

IoT based Intruder Alert System for Forests

Amruta Shivale, Pragati Kamthe, Prof. Vinod Badgujar

Department of Computer Engineering, SRCOE, Pune Maharashtra, India

ABSTRACT

There is much news that reads smuggling of trees like sandal, sagwan etc. The wood from these trees are very costly and are not widely available everywhere. The scope of the project is to provide alerts about changes happening in the forest due to intrusion. The system not only provides data regarding intruder but also helps to monitor forest fire, fall detection as well as pH content of soil. The system sends various alerts regarding to the type of issue occurred. Multiple sensors are used in this system to monitor data. These sensors reduce the extent of danger that may be caused in a forest. This system can prove very helpful for monitoring areas in forests which have such issues.

Keywords : NodeMCU, IoT, Sensors, Intruder Alert System.

I. INTRODUCTION

Poaching of trees which provide a good cost to the smugglers is a problem faced in forests which have trees like Sagwan or Sandal. The poachers use various methods to cut the wood from the trees. The poachers can cut the tree or make use of chemicals to make the roots of the tree weak so that tree will fall after some time making their work easier. Another problem faced in forests is forest fires. Wildfire is an uncontrolled fire which cause significant damage to forests. Once the fire starts it rapidly spreads all over the forest and results in massive destruction. Some of the reasons for wildfire are lightning, extreme hot and arid weather, severe drought, and human unawareness. Over the past decade there is enormous destruction in forest, in which the majority of those accidents were caused by forest fire. Based on the Forest Survey of India's data on forest fire it is stated that around 50% of the forest areas are fire prone. This incident shows that forest do not have proper fire prevention system.

In this project, we have designed an IOT system for forest fire detection system to help detect fire as soon as possible, before the fire spread over the large area. The device will be placed on proper place after doing surveys. The data collected by sensors will be sent to.

Thing Speak Server and then to Android App which is specially built for this system. The system will process the data and at the same time the system will send alerts to the concerned person. Several types of sensors used in the system are Flame Sensor, Ultrasonic Sensor, Accelerometer and a pH sensor.

II. LITERATURE SURVEY

An Autonomous IoT Infrastructure for Forest Fire Detection and Alerting System [1] - In this paper, they have built a fire detector using Arduino which is interfaced with a temperature sensor, a smoke sensor and buzzer. They have tried to make it smarter by connecting the whole data monitoring process to the webpage and controlled by the Arduino. In this paper they designed and evaluated the system for its

effectiveness as well as scalability due to the improvement of sensor technology.

An IOT based fire alarming and authentication system for workhouse using Raspberry Pi3 [2] - In this paper, they have designed and implemented a fire detection system for factories using Raspberry Pi. They have used a temperature, flame and smoke sensor for sensing fire and PIR sensor & camera for Intruder detection i.e. Authentication. They have provided a confirmation of the fire suspecting system to avoid any false alarm and System will start firing suppression system, like opening fire extinguishing water valves when fire occurs.

Forest fire detection using optimized solar-powered ZigBee wireless sensor networks [3] - In this paper, they have developed a system for Forest Fire Detection which overcomes the demerits of the Existing technologies of Forest Fire Detection.

IoT Enabled Forest fire detection and online monitoring system [7] - The objective of this project is to detect the forest fire as early as possible by measuring the level of temperature and CO2 level. They used Temperature and smoke sensor to detect the ignition alarming temperature and the level of carbon dioxide gas (CO2). Early alerting and immediate response to a forest fire is the only way to avoid great losses. Hence, the most important goals in fire surveillance are early and reliable detection.

III. SYSTEM ARCHITECTURE

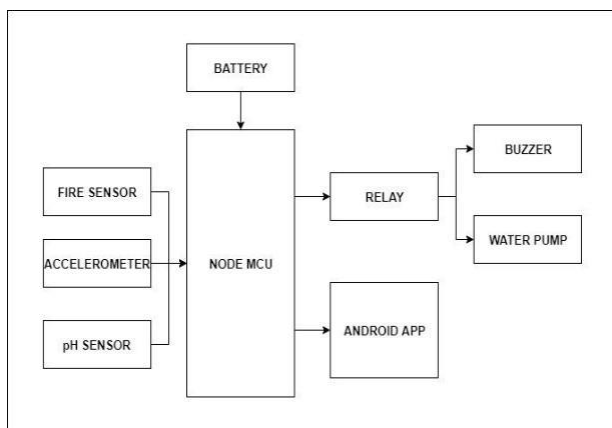


Figure 1: Architecture Diagram

The architecture shown above has various modules as stated below:

a. NodeMCU



Figure 2: NodeMCU

Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106

- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 Mhz
- Wi-Fi: IEEE 802.11 b/g/n

b. Battery



Figure 3: 9V Battery

Battery is used to continuously provide power to the system. A 9V battery is used to power the device. c. Relay



Figure 4: Single Channel Relay Module

Relay is used to activate the motor in case of forest fire. A 9V single channel relay module is used to power the system.

d. Water Pump



Figure 5: 12V Water Pump

NodeMCU is the micro controller which is used to power the system. It is a low-cost micro controller that is used for IoT applications. The NodeMCU v3 device features a 4 MB (32 Mb) flash memory made in sectors of 4k each. The flash memory address starts at 0x40200000.

A 12V water pump is used to supply water. A Generic DC 12V 5.5m 1000L/H brushless motor submersible water pump submersible water,

e. Buzzer



Figure 6: Buzzer

A buzzer is an audio signalling device, which may be electromechanical, mechanical or piezoelectric. Typical uses of buzzers include alarm devices, timers etc. Buzzer is used to provide alerts in case of any issue.



Figure 7: Fire Sensor

A fire sensor module is used to detect the forest fires that occur in surrounding of the sensor. This sensor can be used to detect fire source of the wave length in the range of 760nm - 1100 nm.

f. Accelerometer

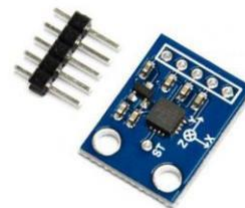


Figure 8: Accelerometer ADXL335

An accelerometer is an electromechanical device used to measure forces created by acceleration. The accelerometer is used detect the tree falls in forest. c. pH Sensor

g. Fire Sensor



Figure 9: pH Sensor

An Arduino pH Sensor Meter Kit with industrial electrode is seen in above diagram. The pH sensor is used to detect the pH value of soil. If the intruder tries to use chemicals to make the roots of tree weak then the pH change of soil is detected and an alert is sent. d. Ultrasonic Sensor



Figure 10: HC-SR04 Ultrasonic Sensor

HC-SR04 Ultrasonic Sensor has four pins Vcc, GND, Trig, Echo. It is used for measuring distance and intrusions. Four ultrasonic sensors are connected in order to provide surveillance in the forest.

IV. SOFTWARE USED

The software used in this are as follows:



Figure 11: Arduino IDE

The Arduino IDE is a cross platform Integrated Development Environment for Arduino. It is used to burn programs to Arduino board. The source code for the Arduino is released under the GNU License. The Arduino IDE supports C and C++ languages. It has multiple number of libraries for various input and output devices. Only two basic functions are required for user written codes. The Arduino has avrdude

which is used to convert code into hex format to upload it is not a boot loader. It is also used to program NodeMCU. b. MIT App Inventor 2

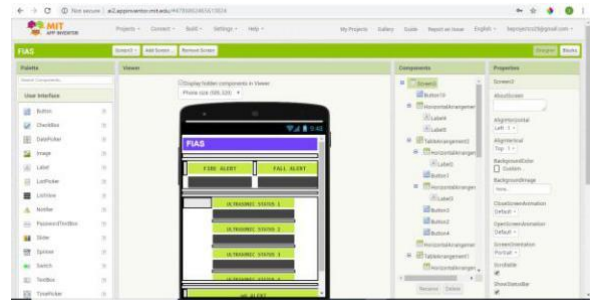


Figure 12: MIT App Inventor

MIT App Inventor 2 is a GUI based app inventing machine used to develop apps for Android and IOS. It is used for easy coding and it supports coding in block format. The code can be created using blocks for various elements placed on Screen.

c. Thing Speak Cloud

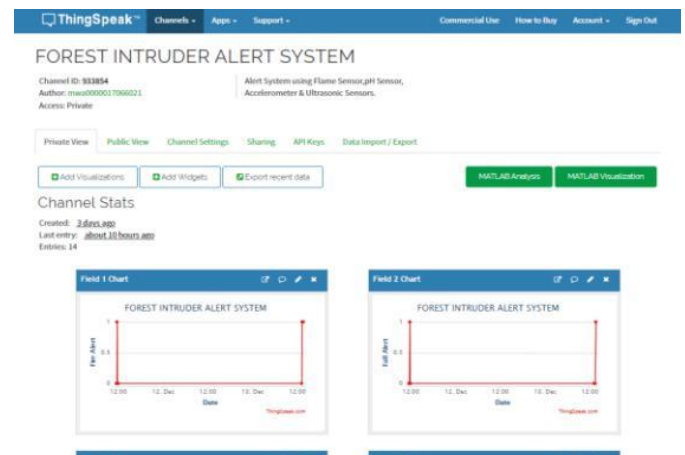


Figure 13: Thing Speak Cloud

Thing Speak is cloud based server where one can log data. In Thing Speak one can create a channel to log data of their system in use. We have used Thing Speak to log sensor data of our system.

V. WORKING

This project uses NodeMCU as the microcontroller. It has various sensors for controlling the system. A flame sensor is used to detect forest fires. An ultrasonic sensor is used to detect intrusion activities in forest. An accelerometer checks the value of initial tree position and final tree position in case of fall. A pH sensor detects changes in soil pH. The device would be powered by USB charger as well as it can be operated using power banks or any other power source. A water pump is used to water during forest fire. The android app for the Forest Intruder Alert System will have these data. The android app is developed on MIT App Inventor 2. If any of the value goes beyond threshold value then the change is sent to Thing Speak and an alert is given. The Thing Speak server then sends data to app. The app continuously shows readings of the sensor.

VI. CONCLUSION

We have designed a system for detecting intruders in forest as well as monitoring forest fires which overcomes the limitation of the existing technologies. In this project, we have developed a system which can reduce catastrophic events caused due to fire. This system detects the forest fire as early as possible before the fire spreads over a large area and prevents poaching. It also detects intrusion of poachers as well as actions done by intruders on trees.

VII. REFERENCES

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