

Internet of Things-Based Wireless Sensor Network for Soldier Safety

Chittaluri Gunavanth ^{*1}, Dr. Shaik Saidulu ^{*2}, Dr. G. Ravi Kumar ^{*3}

^{*1} PG Student Department of ECE (Embedded Systems), Shadan College of Engineering and Technology, Telangana, India

^{*2,3} Professor, Department of ECE, Shadan College of Engineering and Technology, Telangana, India

ABSTRACT

Soldiers are a vital cog in the safety machine of any nation. Many service members are lost or injured during war and rescue operations. Because they will ultimately save us, the health and fitness of our armed forces personnel are of paramount importance. Who defends us from foreign invasion, terrorist attacks, and other threats to our safety and the security of our nation and its citizens, including many potentially dangerous sports? With this mission, we can keep tabs on our troops' whereabouts and health in real-time, which is especially helpful when they get separated or hurt in combat. It aids in reducing the army control unit's time spent searching for and rescuing people. Using an Internet of Things (IoT) module and wireless body area sensor networks (WBASNs), such as a temperature sensor, heart rate sensor, etc., this gadget connects to a military base station to monitor a soldier's location and reveal his or her health. Using a ZigBee module, sensor data can be transmitted wirelessly. Moreover, a service member can get help from the managed area and communicate with other service members in the area who have Wi-Fi transmission and reception capabilities.

Keywords : Arduino, IOT, Border Security System, Temperature Sensor.

Article Info

Volume 9, Issue 5

Page Number : 267-275

Publication Issue :

September-October-2022

Article History

Accepted : 10 Oct 2022

Published: 30 Oct 2022

I. INTRODUCTION

In these days solid affiliation business centers, the affiliations face creating necessities to additionally foster way efficiencies, investigate ordinary recommendation, and meet corporate monetary targets. Given the making period of different present-day frameworks and the extraordinary business-producing business center, reasonable and unimportant expense business robotization structures are depended upon to work on the capability and execution of such structures[2], [3]. all around,

business computerization structures are perceived through spurring out exchanges. in any case, the wired computerization structures require outrageous verbal trade interfaces with be mounted and much of the time remained mindful of, and in this manner, they are not regularly done in business plants by their huge expense [4]. as such, there's a true necessity for savvy distant robotization structures that award huge cash related hold saves and reduce air-poison floods through upgrading the association of current plans. WSNs, the conviction of insignificant cost implanted business robotization structures have become practical [5]. In

the one's turns of events, distant little sensor community focuses are related on endeavor gear and reveal the cutoff points basic for each gadget's efficiency fundamentally settled on several appraisals like vibration, temperature, strain, and power quality. This information is then to some degree transported off a sink community that evaluations the information from every sensor. Any end loads are told to the plant workers as a perplexed warning framework. This awards plant staff to fix or abrogate contraptions, sooner than their sufficiency drops or they flop. Consequently, miserable device screw-ups and the related fix and substitution expenses might be stayed away from, simultaneously as consenting to genuine natural guidelines. The accommodating considered IWSNs brings two or three benefits over customary disturbed out the business following and control structures, which unite self-affiliation, quick blueprint, flexibility, and intrinsic wily dealing with limit. In such a manner, WSN plays a basic breaking point in making an unequivocally dependable and self-recuperating present-day gadget that quickly reacts to consistent occasions with genuine activities. In any case, to comprehend the imagined current applications and, therefore, take the upsides of the support benefits of WSN, productive dispatch shows, which can manage the right disagreeable conditions presented through such frameworks, are required. The imaginative improvement inside the worldwide has during that time-shifted direction and measures to show sports associations are being made to allow let free to encounters and guide for giving clients [6]. This is a delayed consequence of the staggering name for assets reasonable in helping industrialists with achieving put forward targets and foster applications for the supporting of time transportation of materials and set out a chance for expanded data [7]. The significance of introducing a pleasantly unprecedented model wi-fi Sensor social class (WSN) in business take a stab at programming can't be over-featured; as needs are, this experience tends to the great master in intersection the distance among the accessibility of OK

after information offering all due appreciation to cultivate the current turns of events and the standard methodology for endeavors. WSN is a progression wherein basically confined focuses help each other in sending loads of information through the local vehicle to the spot for moving unendingly. The WSN joins focuses that can send and get messages in a cross fragment plan and a middle that can fill in as a switch and can also hand-off messages for its neighbour. Through thusly, Wi-Fi group encounters will notice their course to the predetermined occasion spot, using transitory focuses with reliable correspondence procedures. WSN programming sways from one locale to another. Different fields including fire, equipped power establishments, contamination, machine success, and regular parts following fuse gifted creating insubordination inside the execution of this time in checking sports incorporate them. In many preposterous areas, clear controlling is utilized because in reality the area, at the indistinct time as new flooding-based thoroughly time, offers the open door and advantages, especially in gigantic affiliations.

II. LITERATURE REVIEW

In 2017, Nike Patil and Brijesh Iyer proposed wearables that would monitor soldiers' fitness and location using the Internet of Things. Since Arduino is connection focused (it has a USB port), they have not described how the conversation is established between the client and server sides.

To track and record vital signs like a patient's temperature, heart rate, and electrocardiogram in real time, R. Shaikh et al. [2012] proposed using an ARM processor. Using wireless technologies like ZigBee and GSM, we can update doctors in real-time so they can take swift action when necessary. ZigBee-based wireless body area sensor networks (WBASNs) continuously monitor patient status and location.

The LM35 temperature sensor, Pulse fee sensor, and oxygen degree detector sensor proposed by S. Rajeswari and R. Kalaiselvi [2017] can be used to

monitor service members' health status in real-time. Positioning and navigation in real-time via GPS. A wrist multi-sensor device for continuous monitoring of health status and alert, integrating biomedical sensors for heart rate, 1-lead ECG, blood pressure, oxygen blood saturation, and skin temperature measurement, is processed and accumulated using Arduino (ATmega328P). The use of GSM and GPS in a monitoring device can help keep teachers and parents up-to-date on a child's whereabouts via a short message service.

The ZigBee transceiver continuously monitors the patient's vitals and sends the data about their health to a central server. A "Soldier fitness and function monitoring device" using a Barometric stress sensor, GPS, GSM, and WBASNs has been proposed (heartbeat sensor, temperature sensor). The ATmega328p microcontroller was used to create the prototype. The soldier's health status has been learned using only pure conditional statements, with no machine learning or human education involved. GSM has been used as the primary means of communication despite its obvious disadvantages in high-altitude areas, where establishing network connectivity may be a difficult task. After normal time intervals, GSM transmits a message with the soldier's health status. In their paper titled "IoT-based health monitoring via LoRaWAN," the authors propose sending data from medical sensors to an evaluation module via low-cost, low-strength, and comfortable communication via a LoRaWAN (extended variety, big location network) network. In rural areas, where cellular community coverage is both lacking and not allowing records of transmission, blood pressure, glucose, and temperature have been measured. When the LoRaWAN Gateway is installed outside at a height of 12 meters, the expected coverage area is 33 square kilometers. The power requirements of this monitoring device are said to be at least ten times lower than those of various lengthy-range cell solutions, such as GPRS/3G/4G.

Prototype hardware for the authors' proposed "Soldier tracking and fitness Indication system" includes a Global Positioning System (GPS) receiver, a heart rate sensor, a temperature sensor, a vibration sensor, a bomb detector, and a PIC16F877A microcontroller. To monitor your heart rate, we'll be employing a polar heart rate transmitter and an RMC01 receiver. The piezo disc vibration sensor with a piezo-electrically powered plate is proposed in this paper. The piezoelectric film offers a lightweight, flexible, reliable, cellular, and low-cost alternative to expensive sensors. Hypothermia and Hyperthermia can be detected with the temperature sensor by using standard, everyday conditional statements. Paper sensors, also known as IED bomb detectors, are what used (Improvised Explosive gadgets) are. You can tell what kind of IED it is just by looking around you and picking up on the chemical signatures, and it can also detect the shape of the device without any additional structures. The goal of this paper is to incorporate the low-power and long-range characteristics of LoRaWAN and ZigBee. We can send and display health data and real-time location data sensed by far-flung squad members to the squad chief via ZigBee and onto the bottom station via a LoRaWAN module. Factors like cell connectivity at higher altitudes, weather and environmental conditions throughout the soldier's unit, and lengthy variable signal strength make GSM (a global device for mobile communique) and RF (Radio Frequency) unfavorable for communication skills.

III. METHODS AND MATERIAL

3.1 AIM

Primary to this mission is the development of an IoT-based system for monitoring and managing the physical well-being of the infantrymen.

3.2 IMPLEMENTATION

The Arduino Uno, NodeMcu, and sophisticated domestically available regulators for commercial applications all contributed to the realization of this mission.

3.3 DESCRIPTION:

The military is a crucial component of any functional kingdom's security system. Soldiers sustain wounds and lose countenance in the course of battle and search and rescue missions. As such, the well-being of our armed forces is crucial, as they are the ones who defend us from foreign invasion, terrorist acts, and any number of other threats to our safety and the safety of our country. As a result of this mission, infantrymen who become disoriented or injured on the battlefield can have their status updated in real-time, and the surrounding area can be listened to and viewed in musical detail. The time and energy spent on search and rescue operations by army management units are reduced. Using an Internet of Things (IoT) module and wireless frame location sensor networks (WBASNs), such as a temperature sensor, coronary heartbeat sensor, etc., the military base station can track the location of infantrymen and reveal their health status. Utilizing a ZigBee module, records from sensors can be sent wirelessly. To top it all off, a service member within the wireless transmission and reception range can talk to other service members and even ask for help from the command center.

Block Diagram

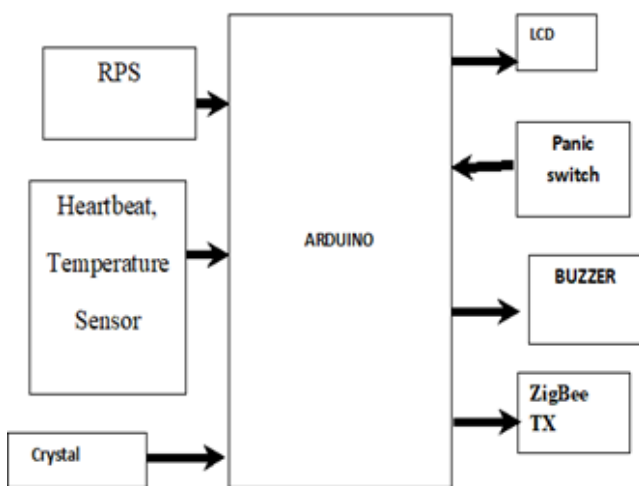


Fig 3.0. Block Diagram

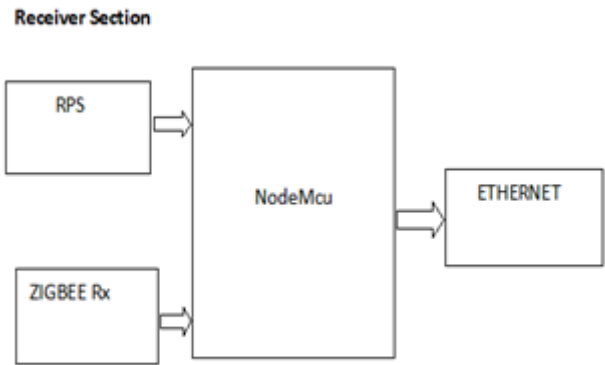
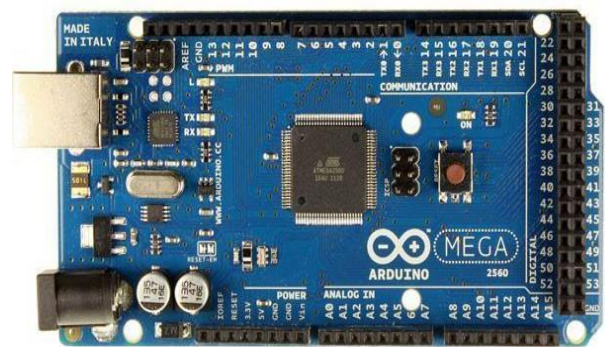


Fig 3.1. Receiving Section

IV. ARDUINO



Overview

Arduino Uno is a microcontroller board subject to the ATmega328P (datasheet). It has 14 pushed data/yield pins (of which 6 can be used as PWM yields), 6 crucial data sources, a 16 MHz finished resonator (CSTCE16M0V53-R0), a USB affiliation, a power jack, an ICSP header, and a reset button. It contains all that normal to help the microcontroller; on a fundamental level interface it to a PC with a USB affiliation or power it with an AC-to-DC connector or battery to start. You can meddle with your Uno without anguishing significantly overachieving something incorrectly, most fundamental result conceivable you can exchange the chip for a couple of dollars and start again.

"Uno" recommends one in Italian and was picked to stamp the presence of Arduino Software (IDE) 1.0. The Uno board and structure 1.0 of Arduino Software (IDE) were the reference types of Arduino, direct made to ceaselessly current releases. The Uno board is the first

in the advancement of USB Arduino sheets and the reference model for the Arduino stage; for an expansive once-over of current, past, or old sheets see the Arduino report of sheets.

NodeMCU

NodeMCU is an unimportant expense open-source IoT stage. It at first included firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems and stuff that depended upon the ESP-12 module. Sometime later, support for the ESP32 32-cycle MCU was added. NodeMCU joins "center" and "MCU" (small scale controller unit). The articulation "NodeMCU" thoroughly talking suggests the firmware rather than the connected progression packs.



Fig : NODEMCU Module

LM35 TEMPERATURE SENSOR

LM35 is a precision IC **temperature sensor** with its output proportional to the temperature (in °C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With **LM35**, temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 °C temperature rise in still air.

The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every °C rise/fall in ambient temperature, i.e., its scale factor is 0.01V/°C.

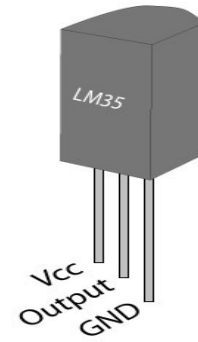


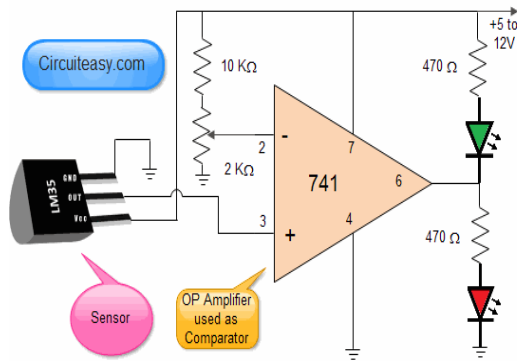
FIG: Temperature Sensor LM35

TEMPERATURE SENSOR

This project uses IC LM35 as a sensor for detecting accurate centigrade temperature. Linearity defines how well over a range of temperature a sensor's output consistently changes. Unlike thermistor, Linearity of a precision IC Sensors are very good of 0.5°C accuracy and has wide temperature range. its output voltage is linearly proportional to the Celsius (Centigrade) temperature.

The LM35 is rated to operate over a -55° to +150°C temperature range. It draws only 60 μA from its supply, it has very low self-heating, less than 0.1°C in still air. LM35 Operates from 4 to 30 volts.

Output of IC is 10mv/degree centigrade for eg if the output of sensor is 280 mV then temperature is 28 degree C. so by using a Digital multimeter we can easily calculate the degree temperature. For trigger point you should set the voltage of pin 2 of IC 741 by using preset or potentiometer. Our aim of this project is not to construct a thermometer but to activate or deactivate a device at a particular margin temperature. For simplicity we have used 2 LED for indication of both low (Green) and high (Red) temperature.



Circuit Diagram of temperature sensor

Working: The output of IC2 increases in proportion to the temperature by 10 mV per degree. This varying voltage is feed to a comparator IC 741 (OP Amplifier). OP Amplifier are among the most widely used electronic devices today. The op-amp is one type of differential amplifier. It has two input inverting (-) and non-inverting (+) and one output pin. We have used IC741 as non-inverting amplifier which means pin 3 is the input and the output is not reversed. This circuit amplifies the difference between its input terminals.

As a comparator, Bistable output of an op amplifier is as follows :-

$$V_{out} = \begin{cases} V_{S+} & \text{if } V_1 > V_2, \\ V_{S-} & \text{if } V_1 < V_2, \\ 0 & \text{if } V_1 = V_2, \end{cases}$$

Part list:

IC LM35, IC LM741

Resistance: 10K Ohms, 470 Ohms X 2Pcs

Preset or P.O.T of 2K Ohms

LED 2pcs (Red and Green)

9V Battery with Snap

Switch, wire

*By making this Temperature Sensor Project, student will be capable of making many similar project i.e Automatic room heater controller, determine hotness of Tea or Coffee to avoid burning your tongue, Automatic Fan Controller etc.

IV. Zigbee Technology

When it comes to wirelessly link sensors, instruments, and control systems, ZigBee is the gold standard. It has

been speculated that ZigBee, a specification for communication in a WPAN, is the "Internet of things." In theory, if both your coffee maker and toaster are ZigBee-enabled, they will be able to exchange information with one another. ZigBee is an easy-to-implement framework for establishing low-power, secure wireless networks worldwide. ZigBee and IEEE 802.15.4 are low-rate wireless networking technologies that can replace the expensive and easily-damaged cable traditionally used in industrial control systems. Equipment used to regulate flow or process can be located anywhere in a facility while still maintaining two-way communication with other nodes. And because the network doesn't mind where a sensor, pump, or valve is physically located, it can be relocated if necessary. By offering a straightforward networking layer and standardized application profiles, the ZigBee RF4CE standard paves the way for the development of multi-vendor, interoperable solutions in the realm of consumer electronics.

This technology has far-reaching benefits; ZigBee uses include:

- Automation for the home and workplace
- Robotics and automated production
- Constant medical observation
- Ultra-low power sensor technology
- Temperature and humidity regulation in a building
- Not to mention the plethora of different control and monitoring applications



Figure 1: ZigBee Applications

Low-power, low-duty-cycle, low-data-rate devices are ZigBee's intended audience. The ZigBee network example is depicted in the following figure.

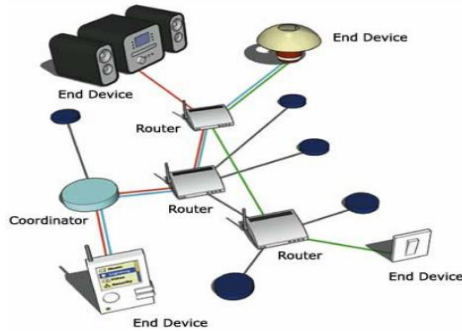


Figure 2: ZigBee Network

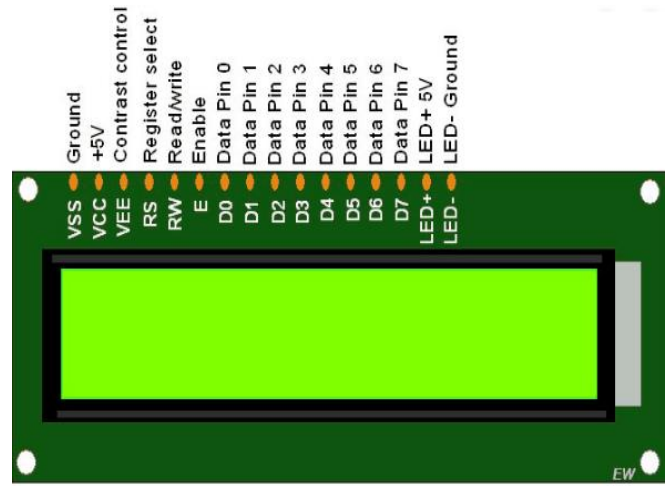
V. LCD

Introduction

LCD (Liquid Crystal Display) is such a level board show which uses liquid significant stones in its fundamental kind of movement. LEDs have an enormous and moving approach of utilization cases for customers and relationships, as they can be ordinarily found in phones, TVs, PC screens, and instrument sheets.

LCDs were an imperative ricochet the degree that the movement they removed, which breaker light-passing on the diode (LED) and gas-plasma shows. LCDs allowed colleagues to be inside and out more thin than the cathode bar tube (CRT) movement. LCDs eat up generously less power than LED and gas-show shows since they seek after the norm of obstructing light as opposed to releasing it. Where a LED radiates light, the liquid huge stones in an LCD pass on an image using establishment enlightenment.

As LCDs have replaced progressively organized hotshot drives, LCDs have begun being removed by new introduction enhancements, for instance, OLEDs.



VI. SOFTWARE TOOLS

Arduino IDE compiler:

Arduino is an open-give contraptions stage subordinate by and large upon smooth to utilize stuff and programming utility. Arduino sheets can see inputs - slight on a sensor, a finger on a button, or a Twitter message - and flip it into a result - inducing an engine, turning on a LED, dissipating a few locales on the web. You could put together your board by sending a firm of mentioning to the microcontroller at the board. To do such a ton of that you utilize the Arduino programming language (set up all around concerning Wiring), and the Arduino programming (IDE), pondering Processing.

All through the long Arduino has been the mind of loads of liabilities, from standard devices to complex clinical contraptions. Overall neighborhood creators - understudies, informed subject matter experts, arranged specialists, originators, and coordinated prepared experts - have amassed unusual this open-convey stage, their responsibilities have brought whatever amount of a dazzling level of open limit that can be of astonishing help to understudies and specialists the same.

Arduino has become brought into the world on the Ivrea correspondence setup Institute as an ideal contraption for second prototyping, prepared towards school understudies without an obvious past in stuff and programming. As fast as it displayed at a miles

more broad district, the Arduino board began changing back to adjust to new dreams and unwanted conditions, segregating its give from smooth eight-cycle sheets to stock for IoT

Programs, wearable, three-d printing, and installed conditions. All Arduino sheets are without a doubt open-convey, attracting clients to total them excitedly and in the end change them to their extraordinary dreams. The thing program, additionally, is open-supply, and its miles making through the responsibilities of clients from one side of the world to the next.

The typical augmentations of the Arduino IDE utility are

1. Much less steeply-regarded
2. The clean smooth programming regular parts
3. Extensible programming program application utility and equipment

VII. CONCLUSION

One of the major drawbacks of military operations is that troops are unable to communicate with the control room and other authorities. Troops have a vital role to play in ensuring national safety. The situation with the soldiers is then monitored. In the same vein as its rivals, the paper details an Internet of Things-based architecture for health monitoring. Here, an Arduino board is being used. In a similar vein, biomedical sensors can report vital signs like body temperature and heart rate to the command center. This development will be helpful in providing the specific area of the missing authority in basic condition and assessing the damage to the authority's historical record. The monitoring system can also help with improving official-to-hero communication in times of crisis and providing a more direct line to the control room. It follows that the military personnel of any country in the world will benefit greatly from this design. Eventually, a more compact handheld sensor gizmo with additional perceiving decisions may be developed to aid the rivals in the game.

VIII. REFERENCES

- [1]. Shruti Nikam, Supriya Patil, PrajkaPowar, S.Bendre, "GPS BASED SOLDIERTRACKING AND HEALTH INDICATIONSYSTEM", International Journal of AdvancedResearch in Electrical, Electronics andInstrumentation Engineering, Vol. 2,Issues 3, March 2013.
- [2]. Richard B. Marth, Robert Levi, Dr. I. NewtonDurboraw, Kenneth Beam, "The IntegratedNavigation Capability for the Force XXI L andWarrior".
- [3]. Ping Wang, Xinfeng BA, "Design of SoldierStatus Monitoring and Command and ControlSystem Based on Beidou System", 2012 2ndInternational Conference on Computer Science and Network Technology.
- [4]. VongsagonBoonsawat, Jurarat Patil KulwadeeBumrunghket, andSomsakKittipiyakul, "Monitoring", Sirindhorn International Institute of Technology, Thammasat University, Pathum-Thani, Thailand 12000.
- [5]. R. Archana, S. Indira, "Soldier Monitoring and Border Security Indication System", International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064, 2013.
- [6]. Harshavardhan ,B.Patil, Prof.V.M.Umale, "Arduino Based Wireless Biomedical Parameter Monitoring System Using Zigbee", International Journal of Engineering Trends and Technology (IJETT) – Volume 28 Number 7 - October 2015.
- [7]. Hublikar, Shivaraj, Arun L. Kakhandki, and Anil M.Kabbur. OPNET:a Solution for Software, and Hardware Networking. Journal of Engineering EducationTtransformations,2016.
- [8]. Gao, Heng and Li."An OPNET-based simulation approach for the deployment of Wireless HART." Fuzzy Systems and Knowledge Discovery,9th International Conference on IEEE,2012 Image processing, IOT.

AUTHOR PROFILE

Mr. CHITTALURI GUNAVANTH, M.Tech student in ECE (Embedded Systems) from Shadan College of Engineering And Technology, Peerancheru, Telangana.

Dr. SHAIK SAIDULU, PROFESSOR Dept. of ECE from Shadan College of Engineering and Technology, Peerancheru, Telangana.

Dr. G. RAVI KUMAR, Professor, Dept. of ECE from Shadan College of Engineering and Technology, Peerancheru, Telangana.

Cite this article as :

Chittaluri Gunavanth, Dr. Shaik Saidulu, Dr. G. Ravi Kumar, "Internet of Things-Based Wireless Sensor Network for Soldier Safety", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 9 Issue 5, pp. 267-275, September-October 2022.

Journal URL : <https://ijsrset.com/IJSRSET229542>