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Exploration of Landslide Detection Model using Deep Learning

R. Rajeswari[1], Borra Surendra[2], D. Dhilipkumar[3], S. Gogula Krishnan[4]
[1]*Assistant Professor - Computer Science and Engineering, IFET College of Engineering, Villupuram, TamilNadu*
[2,3,4] *UG - Computer Science and Engineering, IFET College of Engineering,Villupuram, TamilNadu*

ABSTRACT
People who work in mining locations put their lives on the line for valuable resources; landslides and the emission of hazardous gases are the leading causes of worker fatality. In general, underground mining is far more perilous than surface mining. The landslide occurs in a matter of seconds, and although warning surface mine employees is simple, informing underground mining personnel is complicated and has a low likelihood of escape. The proposed solution for our project is to use deep learning technology to monitor and anticipate landslides. It does an amount analysis of the mining zone, which is backed by IoT sensors that monitor the landslide. A trained model is developed and fed into the computer system. By predictive analysis, the system issues an alarm.
Keywords—Deep learning, landslide prevention, Remote monitoring, Mining

1. Introduction
Landslides in mining are caused by the collapse of the soil and rock components while digging, that make up a slope's structure. This might result in catastrophic human deaths, property losses, and environmental harm. A landslide happens when the slope's stability conditions are disrupted, either by increasing the slope's stress or decreasing the strength of the planet's material. Developing an early warning system for the observation and prediction of landslides will be accomplished by performing various research in the mining region and determining the factors and pattern of the landslide, to train the model. A deep learning technique will be used to make all of these predictions.

2. The Objective of the Project
The primary goal of this application is to notify personnel in the mining region if a landslide happens. High accuracy, alarms to notify workers, and periodic reports to the server are the main characteristics of this application, which may also be monitored remotely by hosting the Live Generating data and Predicted data through the Internet.

3. Proposed System
The major issue of the landslide in mining is disturbances in the natural stability of a slope while using equipment like Sandvik Roof Bolter,Hitachi Feeder Breaker, Hitachi Feeder Breaker, Hitachi Drill, etc. The mining industry consumes a lot of water and the dangerous toxic gases were released while digging if the gases are combined with water, it will become dangerous. The use of sensors like accelerometer sensor gives high accuracy readings of the vibration, Moisture Sensor, Gas Sensor was connected to the NodeMCU has the inbuilt WiFi module can transfer the data to the server all their data are lively monitor remotely.In the monitoring screen, a graph like interference is employed to quickly express the present Vibration pattern.Deep learning technology is used to predict the incidence of landslides.

4. Deep Learning
Deep learning, like machine learning, which is similar to the human, Computer learn by example and mistakes. In recent days it become very popular and doing good things. It's completing the tasks that human can't imaginable. Directly with the help of images, text file the computer machine learns to execute variety of tasks. Deep Learning prototype design has attained the extremely high level of precision, sometimes even outperforms human capability. Models are trained to utilize a huge set of

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labelled data and multi-layer neural network Design. It features a deep neural network. The typical neural network has just 2-3 layers, but the deep neural network has 150 or more. Deep learning models are trained by massive volumes of classified data and neural network topologies that learn new concepts directly from the data, removing the need for human feature extraction. Layers make up neural networks, each of which has a set of interconnections. In a network, there might be tens or hundreds of hidden layers. Deep learning networks have the benefit of improving over time as the amount of data you have risen. To train a deep network from the ground up, you'll need a big labelled data set and a network architecture that can learn the features and model. This is beneficial for new apps or those with a high number of output types. This is a less frequent strategy since these networks often take days or weeks to train because of the massive volume of data and pace of learning.

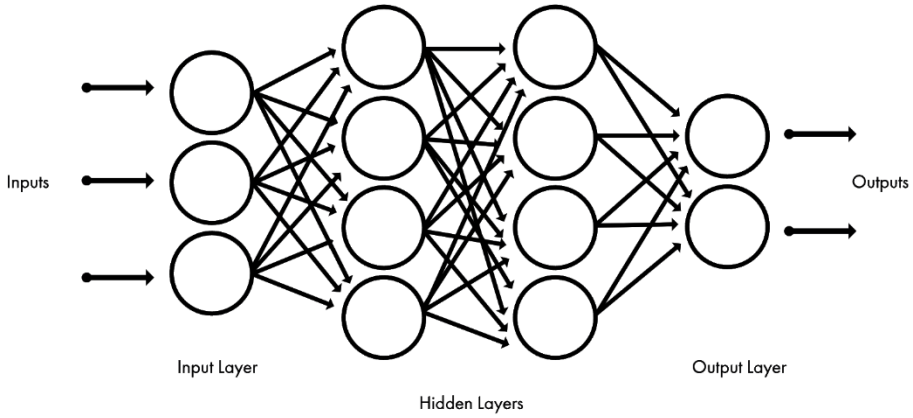

Fig. 1. Deep learning hidden layers

5. Block Diagram

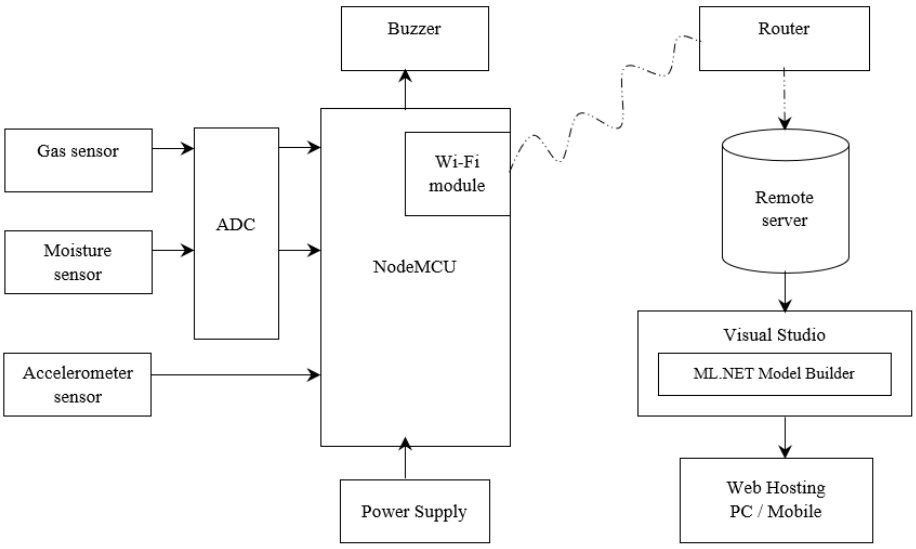

Fig. 2. Block Diagram of the proposed system

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6. Description of the Block Diagram

6.1 Node MCU

The NodeMCU is free and open-source IoT platform. It comprises firmware that runs on Espress-if Systems' ESP8266Wi-Fi SoC. Lua Scripting language is used by firmware. It is developed on the Espress-if Non-OS SDK for ESP8266 and is based on the eLua project. Many open-source projects are used, including spiffs and lua-cjson.

Fig. 3. Node MCU

6.2 ADXL345 Vibration Sensor

The ADXL345 is a full 3-axis accelerometer with signal conditioned voltage outputs that is tiny, thin, and low power. With a full-scale range of 3 g, the device monitors acceleration. It can detect gravity's static acceleration as well as dynamic acceleration caused by motion, shock, or vibration in tilt-sensing applications. The CZ, CY and CX capacitors at the Z OUT, Y OUT, and X OUT ports are used to select the accelerometer's bandwidth. Bandwidths ranging from 0.5 Hz to 1600 Hz for X- axis and Y- axis, while the Z-axis ranging from 0.5 Hz to 550 Hz.

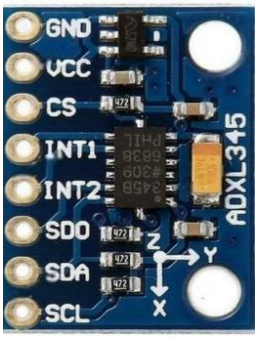

Fig. 4. ADXL345 Vibration Sensor

6.3 MQ135 Gas sensor

The MQ135 Gas Sensor detects benzene, alcohol, and smoke and is quite sensitive to them. As the concentration of gases rises, so does the output voltage of this sensor. This sensor is well-known for its quick reaction and recovery times. The blue color variable resistor may be used to simply alter the sensitivity.

Fig. 5. MQ135 Gas Sensor

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6.4 Moisture Sensor

This sensor is used to measure soil moisture; when the soil is dry, the module output is high; otherwise, the output is low. This sensor may be used to water a blooming plant or any other plant that needs to be watered automatically. Digital output, analogue output, and serial output with accurate readings are the three output modes of the module.

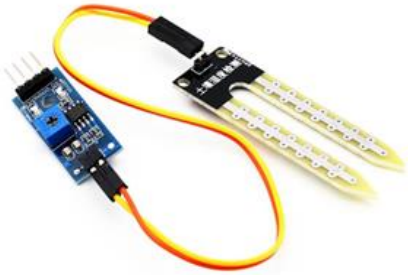


Fig. 6. Moisture Sensor

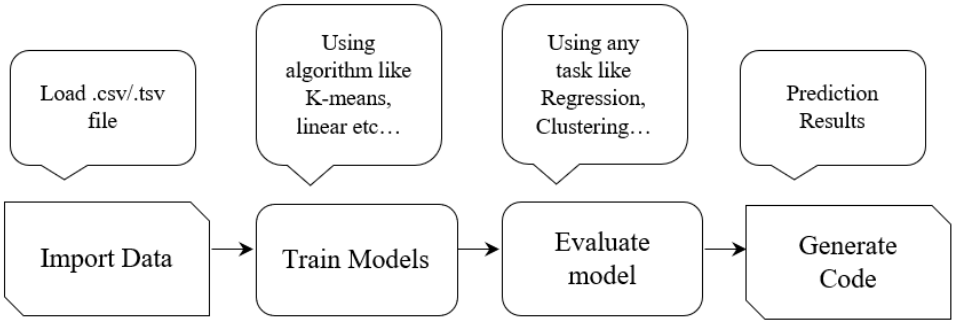
6.5 Visual Studio

Visual Studio is the Microsoft company's IDE. It's used to create websites, web applications, internet services, and phone applications. Microsoft Silverlight, Windows PowerShell, Windows API and Windows Store are some of the Microsoft application development platforms used by Visual Studio. It can generate both native and managed code.

7. ML.NET Model Builder

ML.NET Model Builder is a graphical application for Visual Studio that allows you to create, train, and deploy bespoke machine learning models. Model Builder explores several machine learning algorithms and parameters using autoML to assist you to identify the one that best matches your circumstance. Model Builder does not require any prior knowledge of machine learning. You only need some information and an issue to solve. Model Builder creates the code needed to integrate the model into your.NET program. To generate a model for an application, a scenario describes the sort of prediction you wish to make using your data. For instance, based on previous sales data, forecast future product sales volume. Model Builder will prompt you to supply a dataset once you've picked your scenario. The information is utilized to train, analyze, and choose the most appropriate model for your situation.

Fig. 7. Processing of Dataset



A dataset is a table with training examples in rows and attributes in columns. Model Builder can work with datasets in the.tsv,.csv, and.txt formats, as well as SQL databases. If you have a .txt file, you can use it. If the dataset contains images, the file types .jpg and .png are supported.

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7.1 Import Data

We must provide a large amount of data to train the model in order to get excellent outcomes prediction. We may use a Text (CSV/TSV, Relational Database) to provide data for both training and testing in ML.NET.

7.2 Train Models

To train the model, we must choose the appropriate algorithm. We must select the appropriate method to train and forecast the results based on our requirements.

7.3 Evaluate Model

For our model training and prediction, choose Machine learning. You can use the Clustering model if you need to deal with a segment. If you need to discover the price of a stock forecast, choose Regression; if you need to find sentiment analysis, use the Classification model.

7.4 Generate Code

The final forecast will be shown using the ML.NET application based on the train and test data with the trained model. The trained model will be stored in binary format, which may be used with any of our.NET apps.

7.5 .csv File

CSV (comma-separated values) file is a text file, any text editor may be used to generate and modify it. A comma is commonly used to split or delimit its data fields. A CSV file is most commonly produced by exporting a spreadsheet or database from the application that developed it (File > Export).

7.6 Creating .csv/.tsv File with Text Editor

Start a new file in your favourite text editor, such as Notepad. Then, using a comma to separate each value and a new line to separate each row, add the text data you want in the file.Use the .csv extension to save this file. After that, you may use Microsoft Excel or another spreadsheet tool to open the file. If your CSV file has commas in the data fields, you may safeguard them by surrounding them in double-quotes ("). The commas used to divide your data from the commas used to delimit the fields are kept separate. We may also use another double quotation to safeguard the double-quotes.

7.7 Creating .csv/.tsv File with Excel

To make a CSV file in Microsoft Excel, open the file you want to save in CSV format. Once the programme is open, go to File and select Save As, depending on your version of Microsoft Excel, choose CSV (Comma delimited) or CSV (Comma delimited) (*.csv) as file format.

Table. 1. Example of a .csv/.tsv File with Excel

Prediction Table				
Moisture	**X-axis**	**Y-axis**	**Z-axis**	**Chance%**
2.0	185	90	0	1
12.0	190	85	5	30
26.0	195	80	15	75
40.0	210	75	20	100

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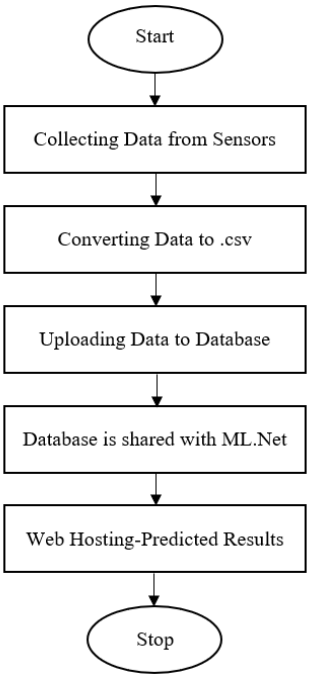
8. Flow Diagram

Fig. 8. Flow Diagram



The data from the sensors is first converted to digital form by the analog to digital converter. Data is wirelessly sent to the remote server with the help of the NodeMCU. The acquired data is then converted to .csv format, the .csv file is generated using code. The .csv file is subsequently posted to the MongoDB database, which serves as the server. The ML.Net Model Builder has access to the database. The main objective of ML.NET is to predict continuous values from previously produced data. Finally, Live Generating data and Predicted data are hosted on a specific IP address linked with the domain in a user-friendly interface.

9. Results

Fig. 9. HomePage

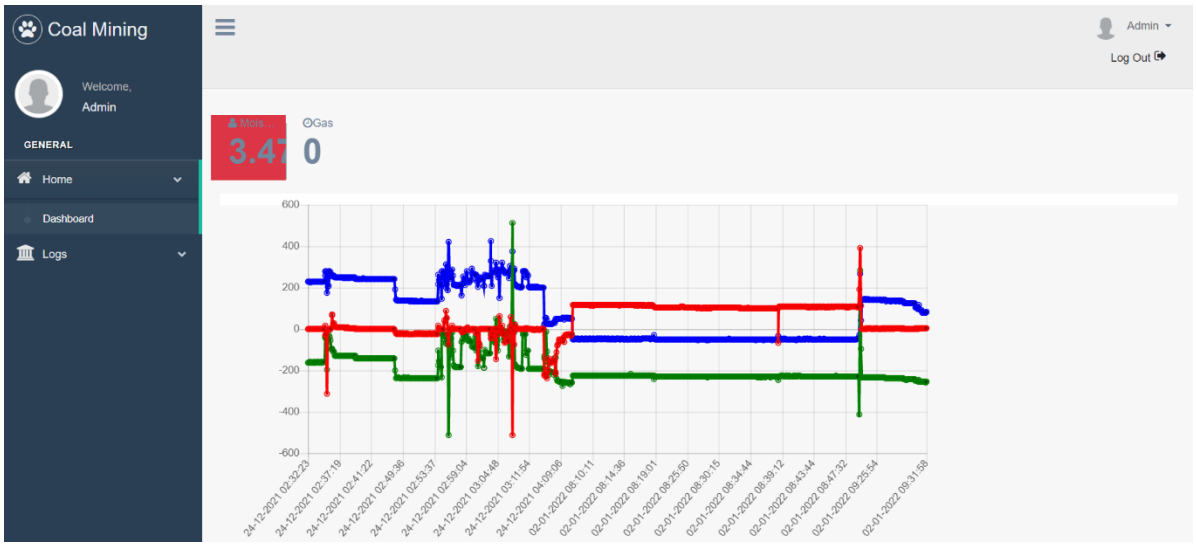


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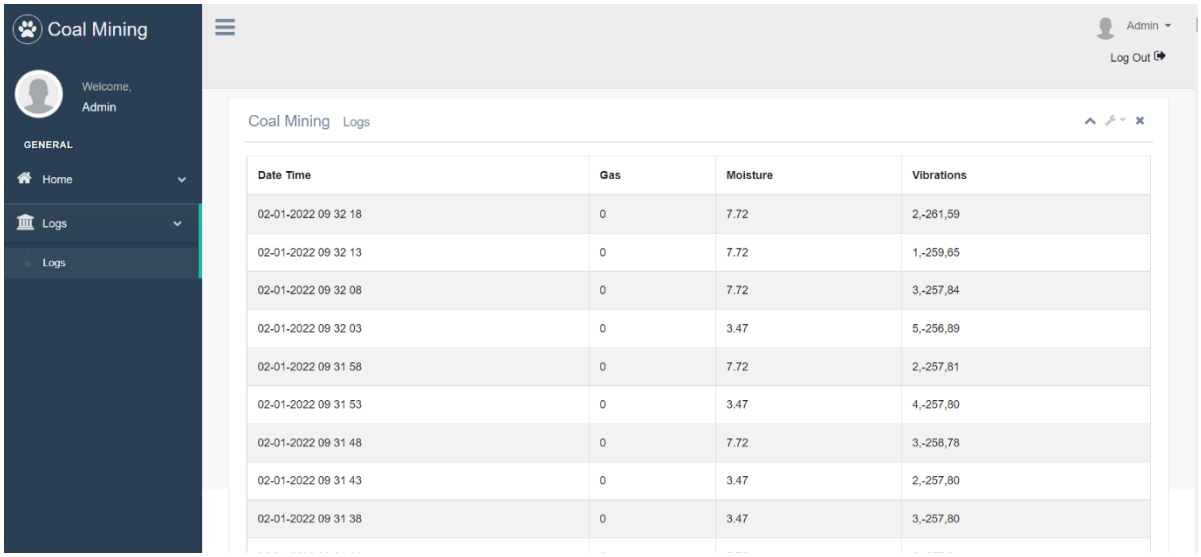
Fig. 10. Live Generating Data – Logs



CONCLUSION

This work applies deep learning algorithms to landslides in mining, with an emphasis on landslide identification based on vibration pattern and moisture level, as well as the establishment of a landslide warning system. This will save lives by predicting vibration patterns and sending out an alarm message. The data collected during the underground mining research test is included in the trained model set. Moreover, the model is taught daily by gathering data for the sensor of various Patterns. A smartphone with a good internet connection is sufficient for monitoring the system and seeing the live data logs.

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