iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** III **Month of publication:** March 2019

DOI: http://doi.org/10.22214/ijraset.2019.3314

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue III, Mar 2019- Available at www.ijraset.com

Speed Control of Three Phase Induction Motor through V/F Scheme using Arduino Uno

Mr. Abhishek Srivastava[1], Mr. Piyush Agnihotri[2], Mr. Brijesh Kumar Dubey[3]
[1]*Scholar,* [2, 3]*Assistant Professor, Department of Electrical & Electronics Engineering, PSIT, Kanpur, Uttar Pradesh*

Abstract: ***Induction motor keep running at their rated speed when it is associated with the supply, numerous applications requiring variable speed task. Proficiently controlling the speed of induction motor is a key issue these days. With quick advancement in semiconductor generation innovation, the size and estimation of the semiconductor have diminished profoundly. Also, because of this the motor client can trade incapacitated mechanical motor drives with the inverter. This paper is vital for speed control of acceptance motor. Of the different techniques for motion control of induction motor, the strategy for V/F speed control affirms to be the most multilateral. The arrangement to finish the submitted V/F speed control. Inductor is one of the fundamental prerequisites for motor speed control by inverter v/f strategy, inverter customary control techniques are changed utilizing Arduino Uno, which oversees the general activity of the proposed arrangement, which is the V/F ratio and Smooth speed control is a decent control. The plan has been worked, the expense of the amended plan is low, the code is simple and can be effectively refined to accomplish diverse outcomes, this plan can be controlled from remote territories.***
Keywords: Arduino Uno, Induction motor, Speed controls.

I. INTRODUCTION

Induction motors control above 85% of the motor utilized in industry and household applications. Induction motors are regularly qualified for "industry workhorse". This is because of the way that it is the most utilized motor on the planet. It is utilized in enterprises, transport, research facilities and home apparatuses. Induction motors gained this notoriety since they are modest contrasted with synchronous and DC motor, in this time of rivalry, this is the principle necessity for any machine. Induction motors are considered as the principal decision for a hardware procedure, with the purpose behind the obtaining, establishment and utilization of taking care of, Induction motors with the squirrel Cage Rotor are hard to build. There the period enables them to be utilized in various situations and they are productive in vitality change for quite a while, they are great in development, they are basic with low upkeep cost furthermore, they have a high starting torque, Very valuable with the application before the motor is run. One of the advantages of Induction motors is smoothness with speed control. To run distinctive applications and loads then extraordinary motor speed is required. Before, Induction motors are not utilized for applications when the speed ought to be kept in light of the fact that conventional strategies for speed control are not productive contrasted with DC motor speed control. Nonetheless, DC motor require the support of the commutator and the brush. In this way, Induction motors are chosen. It is important to control the speed of Induction motors because of different factors, for example, assurance of smooth task, torque and increasing speed control, forms with various paces The establishment time requires moderate motion of motor. The previously mentioned elements present solid defense for speed control or execution of drive with variable speed in Induction motors. Different strategies exist to control the development of Induction motors, for example, the quantity of shaft change, flexible voltage supply control, customizable rotor opposition control, variable voltage variable frequency (V/F) control, slip recovery, speed control for vector Control, and so forth. From the previously mentioned speed control strategies, the V/f strategy is viewed as the most prevalent, the above techniques, V/F control is the most favoured and as of late found in local and broadly utilized Industrial applications because of the simplicity of execution. In any case, there is less unique execution in contrast with vector control. In this manner, in those applications where accuracy is wanted, V/F control isn't utilized. Different favourable circumstances of V/F control, for example, a great scope of speed alteration, it gives extremely great running and good transient performance, for this, the accompanying beginning, exhaustive stable working zone, frequency and voltage need to achieve its evaluated qualities at the rate speed. it happens. motor speeding up can be constrained by the difference in frequency. Different techniques and impersonations connected before controlling the motion of induction to control the output frequency by utilizing the V/F strategy, for example, the genuine PWM design and associating the inverters, utilizing the PIC microcontroller to send the flag to control the frequency of inverters. This paper exhibits another arrangement, which is actualized to control the inverter frequency utilizing the indications of PWM of Arudino Uno, which will be nourished to the control signal of the inverter and result in a smooth control of the speed.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue III, Mar 2019- Available at www.ijraset.com

II. MATHEMATICAL OPERATION

For the induction motor from the following expression,

$$N \propto N_s (1 - s)$$

The speed of induction motor can be changed by evolving the "Ns" or slip (s). Additionally, the induction motor was delivered The torque can be found from the following expression,

$$T \alpha \frac{s E_2^2 R_2}{R_2^2 + (s X_2)^2}$$

Consequently, when the motor slip changes, at that point by changing the R2, E2, the torque will be kept consistent for the situation of steady burden. Its speed will change Synchronous speed is giving by,

$$N_s = \frac{120 f}{P}$$

Consequently, by controlling the supply frequency easily, synchronous speed can be controlled on a wide range, which gives smooth motion control of an induction motor. Be that as it may, the outflow of the air gap flux is given by,

$$\phi_g = \frac{1}{4.44 K_1 T_{ph1}} \left(\frac{V}{f} \right)$$

It is as per the e.m.f condition of a transformer which is additionally connected on the induction motor. It tends to be seen from this articulation along these lines the supply frequency (f) is change, the air gap transition esteem will be influenced. Therefore, saturation in the stator and rotor center can happen. This sort of saturation prompts a sharp increment in the present heap of the motor (attraction). In this way, to keep up its frequency, it is important to keep up the air gap transition when the supply frequency f is changed to accomplish it, at that point it tends to be seen from the above expression that the voltage alongside the frequency There will likewise be changes to keep up the proportion of V/F to stable. This static air influences the distinction stream which gives speed control without influencing the motor execution. Thusly, for the V/F strategy, the provided variable voltage variable frequency provided to the required acceptance induction motor.

III. THE PROJECTED SCHEME

Available general supply constant voltage is steady frequency AC supply. Using a converter and inverter circuitry to obtain variable frequency variable voltage source, an electronic plan is used with Arduino Uno as shown in Fig. 1

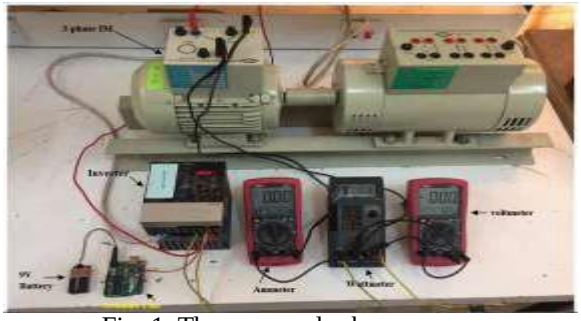


Fig. 1. The proposed scheme

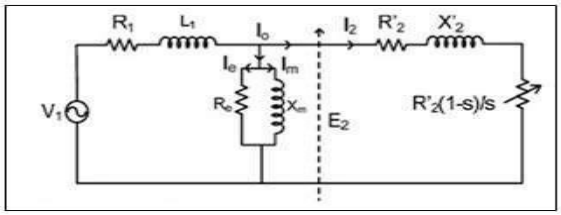


Fig. 2. The equivalent circuit of 3-phase induction motor

This plan is associated with a 3-phase induction motor to the squirrel cage rotor and the equivalent circuit of the motor shown in Fig. 2

A. AC Drive (Inverter)

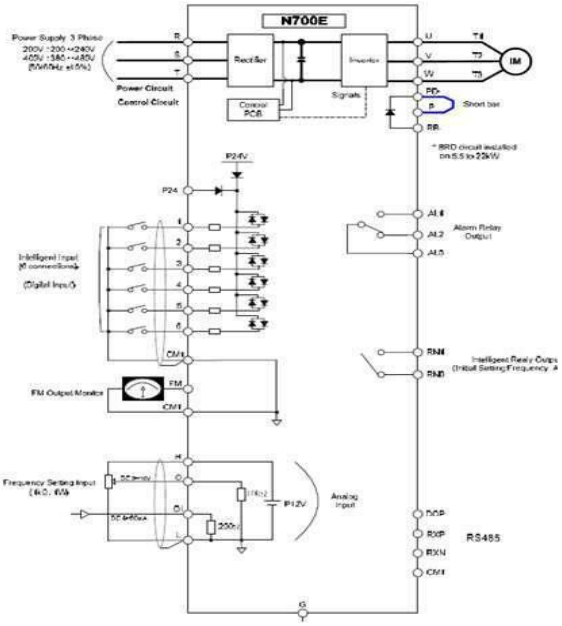


Fig. 3. The electronic scheme using converter and inverter circuitry (Ac drive)

The three phase inverter is associated with the three phase induction motor as appeared in Fig. 3. Inverter has a rectifier which changes over fundamental single-phase supply into DC supply. The output wave of the DC bus utilizing capacitors is separated and smoothed. The filtered output DC is giving only three phase inverter, the output of this inverter is variable frequency variable voltage with constant proportion of V/F.

The output of the inverter is in the scope of frequency (0.01 to 400Hz), so it is accessible to work with various applications, the output frequency is controlled through the different techniques accessible in the inverter, for example, the potentiometer or control input where there is 4 pins. should be possible. Contribution to include contribution to the output frequency in various ways.

B. *Arduino Uno*

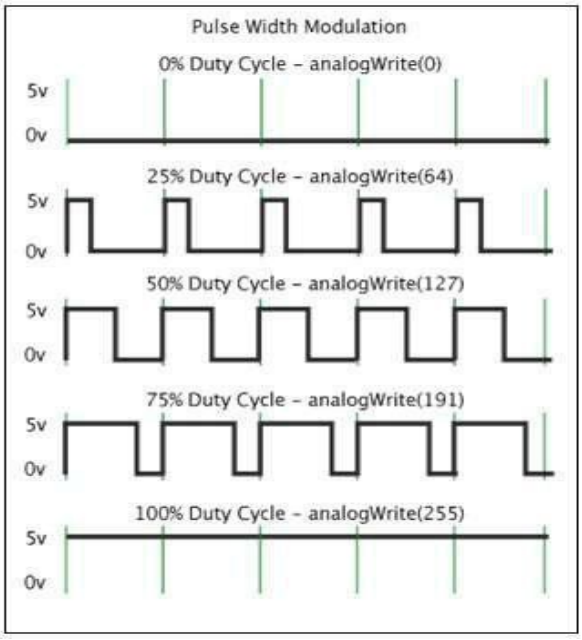


Fig. 4. PWM signals of Arduino Uno

It is a microcontroller chipset dependent on ATmega328. There are 14 computerized info and output pins (6 of them are utilized as PWM output), 6 simple sources of info, one of the highlights of Arduino Uno, this is PWM, and this is to accomplish a simple outcome with advanced guidelines Is the innovation.

A square wave is made by computerized control, the signal is turned on and off, and it reproduces the voltage between full (5 volts) and full off (0 volts) by changing the on-off style time flag cost bit is. Time v. Signs stop. The length of "auspicious" is called heartbeat width. To get distinctive simple qualities, compose the suitable code and control the beat width. The image (4) speaks to PWM signals taken from Arduino the green lines in Fig 4 show regular time periods. This time period is the inconspicuous inversion of the frequency of PWM. This implies when the frequency of PWM of Arduino is around 500 Hz, at that point the green lines (two milliseconds) measure. By composing the direction simple right () with a size of 0 - 255, which will return 0-5volt to Arduino Uno PWM output in turn, so analog compose(255) demands (5V) 100% charge cycle, and simple form (127) (2.5 V) half is the expense cycle

IV. OPERATION AND EXPERIMENTAL RESULT

Control signal pins enable the inverter to be controlled in various ways, Arduino Uno is utilized In request to control the inverter activity, as appeared in Fig. 5, by choosing the proper frequency and keeping up the proportion of v/f consistent, smooth speed control, the whole task of the supply of variable frequency variable voltage to induction motor Arduino Uno is added to control. Induction motor is conceivable. A trial test has been finished utilizing an inverter, whose output frequency is set to 50 Hz by its human interface monitor, the output frequency of the inverter is controlled through its control contribution, in which the scope of 10 volts 20mA , So associate the Arduino Uno to the control signals utilizing the inverter stick and the PWM Arduino Uno output (0-5 volts) Is gotten Ej range and it is composing a code. Arduino Uno coding language wipes out a smooth increment of the whole task and Arduino Uno output voltage, and thus increment in inverter frequency and voltage. Arduino controls the output voltage in the uno coding language (0-5 volts) by setting the direction at the order esteem (0-255) in the direction. This PWM flag (Arduino Uno output voltage) is provided to the control signal pin of the inverter.

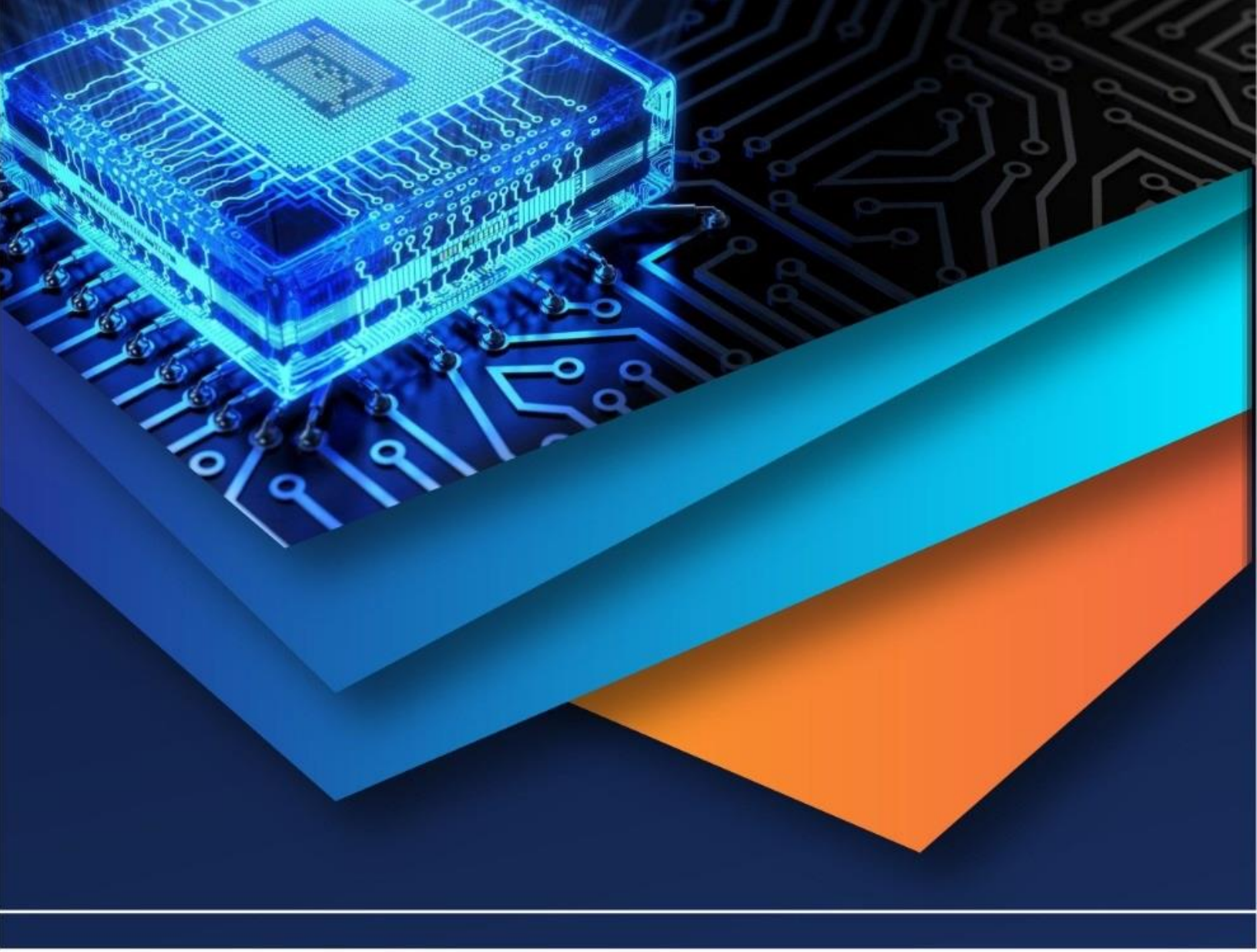
So as to maintain a strategic distance from immersion in the stator and rotor center, the V/F proportion should be steady and the proposed plan directs a decent V/F proportion as appeared in fig 6, showing that when the Arduino Uno voltage frequency and Output voltage was increased. Inverter additionally expanded the adjustment of the V/F proportion to stay away from immersion. In any case, when the voltage achieves 250v, its value has not changed further, and that the greatest output voltage of the inverter is because of the reality of 250v. Fig. 7 demonstrates the association between the changing V/F proportion and the speed of the induction motor, when the Induction Arduino Uno output voltage for the contribution of the inverter will increment all the while in the frequency and output voltage and the speed of the speed increase motor . The outcomes are plotted utilizing Matlab R2015a.

V. CONCLUSION

Speed control of induction motor is a standout amongst the most slanting themes today, through this paper, we found another technique to control the speed by the frequency distinction of the induction motor utilizing Arduino Uno, A smooth control demonstrates the output frequency by setting the code written in the Arduino Uno coding language. This code will control the whole activity by changing the Arduino output voltage and it will change the output frequency and voltage of the inverter and the subsequent induction motor will be changed, setting a particular time for each speed, can code distinctive applications To accomplish the ideal speed can be effectively altered, it is a talented route through the accompanying realities Received, its utilization is low power in light of the fact that Arduino can just work by interfacing 9V battery. The arrangement can be moved up to add an Ethernet shield to control the task from a removed territory.

REFERENCES

[1] Aung Zaw Latt, Ni Ni Win, 2009, Variable speed drive of single phase induction motor using frequency control method, International conference on education technology and computer, pp. 30-34.
[2] Bakshi, U. A., Bakshi V. U., 2007, Electrical Machine, Technical Publication, I edition, Pune.
[3] Thida Win, 2008, Analysis of variable frequency three phase induction motor drives, World academy of science, engineering and technology.
[4] Bimbhra P. S., Electrical Machinery, Khanna Publishers, 7th Edition, New Delhi, 2010.
[5] Gopal K. Dubey, Fundamentals of Electrical Drives, Narosa Pusblishing House



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY