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# Design of Three Phase Prevention, Detection and Correction System for Rural Area Industrial Application

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**Abstract** — *This paper presents an enhanced three phase prevention, detection and correction for rural area industrial applications. Now a day's industry uses 3 phase supply that cannot afford a failure of even a single phase. Failures of any phases make appliances prone to erratic functioning and may even lead to failure of that appliance. Goal is to build a system that can support one of the phase supplies with the help of existing phase supply. The development of this system will be achieved by using microcontroller which can be programmed using embedded. This microcontroller is then coupled with inverter using driver circuitry. If we go to have a three-phase inverter, which is available in market the cost of it is more. So, here is an attempt made to have single phase to three phase inverter using Microcontroller, which saves money up to great extent.*

***Keywords***-*RYB indicator, automatic phase selector circuit, MOSFET based inverter, microcontroller 89c51, induction motor.*

## I. INTRODUCTION

The three phase inverters are used for high power applications such as an ac motor drives, induction heating, and ups. A three phase inverter circuit changes DC input voltage can be from a DC source or a rectified AC voltage. A three phase bridge inverter can be constructed by combining three single phase half bridge inverter. In three phase inverter which is based on a novel three-phase uncontrollable rectifier inverter without or with a quite small dc-link capacitor. This inverter has many advantages such as simpler structure, higher reliability, more effective harmonics elimination .Inverter are widely used in many industrial applications such as variable-frequency velocity modulation, UPS, VAR compensator etc. In order to supply high quality power for loads, it is significant for this inverter to eliminate harmonics in output voltage effectively. Pulse width modulation (PWM) technique that has satisfied performance in harmonics elimination, voltage regulation, responding speed is widely used in all kinds of inverters. Another system which is based on Multilevel Inverter-Fed Induction Motor Drive in which the output harmonic content is reduced by using multilevel inverter. In symmetrical circuit, the voltage and power increase with the increase in the number of levels of inverter. The switching angle for the pulse is selected in such way to reduce the harmonic distortion. This drive system has advantages like reduced total harmonic distortion and higher torque. The model of the multilevel inverter system is developed with SVM strategy to control the induction motor

Cascaded H-Bridge Multilevel Inverter Using Micro-Controller for Single Phase Induction Motor. IGBT is used as power element. It is based on the symmetric regular sampling PWM with a single carrier and multiple modulating signals. This algorithm is implemented by a low-cost fixed-point microcontroller on an experimental five level cascaded inverter test-rig. Hardware is implemented using the PIC microcontroller PIC16F877. The advantages of the PIC microcontroller is that the instruction set of this controller are fewer than the usual microcontroller. Unlike conventional processors, which are generally complex, instruction set computer (CISC) type, PIC microcontroller is a RISC processor. The advantages of RISC processor against CISC processor are RISC instructions are simpler and consequently operate faster A RISC processor takes a single cycle for each instruction, while CISC processor requires multiple clocks per instruction. In the main routine the port c, inputs to the IGBT gate driver circuit produced by the controller, are used, firstly, we determine the IGBT combination to be switched ON and output values to the corresponding port C which is connected too gate driver circuit. After each PWM counter next combination is switched ON. This system having some demerits like Limited to certain applications where separate DC Sources are available, Usage of the power semiconductor switches increases exponentially whenever the level is to be increased and Each H-bridge needs an isolated DC supply compared to the other solutions which need only one supply. Enhanced Performance of Multilevel Inverter Fed Induction Motor Drive.

Implementation of Multilevel Inverter-Fed Induction Motor this paper presents the simulation and implementation of multilevel inverter fed induction motor drive. The output harmonic content is reduced by using multilevel inverter. In symmetrical circuit, the voltage and power increase with the increase in the number of levels of inverter. The model of the multilevel inverter system is developed with SVM strategy to control the induction motor. SVM is based on vector selection in the q-d stationary reference frame. The induction motors were mainly used for essentially constant speed applications because of the unavailability of the variable-frequency voltage supply. The concept of multilevel inverter control has opened a new possibility that induction motors can be controlled to achieve

 

dynamic performance equally as that of DC motors. AC input is rectified using a diode rectifier. It is filtered using a capacitor filter. DC is applied to the multilevel inverter. The output of the inverter is fed to the induction motor. The pulses are generated using SVM method. The speed loop ensures that the actual speed of the motor is equal to set speed. The torque of the motor is improved due to the elimination of the fifth harmonic, which produces negative torque. A Microcontroller based gating circuit generates the pulses required by the inverter.

## II. PROPOSED WORK

The objective of this dissertation is to present An Enhanced Three Phase Prevention, Detection and Correction System for Rural Area Industrial Application scheme for continuous power supply with reduced harmonics.

**Hardware Model**

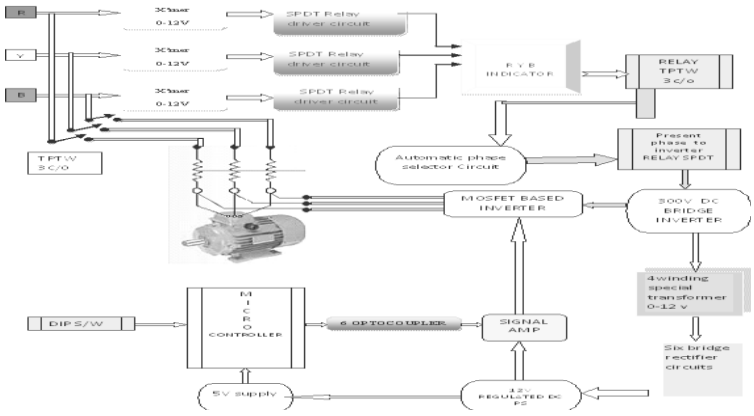


***Fig.1 Block Diagram of Proposed Work***

### 2.1 Rf Choke

It consists of capacitor and inductor connected in parallel. Inductor has ability to resist abrupt changes in supply frequency due to which high voltage pulses are removed. Capacitor by passes AC and blocks DC. Any DC component present in AC is removed. The output of RF choke filter is given to step down transformer.

### 2.2 DIP SWITCHES

DIP switches are used as input to the microcontroller 89C51. The DIP switches are consist of 8 parallel switches; they are used as follows.
SWITCH 1: To turn on or off the whole DIP.
SWITCH 2: it is used to select the 120 and 180 deg. mode of inverter.
SWITCH 3: MASKED.
SWITCH 4: MASKED.
SWITCH 5, 6, 7, &8: Used to generate variable frequency.
The output of the DIP switches is given to the port 1 of microcontroller 89C51 is used to select the appropriate frequency as well as to select the mode of operation.

### 2.3 MICROCONTROLLER

The microcontroller 89c51 is used to generate six pulses PWM output in both 120 and 180 deg. Mode The output of DIP switches is accepted on input port that is port 1 and is processed and transferred on output port to display the six-pulse PWM waveform. Each time an interrupt is generating when particular time period of the frequency selected from DIP switches.

### 2.4 OPTOISOLATOR

The output of microcontroller that is six pulses is given to the input of 6 Optoisolator separately. Isolates the control circuitry from the power circuitry. The coast of control circuitry; to avoid this problem the control circuit and power circuit will damage the control circuitry are isolated from each other.

### 2.5 SIGNAL AMPLIFIER

The output of opto coupler is not sufficient for driving the MOSFET so amplification of signal is required. The Darlington pair TIP 122 is used which amplifies the signal such that sufficient to drive MOSFET circuitry. The Darlington transistor is mainly used to amplify the current which is required by the mosfet for operation.

 

## 2.6 INVERTER CIRCUITORY

The inverter circuitry consisting of power device named as MOSFET; they are connected in the bridge configuration MOSFET stands for metal oxide semiconductor for filled effect transistor which having many advantages other power device like MOSFET, FET and SCR. The 300V DC power supply is given to inverter circuitry and is converted into the 110 V AC supply. The output of inverter is can be obtained in either 180deg or 120 deg depending on the users requirement In the 120deg mode phase voltage waveform is quasi square while line voltage is of six step waveform. In 180deg mode the phase voltage is of six step waveform while line voltage waveform is quasi square waveform.

## 2.7 OPTOISOLATOR GATE DRIVE POWER SUPPLY

The 230V AC 50 Hz is given to the primary winding of the transformer. The secondary winding of the transformer is divided into four winding of the transformer is divided into four winding among which one is connected to the three separate bridge rectifier circuits. The secondary turns of the transformer are reduced to have 12V AC at the secondary winding. The 12V AC is further given to the rectifier circuitry to convert it into 10 V DC. This voltage is further given to opto isolator for its proper operation.

## 2.8 MOSFET BASED INVERTER

The D.C. supply to the inverter is derived from single phase 230 VA.C. Mains supply. Here in lies the beauty of the inverter; it provides total isolation of the input supply and output to the motor, allowing us to operate a three phase induction motor on a single phase supply. In system such as electrical vehicles where energy generated Is stored in large battery array, we can replace the A.C. supply- rectifier- filter assembly by a battery and battery charger assembly

## 2.9 Phase controlled motor drive:

This technique involves the control of the phase angle of supply voltage. A slip energy recovery scheme is used along with this to improve the drive efficiency

## 2.10 Frequency controlled motor drive:

This method involves changing synchronous speed by changing frequency of a.c. supply to motor to cause speed variation, as the true speed of the motor is very close to synchronous speed. Either voltage source inverters or current source inverters may be used. This project is based on a voltage source inverter using this method of speed control.

## 2.11 Vector controlled motor drive:

Independent control over flux and torque is possible in A.C. drives, as is possible in D.C. drives. The control is achieved by phasor control of rotor flux linkages. Vector control, or alternatively, field oriented control is achieved by suitably controlling the inverter to obtain correct values of frequency, phase, and current and hence control the flux phasor. This control technique has made A.C. drives superior to D.C. drives, as vector control drives provide independent control of flux and torque is improved dynamic response in compare

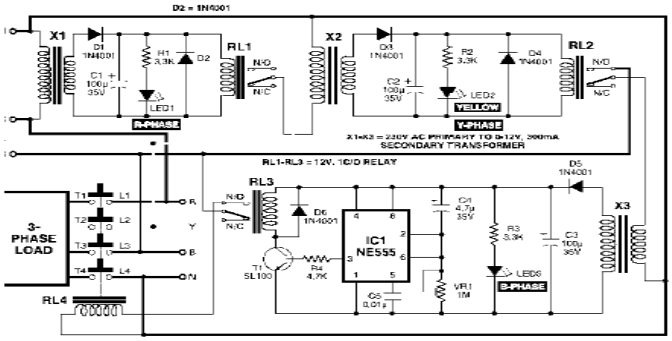


***Fig.2 Three Phase appliance protectors***

Automatic phase selector circuit select any one phase from main three phase supply. The complete circuit of a three Phase appliance protector is described here. It requires three-phase supply, three 12V relays and a timer IC NE555 along with 230V coil contactor having four poles. Relays RL1 and RL2 act as sensing devices for phases Y and B, respectively. These relays are connected such that each acts as an enabling device for the subsequent relay. Therefore the combination of the relays forms a logical AND gate connected serially. The availability of phase R energies relay RL1 and its normally opened (N/O) contacts close to connect phase Y to the input of transformer X2. The availability of phase Y energies relay RL2 and its N/O contacts close to connect phase B to the input of transformer X3, thus applying a triggering input to timer IC NE555 (IC1). Therefore the delay timer built around NE555 triggers only when all the phases (R, Y and B) are avail- able. It provides a delay of approximately four seconds, which energies Relay RL3 and its N/O contact closes to connect the line to the energizing coil of four-pole contactor relay RL4. Contactor RL4 closes to ensure

 

the availability of the three-phase supply to the appliance. The rating of contactor RL4 can be selected according to the full-load current rating of the appliances. Here the contact current rating of the four-pole contactor is up to 32A. The availability of phases R, Y and B is monitored by appropriate LEDs connected across the secondary windings of transformers X1, X2 and X3, respectively. Hence this circuit does not require a separate indicator lamp for monitoring the availability of the three phases. When phase R is available, LED1 glows. When phase Y is available, LED2 glows. When phase B is available, LED3 glows. The main advantage of this protector circuit is that it protects three-phase appliances from failure of any of the phases by disconnecting the power supply through the contactor and automatically restores the three-phase supply to the appliance (with reasonable time delay) when all the phases are available.

## III. EXPERIMENTAL RESULT

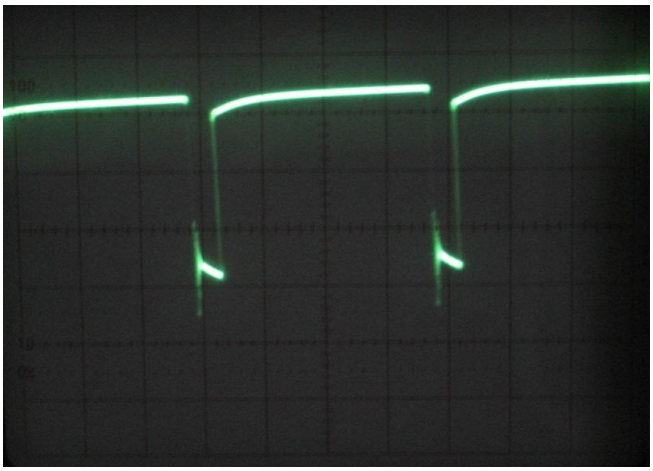

***Fig.3: TP1, TP2, TP3, TP4, TP5, TP6 – R, Y, B Phase Outputs of 89c51***

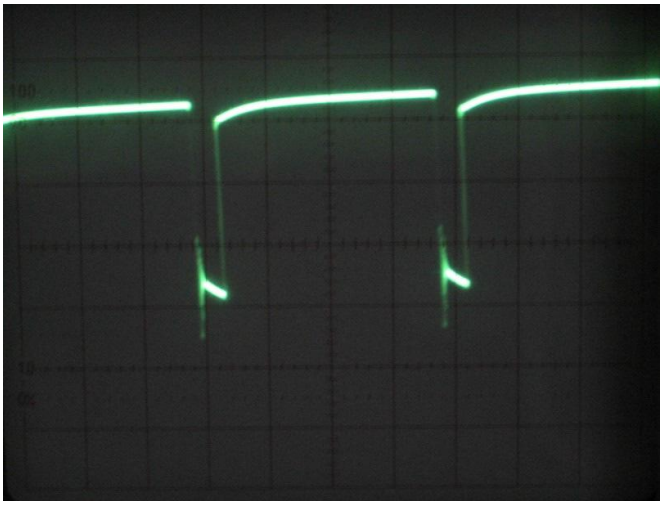

***Fig. 4: Control Pulse***

 

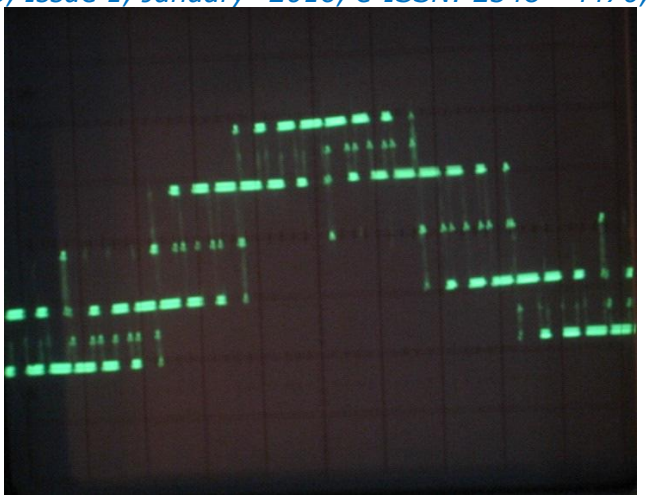

***Fig. 5: RYB phase output of inverter with respect to neutral***

## IV. CONCLUSION

Using microcontroller we can operate different industrial operation in relation with their time using three phase preventer and selector system. The system has significant excellences such as continue supply and low expenses.

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