CONTINUOUS POWER SUPPLY BY SWITCHING THREE SOURCES

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ABSTRACT*: The project mainly aims in designing a completely automatic and continuous power supply to the load with the help of LCD. There is no need of person to select any available source from AC mains, solar and inverter to the load. In this system the AC mains is used continuously as supply to the load, if by some cause AC mains power supply fails then load gets supply from Solar. To get maximum power from solar, tracking of solar panel is done. We are using Inverter as third option of power supply to maintain continuous power supply when solar energy unable to provide energy i.e. in rainy season and at night. When Solar is not in use as power supply to the load, the energy of Solar is given to the Inverter to charge it. When Solar fails the load gets supply from Inverter and so on.*

Key words: Micro controller, Solar panel, Inverter, LDRs, LCD.

1. INTRODUCTION

1.1 Need of continuous power supply

The demand for power is rising day by day. As most of work depends on electricity, which causes loading effect on electricity distribution. So regular electricity cuts create a lot of troubles in a range of areas where maximum and continuous electricity required such as- houses, hospitals and industries.

If power supply cuts are happened regularly then industries, hospitals etc got lots of troubles. The system in use now a day is mainly on AC Mains and any available source but in industries preferably generators are used which require fuel and man power to start. It takes time to start power supply. When mains supply get back then this is necessary to turn off generator. This causes delay in processing so there is need of continuous power supply.

1.2 Problems in regular system

In regular system we use the power supply for load is mainly the mains. In industrial application we use mains, generator and inverter. In domestic application we use mains and inverter. But there is high load on mains.

So the load does not get continuous power from the source which results in stopping of the system until source is available.

This unnecessary breaking creates delay in the system, also the use of non renewable sources is increasing day by day. Hence the modification in the system is very necessary.

1.3 Problem Solution

A substitute arrangement for electricity supply is a must, so there is need of continuous power supply. The major aim of this system is to provide continuous energy supply to a process which requires continuous power by picking the supply from any source out of the three like – Ac mains, solar and inverter.[4]

In this system the AC mains is used continuously as supply to the load, if by some cause AC mains power supply fails then load gets supply from Solar[2]. To get maximum power from solar, tracking of solar panel is done. We are using Inverter as third option of power supply to maintain continuous power supply when solar energy unable to provide energy i.e. in rainy season and at night.[4] When Solar is not in use as power supply to the load, the energy of Solar is given to the Inverter to charge it. When Solar fails the load gets supply from Inverter and so on. When AC mains supply is available during any of another source in use then it switches to mains supply i.e. the load gets supply from mains.

2. PROBLEM FORMULATION

To design and develop "Continuous Power Supply from 3 different sources as: AC Mains, Solar and Inverter." using 8952 microcontroller.

The major aim of this new system is to provide continuous energy supply to a process which requires continuous power by picking the supply from any source out of the three like – AC mains, inverter and solar.

The mains supply is used continuously as supply to the load. If AC mains power supply fails then load gets supply from Solar and also we are using Inverter as third option of power supply because sometimes Solar energy is not available i.e. at night and in rainy season, so as to maintain continuous power supply. When Solar is not in use as power supply to the load, the energy of Solar is given to the Inverter to charge it. When Solar fails the load gets supply from Inverter and so on. [2]

2.1 Objective

1. To provide continuous power supply to the load. This supply is provided by 3 different sources as: AC Mains, Solar and Inverter.

2. Among these the available source is given to the load as supply. AC mains supply is continuously provided.

If it fails then load gets supply from next alternative i.e. Solar and so on.

3. Solar tracking system is used.

4. Instead of stationary solar panel, movable solar panel is used to receive maximum power.

5. Also the inverter is charged by solar power.

6. The available source and values of LDR are simultaneously displayed on LCD.[5]

3. METHODOLOGY

3.1 Main block diagram

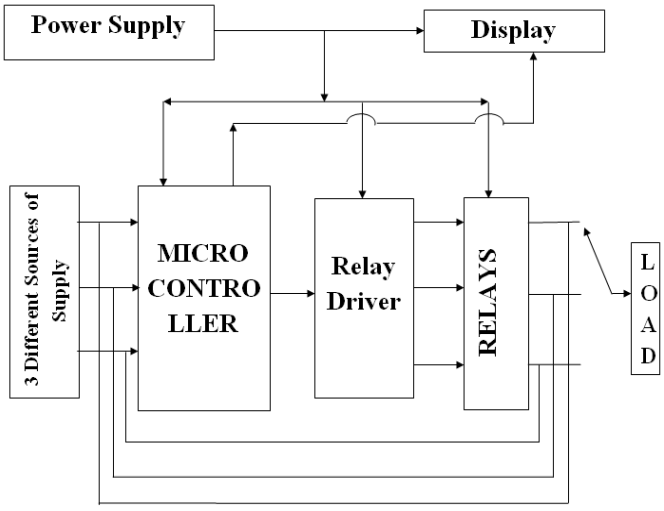

Fig. 3.1 Main Block Diagram

Description

In this project, three different sources acts as input to the micro controller as shown in fig 3.1 so as to give continuous power supply to the load. The output of microcontroller is given to the ULN2003A, this acts as a relay driver. This can drive up to 7 relays. The relays which are used here are 12V relay. The output can be observed using bulb which is getting uninterrupted power supply from other means if main supply is cut off. The power supply consist of a step down transformer 230/12V, which steps down the voltage to 12V AC. It converts into DC using a Bridge rectifier. The ripples are removed by 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. Also the available source is displayed on LCD. The three primary components for producing electricity using solar power which provides common 110-120 volt AC power for daily use are: Solar panels, battery and inverter [2]. Solar panel charges the battery and the regulator insures proper charging of the battery. The battery provides DC voltage to inverter and inverter converts the DC voltage into normal AC voltage. If 220-240 volts AC is needed then either a transformer is added or two identical inverters are series-stacked to produce the 240 volts [2].

3.2 Solar Tracking system

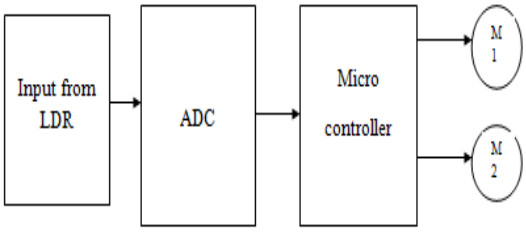

Fig. 3.2 Block diagram of solar tracking

The main idea of design the solar-tracking system is to sense the sun light by using four light dependent resistors (LDRs). [1] As a fig 3.2 each LDR is fixed inside the hollow cylindrical tubes. A pair of them controlling the angle of azimuth are positioned East-West direction and two of them controlling the angle of tilt are positioned South-North direction. The LDR assembly is fixed onto the flat-solar panel. [1][5]

4. DESIGNS AND IMPLEMENTATION

Hardware and software are two main aspects of the design. The system is mostly depends on microcontroller. Here the microcontroller 8952 is used. This is low power, high performance, 8-bit microcontroller. It has 4.0V to 5.5V operating range so it is selected.

4.1 Step Down transformer

Step down transformer is a first part of regulated power supply. To step down the mains 230V AC we require step down transformer. Following are the main characteristic of electronic transformer.

1. Power transformers are usually designed to operate at a single frequency from source of low impedance.

2. It is required to construct with sufficient insulation having necessary dielectric strength. Transformer ratings are expressed in volt-amp. The volt-amp of each to this are added the load losses.

3. Temperature rise of a transformer is decided on two well-known factors i.e. losses done by transformer and heat dissipating and cooling facility provided unit.

4.2 Rectifier design

R.M.S. Secondary voltage available at secondary of transformer is 12V. So maximum voltage Vm developed across Secondary is = Rms. Voltage × $\sqrt{}$ 2=12× $\sqrt{}$ 2=16.97V

D.C. output voltage at rectifier output terminals is Vdc=2Vm/π

PIV rating of each diode used in rectifier is 2 Vm. & maximum current which flow from each diode is 500mA. So from above parameters we select diode IN 4007 from diode selection manual.[1]

4.3 Filter design

Generally a rectifier used in circuit is required to produce pure D.C. supply. However, the output of rectifier contain A.C. and also D.C. components. The A.C. components which are present in rectifier output are undesirable and must be kept away from load so that filter circuit is used which filters the A.C. components to reaching the load. A filter circuit is used in between rectifier and voltage regulator. In our project we used here a capacitor filter because of its low cost, little weight and small size and having good characteristic. Capacitors are connected in parallel to the rectifier output because it passes only A.C. to the ground but not pass D.C. at all the voltage rating of filter capacitor is always double of rectifier output i.e Vdc and it is reached upto 12V. So we choose 1000 µf/ 25V capacitor as a filter.

4.4 Schematic diagram of overall system

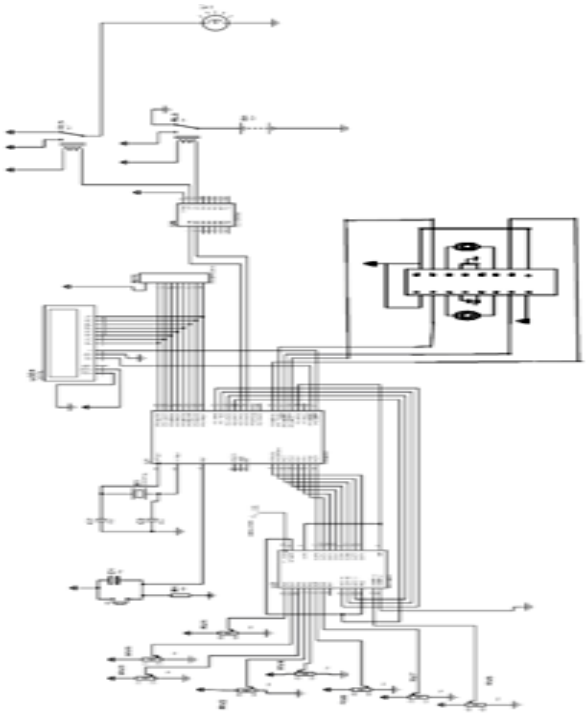

Fig 4.4.1 Schematic diagram of overall system

Our aim is to build no break power supply system which is based on switching system. The sources being used are: AC Mains, Solar and Inverter. Also solar tracking is done to get maximum power. The hardware will be based upon microcontroller and additional supporting circuitry. To get continuous power supply to load, three sources are used which are AC Mains, Solar and Inverter. These sources are sensed by sensor circuit which is as shown in Fig. 4.4.1

The AC Mains voltage, typically 230V rms, is connected to transformer primary, which steps that ac voltage down to the level for the desired dc output. A diode rectifier then provides a full wave rectified voltage (pulsating dc voltage) that is initially filtered by a simple capacitor filter to produce a dc voltage. We get voltage across capacitor approximately equal to 6V which is converted to 3 to 4 volt by using preset.

As output of solar is DC, it is directly given to preset. This voltage is also adjusted to 3 to 4 volt. The ac voltage from inverter, typically 200V rms, is connected to transformer primary, which steps that ac voltage down to the level for the desired dc output. A diode rectifier then provides a full wave bridge rectified voltage (pulsating dc voltage) that is initially filtered by a simple capacitor filter to produce a dc voltage. We get voltage across capacitor approximately equal to 6V which is converted to 3 to 4 volt by using preset.

The output of sensor circuit is given to ADC as input. A particular input channel which is applied to analog to digital converter is selected by using the address decoder. Table 4.2 shows the input states for the address lines to select any relevant channel. The address which is selected or latched into the decoder on the low-to-high transition of the address latch enable signal used in the decoder.

4.5 SYSTEM DESIGN AND IMPLEMENTATION

Table 4.5.1 Input states for address line

Address line			channel
C	B	A	
0	0	0	IN0
0	0	1	IN1
0	1	0	IN2
0	1	1	IN3
1	0	0	IN4
1	0	1	IN5
1	1	0	IN6
1	1	1	IN7

Table 4.2 shows the input states for the address lines to select any channel. As per the A, B, C input given to the ADC then particular channel is selected. The analog four channels starting from IN0 to IN3 are used for four LDR values to show their output voltage. Remaining three analog channels IN4, IN5 and IN6 are used for showing availability of AC mains, solar and inverter respectively. [3]

4.6 Tracking of Solar Panel

One of the three sources is solar source. To get maximum power from sun we established here tracking system of solar panel. In tracking system we are going to detect the

maximum light intensity from the sun and as per this solar panel is moved.[1][5]

Four LDRs are used for sensing the light which are connected to first four channels of ADC.[5] This system deals with controlling the solar panel at two axis (or two angles) by using LDRs as sensors, DC motors as actuators (M1, M2) and microcontroller as a controller. In order to keep the design as simple and cheap we have chosen 89C52 as a microcontroller unit (MCU). Also the values of LDRs are displayed on LCD. [1]

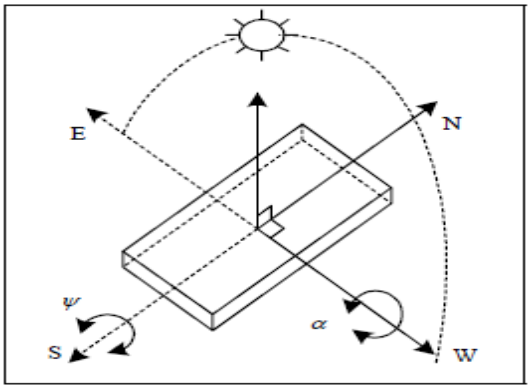

Fig. 4.6.1 Two axis position control of the solar panel

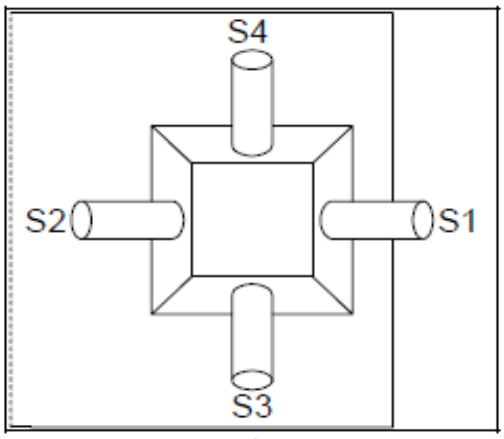

Fig. 4.6.2 The LDR's assembly

Fig. 4.6.1 and Fig 4.6.2 shows the two axis position control of solar panel and how the LDRs are mounted on solar panel respectively. Each LDR which are mounted is fixed inside the hollow cylindrical tubes and tube is fixed at center of each side of panel. A pair of opposite LDR controlling the angle of azimuth which are positioned East-West direction and other two of them, controlling the angle of tilt which are positioned South-North direction. The LDR assembly is fixed to measure the angles onto the flat-solar panel.[1]

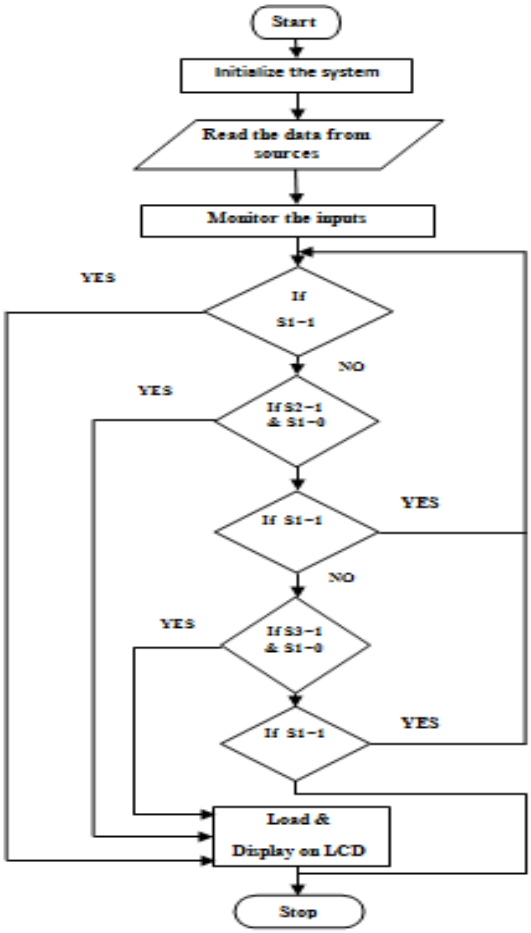

Fig. 4.6.3 Flowchart of working of overall system

5. RESULT

5.1 Observation:

The project works successfully and helps to provide continuous power to the load. In this system we observed that AC mains is used continuously as supply to the load. If at day, by some cause AC mains power supply fails then load gets supply from Solar. We are using Inverter as third option of power supply to maintain continuous power supply when solar energy unable to provide energy i.e. in rainy season and at night.

When Solar is not in use as power supply to the load, the energy of Solar is given to the Inverter to charge it. When Solar fails the load gets supply from Inverter and so on. When AC mains supply is available during any of another source in use then it switches to mains supply i.e. the load gets supply from main to get maximum power from solar, tracking of solar panel is done. In that solar panel moves with direction of Sun.

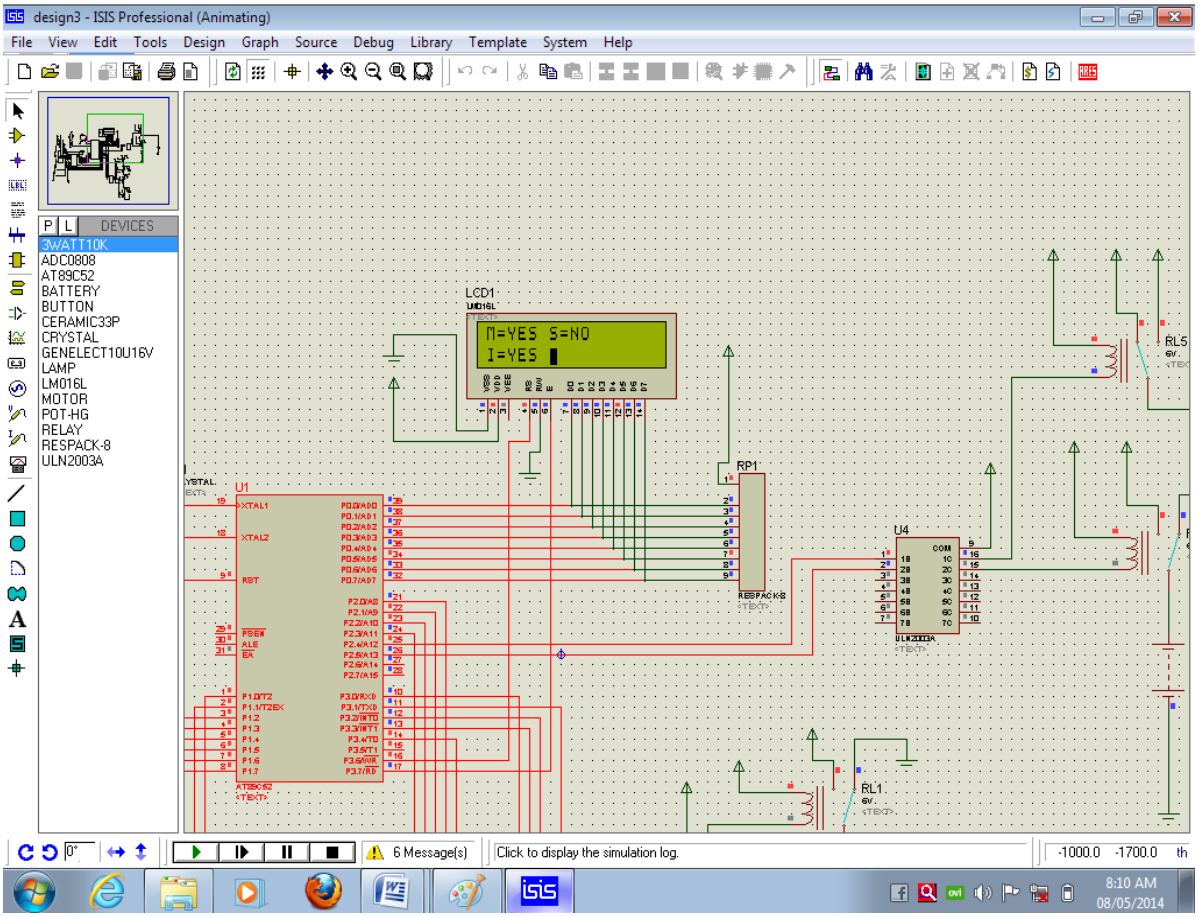

Fig.5.1: Display of available source

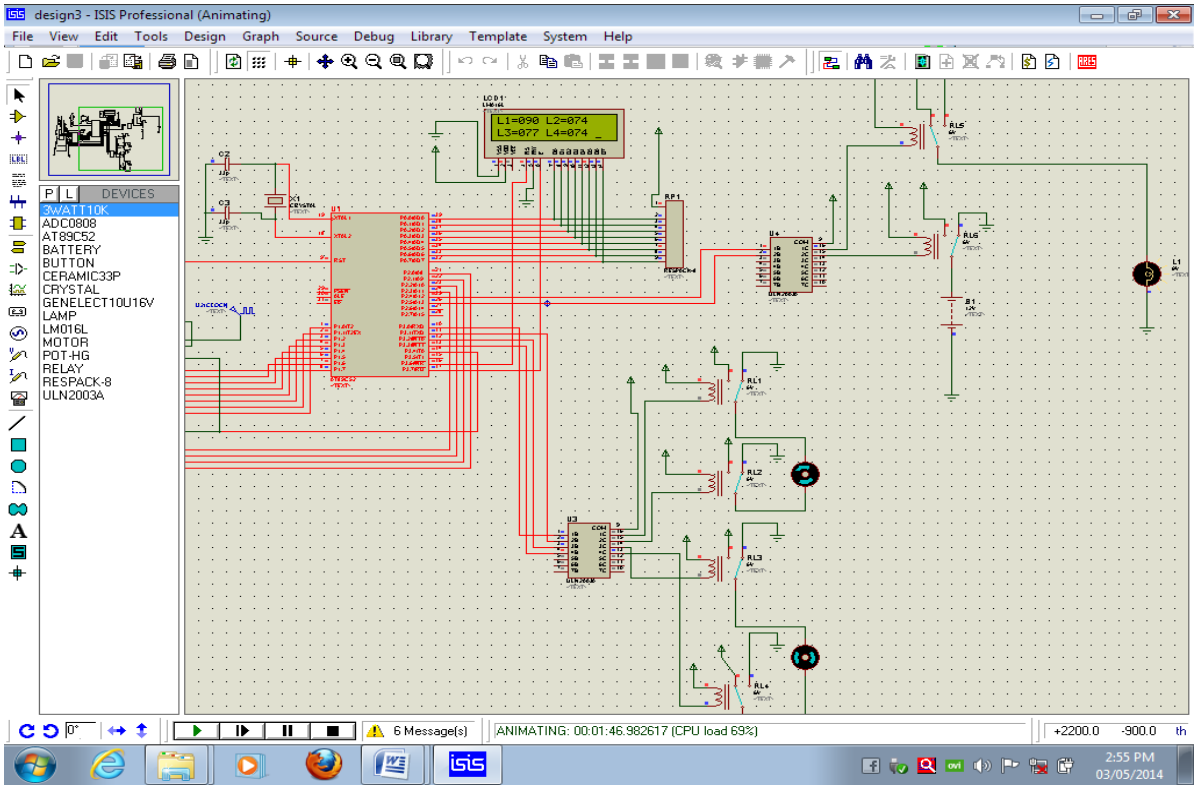

Fig.5.2 Display of LDR value

6. FUTURE SCOPE

India is 7th largest country in the world. There are so many industries in India which require greater power supply. These industries would not afford any power failure during process. So here we are introducing a system which provides continuous power supply.

By reducing delay the switching of sources will be done in few seconds and load get supply from another source immediately on failure of current available source.

If sensors are used for sensing of available source, then fast switching will takes place. This will result in providing immediate power supply on failure of available power supply.

1. Scope of this project in industries:
Instead of using relays, if contactors are used for high voltage and current rating then this system can be applicable for industries.

2. Scope of Solar tracking:
By increasing DC motor capacity we can track maximum solar energy with the help of larger solar panel.

7. CONCLUSIONS

Finally, I am on the conclusion page which is giving us an immense pleasure as to having worked on such a wonderful concept of **"CONTINUOUS POWER SUPPLY BY SWITCHING THREE SOURCES".** It was a great learning experience, I crossed over quite a few hurdles and now in a true sense, we can say that I do have an idea about 'Electronics strength'.

The project works successfully and helps to provide continuous power to the load. Also the solar tracking system works successfully which holds great future scope. We observed that load gets continuous power supply from one of the three sources.

8. ACKNOWLEDGEMENT

It gives immense pleasure in presenting a paper on "CONTINUOUS POWER SUPPLY BY SWITCHING THREE SOURCES" I take opportunity to acknowledge the enormous assistance & excellent cooperation extended to us by concerned in the department. Also thanks to our project guide Mr. U. A. Patil for his valuable guidance, inspiration & motivation. In spite of his busy schedule he gives us more time for discussion.

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10. BIOGRAPHY

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