Digitally Controlled Single Phase Transformer based Inverter for Nonlinear Load Application

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Abstract— The power electronics device which converts DC power to AC power at required output voltage and frequency level is known as inverter. Inverters can be broadly classified into single level inverter and multilevel inverter. Multilevel inverter as compared to single level inverters have advantages like minimum harmonic distortion, reduced EMI/RFI generation and can operate on several voltage levels. A multi-stage inverter is being utilized for multipurpose applications, such as active power filters, static var compensators and machine drives for sinusoidal and trapezoidal current applications. The drawbacks are the isolated power supplies required for each one of the stages of the multi-converter and it's also lot harder to build, more expensive, harder to control in software. This project is designed to monitor and switching the inverter by means of providing a password. The design of this project is a much improved version of the digital code lock which comes with a user defined password and LCD display. The user will be prompted to set a password at installation. This password inputted at installation will continue to serve the lock until it is changed. By inputting the preset password in the system the inverter will be switched ON through relay circuit.

Key words: Microcontroller, Sensors, Inverter, SPWM (Sinusoidal Pulse Width Modulation), MOSFET etc

I. INTRODUCTION

This project explains about the switching ON/OFF to the inverter by inputting the valid password, preinstalled during the software design of the system. This system demonstrates a circuit named Password based Digital Inverter wherein once the correct code or password is entered, the inverter is ON and the connected load will be access. In this paper, we present a single-phase inverter using a new switching strategy based on the use of pre-calculated switching angles. A microcontroller system is used to control the inverter switching process.

II. LITERATURE REVIEW

In this project, we will investigate the use of single phase transformer based inverter for non-linear load applications. There are several parameters that can be monitored for efficient operation of single phased transformer, although temperature, voltage, loads, current is considered in this work because they are major cause of transformer failure.

III. PROPOSED CIRCUIT

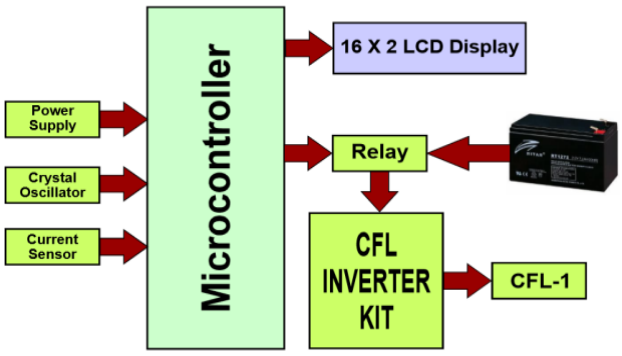

Fig. 1: Proposed Circuit

A. *Circuit Diagram:*

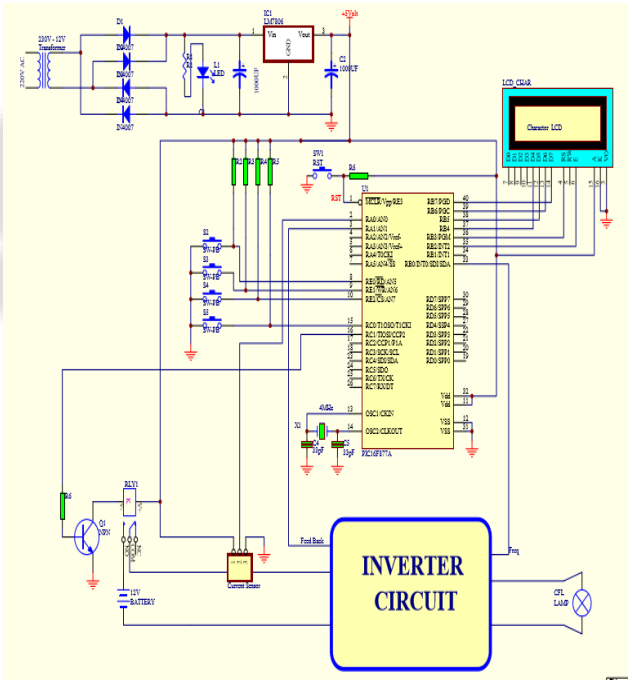

Fig. 2: Circuit Diagram

IV. OPERATION

To drive all the components in this circuit 5V dc and 12V dc are required. The mains give the 230V ac. The 230V ac is stepped down to 12V ac by using step down transformer. Then the output is given to the full wave rectifier. The rectifier eliminates the negative peak voltage of the input voltage .The output of the rectifier is the pulsating dc. The error pulses are eliminating by using capacitor filter. Then the output at the parallel of the capacitor is the 12V dc. But the Micro Controller works on 5V dc .To convert the 12V dc into 5V dc a regulator IC LM7805 is used. The output of the regulator is constant irrespective of the input voltage.

This supply is provided to the PIC controllers at pin no 1. An LED is connected in between the regulator and the controller to indicate whether the power is on or off. At pin no 1 of PIC we have connected a switch and the other terminal of the switch is connected to ground. So that when this switch is pressed the supply to the controller will be directly transferred to ground and in this way the controller gets reset.

A crystal of 20MHz is connected at the pin no 13 and 14 of the PIC controllers. Two capacitors are also connected in parallel at both the terminal of the crystal. This forms a crystal oscillator which provides machine cycle to the controller. Pin no 31 and 12 are connected to the ground and pin no 32 and 11 of PIC controllers are connected to 5v supply.

In this system an inverter circuit which is to be controlled by the microcontroller, is connected through relay and driver circuit to the microcontroller. A 12v relay is used to ON the inverter after pressing correct password in the system through the switches connected to the microcontroller.

A 4 digit password is set for the operating of the inverter. Hence four switches are connected to the microcontroller. When the password is entered by the user through switches, then the microcontroller reads that password and checks for the valid password. If the password is correct then the relay is ON by the microcontroller. This relay then turns ON the inverter and a CFL light connected to the inverter as a load will be ON. If the password is not correct then relay will remain in OFF condition. And light will also be in OFF condition. When incorrect password is entered by the user then LCD display will display a message as "Invalid Password".

A current sensor is interfaced in the system to measure the load current flowing in the circuit when the load is connected to the inverter. The output of the current sensor is given to the microcontroller. After processing the data microcontroller sends the data to the LCD display for display purpose. This LCD display will show the value of current in Ampere in the circuit.

The system is also designed to monitor the voltage and frequency of the inverter. Voltage is monitored and it is directly given to the internal ADC of the microcontroller. The microcontroller processes and digitize the data and display it on LCD display.

For calculation of frequency, interrupts are given to the microcontroller. By calculating the number of the interrupts frequency is measured by the microcontroller. This calculated value of the frequency is also displayed on the LCD display.

A16x2 LCD display is interfaced with the microcontroller in 4 bit mode. In 4-bit mode only 4 bit data is send to LCD. Since 8-bit microcontrollers contains data in 8-bit form so we divide our data in to two nibbles(1 nibble=4-bits). First higher 4-bits(nibble) are send to LCD and then the lower 4-bits(nibble). Only D4,D5,D6,D7 data pins of LCD are used in 4-bit mode. D1, D2,D3,D4 are left empty. D4 is our least significant bit and D7 is Highest significant bit. Interfacing LCD with PIC 16f877 is simple. Port-B first 4 bits (RB0,RB1,RB2,RB3) of PIC 16f877 are used to send 4-bit data and commands to LCD. These four Pins (RB0,RB1,RB2,RB3) are Connected to four data pins of 16x2 LCD (D4,D5,D6,D7). Port-D pin no 5 is connected to RW (read-write) pin of LCD. Port-D pin no 6 is connected to RS (register select) pin of LCD. Port-D pin no 7 is connected to EN (Enable) pin of 16x2 LCD. The data lines of LCD are connected at pin no 37, 38, 39 and 40 of the controller IC. The enable and RS pin is connected to pin no 35 and 36 of the controller IC. The anode terminal is connected to 5v supply and the cathode terminal is connected to ground. A variable resistor is connected to the VO pin of the LCD. This variable resistor is connected to adjust the brightness of the LCD. This display will also display the status of the pumps. This LCD display is connected in 4 bit mode with the microcontroller. In 4-bit mode, only four data pins of LCD are connected to the controller. This mode, thus, saves four pins of the controller unlike 8-bit mode.

V. CONCLUSION

This paper is mainly emplacing the minimization of losses with continuous operation, avoiding power demand by reducing the maximum power consumption. Password Based Digital Inverter project is used to curtail electricity consumption, positive limits within contracted demand so as to avoid the discharging of battery which minimizes the life of the inverter. It is useful in load shedding that helps to use the minimum implant generation and optimum utilization of both EB power and implant generation leading to low pay back period and high savings of power and money .

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