IJAREEIE

e-ISSN: 2278-8875
p-ISSN: 2320-3765

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

Volume 9, Issue 9, September 2020

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.122

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

|| Volume 9, Issue 9, September 2020 ||

Forest Fire Detection Using Lora

Dr.N.Anusha[1], R.Balaji[2], N.Murugavel[3], R.Naveen Nachiappan[4]

Professor, Dept. of Electronics and Communication Engineering, S.A Engineering College, Chennai, India[1]

Final Year Student, Dept. of Electronics and Communication Engineering, S.A Engineering College, Chennai, India[2,3,4]

ABSTRACT: Forest is considered as one of the most important resources. As a human being its our duty to protect the animals, trees in the forest from any natural calamities. The main natural calamities or the one caused by human being was the forest fire. This LORA project overcomes or proposes the new method of detecting forest fire using some sensors and it intended to send messages to nearby areas. In this project, Fire and Smoke detection system is developed. It can sense smoke and the rise in temperature and alert user by activating buzzer also send commands on virtual terminal of controller . Fire hazards are not uncommon. All the information sending through LORA and monitored in PC.

I.INTRODUCTION

An innovative design and development process is presented for a Wireless Sensor Network (WSN) prototype aimed at detecting and monitoring forest fires at the Guanguiltagua Park located in the Metropolitan District of Quito (DMQ), capital of Ecuador. Every year the city of Quito is affected by recurrent forest fires, especially in summer time where high temperatures and soil dryness contribute to the propagation of fire in areas with vast vegetation. As a result to this problem, a WSN technological solution was created to address this problem which can detect forest fires in real-time sending alerts immediately to the end user. This prompt response helps to attenuate the impact of forest fires such as loss of human lives, loss of large areas of vegetation, economic loss and environmental contamination. The WSN prototype described in this document uses hardware, software, communication protocols, topology and functionality focused on optimizing its end results. The system is based on measuring continuously three types of gases, which are present in a combustion process such as CO2, CO and CH4. In addition to these sensors, environment temperature and humidity, as well as GPS location data is provided; this data is transmitted via wireless communications toward a graphical interface where the sensors data will be interpreted and statistical information can be generated. Finally, through a WSN prototype validation process, it is demonstrated that such prototype provides an efficient and reliable method to detect and monitor forest fires in a short amount of time

II. LITERATURE REVIEW

1.Forest Fire Detection System based on Wireless Sensor Network, Junguo ZHANG, Wenbin LI, Zhongxing YIN, Shengbo LIU, Xiaolin GUO School of Technology Beijing Forestry University

As we all know, the forest is considered as one of the most important and indispensable resources, the prevention and detection of the forest fire, have been researched hotly in worldwide Forest Fire Prevention Departments. Based on the deficiencies of conventional forest fire detection on real time and monitoring accuracy, the wireless sensor network technique for forest fire detection was introduced, together with satellite monitoring, aerial patrolling and manual watching ,an Omni bearing and stereoscopic air and ground forest-fire detection pattern was found so that the decision for fire-extinguishing or fire prevention can be made rightly and real-timely by related government departments. A cluster-based wireless sensor network paradigm for forest fire real-time detection was put forward in this paper. Some key questions were discussed emphatically, such as the ad hoc network related technology, the node hardware designing, the forest-fire forecasting model and the propagation characteristic of UHF wireless signal and so on.

2. Forest Fire Detection and Localization with Wireless Sensor Network,*International Conference on wireless network system.*

Location determination is an important problem for almost all WSN applications. However, obviously becomes an important target in the case of surveillance systems for forest fires do not have to support real-time monitoring of each point of an area at any time location early threat of fire. Solutions applying wireless sensor networks, on the other hand, can gather sensorial data values, like temperature and humidity, from all points of a area incessantly, day and night, and allow for fresh and precise data to the fire-fighting center rapidly. In this paper, we present the pattern and

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

|| Volume 9, Issue 9, September 2020 ||

implementation of a model for the detection and localization of forest fires and the control environment. In order to know precisely and almost in real time the risk of forest fires, we design and are implementing a protocol type "Range-based" for a large-scale deployment based on convex hull. The effciency of the method is demonstrated by simulations, we show that our framework can supply quick response to forest fires while consuming energy effciently.

3.Spectral analysis of forest fire noise for early detection using wireless sensor networks, Alexander A. Khamukhin Institute of Cybernetics Tomsk Polytechnic University Tomsk,

Crown fires are extremely dangerous, very difficult to fight and often have a rate of spread over 100 times more than a surface fire. Therefore, it is important to determine the type of forest fire in the early detection based on wireless sensor networks (WSNs) to adopt the proper strategy to fight the fire. It is shown that this could be done analyzing the noise power spectrum of forest fires: surface fires noise spectrum can be modeled as the red noise (gradual increase of trend line amplitude toward lower frequencies), while for crown fires noise spectrum trend line has an almost bell-shaped (Gaussian) type. The noise frequency range is relatively narrow for crown fires and ranged from 250 to 450 Hz. The intermediate type of fires (strong surface fire and incipient crown fire) has a transient noise spectrum from broadband red to narrowband Gaussian. The article presents the spectrums of 9 different forest fires. The different trend line of the forest fire noise power spectrum is the parameter that can be used to determine the type of forest fire in WSNs.

4**. Energy Efficient Routing Protocol in Forest Fire Detection System**, V. Devadevan Dept. of Information Technology and QT Indian Institute of Forest Management Bhopal
Forest is one of the most valuable and indispensible natural resource. The forest fire is one of the natural disasters that destroy the forest not only in India but countries like Australia, USA etc which is called as bush fire, wild fire respectively. Now in terms of deploying Wireless Sensor Networks for forest fire monitoring and detection, there is a need to investigate appropriate routing protocol which fits well. There are lots of routing protocols available in Wireless Sensor Networks which are classified as Flat, Data Centric, Hierarchical, and Location based and so on. But in terms of forest fire where these wireless sensors are dependent on battery power and not any other power sources. There is a need to look into energy efficiency of such routing protocol being deployed for forest fire towards continuous monitoring and analysis. So accordingly we have compared DSDV, LEACH and APTEEN routing protocols for forest fire monitoring. Further, the APTEEN routing protocol under forest fire scenario for high, moderate and less fire prone zones been simulated using ns-2 and result compared in terms of packet delivery and zone wise energy consumption.

5. **Forest Fire Detection in Wireless Sensor Network Using Fuzzy Logic**, Pouya Bolourchi and Sener Uysal Electrical and Electronic Engineering Department Eastern Mediterranean University Gazimagusa,
The multi-purpose integrated homeland surveillance security systems are usually located in remote areas. Intelligent decision making (IDM) capability emerges as the primary feature in the realization of the T/R architecture. The aim of employing IDM is two-fold. First is to save energy, as the system operation is desired to be autonomous based on the available solar power and the corresponding battery-bank. Second is to activate the necessary action(s) required based on the pre-defined sensitivity levels. The current work is focused on the second aim using the pre-defined sensitivity levels. We propose to use a wireless sensor network (WSN) for data harvesting to be used as raw input data into our control system. Fire detection has been chosen to illustrate the IDM capability of the system. A Fuzzy Logic algorithm is developed using five membership functions as temperature, smoke, light, humidity and distance. Simulation results for the probability of fire based on the fuzzy rules using the status of the membership functions are presented in the paper.

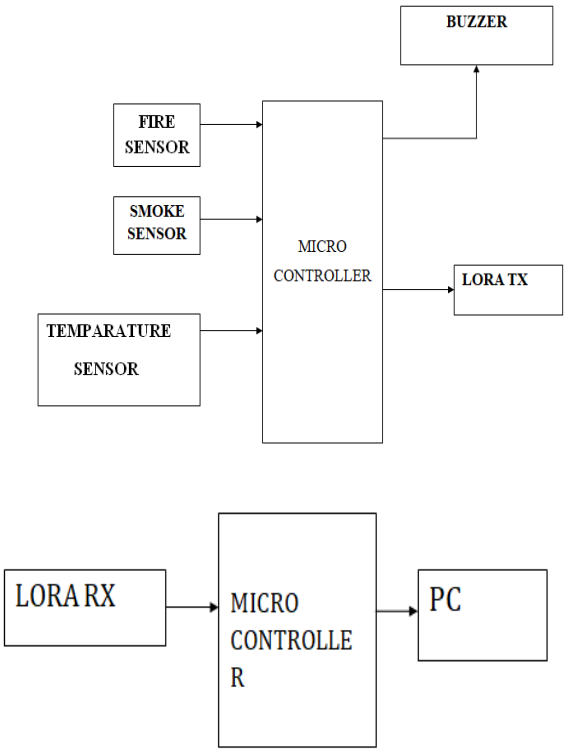
III.PROPOSED SYSTEM

- The proposed system In this project, Fire and Smoke detection system is developed.
- It can sense smoke and the rise in temperature and alert user by activating buzzer also send commands on virtual terminal of controller.
- Fire hazards are not uncommon. All the information sending through LORA and monitored in pc.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

|| Volume 9, Issue 9, September 2020 ||

BLOCK DIAGRAM



HARDWARE REQUIREMENTS:

POWER SUPPLY:

A power supply is used to reduce the mains electricity at 240 volts AC down to some thing more useable, say 12 volts DC. There are two types of power supply, linear and switch mode.

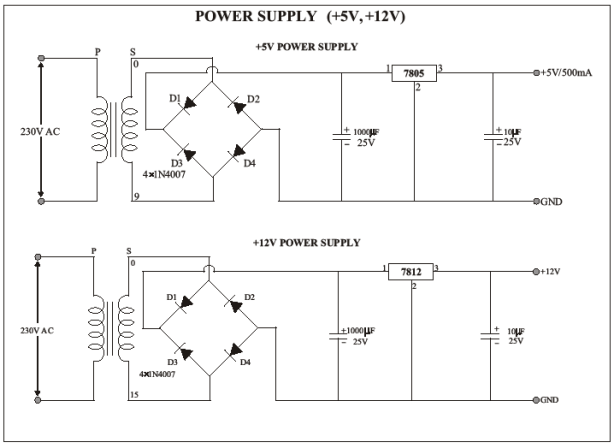
A linear power supply uses a transformer to reduce the voltage. The ratio of primary windings (connected to the mains) to the number of secondary windings (connected to the output) would give the ratio of how much the voltage reduced by, in this case a ratio of 20:1 reduces the 240 volts AC input in to 12 volts AC on the secondary windings. A switch mode supply works by turning the mains electricity on and off very quickly to reduce the voltage. In this case the reduction in voltage depends upon the ratio of the on time and off time. Switching takes place very fast, at 10,000 times SSa second or quicker. Using this technique the bulky transformer found in a linear supply can be replaced with a smaller one. The AC signal is rectified and regulated to produce a high DC voltage. This is then switched on and off rapidly by a FET. Then the switched signal goes through a transformer, although this can reduce the voltage it isolates the output from the mains electricity (for safety reasons). Feedback of the output is then used to control the mark space ratio of the switching so that the output stays at the required voltage. The transformer used in a switch mode supply is much smaller and cheaper than the type used in linear supply, but must be able to handle the higher switching frequencies.

Transformers

We have already mentioned that there are two types of transformer, those used at low frequencies (50Hz) in a linear power supply and the high speed (>10KHz) version used in switch mode supplies. The linear power supply transformer typically uses a steel core. Because eddy currents would occur in a solid steel core and reduce the efficiency the core is made from insulated steel plates stacked next to each other with the windings wrapped around them.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

|| Volume 9, Issue 9, September 2020 ||



PIC MICRO CONTROLLER:

A microcontroller (also microcontroller unit, MCU or µc) is a small computer on a single integrated circuit consisting of a relatively simple CPU combined with support functions such as a crystal oscillator, timers and etc. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, remote controls office machines, appliances, power tools, and toys.

MEMORY UNIT

The PIC16F887 has three types of memory ROM, RAM and EEPROM. All of them has specific functions, features and organization.

PROGRAM MEMORY-ROM

ROM memory is used to permanently save the program being executed. This is why it is often called 'program memory'. The PIC16F887 has 8Kb of ROM (in total of 8192 locations). Since the ROM memory is made with FLASH technology, its contents can be changed by providing a special programming voltage (13V).However, it is not necessary to explain it in detail as being automatically performed by means of a special program on the PC and a simple electronic device called the programmer.

EEPROM MEMORY

Similar to program memory, the contents of EEPROM is permanently saved, even when the power goes off. However, unlike ROM, the contents of EEPROM can be changed during the operation of the microcontroller. This is why this memory (256 locations) is perfect for permanently saving some of the results created and used during the operation.

DATA MEMORY-RAM

This is the most complex part of microcontroller memory. In this case, it consists of two parts: general-purpose registers and special-function registers (SFR). All these registers are divided into four memory banks. Two bits of status register will perform bank selection. Most commonly used SFRs will have the same address in all the four banks.

STACK

A part of RAM used as stack consists of eight 13-bit registers. Before the microcontroller starts to execute a subroutine (CALL instruction) or when an interrupt occurs, the address of the first next instruction to execute is pushed onto the stack, i.e. one of its registers. Data is always circularly pushed onto the stack. It means that after the stack has been pushed eight times, the ninth push overwrites the value that was stored with the first push.

PIC ANALOG TO DIGITAL CONVETER

The role of the ANALOG-TO-DIGITAL CONVERTER (A/D) is to convert analog voltage values to digital values. Let's explore the principle of operation of the A/D converter: The ANALOG-DIGITAL-CONVERTER converts analog voltage to binary numbers. These binary numbers can be in different length – 2,4,8,10-bit. The more bits the binary number has, the higher the resolution of the A/D.

For example: Suppose that the voltage that supplied to the A/D converter varies from 0-5 volt, and the A/D converter converts the input voltages to a binary number of two-bits. Therefore the ANALOG TO DIGITAL CONVERTER (A/D) of the microcontroller with a larger amount of bits has a higher resolution and better accuracy

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

|| Volume 9, Issue 9, September 2020 ||

when converting from analog to digital signal. There is another fact to mention about the resolution of the A/D converter. Since the converter converts the signals, it takes a certain time. The conversion time of the low resolution A/D takes less time than the conversion time of the high resolution A/D.

When you are planning special systems, you have to take into account this fact. If you are planning to build accurate and fast systems, you have to consider carefully which convert to choose: if you select an analog to digital converter (A/D) with high resolution – system will not be as "fst; but if you select an analog to digital converter (A/D) with high-speed response – you will lose the resolution of the system.

SMOKE SENSOR:

MQ-2 Gas Sensor is designed with sensitive material of sno2, which with lower conductivity in clean air. When the target combustible gas exists, the sensor's conductivity is higher. Signal conditioning circuit is used to convert the change of conductivity to correspond output signal with the input gas concentration. MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen, also could be used to Methane and other combustible steam, it is with low cost and suitable for different application.

FIRE SENSOR:

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire. It also can detect ordinary light source in the range of of a wavelength 760nm-1100 nm. The detection distance is up to 100 cm. The Flame sensor can output digital or analog signal. It can be used as a flame alarm or in fire fighting robots.

TEMPERATURE SENSOR:

The **LM35** is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in oC). You can measure temperature more accurately than a using a thermistor. The sensor circuitry is sealed and not subject to oxidation, etc. The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified.

LORA

Long range modem that provides ultra-long range spread spectrum communication and high interference immunity whilst minimising current consumption. Using Hope RF's patented LoRaTM modulation technique RFM95/96/97/98(W) can achieve a sensitivity of over - 148dBm using a low cost crystal and bill of materials. The high sensitivity combined with the integrated +20 dBm power amplifier yields industry leading link budget making it optimal for any application requiring range or robustness. LoRaTM also provides significant advantages in both blocking and selectivity over conventional modulation techniques, solving the traditional design compromise between range, interference immunity and energy consumption. These devices also support high performance (G)FSK modes for systems including WMBus, IEEE802.15.4g. The RFM95/96/97/98(W) deliver exceptional phase noise, selectivity, receiver linearity and IIP3 for significantly lower current consumption than competing devices.

MPLAB COMPILER:

The MPLAB X IDE is the new graphical, integrated debugging tool set for all of Microchip's more than 800 8-bit, 16-bit and 32 bit MCUs and digital signal controllers, and memory devices. It includes a feature-rich editor, source-level debugger, project manager, software simulator, and supports Microchip's popular hardware tools, such as the MPLAB ICD 3 in-circuit debugger, PIC kit Tm 3,and MPLAB PM3 programmer. **B**ased on the open-source Net Beans platform, MPLAB X runs on Window OS MACOS and LINUX, support many third-party tools, and is compatible with many Net Beans plug-ins.

EMBEDDED C:

Embedded c is a set of language extension for the C Programming language by the C Standards committee to address commonality issues that exist between C extension for different embedded systems. Historically embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations.

IV.CONCLUSION

This LORA project overcomes or proposes the new method of detecting forest fire using some sensors and it intended to send messages to nearby areas. In this project, Fire and Smoke detection system is developed. It can sense smoke

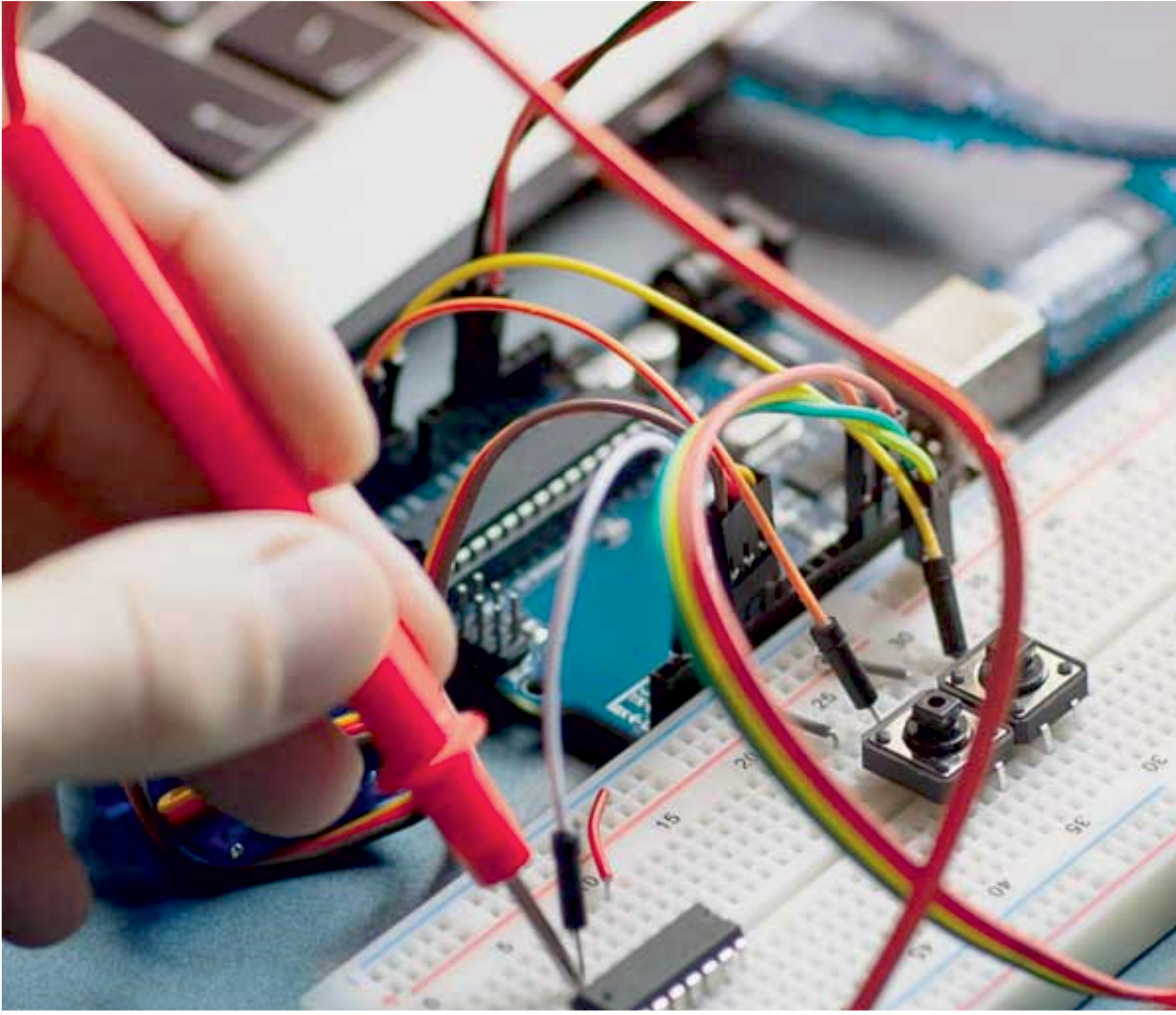
| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

|| Volume 9, Issue 9, September 2020 ||

and the rise in temperature and alert user by activating buzzer also send commands on virtual terminal of controller . Fire hazards are not uncommon. All the information sending through LORA and monitored in PC.

REFERENCES

[1] Y. Zhu, L. Xie, and T. Yuan, “Monitoring System for Forest Fire Based on Wireless Sensor Network,” pp. 4245–4248, 2012.
[2] D. V. Kirubaharan, A. J. C. Sunder, S. M. Ramesh, and P. Dhinakar, “Intruder Detection and Forest Fire Alert System with Using Wireless Sensor Network,” vol. 1, no. 3, pp. 136–140, 2014.
[3] R. Q. V. P. Chandrasekharan, “Forest Fire Detection Using Temperature Sensors Powered by Tree and Auto alarming Using Gsm,” Ijrsi 2(3) 23-28, vol. II, no. 100817, pp. 23–28, 2015.
[4] L. R. Patil, D. Chopda, and M. Borse, “Forest-Fires Monitoring System Using Wireless Technology,” vol. 6, no. 4, pp. 4–7, 2016.
[5] W. San-urnl, P. Lekbunyasinl, M. Kodyool, and W. Wongsuwanl, “A Long-Range Low-Power Wireless Sensor Network Based on U-LoRa Technology for Tactical Troops Tracking Systems,” pp. 5–8, 2017.
[6] K. H. Ke, Q. W. Liang, G. J. Zeng, J. H. Lin, and ..., “A LoRa wireless mesh networking module for campus-scale monitoring: demo abstract,” Proc. 16th …, pp. 259–260, 2017.
[7] X. W. Ian Akyildiz, Wireless Mesh Networks, London: John Wiley & Sons, 2009
[8] Y. Liu and K. Tong, “Wireless Mesh Networks in IoT Networks,” pp. 183–185, 2017.
[9] C. Pham, "Building low-cost gateways and devices for open LoRa IoT test-beds". Proceedings of the 11th EAI International Conference on Testbeds and Research Infrastructures for the Development of Networks & Communities (TridentCom'2016) , Hangzhou, China, June 13-15, 2016.
[10] F. Adelantado, X. Vilajosana, P. Tuset-Peiro, B. Martinez, J. MeliaSegui and T. Watteyne, "Understanding the Limits of LoRaWAN," in IEEE Communications Magazine, vol. 55, no. 9, pp. 34-40, 2017.



INNO SPACE
SJIF Scientific Journal Impact Factor

Impact Factor:
7.122

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर
NISCAIR

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

9940 572 462 6381 907 438 ijareeie@gmail.com