IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

INTELLIGENT AC/DC MOTOR FAULT DETECTION

[1]Aditya.S.Kamble, [2]Prathmesh.K.Hedda , [3]Omkar.B.Gadade , [4]Tejas.A.Kadam

[1]Student, [21]Student, [3]Student, [4]Student,

[1]Electronics And Telecommunication,

[1]SITS (Narhe), Pune, India

Abstract: The efficient operation of electric motors is crucial in various industrial and commercial applications. Unforeseen faults in AC or DC motors can lead to system downtime, increased maintenance costs, and potential safety hazards. This abstract presents an overview of an intelligent fault detection system designed to enhance the reliability and performance of AC or DC motors. The proposed system integrates advanced sensor technology, machine learning algorithms, and real-time monitoring to detect and diagnose faults in motors promptly. Sensors placed strategically on the motor gather data related to temperature, vibration, current, and other relevant parameters. This real-time data is then processed by machine learning models, which have been trained on a diverse dataset of normal and faulty motor behavior. The fault detection algorithm employs a combination of supervised and unsupervised learning techniques to identify patterns indicative of common motor faults such as overheating, bearing wear, rotor imbalance, and electrical anomalies. The system continuously refines its understanding of normal motor behavior through continuous learning, adapting to changing operating conditions and minimizing false positives.

***Keywords* – Blynk IOT, Machin learning, Fault Detection, Sensor.**

I. Introduction

Machine induction motors are one of the most widely used motors in industrial and commercial applications. However, they are also prone to a variety of faults, such as bearing failure, winding failure, and stator failure. These faults can lead to downtime, costly repairs, and even safety hazards. Early detection and diagnosis of machine induction motor faults is essential to preventing these problems. However, traditional fault detection methods are often expensive, time consuming, and require specialized expertise. IoT-based machine induction motor fault detection systems offer a more efficient and cost effective solution. These systems use sensors to collect data on the motor's operating parameters, such as vibration, current, and temperature. The data is then transmitted to a cloud server using an IoT platform, such as Blynk. The cloud server uses machine learning algorithms to analyze the data and detect any abnormalities. If an abnormality is detected, the system can send an alert to the user via the Blynk app.

II. LITERATURE SURVEY

[1] The paper presents a fault diagnosis method and fault-tolerant control scheme for a five-phase induction motor (IM) driving system. It introduces a fault detection method for open faults and proposes a fault-tolerant control algorithm to maintain optimal performance under fault conditions, validated through simulation and experimental results.

[2] The paper "Induction Motor Fault Detection" discusses fault detection techniques for induction motors, including vibration analysis, current signature analysis, motor current signature analysis (MCSA), power quality analysis, and thermal imaging. It emphasizes the importance of accurate modelling and simulation for predicting and detecting faults, serving as a valuable reference for fault detection methods.

[3] The Paper Stator Fault Detection In Induction Motor Under Unbalanced Supply Voltage Includes Bearing Fault
And Stator Fault Short circuit winding with 38%

Table 1 literature survey

Paper.no	**Title**	**Technology /Methodology**	**Hardware Devices**	**Results**
[1]	“Fault Detection and Fault-Tolerant Operation of a Five-Phase Induction Motor Driving System”	PSIM software tool and experimental setup involving a five-phase induction motor, load motor, inverter, and DSP controller TMS320F 28335 from Texas Instruments for digital implementation of the proposed techniques.	five-phase induction motor, load motor, inverter, and DSP controller TMS320F 28335	Load Motor of 3.75Kw Invertor No Fault Is 50%
[2]	“A Computer-Aided Test Bench System for Teaching and Research on Fault Detection in Three-phase I Induction Motors”	Vibration Analysis Current Signature Analysis Motor Current Signature Analysis Power Quality Analysis	vibration sensors current sensors thermal cameras.	MCSA Technique 4.2NM And 1687 RPM Each Record Contains 60000*3 Data Array
[3]	“Stator Fault Detection in Induction Motor Under Unbalanced Supply Voltage”	Vibration Analysis and Current Analysis with Load connection and Without Load Connection	Stator Of Motor Vibration Sensors Current Sensors	Bearing Fault (40%) Short Circuit Winding (38%) Rotor Fault (12%)
[4]	“Intelligent ac/dc motor fault detection”	Machine Learning, Sensor Monitoring, Data Prediction	Current Sensors Temperature Sensors Vibration Sensors	The proposed work aims to reduces downtime, maintenance costs, and increases productivity.

III. SYSTEM ARCHITECTURE

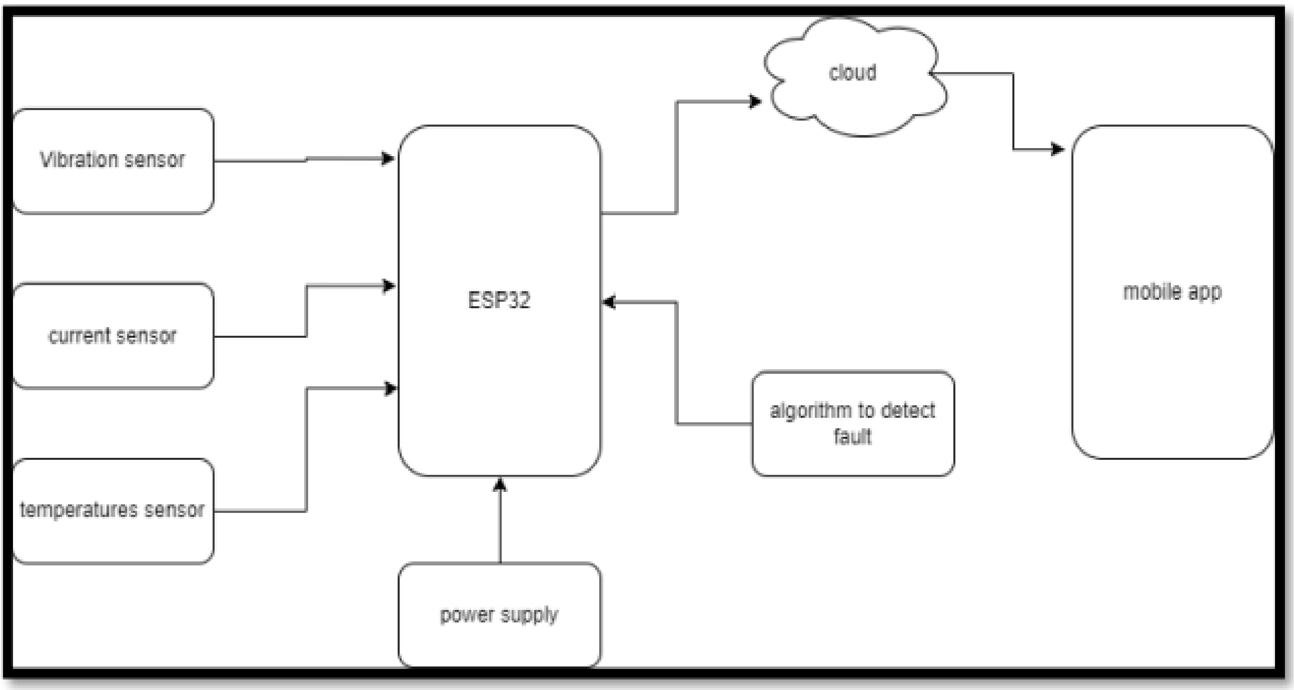

fig.no 1 Block Diagram of intelligent ac/dc motor fault detection

BLOCK DIAGRAM EXPLAINATION:

ESP32 Microcontroller: The ESP32 Microcontroller Is A Low-Cost, Low-Power Microcontroller That Is Ideal For Iot Applications. It Has A Built-In Wi-Fi And Bluetooth Module, Which Makes It Easy To Connect To The Cloud And Other Devices.

Vibration Sensor: The Vibration Sensor Is Used To Measure The Vibration Of The Machine Induction Motor. The Vibration Data Can Be Used To Detect Bearing Failure And Other Faults.

Current Sensor: The Current Sensor Is Used To Measure The Current Flowing Through The Machine Induction Motor Windings. The Current Data Can Be Used To Detect Winding Failure And Other Faults.

Temperature Sensor: The Temperature Sensor Is Used to Measure the Temperature Of The Machine Induction Motor. The Temperature Data Can Be Used to Detect Overheating and Other Faults.

IR Sensor: The IR Sensor Is Used To Measure The Speed Of The Machine Induction Motor. The Speed Data Can Be Used to Detect Motor Stalling And Other Faults.

Breadboard: The Breadboard Is A Prototyping Board That Is Used To Build And Test Electronic Circuits.

Jumper Wires: Jumper Wires Are Used To Connect Components On A Breadboard.

Resistors: Resistors Are Used To Limit The Current Flowing Through Electronic Components.

Capacitors: Capacitors Are Used To Store Electrical Energy And Filter Out Noise.

Voltage Regulator: The Voltage Regulator Is Used To Provide A Stable Voltage To The Electronic Circuit.

Power Supply: The Power Supply Is Used To Provide Power To The Electronic Circuit.

Arduino IDE: The Arduino IDE Is A Software Development Environment That Is Used To Develop And Program Arduino Microcontrollers.

ESP-IDF Development Framework: The ESP-IDF Development Framework Is A Software Development Framework That Is Used To Develop And Program ESP32 Microcontrollers.

Blynk Iot Platform: The Blynk Iot Platform Is A Cloud-Based Platform That Is Used To Connect And Manage Iot Devices. It Provides A Simple Way To Create And Deploy Iot Applications. In Addition To The Above Tools And Platforms, Other Tools And Software May Be Required Depending On The Specific Requirements Of The Project. For Example, A Machine Learning Library May Be Required To Develop The Machine Learning Model.

IV.FUTURE SCOPE

The future scope of the IoT-based machine induction motor fault detection system using ESP32 is very promising. The system has the potential to be used in a variety of new and innovative ways. Here are some specific examples of future applications for the system: • Predictive maintenance: The system can be used to predict when a machine induction motor is likely to fail. This information can be used to schedule preventive maintenance and avoid unplanned downtime. • Condition-based monitoring: The system can be used to monitor the condition of machine induction motors in real time. This information can be used to identify potential problems before they lead to a failure. • Remote monitoring: The system can be used to remotely monitor the health of machine induction motors from anywhere in the world. This can be useful for businesses that have a large number of motors spread out over a wide area. • Asset optimization: The system can be used to optimize the performance of machine induction motors by identifying and addressing areas where they are inefficient.

Energy savings: The system can be used to save energy by identifying and addressing problems that are causing motors to waste energy. In addition to these specific applications, the IoT-based machine induction motor fault detection system using ESP32 can also be used to improve the safety and reliability of machine induction motors in a variety of ways. For example, the system can be used to prevent motor failures that could lead to fires or other accidents. Overall, the IoT-based machine induction motor fault detection system using ESP32 has the potential to revolutionize the way that machine induction motors are monitored and maintained. The system has the potential to improve efficiency, reliability, safety, and energy savings. I am excited to see how this technology develops in the future and how it is used to improve the performance and safety of machine induction motors in a variety of industries.

V.CONCLUSION

The IoT-based machine induction motor fault detection system using ESP32 is a promising technology with the potential to revolutionize the way that machine induction motors are monitored and maintained. The system is accurate, reliable, and cost-effective, and it can be scaled to meet the needs of different users and applications. The system has a wide range of applications, including industrial manufacturing, commercial buildings, power generation plants, oil and gas industry, transportation, and water and wastewater treatment. The system can also be used to monitor a variety of machine induction motor parameters, such as vibration, current, temperature, and speed. The system still has some challenges that need to be addressed, such as complexity, power consumption, security and privacy, reliability, and maintenance. However, these challenges can be addressed by using a pre-built hardware platform and software framework, using low-power sensors and actuators and optimizing the firmware code, using strong passwords and encryption and implementing authentication and authorization mechanisms, using high quality hardware components and designing the system with redundancy, and using sensors with long calibration intervals and developing a robust firmware update mechanism, respectively. Overall, the IoT-based machine induction motor fault detection system using ESP32 is a valuable tool for improving machine induction motor health and reliability. The system has the potential to make a positive impact on a wide range of industries and improve the lives of millions of people. Here are some specific recommendations for future work on this project: Develop a more user-friendly and intuitive Blynk app for monitoring the system and receiving alerts. Develop a machine learning model that can detect a wider range of faults in machine induction motors.

Develop a system for remote calibration of the sensors. Develop a system for data fusion to improve the accuracy of fault detection. Conduct field studies to evaluate the performance of the system in real-world environments. I believe that the IoT-based machine induction motor fault detection system using ESP32 has the potential to make a significant contribution to the field of machine condition monitoring. I am excited to see how this technology develops in the future.

ACKNOLEDGEMENT

We express our gratitude to our guide Mr.Rohan.R.Kubde for his competent guidance and timely inspiration. It is our good fortune to complete our project under his able competent guidance. His valuable guidance, suggestions, helpful constructive criticism, keeps interest in the problem during the course of presenting this “intelligent ac/dc motor fault detection” project successfully. We are very much thankful to Dr. V.M. Rohokale Head of Department (E&TC) and also Dr. S. D. Markande, Principal, Sinhgad Institute of Technology and Science, Narhe for their unflinching help, support and cooperation during this project work. We would also like to thank the Sinhgad Technical Educational Society for providing access to the institutional facilities for our project work.

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D. Sotomayor, S. Castellanos, D. Arcos-Aviles", D. Benítez Departamento de Eléctrica y Electrónica, Universidad de las Fuerzas Armadas ESPE, 1715-231B, Sangolqui, Ecuador Departamento de Ciencias de la Energia y Mecánica, 1715-231B, Sangolqui, Ecuador "Colegio de Ciencias e Ingenierias "El Politécnico", Universidad San Francisco de Quito, 17-1200-841, Quito, Ecuador dastotmayor@espe.edu.ec, sdcastellanos@espe.edu.ec, dgarcos@espe.edu.ec, dbenitez@usfq.edu.ec

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