FOREST FIRE DETECTION USING Lora

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Abstract:
Portugal, like many countries all over the world, is affected every year by fires that consume and destroy thousands of hectares of forest territory and endanger people lives, homes and properties. Despite the investment and evolution in fire fighting techniques and equipment, it is common for fires to achieve a greater proportion then they should, due to late detection. This project aims in detection of occurrence of fire in forests. Fire detection should be taken place in right time to avoid damage for large amounts of natural resources. Our project succeeds in detecting the occurrence of the fire without any delay using LoRa communication system. The project makes a use of Arduino microcontroller and sensors to achieve this task.

Keywords:
ArduinoUNO;LoRa communication; DHT11;CO2 sensor;LCD module;Buzzer;USB TTL.

1. Introduction

Our project is implemented with the help of fire sensor, Co2 sensor MQ02, LoRa Modules, LCD, buzzer modules. We employ fire sensors to sense the presence of fire and also MQ02 sensor for C02 detection. The output of the fire sensor and Co2 sensor detection are fed as input to the Arduino micro controller. Whenever fire arises or the Co2 is detected the sensor communicates the message with the central control station using LoRa communication network. This project consists of an onboard computer, which consists of number of input and output ports. These onboard computers are commonly termed as micro controllers. The input and output port of the controller are interfaced with different input and output modules depending on the requirements. In other words micro controller acts as a communication medium for all the modules involved in the project.

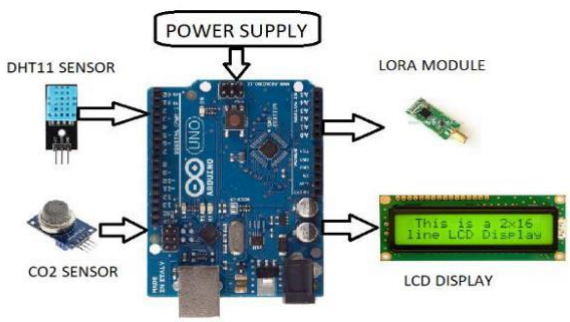
LoRa (Long Range) is a patented digital wireless data communication technology developed by Cycleo of Grenoble, France, and acquired by Semtech in 2012. LoRa is a long-range wireless communication protocol that competes against other low-power wide-area network (LPWAN) wireless such as narrowband IoT (NB IoT) or LTE Cat M1. Compared to those, LoRa achieves its extremely long range connectivity, possible 10km+, by trading off data rate. Because its data rates are below 50kbps and because LoRa is limited by duty cycle and other restrictions, it is suitable in practice for non-real time applications in which one can tolerate delays

2. Literature Survey

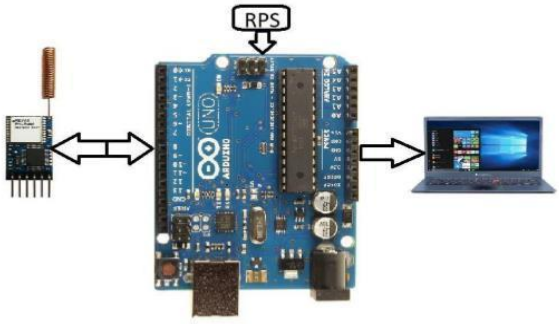
[1] An Efficient and Effective Forest Surveillance System to Prevent Malicious Activities using LoRa , Chandra.B, S. Usha Kiruthika, Dinesh Kumar.S, Anish.S, Kabilesh.E This paper proposes an IOT based forest surveillance system which employs the benefits of LoRa technology to detect theft of trees in forest by recognizing the sound produced by certain equipments while cutting the trees. And this paper also proposes the use of gas and temperature sensors to calculate the temperature, humidity, carbon monoxide to predict the forest fire well in advance.PIR sensor is used to find the motion of human beings around the forest and protect the device from the animals. The information is transmitted by the Lora technique. The inserted framework engineering and the equipment/programming plans are explained in detail. The exploration results demonstrate that Lora innovation had a decent transmission impact among forest

[2] 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.

3. Implementation:



Transmitter Section



Receiver Section

In this project, we have two sections. Transmitter and Receiver. In Transmitter section, all the sensors data is being given to the Arduino Microcontroller. This sensors data is transmitted to receiver section through LoRa. In Receiver section, the data is received by LoRa and is displayed on Laptop through HyperTerminal application. LCD and Buzzer gives the visual and audible alerts accordingly. Visual alerts are shown on LCD.The Microcontroller is programmed using Embedded C language.

4. Related Work:

The brief introduction of different modules used in this project is discussed below:

ARDUINO UNO:

The **Arduino Uno** is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

DHT11 sensor:

A Fire detection sensor senses, measures and regularly reports the relative temperature in the air. It measures both moisture and air temperature. Relative humidity, expressed as a percent, is the ratio of actual moisture in the air to the highest amount of moisture air at that temperature can hold. The warmer the air is, the more moisture it can hold, so relative humidity changes with fluctuations in temperature.

CO2 sensor:

This semiconductor MQ02 sensor detects the presence of combustible co2 along with smoke at concentrations .These are easy to install and are used in both residential as well as commercial sectors. If any Co2 is detected by the sensor then it is going to alert the micro controller.

LCD (LIQUID CRYSTAL DISPLAY) :

One of the most common devices attached to a micro controller is an 16x2 LCD display. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively. The project status will display on LCD.

Buzzer:

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or electronic. A buzzer can be operated on two principles..piezo electric buzzer, it generates

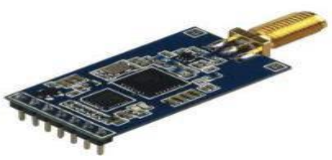
sound because of the piezoelectric effect. magnetic buzzer is based on the electromagnetic principle. In this project we are going to use magnetic buzzer.

Characteristics of buzzer circuit :

1. sound level ----------70-95 dB
2. current consumption---------35-60 ma
3. resonant frequency---------- 1-3 khz

LoRa Module:

"LoRa (short for long range) is a spread spectrum modulation technique derived from chirp spread spectrum (CSS) technology" by Semtech. It is a wireless modulation technology with low power consumption and effective long-range capability. It can achieve a range up to 15 km while consuming very little power (100 mW constant RF output @3.3V, based on Semtech SX1276), and it is designed specifically for M2M and IoT network. LoRa transceivers operate in 860-1000 MHz range. There are a large of range of LoRa development kits available in RS. The article below also mentions some LoRa kits. And of course, you may find what you want and like on the RS website. To further explore the modulation technology of LoRa, extra information can be found at RF Communication and the Internet of Things. Because of the great ability of LoRa, it is suitable for remote devices to communicate. Also, remote devices can benefit from the low power consumption of LoRa, so they can be powered by a battery and can last for a few years without battery replacement**.**

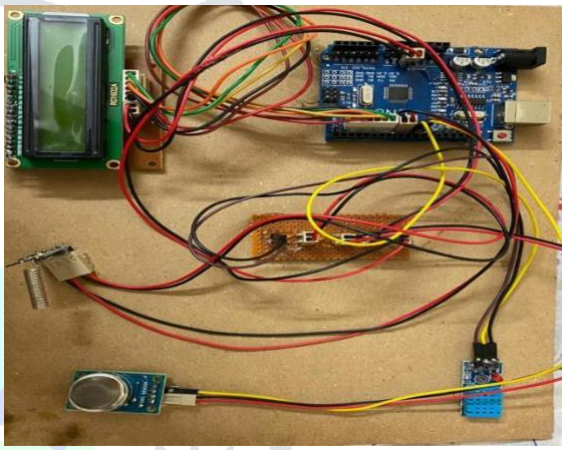


4. CONCLUSION:

The existing model presents an Integrating feature of all the hardware components which has been used and developed in it with ARDUINO UNO ATMEGA328P MICROCONTROLLER. The Presence of each and every module has been reasoned out and placed very carefully. Hence the contributing to the best working unit for "**FOREST FIRE DETECTION USING LoRa**" has been designed perfectly uses Lora communication technology to send alert messages to long distance. This system has an advantage of low power, reliable and long distance message transmission in real time which has a better scope in applications like forest fire and monitoring. Thus, the project has been successfully designed and tested.

5 RESULTS:

Transmitter:



Receiver:

6. ACKNOWLEDGEMENT:
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