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Research on motor control and simulation based on PID and Internet of Things system

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ABSTRACT

A motor application consists of a Single Phase Induction Motor, and it has single-phase winding, which is winding on the stator of the motor and a winding placed on the rotor. A pulsating magnetic field is produced when a phase supply energizes the single-phase induction motor's stator winding shown below. In the existing method, DTC (Direct Torque Control) is based on converting alternating source and fed to the desired source motor low efficiency and high speed. So in this proposed method, Induction Motor Using Proportional-Integral-Derivative (PID) and IOT (Internet of Thing) for Inverter based achieving an efficiency output voltage or with the lowest amount of ripple content, the high switching frequency. Proportional Integral Derivative (PID) is an emerging technique for controlling PWM (Pulse Width Modulation) Inverter-Fed Induction Motor (IM) drives. The precise and quick inspection of the IM (Induction Motor) flux and torque without calling for complex control algorithms. In principle, moreover, it requires only the knowledge of the stator resistance. The application reviews an IM (Induction Motor) essential operation and a PWM (Pulse Width Modulation) inverter using the space vector theory. The IOT (Internet of Thing) control is a monitoring application of a Checking and controlling compliance and boundary is essential in many applications. The reliable functionality Policies available for equivalents and handles Observing different boundaries and three control.

1. Introduction

The induction motor has a fixed exterior, stator, and rotor interior with a carefully wound air gap between them. Almost all electric motors use magnetic field rotation to rotate their rotors. A single-phase induction motor is usually generated in the input source stator due to the rotating magnetic field. DC (Direct Current) motors rely on a mechanical or electronic correction to generate a rotating magnetic field. There is no direct way to get control output from command input. Therefore, we need to generate comparable data for output control. This is achieved through three phases of two-phase conversion to obtain magnetic flux and output equivalents of torque. The equal phase circuit of the machine is useful in a steady state. In variable speed drives, the device usually contains an element in the feedback loop, so its transients must be considered. Besides, higher performance than control, such as space vector control, depends on the machine's dynamic model DQ (Direct Quadrate). Therefore, we go to the DQ (Direct Quadrate) model to understand the space vector control principle. Differential equations can explain Fig. 1 Switching device based on Motor control and show the interaction of time and machine design and requirements, but this model is often quite complex.

Proportional-Integral-Derivative (PID) is the given pulse is generated by comparing the high- frequency with the modified waveform of the vertical triangular waveform. You can follow the steps below to implement mathematical modeling. The symmetric pulse modes of two intervals in a row are to switch between frequency and sample time. The symmetric pulse is conveniently distributed between the width and the full time to describe. Induction motors are material-type motors that use electromagnetic induction for power rotating devices. The motor is another commonly used name because a rotor bar with a short circuit is similar to a cage motor. A device that converts energy into mechanical energy through a universal rotor. There are many ways to activate the rotor. Unlike previous models of static mechanical transformers, it has an almost sinusoidal distribution throughout the rotor performance. The generated stator current rotates clockwise, and the motor rotates clockwise. The capacitor resistor must be provided in parallel.

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2. Related work

However, there is a massive gap between energy production and demand for the country. Due to geographical and economic factors, two-thirds of the villages have electricity [1]. Solar energy technology is a breakthrough that generates energy in the office and eliminates installation costs and losses [2]. To overcome these energy quality issues, this article proposes an alternative drive system for exercise. Fixed bolt/hertz control of induction motors with matrix converters. The Matrix converter is a relatively new AC (Alternating Current) voltage controller that can provide a controllable output voltage at an available frequency, maintaining the required power quality at the input and output ends [3]. In addition to working as an improved power quality driver, conventional drivers require induction motor drivers based on matrix converters to provide single-stage AC (Alternating Current) to AC (Alternating Current) and DC bus system [4].

Another drive system is based on the MC (Matrix Converter) to overcome the power quality problems associated with traditional voltage sources [5]. In addition to improving power quality on the power supply side, the matrix converter needs to be integrated into a single-phase such as induction motor drive base and AC (Alternating Current) conversion, power storage components, orientation and almost eliminated. Effect AC (Alternating Current) means a reduction of [6]. However, the dynamic response of MC (Matrix Converter) based drive systems is that due to inherent limitations, MC (Matrix Converter) based drives and conventional PWM (Pulse Width Modulation) and VSI (Voltage Source Inverter) drives generally compromise speed control. The function provided is very similar to the function provided and is the most modulated algorithm for a matrix converter [7].

PLLC (Phased Locked Loop Control) Estimate the frequency and amplitude of each voltage / current waveform of the Induction Motor (IM) [8]. The current/other two voltages are used to provide an accurate delay estimate using the propagation delay. Additionally, the Induction Motor (IM) speed (phase gate lock loop control) is estimated by PLLC's (Phased Locked Loop Control) frequency command. Due to the PI-controller's poor performance [9], the current, magnetic flux, torque, and velocity are significantly distorted [10]. Direct torque and flux control is a novel form of the MPC (Model Predictive Control) [11]. Then, from the angle of the power supply (three-phase inverter), the method. Instead, it uses the same voltage vector used in the controller's control operation for the full sample period, similar to the standard direct torque and flux control strategy [12].

The three-stage acceptance engine is well known and well versed with the machines in the industry. The weight ratio has a simple plan, so efficiency is high and easy to maintain. Acceptance engine V / f has a considerable application in the control industry [13]. The control method involves keeping the reciprocating voltage constant to the ratio of the receiving engine. Check the PID regulator against the closed-loop frame, limiting the squirrel enlightenment engine to a constant volt/hertz ratio [14]. The inductance grid indicates this in the conversion operation based on the probe engine or engine L grid. The engine displays the client's features and order for faster execution. Known controllers calculated in recent years include traditional controllers [15].

The common for all regular regulators to know the numerical layout is to plan the regulator. Strange controllers use another way to deal with a regulator plan that does not require information on the numerical pattern [16]. Examples of the unpredictable regulator are the fluffy regulator and Nero or Nero-fluffy regulators. Many current cycles are simple and subsequently confusing to describe numerically.

The numerical layout of the framework for general oversight of all formal regulatory bodies. The whimsical controller uses another method to handle the information that the voltage regulator design does not require a numerical pattern on the cycle [17]. Examples of unpredictable conditioners are fluffy adjusters and Nero or Nero fluffy adjusters. Most modern wheels are simple and are then written in chaotic numbers. The boundary of the regulator is adjusted. Relative (P), Integrated (I) and Auxiliary (D): This type of control, based on three basic types of movements, shows essential or reasonable experience. Instead, a large number of primary PID (Proportional-Integral-Derivative) controllers use several complex controllers to control robotizing, which can interfere with some multiple cycles and therefore cause a certain number of complicated cycles [18]. PID (Proportional-Integrated-Derivative) controllers and their different controller construct blocks require different loop controls [19].

To describe highly unpredictable control problems, especially when combined with various useful squares, channels (fixing agents or

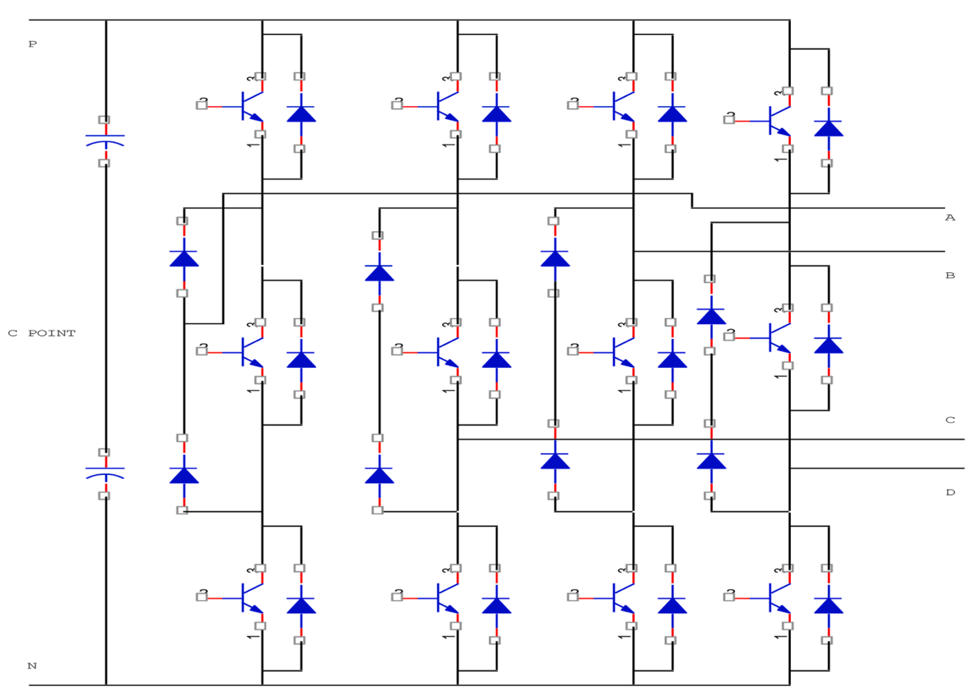

Fig. 1.. Switching device based on Motor control.

adjusting blocks), selectors, etc. As the PID (Proportional-Integrated-Derivative) gradually improves (the ratio of the integral derivatives of the clock) has not yet been approved by regulatory agencies, this necessary calculation will have a measurement control role in the future. It is the backbone of a very complex control framework. This section studies the PID (Proportional-Integral-Derivative) controller based on numerical performance and required engine speed control [20].

3. Materials and method for motor control and simulation based on PID and Internet of Things system

The induction motors have a standard range of many industries and traction applications. Thus, the regulation of induction motors has become popular and the focus of researchers in recent years. Proportional Integral Derivative (PID) is one of the methods used to control the operation of excitation motors capacity. Asynchronous motors, also known as asynchronous motors, are engines commonly used in industrial applications. Due to the low power consumption, user-friendliness and reliable characteristics of these machines, winding induction motors are widely used in electric motors, especially biological applications. Fig. 2: Proposed Block diagram Based Motor Control and PID (Proportional-Integral-Derivative) and Internet of Things System. They are available in the ranges of several Horse Power to multi-output capacity.

The power motor source is available in single-phase and multi-phase (single-phase). Phase drive torque demand controllers are commonly used in high variable speed drives. Asynchronous motor technology is an AC (Alternating Current) motor that supplies power to the rotor using electromagnetic induction. Thus, the three-phase squirrel cage is modulated by the induction motor space vector. The control strategy is used to differentiate motor speed and torque characteristics. When the magnetic motor rotates, it acts between the electromagnetic stator's windings and between the rotors called by the rotating application. The source on the stator side converts the electrical energy into mechanical energy, generating an electromagnetic field that interacts with the secondary produce.

3.1. Induction motor (Im)

Induction motors are called asynchronous motors, which are the most common motor used for industrial applications. The induction motors are incredibly standard, used motors for home and industrial applications because these machines are very economical, durable and reliable and used in the partial throat work range with a capacity of several megawatts. Fractional horsepower motors can be used in multiple stages (Single-phase) and a single phase. Three-phase motors are mostly used in variable speed drives with torque requirements. An induction motor or asynchronous motor is a type of AC (Alternating Current) motor in which electrical power is supplied to the rotor by electromagnetic induction. Because the magnetic force acts between the motor and the static electromagnet rotating, it is called the rotating electromagnet, the stator and the rotor. The current on the stator side interacts with the secondary, converting electrical energy into mechanical energy and producing the resulting torque, which produces an electromagnetic field.

The two motors' stator structure is the same, and when three-phase power is supplied to the three-phase stator windings, a magnetic field is generated, which rotates with constant amplitude at synchronous speed. This rotating magnetic field rotates across the rotor conductor, which induces Electromagnetic Force (EMF) in the rotor conductor. When the conductor in its rotor is short-circuited, the excited electromotive force sets the current in the rotor conductor's direction, causing the rotor to rotate like a magnetic field, thereby reducing its relative speed to produce torque. The rotor's speed gradually increases and tries to catch up with the rotating magnetic field's speed. Still, when it catches up with the magnetic field's speed, the relative speed becomes zero. The EMF (Electromagnetic Force) disappears, so the synchronous speed should not be reached when the torque guided by the rotor conductor is zero. Therefore, the rotor does not maintain the magnetic field's speed, but at the rotational speed Nr, which is slightly slower than the synchronous rotation speed.

Fig. 3 shows the equivalent circuit of Induction Motor. The stator is a steel frame surrounded by a hollow cylindrical iron core, made of thin silicone steel laminate that can reduce eddy current and hysteresis losses. Uniform long grooves are cut in the inner perimeter of many cores. The stator conductors are also separated from the slots and placed in these slots. These conductors are connected by a balanced three-phase star or delta windings. Depending on the speed requirement, the winding is wound with a certain number of magnetic poles. If the required speed is low, and vice versa, convert it into more columns. The rotor is the rotating part of the induction motor and is mounted on the motor's shaft. Any mechanical load can be connected to the shaft. According to the structure of the rotor, induction motors are roughly divided into two categories and Cage motors and slip ring motors.

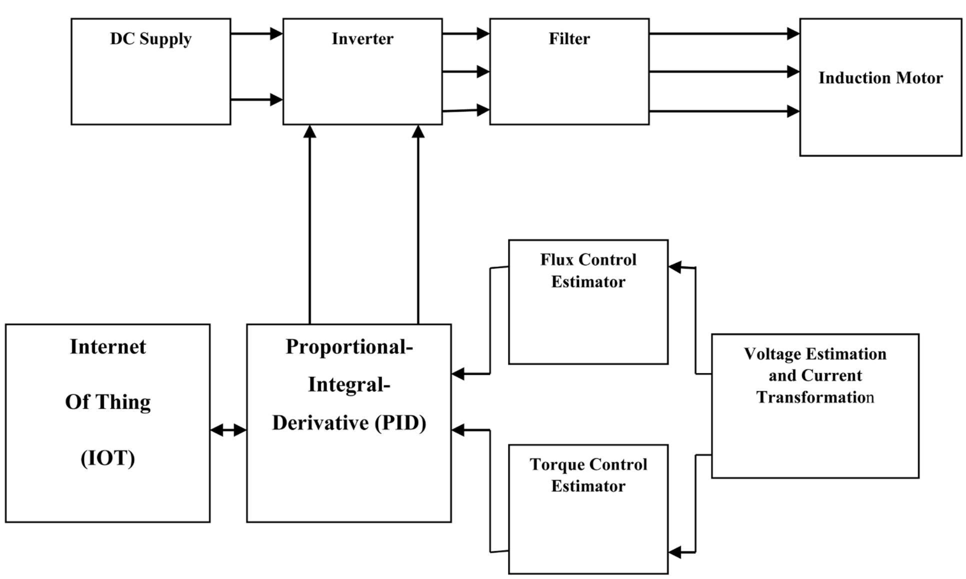

Fig. 2.. Proposed Block diagram Based Motor Control and PID (Proportional-Integral-Derivative) and Internet of Things System.

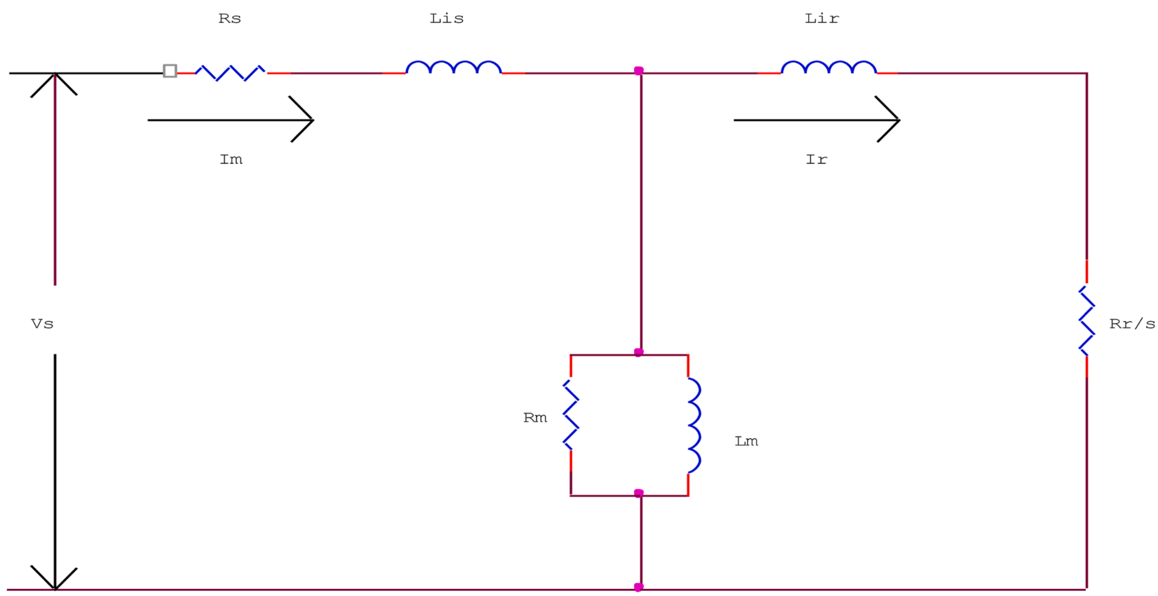

Fig. 3.. Equivalent circuit of Induction Motor.

3.2. PID controller

The proportional essential subordinate regulator is the most widely used component of the traditional control circle (regulator) mechanical control framework. PID (Proportional Integral Derivative) is a regularly used Critic controller. A PID (Proportional Integral Derivative) controller calculates "error" respect as the difference between an intentional cycle variable and an ideal set point. The controller wheel attempts to limit the error by changing the control inputs. The PID (Proportional Integral Derivative) regulator count (calculation) has three different fixed boundaries, as well as what is now called three-time control: proportional, integral and derivative properties, i.e., P, I and D. As a heuristic, these properties can be understood Time: P depends on current errors.

Fig. 4 describes (Professional-Integral-Derivative) by tuning the three boundaries of the PID regulator calculation, the regulator can give the control function intended for exact cycle requirements. The regulator's reaction is related to the regulator's response that the regulator has exceeded the set point and framework swaying level. The collection of past mistakes and future mistakes in terms of current progress.

The total control component cycle includes the condition of the control valve or the power supplied to the heating component. Without information on the primary cycle, the PID (Proportional Integral Derivative) regulator is the best regulator. Note that PID's use (Proportional-Integral-Derivative) calculation for control PID's not ideal control of framework stability. Some applications require the use of certain functions to give proper framework control. This is achieved by setting different boundaries to zero. A (Proportional-Integral-Derivative) PID controller that does not have specific control functions is called a controller virtually standard because the subordinate performance assessment touches the fuss. Simultaneously, the primary term's triviality prevents the framework from getting its objective promotion due to the control functionality.

3.3. IOT (Internet of Thing)

Early clinical trials and expansion of IoT (Internet of Thing) networks began with integrating industrial equipment. Today, the Internet of Things' focus extends from industrial equipment to all connections of everyday objects. Project types range from gas turbines to utility meters to automobiles. Organisms such as plants, livestock and humans can also be included. For example, Essex's livestock tracking project uses data collected from radio stations. Monitor diseased cows and keep tags to know the behavior of the herd. The wearable computing and digital medical devices Nike + Fuel Band and Fit bit are examples of how people connect to the Internet on the Internet of Things. Cisco is all about people, places, things and everything. Expand the definition of the Internet of Things to the Internet. Fig. 5: Building Blocks of IOT Architecture and the connection with any content sensor that can be attached allows you to join the newly connected ecosystem.

The motor connected a physical object to one or more sensors. Each sensor monitors specific conditions such as position, vibration, vibration

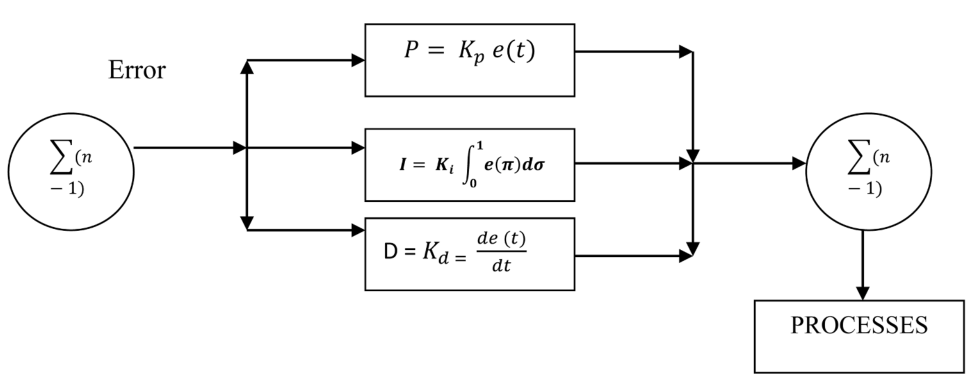

Fig. 4.. working principle of Proportional-Integral-Derivative.

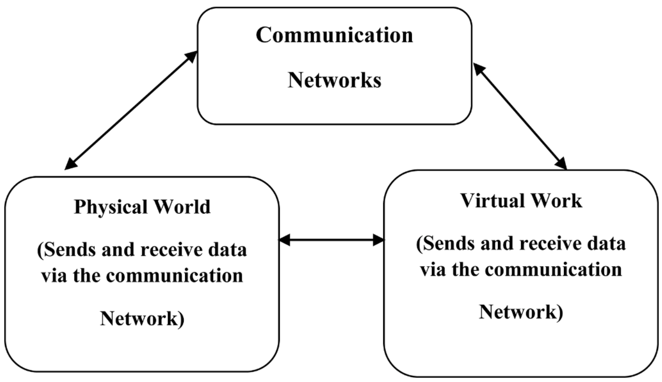

Fig. 5.. Building Blocks of IOT Architecture.

and temperature. These sensors are interconnected to systems that can understand or display information from sensor data sources on the Internet of Things. These sensors provide new information to company systems and staff. Monitoring and remote control of various parameters of three-phase asynchronous (Induction Motor) IM based on the Internet of Things [Iot]. The sensors and sensor modules monitor the induction motor temperature, current and voltage and other parameters and send them to the processing unit to display these parameters on the server. The (Induction Motor) IM based Internet of Things [IoT] system provides automatic and manual control methods to stop or start induction motors to prevent system failures through the server gateway. This program improves the execution machine's efficiency by preventing and constantly monitoring failures to determine preventive maintenance.

4. Result and discussion for motor control and simulation based on PID (Proportional-Integral-Derivative) and Internet of Things system

MATLAB (matrix laboratory) is a multi-paradigm numerical computing environment. A proprietary programming language developed by Math Works, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, and they create Simulink model for power system and power electronics-based models.

Fig. 6 shows the Simulink model for the carrier wave modulation strategy based induction motor, which is strategy is effectively controlled speed /torque characteristics of the Induction motor.

Fig. 7: The frequency **WR**WR* is the required variable (electrical rotor angular speed where mechanical speed is **WM**WM = **W**.R.W.R./ Pole pairs). It is approximately equal to speed, neglecting the small **slip** frequency WSL of the **machine**.

$$W_{r=W_{m-}W_{slip}} \tag{1}$$

Fig. 8: The Torque /speed characteristics of induction motor the waveform describe the electromagnetic torque= 30 N-m, rotor angle = three (rad).

Table 1 gives the Sensor modules were used to monitor different parameters, current, voltage, temperature and power are processed using a PID (Proportional Integral Derivative) controller for analysis and display purposes. The Internet of Things (IoT) module is used for wireless remote monitoring to send information from the microcontroller to the cloud database to control the induction motor. This system is implemented to monitor and control various parameters in real time, and it improves the detection of limiting current, voltage, temperature and speed values on various faults. The proposed system has great potential for real-time and safe monitoring of machine status in complex systems and economical industrial environments.

The technological advancement to achieve reliability in motor applications. Fig. 9 gives the continuous monitoring and reliable and straightforward control of high-power induction motors used in various industry sectors. System reliability ensures that abnormal situations are easy to detect and correct. Induction motors used in most industries are required to monitor financial data. Induction motors can improve industrial productivity through preventive maintenance. By taking this measure, preventive measures against system failures and high-cost horsepower motors can be avoided. Based on the Internet of Things (IoT) to monitor and control induction motors in the industrial sector to achieve secure and financial data communication

A motor is an indispensable machine, and it can even fail at times. For example, industrial motors can cause motor failure due to lubricating oil content, electrical factors, motor ventilation, alignment, and motor load. These factors can cause the motor to vibrate, critical levels or other failures and the motor temperature rise. By overcoming the difficulties of other methods of maintaining motor status over time, the

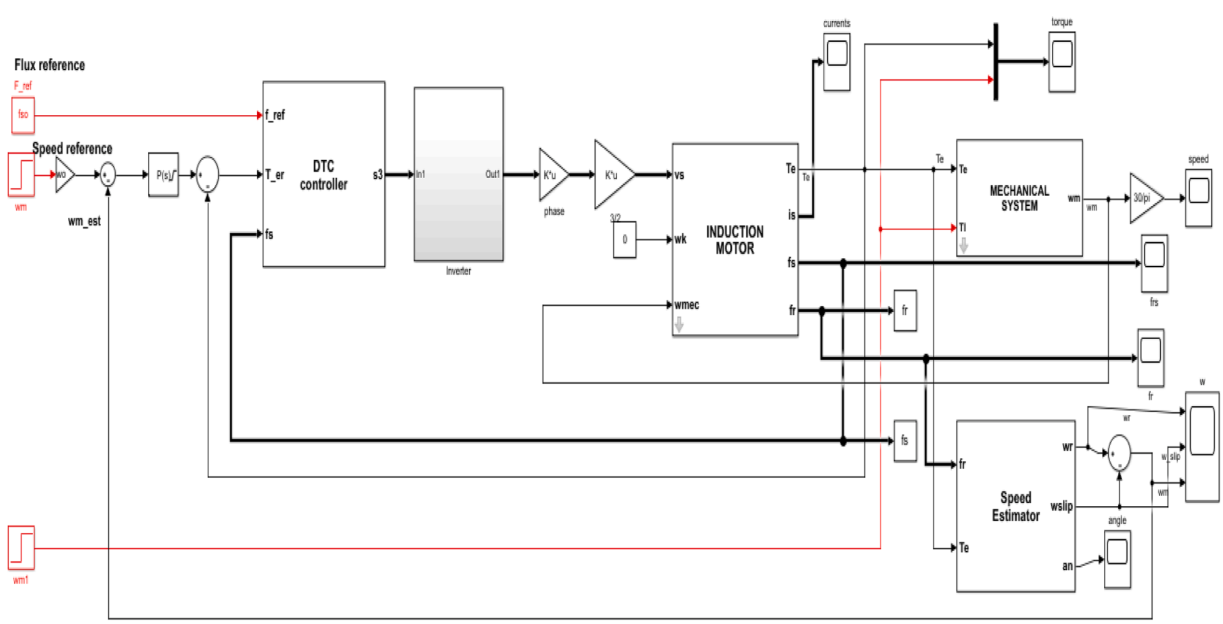

Fig. 6.. Simulink model for (Proportional-Integral-Derivative) based induction motor.

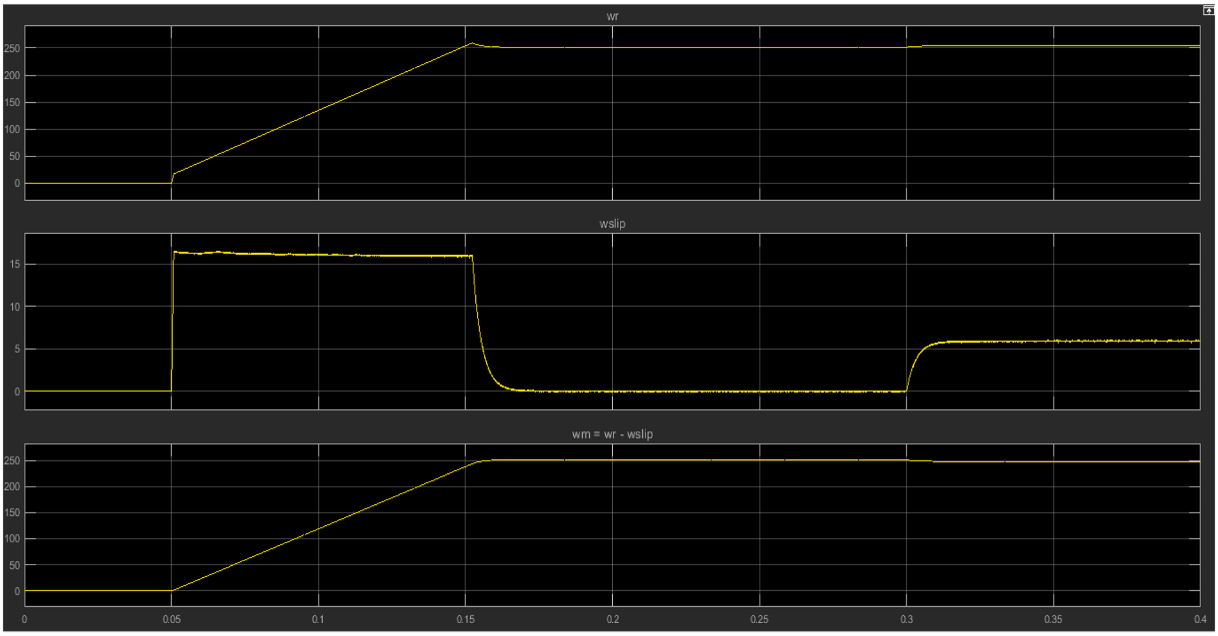

Fig. 7. Output source of induction motor.

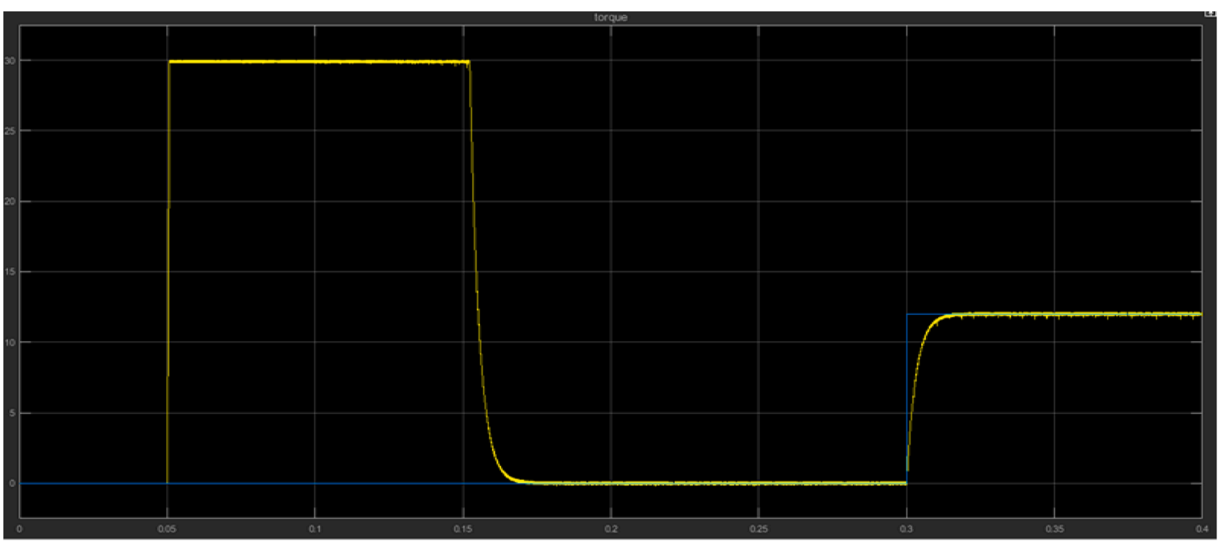

Fig. 8.. Torque/speed characteristics of induction motor.

Table 1.
Observation from resistive load using induction motor based on pid (proportional integral derivative).

Parameters		No Load	Half load	Full Load
Input	Voltage (V)	540	235	320
	Current (I)	0	3	0.56
	Power (W)	50	260	320
Output	Voltage (V)	430	314	3.6
	Current (I)	1.03	2.25	70
	Power (W)	5.09	50	210
Temperature ©		43	94	221

Fig. 9.. Internet of Things (IoT) module for Induction Motor.

impulse motor's health can be easily assessed. Perform timely motor maintenance, even if accidentally shut down. On the other hand, condition monitoring requires some maintenance and provides motor condition and performance. Fig. 10 Circuit Diagram of Motor Control and Based on PID (Proportional Integral Derivative) and Internet of Things

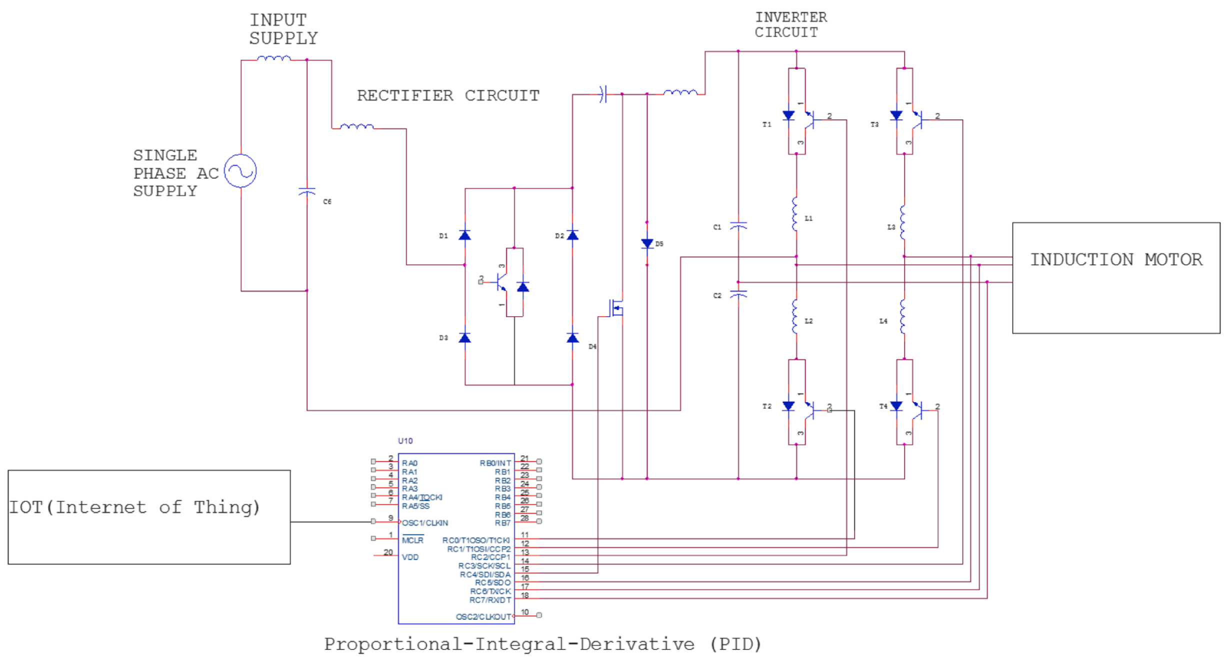

Fig. 10. Circuit Diagram of Motor Control and Based On PID (Proportional Integral Derivative) and Internet of Things System.

System and condition monitoring has become very important because it helps assess equipment performance conditions to optimize equipment performance reduce maintenance costs.

5. Conclusion

Induction motor drives, direct torque control is one of the best controllers proposed. It allows decoupled control of motor stator flux and electromagnetic torque. The examination demonstrated that this IM (Induction Motor) technique is clearer to actualize than other vector control strategies. It doesn't need a heartbeat width modulator and co-ordinates changes. Be that as it may, it presents undesired force and current wave. PID (Proportional-Integral-Derivative) utilizes a fixed D-q reference outline with a D-pivot lined up with the stator hub. Stator voltage space vector characterized in this reference outline controls the force and transition. A reenactment interface is model has been completely evolved. The outcomes show that the control procedure is more direct to execute than the vector control strategy since voltage modulators and improved and exchanging recurrence are looked after consistent.

Declaration of Competing Interest

We declare that we have no conflict of interest

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