

Coal Mine Monitoring System using Machine Learning

21AIE211-Introduction to Computer Networks

TEAM 9

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Introduction

- A safe and secure environment in places like coal mines is a crucial aspect and is in need of the hour. Countless accidents are caused due to the lack of a proper monitoring system.
- Coal mine monitoring System using Machine Learning has numerous advantages in intelligent analysis and decision-making. Our project includes a safe coal mine monitoring system using machine learning algorithms. It monitors the concentration of gas and the values of temperatures as the parameters if the values of the parameter the alarm will ring.
- We present machine learning based web interface which is designed on SVM, KNN, Decision Tree, Random Forest, Gradient Boosting.
- Using Streamlit we deploy machine learning model into a user-friendly Web Interface.



Problem Statement

- The current coal mine monitoring systems lack the ability to effectively analyze and interpret the vast amount of data generated in real-time, resulting in suboptimal safety practices, increased risk exposure, and inefficient resource allocation.
- There is a critical need to develop a monitoring system that utilizes machine learning models to analyze the data collected from various sensors and parameters within the coal mine.

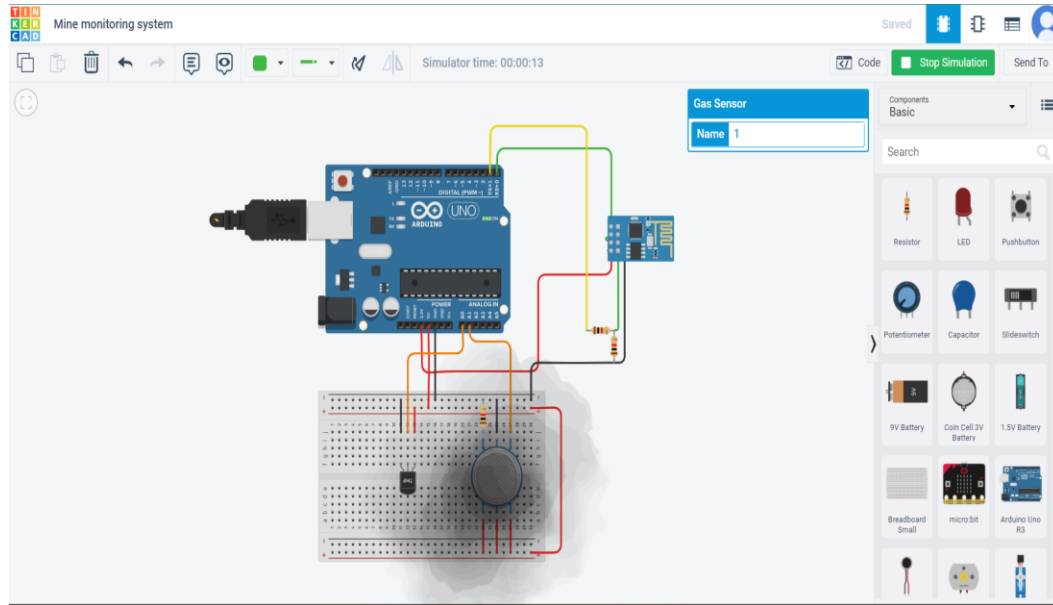


Objectives

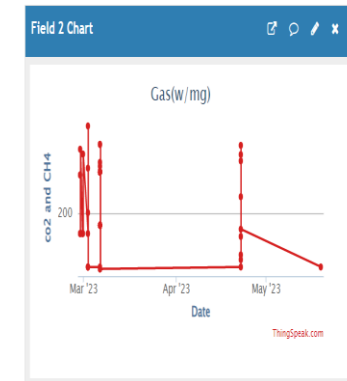
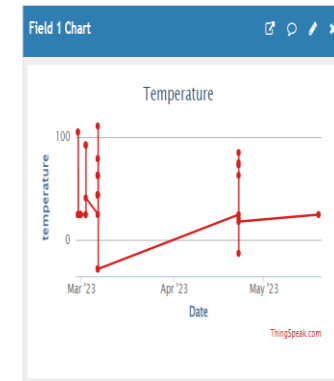
- Our project focuses mainly to develop various machine learning models to make informed decisions, making analysis more effective.
- Machine learning algorithms like Decision Tree, Logistic Regression, KNN, Gradient Boosting, SVM and Random Forest are used to develop the model.
- To design a user-friendly web interface for monitoring the coal mining system using Streamlit.



Data collection



Circuit in TinkerCAD



Collecting Data in ThingSpeak



Existing Works

Author Name	Algorithms & Methods Used	Description	Remarks
M. Fatemeh	IoT, Wireless Sensor Networks (WSNS)	A Comprehensive review of the Internet of Things (IoT) and its impact on the mining industry	They explored the current challenges facing the coal mine industry and make recommendations in 2020 to build better models for the industry's different risks.
Duarte J Rodrigues F Branco JC	IoT	Sensing Technology Applications In the Mining Industry- A Systematic Review	They developed a technique in 2022 that analyzes the measured data by creating a wireless connection at the edge with the help of sensors that uses less electricity
SathisKumar N	IoT using LoRaWAN	Clean IoT based coal mine safety and health monitoring using LoRaWAN	They developed an integrated communication and data transmission system using deep learning services in the article. And they created a graphical user interface of different underground body sensor devices with the help of visual techniques.



Existing Works

Author Name	Algorithms & Methods Used	Description	Remarks
Yang L Birhane GE	IoT	Mining employees safety and the application of information technology in coal mining	They presented a review paper in 2021 where the safety issues of the workers in the coal mines are discussed along with the significant of the information technology.
Matloob S Li Y Khan KZ	AI and ML	Safety assessment and risk assessment for the coal mining industry using artificial intelligence and machine learning	They developed several models for improving safety measures in mines. However, the need for big data management degrades physical performance.
Skora M Gilerson A Sherikar M Mitra R	Wireless transmission system	Design and survey to evaluate singlewire and wireless transmission systems in the blast zone of underground mines	The authors developed several models for improving safety measures in mines. However, the need for big data management degrades physical performance.



Research Gap

- **Sensor Technology:** The development of advanced sensor technologies can accurately detect and monitor various parameters in coal mines.
- **Wireless Communication:** Most coal mines are vast and complex environments, making wireless communication crucial for transmitting data from sensors to the monitoring system.
- **Real-time Monitoring and Warning Systems:** Enhancing real-time monitoring capabilities and developing effective warning systems are vital for ensuring safety of coal mine workers.
- **Automation and Robots:** Integration of automation and robotics technology in coal mine monitoring systems can improve efficiency.

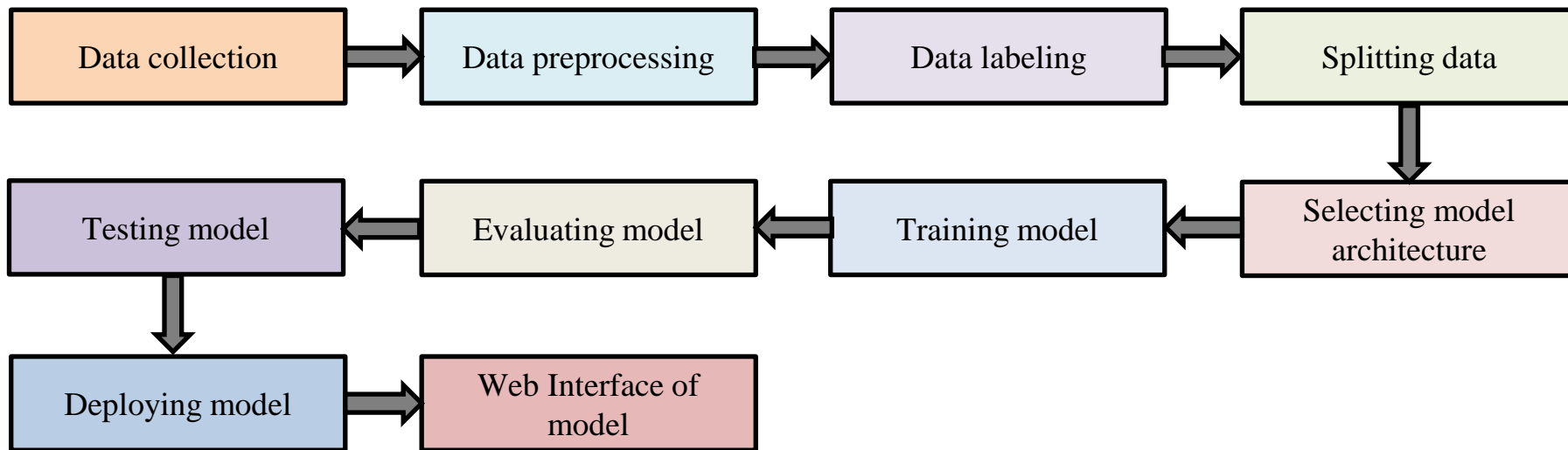


Proposed Algorithm

- SVM (Support Vector Machine)
- KNN
- Decision tree
- Random Forest
- Gradient Boosting
- Logistic Regression



Proposed Architecture



Implementation Details

In this project we are using streamlit to deploy the machine learning model. The trained machine learning models are deployed in Stream lit – a python framework to make it as a user-friendly web interface.



Implementation Details



Implementation Details

Menu

SignUp

Coal Mining System

Create New Account

Username

Password

Signup



Results

S.NO	Algorithm	Training Accuracy	Testing Accuracy
1.	Logistic regression	78.86	85.52
2.	KNearestNeighbors	93.20	94.73
3.	SVM	80.16	85.52
4.	Decision Tree	99.71	88.15
5.	Random Forest	97.16	92.16
6.	Gradient Boosting	99.71	93.42



Conclusion

- We conclude, our project shed new light on making effective decisions, monitoring 24/7, and alerting the employees through sensors.
- Machine Learning Models such as Decision tree, logistic regression, K-nearest neighbor, gradient boosting, Support vector machine (SVM), random forest is compared in various aspects to obtain the most accurate prediction and consequently improve the coherence of a traditional monitoring system.



Futurescope

- In this project we are using only two parameters like concentration of gas, and temperature.
- In the future we would like to add some more parameters like humidity, pressure, etc. Our project improves the efficiency, sustainability, and safety of the coal mine monitoring system. We can improve the scalability of the web interface.



THANK YOU

