Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 5, May : 2023

IOT BASED INDUCTION MOTOR SPEED CONTROL AND TEMPERATURE MONITORING SYSTEM

[1]P. Neelima, [2]N. Tejasree, B. Sravani, [4]J. Shilpa, [5]K.P. S. Kusuma Kumari.
[1,2,3,4,5]Students, Dept. of Electrical and Electronics Engineering. Vignan's Institute of Engineering for Women, Visakhapatnam.
[6]**Kapu V Sri Ram Prasad**, Assist. Prof., Dept. of Electrical and Electronics Engineering, Vignan's Institute of Engineering for Women, Visakhapatnam.
E-Mail: sriramkapu@gmail.com, karanamlakshmiprasanna1316@gmail.com

ABSTRACT
The Internet of Things (IoT) has revolutionized the way of rotating machine by interfacing Blynk platform. This technology has found its application in the control and monitoring of induction motors used in industrial processes. The speed and temperature of an induction motor is monitored by using sensors (SCT-013-030-current sensor, DHT 22-temperature sensor, ZMPT101B AC Voltage Sensor) connected to the motor with Wi-fi module. The system transmits the sensor data to the cloud for archival and analysis via a Wi-Fi module. This system allows real-time monitoring parameters and to control motor speed and temperature from anywhere in the world using a mobile phone or computer. The real time monitoring of motor speed and temperature by using Blynk application. The proposed work reduces the man power in emergency operations ensuring motor control and equipment safety. Furthermore, the system optimizes energy consumption by frequent turn on and turn off 24/7 and detecting various faults. Finally, by using IoT application can increase production, efficiency and reduces breakdown time.

INTRODUCTION
The most widely used kind of motor right now across all industries is the induction motor.The induction motor is responsible for almost 50% of the world's electricity use.In Industry, 90% of induction machines are used because they have necessary qualities such as being a'self-start' motor, not requiring a permanent magnet, no brushes, no commutator rings, and no position sensor [4].Induction motors also have a simple and durable operation, a high-power factor, require less maintenance, are small in size, are reliable, and are less expensive than other types of motors.Induction machine ratings range from a few watts to tens of Megawatts, making them suitable for a wide range of industrial applications[1].The majority of them presented various approaches for locating faults of an induction motor.

Monitoring an induction motor's parameters using the internet of things, which can identify problems before they arise and extend the life of the unit.We utilized the blynk application to monitor the induction motor's properties such as voltage, current, temperature, and humidity. We not only monitor parameters, but we also use voltage control technique to control the speed of the induction motor by attaching a speed regulating circuit to the induction motor. We use various sensors and interface with induction motors via esp32 wi-fi module through which it is connected to cloud platform where data is monitored.

Motor is effectively and continuously monitored by using web location."IoT-based traction motor drive condition monitoring in electric vehicles: Part 1." In electric vehicles, the motor drive condition for traction was supervised by applying the implementation of a wireless Internet ofThings(IoT).Thedesignandtesting of the prototype using an ESP8266 microcontroller module to acquire motor condition is presented. "Smart Shut-Down and Recovery Mechanism for IndustrialMachines Using Internet of Things."

"The application of wireless sensor networks for condition monitoring in three-phase induction

motors".IoT-based Induction Motor Speed Control and Temperature Monitoring System is an emerging research area that has gained considerable attention in recent years. Several studies have been conducted in this field, and the following literature review highlights some of the significant contributions to this area. "IoT-Based InductionMotorSpeedControlandTemperatureMonitoringSystemUsingMachineLearning"byH.B. Zadeh et al. (2021): This paper proposes an IoT-based induction motor speed control and temperature monitoringsystemthatusesmachinelearningalgorithmstooptimizemotorperformance.Thesystemuses sensors to collect data on motor speed and temperature and then uses machine learning algorithms to adjust the motor's speed to achieve optimal performance.

"IoT-Based Induction Motor Speed Control and Temperature Monitoring System Using Cloud Computing"byS.M.Kangetal.(2020):ThispaperproposesanIoT-basedinductionmotorspeedcontrol andtemperaturemonitoringsystemthatusescloudcomputingtostoreandanalyzedata.Thesystemuses sensors to collect data on motor speed and temperature and then sends this data to the cloud, where it is analyzed and used to adjust the motor's speed.

"IoT-Based Induction Motor Speed Control and Temperature Monitoring System Using Arduino" by P. Kumar et al. (2019): This paper proposes an IoT-based induction motor speed control and temperature monitoring system that uses an Arduino microcontroller to control the motor's speed. The system uses sensors to collect data on motor speed and temperature and then uses the Arduino microcontroller to adjust the motor's speed.

"IoT-Based Induction Motor Speed Control and Temperature Monitoring System Using Raspberry Pi" by S. S. Patil et al. (2018): This paper proposes an IoT-based induction motor speed control andtemperaturemonitoringsystemthatusesaRaspberryPitocontrolthemotor'sspeed.Thesystemuses sensors to collect data on motor speed and temperature and then sends this data to the Raspberry Pi, where it is analyzed and used to adjust the motor's speed.

"IoT-BasedInductionMotorSpeedControlandTemperatureMonitoringSystemUsingWirelessSensor Networks"byS.K.Sahooetal.(2017):ThispaperproposesanIoT-basedinductionmotorspeedcontrol andtemperaturemonitoringsystemthatuseswirelesssensornetworkstocollectdataonmotorspeedand temperature. The system uses these data to adjust the motor's speed and monitor itstemperature.

TheliteraturesuggeststhatIoT-basedinductionmotorspeedcontrolandtemperaturemonitoringsystems havethepotentialtooptimizemotorperformanceandreduceenergyconsumption.Thesesystemscanbe implemented using various hardware and software platforms, including machine learning algorithms, cloud computing, microcontrollers, and wireless sensornetworks. Monitoring parameters of induction motor such as voltage, current, power, temperature and humidityare done using IoT but also monitoring parameters of induction motor remotely is also done by using lcd screen.

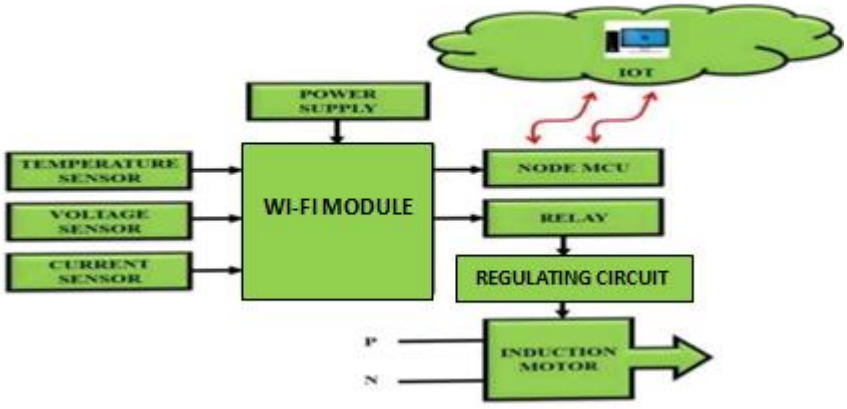


Figure 1:Block diagram for monitoring parameters of an Induction Motor using Internet of Things

Figure 1 represents block diagram for monitoring induction motor parameters.The main parts are explained,

Induction Motor: This is the machine that will be monitored, and its parameters such as voltage, current, speed, and temperature will be measured and transmitted to the Blynk IoT platform.ESP32 Wi-Fi Module: This is a microcontroller board that can connect to a Wi-Fi network and communicate with the Blynk IoT platform.

Blynk IoT Platform: This is a cloud-based platform that enables the creation of mobile and web applications for the Internet of Things (IoT) devices. In this system, the Blynk app will be used to visualize and control the data transmitted from the ESP32 module.

As shown in the diagram, the system consists of main components: Induction Motor, Various Sensors like current sensor, voltage sensor temperature and humidity sensor, relay module and the ESP32 Wi-Fi Module. The Induction Motor is connected to the varioussensors, which measures the current flowing through the motor. The Sensors then connected to the ESP32 Wi-Fi Module, which uses its analog-to-digital converter (ADC) to convert the current, voltage, and temperature measurements into digital signals that can be processed by the microcontroller.The ESP32 Wi-Fi Module is then connected to the Blynk IoT Platform, which is responsible for visualizing and controlling the data received from the ESP32. The data transmitted from the ESP32 includes the motor parameters, such as voltage, current, speed, and temperature. The Blynk app can be used to display these parameters in real-time, as well as to control the motor remotely.

PROPOSEDSYSTEM

Sensor selection: The first step is to select the appropriate sensors for measuring the motor parameters and temperature. Different types of sensors such as voltage sensor, current sensor, temperature and humiditysensors.

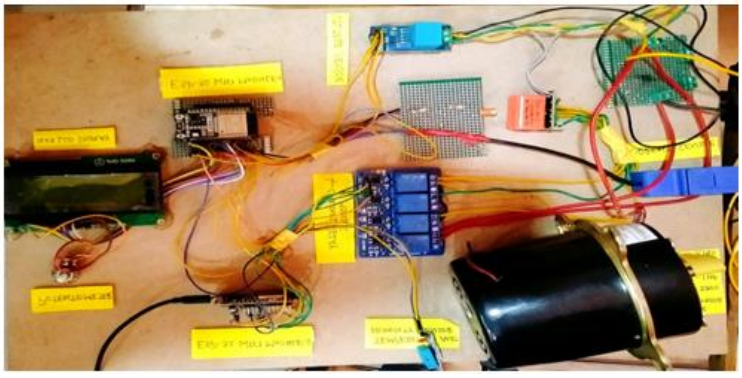
IoT device integration: The sensors are then integrated into an IoT device that is capable of measuring and transmitting data over the internet. This device is typically a microcontroller- based system with built-in wireless connectivity such as Wi-Fi module orBluetooth.

Cloudplatformsetup:TheIoTdeviceisthenconnectedtoacloud-basedplatformsuchasBlynk orThing speakwherethedataisstoredandprocessed.Thisplatformprovidesauserinterfacefor monitoring and controlling the motor parameters and temperatureremotely.

Datatransmission:TheIoTdevicecontinuouslymeasuresthemotorparametersandtemperature, sends this data to the cloud platform via a secure internetconnection.

Data processing and analysis: The cloud platform receives the data and processes it to provide real-time monitoring and control of the motor parameters andtemperature.

User interface development: The cloud platform provides a user interface that can be accessed via a web browser or mobile app. This interface allows authorized users to monitor the motor's performance, adjust the speed and temperature. As per the proposed system hardware implantation is done as shown in figure 2.



Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 5, May : 2023

Figure2: Hardware Implementation

RESULTS AND DISCUSSIONS

Monitoring induction motor parameters using an ESP32 Wi-Fi module and Blynk is a useful application for industrial automation and control. Blynk is a mobile application that allows users to control and monitor their devices remotely as shown in figure 3. By using an ESP32 Wi-Fi module, which is a powerful microcontroller with built-in Wi-Fi capabilities, the motor parameters can be monitored in real-time and transmitted to the Blynk app. The ESP32 can be connected to various sensors that measure parameters such as motor current, voltage,power, temperature and humidity.The Blynk app can display the real-time data as graphs or charts, which can be used to monitor the performance of the motor and detect any abnormalities. The app can also be configured to send alerts if any of the parameters exceed predetermined thresholds, allowing for prompt action to be taken.
Overall, using an ESP32 Wi-Fi module and Blynk for induction motor parameter monitoring is a cost-effective and efficient solution for industrial automation and control. It allows for real-time monitoring, analysis, and alerting of motor parameters, improving the reliability and performance of industrial equipment.

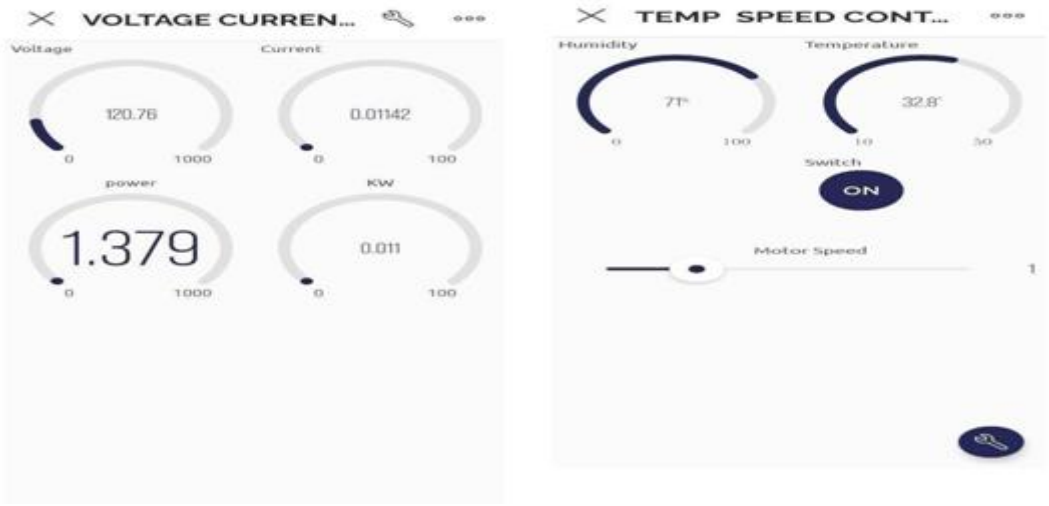


Figure No 3: Experimental results from Blynk Application

Some of the results are tabulated based on regulating speed of induction motor using IoT. Here by applying speed i.e., 25% of rated speed we monitored parameters of an induction motor such as voltage with 82.7V, current with 0.009A,power with 6.749W, humidity and temperature with 44 and 33.8°C respectively. By applying speed i.e., 50% of rated speed we monitored parameters of an induction motor such as voltage with 122.2V, current with 0.011A, power with 1.373W, humidity and temperature with 45 and 33.8°C respectively. Likewise, on increasing the percentage speed of rated speed parameters of induction motor is monitored. Results on blynk application is tabulated as shown in table 1.

Table 1: Results on Bylnk Application

S. No	Speed Percentage(%N)	Voltage(V)	Current(A)	Power(W)	Humidity	Temperature(°C)
1	25	82.7	0.009	6.749	44	33.8
2	50	122.2	0.011	1.373	45	33.8
3	75	167.6	0.024	3.625	43	34.2
4	100	204.2	0.026	5.458	41	35.2

CONCLUSION

There are many advantages to using Blynk IoT for induction motor speed control and parameter monitoring. The motor speed can be remotely controlled, as well as other characteristics including temperature and humidity, power, current, and voltage. The mobile application and user-friendly interface of Blynk allow for convenient real-time monitoring and control, giving consumers flexibility and accessibility. Blynk makes it easy to apply speed control schemes for induction motors that are effective and efficient, improving motor performance while saving energy and lowering maintenance costs. Real-time monitoring of motor characteristics also enables prompt detection of any problems or malfunctions, enabling preventive maintenance, and avoiding motor failures**.**

FUTURESCOPE

The Blynk application's in IoT-based induction motor speed control and temperature monitoring system has a lot of scope to evolve and grow in the future. This technology has the potential to be a vital tool for many sectors by interacting with other IoT devices, creating predictive maintenance algorithms, improving energy efficiency, providing remote monitoring and control, and implementing machine learning.

REFERENCES

1) IoT platform for condition monitoring of industrial motor: Published in 2nd International Conference on Communication and Electronics Systems (ICCES 2017) IEEE Explore Compliant - Part Number: CFP17AWO-ART, ISBN:978-1-5090-5013-0 by Shyamala. D.
2) Chilaka Ranga, Ashwani Kumar Chandel, "Advanced Tool Based Condition Monitoring of Induction Machines by Using LabVIEW–A Review," IEEE UP Section Conference on Electrical Computer and Electronics (UPCON), 2015, DOI:10.1109/UPCON.2015.7456693.
3) M. Shailaja, G. Nikkam, V.R. Pawar, Water parameter analysis for industrial application using IoT, in Proceedings of 2nd International Conference on Applied and Theoretical Computing and Communication Technology (iCATccT) (2016), pp. 703–707.
4) Ashwini B Kaule, M.R. Bachawad "IoT Based Monitoring and Speed Control of an Induction Motor"International Journal of Engineering Research and Application ISSN: 2248-9622, Vol. 10, Issue 11, (Series -III) November 2020, pp.06-10.
5) J.A. Carino, enhanced industrial machinery condition monitoring methodology based on novelty detection and multi-modal analysis. IEEE Access 4, 7594–7604(2016).
6) Prasad, K.V.S.R., Singh, V. Numerical Investigation and Experimental Modal Analysis Validation to Mitigate Vibration of Induction Machine Caused due to Electrical and Mechanical Faults. J. Electr. Eng. Technol. 17, 2259–2273 (2022).
7) B. Lu, C. VehbiGungor, Online and remote motor energy monitoring and fault diagnostics using wireless sensor networks. IEEE Trans. Ind. Electron. 56, 4651–4659 (2009).
8) L. Hou, W. Bergmann Neil, Novel industrial wireless sensor networks for machine condition monitoring and fault diagnosis. IEEE Trans. Instrument. Meas. 61, 2787–2798(2012).
9) Q.P. Chi, H. Yan, C. Zhang, Z. Pang, L. Da Xu, A reconfigurable smart sensor interface for industrial WSN in IoT environment. IEEE Trans. Industrement. Inf. 10, 1417–1425(2014).
10) F. Salvadori, Monitoring in industrial system using wireless sensor network with dynamic power management. IEEE Trans. Instrument. Meas. 58, 3104–3111(2009).
11) Y. Lei, J. Lin, M.J. Zuo, Z. He, Condition monitoring and fault diagnosis of planetary gearboxes: A review. Measurement 48, 292–305(2014).
12) V Sri Ram Prasad, K., Singh, V. Experimental Modal Analysis of Induction Machine Stator End Windings of Driving End and Non-Driving End to Predict the Looseness. J Fail. Anal. and Preven. 22, 1151–1163 (2022).
13) IoT-based traction motor drive condition monitoring in electric vehicles: Part1: published in Power

Electronics and Drive Systems (PEDS), 2017 IEEE 12th International Conference on. IEEE,2017.
14) Smart Shut-Down and Recovery Mechanism for Industrial Machines Using Internet of Things: Published in 2018 8th International Conference on Cloud Computing, Data Science & Engineering (Confluence). IEEE, 2018 by Prakash, Chetna, and SanjeevThakur.
15) IoT-based wireless induction motor monitoring: Published in Scientific Conference Electronics (ET), 2017 XXVI International. IEEE, 2017, by Sen, Mehmet, and BasriKul.
16) The application of wireless sensor networks for condition monitoring in three-phase induction motors: Published in Electrical Insulation Conference and Electrical Manufacturing Expo, 2007. IEEE, 2007 by, Xue, Xin, V. Sundararajan, and Wallace P. Brithinee.