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Industrial Power Control by Integral Cycle Switching Without Generating Harmonics

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Abstract: *This project is intended to attain vital cycle switching – a technique to get rid of the complete cycle, cycles, or fractions of cycles of an AC signal. It is a renowned and aged technique of managing AC power, principally across linear loads for instance heaters brought into play in electric oven. However, the concept of achieving the cycle stealing of voltage waveform by the use of Arduino can be very precise as per the program written in Arduino C language so that the actual time-average voltage or currently experienced at the load is proportionately lower than the whole signal if applied to the load. In this project, we are using a comparator for zero crossing detection which is fed as an interrupt to the Arduino Here, delivers the output based on the interrupt received as the reference for generating triggering pulses. Using these pulses, we drive the Opto-isolators for triggering the TRIAC to achieve integral cycle control as per the input switches interfaced to the microcontroller. In place of a linear load to be used in the output, a series motor or lamp can be used to verify the output. One side effect of utilizing this scheme is an imbalance in the input current or voltage waveform as the cycles are switched on and off across the load. A lamp is provided in this project in place of a motor for demonstration purpose. The project output with a lamp appears to be a simple project of lamp flickering but the real objective is to verify in a CRO/DSO ,whether at the random switching also the load switches on at zero cross of the waveform or not. The power supply consists of a step-down transformer 230/12V, which steps down the voltage to 12V AC. This is converted to a DC using a Bridge rectifier. The ripples are removed using a capacitive filter, and it is then regulated to +5V using a voltage regulator 7805, which is required for the operation of the microcontroller and other components. Furthermore, this project can be enriched by using a feedback mechanism to automatically maintain the desired output to the load by appropriate cycle stealing*

Keywords: Arduino, Arduino Power Control without Generating Harmonics

I. INTRODUCTION

In today's world the life of people is becoming complex. The value of the time is increased to the top level. In this project.

II. OBJECTIVE

The main objective of this project is to eliminate the loss of valuable time required for billing and waiting in long queues and handling for trolley. This will also help in reducing the manpower required for the billing purpose.

III. CONCEPT

The paper is designed to achieve integral cycle switching, a method to remove whole cycle, cycles or portions of cycles of an AC signal. It is a well-known and old method of controlling AC power, especially across linear loads such as heaters used in electric furnace.

However the concept of achieving the cycle switching of voltage waveform by use of Arduino can be very precise as per the program written in assembly language so that the actual time-average voltage or current experienced at the load is

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proportionately lower than the whole signal if applied to the load. In place of a linear load to be used in the output, a series motor or lamp can be used to verify the output.

One side effect of utilizing this scheme is an imbalance in the input current or voltage waveform as the cycles are switched on and off across the load. In this paper we are using comparator for zero crossing detection which is fed as an interrupt to Arduino.

Here the Arduino delivers the output based on the interrupt received as the reference for generating triggering pulses. Using these pulses, we drive the opto-isolators for triggering the trial to achieve integral cycle control as per the input switches interfaced to the Arduino. A lamp is provided in this project in place of a motor for demonstration purpose. Further this project can be enhanced by using feedback mechanism to automatically maintain desired output to the load by appropriate cycle switching.

IV. Block Diagram

In this block diagram the A.C supply is given to the transformer to step down the voltage then to the rectifier from rectifier to regulator in between them the Arduino/Microcontroller and opto-coupler is also connected. And the output is shown on the LCD display

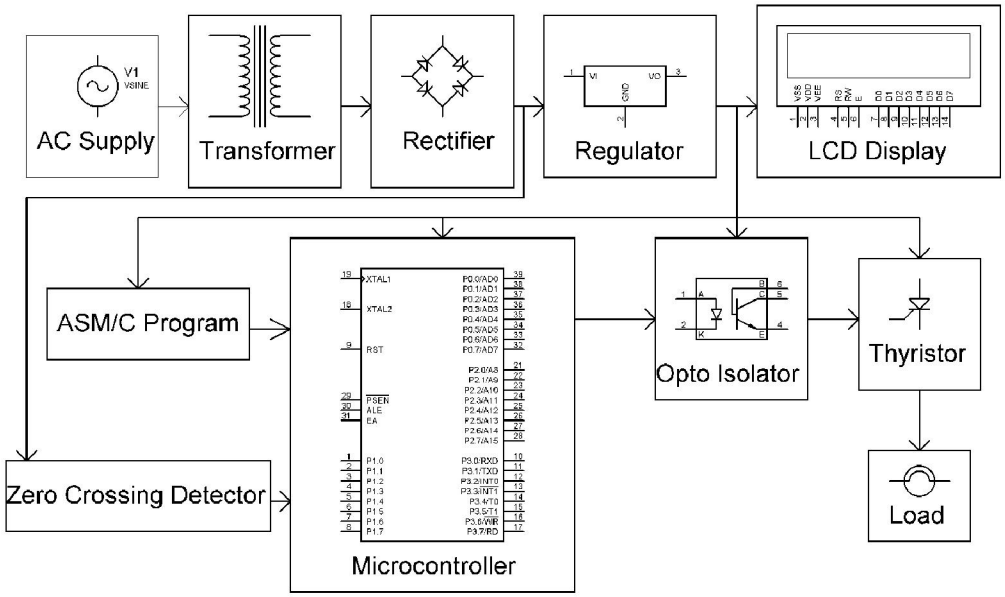
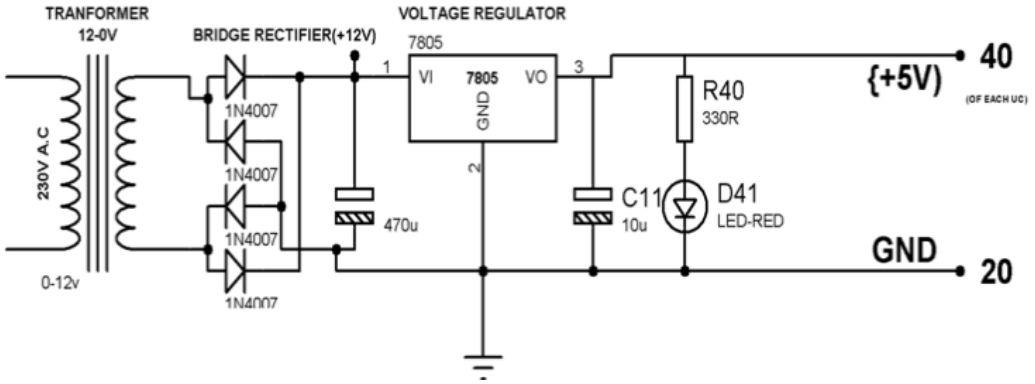


Figure 1: Block Diagram

V. Power Supply Chart



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VI. WORKING

In this project, when a AC signal is applied to the bridge rectifier circuit, it is converted into pulsating DC signal. This output is given to the opto-coupler. And whenever voltage is being detected only then the opto-coupler conducts. So, when zero cross over voltage is detected this input is given to the Microcontroller. We power up the chip when the power is high. Now the TRIAC is being triggered with desired value. And MOC 3021 chip is connected to the TRIAC gate because microcontroller cannot directly handle more voltage from AC to DC communication device. So, after the opto-coupler receives the desired value it will fire the gate, according to the angle and the TRIAC will be allowed to rotate the motor. Four switches are required to read the input values and four connections are made as shown in the code of ARDUINO. Resistor is connected for switch concept, because it has to shift from low to high positions.

The bulb is being connected to the power supply and the code from the ARDUINO is uploaded. Now the switch is being turned ON and the operation is performed. A lamp is provided in this project in place of a motor for demonstration purpose. The project output is shown with an AC single phase motor.

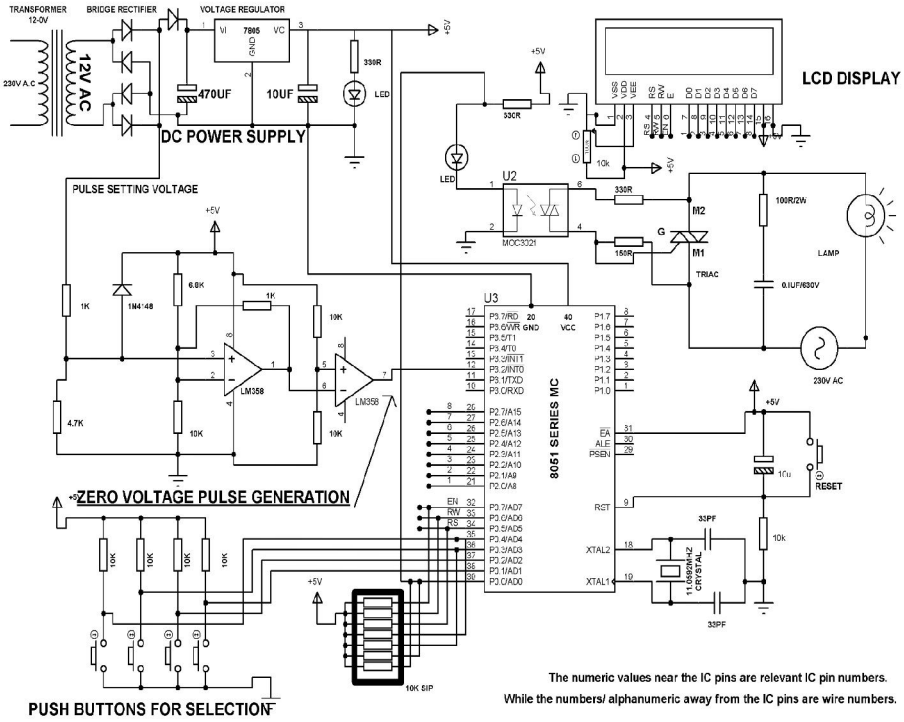

Figure 4: Circuit diagram

V. ADVANTAGE

1. Low-cost.
2. Low/medium-power applications.
3. High efficiency.
4. It does not use a conventional converter topology to produce the output voltage waveform.
5. It directly modulates the mains a.c. voltage.
6. Compared with costly converter, it requires a lower number of active and passive power components.
7. It is uses in washing machine, dishwashers, ventilators, compressors.

VI. LIMITATION

- It includes new technology therefore design of system is difficult. Power can be delivered with percentages 20% 60% 80% and 100% in between power delivering required modification on the circuit

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VII. Conclusion And Future Scope

In this way, we can control the power by using integral cycle switching. We understand how to remove cycle from main input. We get output without any distortion. We can see our output on CRO with integral cycle switching.
In this paper voltage is controlled through integral cycle switching and controlling AC power is used. Through integral cycle output signal we get pure sine wave so it reduces harmonics and improving power factor. It has low cost and easy to operate. Less AC power losses. So better efficiency output in AC power.

VIII. Future Scope

This project can be further modified by making the all process automatic by adding the sensors in the system in that it can do the reduction and increment depending on the temperature of the output (load). Also the changes in the cycles can be directed to the CRO screen for proper viewing

IX. Acknowledgment

I would like to express profound gratitude to my guide Prof. Mr Y. B. Vaswade on his invaluable support, encouragement, supervision and useful suggestions throughout this seminar work. His moral support and continuous guidance enabled me to complete my work successfully. Last but not the least, I am thankful and indebted to all those who helped me directly or indirectly in completion of this report.

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