

**Implementation Internet of Things (IoT) Based Predictive Maintenance System
for Washing Machine (Machines)**

By

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● **STATEMENT BY THE AUTHOR**

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.

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● **ABSTRACT**

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This thesis aims to implement an Internet of Things (IoT)-based predictive maintenance system for household washing machines, focusing on the early detection of component degradation, particularly within bearings. As modern appliances become more integrated with smart technologies, proactive maintenance strategies are essential to enhance operational reliability and extend equipment lifespan. The methodology involves the integration of multiple sensors—including an MPU6050 accelerometer for vibration monitoring, an GY MAX4466 for audio frequency readings, and an ACS712 for current sensing—connected to an ESP32 microcontroller. Data are collected and analyzed in both time and frequency domains to isolate irregular patterns that signify mechanical anomalies, especially bearing wear. The system employs signal processing techniques such as Fast Fourier Transform (FFT) for frequency analysis, and some filtering technique to increase the system's accuracy. Preliminary testing has demonstrated the system's capacity to detect early signs of wear through distinct vibration and audio signatures. The research concludes that such IoT-enabled monitoring systems can significantly enhance maintenance accuracy and reduce downtime, while also serving as a scalable model for broader home appliance diagnostics.

Keywords: Predictive Maintenance, IoT, FFT, Vibration Analysis, Smart Washing Machine.

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