatically the LED glows. The generated 5v dc current passes to every hardware co- component in the circuit.



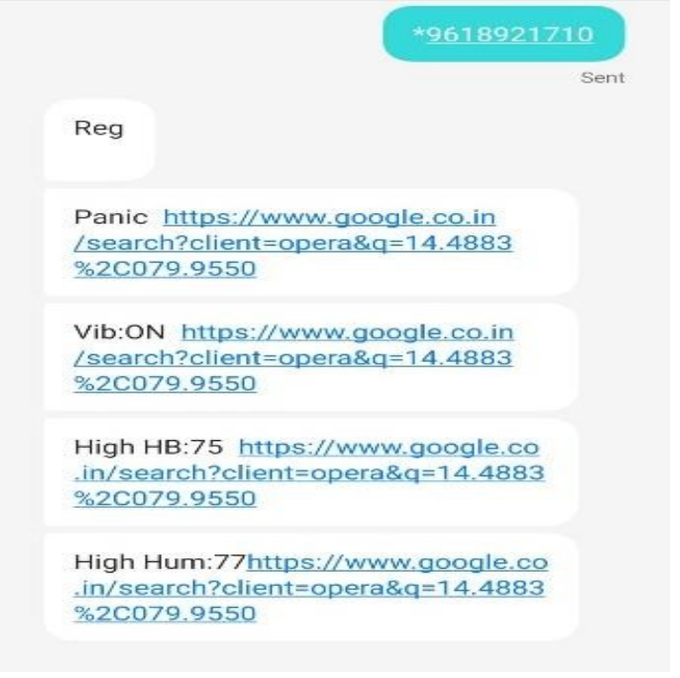
Once the 5v DC current passes throughout circuit the LED is glowed to indicate that the circuit is ready to perform, once the 5v current flows or if we hit the reset button after providing the regulated power supply, the LCD will be displayed the title as SOLIDER SECURITY System. The current output can be seen in the above image.



After we have connected the GSM module via a SIM and The System Starts to fetches the current GPS location by providing a message on the LCD as Waiting for GPS as shown in above figure.



The System counting heartbeat and measuring body temperature correctly. Whenever beat count increase or decrease to certain level or body temperature increases or decreases below certain level system will display the current status of parameters. System also sends the exact location of the soldier when he or she press the panic mode switch to desired Registered Mobile Number through SMS .



Alert the base unit by alert sound and sends exact location of soldier with the help of GSM and GPS module in the form of text message to desired receiver confirming about GPS geography.

5.CONCLUSION

Security and safety for soldiers: GPS tracks position of soldier anywhere on globe and also health system monitors soldiers vital health parameters Which provides security and safety for soldiers. Modules used are smaller in size and also lightweight so that they can be carried around. So in this way concept of tracking and navigation system is very useful for soldiers when they are on military field during war. And also for base station so that they can get real-time view of soldier's on field displayed on PC. From above proposed system, we can conclude that we are able to send data which is sensed from remote soldier to army control room using GSM. The system is completely integrated and can track the location of soldier at anytime from anywhere on the earth using GPS receiver. This system helps to monitor health parameters of soldier using heart beat sensor to measure heart beats and temperature sensor to measure body temperature of soldier. This system helps the soldier to get help from army base station and/or from another fellow soldier in panic situation. This system provides the location information and health parameters of soldier in real time to the army control room. Security and safety for soldiers: GPS tracks position of soldier anywhere on globe and also health system monitors soldier vital health parameters Which provides security and safety for soldiers.

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