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CONTROLLING INDUCTION MOTOR BY USING LATCHING CIRCUIT THROUIGH 3 PHASE VARIABLE FREQUENCY DRIVE

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Abstract:
The main aim of the project dealt with the concept of speed control of a three-phase induction motor with energy saving. To do so, a VFD (Variable Frequency Drive) is used for controlling the speed of a three-phase induction motor with variable load attached to the motor. It certainly leads to the best performance and high efficiency of the induction motor. In recent years, a major issue that is threatening Tamil Nadu for the past two years is the shortage of electricity. In such case, the unwanted energy should be saved. As a result, the implementation of VFD helps in saving a large amount of energy by reducing the sudden jerks happening at the starting of the motor. An experimental setup is designed using VFD & without VFD and the outcomes are displayed to prove the concept of energy saving.

Keywords: Variable frequency drive, three-phase induction motor, pulse width modulation, insulated gate bipolar transistor.

1. INTRODUCTION

A new trend to adjust the speed of a three phase induction motor is by using variable frequency drives. Generally, an induction motor can run only at its rated speed when it is connected directly to the main supply. However, many applications need variable speed operations. In most of the applications the input power is directly proportional to the cube of motor speed. In certain applications like induction motor-based centrifugal pump, a speed reduction of 20% results in an energy saving of approximately 50%. In today's modern era, driving and controlling the induction motor efficiently are the two important constraints. With the new innovations developed in the semiconductor fabrication technology, the size and the price of semiconductors have drastically gone down, which means that the end user can replace an energy inefficient mechanical motor drive and control system using a Variable Frequency Drive (VFD). The VFD not only controls the motor speed, but can improve the motor's dynamic and steady state characteristics as well. In addition, the VFD can reduce the system's average energy consumption. Distributed Control System (DCS) is broadly utilized as a part of numerous mechanical domainwhere checking and detail gathering procedure is required. DCS is a framework which alludes to the specific practical circulated control system outline that exists in mechanical process plants. This idea obviates the need to assemble information and control the system on an extensive scale. Run from object-oriented task to a more confounded process incorporating organizing, correspondence, checking, information gathering, information logging and continuous data display. Research to study variable frequency drive and its energy savings Paper tells about Simulation and circuit analysis of result then How to change of motor speed and Waveform analysis of speed torque. voltage, current.From the paper "monitoring and control of a variable frequency drive using PLC and

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SCADA" I learn the function of PLC(PROGRAMMABLE LOGIC CONTROLLER) and SCADA(SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEMS).

2. RELATED WORK

These motor drives are designed to be used in conjunction with a 3-phase induction motor. Because these motors typically only have an on/off state of operation, a VFD is needed if multiple operation speeds are desired. Also, apart from selectable speeds, the efficiency of the overall system is increased due to the fact that the motor only sees the necessary amount of input power to achieve desirable output power. Also, the motor can be slowly brought up to speed, eliminating huge start-up current spikes. The testing was broken down into two categories: small and large scale power circuits. The controlling circuit was kept the same.The small scale testing was essential because the power handling capabilities of the circuit at its initial prototype levels was not possible. Due to the large power demands, the large IRFP360PBF MOSFETs from International Rectifier were traded in for smaller switches IRF510 from International Rectifier as well.

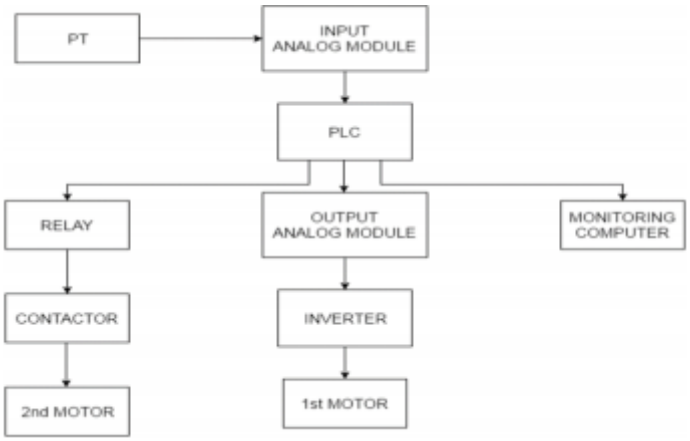

Fig.1.Block Diagram

The DC rails were reduced to 10V and obtained from a DC power supply instead of a rectified signal. Testing for the drive was done for a range of 40-80 Hz. Key nodes were probed and their signals analysed. The captures included in this report are the result of the small scale testing. While a complete large scale test was not completed due to a lack of components (PCB), the small scale test was a success. All the signals behaved as predicted. Additional testing is required, but must be done using a combination of PCB to ensure proper connections as well as proper power capabilities. You can divide the world of electronic motor drives into two categories: AC and DC. A motor drive controls the speed, torque, direction and resulting horsepower of a motor. A DC drive typically controls a shunt wound DC motor, which has separate armature and field circuits. AC drives control AC induction motors, and-like their DC counterparts-control speed, torque, and horsepower. Design Optimization of Induction Motor explains the Conventional Algorithms and AI and NIA Based Algorithms. Conventional Algorithms tells about the Effect of different step size, Effect of constraints, Effect of changing objective function. VF control provides a simple and cost efficient method for open-loop speed control of 3-phase induction motors. In future we can use low-cost VF solution can be implemented using the PIC16F7X7 family of devices. With three dedicated PWM modules implemented in hardware, it is ideal for controlling 3-phase induction motors.

3. PROPOSED SYSTEM

For industrial purpose the power is to be delivered for larger distance hence AC power supply is required to drive the motors. The rectifier in a VFD is used to convert incoming ac power into direct current (dc) power. There are 3 pair of rectifier combination is used for converting 3 phase AC into DC.Normally 6,12 or 18 diodes will be used to serve this purpose. Rectifiers can be built using diodes, silicon controlled rectifiers (SCR), or transistors to rectify power. After the power flows through the rectifiers it is stored on a dc bus. The dc bus contains capacitors to accept power from the rectifier and stores it and finally delivers that power through the inverter section. DC drives are still prevalent in the drive industry, making up some 40% of the market. VFD performance has improved so much in the recent past that DC drives are often replaced with AC machines that provide added benefits. There are applications, in particular very large, high-power, low-speed drives, where DC will be used for many years to come. The dc bus may also contain inductors, dc links, chokes, or similar items that add inductance, thereby smoothening the incoming power supply to the dc bus. The final section of the VFD is referred as an "inverter." The inverter contains transistors that deliver power to the motor. The "Insulated Gate Bipolar Transistor" (IGBT) is a commonly used one in modern VFDs. The IGBT can switch on and off several thousand times per second and precisely control the power delivered to the motor. To serve the above mentioned purpose the IGBTs uses a method named "pulse width modulation" (PWM) to simulate a current sine wave at the desired frequency to the motor. Motor speed (rpm) is The speed of the induction motor is directly proportional to the supply frequency and the number of poles of the motor. Since the number of poles is fixed by design, the best way to vary the speed of the induction motor is by varying the supply frequency. The torque developed by the induction motor is directly proportional to the ratio of the applied voltage and the frequency of supply. By varying the voltage and the frequency, but keeping their ratio constant, the torque developed can be kept constant throughout the speed range.

4. ANALYSIS

Fig.2.Exprimental Analysis

The essential target of this project lies in the controller part of the system, the assimilation of sources of input and output, executes furthermore the data acquisition device are additionally considered. The choice of specialized strategy and selection of communication method will incredibly rely on upon the usefulness. All the selected technique and the most appropriate devices and innovations utilized as a part of the system will be clarified in points of interest in the next section.

The major technologies utilized as a part of this system are Supervisory Control and Data Acquisition (SCADA), Programmable Logic Controller (PLC) and Variable frequency drive. This system is additionally a new thought that we are consolidating parts of electrical and electronic hardware together. It will help you to see how we can operate water pump utilizing PLC. We can deal with the water pressure required through PLC. The framework additionally permits the reassure to be physically segregated from the organ itself. The main association was through VFD an electrical link from the support to the transfer and contact on-screen character, with some early organ reassures using a different twist supply to work blend of theframe work. Standard water supply division contains three particular section for water supply. Firstly the pumping station, which does the sucking of water from thewater source. The second area is a filtration division in which estimation of pH and chlorine is done. The third zone is the movement section through which water is circled in all the city wards. Starting now these three regions are working freely. The critical issues in the water supply system are spillage, wastage of water or none- uniform supply of water and in bigger part open is using thesuction motor to suck water from central supply association, which diminish in water weight. The system performed the desired tasks according to the instructions. All the sensors work in an integrated way, PLC sends signals to the inverter and inverter drives motor pump. If the desired instruction is to slow down the water pressure, the second motor is automatically on to regulate the required pressure.

CONCLUSION

Utilization of automated systems like PLC & SCADA to regulate the supply of clean water. It increases the productivity and provides automation of work ease in access and reduce human efforts. Itincreases the productivity which leads to a decrease in production time thus reduces human effort. The intent of Info-U is to mimic real world devices as a method of creating software graphically It is composed of avirtual instrument such as knobs, meter, and oscilloscopes, all of which can be presented in theInfo-U front panel. It provides agraphical user interface to underlying code and a commonly used as the main interference in HMIs. Info-U can display values from thereal-time controller on an operator interface and can easily incorporate alarms and measurements for protection system.Implementation of an automotive HMI requires an interface, an HMI computer, and a method of the communication between the HMI computer and the PAC. It can be effectively used as event management and alarm indication.

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