UNDERGRADUATE FINAL YEAR PROJECT REPORT

Department of Electrical Engineering

Faculty of Engineering, Science and Technology

Indus University

IoT based Control and Monitoring of Three Phase Induction Motor

Group Number: 02 **Batch: 2019-B**

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Author’s Declaration

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CERTIFICATE

This is to certify that the project namely "IoT based Control and Monitoring of Three Phase Induction Motor" presented by Ayesha, Waqar Hussain, Qadder Ahmed, under the direction of their project advisor's and approved by the project examination committee, has been presented to and accepted by the Department of Electrical Engineering, Faculty of Engineering Science & Technology, Indus University, in partial fulfillment of the requirements for Bachelor of Electrical (Electronics) Engineering. Plagiarism test was conducted on complete report, and overall similarity index was found to be less than 20%, with maximum 5% from single source, as required.

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Statement of Contributions

Ayesha played a vital role in software area of the project. She was responsible for emerging an intuitive and user-friendly interface that allowed seamless interaction with the three-phase induction motor through IoT devices. Her design ensured remote monitoring and control capabilities, enabling users to access and manage the motor system efficiently. Ayesha's expertise in user experience design enhanced the accessibility and usability of the entire solution.

Waqar's expertise lay in the hardware integration aspect of the project. He skillfully integrated a range of sensors and actuators into the motor system, ensuring smooth communication between the physical components and the digital interface. His meticulous approach to hardware configuration and connectivity contributed to the accurate collection of real-time data from the motor, forming a critical foundation for effective monitoring and control.

Qadeer, with a deep understanding of motor behavior, played a pivotal role in optimizing the motor's performance. He contributed by refining the control mechanisms to ensure the motor responded accurately and efficiently to user commands. His expertise ensured that the motor-maintained stability and precise control through the IoT interface.

Executive Summary

Problem Statement

The major internal faults experienced by this motor are rotor broken bar, bearing defect, overheating, continuously running which may cause the motor winding damage. The external problems are over speed, reverse and forward direction, phase sequence, voltage control and current control. Aiming to monitor remotely the different quantities of Three-Phase Induction Motor such as, speed, temperature, vibration, forward and reverse direction and its IoT based control using Arduino is much opted choice at this moment for its maximum torque & efficiency.

Background information

IoT based control and monitoring of three phase induction motor involves the use of sensors, software, and electronic devices to continuously monitor and regulate the motor's performance in real-time. this technology can improve energy efficiency, reduce wear and tear on the motor, and provide operators with greater control over their processes.

Methodology used to solve the problem

- IoT based control and monitoring of three phase induction motor involves the use of sensors to collect real-time data on the motor's performance, which is then transmitted to a cloud-based platform for analysis. this data is used to monitor the motor's health and detect any potential issues, allowing for proactive maintenance and reducing downtime.
- The control aspect involves the use of actuators to adjust the motor's speed or direction, based on the analysis of the data collected. This allows for optimal performance and energy efficiency.
- The methodology involves the integration of IoT technology with three phase induction motors to improve their performance and reduce maintenance costs.

Major findings

Overall, IoT based monitoring and control of three phase induction motor has several benefits, including improved energy efficiency, enhanced motor performance, cost savings, improved system reliability, and remote monitoring and control.

Conclusion

In conclusion, IoT-based control and monitoring of a three-phase induction motor using an Arduino and cloud technology which provides a cost-effective and efficient solution for industrial automation. With real-time monitoring of motor parameters, such as Vibration, temperature, Forward direction, Reverse direction, on and off the motor as the system can detect abnormalities and take corrective actions. The use of cloud technology enables remote monitoring and control of the motor, providing greater flexibility and convenience for operators. Overall, this system enhances the reliability, performance, and energy efficiency of the motor while reducing maintenance costs and downtime.

Acknowledgments

First and foremost, we are grateful to Almighty Allah for blessing us with the capacity to reason, work, and complete the task at hand. Second, we want to express our gratitude to our project supervisor, Engr.Ali Zain ul Abdin, who served as both our mentor and finest guide. We also thank the departmental and university staff, as well as our teachers, who have assisted and guided us throughout our academic careers.

First and foremost, Almighty Allah deserves all the praise for giving us the aptitude and knowledge needed to complete this project right away; without His grace, it would not have been possible.

First and foremost, we want to show credit towards our mentor Engr.Ali Zain ul Abdin, for their helpful supervision, assist, as well inspiration during our project. Their skill and insights involved in shaping this project and serving us to get the better of challenges.

We are thankful toward the management of **Faculty of Engineering Science & Technology** for providing us with the resources and facilities needed to complete this project. their support has been instrumental in outstanding achievement of our project.

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List of Abbreviations

VFD	Variable Frequency Drive
IoT	Internet of Things
PID	Proportional Integral and Derivative
IFOC	Indirect Field Oriented Control
NDT	Non-Destructive Testing
PI	Proportional Integral
SVPWM	Space Vector Pulse Width Modulation
PWM	Pulse Width Modulation
Kp	Proportional Integral
Ki	Integral gain
RPM	Revolution Per Minute
TPIM	Three Phase Induction Motor
PSO	Particle Swarm Optimization

Chapter 1

Introduction

The convergence of IoT technology with industrial automation is exemplified by the development of an IoT-based control and monitoring system for three-phase induction motors. Traditionally used in industrial applications for their accuracy and efficiency, these motors require continuous supervision and management. The advent of IoT offers an efficient alternative, integrating sensors, microcontrollers, and communication technologies to remotely oversee motor performance. This technology's importance lies in its potential to optimize motor speed, leading to energy savings, extended motor life, and improved performance. Real-time monitoring of parameters like temperature, vibration, and voltage also simplifies analytical maintenance. The project's objectives encompass speed control via Arduino using PWM technique, vibration and temperature monitoring for fault detection, bidirectional control, and real-time data analysis for act estimation. With a method across sensor addition, data gathering, mobile app integration, cloud-based monitoring, and accurate speed control using Arduino with PWM technique, this project subsidizes to industrial proficiency and sustainability through all-in-one IoT integration.

1.1 Background Information

An IoT based control and monitoring system of three phase induction motor involves the use of sensors, microcontrollers, and communication technologies to remotely monitor and control the motor's performance.

Three phase induction motors are most commonly motors which are widely used for industrial purposes because of its accuracy, proficiency, and easiness of repairs. However, they require proper monitoring and control to ensure optimal performance and prevent damage or failure. Traditional monitoring and control methods involve manual inspections and adjustments, which can be time-consuming, costly, and prone to errors.

IoT-based control and monitoring systems offer a more efficient and cost-effective solution. Sensors installed on the motor can detect various parameters such as temperature, vibration, and current. Microcontrollers or other embedded systems process this data and transmit it to a central server via wireless communication technologies such as wi-fi, Bluetooth, or cellular networks. This data can be analyzed in real-time, and appropriate actions can be taken to optimize the motor's performance, prevent breakdowns, and minimize downtime.

1.2 Significance and Motivation

IoT based control and monitoring of three phase induction motors is significant part of study and growth in the field of industrial automation and control.

The significance of this technology lies in its capability to offer precise and efficient control of the motor's speed, which can lead to significant energy savings, improved performance, and increased lifespan of the motor. Real-time monitoring of the motor's performance parameters such as speed, voltage, vibration and temperature can also provide valuable information for predictive maintenance and fault diagnosis.

The motivation for developing this technology is primarily driven by the need to improve the efficiency and productivity of industrial processes. Variable frequency drives are widely used in industries for control the speed of induction motors, but the huge price of these drives might be bound to their general acceptance, mostly in small and medium-sized enterprises. Low-cost VFDS can provide a cost-effective solution to this problem, but they often lack the advanced control features and real-time monitoring capabilities of their high-end counterparts.

By developing real-time monitoring and speed control techniques for low-cost VFDS, researchers and engineers can support to develop these drives further available and inexpensive to a higher area of industries and applications. This can ultimately lead to greater energy efficiency, improved productivity, and reduced environmental impact.

1.3 Aims and Objectives

Aim of our project is to plan and implement a real-time monitoring and speed control system for a low-cost variable frequency drive (VFD) fed three-phase induction motor. The system should be able to measure and display the motor's speed in real-time, and provide a means to controlling the speed of the induction motor through Arduino.

The objectives of the project are:

Following are the objectives of IoT-based control and monitoring of a three-phase induction.

- To control the speed of three phase induction motor by using Arduino.
- To monitor vibration of three phase induction motor, thus most often fault occurs in rotating elements such as bearing.
- To monitor the temperature of three phase induction motor, as increase in temperature of an induction motor reduce its lifespan.
- To control reverse and forward direction of three phase induction.
- To enable real-time data acquisition and analysis for monitoring motor performance and detecting faults.

1.4 Organization of Thesis

The flow and organization of report of "**IoT based monitoring and control of three phase induction motor**" are alienated in five sectors. The details of these sections are as follows:

- In chapter one of report its cover's introduction, background information and technical features in detail. We also have included the significance and motivation that motivated us to made this project. Furthermore, we covered main aims and objectives in this section.
- Chapter two contain of literature review. The modern work is done by scholars.
- Chapter Three involves of Methodology and idea of design and experimental setup and method of project completed by students. This chapter is of project hardware detail and software.
- Chapter four mainly absorbed on experimental results where user get results and involved in this report.
- Chapter five is mainly founded on conclusion and future recommendation.

Chapter 2
Literature Review

2.1Introduction

IoT based control and monitoring of three phase induction motor is a serious zone of study which has acknowledged important consideration in current years. The induction motor is one of the most widely used types of electrical machines in industrial purposes because of its accuracy, proficiency, due to less cost, and robustness. However, work of these machines is highly dependent on the accuracy of their speed control system. The VFD is an electronic device used to control the speed of three phase induction motors by adjusting ac voltage frequency provided to the motor. Real-time monitoring and speed control of low-cost VFD can provide several benefits, including reduced energy consumption, improved efficiency, and enhanced motor performance.

In recent years, several studies have been conducted on IoT based monitoring and control of three-phase induction motor the most common control techniques used in these studies include and model predictive control. These control techniques have been applied to different types of low-cost VFDS, including V/F and space vector pulse width modulation (SVPWM), Indirect Field Oriented Control (IFOC). Additionally, several monitoring methods, like vibration analysis, and heat monitoring, have been used to monitor motor's performance and detect faults. The results of these studies have shown that real-time monitoring and speed control of low-cost VFD for three phase induction motor can significantly improve their performance and reduce their energy consumption, making them more suitable for industrial applications.

2.2 PSO algorithm for Three Phase Induction Motor drive with SVPWM Switching and V/f Control

To control speed pf induction motor typically used these techniques which are V/F and space vector pulse width modulation (SVPWM) are used to decrease harmonic level in induction motor. This paper presents PI controller tunning which can be used in Induction Motor. To improve the speed performance of induction motor PI speed controller is used. With help of SVPWM switching and V/F control Kp and Ki of the PI speed controller parameter are tuned for three phase induction motor operation. Under speed response condition because of PI controller its change the speed. Performance of PI controller is robust in terms of overshoot, settling time, steady state error.

2.3 Scheme for safety of three phase induction motor using microcontroller

For a three-phase induction motor, a low-cost and dependable protection scheme against unbalanced voltages, undervoltage, overvoltage, and overheating protection has been developed. The design that has been proposed makes use of a microcontroller Atmega32, with different transistors, relays and other components to reduce costs. However, the safety design sensitivity has not been compromised. The scheme has been confirmed in the laboratory with slight electric motor, which used with larger motors by changing the appropriate ratings of the different converters and relays.

2.4 Speed Control of Three Phase Induction Motor Using Indirect Field Oriented Control Based on Real-Time Control System

This paper deal with speed IFOC-primarily based induction motor power due to enhance temporary speed completion. Due to complexity of control system on induction motor, PID (proportional Integral and derivative) tuning is used to study the transient speed performance of induction motor thru the actual time workshop (RTW) in MATLAB Simulink with three segment voltage source inverters. The RTW is simple and time saving device to put into effect velocity controller on IFOC-primarily based induction motor force in actual time without the usage of other complicated programming languages. Primarily based at the experimental result via RTW, PID velocity controller has better overall performance and does not produce overshoot in this situation while in comparison to open loop response.

2.5 Health Monitoring of Induction Motor through Vibration Analysis

The process of monitoring a condition parameter in machinery so that a significant change indicates a failure in development is known as machinery monitoring. Vibration measuring used for machine condition monitoring. The Non-Destructive Testing (NDT) method of measuring vibration signals are often used to find problems with machines. Over the past few decades, numerous studies have attempted to predict mechanical wear, fault, and failure. The vibration signals are processed using signal processing methods to extract important characteristic information. As a means of diagnosing three-phase induction motors, this paper attempts to summarize the findings of a review of vibration analysis methods**.**

2.6 Speed Control of Three Phase Induction Motor using Variable Frequency Derive Control System

Three phase induction motor show major part in industry because of its less price and easiness. Three phase induction motor is used to transform electrical energy into mechanical energy. This paper present simple converter of three phase AC supply through variable frequency drive with in feedback. By using variable frequency drive with controller speed of induction motor control will be controlled. Speed depends upon voltage, pole and frequency this is easy and effective method to control the speed. We cannot change the pole of motor poles are constant in motor which we change the frequency and voltage to control the speed of motor. This technique is robust and simpler to implement.

2.7 Summary

The literature review in chapter 2 provides a complete outline of IoT-based monitoring and control of three phase induction motors. The review highlights the importance of accurate speed control in and the use of variable frequency drives (VFDS) for this purpose. Real-time monitoring and speed control of three phase induction motors using various control and monitoring techniques are discussed, with the benefits of these techniques highlighted.

Research papers related to the topic are presented, which provide insights into the tuning of pi controllers, protection schemes using microcontrollers, speed control based on indirect field-oriented control (IFOC), and health monitoring through vibration analysis.

Overall, the literature review provides valuable insights into the various techniques and methods that can be used for IoT-based monitoring and control of three phase induction motors. It emphasizes the importance of real-time monitoring and speed control in improving the performance of these machines.

Chapter 3
System Architecture and Design

3.1 Introduction

This section shows IoT-based three-phase induction motor control system designed to capably control motor speed with help of Pulse Width Modulation (PWM). The essential components of system contain an Arduino and an ESP32 microcontroller, while Arduino is being used for PWM-based speed control and the ESP32 conduct inclusive gathering of data, which proceed for remote monitoring abilities. The system comprises number of sensors and relays which are as ADXL345 vibration sensor, MAX6675 temperature sensor and the NPN proximity sensor, which gather significant temperature, vibration and proximity data which gives a real-time indication of Asynchronous motor's performance. To control direction of motor, the system combines 4-channel relay and magnetic contactors with esp32. The ESP32 control relays and contactors which changes phase order of the motor to control its direction either forward as well as reverse. In adding, shielding procedures such as a 3-pole circuit breaker (32 A) and a thermal relay are integrated to confirm harmless operation of motor and defend compared to potential complications such as overheating. The experimental setup includes deliberately employing the sensors on motor and connecting them to the ESP32 while Arduino uses PWM method to control speed of motor, while ESP32 gather and processes data from sensors and analyzes basic motor parameters such as forward and reverse direction, motor power status such as on and off, display of RPM and temperature of the motor and its vibration.

3.2 Methodology

The method is to implement IoT-based three-phase asynchronous motor speed control and monitoring which contains Arduino-based PWM control (for speed change) and Blynk application integration (for monitoring multiple events) Integration. The Parameters such as temperature, vibration, motor direction and power status. The process can be summarized as follows:

3.2.1 System Implementation and Experimental Setup

The IoT-based three-phase induction motor control system exploits a mixture of hardware components, which including an Arduino, an ESP32 microcontroller, 4-channel relay, magnetic contactors, a 3-pole circuit breaker (32 A), thermal relay, Digital Voltage Monitor Indicator Light (AC 220V), and various sensors. The Arduino, in combination with PWM, is employed for exact motor speed control. The system goals to monitor crucial motor parameters, such as temperature, vibration, Motor RPM and motor direction, and let remote monitoring throughout the Blynk app. The Arduino employs PWM to accomplish exact motor speed regulation. PWM includes quickly switching motor on and off at a specific frequency, and the duty cycle limits usual power supplied to the motor. By changing the duty cycle, system can efficiently vary the motor's speed, permitting higher duty cycles to increase power and speed while lower duty cycles make speed and power reduce.

The experimental setup starts with deliberately employing sensors such as the ADXL345 vibration sensor, MAX6675 temperature sensor, and NPN proximity sensor on the motor. These sensors are connected to ESP32 microcontroller, allowing real-time data gathering and providing perceptions into the motor's performance. The ESP32 processes the collected data and calculates essential motor parameters such as forward and reverse direction, motor power status like on and off, RPM display and motor temperature and its vibration.

Furthermore, the system contains a 4-channel relay, magnetic contactor, 3-pole circuit breaker (32 A), and a thermal relay for effective motor source control and safety in contrast to potential problems.

To control the motor's direction, relay and magnetic contactor are combine to change phases of the three-phase induction motor. By properly energizing the relay coils, the motor's phase order can be changed which lead to change in direction. The Arduino, automated with suitable logic, drives. Relay and magnetic contactor to accomplish the wanted direction of motor.

The system as well contains protecting measures such as 3-pole circuit breaker (32 A) and thermal relay, which support to make sure safe operation and keep the motor from potential problems like overheating. The Digital Voltage Monitor Indicator Light (AC 220V) is combined to deliver a visual sign of the motor's power supply position.

The united Blynk app let users to remotely monitor the motor parameters. Through Blynk app easy to use interface, users can access performance data in real-time, allowing analytical maintenance abilities and initial detection of potential problems.

The mixture of the Arduino's PWM-based motor speed control and the ESP32's data gathering and monitoring abilities makes this IoT-based motor control system highly effective and useful. The integration of various sensors, protective measures, and remote monitoring capabilities delivers a complete solution for motor control and predictive maintenance, increasing motor lifetime which makes it a valuable benefit in industrial applications and beyond.

The goal of this methodology is to accomplish a complete monitoring and control system for a three-phase induction motor based on the Internet of Things. While motor speed control is finished via Arduino using PWM, the Blynk app is used to remotely monitor and control other basic parameters, including temperature, vibration, motor direction and power status like on and off. This combination of hardware and software integration confirms effective monitoring, predictive maintenance abilities.

The experimental setup and procedure validate effectiveness and flexibility of this IoT-based three-phase induction motor control system. The Arduino's PWM-based speed control, attached with the ESP32's data get-together and processing abilities, facilitates complete motor monitoring. Integration of several sensors, defensive measures, motor direction control, and remote monitoring through the Blynk app creates a holistic solution for motor control, predictive maintenance, and user-friendly access to critical engine performance data. This system suggestions great potential in industrial applications and beyond, confirming improved motor performance, long motor lifetime, and improved safety measures.

3.3 Flowchart Diagram

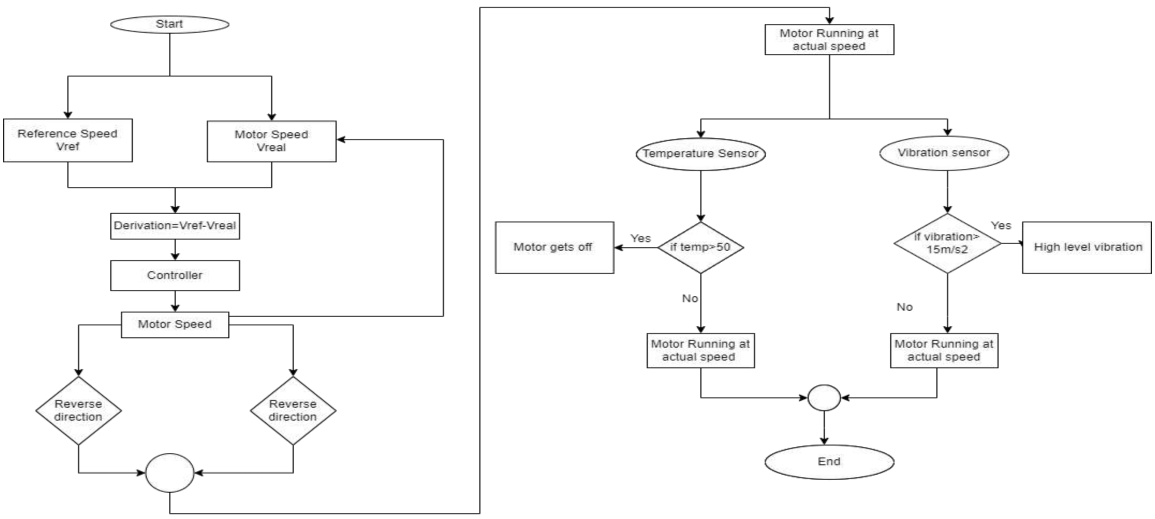

Figure 01: Flowchart Diagram

For speed controlling of Three Phase Induction Motor, a reference value for speed of motor will be set and compared to actual speed of motor. This comparison will produce the desired speed. Three Phase Induction Motor will be operated on both forward and reverse direction. The motor will run on actual speed. For prevention from heating, heat & vibration sensors will be utilized with reference values. If for any case, motor's temperature & speed increase, from reference values, the sensors will be operated and motor will be turned off automatically.

3.4 Schematic Diagram

Schematic diagram is given below.

3.4.1 Three Phase Inverter

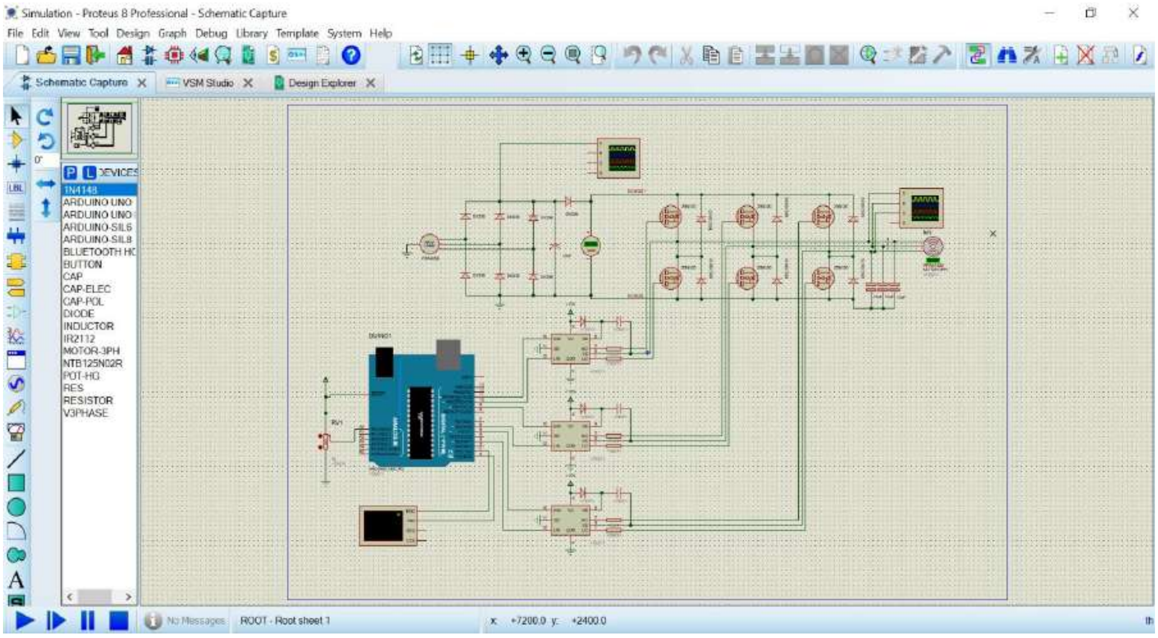

Figure 02: Three Phase Inverter Schematic Diagram

Schematic includes converting single-phase DC input into three-phase AC using a three-phase inverter. An Arduino generates PWM signals to control transistor switches in the inverter. The Arduino's PWM signals are amplified by a gate driver circuit to drive the inverter's FETs. The inverter stage consists of three half-bridge configurations, each with two transistors, creating the AC output. An output filter smooths the waveform, and the output powers a three-phase load like a motor. The Arduino's analogWrite() function generates PWM signals, with modulation techniques ensuring proper waveform generation, making the entire setup a complex interplay of hardware and software for efficient power conversion.

3.4.2 Control and Monitoring Circuit

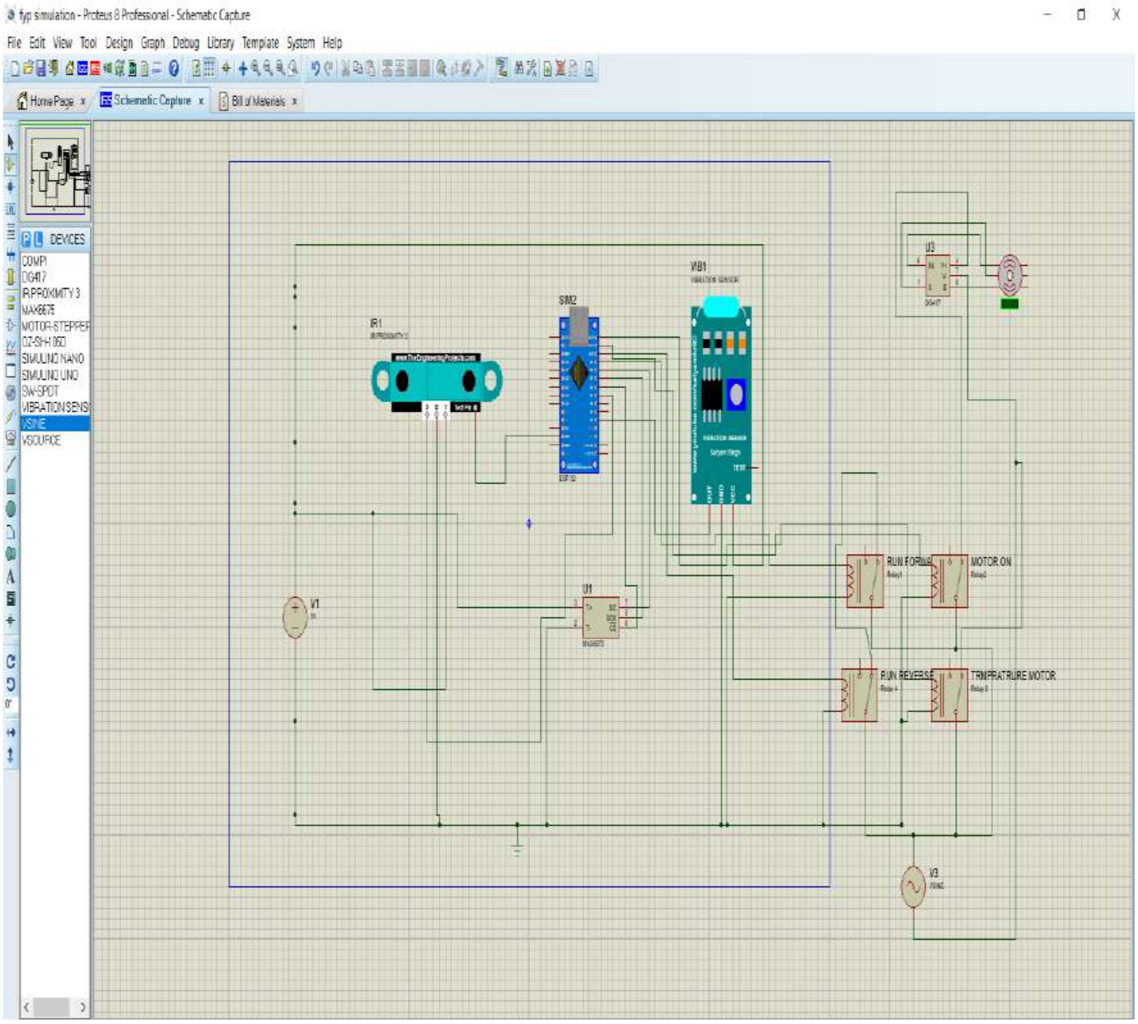

Figure 03: Control and Monitoring Schematic Diagram

The schematic diagram includes an ESP32-based monitoring and control system mixing sensors and devices: a vibration sensor for vibration monitoring of Induction Motor, a temperature sensor for monitoring temperature of motor, a proximity sensor which calculate the RPM of Induction motor . The ESP32 processes data from these sensors, making informed decisions. A relay module controlled by the ESP32 used for monitoring and control the motor status like on and off and forward reverse direction. This design assists as a useful basis for applications in IoT, or industrial settings, with the ESP32 arranging sensor data and relay movements for improved monitoring and control.

3.5 Hardware Components

The hardware components used in the system architecture are:

3.5.1 ESP32 Wi-Fi Module

ESP32 is a powerful Wi-Fi and Bluetooth microcontroller mostly used in different IoT applications. ESP32 is manage to read data from ADXL345 vibration sensor, MAX6675 temperature sensor and NPN proximity sensor. It proceeds data and refers through via Wi-Fi to Blynk app for remote monitoring.

Figure 04: Esp32 Wi-Fi Module

3.5.2 Arduino Board

Arduino is easy to use microcontroller platform which acts as brain of body. Selected for its easiness, flexibility and user friendly, it is perfect for quick advancement and integration with different sensors and actuators. The Arduino microcontroller is managing for controlling the speed of induction motor with help of pulse width modulated (PWM) signal.

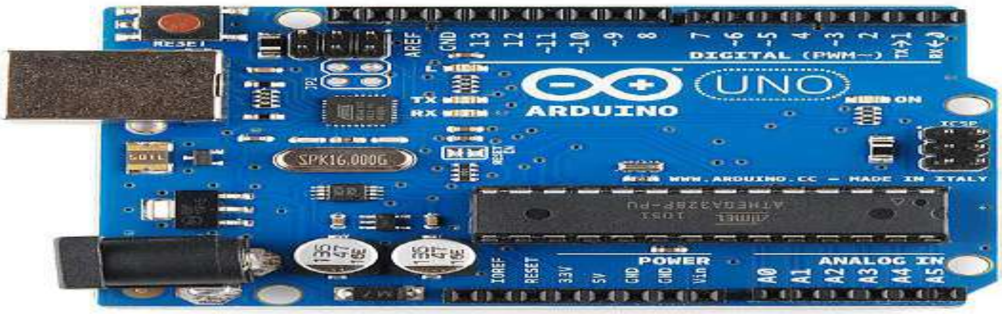

Figure 05: Arduino Uno

3.5.3 MAX6675 Temperature Sensor

The MAX6675 is a thermocouple-to-digital converter that compute temperature with high accuracy. It is working in the system to monitor the temperature of dangerous portions of induction motor. Temperature monitoring is critical to confirm motor's harmless operation within stated temperature restrictions. The MAX6675 sensor permits nonstop temperature measurement, which figure out overheating problems or anomalies that may lead to motor damage. By tracking temperature trends, the system can take corrective actions when the temperature exceeds predefined thresholds.

Figure 06: Max6675 Temperature Sensor

3.5.4 ADXL345 Vibration Sensor

The ADXL345 is a three-axis accelerometer sensor accomplished of measuring acceleration along the x, y, and z axis. It is used in system to monitor the vibration stages of induction motor. The ADXL345 sensor delivers valued perceptions into motor's mechanical health, serving notice abnormal vibrations that may specify misalignment, unbalanced loads, or mechanical faults. By measure vibration levels, the sensor lets initial detection of potential problems, which leads to better maintenance practices and avoiding expensive breakdowns.

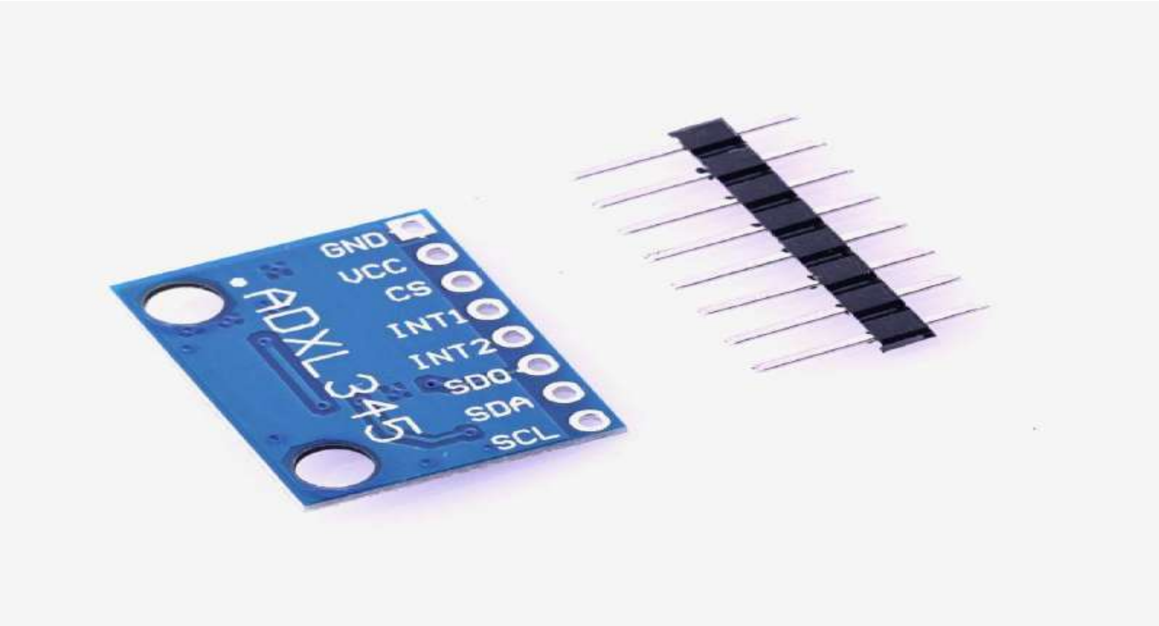

Figure 07: ADXL345 Vibration Sensor

3.5.5 Proximity NPN Sensor

NPN proximity sensor is used to sense running state of motor, either on or off. This works by noticing magnetic field deviations produced by movement of motor. Proximity sensors are to be found near to motor shaft or other tools. It allows system to monitor the initial and rest state of engine by giving actual-time info nearby running condition of engine. This data is precious for development monitoring activities, confirming timely monitoring and optimizing engine performance.

Figure 08: Proximity NPN Sensor

3.5.6 4-Channel Relay

The 4-channel relay element perform as a switch to regulate magnetic contactor and, accordingly, the induction motor. It permits the esp32 to turn motor on or off and select the proper direction of motor like forward and reverse direction. With help of relay, the control electric circuit can be electrically inaccessible from high-power motor circuit, raise protection and dropping risk of harm.

Figure 09: 4-Channel Relay

3.5.7 Magnetic Contactor

The magnetic contactor is an electronic device which holds the real switching of induction motor's power source. Whenever control circuit activates the magnetic contactor, it ends the main power contacts, letting current to pass to motor, which starts its operation. Likewise, whenever the contactor is turned off, the motor's power supply is cut off, stopping its operation.

Figure 10: Magnetic Contactor

3.5.8 Three Pole Circuit Breaker 32 Amp

The three-pole breaker evaluated at 32 Ampere gives overcurrent safety for induction motor. In occasion of an unexpected surge or burden, the breaker trips and releases the circuit, intruding the power source to motor. This defensive measure avoids injury to motor and general system.

Figure 11: Three Pole Circuit Breaker 32 Amp

3.5.9 Thermal Relay

The thermal relay is a shielding device that monitors the motor's temperature. It is linked in series with motor's power source, and its role is to detach motor from power if temperature raises a predefined threshold. This gives an extra coating of safety in contrast to motor overheating and potential damage.

Figure 12: Thermal Relay

3.5.10 Digital Voltage Monitor Indicator Light AC 220V

The Digital Voltage Monitor Indicator Light AC 220V 22mm is a compacted and easy to use friendly LED-based device planned to shows appearances or absence of AC 220V voltage. Through a 22mm diameter, it is perfect for increasing on control panels. Whenever linked with AC power source, the indicator light automatically senses and illumines when source is existing, it gives a clear visual sign of power position. This is usually used in many applications, as well as industrial setups, IoT-based monitoring systems, and electrical panels, to rapidly confirm the accessibility of voltage source.

Figure 13: Digital Voltage Monitor Indicator Light AC 220V

3.6 3.7 Software Components

The software components applied in system building areas given below:

3.7.1 Blynk App

The Blynk app is an easy-to-use mobile application which lets remote monitoring of the motor. It gives a custom make interface where operators can visualize real-time data from motor sensors, including temperature, vibration, forward and reverse direction and rpm display. The app lets users to established thresholds in instance of abnormal situations. Furthermore, it delivers control widgets such as buttons or sliders for remotely adjusting the motor's parameters, such as motor power status on and off vibration, temperature, direction like forward and reverse direction. The Blynk app creates a safe connection with ESP32 module, enabling whole communication with Arduino board and enabling remote monitoring of three-phase induction motor.

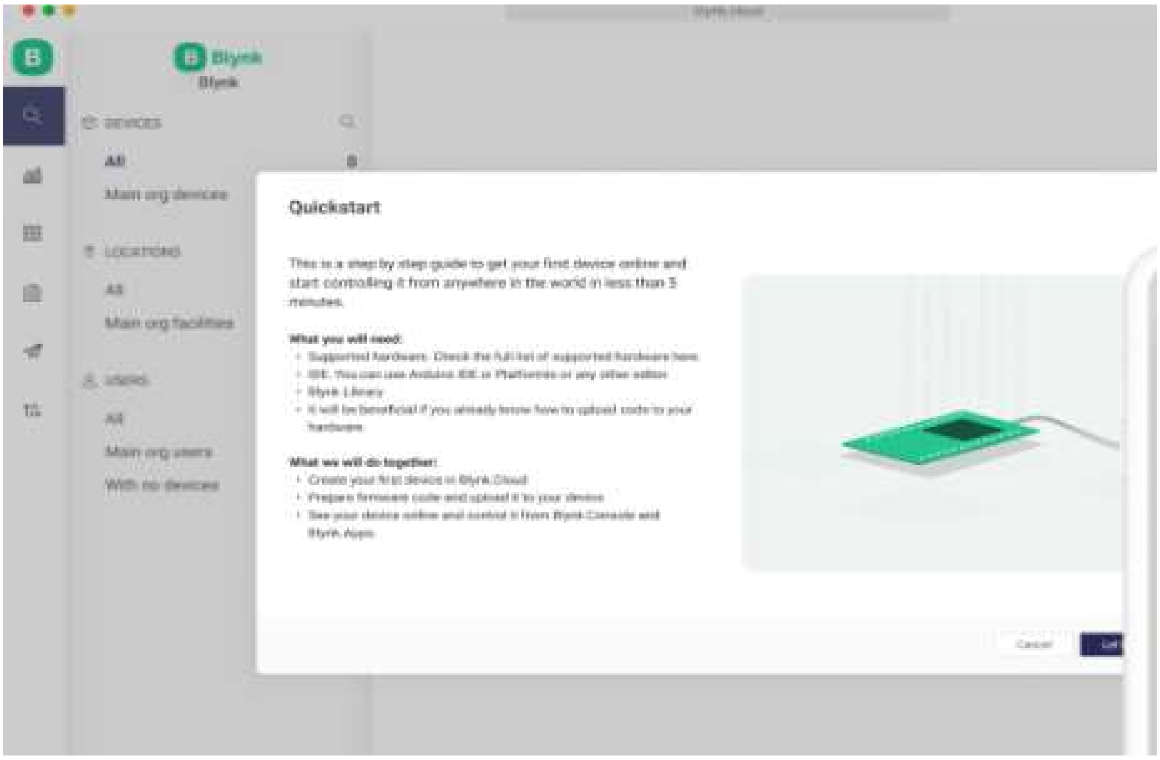

Figure 14: Blynk App

3.7.2 Arduino IDE

The Arduino Integrated Development Environment (IDE) is used for programming the microcontroller. The ESP32 module is programmed to establish a Wi-Fi connection and communicate with the Blynk app.

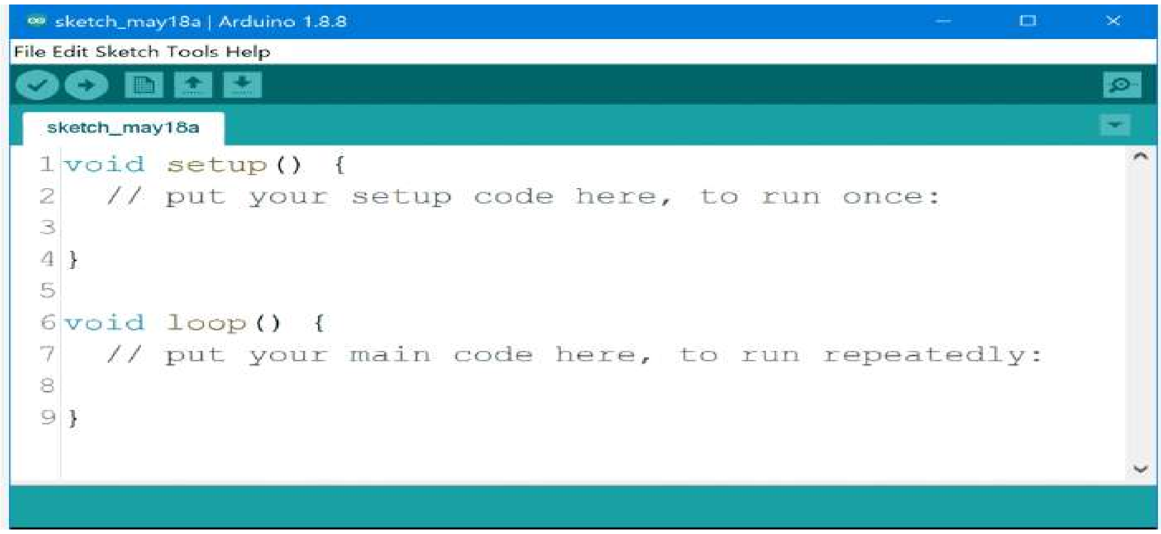

Figure 15: Arduino IDE

Chapter 4

Result and Discussion

4.1 Introduction

In this section, the outcomes found from employing the IoT-based control and monitoring system for a three-phase induction motor will be accessible and deliberated. The act of system, as well as speed control, real-time monitoring of temperature and vibration, motor direction control like forward and reverse direction, and cloud-based monitoring over Blynk app, will be estimated. The conversation will attention on efficiency of system in accomplishing its aims and talking consequence and motivation specified in Chapter 1.

4.2 Speed Control of the Three Phase Induction Motor Result

The speed control of three-phase induction motor was accomplished with help of Arduino-based Pulse Width Modulation (PWM) technique. By changing duty cycle of PWM signal, the normal power provided to motor was adjusted, letting for exact speed control. The Arduino IDE and suitable libraries were used to code the microcontroller and create the PWM signals. The speed control system was verified under different load situations, the results confirmed unchanging and exact speed control.

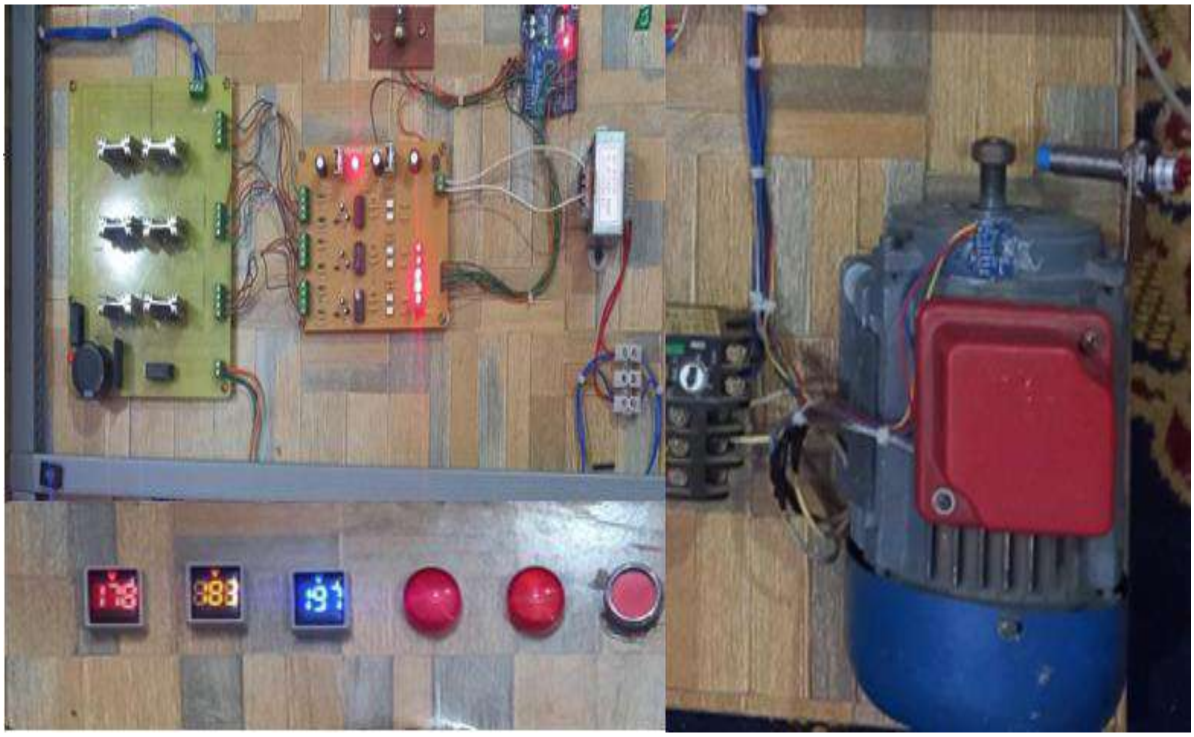

Figure 16: Speed Controlling of Three Phase Induction Motor Result

4.3 Real-time Monitoring of Temperature and Vibration Result

The real-time monitoring of temperature and vibration was achieved by using the MAX6675 temperature sensor and ADXL345 vibration sensor, correspondingly. These sensors were interfaced with help of ESP32 Wi-Fi module, that conveyed data to Blynk app through Wi-Fi connection. The Blynk app's easy to use interface which showed temperature and vibration data in real-time, letting users to monitor the motor's performance and perceive potential faults or anomalies. The monitoring system showed to be operative in giving valued perceptions into motor's performance, serving operators take active maintenance measures and avoid motor failures.

Figure 17: Real time monitoring of temperature and vibration of TPIM Result

4.4 Motor On/Off, Direction Control and RPM display

The direction of three-phase induction motor was controlled using four channel relay and a magnetic contactor. By stimulating exact relay channels, the motor's direction was swapped among forward and reverse direction. The proximity NPN sensor provided feedback on the motor's operating status which shows the rpm of induction motor through Blynk app, allowing system to accurately determine the motor's direction. The direction control was verified numerous times, and the results showed reliable and smooth motor direction switching and rpm display of induction motor. The result shown on and off status of Three Phase Induction Motor.

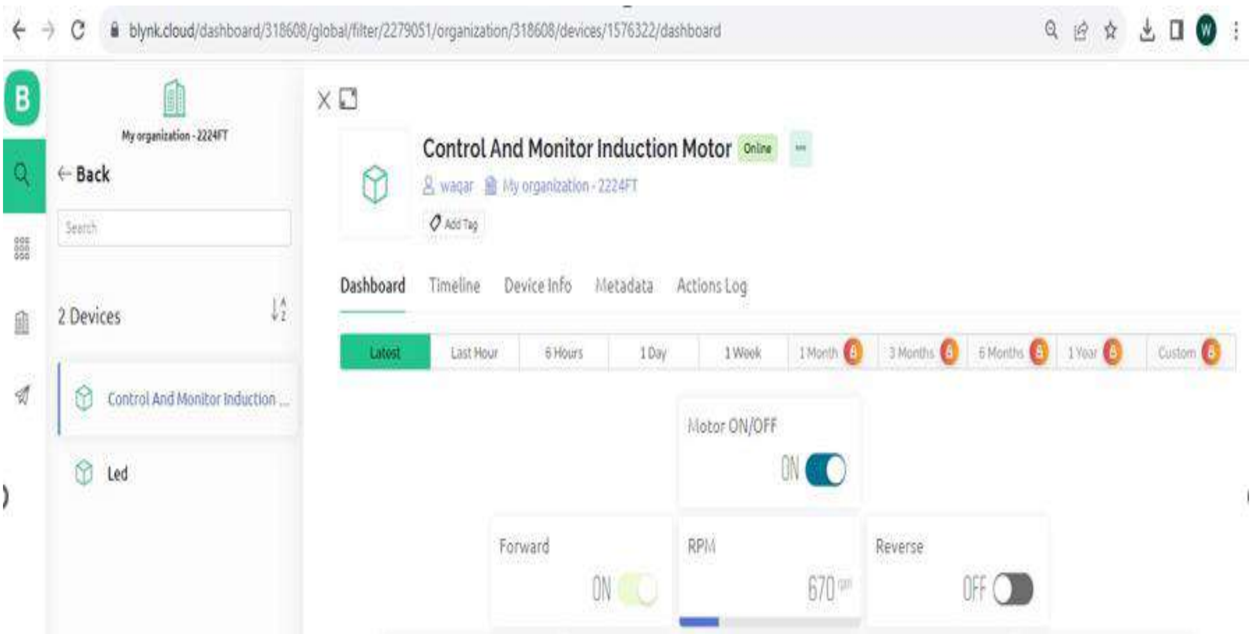

Figure 18: Motor on/off, direction control and rpm display of TPIM Result

4.5 Discussion

The executed IoT-based control and monitoring system for three-phase induction motor established important accomplishment in accomplishing its objectives. The Arduino-based speed control showed to be effective and precise, permitting exact control of motor's speed. The real-time monitoring of temperature and vibration provided valued data for predictive maintenance, serving classify potential faults before they lead to motor letdown. The motor direction control and cloud-based monitoring through the Blynk app extra availability and accessibility to system, creating it appropriate for industrial applications.

The consequence of this system lies in its potential to recover the proficiency and production of industrial processes. By allowing real-time monitoring, analytical maintenance, and remote convenience, the system subsidizes to decreasing downtime, minimizing maintenance prices, and enhancing motor performance. The motivation for developed this technology was to offer a cost-effective solution for affordable VFDs, creating progressive motor control and monitoring features available to a broader range of industries.

Chapter 5

Conclusion

5.1 Summary

In conclusion, the project aimed to develop an IoT-based control and monitoring system for a three-phase induction motor. The objectives were to achieve precise speed control, real-time monitoring of temperature and vibration, motor direction control, and cloud-based monitoring through the Blynk app. Throughout the implementation, these objectives were successfully met, demonstrating the system's effectiveness.

The project's significance lies in providing a cost-effective solution for enhancing the efficiency and productivity of industrial processes. By enabling real-time monitoring and predictive maintenance, the system helps prevent motor failures and reduces maintenance costs.

The literature review highlighted the importance of accurate speed control and monitoring in induction motors. Several control techniques and monitoring methods were discussed, which laid the foundation for the project's approach.

In the system architecture and design chapter, the hardware and software components were detailed, ensuring seamless integration and communication between different components.

The results and discussion chapter presented the system's successful implementation, showcasing stable speed control, reliable temperature and vibration monitoring, smooth motor direction switching, and cloud-based monitoring through the Blynk app. The findings indicated the system's practicality and usability for industrial applications.

The project's achievements include the successful implementation of an IoT-based control and monitoring system, empowering users with remote access to critical motor data and providing valuable insights for proactive maintenance.

5.2 Final Remarks

In conclusion, the IoT-based control and monitoring system for the three-phase induction motor holds immense potential in revolutionizing industrial automation and enhancing motor efficiency and productivity. By leveraging IoT technology and real-time monitoring, the system enables predictive maintenance, reduced downtime, and optimized motor performance.

As technology continues to evolve, the system can be further enhanced and expanded to meet the evolving needs of industrial applications. By implementing advanced fault diagnosis algorithms, optimizing energy efficiency, and integrating with existing industrial automation systems, the system can reach new heights in motor control and monitoring.

The project has laid the foundation for future research and development in the field of IoT-based motor control, offering valuable insights and a stepping stone for future innovations in industrial automation. With continued efforts and advancements, the potential for IoT-based control and monitoring systems in various industrial applications is boundless.

5.3 Recommendations for Future Work

- Implement advanced fault diagnosis algorithms and machine learning techniques for enhanced predictive maintenance capabilities.
- Explore opportunities to optimize the motor's energy efficiency and integrate energy monitoring features.
- Enhance remote control capabilities Through app to allow dynamic adjustments of speed.
- Integrate data logging and analytics to perform long-term performance analysis and data-driven decision-making.
- Consider adding additional sensors for comprehensive motor health monitoring, such as current and power factor sensors.

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Appendix

Inverter code for Speed Controlling of Induction Motor

```
int AA1=3;
int AA2=5;
int BB1=6;
int BB2=9;
int CC1=10;
int CC2=11;

int fase=1;
int tiempo=100;
int Stop=0;
unsigned long previousMillis = 0;
int val = A0;

int timer=0;
void setup() {
  pinMode(AA1,OUTPUT);
  pinMode(AA2,OUTPUT);
  pinMode(BB1,OUTPUT);
  pinMode(BB2,OUTPUT);
  pinMode(CC1,OUTPUT);
  pinMode(CC2,OUTPUT);
  Serial.begin(9600);
  delay(1000);

 previousMillis = micros();
}

void loop() {
```

```
if(timer>3900){ Stop = 0;
tiempo=3900;
digitalWrite(AA1,LOW);
digitalWrite(AA2,LOW);
digitalWrite(BB1,LOW);
digitalWrite(CC2,LOW);
digitalWrite(BB2,LOW);
digitalWrite(CC1,LOW);
}else{Stop = 1;}


if(Stop==1){
 unsigned long currentMillis = micros();


  if(currentMillis - previousMillis >= tiempo){

      previousMillis += tiempo;

  //Phase1 C-B
  switch(fase){
    case 1:
      digitalWrite(AA1,LOW);
      digitalWrite(AA2,LOW);
      digitalWrite(BB1,LOW);
      digitalWrite(CC2,LOW);
      digitalWrite(BB2,HIGH);
      digitalWrite(CC1,HIGH);
      break;

  //Phase2 A-B
    case 2:
```

```
    digitalWrite(AA2,LOW);
    digitalWrite(BB1,LOW);
    digitalWrite(CC1,LOW);
    digitalWrite(CC2,LOW);
    digitalWrite(AA1,HIGH);
    digitalWrite(BB2,HIGH);
    break;

//Phase3 A-C
  case 3:
    digitalWrite(AA2,LOW);
    digitalWrite(BB1,LOW);
    digitalWrite(BB2,LOW);
    digitalWrite(CC1,LOW);
    digitalWrite(CC2,HIGH);
    digitalWrite(AA1,HIGH);
  break;

//Phase4 B-C
case 4:
    digitalWrite(AA1,LOW);
    digitalWrite(AA2,LOW);
    digitalWrite(BB2,LOW);
    digitalWrite(CC1,LOW);
    digitalWrite(BB1,HIGH);
    digitalWrite(CC2,HIGH);
    break;

//Phase5 B-A
case 5:
    digitalWrite(AA1,LOW);
    digitalWrite(BB2,LOW);
```

```
    digitalWrite(CC1,LOW);
    digitalWrite(CC2,LOW);
    digitalWrite(AA2,HIGH);
    digitalWrite(BB1,HIGH);
    break;

  //Phase6 C-A
  case 6:
    digitalWrite(AA1,LOW);
    digitalWrite(BB1,LOW);
    digitalWrite(BB2,LOW);
    digitalWrite(CC2,LOW);
    digitalWrite(CC1,HIGH);
    digitalWrite(AA2,HIGH);
  break;}



  if (fase<6){
   fase=fase+1;}
  else{
   fase=1;
  }
  }
}

int t = analogRead(val); //From the potentiometer
timer=map(t,0,1024,1000,4000); //we obtain the delay speed using the potentiometer

if(timer<tiempo){tiempo = tiempo-1;}
if(timer>tiempo){tiempo = tiempo+1;}

//Serial.print(fase);
```

```
  //Serial.print(" ");
  //Serial.println(tiempo);
  }
```

Monitoring and Control Code

```
#include <Wire.h>
#include <Adafruit_Sensor.h>
#include <Adafruit_ADXL345_U.h>
#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>
#include <max6675.h>

#define BLYNK_TEMPLATE_ID "TMPL6DBYoEokw"
#define BLYNK_TEMPLATE_NAME "home automation"
#define BLYNK_AUTH_TOKEN "HTuX7LaqoF_rdE0l5XwXophHSahUc84T"

#define WIFI_SSID "Ufone_185D61"
#define WIFI_PASSWORD "J3Y5JX37"

char auth[] = "HTuX7LaqoF_rdE0l5XwXophHSahUc84T";

// PIN connections
int thermoDO = 15;     // MAX6675 DO pin
int thermoCS = 2;      // MAX6675 CS pin
int thermoCLK = 4;     // MAX6675 CLK pin
int relayPin1 = 12;    // Relay 1 control pin
int relayPin2 = 13;    // Relay 2 control pin
int relayPin3 = 14;    // Relay 3 control pin
int relayPin4 = 27;    // Relay 4 control pin
int proximityPin = 18; // Pin connected to the proximity switch

// Blynk virtual pin
const int virtualTempPin = V0;
const int virtualRelay1Pin = V1;
const int virtualRelay2Pin = V2;
const int virtualRelay3Pin = V3;
const int virtualRelay4Pin = V4;
const int virtualRPMPin = V5;

// Create objects
```

```
MAX6675 thermocouple(thermoCLK, thermoCS, thermoDO);
Adafruit_ADXL345_Unified accel = Adafruit_ADXL345_Unified(0x53);

BlynkTimer timer;

// Relay states
int relayState1 = LOW;
int relayState2 = LOW;
int relayState3 = LOW;
int relayState4 = LOW;

volatile unsigned int rpmCount = 0;   // Variable to hold the pulse count
unsigned long lastUpdate = 0;   // Variable to store the last update time

// Function to control the relays
void controlRelay(int relayPin, int relayState) {
  digitalWrite(relayPin, relayState);
}

BLYNK_WRITE_DEFAULT() {
  int pin = request.pin;
  int value = param.asInt();
  switch (pin) {
    case virtualRelay1Pin:
      relayState1 = value;
      break;
    case virtualRelay2Pin:
      relayState2 = value;
      break;
    case virtualRelay3Pin:
      relayState3 = value;
      break;
    case virtualRelay4Pin:
      relayState4 = value;
      break;
    default:
      break;
  }
}

void readTemperature() {
  double temperature = thermocouple.readCelsius();
  Serial.print("Temperature: ");
  Serial.println(temperature);

  // Update Blynk virtual pin with the temperature value
  Blynk.virtualWrite(virtualTempPin, temperature);
```

```
  // Control the relays based on temperature
  if (temperature <= 40) {
    controlRelay(relayPin4, HIGH);  // Turn on relay 4
  } else {
    controlRelay(relayPin4, LOW);   // Turn off relay 4
  }
}

void relayControl() {
  controlRelay(relayPin1, relayState1);
  controlRelay(relayPin2, relayState2);
  controlRelay(relayPin3, relayState3);
  // relayPin4 controlled by temperature
}

void rpmInterrupt() {
  rpmCount++;  // Increment the pulse count
}

void updateRPM() {
  unsigned long currentTime = millis();
  unsigned long elapsedTime = currentTime - lastUpdate;

  // Calculate RPM
  float rpm = (float)rpmCount / (elapsedTime / 1000.0) * 60.0;

  // Reset pulse count and update time
  rpmCount = 0;
  lastUpdate = currentTime;

  // Send RPM value to Blynk app
  Blynk.virtualWrite(virtualRPMPin, rpm);
}

void setup() {
  // Set relay pins as OUTPUT
  pinMode(relayPin1, OUTPUT);
  pinMode(relayPin2, OUTPUT);
  pinMode(relayPin3, OUTPUT);
  pinMode(relayPin4, OUTPUT);

  // Start serial communication
  Serial.begin(115200);

  // Connect to WiFi
  WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
```

```
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }

  // Connect to Blynk
  Blynk.begin(auth, WIFI_SSID, WIFI_PASSWORD);

  // Set up timer for relay control
  timer.setInterval(100L, relayControl);  // Adjust the interval as needed

  // Configure proximity switch pin
  pinMode(proximityPin, INPUT_PULLUP);
  attachInterrupt(digitalPinToInterrupt(proximityPin), rpmInterrupt, FALLING);

  // Setup timer to update RPM value
  timer.setInterval(1000L, updateRPM);

  if (!accel.begin()) {
    Serial.println("ADXL345 not found!");
    while (1);
  }
}

void loop() {
  Blynk.run();
  timer.run();
  readTemperature();

  sensors_event_t event;
  accel.getEvent(&event);

  float x = event.acceleration.x;
  float y = event.acceleration.y;
  float z = event.acceleration.z;

  float magnitude = sqrt(x * x + y * y + z * z);

  Blynk.virtualWrite(V6, magnitude); // Update virtual pin V6 with magnitude value

  delay(100);}
```

Project Cost

Table 01: Estimated Cost

Components	Cost
Three phase induction motor 0.5 Hp	12000
Arduino Uno	2000
Esp32 Wi-Fi Module	1500
NPN proximity sensor 0 to 36v	1500
Vibration ADXL345 sensor	1000
Max6675 Temperature sensor	1000
4 Channel Relay	500
Thermal Relay 0.5A to 8 A	2500
2x1 Buck Converter	600
Three pole circuit breaker 32 Amp	3000
3x1 Magnetic contactor	9000
3x1 Voltmeter	1500
2x1 Light indicator	600
Three phase driver	6000
Three phase FET drive	4000
Structure	5000
Other expensive	10000
Total cost	61300/=

E. FYP Picture

FYP Report

ORIGINALITY REPORT

12%	9%	9%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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Annexure

A. Feedback on PLOs Attainment

Student Feedback Form **PLOs Attainment** In Final Year Project (FYP)			
PLO#	**PLO Attribute**	**PLO Statement**	**Feedback on PLO Attainment**
PLO-1	**Engineering Knowledge**	An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	In this project we demonstrated a comprehensive understanding of IoT principles, motor control mechanisms, and monitoring systems.
PLO-2	**Problem Analysis**	An ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	Throughout the project, we effectively identified, analyzed, and addressed various challenges associated with motor control and data communication. Our ability to troubleshoot issues and devise innovative solutions showcased our adept problem-solving skill.
PLO-3	**Design/ Development of Solutions**	An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	Our project's well-planned design and meticulous implementation stood out. Our thoughtful selection of communication protocols, sensors, actuators, demonstrated our skill in design concepts into functional IoT-based motor control system."
PLO-4	**Investigation**	An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.	We investigated in deep by going with different research papers, case studies, teacher's guidance's and also visited on different industries for more investigations.

PLO-5	**Modern Tool Usage**	An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.	Our project's successful implement demonstrates not only our technical competence but also our ability to adapt these tools to suit specific project requirements. Our project is based on IOT therefore we are using different sensors, motors, Arduino
PLO-6	**The Engineer and Society**	An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.	This project on IoT-based monitoring and control of an induction motor not only showcased our technical skills but also highlighted your ability to contribute meaningfully to the betterment of society through engineering
PLO-7	**Environment and Sustainability**	An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.	The project on IoT-based monitoring and control of an induction motor exemplifies a holistic understanding of the impact engineering projects can have on sustainability and the environment
PLO-8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.	In this project original and free from copyright infringement is a testament to our creative problem- solving abilities. The engineering field thrives on innovation which showcases our capacity to back novel solutions without bargaining on ethical principles. Our approach to maintaining a friendly team environment speaks volumes about your commitment to collaboration and effective communication.
PLO-9	**Individual and Team Work**	An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.	Our team did their work entirely like case study visit of market study of research giving point of view according to their knowledge and what they study from research paper. Also, we did in teamwork as well like visiting industrial visit, working on ppt etc.

PLO-10	**Communication**	An ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	Communication in group is leading by Ayesha group leader who communicate with every member and assigns different task or any problem or communication occurs between members leader try to solve with intelligence other communication with teachers who guide us with their knowledge, research communication, visit industrial communication and employees many other communications are implemented with our project.
PLO-11	**Project Management and Finance**	An ability to demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments, business practices, such as risk and change management, and understand their limitations.	Under the guidance of our supervisors, our project underwent systematic management, involving the allocation of distinct responsibilities. Our group leader played a pivotal role in distributing tasks evenly among team members. This approach aimed to highlight our individual capabilities and foster skill enhancement. Similarly, the financial aspect of the project was managed by equally sharing the financial burden among all group members.
PLO-12	**Lifelong Learning**	An ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments.	Our all learning which we study during these 4 years of engineering is used in our project and also this whole combined knowledge of this project will also helpful for our furthered fatore care like analyzing use of sensors work of individuality, working in team like a team
FYP Students Name: Ayesha Signature:___________ FYP StudentsName: Waqar Hussain Signature:___________ FYP Students Name: Qadeer Ahmed Signature:___________			Supervisor Name: Engr.Ali Zain ul Abdeen Signature:_________________ Date:_____________________

B. Feedback on PBL

Student Feedback Form **Exposure of Problem Based Learning (PBL)** in Final Year Project (FYP)	
FYP Title: IoT based Monitoring & Control of Three Phase Induction Motor	**Program:** BE Electrical(Electronics) **Offering Semester:** Spring 2023

Remarks on exposure of Problem Based Learning in FYP Course by FYP Students:

Our project on IoT-based monitoring and control of induction motors serves as an exemplary demonstration of problem-based learning (PBL) principles. The project's core focus on efficiently managing and controlling induction motors through IoT reflects the essence of PBL by addressing a significant real-world challenge. Our approach of integrating technology to optimize motor operations showcases a deep understanding of theoretical concepts and their practical applications.

Throughout the project, our commitment to PBL is evident in how we've delved into various facets of motor control, data communication, and real-time monitoring. By tackling a complex issue like motor efficiency, we've engaged in self-directed learning and problem-solving, two fundamental tenets of PBL. Moreover, the collaborative dynamics among team members resonate with PBL's emphasis on teamwork, communication, and cooperative learning.

Our project's ability to translate theoretical knowledge into an innovative, functional solution further underscores the effectiveness of the PBL approach. Through our exploration of IoT technology and its integration with motor control, we've not only enhanced our technical skills but also cultivated critical thinking and adaptability – quintessential attributes fostered by PBL.

In essence, our project showcases the synergistic relationship between problem-based learning and cutting-edge technology. By applying PBL principles to a real-world engineering challenge, we've not only gained invaluable insights and skills but also contributed to the field by presenting a tangible solution to a pertinent issue. Our work stands as a testament to the transformative power of PBL in nurturing well-rounded.

FYP Students Name: Ayesha Signature:___________ FYP Students Name: Waqar Hussain Signature:___________ FYP Students Name: Qadeer Ahmed Signature:___________	Supervisor Name: Engr.Ali Zain ul Abdeen Signature:_________________ Date:_____________________

C. Feedback on CEP

<table>
<tr><td colspan="2">Student Feedback Form
Exposure of Complex Engineering Problem (CEP)
in Final Year Project (FYP)</td></tr>
<tr><td>**FYP Title:** IoT based Monitoring & Control of Three Phase Induction Motor</td><td>**Program:** BE Electrical(Electronics)
Offering Semester: Spring 2023</td></tr>
</table>

Remarks on exposure of Problem Based Learning in FYP Course by FYP Students:

Our project, centered around the IoT-based monitoring and control of induction motors, exemplifies our aptitude for tackling complex engineering problems with innovation and expertise. The intricate nature of the project required to navigate various technical challenges, and our approach to solving these challenges showcased our proficiency in addressing complex engineering issue.

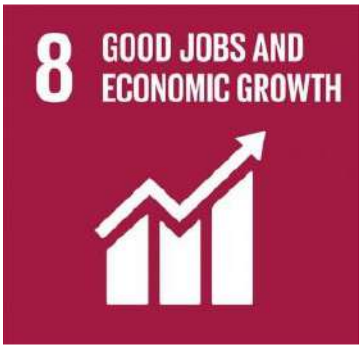
The integration of loT technology for monitoring and controlling induction motors is no small feat. Our project reflects our ability to harmonize multiple technical aspects, including sensor integration, data communication protocols, and real-time control mechanisms. This integration demonstrates our adeptness at solving complex problemsthrough cutting-edge solutions.

Complex engineering problems often require innovative solutions. Our project's use of IoT technology to monitor and control induction motors not only addresses the challenge at hand but also showcases our creative thinking and adaptability to emerging technologies. From understanding the intricacies of motor control to developing a comprehensive system for real-time monitoring, our project exemplifies the depth of analysis and synthesis needed to conquer complex engineering problems.

In essence, our project stands as a testament to our prowess in tackling complex engineering problems head-on. Through innovative solutions, interdisciplinary knowledge, and technical proficiency, we've not only demonstrated our capacity to overcome challenges but also our potential to contribute to advancements in engineering.

<table>
<tr><td>FYP Students Name: Ayesha   Signature:___________
FYP Students Name: Waqar Hussain   Signature:___________
FYP Students Name: Qadeer Ahmed   Signature:___________</td><td>Superviso Name:Engr.Ali Zain ul Abdeen
Signature:_________________
Date:_____________________</td></tr>
</table>

D. Feedback on SDGs

Students' Feedback Form Sustainable Development Goals (SDGs) Implementation In Final Year Project		
Prescribed SDGS	SDGs Attained	Feed Back
		Our Project is to Promote development-oriented policies that support productive activities, which create decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial service.
		Our project's use of IoT technology reflects our dedication to innovation in engineering. By incorporating advanced monitoring and control techniques, we have directly contributed to the advancement of industry and infrastructure in a sustainable manner. The new innovation and better idea have been proposed which includes the sensors to be added for the monitoring and controlling of three phase induction motor.
		The application of IoT technology for motor control has the potential to contribute to creating smarter and more sustainable urban environments. Our project's implications for urban infrastructure align with the objective of building resilient and sustainable cities.

E. **Feedback form from associated of Industry**

IoT based Monitoring and Control of Three Phase Induction Motor

Project Supervisor Name: Engr. Zain ul Abdeen

Ayesha	2477-2019
Waqar Hussain	2443-2019
Qadeer Ahmed	2478-2019

Abstract of Project (Around 350 words)
This project addresses the significant issues faced by three-phase induction motors in industrial applications, encompassing internal faults like rotor damage and overheating, along with external concerns such as speed irregularities and voltage control. Employing an IoT-based system with Arduino and Esp32 , it aims to remotely monitor and regulate critical motor parameters like speed, RPM display, temperature, overspeed vibration, and direction. This IoT integration involves sensor data collection, cloud-based analysis, and actuator-driven control, facilitating proactive maintenance and optimal performance. The project's key findings highlight enhanced energy efficiency, improved reliability, cost savings, and the convenience of remote operation. In conclusion, this IoT-based system offers an efficient, cost-effective solution for industrial motor automation, promoting reliability, performance, and energy efficiency while reducing maintenance and downtime.

Industry Feedback

Name of Industry:	Shan Controls
Name of Supervisor/Concerned Person in Industry:	Zaryab Khan (control Engineer)
Contact No./Email of Concerned Authority	0300-2037535
Type of Industry	Services provider

Feedback from Industry

- ✓ Strongly Recommended
- ◇ Partially Recommended
- ◇ Not Recommended

Comments (if any)

At the student level great Idea to move your project put AI technology in this project.

Signature

15-08-2023

Date:

FYP Poster

IoT Based Control And Monitoring Three Phase Induction Motor

INDUS UNIVERSITY

Ayesha (2477-2019)
Waqar Hussain (2443-2019)
Qadeer Ahmed (2478-2019)

Project Supervisor :Engr.Zain ul Abdeen
Project Co-Supervisor :Engr.Sajid Ahmed
Project Internal Expert: Engr.Shafique Soomro

Abstract

This project tackles issues in industrial three-phase induction motors, both internal (like rotor damage and overheating) and external (speed irregularities and voltage control). We use an IoT system with Arduino and ESP32 to remotely monitor and control critical motor parameters like speed, temperature, vibration, and direction. This approach enhances energy efficiency, reliability, and cost savings while allowing for convenient remote operation, ultimately reducing downtime in industrial settings.

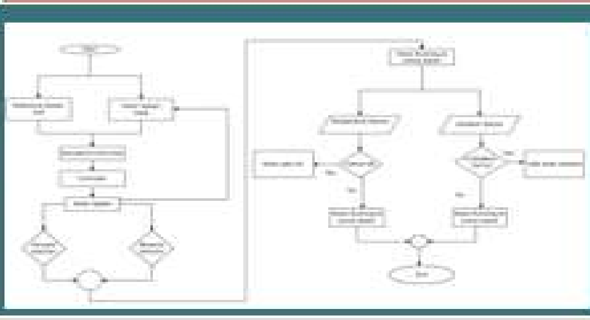
Introduction

- Three-phase induction motors are crucial in industrial settings.
- They can experience internal issues like rotor damage and overheating.
- .External problems include speed, direction, voltage, and current.
- Our solution is an IoT system using Arduino and ESP32.It monitors temperature, vibration, and direction.
- It also controls motor speed, voltage, and current.If trouble is detected, it automatically shuts off the motor.
- This project is part of our final-year poster, emphasizing motor safety and performance.

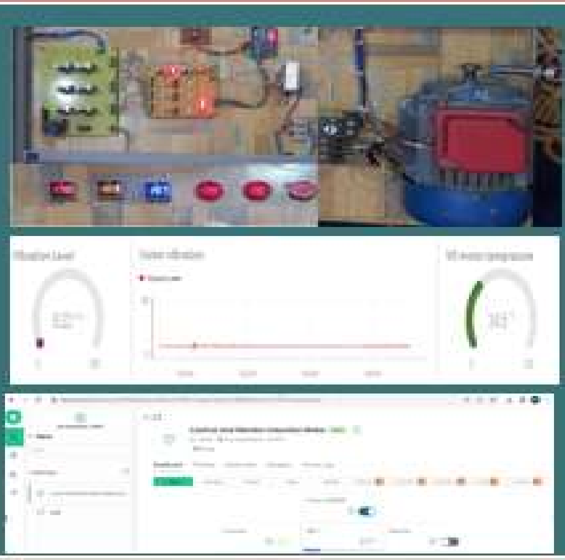
Objectives

- To control the speed of 3-phase induction motor by using inverter (1P single phase and OP three phase).
- To monitor vibration of 3-phase induction motor, thus most often fault occurs in rotating elements such as bearing.
- To monitor the heat of 3-phase induction motor, as increase in the temperature of an induction motor reduce its lifespan.
- To control reverse and forward direction of three phase induction motor.
- To provide a Blynk app interface that allows remote monitoring of the induction motor parameters.

Flowchart Diagram



Results



Conclusion

- All in all induction motor is one of the most important motors used in industrial applications.
- Induction motor problems in terms of over speeding, over heating, overloading, & winding damage are studied.
- To address these issues, an IoT-based system has been developed, integrating Arduino PWM technique for speed control and utilizing temperature, NPN proximity sensor, and vibration sensor along with the ESP32 microcontroller.
- Integration of temperature, NPN proximity sensor, and vibration sensor enables continuous monitoring of motor parameters, promoting early fault detection and preventing potential damages.

SDGs