

Landslide Detection and Prediction using IoT Based System

Introduction

Landslides are common Natural disaster in every geographical region. It's a serious threat to the Human and damage the various poverty and surface Environment of the global. As we all know that Landslides occurs naturally so that we don't know about when it occurs. It is very important to get exact location for rescuing the people from it. We can get the information from satellite and different sensor which are embedded on it. It makes easy for making landslides databases, find the landslides occurring area and makes friendly environment for people and Nature. The author **Jiang, S** focused on landslide detection and predictions [1]. If we detect or predict the information about landslides, then we don't have to get several damages in the environment. So, it's necessary that we can find the solution in which we get information quickly and data accurately. Landslides mainly occurs due to climate change in the environment.

There is various method to detect the landslides, mostly used three types:

1. Field survey method
2. Traditional remote sensing image processing method
3. Statistical and machine learning method

Landslides prediction and detection relies on scientific method and data which will require the series of input from time series of data from the geographical and Environment. The **author L Cheng** describe in his article yolo model for landslides prediction and detection [2]. These data are collected from the various sensing satellite and Internet of things sensor which are embedded on the disaster sites. There are various devices which are embedded on the prone area, that are Raspberry pi, soil moisture sensor etc.

1.Hardware Interface:

1.1-Raspberry pi:

It's a fast and versatile IOT based microcontroller board. It is low cost and can be available easily and have an ability to connect wirelessly and have it's own operating system. Only it needs the power supply from the adopter and is based choice for the IOT based project. It is a system where we can store the information from the sensor and give command to it. Further we can send that data to the IOT cloud for processing. It also provides the platform to connect various device which are used in the prediction and detection process. It also gives the data output which we can see on the screen or on the website. According to the **Rasperrypi.com** [3].

1.2-Soil moisture sensor:

Landslides mainly occurs due to heavy rainfall in the area. Every soil has it's unique property. Some soils are loosely, and some are tightly packed. Landslides mainly occurs in loosely soil. To know the quality of the soil we required the sensor known as soil moisture sensor. It checks the quality of the soil and sends the data for the processing, and we can detect and predict the disaster in the early stage. Frequency domain Reflectometry and Time domain Reflectometry sensor are mainly used in this landslide's prediction and detection. It is also used to determine the characteristics of the soil with respect to the content of water present in it for the landslides. The author **Nadim F and Yurui S** focused on the article Landslide and Sensor Actuate [4].

1.3- Accelerometer:

An accelerometer is a device that measures the vibration, or acceleration of motion of a structure. Accelerometer became a good candidate for replacing the geophone and inclinometer in landslide monitoring. We will use ADXL345 chip-based accelerometer in our landslide prediction and detection model to measure and real-time monitor the inclination, the vibration and the displacement of the soil slope. ADXL345 chip-based accelerometer can acquire subsurface movements automatically at a programmable time intervals. The author **Kanak Kumar and Suman Lata** described in their article Electronic, device and circuit [5].

ADXL345 is small, low power, 3-axis accelerometer with the conditioned voltage output. The landslide is one kind of serious hazards that cause substantial life and financial losses. In order to manage and reduce its damages, many efforts to monitor and alert landslides are studied and developed. Among these technologies, wireless sensor network (WSN) that has accelerometer can be used to monitor and alert landslides in specific slopes that belong to the high risk According to the author **Nguyen Dinh-Chinh** focused on the Development of a Rainfall-Triggered Landslide System using Wireless Accelerometer Network [6].

2- Software Interface:

2.1-Raspberrypi Operating System:

It's a Debian based operating system for Raspberry pi. It has a desktop environment, pixel based on LXDE. It supports all the system having less feature. According to the **Wikipedia** [7].

3-Data storage:

3.1-IOT Based Cloud:

An IoT cloud is a massive network that supports IoT devices and applications. IoT cloud consists of various servers, storage, real-time operations and processing. It also includes the services and standards necessary for connecting, managing and securing of different IoT devices. It is an easy way to move large data packets across the internet generated by the IoT. IoT clouds offer on-

demand, cost-efficient hyper scale so organizations can leverage the significant potential of IoT without having to build the underlying infrastructure and services from scratch.

3.1.1-IOT CLOUD IN LANDSLIDE DETECTION

During the working of IoT system we go through a lot of data's and managing them is only possible due to the cloud computing. All our installed sensors like soil moisture sensor and accelerometer produce data continuously since installation, all these data are sent in servers and then further clean data into the IoT cloud.

Every day the climate is different which effects the soil. Factors like water, heat effects the soil every day so the data may come accordingly in the cloud. So, the processor helps in data collection and cloud further processes it.

3.1.2- Cloud working Principle:

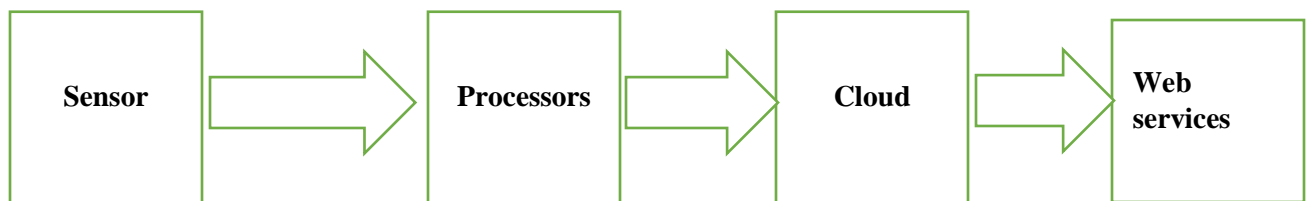


Fig:3.1.2.1

Sensor collects the data from the sites where we want to detect the information and sends to the data for processes when data are being processes that data are sent to the cloud for storage and Stored data are being analyzed in the cloud and it's ready to prediction and sent to the web services for information According to the [Internet \[8\]](#).

4-Working Principle:

Below diagram shows the working principle of our project. First, we need to have hardware and software interface where we need to connect our sensor like (Soil Moisture Sensor and Accelerometer). Data collected from sensor should be perfect so that we need to store that data and processed it to get the result and send it to the software interface to take the decision.

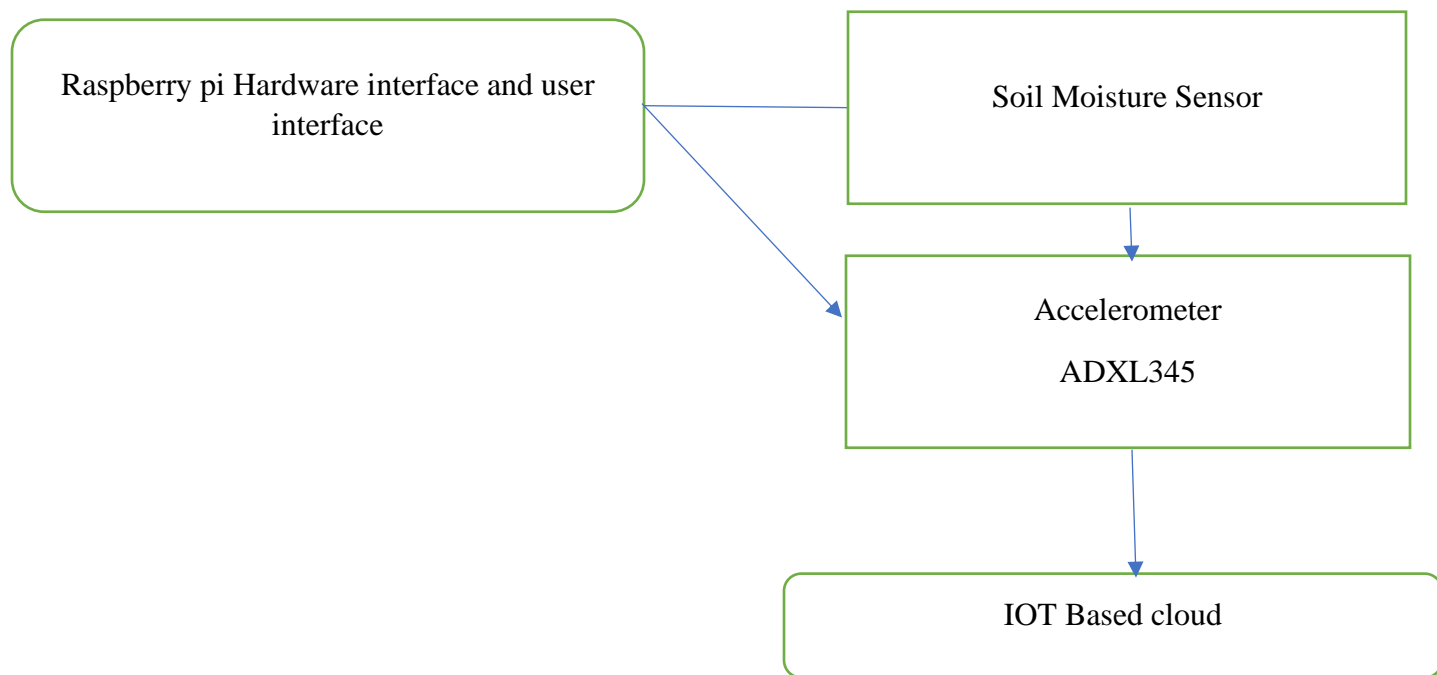


Fig: 4.1

5-Conclusion:

1. Landslides are very dangerous Natural disaster because it occurs suddenly and cause serious damage in the area where it occurs. To prevent this, we should have proper plan to detect and prevent from it.
2. There are various Model to detect, and we must choose best one for proper examine and understand the fundamental aspect of landslides.
3. Although, it can depend on the model which we are using but we need to find and select the complexity of the geographical area to predict the accurate result.
4. If we collect data from the sources but we must analyze that data properly so that we can prevent the disaster.
5. Architecture of the model should made correctly so that it can collect the better result.
6. Sensor should be connected well enough to give the result.
7. These data are not 100% correct so that we need also more focus towards our daily prevention.

References

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