FOREST-FIRE AND LANDSLIDE MONITORING IOT POWERED BY A RENEWABLE SOURCE OF ENERGY

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Abstract- The phenomenon of landslides and forest-fires are natural disasters that causes damages of severe magnitude. They are so intense that they cause damages to the human society as well the wildlife residing in those forests. The slides and forest-fires scare the animals and push the people and tribal who reside in the forests to distressed state. The Early Warning systems are monitoring devices designed to avoid, or at least to minimize the impact imposed by the calamities. The power source becomes a major issue in the forest area and it can be overcome by using a renewable power source like solar panel which converts the solar energy into the direct current. Here we indent to propose a monitoring system with power driven from a solar panel

Keywords- IoT, Renewable energy, Solar panel, Sensors, Location, Monitoring, Tracking, Wildlife and Human Conflicts

I. Objective

Our objective is to create an IoT that can predict the landslides and forests fires thereby acting as a source of information that can prevent disasters. Solar panel is our source of energy.

II. Introduction

I.1.Landslides

A landslide is defined as the movement of a mass of rock, debris, or earth down a slope due to gravity. The materials may move by falling, toppling, sliding, spreading, or flowing. Almost every landslide has multiple causes. Slope movement occurs when forces acting down-slope (mainly due to gravity) exceed the strength of the earth materials that compose the slope. Landslides can be triggered by rainfall, snowmelt, changes in water level, stream erosion, changes in ground water, earthquakes, volcanic activity, disturbance by human activities, or any combination of these factors. Earthquake shaking and other factors can also induce landslides underwater. These landslides are called submarine landslides. Submarine landslides sometimes cause tsunamis that damage coastal areas. Landslides can move slowly, (millimeters per year) or can move quickly and disastrously, as is the case with debris flows. Debris flows can travel down a hillside at speeds up to 200 miles per hour

(more commonly, 30 – 50 miles per hour), depending on the slope angle, water content, volume of debris, and type of earth and debris in the flow. These flows are initiated by heavy periods of rainfall, but sometimes can happen as a result of short bursts of concentrated rainfall or other factors in susceptible areas. Burned areas charred by wildfires are particularly susceptible to debris flows, given certain soil characteristics and slope conditions. Landslides are a serious geologic hazard. It is estimated that in the United States they cause in excess of $1 billion in damages and from about 25 to 50 deaths each year. Globally, landslides cause billions of dollars in damages and thousands of deaths and injuries each year. As people move into new areas of hilly or mountainous terrain, it is important to understand the nature of their potential exposure to landslide hazards, and how cities, towns, and counties can plan for land-use, engineering of new construction and infrastructure, and other measures which will reduce the costs of living with landslides. Although the physical causes of many landslides cannot be removed, geologic investigations, good engineering practices, and effective enforcement of land-use management regulations can reduce landslide hazards. In some cases human activities can be a contributing factor in causing landslides. Many human-caused landslides can be avoided or mitigated. They are commonly a result of building roads and structures without adequate grading of slopes, of poorly planned alteration of drainage patterns, and of disturbing old landslides.

II.2 **Internet of Things (IoT)**

The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. A thing, in the Internet of Things, can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low -- or any other natural or man-made object that can be assigned an IP address and provided with the ability to transfer data over a network.

IoT has evolved from the convergence of wireless technologies, micro-electromechanical systems (MEMS), microservices and the internet. The convergence has helped tear down the silo walls between operational technology (OT) and information technology (IT), allowing unstructured machine-generated data to be analyzed for insights that will drive improvements. “Today computers -- and, therefore, the internet -- are almost wholly dependent on human beings for information. Nearly all of the roughly 50 petabytes (a petabyte is 1,024 terabytes) of data available on the internet were first captured and created by human beings by typing, pressing a record button, taking a digital picture or scanning a bar code.

The problem is, people have limited time, attention and accuracy -- all of which means they are not very good at capturing data about things in the real world. If we had computers that knew everything there was to know about things -- using data they gathered without any help from us -- we would be able to track and count everything and greatly reduce waste, loss and cost. We

would know when things needed replacing, repairing or recalling and whether they were fresh or past their best."

IPv6's huge increase in address space is an important factor in the development of the Internet of Things. According to Steve Leibson, who identifies himself as "occasional docent at the Computer History Museum," the address space expansion means that we could "assign an IPV6 address to every atom on the surface of the earth, and still have enough addresses left to do another 100+ earths." In other words, humans could easily assign an IP address to every "thing" on the planet. An increase in the number of smart nodes, as well as the amount of upstream data the nodes generate, is expected to raise new concerns about data privacy, data sovereignty and security.

Practical applications of IoT technology can be found in many industries today, including precision agriculture, building management, healthcare, energy and transp ortation. Connectivity options for electronics engineers and application developers working on products and systems for the Internet of Things include:

Although the concept wasn't named until 1999, the Internet of Things has been in development for decades. The first internet appliance, for example, was a Coke machine at Carnegie Melon University in the early 1980s. The programmers could connect to the machine over the internet, check the status of the machine and determine whether or not there would be a cold drink awaiting them, should they decide to make the trip down to the machine.

III. **Proposed System**

Our objective is to create an IoT that can predict the landslide and forest-fire. There-by acting as a source of information that can prevent the human and the wildlife from getting affected in the crisis. The IoT that we design detects those calamities before hand and sends signals to the forest department and the fire-engine service, so that they can reach to the place sooner and help in the eradication of the disaster. The major disadvantage of the IoT system is the power consumption. IoT consumes more power compared to other electronic devices and that disadvantage will be compensated in our device. We are using solar panel as the source of energy for the IoT device so that we can get power supply without any interruption and the excess power will be stored in battery to use it during night time.

IV. **Mechanism**

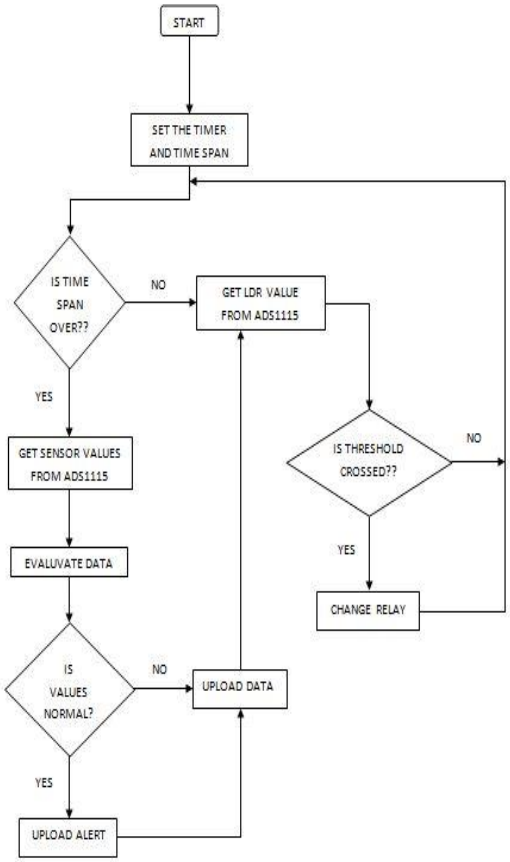
IV.1.**Landslide**

The main reason behind the land slide is the sudden increase of the soil mass. In the hilly region the soil gets settled on the sloppy surface and they possess a certain mass, due to rain fall the moisture content of the soil increases steadily, if this continues after a certain period of time the soil mass crosses a peak value, at that time the gravitational pull increases and this makes the soil to slide down causing the land slide, in our project we use the soil humidity sensor to monitor moisture content of the soil, the readings of the sensor will be analyzed and the data will be used to predict the occurrence of the landslides well in advance so that we could minimize the damage.

IV.2.**Forest fire**

With the mercury level shooting up high in several parts of the state, it causes a drastic damage to forest areas. Due to this forest fire occurs and it is very difficult to control when it attains a higher possible state. In our project we use gas sensor and temperature sensor to detect the forest fire. The gas sensor will detect the smoke and the temperature sensor will detect the amount of heat generated from forest and these data will be sent to the IoT device..

V**. Device End algorithm**



Step 1: start

Step 2 : initialise the timer and set time span value

Step 3 : check the time span if it is over then go to next step else go to step 5

Step 4 : fetch LDR value from ads1115 and check against the threshold value if crossed switch relay and go to step 3 else directly go to step 3

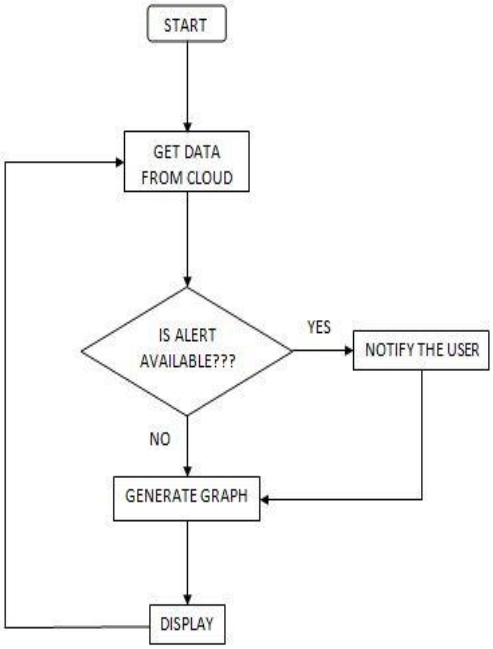
Step 5: fetch all the sensor values from ads1115 and store in the local database

Step 6 : evaluate the value fetched from step 5 , if the evaluation generates an alert go to step 7 else go to step 8

Step 7 : upload alert to the local database

Step 8 : upload the local database to the cloud and go to step 4

VI. Application end algorithm



Step 1 : start

Step 2 : get the data from the cloud database

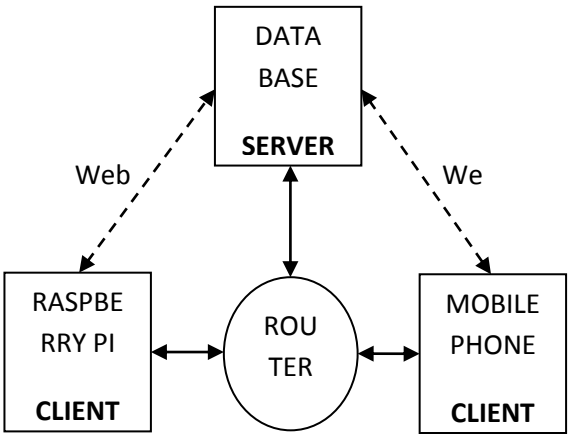
Step 3 : analyse the data and check if alert it set or not if yes got to next step else step5

Step 4 : notify the user by setting an alarm and pop up message

Step 5 : generate a graph with the data fetched at step 2

Step 6: display the generated graph and go to step2

VII. **Methodology behind IoT**



The above block diagram shows how the client and server are connected in our prototype the end points are the three sensors (gas sensor, soil humidity sensor, temperature sensor) and the LDR, the raspberry pi collects the data from the end points periodically and the analyzes the data and then it uploads the data to the server through the web API. The API gets the data from the client and sends it to the server via an http protocol and the server stores the data in its database, meanwhile the mobile phone which is connected as another client fetches the data from the server through the web API and then it displays the data of the end points to the user of that application if there are any abnormalities in the data alerts are given to the user.

VIII. **Expected Result**

In our project, during forest fire gas sensor is used to sense the smoke produced and the intensity of the fire can be measured using temperature sensor. Block diagram of our proposed system shows that, all the endpoint of the sensors are connected to the microcontroller, in which the parameters measured by the sensors are compared with the database present in the microcontroller and it is used to detect the landslides and it will be intimated to the forest office and fire service.

IX. **Acknowledgement**

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X. Conclusion

Thus , an IoT is proposed to be designed that can detect the landslides and send the information to the forest department as well, predict the occurrence of forest fires and send those details to the fire-service department too, all with the help of an efficient renewable energy source.

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