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Review Soft Switching Methods for Parameter Monitoring of AC Machine Drives

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***Abstract*—** Industrial applications continue to primarily use induction motors (AC Motor), and dependable performance depends on efficient monitoring and control of these motors' properties. There are several ways to accomplish this, and the focus of this project is on controlling and monitoring a single-phase induction engine. Important parameters of the induction motor, such as temperature, current, and voltage, are continually monitored by means of a module that is fitted with sensors and transducers. After being gathered, the data is sent to an information processing unit, which shows its parameters on a display. Through a LCD display gateway, the system integrates both automatic and human control techniques to start or stop the AC Motor, reducing the possibility of system failures. It is projected that this system's deployment will improve operational effectiveness by guaranteeing ongoing observation, averting problems, and encouraging preventative maintenance.

***Keywords*— Arduino Controller, LCD Display, Parameter Monitoring, AC motor, Parameter Controlling etc.**

I. INTRODUCTION

Induction motors (AC Motor) are extensively employed in contemporary industrial sectors, both mechanical and electromechanical. Prior to the introduction of induction drives, DC motors were dominant in servicing industrial demands. However, due to their better performance characteristics, induction motors have replaced DC motors in manufacturing automation.

AC motors, particularly those powered by induction, have several advantages, including a simple rotor structure that leads to cheaper prices, robustness, and low maintenance needs. An investigation of the structure and functioning of induction motors indicates that flaws in these motors may be classified into three major categories:

(a) Electrical faults: Resulting from single phases, under- or overvoltage, uneven supply voltage or current, stress, and other conditions.

(a) Mechanical faults: Caused by difficulties such as broken rotors bars, weight imbalance, air gap bizarre behavior , bearing damage, winding failure, and armature wound failure.

(c) Environmental faults: These might be caused by changes in ambient temperature, external moisture, or machine vibrations.

The performance with an induction motor is inextricably connected to all of these mechanical, electronic, and environmental factors. As a result, control methods for induction motors with AC are heavily dependent on these motor characteristics. Thus, monitoring induction motor characteristics is critical for continuous operation and estimating the pre-fault state, thus minimizing breakdowns.

Nikola Tesla's discovery of the induction motor led to its widespread adoption, accounting for around 50% of worldwide electric power consumption. Induction motors are used in nearly 90% of industrial applications due to its inherent qualities, such as being a 'self-start' motor with no permanent the magnets, brushes, commutators rings, etc. position sensors. Induction motors have easy yet robust operation, retain a good electrical efficiency, require little upkeep, are highly efficient, small, dependable, and so on economical than other motor types.

This project combines sensors and cloud technologies to monitor the properties of an induction motor, including voltage, current, acceleration, and temperature. The speed for the induction motor may be readily changed by adjusting the power input frequency. Regular tracking of these parameters promotes continued production in industries, improving motor dependability and thereby increasing industrial output.

Furthermore, the initiative tries to prevent anomalies in induction motors by recognizing early problems. If a failure occurs, sensors monitor the current, voltage, speed, and temp parameters and send signals to the Arduino Uno. From the cloud, an order is sent to disconnect the drive from the system. Additionally, a distress signal is delivered to mobile devices after the issue has been resolved, functioning as a preventive precaution for future recurrence.

II. OBJECTIVES

The main goal is to use recent technological advancements to increase the reliability of motor applications. High-efficiency induction motors are utilized in many different industrial applications, and this project offers easy administration and continuous surveillance of these motors. By ensuring system reliability, anomalous situations may be quickly identified and fixed.

Given that AC equipment account for roughly 90% of industrial utilization, tracking economic data becomes critical. The regular upkeep of induction devices is essential for increasing industrial output. Proactive steps to avoid system failure and safeguard large horsepower engines from excessive expenses are critical.

The project's precise aims are as follows:

• Monitor and operate an induction motor via an LCD display, allowing for safe and cost-effective data transfer in industrial areas.

• Use automated and manual control techniques to start and stop the induction machine, preventing system faults.

• Determine the voltage, current, frequency, acceleration, and heat of the induction motor's coil.

III. LITERATURE SURVEY

- Shyamala.D "IoT platform for monitoring industrial motor conditions" [1], Many products are effectively networked, enabling condition and equipment monitoring to increase output. Constant equipment monitoring, including data accessible for preventive maintenance and alerts. The motor is effectively and continuously inspected by using a web address.

- Kunthong, Jakkrit, et al. "Power Engineering with Drive Techniques (PEDS), 2017 IEEE 12th International Conference on [2]. IoT-based traction battery state tracking in electric automobiles; Part 1. An internet-connected Web of Things (IoT) was used to monitor the engine's health for propulsion in electric automobiles. The process for developing and testing the prototype—which uses an ESP8266 control module to measure motor condition—is described.

- Prakash, Chetna, and Sanjeev Thakur. "Smart Shut-Down: Industrial Machines' Recoveries Using the Internet of Things." Confluence is the host of the 8th International Symposium on Computers in the Cloud, Data Sciences, and Engineering in 2018. IEEE[3] Continuous monitoring is necessary to identify any decline performance or motor breakdown for the purpose of preventative service of motors in industries. The backup machine is started by the recovery mechanism after the primary motor is switched off. This lessens the potential loss that might occur during the outage. This encourages consistency.

- Şen, Mehmet, and Basri Kul. "Internet of Things-based cordless inductive motor monitoring." IEEE, 2017's XXVI International Scientific Conference Electrical (ET).[4], As a consequence, there is no disruption to the production process and any required replacement or repair may be done with little difficulty. This study has provided statistics that the CMS operator may use to create a motor maintenance plan in addition to helping to build mathematical models.

- Xue, Xin, V. Sundararajan, and Wallace P. Brithinee. "The use of wireless sensor networks in three-phase immersed motors for condition monitoring." 2007 Electrical Industrial Expo and Conference on Insulation. IEEE, [5] in 2007. The most common method for finding flaws in large three-phase induction motors is to watch the motor's supply current and look at the signal spectrum. This part ensures that worker efficiency is not impacted when fixing machinery, helping businesses save downtime.

- R. Deekshath et. al. 2018 "IoT platform for condition monitoring of industrial motors" [1], Numbers of things are efficiently interconnected**,** which leads to condition and controlled monitoring to increase productivity. Continuous monitoring of the equipment, receiving alerts and data availability for predictive maintenance. Motor is effectively and continuously monitored by using web location.

- Sharmad Pasha, et al. 2016 "IoT-based traction motor drive condition monitoring in electric vehicles: Part 1." Power Electronics and Drive Systems (PEDS), 2017 IEEE 12th International conference [2]. In electric vehicles, The motor drive condition for traction was supervised by applying the implementation of a wireless Internet of Things (IoT). The design and testing of the prototype using an ESP8266 microcontroller module to acquire motor condition is presented.

- S. S. Darbastwar et al. 2016. **"**Smart Shut-Down and Recovery Mechanism for Industrial Machines Using Internet of Things.**"** 2018 8th International Conference on Cloud Computing, Data Science & Engineering (Confluence). IEEE[3], For predictive maintenance of motors in the industries, monitoring needs to be performed continuously so as to determine any degradation in performance or failure of the motors. The recovery mechanism provides a back-up machine which is started when the main motor is shut down. This helps in decreasing the loss that would occur during the downtime. This increases the reliability.

- B. Lu, T. G. Habetler et al. 2008. "IoT-based wireless induction motor monitoring. **"** Scientific Conference Electronics (ET), 2008 XXVI International. IEEE, 2008.[4], In this way, the production process is not impeded and the required maintenance or replacement can be performed with the least possible disruption. This study has provided statistics not only for creating mathematical models but also for enabling the CMS operator to establish a motor maintenance schedule.

- J. Pedro Amaro 2010. **"**The application of wireless sensor networks for condition monitoring in three-phase induction motors.**"** Electrical Insulation Conference and Electrical Manufacturing Expo, *2007*. IEEE, 2007.[5], The most commonly used technique for the detection of faults in large three-phase induction motors is to measure the supply current fed into the motor and analyse the signal spectrum. This aspect allows companies to reduce downtime when repairing machinery and ensures that productivity does not suffer.

IV. PROPOSED SYSTEM

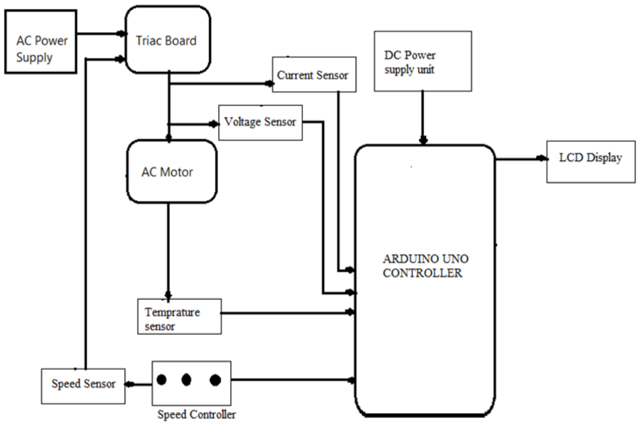

Fig.1. Block Diagram of system

V. WORKING

• This research presents a revolutionary speed control method for an one-phase AC induction engine. It provides a low-cost, high-efficiency drive that can power an induction motor with a single phase using PWM regulated sinusoidal voltage. An Arduino controller controls the circuit's functionality.
• The goal is to replace the frequently utilized TRIAC angle of attack control drives. The circuit is intended to power a single-phase duction motor, whether capacitive or resistive, with variable AC voltage.
• The block diagram depicts the integration of the four sensors for tracking critical metrics, including voltage, current, velocity, and temperature. These sensors play an important role for tracking the motor's condition.
• The LCD display module shows the real-time status updates that the Arduino Uno gets from the induction motor. The LCD display gives a thorough overview of the operating characteristics of the induction motors by visualizing crucial data including temperature, voltage, current, and speed.

This project takes a unique approach for acceleration control, emphasizing efficiency and efficiency, and employs sensors for thorough motor parameter monitoring. The addition of an Arduino microprocessor and an LCD display improves the general functionality and user experience for the system.

VI. FLOW DIAGRAM

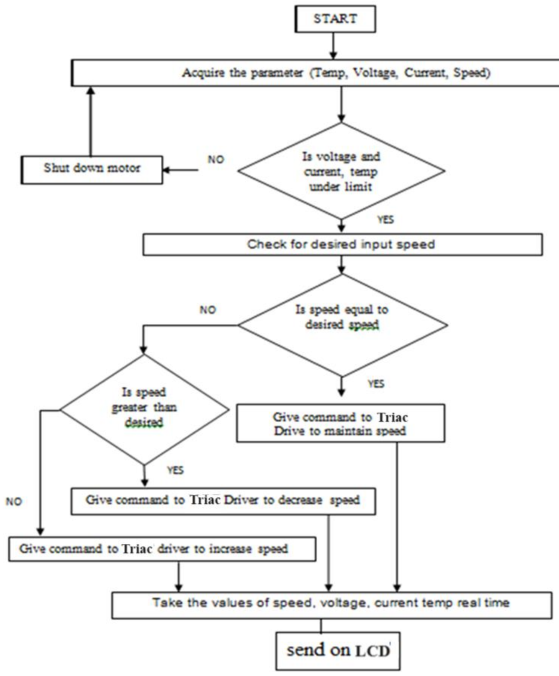

Fig.2. Flow Diagram of system

VII. ADVANTAGES

• Eliminates excessive inrush current and mechanical torque at starting.
• Lower ratings for switchgear and cables inside the power delivery network.
• Reduced loss in line voltage.
• Applying gradual, gentle acceleration and deceleration.
• A kick-start function with strong starting torque designed for large and demanding loads.
• Including the current constraint.
The application of by-pass the contactor to save electricity.
• Avoiding power and current peaks reduces the mechanical and electrical stress on the drive as a whole as well as the power supply network.
• Reduction of stress on gearboxes, couplings, shafts and belts, among other gearbox components.

VIII. DISADVANTAGES

• Requires dynamic braking to manage regenerative loads.
• VFDs without proper harmonic mitigation methods may generate significant supply voltage harmonic distortion.
• For low-speed operation, the motor may need to be de-rated or additional cooling may be required.
• System efficiency will decrease by 1-2 %.).

IX. APPLICATIONS

• This variable speed motor with variable power control offers cost-effective solutions for light industrial and consumer applications.

X. CONCLUSION

This project aims to create an Internet of Things-driven induction motor parameter tracking system. The created system will be capable of performing tasks such as starting and halting the motor, as well as keeping track of characteristics such as temperature, speed, voltage, or current. The values that have been recorded for these parameters are efficiently transmitted to the interface's LCD display. Long-term monitoring of basic parameters for induction motors can be achieved using a variety of ways.

REFERENCES

1] Mr. R. Deekshath, Ms. P. Dharanya, Ms. K. R.Dimpil Kabadia & Mr. G. Deepak Dinakaran "IoT Based Environmental AC Motor Monitoring System using Arduino UNO and Thingspeak", IJSTE - International Journal of Science Technology & Engineering | ISSN (online): 2349-784X | Volume 4 | Issue 9 | March 2018

2] Sharmad Pasha, "Thingspeak Based AC Motor Sensing and Monitoring System for IoT with Matlab Analysis" International Journal of New Technology and Research (IJNTR) | ISSN: 2454-4116 | Volume-2, Issue-6 | PP 19-23 | June 2016

3] S. S. Darbastwar, S. C. Sagare, V. G. Khetade "IoT Based Environmental Factor Sensing and Monitoring System for AC Motor over Wireless Sensor Networks." International Journal of Advanced Research in Computer Science and Software Engineering Research Paper | ISSN: 2277 128X| Volume 6 | Issue 12 | December 2016

4] B. Lu, T. G. Habetler, and R. G. Harley, "A nonintrusive and in-service motor-efficiency estimation method using air-gap torque with considerations of condition monitoring" IEEE Trans. Ind. Appl | vol. 44 | pp. 1666–1674 | Nov./Dec. 2008.

5] J. Pedro Amaro_†, Fernando J.T.E. Ferreira, "low cost wireless sensor for in field monitoring of AC motor" IEEE Trans. Ind. Appl. | vol. 44, no. 6 | pp. 1666–1674 | Nov./Dec. 2010.

6] Yanfeng Li 1,2, Haibin Yu, "Energy management of AC motors based on non-intrusive efficiency estimation", Proceeding of International Conference on Electrical Machines and Systems 2007.

7] Nagendrappa. H1, Prakash Bure2, "energy audit and management of AC motor using genetic algorithm" International Journal of Recent Trends in Engineering

8] Ovidiu Vermesan, Peter Friess, "Internet of Things From Research and Innovation to Market Deployment", Rivers publication.

9] Dave Evans, "The Internet of Things-How the Next Evolution of the Internet is Changing Everything", Cisco Internet Business Solutions Group (IBSG).