IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

ARDUINO BASED INDUCTION MOTOR SPEED CONTROL AND PROTECTION SYSTEM

Adithya Kulala[1], Anush[2], Faisal Ahmed, Manish[4], Sudhir P[5]

Designation of 5th Author- Assistant Professor, EEE Department,

Yenepoya Institute of Technology, Moodbidri, Dakshina Kannada, India

Abstract: In the realm of industrial automation, our project, titled "Arduino-based Induction Motor Speed Control and Protection System," aims to enhance the performance and longevity of induction motors. We focus on two key objectives: implementing a sophisticated speed control system using advanced methodologies and developing a comprehensive protection mechanism against electrical and mechanical faults. To achieve real-time monitoring and control, we integrate the speed control system with an Arduino microcontroller, providing operators with precision control and the ability to monitor motor performance. Additionally, we prioritize user-friendly interaction by creating an intuitive Graphical User Interface (GUI) for effortless motor speed adjustment and health parameter monitoring.

Keywords- Speed and Temperature sensor, Rectifiers & Inverters, Current & Voltage sensors, ARDUINO UNO, IoT, Graphical User Interface(GUI).

I. INTRODUCTION

In the present time, in the most of the applications, AC machines are preferable over DC machines due to their simple and most robust construction without any mechanical commutators. Induction motors are the most widely used motors for appliances like industrial control, and automation; hence, they are often called the workhorse of the motion industry. As far as the machine efficiency, robustness, reliability, durability, power factor, ripples, stable output voltage and torque are concerned, three- phase induction motor stands at a top of the order. Motor control is a significant, but often ignored portion of embedded applications. Motor control applications span everything from residential washing machines, fans to hand-held power tools, and automotive window lift, traction control systems and various industrial drives. All most in all the applications there is a drastic move away from analog motor control to precision digital control of motors using different processors. Digital control of induction motors results in much more efficient operation of the motor, resulting in longer life, lower power dissipation.

Because of their continuous use, failure or faults may occur in the motor such as electrical faults, mechanical related, environmental impacts etc. An Induction motor must be protected from these faults as these can be costly, increase maintenance cost and wasted material. To overcome the above problems our protection system can be used.

This project enhances industrial automation and defect monitoring with an Arduino-based system for tracking key parameters of induction motors. It tackles challenges like overvoltage, over current, and over temperature, ensuring precise data transmission in industrial settings. By incorporating induction motors, IoT, Arduino Uno, and Proteus software, the project aims to boost machine productivity through continuous monitoring and preventive maintenance. Despite addressing crucial motor protection and data monitoring aspects, it acknowledges a limitation—the current lack of a user-friendly interface. Future iterations could improve this by incorporating enhanced user control features for a more seamless and accessible experience for operators and maintenance personnel. [1].

The article introduces a wireless system for remote control and protection of AC motors, using an Arduino microcontroller and an Android app. It enables seamless switching between high and low voltage, along with overcurrent conditions. Our project aims to develop a similar wireless control and protection system, utilizing a microcontroller and a mobile app for efficient remote operation. Key objectives include enhancing protection mechanisms and adaptability across industrial environments. [2].

This article highlights the crucial need for strong protection measures for industrial induction motors. It emphasizes the importance of ensuring safety from issues like single phasing and overheating. Using a DHT22 thermistor for temperature readings, the article proposes a solution that disconnects power if the motor temperature exceeds a set limit, ensuring motor safety. The research introduces transformers and a microcontroller to address challenges like single phasing and overheating comprehensively. Our project, inspired by these concepts, aims to design an advanced protection system for industrial induction motors, incorporating elements like multiple transformers, temperature sensors, and a microcontroller to enhance safety and reliability. [3].

II. RESEARCH METHODOLOGY

2.1 Block Diagram

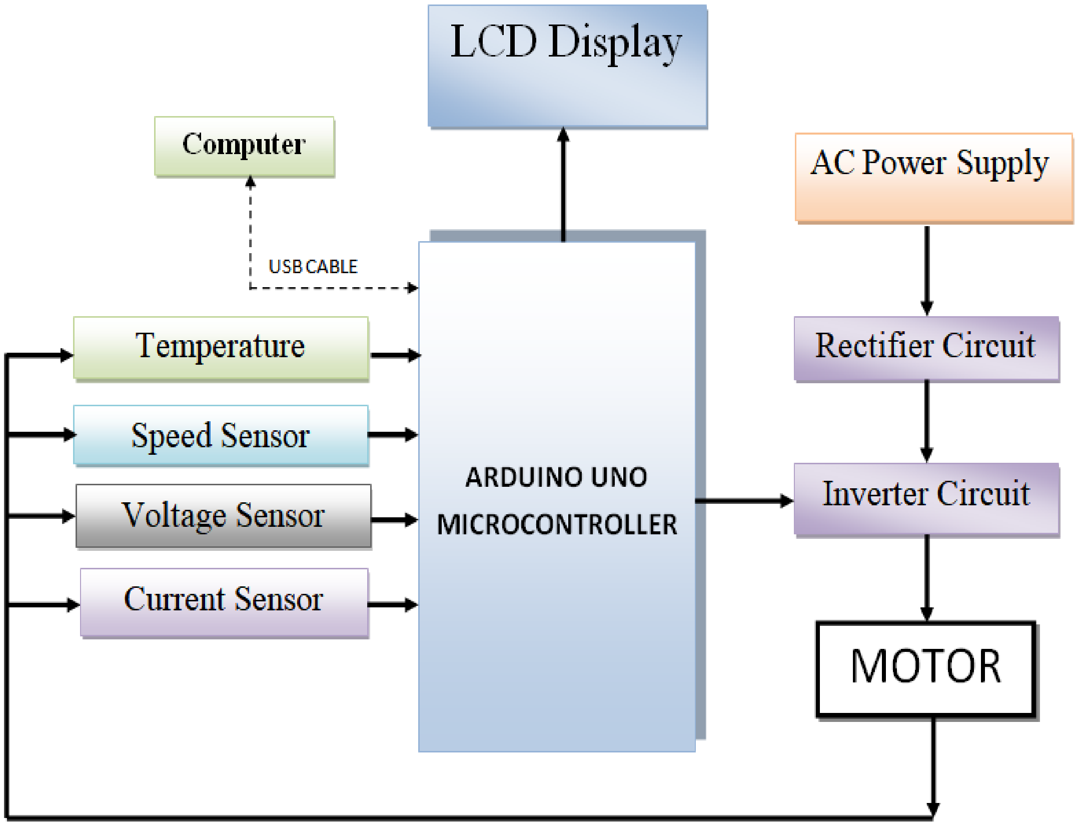

Fig:2.1 Block diagram

The methodology involves implementing a speed control and protection system for induction motors, depicted in the block diagram. The Speed Control Circuit comprises a rectifier to convert fixed-frequency single-phase AC to DC, followed by an inverter controlled by an Arduino microcontroller to generate variable frequency AC for motor speed regulation. The Protection Circuit integrates temperature, speed, and current/voltage sensors to monitor respective parameters. If measured values exceed preset thresholds, protective measures are activated. The Arduino facilitates communication between the speed control and protection circuits, while a user-friendly GUI enables motor speed adjustment and parameter monitoring. Rigorous testing in practical industrial scenarios ensures system reliability, efficiency, and safety, with comprehensive documentation for future reference.

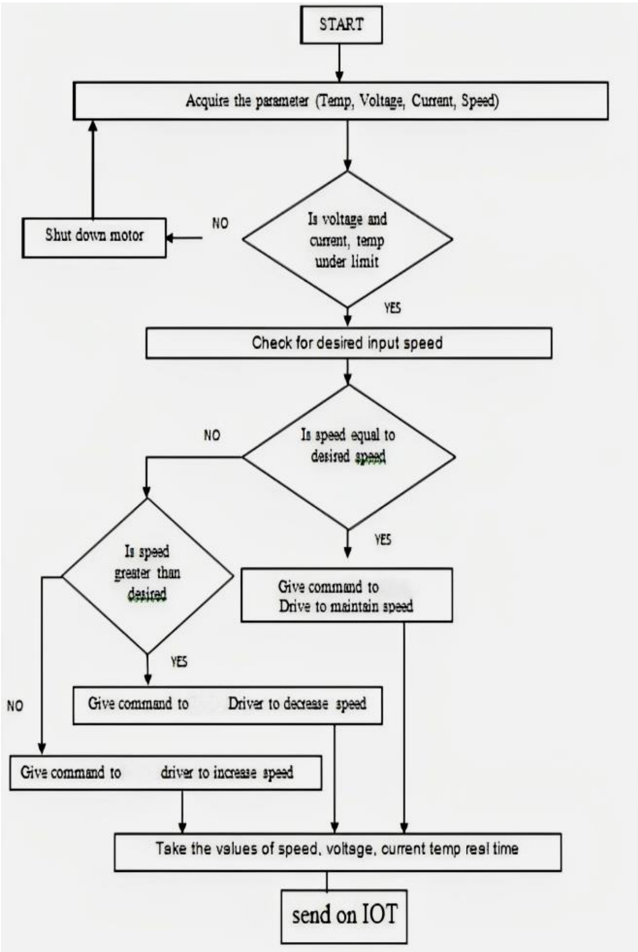

Fig: 2.2 Program flow chart

The flowchart illustrates a safety-focused control system for an induction motor. It starts by acquiring critical parameters like temperature, voltage, current, and speed, checking if they are within limits. If any parameter exceeds the threshold, the system initiates a motor shutdown. After validating parameters, it assesses if the motor speed matches the desired level. If equal, it maintains the speed; if not, it adjusts speed using the MOSFET drive. Real-time data on speed, voltage, current, and temperature are sent to the IoT for analysis, monitoring, or logging. The process ensures optimal motor performance and integrates seamlessly with IoT for enhanced oversight.

III. CONCLUSION

3.1 Conclusion:

The objectives of the project have been met because the design has been developed and it is working perfectly, sensors accurate and controllers are efficient. The design has been developed with the economical and most efficient components. So, it is possibly economical Speed control design of single phase induction motor with good efficiency. In this project, a protection system has been designed for safeguarding induction motors against several faults. Sensors are used to keep tabs on temperature, vibrations and speed. We have learned a lot about protection and control of an induction motor while working on this project.

While the project has successfully met its objectives and provides efficient speed control and protection for induction motors, it's essential to acknowledge potential limitations. One limitation may be the complexity of the system for users unfamiliar with advanced control mechanisms. Additionally, the reliance on sensors may introduce a vulnerability to sensor malfunctions or inaccuracies, requiring periodic calibration and maintenance. The economical design choice, while beneficial, might have certain trade-offs in terms of long-term durability or adaptability to specific industrial environments. Regular updates and improvements may be necessary to address emerging challenges in motor technology and maintain the system's effectiveness over time.

REFERENCES

[1] "Induction Motor Protection System and Data Monitoring over IOT Blynk". Shahu Kambale, Kunal Patel, Viraj Mali, Kshitija Bargale, AmrutaTawade, Rutuja L. Patil,.(IJRET) Vol.4, Issue 7, pp(1463-1469), July 2022.

[2] "Induction motor control and protection using IOT"- Sukhada B Dombale, Pratik V Deshmukh, Pankaj G, Pratik B Patil. (IJISRT) Vol7, Issue 5, pp(450-455), May 2022.

[3] "Protection system design for Induction Motors for Industries"- Shoaib Shaikh, Dileep Kumar, Abdul Hakeem and Arsalan Soomar. Hindawi Modelling and Simulation in Engineering,Vol. 2022, Art.ID. 7423018, 13 pages.

[4] "Review on IOT based Monitoring and Speed Control of an Induction Motor"- Ashwini B. Kaule, Manjusha R. Bachawad. (IJRCT) Vol. 8, Issue 6, pp(3594-3597), January 2020.

[5] "Arduino Uno based Fault Detection, and Speed Control Scheme for Single Phase Induction Motor", Santosh Kumar Bisoriya, , C.S.Sharma (JETIR) Vol 8, Issue 7, pp(a486-a493), July 2021.

[6] Power Electronics by P.S.Bimbhra, Khanna Publishers. Ch-8 "Inverters" pp(309-391).