Project Development Phase Report

Project Name: Electric Motor Temperature Prediction Using Machine Learning

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Date: _____

1. Requirement Analysis Phase

In this phase, the problem of electric motor overheating was identified. Industrial motors frequently fail due to excessive temperature rise, leading to downtime and increased maintenance costs. The requirement was to build a predictive system that estimates Permanent Magnet (PM) surface temperature using motor operational parameters.

2. Data Collection Phase

The dataset was collected from the Kaggle Electric Motor Temperature Dataset. Relevant features such as ambient temperature, coolant temperature, voltage (u_d), and current components (i_d, i_q) were selected.

3. Data Preprocessing Phase

Data preprocessing included handling null values, dropping unnecessary columns, feature selection, and scaling using MinMaxScaler. Data visualization techniques such as histogram, scatter plots, and heatmaps were used for exploratory data analysis.

4. Model Development Phase

Multiple machine learning models were implemented including Linear Regression, Decision Tree Regressor, Support Vector Machine (SVM), and Random Forest Regressor. The Random Forest model achieved the best performance with high accuracy.

5. Model Evaluation Phase

Model performance was evaluated using MAE, RMSE, and R^2 Score. Random Forest Regressor achieved an R^2 score of 0.964, indicating strong prediction accuracy.

6. Model Saving Phase

The trained model and MinMaxScaler were saved using Joblib. This enables reuse of the model without retraining during deployment.

7. Deployment Phase

The saved model was integrated into a Flask web application. An HTML-based user interface was developed to accept motor parameters and display predicted temperature. The system was deployed locally using VS Code.

8. Testing Phase

Functional testing was performed with multiple input values to verify prediction accuracy. Input validation and error handling were implemented to ensure reliability.

9. Documentation Phase

Comprehensive documentation including system architecture, data flow diagrams, solution architecture, sprint planning, and estimation was prepared.

Conclusion

The project successfully developed and deployed a Machine Learning-based Electric Motor Temperature Prediction System. The solution enables predictive maintenance, reduces downtime, and improves motor efficiency.