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Active Power Line Selector by using Single Phasing for Efficient Power Distribution for Renewable Source

Ashwini K. Tulankar[1] , Dr. Harikumar Naidu[2] , Mr. Pratik Ghutke[3]
[1,2,3]*Dept of Electrical Engg., TGPCE, Nagpur*

Abstract: Phase absence is a very common and severe problem in any industry, home or office if the supply is given from renewable source. Many times one or two phases may not be live in three phase supply. Because of this, many times, some electrical appliances will be on in one room and OFF in another room. This creates a big disturbance to our routine work. This project is designed to check the availability of any live phase and the load will be connected to the particular live phase only. Even a single phase is available and then also the load will be in ON condition. One more operation that can be used is energy saving method. This can done with RTC by providing time schedule for energy saving, according to time controller switch On/off the load in any Phase condition.

Keywords: Step-down transformer, ARM7, Filter & regulator, Relay

I. INTRODUCTION

Nowadays, in Industrial applications most of the appliances operate on three phase supply. This paper is about developing a system that can support one of the phase supplies with the help of existing phase supply. The project basically consists of Arm7 LPC 2148 which generate pulses at its output. ARM7 has inbuilt flash EPROM. LPC 2148 Microcontroller Based Energy saver with RTC which uses LPC2148 microcontroller as its brain. Data stored remains in the memory even after power failure, as the memory ensures reading of the latest saved settings by the micro controller. Port 0 and Port 1 is used for generating six pulse output. This controller continuously checks for live condition of all phases connected to it, and the controller connects the load to the active phase using a Relay. This relay is driven with a transistor. If two or three phases are alive, the load will be connected to phase I only. An LCD is provided to display the status of the phase condition. Contrast control preset is given for LCD contrast control. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer. The mains power supply phase is stepped down by transformer to deliver 12V, 500 mA, which is rectified by diode and filtered by capacitor to produce the operating voltage for the operational amplifier. The voltage at inverting pin of operational amplifier is taken from the voltage divider circuit. A preset is used to set the reference voltage according to the requirement.

II. METHODOLOGY

During the design of the phase selector, a lot of considerations, conditions and cases where considered which at the end give rise to the design of phase selector control. These considerations are guided by a truth table of a three variable input of a digital system as shown below.

A. Truth Table

S/N	R	Y	B	X
1	1	1	1	1
2	1	1	0	1
3	1	0	1	1

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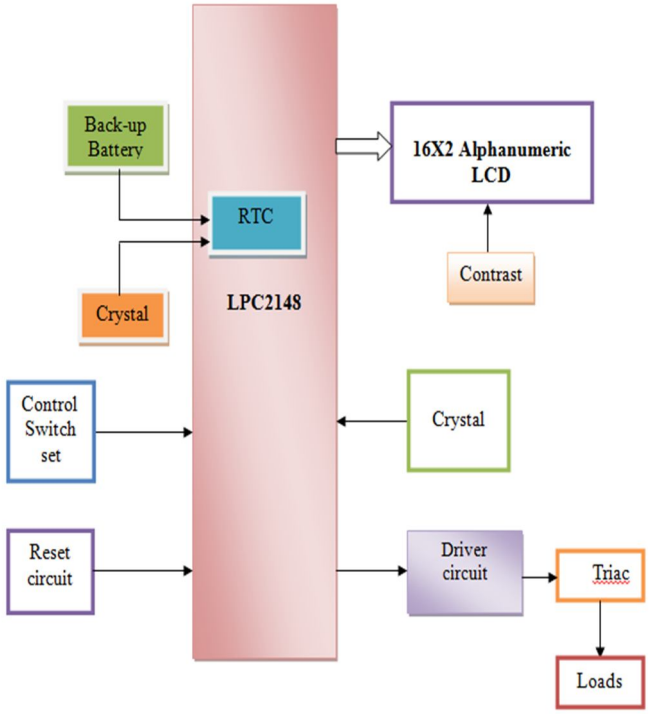
4	1	0	0	1
5	0	1	1	1
6	0	1	0	1
7	0	0	1	1
8	0	0	0	0

The above conditions and questions were considered during the design of the phase selector control. Having the truth table, the "X" is the output of all the conditions in a particular row in the table, with "1"meaning on, up or high while "0" means off, down, low or no output from the phase selector.

III. BLOCK DIAGRAM

Block Diagram



A. Power Supply

The input to the circuit is applied from the regulated power supply. The a.c input i.e. 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating d.c voltage. So in order to get a pure d.c voltage, the output voltage from the rectifier is fed to a filter to remove any a.c components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.

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B. Voltage Regulator

A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. In this project, power supply of 5V and 12V are required. In order to obtain these voltage levels, 7805 and 7812 voltage regulators are to be used.

C. LPC2148 Controller

The LPC2148 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-CPU with real-time emulation and embedded trace support, that combine microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate.

D. Board Technical Specifications

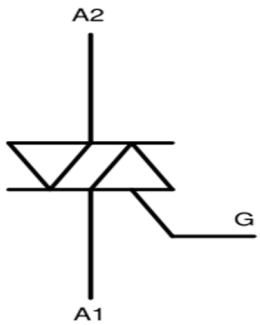
Processor	: LPC2148
Clock speed	: 11.0592 MHz / 22.1184 MHz
Clock Divisors	: 6 (or) 12
Real time Clock	: DS1307 on i2c Bus /w Battery
Data Memory	: 24LCxx on i2c Bus
LCD	: 16x2 Backlight
LED indicators	: Power
RS-232	: +9V -9V levels
Power	: 7-15V AC/DC @ 500 mA
Voltage Regulator	: 5V Onboard LM7805

E. Display

Use of 2x16 LCD Display, which has normally, shows scrolling text. By using left justifying the higher four data bits are used for displaying the data, and Enable and RS pins are used for operating the LCD display. The R/W pin connected to ground because it is only used for busy check and that precision checked out by giving suitable delays. Pin1 is connected to the ground, pin 2 is connected to +5v and pin 3 is connected to the trim pot through resistor to improve the readability of the LCD and varies with the brightness of the surrounding.

F. TRIAC

A TRIAC is approximately equivalent to two complementary unilateral thyristors (one is anode triggered and another is cathode triggered SCR) joined in inverse parallel (paralleled but with the polarity reversed) and with their gates connected together. It can be triggered by either a positive or a negative voltage being applied to its gate electrode (with respect to A1, otherwise known as MT1). Once triggered, the device continues to conduct until the current through it drops below a certain threshold value, the holding current, such as at the end of a half-cycle of alternating current (AC) mains power. This makes the TRIAC a very convenient switch for AC circuits, allowing the control of very large power flows with milliampere-scale control currents. In addition, applying a trigger pulse at a controllable point in an AC cycle allows one to control the percentage of current that flows through the TRIAC to the load (phase control).



IV. ADVANTAGES

A. Highly sensitive
B. Works according to the phase availability
C. Fit and Forget system
D. Low cost and reliable circuit
E. Complete elimination of manpower
F. Can handle heavy loads up to 7A

V. APPLICATIONS

A. Hostels and Hotels
B. Balcony / stair case / parking Lightings
C. Street lights
D. Garden Lights
E. Offices
F. Industries

VI. CONCLUSION

After the implementation of the design, various tests were carried out and validation of its design and construction is achieved. The system worked according to specification by monitoring phase failure and under-voltage thereby changing over to the alternative power supply. This automatic electronic system operates without human intervention hence the sluggishness of manual operation is eliminated and production downtime is reduced to the barest minimum thereby reducing production losses and cost escalations.

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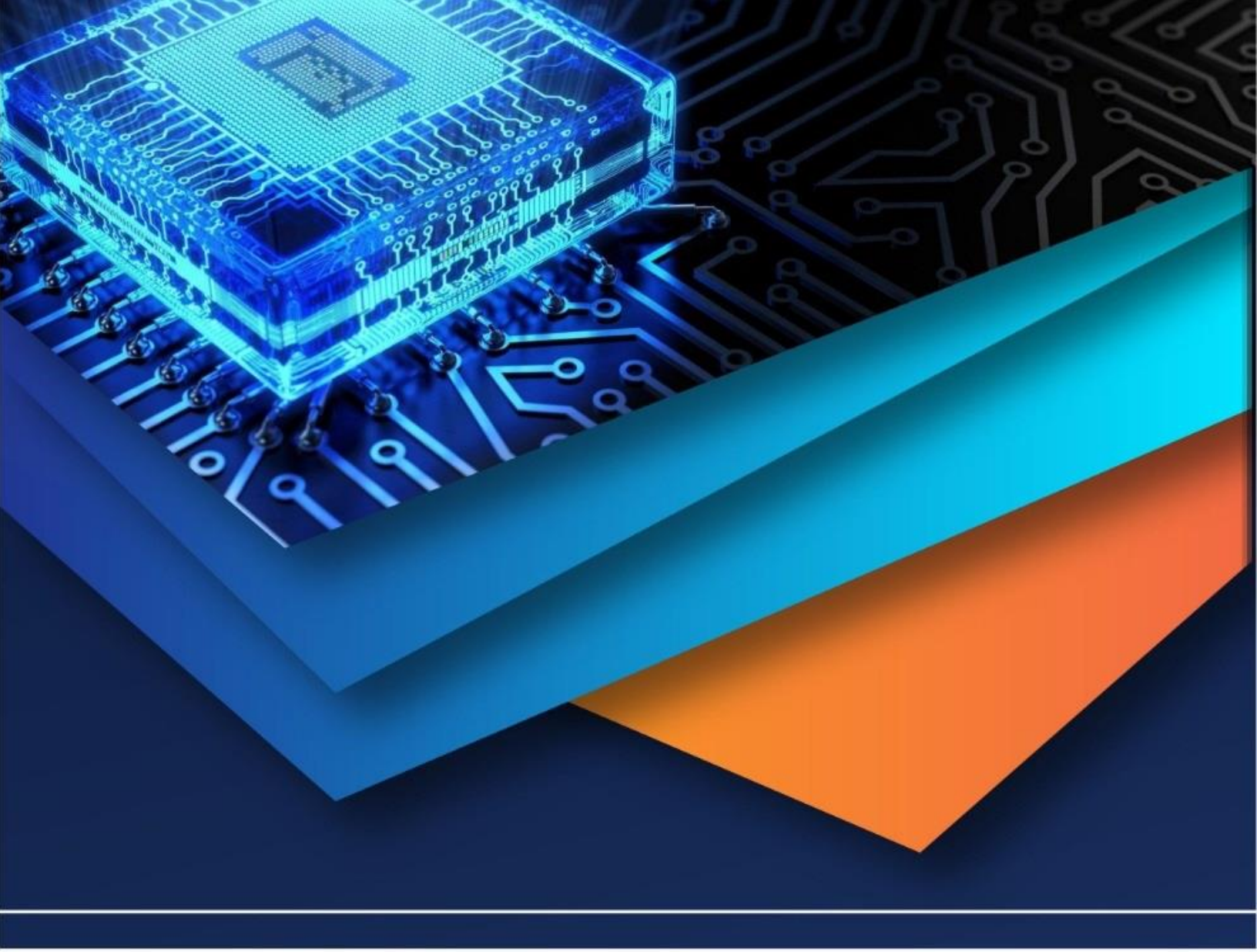

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