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Speed Control of Single-Phase Induction Motor using IOT Module and Arduino

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Abstract: This study focuses on controlling the exterior operation of the system's associated electrical appliances from a distance. The user can use the Wi-Fi module for this purpose. Electrical device switching and defect finding are possible with the help of IOT. This finds use in the fields of agriculture, industry, home, and commerce. Either a single phase or three phases should be present on the load side. This paper describes how the ARDUINO UNO is used to operate a single-phase induction motor. In this project, we are keeping an eye on and managing the induction motor's speed and direction.

***IndexTerms* - IOT MODULE, TRIAC, Transformer**

I. Introduction

The project's goal is to enable global control over the speed of an induction motor and any electrical or electronic devices attached to it. This person is able to use any kind of mobile device. It gets over the restricted range of radio and infrared remote controls in this way. Our idea uses a combination of technologies, including wireless connectivity, embedded technology, and electric drives, to reduce the amount of physical labour. The voltage delivered to the stator winding of an induction motor can be adjusted within a limited range, hence adjusting its speed. This kind of speed control is useful in situations where the load fluctuates roughly in proportion to the square of the speed, like in centrifugal pump drives and fan loads. This project focuses on IOT

II. Methodology

Figure displays the project's general block diagram. In this project, an ATmega328P microcontroller has been utilized. Serial pins (Rx,Tx) are used to interface the microcontroller with the esp8266 (NodeMcu) WiFi IOT module. A single phase induction motor with a capacitor start/tum is used to regulate the motor's speed and direction. A step-down transformer operating at 230/9V is utilized to deliver power to the microcontroller circuit and the circuit for the zero crossing detector. When the input AC supply reaches zero, a zero crossing detector circuit sends a low pulse to the microcontroller, which in turn controls the TRIAC. A TRAIC is linked as a switch in series with the induction motor. An The motor's speed is regulated by a microcontroller receiving data from a Node MCU through digital pins 11 and 12, with the speed controlled by a slider button in the Blynk app assigned to virtual pin 'V6'. This slider, ranging from 5 to 15, determines the firing delay for the gate signal of a TRIAC, altering the voltage across the motor. The delay, denoted as 'Firing delay', is calculated as a fraction of the total half-cycle optolsolator (4825) is used to connect a zero-crossing detector circuit to a microcontroller. There have been two SV DC relays.

III. Hardware and Iplementation

The overall block diagram of the project is shown in Fig.1. An ATmega328P microcontroller has been used in the project. The microcontroller is interfaced with the esp8266 (Node MCU) WiFi IOT module through serial pins (Rx,Tx). A capacitor start/run single-phase induction motor is used in order to control the speed and direction of the same. A 230/9V step-down transformer is used to supply power to the microcontroller circuit along with the zero-crossing detector circuit. A TRAIC is connected as a switch in series with the Induction motor, and TRIAC is controlled via microcontroller through an opto-Isolator (moc3021) after getting a low pulse from zero crossing the detector circuit whenever the input AC supply crosses zero. A zero-crossing detector circuit is connected to a microcontroller via an opto-Isolator (4n25). Two 5V DC relays have been used for controlling the direction of single-phase induction motors which are controlled by microcontrollers. An IOT-based Blynk app (mobile app) is implemented for controlling the speed and direction remotely.

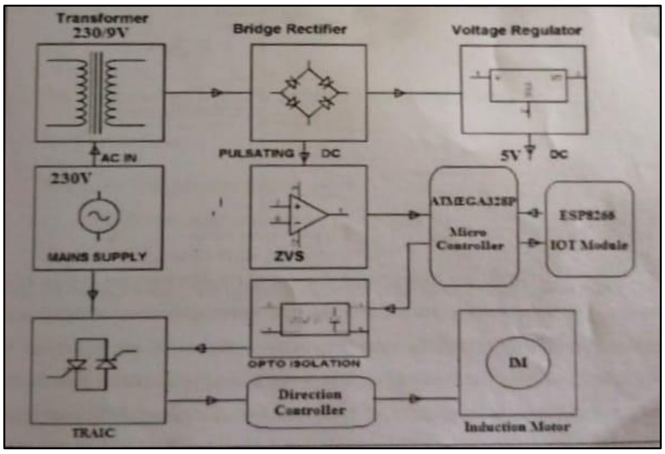

Fig.1. Block Diagram

period (10ms for 50Hz AC) and corresponds to an angle α. Direction control employs two 5V DC relays, with relay-1 and relay-2 toggling to dictate clockwise or anticlockwise rotation, respectively, by adjusting the capacitor's connection to the main or starting winding. The direction is controlled via a switch in the Blynk app, with ‘3’ for anticlockwise and ‘4’ for clockwise, assigned to virtual pin ‘V8’. Additionally, motor power is managed using an ON/OFF switch in the Blynk app, outputting ‘1’ for ON and ‘2’ for OFF, controlled through virtual pin ‘V1’, with a power LED indicating the motor's operational status.

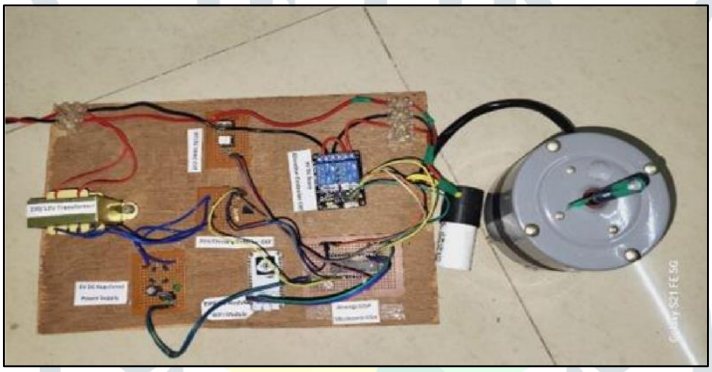

Fig.2.Overall Image of Project

3.1Advantages of Speed Control of single phase induction motor.

Global Control: Enables remote control over the speed of the induction motor and any attached electrical or electronic devices via Wi-Fi communication, offering flexibility and convenience.

Compatibility with Mobile Devices: Allows control from any type of mobile device, overcoming the limitations of traditional radio and infrared remote controls, making it accessible and user-friendly.

Cost-effectiveness and Easy Design: Utilizes a combination of wireless connectivity, embedded technology, and electric drives, offering a cost-effective solution with a simple design compared to other speed control methods like frequency control, PWM, and TRIAC control.

Variable Speed Control: Adjusts the voltage delivered to the stator winding, thereby regulating the motor's speed within a limited range, making it suitable for applications where load fluctuates roughly in proportion to the square of the speed, such as centrifugal pump drives and fan loads.

Focus on IoT: Emphasizes Internet of Things (IoT) technology, allowing for seamless integration with IoT platforms like Blynk for remote monitoring and control, enhancing accessibility and functionality.

Versatile Motor Options: Supports different types of induction motors, including single-phase and three-phase, catering to various industrial and commercial applications with differing power requirements and operational demands.

Efficient Control Mechanisms: Incorporates relays for detecting circuit faults and controlling the motor's direction, as well as TRIACs for bi-directional switching of AC applications, ensuring precise and efficient control over motor operations.

3.2 Conclusion

The project "Speed Control of Single-phase Induction Motor via Android Mobile Phone" was developed to regulate AC motor speed through Wi-Fi communication, utilizing a practical control approach with an Android mobile device. This method stands out for its cost-effectiveness and simplicity in design when compared to alternative techniques such as frequency control, PWM, TRIAC control, and Thyristor firing angle control. Additionally, it incorporates phase monitoring capabilities.

3.3 Reference

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