Electric Motor Temperature Prediction using Machine Learning

1. ABSTRACT

Electric motors are widely used in industrial applications. Overheating of motors can lead to system failure and increased maintenance cost. This project aims to predict the Permanent Magnet (PM) temperature of an electric motor using Machine Learning techniques.

The dataset contains various sensor parameters such as voltage, current, torque, motor speed, coolant temperature, and ambient temperature.

A Random Forest Regressor model is trained on the dataset to predict the motor temperature accurately. The model is deployed using Flask to create a web application for real-time temperature prediction.

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2. INTRODUCTION

Electric motors are critical components in industries. Monitoring motor temperature is important to avoid overheating and damage. Traditional monitoring methods may not predict future temperature accurately.

Machine Learning helps analyze historical data and predict motor temperature in advance. This helps in preventive maintenance and improves efficiency.

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3. OBJECTIVE

- To analyze motor sensor data
- To train a machine learning model
- To predict permanent magnet temperature
- To deploy the model using Flask

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4. TECHNOLOGIES USED

- Python
- Pandas
- NumPy

- Scikit-learn
- Flask
- HTML

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5. DATASET DESCRIPTION

The dataset used is pmsm_temperature_data.csv.

Input Features:

- u_q (Quadrature Voltage)
- coolant (Coolant Temperature)
- u_d (Direct Voltage)
- motor_speed (Motor Speed)
- torque (Torque)
- i_d (Direct Current)
- i_q (Quadrature Current)
- ambient (Ambient Temperature)

Target Variable:

- pm (Permanent Magnet Temperature)

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6. METHODOLOGY

1. Data Collection
2. Data Preprocessing
3. Feature Selection
4. Train-Test Split
5. Model Training (Random Forest Regressor)
6. Model Evaluation
7. Model Deployment using Flask

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7. MODEL USED

We used:

👉 Random Forest Regressor

Reason:

- Handles nonlinear relationships
- High accuracy
- Less overfitting
- Works well with sensor data

📄 8. WORKING OF THE SYSTEM

1. User enters motor parameters in web interface
2. Data is scaled using StandardScaler
3. Trained model predicts temperature
4. Result is displayed on webpage

📄 9. RESULTS

The model achieved good prediction accuracy using R^2 Score.

The web application successfully predicts motor temperature based on input values.

📄 10. CONCLUSION

This project demonstrates how machine learning can be used to predict electric motor temperature. It helps prevent overheating and improves industrial safety.

Future improvements can include:

- Deep Learning models
- Real-time IoT integration
- Cloud deployment

📄 11. FUTURE SCOPE

- Integration with IoT sensors

- Real-time monitoring dashboard
- Deployment on IBM Cloud
- Mobile application development

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12. REFERENCES

- Scikit-learn Documentation
- Flask Documentation
- SmartBridge Training Materials