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IOT-BASED SMART SPEED CONTROL AND PROTECTION SYSTEM FOR INDUCTION MOTOR

Mr. BABJINAIDU DASARI, Assistant Professor, Department of EEE, Satya Institute of Technology and Management, Vizianagaram, Andhra Pradesh, India. Email: - dasaribabjinaidu@gmail.com

MADAPAKA MOUNASRI, B Tech Student, Department of EEE, Satya Institute of Technology and Management, Vizianagaram, Andhra Pradesh, India. Email: - mandapakamounasri@gmail.com

ALTHI CHANDINI, B Tech Student, Department of EEE, Satya Institute of Technology and Management, Vizianagaram, Andhra Pradesh, India. Email: - chandinialthi@gmail.com

CHITEKELA DURGA PRASAD, B Tech Student, Department of EEE, Satya Institute of Technology and Management, Vizianagaram, Andhra Pradesh, India. Email: - sanjuchitikela4@gmail.com

KANGATI ASHOK KUMAR, B Tech Student, Department of EEE, Satya Institute of Technology and Management, Vizianagaram, Andhra Pradesh, India. Email: - vickybabu3653@gmail.com

BOTTA VIGNESH YADAV, B Tech Student, Department of EEE, Satya Institute of Technology and Management, Vizianagaram, Andhra Pradesh, India. Email: - vighneshyadav24@gmail.com

ABSTRACT

In industrial and agricultural applications, the efficiency and longevity of induction motors are crucial. This project presents an IoT-based smart speed control and protection system for induction motors. The system enables remote speed control through an lOT application while continuously monitoring temperature and humidity. If the temperature exceeds a predefined threshold, the system automatically shuts down the motor to prevent overheating and potential damage. The system is designed using microcontrollers, temperature sensors, humidity sensors, and IoT connectivity. Real-time data is transmitted to an IoT dashboard, allowing users to monitor motor performance and environmental conditions. The speed of the induction motor can be adjusted via a mobile application, ensuring optimal performance and energy efficiency. Additionally, alerts and notifications are sent in case of temperature spikes, enhancing safety and reliability. This solution provides a cost-effective, automated, and remote-controlled approach to manage Induction motors , making it ideal for industrial and agricultural applications.

I. INTRODUCTION

Induction motors are widely used in industrial and domestic applications due to their rugged construction, low cost, and reliability. However, uncontrolled speed and adverse operating conditions can lead to performance inefficiencies, overheating, and eventual motor failure. Traditional control and protection methods often lack remote monitoring and real-time response capabilities.With the advancement of the Internet of Things (IoT), it is now possible to enhance motor control systems by integrating smart sensors and communication technologies. This project aims to develop an IoT-based speed control and protection system for induction motors, enabling remote monitoring, automatic fault detection, and dynamic speed regulation based on operating conditions. By leveraging microcontrollers, sensors, and IoT platforms, the system enhances operational safety, improves energy efficiency, and reduces maintenance costs.

The Smart Motor Control System using ESP32 is an advanced automation project designed to enhance motor efficiency, reduce energy consumption, and enable remote control using IoT capabilities. Motors are widely used in industries and home automation systems, but traditional motor control methods often involve manual intervention, inefficient power usage, and lack of real-time monitoring.

This project addresses these limitations by integrating the ESP32 microcontroller, which provides Wi-Fi-based remote control and automation. The system includes a 4-channel relay module for motor switching, a power module for stable power supply, and a DHT11 sensor for temperature and humidity monitoring.

By utilizing wireless control, cloud connectivity, and AI-based predictive maintenance, this system ensures efficient motor operation, real-time monitoring, and long-term reliability in industrial and home applications.

II. COMPONENTS FOR IOT-BASED SMART SPEED CONTROL AND PROTECTIN SYSTEM FOR INDUCTION MOTOR

BLOCK DIAGRAM

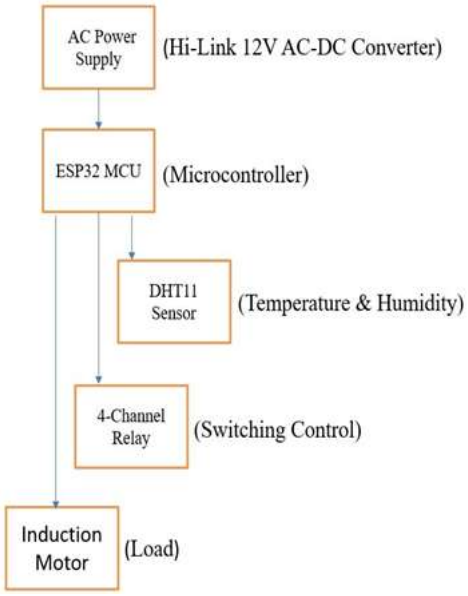


Fig. 2. 1 Block diagram of Iot based smart speed control and protection system for induction motor

III. METHODOLOGY

The Smart Motor Control System integrates the ESP32 microcontroller with various components to enable efficient and automated motor control. The system leverages a 4-channel relay module for switching, a power module for stable power supply, and a DHT11 sensor for environmental monitoring. The induction motor, controlled via the ESP32, operates using electromagnetic induction, making it suitable for industrial and home applications.

This smart control system enhances automation, energy efficiency, and reliability, with future potential for IoT integration, AI-based predictive

maintenance, energy optimization, and smart grid compatibility. The implementation of wireless connectivity, voice control, and cloud monitoring further expands its usability in industrial and smart home environments.

BLOCK DIAGRAM OF IOT-BASED SMART SPEED CONTROL ANDPROTECTION SYSTEM FOR INDUCTION MOTOR

The sequence of operation of the model is shown in the form of block diagram:

Schematic Diagram of IOT – BASED SMART SPEED CONTROL AND PROTECTION SYSTEM FOR INDUCTION MOTOR

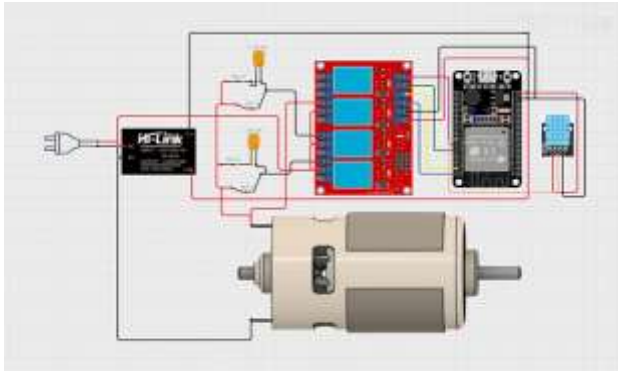
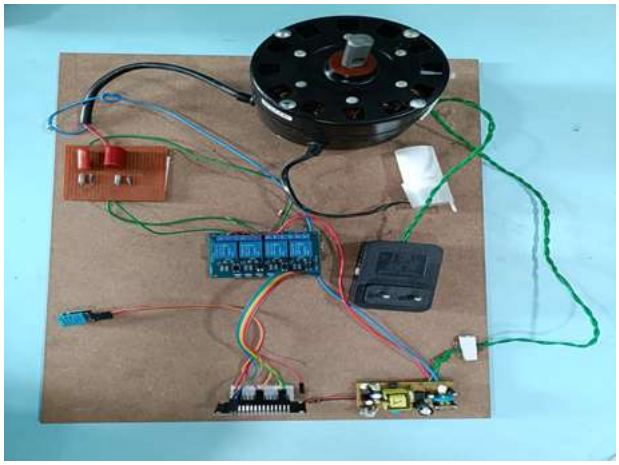
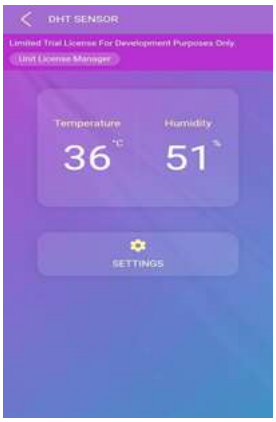


Fig. 3.2 Schematic Diagram of IOT – based smart speed control and protection system for induction motor

IV. RESULT





FUTURE SCOPE

The Smart Motor Control System using ESP32 integrates advanced technologies such as IoT, AI, and cloud computing to enhance automation, efficiency, and reliability in industrial and home applications. With IoT and cloud integration, users can remotely monitor and control motors via mobile apps or web dashboards, ensuring seamless operation. AI-based predictive maintenance enables early fault detection using machine learning, reducing downtime and maintenance costs. Energy optimization is achieved through adaptive speed control, minimizing power consumption. The system supports wireless connectivity through Wi-Fi, enabling automation and real-time data transmission. In industrial automation, it facilitates smart factory setups with real-time motor health monitoring. Additionally, voice and gesture control allow hands-free operation via AI assistants, making motor control more intuitive. With smart grid compatibility, the system contributes to load balancing and power management in modern smart cities. Overall, this solution represents a technologically advanced approach to motor control, offering improved efficiency, automation, and sustainability.

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