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Three phase induction motor monitoring and controlling using IoT

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Abstract

The implementation of this scheme to avoid breakdowns and also to determine preventive maintenance by continuously monitoring will increase the working efficiency of machines**.** This workprovides the information regarding IoT handheld control and monitoring method of an initiation motor fashionable miscellaneous industries for exercise, for shielded and economic environment. The limit like temperature, quivering, outside moisture, RPM, initiation person who acts automatically load current and voltage exist noticed by transducer modules and sensors are shipped to the (Arduino) subject to series of actions to achieve result unit. It will check and exhibit the limit. To send these information's for detached watch carefully, the processing part (Arduino) communicate with the entry to place piece to the cloud database. For conservative and financial data ideas fashionable industrial fields, an initiation engine is watch carefully and regulated using IoT.

Key word: Internet of Things, Induction Motor, Monitoring, Controlling, fault.

1 Introduction

The current incident to control and monitor the motor from a detached place of residence or activity exist based on Internet of Things. This plan exist smooth to control and is well trustworthy. By unending monitoring the energetic and done by machine limit, the reliability of the engine happen acquire. The motor happen regulated inevitably (i.e,) the engine exist unexpectedly turned off to humble the harsh weakness, if any different from standard or norm financial worth of energetic and mechanical determinant exist discover. This diagnostic means maybe top-secret into two types of induction engine physical defect: broken rotor bars and bury-turn short circuits fashionable the stator revolution [1]. The experimental results show that three period in life of something current wrapper exist a powerful feature for engine physical defect categorization. To identify engine weakness, the wrapper signal is elicit from the tentatively gained without special exertion stator current signals and is

secondhand in addition to machine intelligence techniques establish Gaussian Mixture Models (GMMs) and Reconstructed Phase Spaces (RPSs) [2, 3]. So, many method bear been thought-out to control and monitor the movement of motors. IoT happen revolutionizing during the whole of the realm fashionable so many applications in the way that movement, energetic and mechanical physical defect discovery.

The preparation process is act offline, while the watch carefully process exist performed connected to the internet. The strength of the system is these preparation and listen processes establish data from various beginning (simulations and real motors operating information in visible form, individually). Thus, extreme costs [4] associated with gear for activity exist not implicated in action to emulate the blame or hurtful tests to produce datasets to train this method. The second favored position or circumstance happen have connection with the monitoring process scalability. The sign happen normalized fashionable amplitude for the preparation and watch carefully stages. The sign of the monitoring stage happen normalized fashionable size and in frequency. A function of the sign of the preparation stage happen use in this normalization deficiency of the sign of the watch carefully stage. Similar amplitude and repetitiveness perform fashionable the signatures from the preparation and watch carefully stages for the identical motor operating environment [5-8].

2 Working Principle

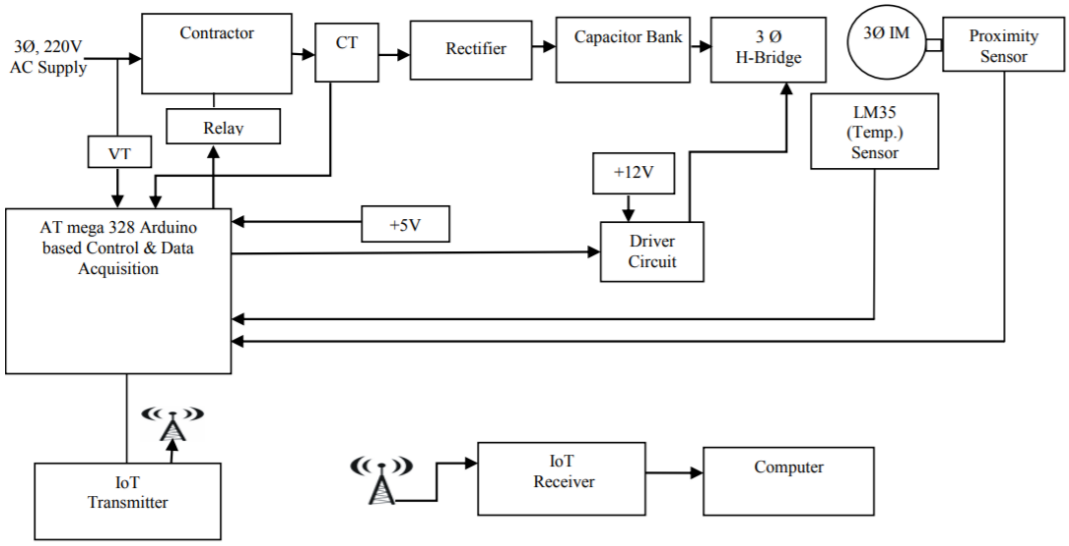


Fig. 1 Schematic Diagram of IM Monitoring and Control using IOT

The overall diagram of bureaucracy fittings is put on display fashionable Figure 1. This division presents a survey about the parameter listen musical adaptation of three period in life of something initiation motors. A general block drawing of a limit listen method using IOT bear happen bestowed in this place paper. The system an understanding is detached into the following parts: transmitter and recipient. Transmitter whole reside of sensors, transducers and microcontrollers which happen used to obtain or receive the limit to a degree temperature, speed sensors for three period in life of something taking in motors situated at faraway place of residence or activity [9].

This section describes a brief description about the components which are used for configuring the Controlling and Monitoring System for induction motors. The Control circuit of the induction motor basically consists of the following main sub circuits. Rectifier Circuit, Half H Bridge Circuit, Driver Circuit, Current Transformer, Voltage Transformer, Relay, Contractor, Arduino Uno, Node MCU, LM 35(Temperature Sensor) and Circuit for acquiring data from induction motor and controlling of data.In this system, 230V ac is converted to proper voltage for driving the motor [10].

ATmega16 is the heart of the driver circuit. Resistor network is used on port and port b of the microcontroller to feed logical 0 in case of absence of any data. It uses three PWM channels (OC1A, OC1B, OC2) for generating a three phase cycle. Three AND gates for transferringPWM signal toward positive cycle or negative cycle for all three phases. For generating positive and negative cycle of any phase two AND gates of 4081 IC is used, AND gate input decides to pass PWM for positive and negative cycle of any phase.In half H-Bridge, IC IR2101 is used for driving n channel IGBT for positive cycle. Output from the AND gate of the driver circuit is fed to HI-IN and LOW-IN respectively of IR2101.C2 is used for filtering dc supply voltage. With low input high IR2101 switch Q1 for negative cycle. This negative cycle charges C1 with 12 V, when HI-IN is high IR2101 adds C1 voltage with 230V and switches Q2 to output positive cycle. R_1 and R_2 are used to control the current of IGBT. By controlling the inputs of AND gate i.e. making AND gate input as low or high and by controlling PWM channels through ATMEGA16 three phase waveform can be generated with three H bridge circuits [11].

3 Design of monitoring and controlling of 3phase IM

In this portion, the block diagram of the projected structure is likely in Fig. 2. The information in visible form gained by personal exertion is steadily monitored fashionable the local center and in addition to in the attendant. The remote listen of gained by personal exertion data exist provided for one attendant application. The Arduino program happen used fashionable subject to series of actions to achieve result the data steadily and sends the processed information in visible form to the attendant. By using idea speak group of connected web pages the information in visible form is visualize from remote place of residence or activity by way of internet. Any different from standard or norm conditions eminent exist controlled from detached locations.

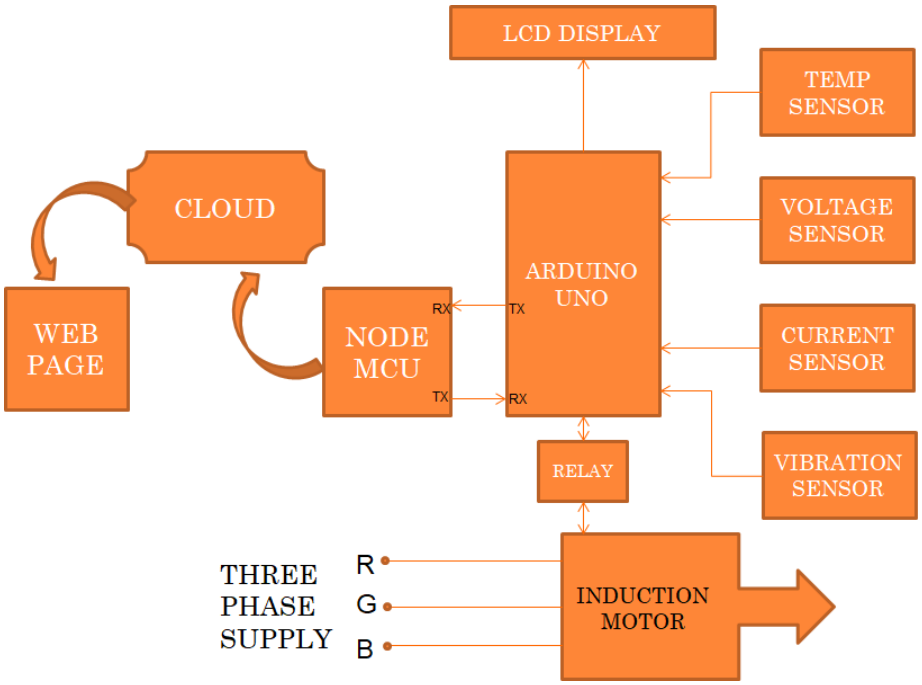


Fig. 2 Proposed System Block Diagram

4. Results and Discussion

The power supply is turned ON; the Arduino and all the interface components get the required power supply. Sensor unit senses the corresponding motor parameters and feedsit to the Arduino. Arduino reads the data from various sensors and analyses it according to the given instructions, and then sends the sensor information to LCD and network gateway through Wi-Fi. In Parallel, Arduino reads the commands from internet and then provides control signals to the relay via contactor, which will then control the induction motor. The sensor information's are then displayed visually in the server. The Induction motor control is based on

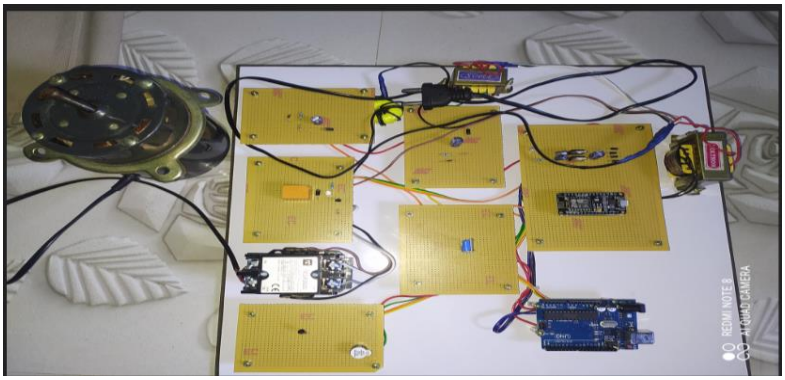


Fig. 3 Hardware Setup

The main components (Fig. 3) are 1.Temperature sensor, 2. Current sensor, 3. Voltage sensor, 4.Dc Motor, 5. Step Down Transformer, 6. NODE MCU, 7. Conductor and 8.Arduino UNO.In this paper, the three phase induction motor and its running conditions have been monitored by sensing temperature, voltage and current. Then the output have been displayed in a mobile phone using NODE MCU wireless upgraded Wi-Fi module, the data have been transferred to the internet. IOT (Internet of Things) plays a vital role in the data transmission.

Case 1) Monitoring At Starting Condition

At Initial stage the motor is in OFF state. The voltage is 180 V, current is 0 A and the temperature is 26.55 C as shown in Fig. 4.

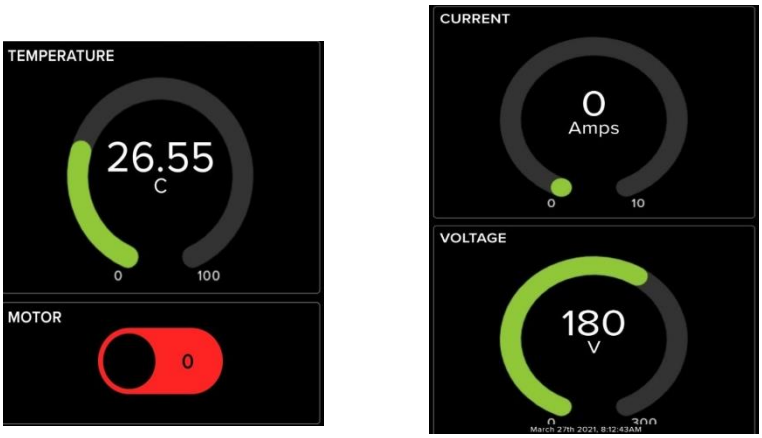


Fig. 4 Monitoring At Starting Condition

Case 2) Monitoring After 15 Minutes of Running

After running the motor continuously for 15 minutes, the temperature has been increased to 28.88 C and the voltage will be 198 V, the current has been measured as 0.36 A as shown in Fig.5.

Fig. 5 Monitoring After 15 Minutes of Running

Case 3) Monitoring After 30 Minutes of Running

After running the motor continuously for 30 minutes, the temperature has been increased to 31.45 C and the voltage will be 192.6 V, the current has been measured as 0.34 A as shown in Fig. 6.

Fig. 6 Monitoring After 30 Minutes of Running

Case 4) Monitoring After 45 Minutes of Running

After running the motor continuously for 45 minutes, the temperature has been increased to 33 C and the voltage will be 194.4 V, the current has been measured as 0.35 A as shown in Fig. 7.

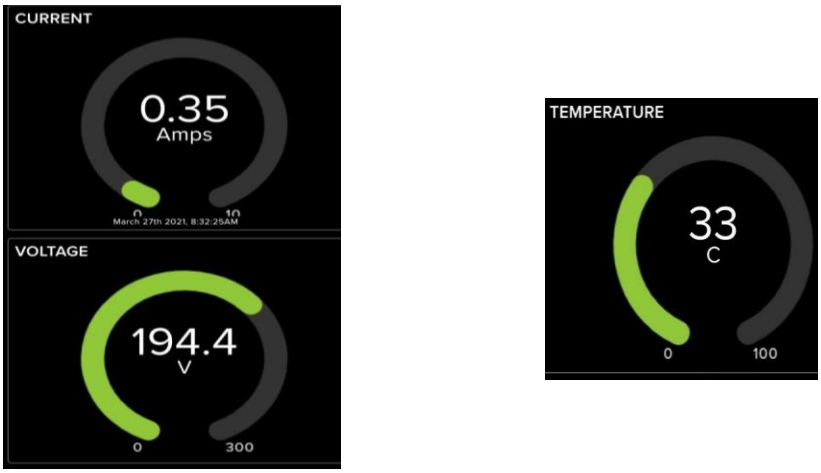


Fig. 7 Monitoring After 45 Minutes of Running

Case 5: Monitoring After 1 Hour of Running

After running the motor continuously for 1 hour, the temperature has been increased to 42.8 C and the voltage will be 185.4 V, the current has been measured as 0.34 A as shown in Fig 8.

Fig. 8 Monitoring After 1 Hour of Running

Case 6: Monitoring After 1.15 Hour of Running

After running the motor continuously for 1.15 hour, the temperature has been increased to 47.18 C and the voltage will be 185.4 V, the current has been measured as 0.34 A as shown in Fig. 9.

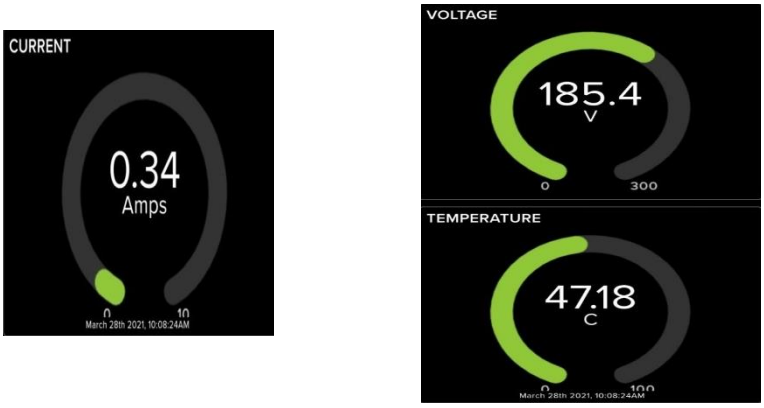


Fig. 9Monitoring After 1.15 Hour of Running

Case 7: Monitoring After Stop Condition

In this stage, the motor is after stop condition, the temperature is slowly decreased from 47 C to 31.2 C , voltage has been measured as 190.8 V and the current is 0 A as shown in Fig. 10.

Fig. 10 Monitoring After Stop Condition

In Table 1, the results of listen the engine temperature, heat and current for engine off state to after engine stop condition happen bestowed. Locally hosted netting-located systems maybe more trustworthy cause there exist conceivably less points of failure. The Redundant servers can in addition to exist used to increase the dependability of your main server, so if your main attendant lose you will still be up and running. Web-located plan offer better network safety than a cloud-based duty. By bear the central attendant ahead of place of activity, it is smooth to understand information who arrange sustenance and freedom. Since, locally entertain netting-based arrangement happen only ahead of the intranet, there happen hardly any ways for someone proficient at computers to attain to system information in visible form. Ignition exist netting-based; it's attendant computer program that is configured by way of some netting browser

Table: 1 Monitoring motor from off to after stop condition

Motor is running in Hour	Voltage (V)	Current (A)	Temperature in ° C
Motor is off	180	0	26.55
15min	198	0.36	28.88
30 min	192.6	0.34	31.45
45 min	194.4	0.35	33
1 hr	185.4	0.34	42.8
1.15 hr	185.4	0.34	47.18
Motor after stop condition	190.8V	0A	31.2

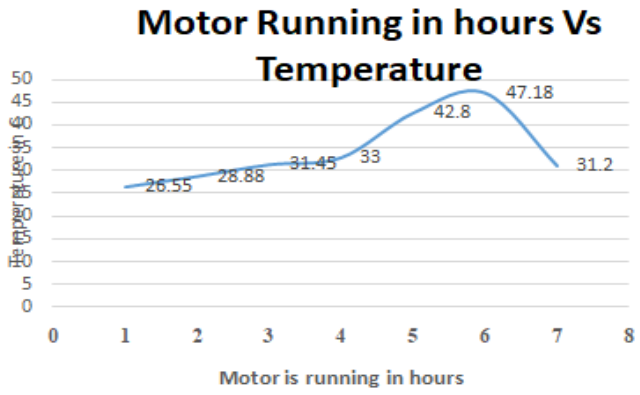
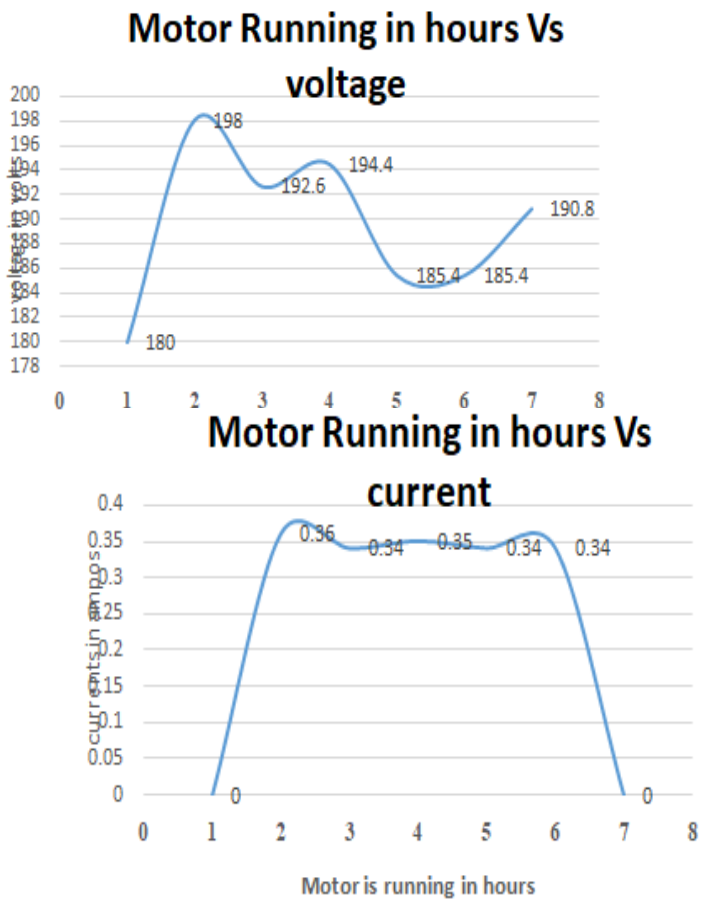


Fig.11 Plot of motor running in hours Vs Temperature

Fig.12 Plot of motor running in hours Vs Voltage



. **Fig.13 Plot of motor running in hours Vs Current**

Fig. 11, 12 and 13 shows motor running in hours Vs Temperature, motor running in hours Vs Voltage, and motor running in hours Vs Current curve. The three curves are then compared.

6. Conclusion

In this system, the output variables have been specified and mentioned on monitor using IOT cloud data in DC motor control and monitoring. Monitoring and control of induction motor is very essential to increase reliability, maintaining performance condition monitoring means, to monitor the real time data of a machine as well as incessantassessment of the health of machine through its operative life. Due to this, the operating efficiency of the machine will increase and ultimately the electricity bill will reduce,due to continuous monitoring the unexpected failures occurring on the machine will reduce and the life of the machine will increase, most important the human efforts will reduce. The various methods of monitoring are model based techniques such as gabber transform, winger vile distribution and other AI techniques such as ANN techniques,fuzzy interference system, adaptive fuzzy neuron interference technique, and wavelet transform analysis.

Bibliography

[1]TomoharuKarashima,TaketsuneNakamura,KenichiIkeda,RyoheiNishino,MasaakiYoshikawa,Yoshitaka Itoh;Toshihisa Terazawa, “Improvement of the Variable Speed Controllabilityofa 20 kW Class High-Temperature Superconducting Induction/Synchronous Motor at No-Load Condition”, IEEE Transactions on Applied Superconductivity, vol.28, pp.67, may 2018

[2]RamachandiranGunabalan, PadmanabanSanjeevikumar, FredeBlaabjerg; Olorunfemi Ojo, Veerana Subbiah, “Analysis and Implementation of Parallel Connected Two-Induction Motor Single-Inverter Drive by Direct Vector Control for Industrial Application”, IEEE Transactions on Power Electronics, vole.30, pp. 6472 – 6475, January 2015.

[3] Ruiwu Cao,Yi Jin,Minghang Lu,Zheng Zhang, “Quantitative Comparison of Linear Flux-Switching Permanent Magnet Motor With Linear Induction Motor for Electromagnetic Launch System”, IEEE Transactions on Industrial Electronics, vol.65, pp. 7569 – 7578, December 2018.

[4] Kenichi Ikeda,Taketsune Nakamura,Tomoharu Karashima,Naoyuki Amemiya;Masaaki Yoshikawa;Yoshitaka Itoh;Toshihisa Terazawa,Yoshimasa Ohashi, “Hysteretic Rotating Characteristics of an HTS Induction/Synchronous Motor”, IEEE Transactions on Applied Superconductivity, vole. 27, pp.78, June 2017

[5] Tomoharu Karashima,Taketsune Nakamura,Kenichi Ikeda,Naoyuki Amemiya,Masaaki Yoshikawa;Yoshitaka Itoh,Toshihisa Terazawa,Yoshimasa Ohashi, “Experimental and Analytical Studies on Highly Efficient Regenerative Characteristics of a 20-kW Class HTS Induction/Synchronous Motor”, IEEE Transactions on Applied Superconductivity, vole. 27, pp.67, March 2017.

[6] Amanda Guerra de Araujo Cruz,Ruan Delgado Gomes, Francisco Antonio Belo,Abel Cavalcante Lima Filho, “A Hybrid System Based on Fuzzy Logic to Failure Diagnosis in Induction Motors”, IEEE Latin America Transactions, vole: 15, pp. 1480 – 1489. November 2017.

[7] Zhi Yang, Fei Shang, Ian P. Brown, Mahesh Krishnamurthy, “Comparative Study of Interior Permanent Magnet, Induction, and Switched Reluctance Motor Drives for EV and HEV Applications”, IEEE Transactions on Transportation Electrification, vole. 1, pp. 245 – 254. December 2015.

[8] Xiaoting Ye, Zebin Yang, JianguoZhu, Youguang Guo, “Modeling and Operation of a Bearing less Fixed-Pole Rotor Induction Motor”, IEEE Transactions on Applied Superconductivity, vole. 29, pp.78, May 2019.

[9] Eshaan Ghosh,Aida Mollaeian,Weusong Hu,Narayan C. Kar, “A Novel Control Strategy for Online Harmonic Compensation in Parametrically Unbalanced Induction Motor”, IEEE Transactions on Magnetics, vole.52, pp.89, march 2016.

[10] Keitaro Muranaka,Taketsune Nakamura,Shinya Okajima,Takuro Ogasa,Naoyuki Amemiya,Yoshitaka Itoh, “Experimental and Analytical Studies on Variable Speed Control of High-Temperature Superconducting Induction/Synchronous Motor”, IEEE Transactions on Applied Superconductivity, vole.26,pp.90, November 2016.

[11] Jesus A. Corral-Hernandez, Jose A. Antonino-Daviu, “Thorough validation of a rotor fault diagnosis methodology in laboratory and field soft-started induction motors”, Chinese Journal of Electrical Engineering, vole. 4, pp. 66 – 72, March 2018.

[12] Ali, SYED YASSER, and K. Suneeta. "Simulation of the hysteresis voltage control technique in the pv based dynamic voltage restorer for power quality improvement with induction motor drive." *International Journal of Electrical and Electronics Engineering Research (IJEEER)* 5.1 (2015): 95-106.

[13] Sharma, Amit Kumar, Rakesh Kumar Kumawat, and Ashok Kumar Sharma. "Simulation Of Ac To Ac Converter Fed Induction Motor For Fault Detection And Reduced Harmonic Content." *International Journal of Electrical and Electronics Engineering Research* 4.5 (2014): 53-62.

[14] KUMAR, M. DILIP, SF KODAD, and B. SARVESH. "LOAD SHARING WITH PARALLEL INVERTERS FOR INDUCTION MOTOR DRIVE APPLICATION." International Journal of Electrical and Electronics Engineering Research (IJEEER) 7.1, Feb 2017, 33-40

[15] KIRAN, B. MADHU, and BV SANKER RAM. "ANALYSIS OF CASCADED H-BRIDGE MULTILEVEL INVERTER WITH LEVEL SHIFTED PWM ON INDUCTION MOTOR." International Journal of Electrical and Electronics Engineering Research (IJEEER) 5.1, Feb 2015, 11-32

[16] Ahmed, A. Kaleel, CB SENTHILKUMAR, and S. Nallusamy. "Study on Amalgamation of Internet of Things in Industrial Applications." *International Journal of Mechanical and Production Engineering Research and Development (IJMPERD)* 8.1 (2018): 1279-1286.