ISSN 2278-3091
Volume 10, No.2, March - April 2021
International Journal of Advanced Trends in Computer Science and Engineering
Available Online at http://www.warse.org/IJATCSE/static/pdf/file/ijatcse411022021.pdf
https://doi.org/10.30534/ijatcse/2021/411022021

Internet of Trees

Pavan S K[1], Kiran V R[2], Dr. Prashant V. Joshi[3], Dr. Sudharshan K.M.[4]
[1] School of ECE,REVA UNIVERSITY, Bangalore,pavansk000@gmail.com
[2] School of ECE,REVA UNIVERSITY, Bangalore, kiranvr96@gmail.com
[3]School of ECE,REVA UNIVERSITY, Bangalore, prashantvjoshi@reva.edu.in
[4]School of ECE,REVA UNIVERSITY, Bangalore sudharshankm@reva.edu.in

ABSTRACT

The frequency of the forest fires that have occurred in the different parts of the world, In recent decades significant population problems and causing the death if the wild animals as the impact of these fires extend beyond the destruction of the natural habitats. The proliferation of the Internet of Things industry, resolutions for initial fire detection should be developed. The valuation of the fire risk of an area and communication of this realities to the population could reduce the amount of fires originated by accident or due to carelessness of the public user. This paper proposes a low-cost network based on NXP Rapid IOT kit and Long Range (Lora) technology to autonomously estimate the level of fire risk in the forest. The system comprises of NXP Rapid IOT kit which humidity, air quality and detection of the tree fall. The data from each node stored and processed in a in a web server or the mobile application that sends the recorded data to a web server for graphical conception of collected data.

Key words : NXP Rapid IOT kit, Fire detection, Arduino, Long range (LORA), LORAWAN, Dragino Lora Shield

1. INTRODUCTION

Forest are important in the ecosystem on earth it is inseparable from the function of the forest itself namely as a producer of oxygen to mankind even during the predicate as the lungs of the world the problem is that when the forest experience of fire there will be a lot of harm to eco system months ranging from air pollution and the destruction of nature ecosystem in the forest itself starting from animals that will die a lot and two living animals can lose their place of residence another thing that become a problem is that in the event of a forest fire the authorities are slow in handling the forest fire one of the reason is the lack in the information of forest fire therefore with under a study that aims to detect forest fires and inform the authorities.[3]

Tree as a normal plant in the nature has a huge impact on the ecological environment protection tree makes an important role in keeping the balance of the earth's atmosphere and mental humidity and ambition temperature without trees on earth various laws could occur. Soil erosion is a typical consequence when trees around rivers disappeared it is reported that a loss of 44.4 billion dollars is caused because of damage caused and prevention cost every year tree can also keep the temperature on earth by absorbing greenhouse gas that is produced by humans living and production which is also thought to be responsible for global warming trees can protect the earth atmosphere and slow down climate warming without trees it is easier to generate extremely hot weather which harms agriculture production a lot for instance high temperature and drought causes and economic loss of 5.4 billion dollars in 2017 given that tree is a such a useful plant for both the nature and environment and human life it is necessary to pay attention to tree health. the environment pollution and climate change that could be the biggest threat in the future society is affecting also to the ecosystem a lot ecosystems are being destroyed rapidly by climate change and various natural and anthropogenic factors according to IPCC intergovernmental panel on climate change the fifth assessment report on the climate change on march 2014 the total world economic damage amount would be estimating about 1.3 trillion dollar if earth temperature rises to 2 degree Celsius in addition the living things of everyday 74 species and every hour 3 species are disappearing by climate change in rainforest off around the world. in reality there are lots of different damage that trees are faced such as extreme weather environment forest fire drought in excessive levels of carbon dioxide to avoid these hazards and eliminate potential threats a tree health monitoring system is needed.[4]

Therefore we are needed to continual a real-time ecosystem monitoring in order to maintain a healthy earth and a sustainable society and threw it this is a time when it is needed to predict and forecasts the ecosystem change was more than ever recently been in ecosystem and environment failed a new paradigm a converging with ICT had started to rise in order to respond to ecosystem change at the national level especially internet of things technologies may be one of the technological alternative that can provide a variety of information and effectively monitor the ecosystem changes with very white and various forms and type properties. the traditional method of forest fire detection and prevention are based on observations through satellite images visual observation by guards observation by air or videos detecting on hay rangers considering all the disadvantage of conventional forest fire detection system in the last you are different solution where propose in order to improve the monitoring system of the environment and to create a new real time forest detection system using device based on the internet of things. the capacity to detect if a fire is present is the most important part of a fire safety strategy without fire detection means it cannot alert the population it cannot take safety

measure against the fire and it cannot alarm the fire fighting services the people by our nature are capable of feeling heat and smoke to see the flames and to hear the fire burning therefore we could be great potential fire detectors but we are not always available or trustworthy and for this reason we need to use the technology to replace that those abilities.

After analysing the problems the losses resulted from the forest fires and the high cost of detection and monitoring systems I believe it is necessary to develop some low-cost system capable of evaluating the risk of a forest fire starting but also its presence. The internet of things is a communication model that represent near future solution capable of integrating sensors and devices that can communicate directly between them without human intervention the things from the internet of things include physical devices accepted with the microcontroller trancs- receivers for digital communication and stacks of protocols for making possible the communication between the users. internet of things enables object to collect or exchange data using many network technologies such as sensor networks wireless communication data collection etc among them sensor network is a indispensable to iot it has been widely used in localization industrial automation and governmental monitoring and other applications sensor network consists of a lot of low cost low power tiny sensor nodes which are randomly distributed this nodes can communicate with each other to collect and forward sensing data with the scale increasing and devices updating the network system becomes more and more complex the memory energy and ability of computing are limited by network nodes in order to maximize lifetime many researchers applied themselves to control network topology build better data transmission route and balance energy conceptions of nodes.[1]

2. LITERATURE SURVEY

An event that causes delays in handling fires was a delay in information to warn of a forest fire. To overcome the problem, we conduct a research so that forest fires can be quickly detected. The problem is generally around the forests there is no data communication network available so that disable the delivery of information in the event of a forest fire. Therefore, we designed forest fire detectors that use LoRa mesh network. The detector is able to inform us where the fire location using Google map. Forest fire detector constitute of Arduino Uno, LoRa modules, DHT 11 humidity and temperature sensor and the MQ2 sensor. We put several nodes within a forest. In this case of forest fire alarm, the best LoRa configurations are BW 250 CR 4/5 SF 10. Using this configuration, we can send data to the LoRa gateway which is 500 meters away from the sensor nodes. With the distance between devices so far, the RSSI level received by the gateway is -136 dBm in addition to avoid collisions between four sensor node we recommended a transmission interval is equal 2020 ms. [1]

A wild land fire is an uncontrolled fire that occurs mainly in forest areas, although it can also invade urban or agricultural areas. Among the main causes of wildfires, human factors, either intentional or accidental, are the most usual ones. The number and impact of forest fires are expected to grow as a consequence of the global warming. In order to fight against these disasters, it is necessary to adopt a comprehensive, multifaceted approach that enables a continuous situational awareness and instant responsiveness. This paper describes a hierarchical wireless sensor network aimed at early fire detection in risky areas , integrated with the fire fighting command centres, geographical information systems, and fire simulators. This configuration has been successfully tested in two fire simulations involving all the key players in fire fighting operations: fire brigades, communication systems, and aerial, coordination, and land means.[2]

Low Power Wide Area Networks (LP-WAN) are receiving a lot of attention because of their ability to communicate using radio frequency in long distances, with low-power consumption and low-cost devices. In this paper, we provide a comparison between the two LP-WAN platforms that are leading the market, the Sigfox and the LoRaWAN, based on the literature. Both platforms are analyzed considering the context of the forest fire detection and verification systems. Many aspects are being considered to identify which LP-WAN is more adequate to be used in this kind of systems, such as battery lifetime, coverage range, business model and costs. The comparison shows that both platforms are very similar in most of the aspects, although LoRaWAN is more flexible than Sigfox on the deployment and management of the network infrastructure. LoRaWAN allows customers to implement and manage their own infrastructure network, which is essential in systems which monitor vast forest areas [3]

The number of forest fires that occurred in recent years in different parts of the world is causing increased concern in the population, as the consequences of these fires expand beyond the destruction of the ecosystem. However, with the proliferation of the Internet of Things (IoT) industry, solutions for early fire detection should be developed. The assessment of the fire risk of an area and the communication of this fact to the population could reduce the number of fires originated by accident or due to the carelessness of the users. This paper presents a low-cost network based on Long Range (LoRa) technology to autonomously evaluate the level of fire risk and the presence of a forest fire in rural areas. The system is comprised of several LoRa nodes with sensors to measure the temperature, relative humidity, wind speed and CO_2 of the environment. The data from the nodes is stored and processed in a The Things Network (TTN) server that sends the data to a website for the graphic visualization of the collected data. The system is tested in a real environment and, the results show that it is possible to cover a circular area of a radius of 4 km with a single gateway.[4]

3. PROPOSED OBJECTIVES

The proposal mainly focuses to develop the ecosystem for Internet of Trees. Proposed architecture will detect and monitor the geographical activities of the forest by connecting the trees with the main server. The main objectives are:

1. Integrating the NXP RAPID IOT PROTYPING KIT, Arduino UNO and LoRa kit with appropriate sensors to build IoT system to detect and monitor the forest geographical activities such as fire and land slide incidents.
2. Establishing the communication between the cluster of trees and central server to achieve real time activity monitoring.

4. DESIGN TOOLS REQUIRED

Table 1: DESIGN TOOLS REQUIRED

Hardware Components	1. NXP RAPID IOT KIT 2. Arduino Uno 3. Dragino Lora Shield 4. Anemometer 5. Lora gateway 6. Bluetooth(hc05)
Software Components	1. Atmosphere platform IDE 2. Atmosphere platform APP 3. Arduino IDE

The table.1 depicts the proposed design tools required in the system mainly consists of the hardware and software components. The hardware components comprises of the NXP RAPID IOT KIT, arduino uno which are the heart of the system. The key sensors of the system are Dragino Lora shield, anemometer, Lora gateway, bluetooth (hc05). The Software Constituents of the Atmosphere platform IDE , Atmosphere application and ardiono ide

5. METHODOLOGY

Internet of tree is the interconnection of network with tree as an node, each node consist of nxp rapid iot kit and LoRa WAN and anemometer and they are interfaced with each other the information collected will be transmitted through LoRa gate way module that acts as an long range communication network interface to the main gate way module. The information contain by NXP Rapid IOT kit are surrounding temperature, humidity, fall detection and information contained by anemometer are wind speed and direction of the wind, and LoRa wan will interface with main gate way module, the final resulting will be of displaying all this information to a concerned person that can be access through web page, that will give alert of the fire spreading in forest region.

6. ALGORITHM

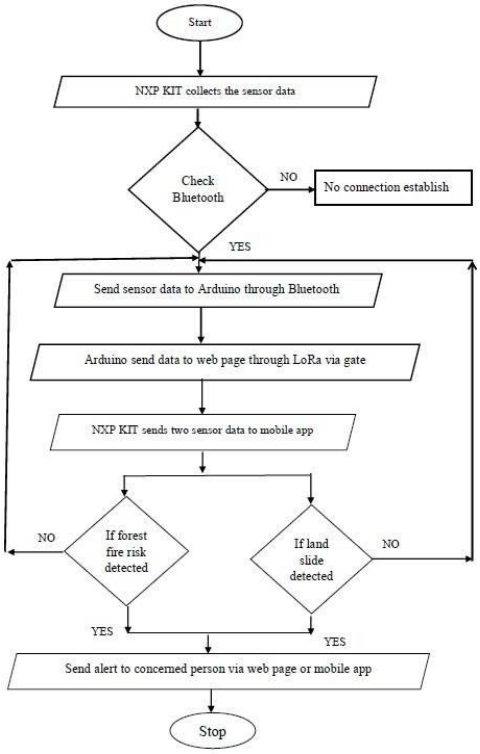

Figure 1: ALGORITHM

7. BLOCK DIAGRAM

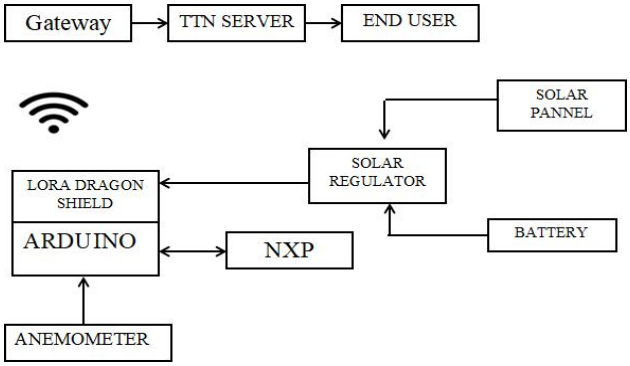

Figure 2: BLOCK DIAGRAM OF PROPOSED SYSTEM

8. CONCLUSIONS

The design and development of the proposed system is low power and low-cost system capable of detect and monitor the level of risk of forest fire and land sliding in a rural area. LoRa based technology and NXP Rapid IOT kit is comprised of a set of nodes and a gateway. Each node is integrated with the NXP RAPID IOT PROTYPING KIT, Arduino UNO and LoRa kit to establishing the communication between the cluster of trees and central server to achieve real time activity monitoring. The data is transmitted to a web server or mobile application. The prospect of "Internet of Trees" is to drive efficiency, improve quality, and improve awareness of soil conditions, the forestry side of things is for ecological monitoring for expand the

process so that we can collect data continuously and helps in isolating specific locations.

ACKNOWLEDGEMENT

The authors are gratefully acknowledge the facilities and support provided by the director of the school of Electronics And Communication Engineering of REVA UNIVERSITY, We also extend thanks to all teaching and non-teaching staff who had helped directly or indirectly to make this project successful

I would like to thank NXP Semiconductors engineers, as they were kind enough to help me with this project. I would also like to thank Mr. Jwalant Joshipura and Mr. Desingh Devibalan B. of NXP Semiconductors for their support throughout the project.

REFERENCES

1. Adnan A. Ejah Umraeni Salam Arham Arifin Muhammad Rizal,(“ Forest Fire Detection using LoRa Wireless Mesh Topology”) INSPEC Accession Number: 19082507DOI: 10.1109/EIConCIT.2018887 8488, Date of Conference: 6-7 Nov. 2018.
2. Antonio Molina-Pico, David Cuesta-Frau,Alvaro Araujo, Javier Alejandre, Alba Rozas(“Forest Monitoring and Wildland Early Fire Detection by a Hierarchical Wireless Sensor Network”) Article ID 8325845, Date of Conference: 14 Feb 2016.
3. Daniel Adorno, Salviano Soares, Jose Lima, Antonio Valente,(“ Evaluation of LP-WAN Technologies for Fire Forest Detection Systems”) ISBN: 978-1-61208-691-0 Date of Conference: February,28,2019
4. Sandra Sendra, Laura García, Jaime Lloret, Ignacio Bosch, Roberto Vega-Rodríguez (“LoRaWAN Network for Fire Monitoring in Rural Environments”) ; doi:10.3390/electronics9030531 Date of Conference: 28 December 2019
5. Chung Kit Wu, Kim Fung Tsang, Yucheng Liu, (“An IoT Tree Health Indexing Method Using Heterogeneous Neural Network”), INSPEC Accession number:18715237, DOI: 10.1109/ACCESS.2019.2918060, Date of Conference: 20 May 2019.
6. Chi-Tsun Cheng, Nuwan Ganganath, Kai-Yin Fok (“Concurrent Data Collection Trees for IoT Applications”) INSPEC Accession Number: 16823976, DOI: 10.1109/TII.2016.2610139, Date of Publication: 15 September 2016
7. Yixiong Wang, Jun Song, Xiaofeng Liu, Shan Jiang, Yunfei Liu(“Plantation Monitoring System Based on Internet of Things”) INSPEC Accession Number: 13972465 DOI: 10.1109/GreenCom-iThings-CPSCom.2013.80 Date of Conference: 20-23 Aug. 2013.
8. Sheng-De Wang, Kuan-Jung Chiang (“BLE Tree Networks for Sensor Devices in Internet of Things”) INSPEC Accession Number: 17661683 DOI: 10.1109/DASC-PICom-DataCom-CyberSciTec.2017.210, Date of Conference: 02 April 2018
9. Nisar Ahmad , Ali Hussain , Ihsan Ullah , Bizzat Hussain Zaidi(“IOT based Wireless Sensor Network for Precision Agriculture”) INSPEC Accession Number: 19228653 DOI: 10.1109/iEECON45304.2019.8938854 Date of Conference: 6-8 March 2019.
10. Tie Qiu , Xize Liu , Lin Feng, Yu Zhou , Kaiyu Zheng (“An Efficient Tree-Based Self-Organizing Protocol for Internet of Things”) INSPEC Accession Number: 16179031, DOI: 10.1109/ACCESS.2016.2578298, Date of Publication: 08 June 2016.
11. Karen Bayne, Samuel Damesin, Melissa Evans (“The internet of things – wireless sensor networks and their application to forestry”) Date of Publication: February 2017
12. Raed Abdulla,, Waleed Al-Gumaei,, Chandrasekharan Nataraj, Sathish Kumar Selvaperumal,(“ Research Article Smart Tree Care System with Internet of Things”), ISSN: 2040-7459; e-ISSN: 2040-7467, DOI:10.19026/rjaset.15.5923, Date of Publication: September 15, 2018