IoT-Based Water Level Monitoring System with Machine Learning Techniques

Abstract

This project focuses on an IoT-based water level monitoring system enhanced using machine learning algorithms. By leveraging real-time sensor data, the system can predict water levels and pump status, thereby assisting in automation and optimization of water resource management. The project evaluates the performance of three machine learning techniques—Linear Regression, and Random Forest—based on a dataset collected via IoT sensors.

Keywords—IoT, Machine Learning, Linear Regression, Random Forest, Water Management.

I. Introduction

\Water scarcity and inefficient usage pose a major concern globally. IoT-based monitoring provides real-time visibility, while machine learning brings predictive capabilities. This project integrates both to enable smart decisions regarding water usage and pump operations.

II. Objective

- To implement an IoT-based system for water level monitoring.
- To use machine learning models (Linear Regression, Random Forest) to predict water level and pump status.
- To compare model performance and visualize trends.

III. Dataset Description

The dataset includes: Date, In_flow_rate, Out_flow_rate, Water_Level (cm), and Pump_Status (ON, OFF).

IV. Methodology

We used Linear Regression for water level prediction and Random Forest for pump status classification. The dataset was cleaned and split into train-test sets. Models were trained using scikit-learn.

V. Results and Discussion

Both Random Forest and Linear Regression achieved an accuracy of 55% due to imbalanced data.
Below is a visual comparison and classification report.

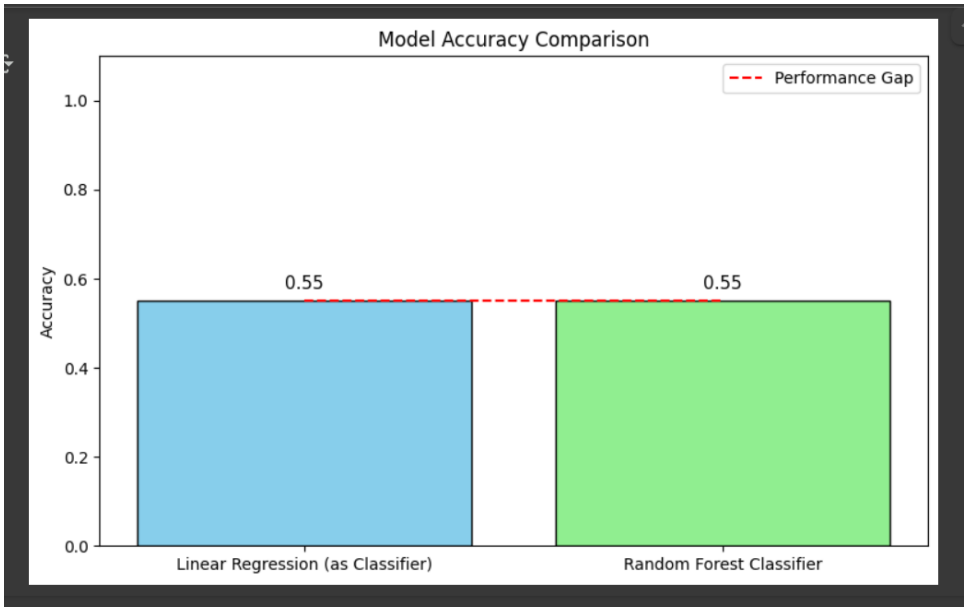
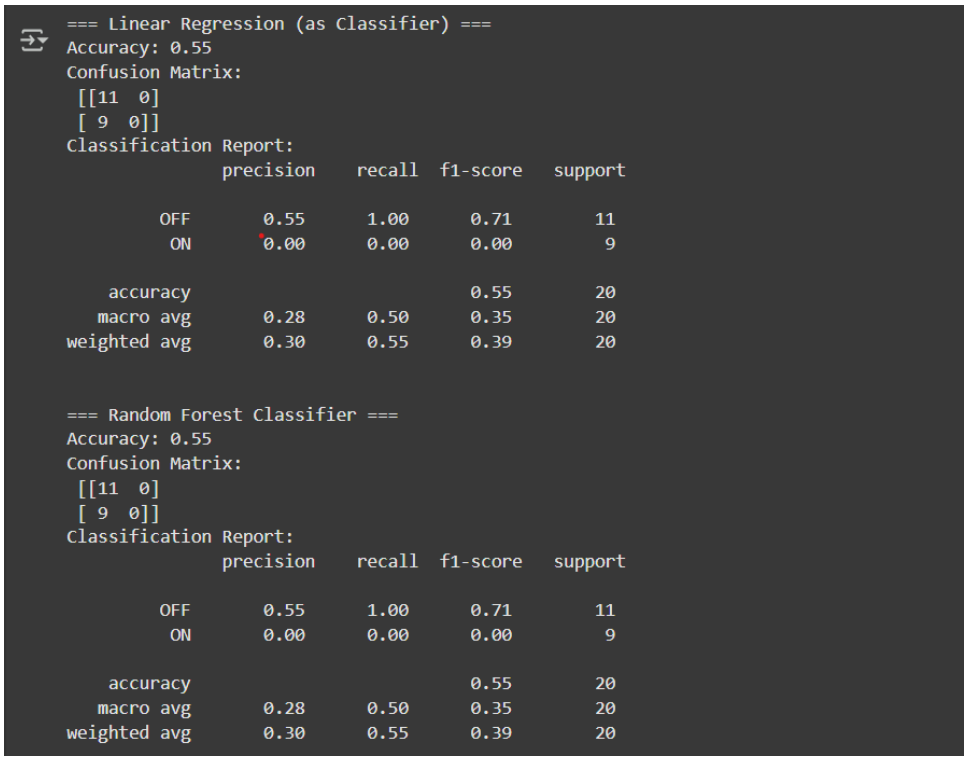


Fig. 1. Accuracy Comparison between Linear Regression and Random Forest



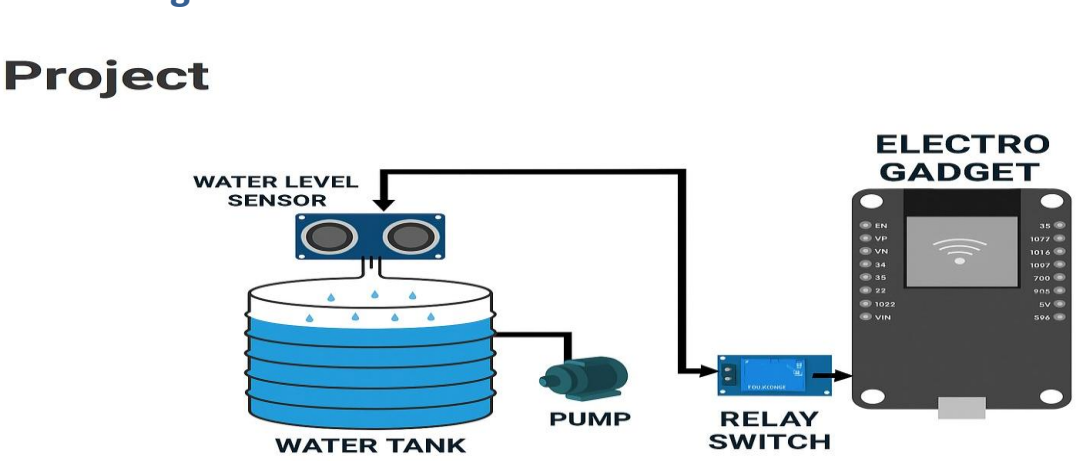
```
=== Linear Regression (as Classifier) ===
Accuracy: 0.55
Confusion Matrix:
 [[11  0]
 [ 9  0]]
Classification Report:
              precision    recall  f1-score   support

         OFF       0.55      1.00      0.71        11
          ON       0.00      0.00      0.00         9

    accuracy                           0.55        20
   macro avg       0.28      0.50      0.35        20
weighted avg       0.30      0.55      0.39        20


=== Random Forest Classifier ===
Accuracy: 0.55
Confusion Matrix:
 [[11  0]
 [ 9  0]]
Classification Report:
              precision    recall  f1-score   support

         OFF       0.55      1.00      0.71        11
          ON       0.00      0.00      0.00         9

    accuracy                           0.55        20
   macro avg       0.28      0.50      0.35        20
weighted avg       0.30      0.55      0.39        20
```

Fig. 2. Confusion Matrix and Classification Report

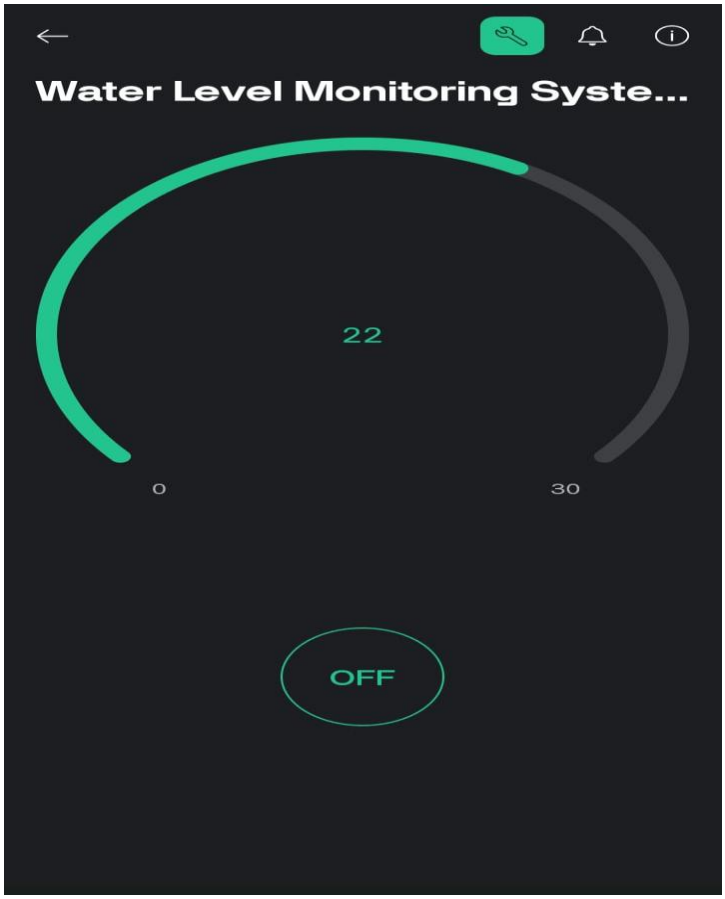
VI. Conclusion

Random Forest showed better potential in real-world settings despite similar accuracy to Linear Regression due to better handling of class imbalance.

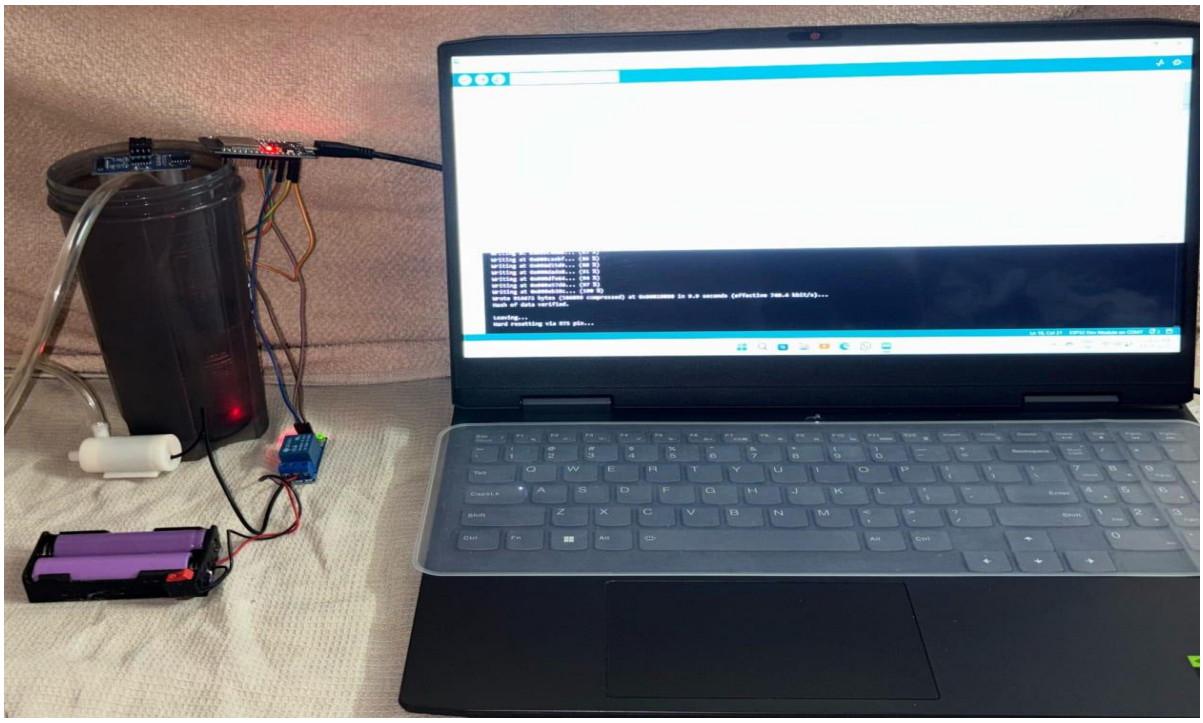
Block Diagram



Blynk App Dashboard



Reference Image



Github link

https://github.com/Suresh-Krishna-P/IoT-Based-Water-Level-Monitoring-System-with-Machine-Learning-Techniques.git

References

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