Integrated Forest Fire Monitoring Using Amazon Web Services

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Abstract- **Most of the time when someone notices Forest Fire, it's already too late to take any action because fire has already been spread widely. It becomes difficult for fire fighters to cover the affected area. Existing Forest Fire detection systems either utilize cameras to monitor the areas by a Forest Guard, or use an infrared sensor system to detect fires or a satellite based system. But there is a lot of capital involved in these methodologies and accuracy and efficiency is a matter of concern. The aim of this project is to develop a low cost hardware solution using Arduino and Raspberry Pi. A network is built using distributed wireless nodes of Arduino each having sensors, randomly spread across the forest that creates a self-organized robust network of nodes to cover large areas in the forest that may be prone to fire. The sensor network monitors their respective areas continuously and at regular interval of time sends the location specific data to the Raspberry Pi for further transmission to Amazon Cloud. The Web Application hosted on the Amazon Servers shows the areas covered by the nodes and retrieves the location specific data from the cloud and sends alert to fire fighters in case Fire has been detected. So this monitoring system is capable of collecting and providing purposeful data and helps in making quick decisions to reduce damages.**

Keywords- fire detection, amazon humidity sensor, forest fire, temperature.

I. INTRODUCTION

One of the most challenging aspect of Forest Fire is that they spread quickly and are unpredictable. Forest can be disastrous and once they grow to certain height, they can be very hard to control. Forest Fires have adverse impact on Social and Environmental aspects regardless of whether they are caused by natural forces or human activities. Thus, once discovered, the Fire Fighters must arrive to the scene quickly in order to control the Fire. This project, Amazon Web Services (AWS) a subsidiary of Amazon, offers a suit of cloud-computing services that make up an

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on demand computing platform. These services operate from 16 geographical regions across the world. There is a need for a feasible and cost effective monitoring strategy that provides timely, precise, and consistent estimates of Forest. Taking in to consideration all this reasons we designed a system that will aid Fire Fighters in such situations with the help of advance technology.

II. LITERATURE REVIEW

One of the Forest proposals of the use of wireless communication for fire detection was the satellite based system. Earth-orbiting satellites and even air-floating devices have been employed for observation and detection of forest fires. The existing satellite-based [1] observations for forest fires suffer from severe limitations resulting in a failure in speedy and effective control for forest areas. The limitations in this approach is that the position and orientation of the satellite might be far from optimal for detecting a forest fire at an early phase. In this system weather condition (e.g. clouds) seriously decrease the accuracy as the limitations led by the long scanning period and low resolution of satellites and this could ultimately affect the quality of the satellite images. Forest Fires could also be detected by optical sensors and digital camera [2]. It automatically gives early detection and warning of Forest Fires. This optical system has various algorithms which unitedly is used to detect forest fires. The image consists of a number of pixels, where the processing unit tracks the motion in images and checks how many pixels contain smoke or fire glow and then the processing unit sends the results for another algorithm to decide whether or not to produce an alarm for the operator. Most of the optical systems need to be integrated with geographical maps for localization reasons. The difficulties of processing landscape images are their varying nature and to the large number of dynamic events that may appear under various illuminating conditions depending on weather, distance, time of day, masking objects, and so forth. These events

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produce dynamic envelopes, which are not always caused by motion. This kind of technology only provides a line of sight vision, where high trees or the hills and mountains can block the vision; plus, it might be impossible to provide images for the point of ignition. Camera surveillance systems [3] with short distance links were tried, but this also proved an ineffective method for fire detection in regard to the need for manual installment for each camera in an appropriate position rather than the line of sight images, night images, bad weather image problems, which resulted in huge possibility of false alarm due to daily motion of the sun, moving clouds, variation of atmospheric extinction, vegetation. All these proposals did not prove the best and are not efficient to detect the fire quickly which basically causes wide amount of disaster. So our idea behind this problem is to get the early detection of fire in the forest before it spreads to the entire forest. We will be using different types of sensors i.e.

1) Gas sensor

Fig 2.1:-MQ2 Gas Sensor

2) Humidity Sensor

Fig 2.2:-DHT11 Humidity Sensor

3) Flame Sensor

Fig 2.3:-LM393 Flame Sensor

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4) Raspberry Pi

Fig2.4:- Raspberry Pi

This will immediately detect fire and other events and will generate signal which on the GUI will display the location of occurrence of Forest Fire. In this way this method prevent the Forest being completely destroyed.

VI. PROBLEM STATEMENT

The most critical issue in a forest fire detection system is to provide highly rapid response in order to minimize the scale of disaster and also to reduce the overall cost of the system which is not possible using highly expensive satellite and traditional systems as it doesn't provide immediate response after detection. So there is need to develop low cost highly responsive system to get the immediate result.

VII. BLOCK DIAGRAM

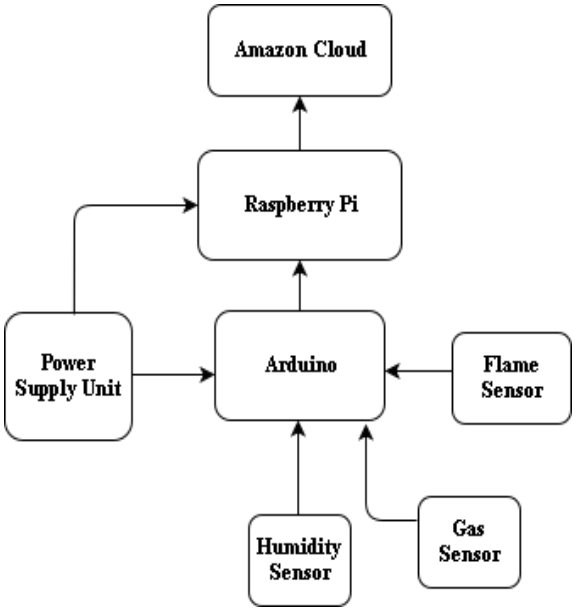

Fig4.1: Block Diagram of Integrated Forest Fire Monitoring Using Amazon Web Services

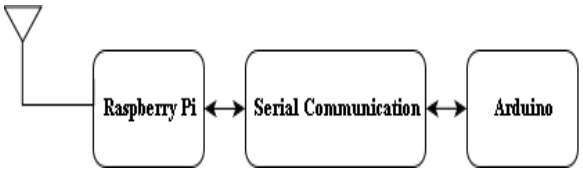

Fig 4.2:-Block Diagram of Amazon Raspberry Pi Serial Communication

V. WORKING

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In this project, there are two hardware entities (Ardunio Uno, Raspberry Pi), Amazon cloud and sensors (MQ2 Gas Sensor, LM393 Flame Sensor, DHT11 Humidity Sensor). In which each Forest section which will contain a Microcontroller unit (Arduino Uno) to which different Sensors are connected. The Gas sensor sense the nature and type of the Gas present in the atmosphere, the Flame sensor senses Fire, the Humidity Sensor measures the Humidity value. Entire circuit will work on 5v power supply. The Arduino Uno collects the data from the various sensors connected to it and transmits it to the Raspberry Pi using Serial connection. The Raspberry Pi in turn collects all the location specific data from various Arduinos in the Forest, decodes it and sends it to the Amazon cloud. The Amazon cloud also hosts a Web Application, developed using HTML, CSS, JavaScript, shows the areas covered by the nodes and at fixed interval retrieves the location specific data from the cloud. When the Fire is detected by the sensors, the location specific signal is propagated to the cloud from the sensors through Arduino and Raspberry Pi, the Web Application sends alert to Fire Fighters.

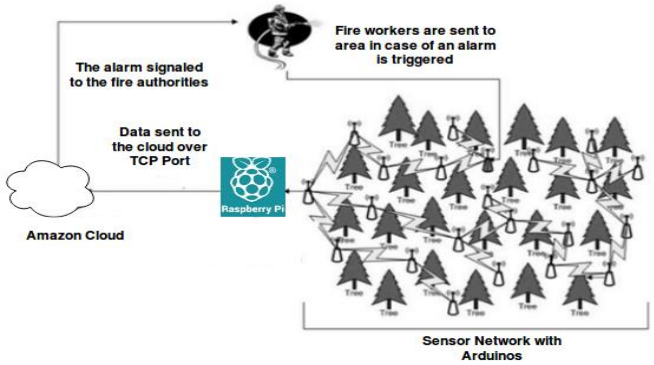

Fig 5.1:-Implementation of Integrated Forest Fire Monitoring Using Amazon Web Services

VI. APPLICATIONS

1. Industrial Fire Detection
2. Green House Monitoring
3. Fire Sprinklers
4. Home Safety

VII. FUTURE SCOPE

1. Module Communication - Effective modes of communication that facilitate no data loss.

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2.Power supply can be replaced by solar battery.

3.Camera can be placed for review.

4. Higher range sensors can be used.

5.All weather durable sensors and microcontrollers can be used.

VIII. CONCLUSION

It can be concluded that Wireless Sensor Technology is best suited for monitoring and detection of forest fire and also the project aims to display the location of fired caused area after sensing the physical effect which is going to be implemented using various sensors and web technology for building graphical user interface. The system will result in regular timely preparation of required output. Real time implementation of this system will be the tiny working model where the total area would be divided into different section where the different sensors would be deployed and real time monitoring and detection of fire would be shown.

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