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Auto Power Supply Control from Different Sources using ARDUINO

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Abstract: The main purpose of this project is to provide continuous power supply to a load, by selecting the supply. Power is most important requirement for all of us. We know that due to large demand of electricity and due to limit capacity of power plant at generating station, power cut off is common for all us. Due to limited amount of power generation at power station and due to shortage of nonrenewable continuous supply source it beings a biggest challenge in whole world. If you see all around us you will observe that due to discontinuity of power supply, many problems have been faced by people in their everyday use. This type of power failure create problem for data centers, hospitals and some research work. This is a biggest reason that every country is researching for the work to supply a continuous power with good efficiency and with good regulation. In this project we can combine the renewable and non-renewable energy sources to get the continuous power supply such as mains, solar, battery, adapter. The power cut of this sources can be manually done by switches. The continuous supply to load can be given by automatic operation of relay, relay driver IC with the help of Arduino microcontroller.

Keywords: Arduino, LCD, Relay, Transformer, Solar Panel, Battery.

I.INTRODUCTION

For a very long time, power outages, power interrupts and also unexpected routine power line maintenance is one of the major problems faced in industries, hospitals, offices, and homes whole over the world. For that case, this project provides an automatic operation of electrical power distribution systems; the rapid and reliable transfer of the system from one power source to another during specific events such as power outages, power interrupts, routine power line maintenance, to achieve the reliability of such systems.

Electrical power supply is one of the primary essential needs of human life today, that is to say, without electrical power supply, most human works become stand still, postponed and even cancelled since most human actions are dependent on the electrical power supply.

Furthermore, the need for power supply through access to electricity by the masses of the population of any country, both developed and developing countries is very important to the development of the economy of that particular country. In other words, the power sector plays an essential role in the socio-economic development of any country.

II.BLOCK DIAGRAM OF PROPOSED SYSTEM

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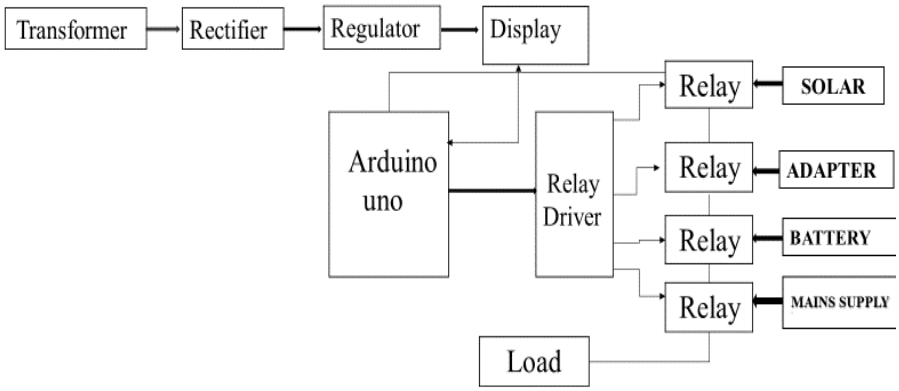

Figure II: Proposed system

III.Hardware

- Step down transformer
- Arduino Uno
- Bridge rectifier
- Relay
- Diode
- LCD
- Regulator
- Solar panel
- Battery
- Adapter

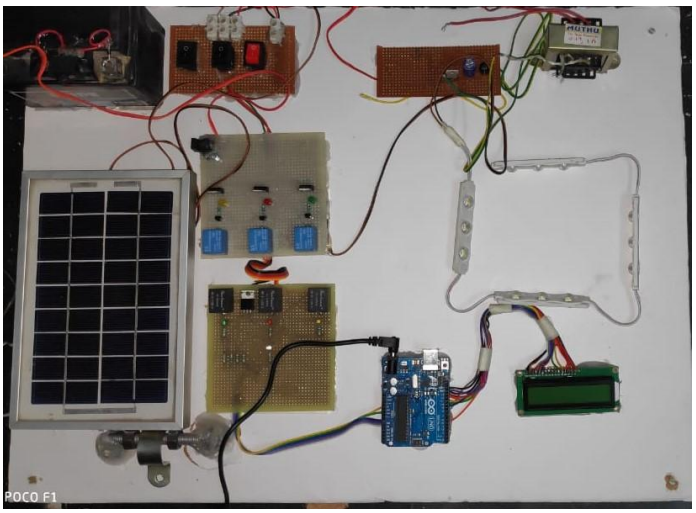

Figure III: Actual Hardware

When mains are ON, the supply 230V AC is stepdown to 12V AC using Transformer. Then the 12V AC supply is given to the bridge rectifier to converter AC to DC Source. Then supply is given to the load i.e.: lamp. It indicates the glow of lamp as shown in the figure below. There are three relays, each relay is given to the mains, solar and wind respectively.

1.ARDUINO

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Fig 1: Arduino

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to- serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards. The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts

2. Voltage Regulator

A voltage regulator is a system designed to automatically maintain a constant voltage level. A voltage regulator may use a simple feed-forward design or may include negative feedback. Depending on the design, it may be used to regulate one or more AC or DC voltages.The voltage regulator IC 7805 is actually a member of 78xx series of voltage regulator ICs. It is a fixed linear voltage regulator. The xx present in 78xx represents the value of the fixed output voltage that the particular IC provides. For 7805 IC, it is +5V DC regulated power supply. This regulator IC also adds a provision for a heat sink. The input voltage to this voltage regulator can be up to 35V, and this IC can give a constant 5V for any value of input less than or equal to 35v which is threshold limit

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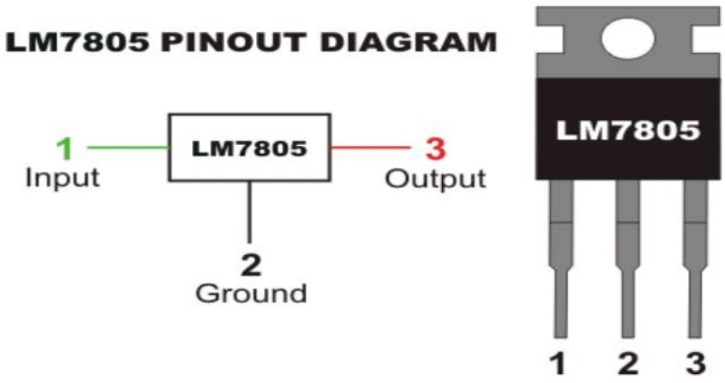

Fig 2: Voltage Regulator

PIN 1-INPUT

The function of this pin is to give the input voltage. It should be in the range of 7V to 35V. We apply an unregulated voltage to this pin for regulation. For 7.2V input, the PIN achieves a maximum efficiency.

PIN 2-GROUND

We connect the ground to this pin. For output and input, this pin is equally neutral (0V).

PIN 3-OUTPUT

This pin is used to take the regulated output. It will be (5v)

3. Bridge Rectifier

A Bridge rectifier is an Alternating Current (AC) to Direct Current (DC) converter that rectifies mains AC input to DC output. Bridge Rectifiers are widely used in power supplies that provide necessary DC voltage for the electronic components.The bridge rectifier circuit diagram consists of various stages of devices like transformer, Diode Bridge, filtering and regulators. Generally, all these blocks combination is called as regulated DC power supply that powers various electronic appliances.

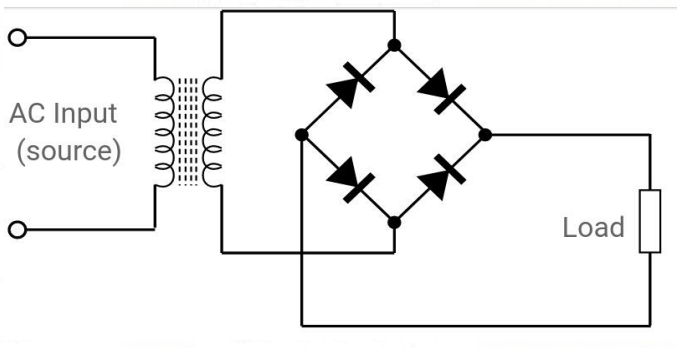

Fig3: Bridge Rectifier

4. Relay

Relays are the primary protection as well as switching devices in most of the control processes or equipment's. All the relays respond to one or more electrical quantities like voltage or current such that they open or close the contacts or circuits. A relay is aswitching device as it works to isolate or change the state of an electric circuit from one state to another.It works on the principle of an electromagnetic attraction.

When the circuit of the relay senses the fault current, it energizes the electromagnetic field which produces the temporary magnetic field.

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Fig 4: Relay

5.Transformer

The Transformer act as step down transformer reducing AC - 240V to AC - 12V. Power supplies for all kinds of project & circuit boards. Step down 230 V AC to 12V with a maximum of 1Amp current. A transformer operates on the principals of "electromagnetic induction", in the form of Mutual Induction.Mutual induction is the process by which a coil of wire magnetically induces a voltage into another coil located in close proximity to it. Then we can say that transformers work in the "magnetic domain", and transformers get their name from the fact that they "transform" one voltage or current level into another.

Fig5: Transformer

6.Solar Panel

A standard solar panel consists of a layer of silicon cells, a metal frame, a glass casing and various wiring to allow current to flow from the silicon cells. Silicon (atomic 14 on the periodic table) is a nonmetal with conductive properties that allow it to absorb and convert sunlight into electricity. When light interacts with a silicon cell, it causes electrons to be set into motion, which initiates a flow of electric current. This is known as the "photovoltaic effect," and it describes the general functionality of solar panel technology.

Fig6: Solar Panel

To construct a solar panel, one requires several solar cells made of doped silicon as has been discussed before. These cells are connected in series to add up the resultant current. This gives strips of clustered cells called a module. A single module could be constructed into a solar panel or combined with others in cases where a large panel is required.

7. System Requirement

1. In case of solar source failure detection, disconnect the loads from the solar.
2. Start the consuming power from wind energy unit.
3. Incase wind source failure then transfer to greed supply.
4. Suddenly grid source is interrupted then give signal to solar starting relay and parallel load connect to battery (which is charged by renewable sources)
5. If the output voltage is stable and reach the required value, then connect the loads to the solar panel.

IV. Working Principle

This auto power supply control system works on the principle of auto function for switch over the load to other available source without wasting any time or switch off the load. Here for the demonstration purposes we have used the selection keys for switch off any source of supply. In this system, the Arduino microcontroller which is very essential component of this system always, keep sensing the whole available sources. When any source is switched off through the selection keys then the Arduino shifted the load to the other supply source by giving the signal to the relay driver IC then the relay driver IC switched on the appropriate load relay. The whole function is done by the Arduino is micro seconds and this shifted time can be changed during the programming of Arduino microcontroller.

Here 3 load relays are used which are connected in parallel with load and 3 sources of supplies are also connected in parallel with these load relays. These load relays consist of NORMALLY OPEN and close contacts and are operated through the relay driver IC. We have checked this system by connecting the Led lamp at output side as a load when any interruption is taking place during the shifted time then the lamp is blinking but here there is no any blinking take place during the shifted time meansthere is no any interruption in supplying the power at outputside.

V. Advantagesof Project

- Automatic Power Sources Selection.
- Easy to use, Self-explanatory kit
- to provide uninterrupted power supply from any of the available supply
- Flexibility in programming and reprogramming

VI.RESULT

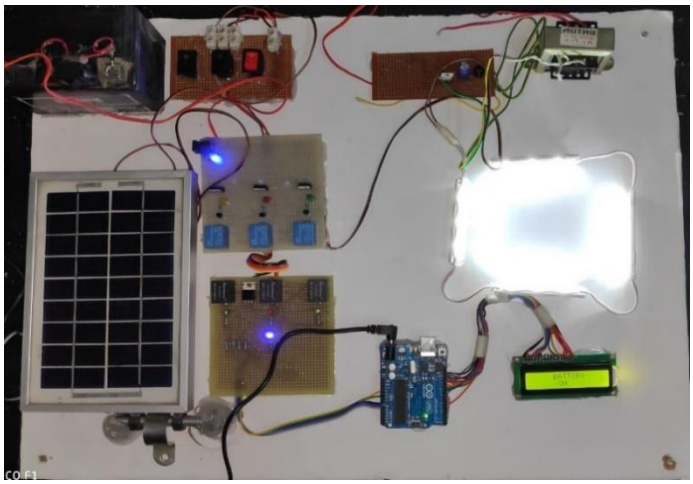

Fig VI. Result of Project

VII. Conclusion

The demand of energy worldwide grows rapidly, because energy generation is low but energy consumption is on a high rate. Electricity companies cannot satisfy the demand and must use nonconventional energy system. Use of renewable energy along with the non-conventional sources not only increases the reliability of the system but also allows higher power demands to be fed. Prioritizing the various available sources makes the selection and utilization economic.

The priorities may be decided according to the availability of source, usage cost, its effects on the operation of other equipment (noise due to generators, smokes etc). The selection algorithm can be coded into an Arduino which will automatically shift between different sources using relays through the relay driver. The project involves four different sources with different parameters to Arduino to judge the selection of best available source to use.

This work is use to provide a continuous power to the load through any of the sources from which we are operating the device i.e. main line, generator, inverter and solar automatically in the absence of any of the source.

The complete operation is based on the microcontroller. This work is a low-cost, reliable, efficient system. The work can be further enhanced by using other sources like wind power also and then taking into consideration for using the best possible power source whose tariff remains lowest at that moment

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