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Landslide Detection Using Wireless Sensor Network in Disaster Monitoring

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ABSTRACT: In this paper a simpler way of detecting landslide has been introduced. It is based on the JAVA API and Linear regression algorithm where the live weather details are fetched from the weather information API. The collected live weather data and the previous details of the weather in a particular place are passed to the linear regression algorithm to predict the current chances of disaster occurrence. If there is a chance of occurrence of the disaster then it is predicted and represented in graph with the percentage of chance. The information is provided to the concerned authority or person of that particular place where the information can be forwarded to the people of the area and save their lives.

KEYWORDS: Landslide, JAVA API (Application Programming Interface), Linear Regression.

I. INTRODUCTION

The goal of this project is to provide an alert to the people before disaster occurs and save their lives. In this system we use an API to fetch the live weather details and linear regression algorithm to predict the chances of the disaster occurrence. Disaster monitoring is a very important task in the world for which the different technologies have been introduced. WSN plays a major role because it is scalable and adaptable to the various scenarios. This paper presents the landslide information based on the rainfall and weather factors at various places of Karnataka. As a recent disaster has occurred in Kodagu (Dist) Karnataka (state) in 2018. In this project the previous 15 years of data is collected regarding the rainfall, temperature and wind variation with the current weather details of the particular place.

II. LITERATURE SURVEY

According to authors Maneesha V. Ramesh, Sangeetha Kumar, and P. Venkat Rangan, landslide detection is a major problem especially at the Idukki, Kerala (dist) where the disaster prediction can be done using wireless sensors which are placed under the ground from which the live weather data is fetched for current time and place by using obtained information then the chances of occurrence of disaster will be predicted [1]. Authors Mr. Pranav Pravin Garje, Mr. Sagar Balasaheb Bawche, Mr. Vaibhav Pandurang Gund, Mr. Suyog. S. Shah use Zigbee to sense the data and based on the soil and rock movements the disaster is predicted. If there is any chance of landslide occurrence the sensors will automatically send the alert message to the people in a particular place by using a warning system which is developed using different sensors [2].

Authors Pawan Nandkishor Hinge, Ramesh Bawage, Smt. Kashibai Navle have predicted the vibrations in the land and rocks which is a sign of danger. Vibrations will be passed to the accelerometer which will predict the danger level and the signals will be passed to the GSM module that will be used to pass an alert message [3]. Authors Huang Qingqing, Meng Yu, Chen Jingbo, Yue Anzhi, Lin Lei have considered the satellite images for research on a particular place. The high resolution images in a spatial area is compared with previous original images and the result is represented in a graph [4]. Authors, Mr. Anand. S. Bhosle, Mr. Laxmikant, M. Gavhane have proposed a method to predict the disaster

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occurred in a forest ex: Fire in the forest. They used a standards such as IEEE 802.15.4 and ZigBee to sense the fire. If fire is detected then notification is provided to rescue operators[5]. Authors Imane Benkhelifa, Nadia Nouali Taboudjemat and Samira Moussaoui have surveyed and collected the data of different disasters like landslide, flood, earthquake by considering parameters atmosphere, humidity and pressure. They are using WSN for collection of data. The data is useful for the designers[6]. Authors Nor Azlina Ab. Aziz , Kamarulzaman Ab. Aziz proposed a method for disaster detection with rescue and alert system and also proves that WSN is a prominent technology for disaster prediction.

III. EXISTING SYSTEM

The live weather data for landslide detection is fetched from the sensors that placed in a particular place. The current weather details are passed to the predicting system and chance of occurrence of disaster will be predicted. The alert message is passed using GSM module.

IV. PROPOSED SYSTEM

To save peoples life earlier the disaster is detected ex: Landslide. To predict the disaster we need live weather information which is fetched from a JAVA API using city id or city name and stored in the database based on day, month and year. There are two modules admin and user, where admin can update and view the current weather details which is obtained from an API. The information is fetched based on the parameters such as mintemp, maxtemp, wind, clouds, rain, pressure, humidity. The major parameter is rainfall passed to the linear regression algorithm to identify the percentage of occurrence of the disaster based on the rainfall. After obtaining the percentage of Landslide chances it is informed to the concerned authority. And also sends an alert message to the people of that particular place.

(a) LANDSLIDE

Landslide occurs when soil and rock move downwards with the organic contents due to the gravitational force from hills or mountains. It is usually started with different weather conditions and by other factors such as:

- construction work of roads sometimes needs to be constructed across hills or mountains which leads to erosion of the stream.
- The changes of ground water level due to Heavy rainfall.
- Due to the construction work and earthquake Vibration occurs.

The landslide occurs due to above factors that leads to transport of materials by sliding, flowing and falling. The above factors which causes the different landslides are:

- Landslide occurrence rate starts from slow (millimeter/year) and rapid(meters/second).
- Due to slide, slump, flow and fall landslide is considered as a major natural disaster /which leads to huge loss of natural calamities such as human settlements, agricultural fields and forest lands. It also leads to loss of lives.

(b) WIRELESS SENSOR NETWORK

Wireless sensor networks (WSN) is used for analyzing of real time events. It is scalable has less maintenance cost and is adaptable for different conditions. But it has less memory and power. By using the sensors we can fetch the live weather information data which is performed by the API also by using satellite. In this project we fetch data from API.

(c) API

Application Programming interface(API) includes a procedural code by using that code a new application can be created and accessed. It acts as a messenger for delivering the requests to providers that we request and responses back. An API means functionalities which are independent of their implementations and definitions to vary without compromising each other. A good API helps makes the development easier by providing the building blocks for the program. API also enables the developer to create apps using the available information. It reduces the complexity of code and it can be used repeatedly.

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(d) API call with the API key implementation

To call an API an API key is necessary because without the key the request cannot be processed.

Call for an API:

`http://api.openweathermap.org/data/2.5/forecast?id=524901&APPID={APIKEY}`

In above example APPID and APIKEY is considered as a different key for each call.

Calling API using APPID:

`api.openweathermap.org/data/4.6/forecast?id=487625&APPID=1110000001`

Current weather of a location can be called using city name or city id.

`api.openweathermap.org/data/4.6/weather?q={city name},{country code}`

Ex: `api.openweathermap.org/data/4.6/weather?id=3596472`

V. ALGORITHM OF LINEAR REGRESSION

Machine learning includes an algorithm called as Linear Regression. It comes under the supervised learning and task of regression can be performed. We can predict the target using independent variables. Regression model depends on the relationship between the dependent and independent variables.

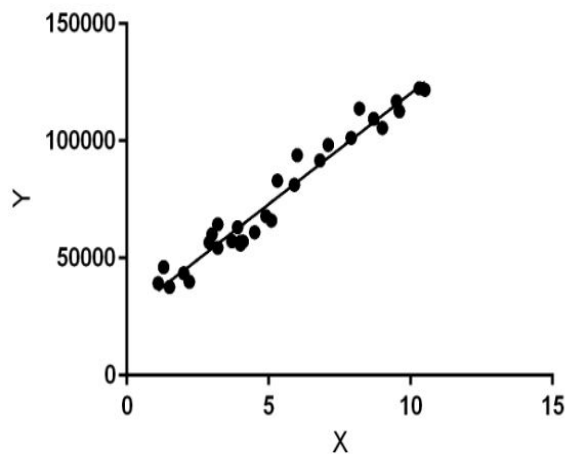


Fig.1. Graph of linear regression (LR algorithm).

In above graph Y-axis represents the dependent variable and x-axis represents the independent variable. Where regression finds the independent variable value. Therefore the relation between X-axis and Y-axis in the form of linear detection. Where X-axis is the rain rate and Y-axis is the landslide rate according to the experiment.

$$y = \theta_1 + \theta_2 \cdot x$$

Fig.2. Linear Regression formula.

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The above formula is considered for the regression task where two independent data is taken for the calculation and x is a dependent variable on one of the data considered. Here rain rate of a research area and the climatic condition of a area when disaster had occurred is considered for the result calculation.

VI. EXPERIMENTAL RESULT

The studied algorithm is implemented by the software Netbeans 8.0. Lets discuss the data used and result set.

(a) DATA SET

Experiment is conducted by using the weather data which consists of temperature, humidity, pressure, wind, clouds and rainfall data. Based on rainfall data the landslide rate will be detected.

WEEK RAIN RATE (mm)	LANDSLIDE RATE(%)
81.9	15
82.2	15
83.1	15.1
83.5	16.45
84.2	16.44
85.7	16.92
86.3	17.7
90	18.9

Table 1. Dataset

The rain dataset is fetched from the API and stored in the database where the week rain rate is collected from the database and passed to the algorithm to predict the chances of landslide based on the rainfall rate.

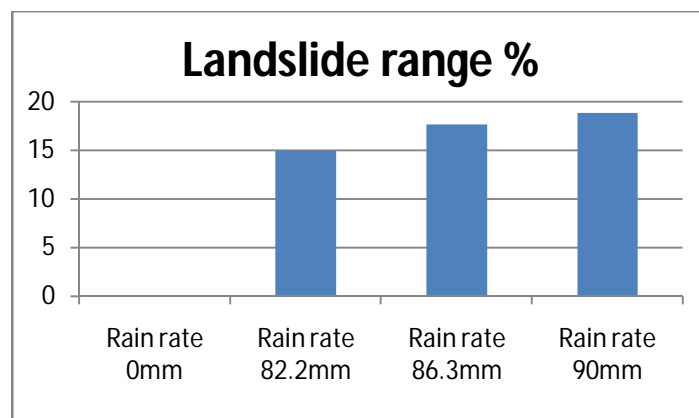


Fig 3. Performance measure.

In the above graph x axis represents the rain rate in mm and y axis represents the landslide rate in percentage (%).As the result of algorithm based on the rain rate the landslide rate is predicted and represented in the above graph.

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VII. CONCLUSION

Landslide detection using wireless sensor network is a challenging research where in this work the disaster is predicted earlier by considering the various factors to save the nature and peoples life. It can be extended for various regions by using JAVA API and the live data can be fetched using sensors for accurate results.

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