

Intelligent Motor Health Monitoring and Predictive Maintenance using IoT & Machine Learning

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Abstract: *In modern industrial environments, the continuous operation of electric motors is essential for maintaining productivity and efficiency. Unexpected motor failures can lead to significant downtime, increased maintenance costs, and reduced system reliability. To address this issue, an Intelligent Motor Health Monitoring and Predictive Maintenance System using IoT and Machine Learning is proposed. The system utilizes an ESP32 microcontroller as the central processing unit to collect and analyze real-time data from multiple sensors. An ADXL345 accelerometer is used to monitor vibration levels, a DS18B20 temperature sensor measures motor temperature, and voltage and current sensors track electrical parameters of the motor. These sensors continuously gather operational data, which is processed by the ESP32 and displayed on an LCD for local monitoring.*

The collected data is also transmitted to a laptop or cloud platform through IoT communication, enabling remote monitoring and data analysis. Machine learning techniques can be applied to analyze the historical and real-time data to identify abnormal patterns and predict potential motor failures before they occur. A relay module is integrated into the system to automatically disconnect the motor during abnormal conditions, thereby protecting the equipment from severe damage. The proposed system enhances reliability, reduces unplanned downtime, and supports predictive maintenance strategies in industrial motor applications..

Keywords: IoT, Predictive Maintenance, Motor Health Monitoring, Machine Learning, ESP32, Vibration Analysis, Temperature Monitoring, Industrial Automation

