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IoT Enabled Speed Control of Single Phase Induction Motor

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Abstract: In domestic applications, induction motor is very important. We are going to use very efficiency while change in speed of induction motor with respect to change in the firing angle of the TRIAC. We are using the ESP8266 chip which will be mounted on PCB board and manually on the board we are going to control speed as well as display characteristics. Also by using Blynk IOT we are going to control the speed.

Keywords: ESP8266, AC Motor, Speed Control, Blynk Application, ThingSpeak, TRIAC, Optocoupler, Automation, Smart System, Remote Monitoring

I. INTRODUCTION

The Electronic motor which functions to convert electrical energy to mechanical energy. AC motor which are very common because it is strong simple and low cost. While using ac motor there is one drawback is speed cannot be easily changed. People are using mechanical method or electronic device these methods are working but they are relatively more expensive and need lot maintenance. We are going to use embedded system and wireless communication system so we can control smart and remote-controlled motor speed. In creating a PWM signal and remote-control using web or app (Blynk IOT).

II. PROBLEM STATEMENT

using single-phase AC motors on a farm or in factory you usually must use old variable resistors or simple regulators. It is hard to use and easy to mess up, and you might forget about things like remote control or real-time monitoring. Look at performance or make things more efficient. It is nearly not possible to manage in this old way, but by using a microcontroller like the ESP8266, combining it with Blynk and ThingSpeak, and makes it more controllable. So after this you can check your motor's status and change or manage its speed from any place. Automation does not just make your work easy it makes your setup safer and cuts down on energy use.

This project flips traditional motor control on its head by weaving IOT into the hardware. The ESP8266 comes in place, connecting directly to the MOC3021 Opto-isolator, BT136 TRIAC, MCT2E Opto-coupler, and HLK-PM03 power module. This arrangement is safe to perform. Using the Blynk app, you can control the motor speed manually or let it work automatically. ThingSpeak offers on-time updates and performance charts, so you are always informed. Forming a full system, the system makes life simpler reducing hassle, boosting efficiency, and cutting down on wasted energy. The product having the remotely control ability, it is easy and convinient if you are at farm, in a factory or doing work at home.

III. SYSTEM ARCHITECTURE

To achieve the success in making any control system is depended on proper planned structured design that combines and integrates hardware, software, and control logic in a organised manner. This project's aim is to control the speed of an AC motor by using a PWM signal generated by the ESP8266 microcontroller, which is controlled by using a web-based interface.

This designs main motive is making the product easy to use, efficiency, safety, remote accessibility, and they can be scalable, making it suitable for both industrial and domestic applications.

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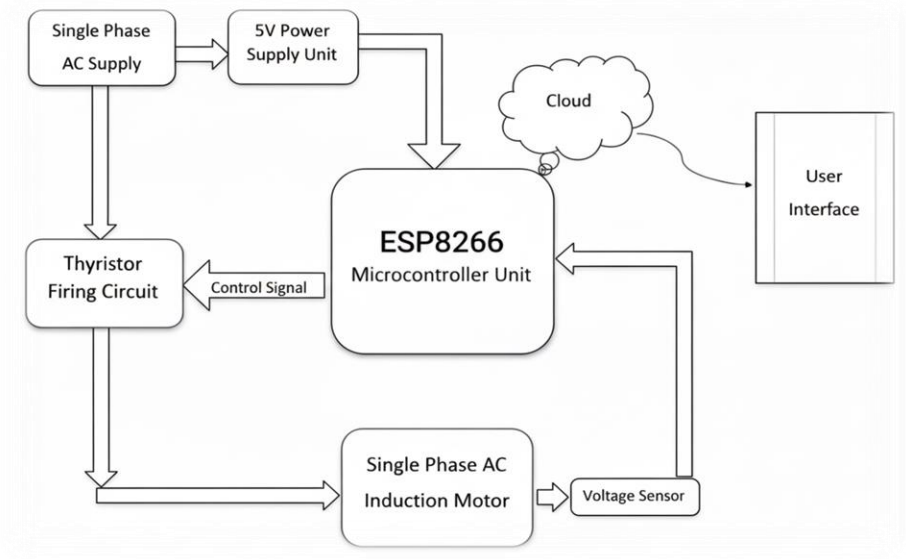

Fig.Block Diagram

In the project what is really happening with this whole "IoT-Based Single-Phase AC Motor Speed Control Using ESP8266" setup. Fundamentally, you have got yourself a single-phase induction motor. Instead of just plugging it in and hoping for the best, this system give you control the speed either manually or automatically using the Internet.

The whole system runs off your regular single-phase AC supply. That is your main power, not only spinning the motor but also powering the control circuit with a 5V supply, because everything in electronics loves five volts. At the center of it all? The ESP8266. That little chip is the brains, calling the shots for when the thyristor firing circuit should do its thing.The firing unit is a combo of components like the MOC3021 and a BT136 TRIAC. These handle the timing of the AC waveform, deciding just how much juice the motor actually gets. It is kind of like having a DJ for your electricity mixing up the power so you get the perfect tempo.

Naturally, you do not want anything that catch fire, for that purpose there is a voltage sensor monitoring into the motor. It consistantly updates the data to the ESP8266, which then uploads all that information to ThingSpeak. For the using, you made available the Blynk app on your phone that allows to adjust the speed, check out the statistic, and switch between manual and automatic modes. You could be out in the field on a tractor or just relaxing at home; it does not have any impact.

So it is a neat blend of IoT and classic power electronics. It makes controlling motors way easier, saves energy, and you don't even have to be there in person. Perfect for farms, factories, or really anywhere you have got a motor that needs a little fine-tuning.

IV. RESULTS

We have successfully created and work properly a single-phase ac induction motor which is control automatic and manually The ESP8266 microcontroller communicated with the Blynk application, allowing users to vary motor speed remotely and monitor performance in real time. The voltage sensor provided accurate feedback, and the thyristor firing unit effectively adjusted the motor's power input without any noticeable delay. Data from the system were continuously updated on the ThingSpeak cloud, confirming reliable connectivity and smooth data transfer.
Overall, the results performed stable motor operation, perfect speed control, and efficient system performance. The proposed design proved to be a minimum cost and user-friendly solution suitable for applications such as agricultural water pumps, fans, and small-scale industrial machines.

V. CONCLUSION

The design and implementation of a system that can remotely control the speed of a single-phase AC induction motor has been successfully demonstrated by the project "AC Motor Speed Control using ESP8266 and Thyristor Firing

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Circuit." The primary goal was to create a dependable, adaptable, and user-friendly way to regulate motor speed via a cloud-connected interface, substituting digital precision for traditional manual regulators or mechanical techniques.

In the course of the design and implementation, the system proved capable of achieving smooth variation in motor speed by adjusting the angle of thyristor triggering, which directly affects the power delivered to the motor. The ESP8266 microcontroller played a critical role by acting as the bridge between the user interface and the motor control circuit, ensuring real-time reception of control commands and generating precise control signals for adjusting the motor performance with desirable characteristics.

A web-based user interface, for example, ensured convenience and meant that operation of the motor system could be done remotely, without any physical interaction with it. It made operational procedures easier and also opened up new frontiers in the integration of cloud-based monitoring and control systems with traditional electrical environments.

Performance under various conditions was tested, and the system was found stable; the motor speed varied correctly with the PWM signal generated by the microcontroller. Safety and reliability during operation were ensured since high-voltage AC circuits have been separated from the low-voltage control logic. By separating it increases the reliablity of the control components by protecting the microcontroller and sensors against electrical transients.

In conclusion, the project successfully demonstrated the practical implementation of microcontroller-based speed control for AC induction motors by integrating embedded systems, power electronics, and IOT concepts within one unified solution. The efficient hardware design, real-time wireless control, and smooth operation of the motor verified that the project had met its objectives. This work adds to the ever-growing field of automation and remote control and forms a good basis for further advancements in the field of intelligent motor control systems.

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