AUTO POWER SUPPLY CONTROL FROM FOUR DIFFERENT SOURCES: SOLAR, MAINS, WIND, and INVERTER

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Abstract---Aim of the project is to provide uninterrupted power supply to a load by selecting the supply from any source out of 4 such as solar, mains, wind supply and inverter, automatically in the absence of any of the source. This project uses four switches to demonstrate the respective failure of that power supply. When any of the switches is off it shows the absence of the particular source, switches are connected to Arduino as input signals. Power supply which is being supplied to the load is displayed on LCD. GSM technology is used to send an SMS about the supply being used.

Index Terms--- *Arduino Uno ATMEGA328P, GSM, LCD, Relay driver, Relays.*

1. INTRODUCTION

India's energy demand out spaced global demand growth in 2018 according to the International Energy Agency. The higher energy demand was driven by a global economy that expanded by 3.7 per cent in 2018, a higher pace than the average annual growth of 3.5 per cent seen since 2010. China, US, and India together accounted for nearly 70 per cent of the rise in energy demand. Comparably, energy consumption worldwide grew by 2.3 per cent in 2018. This is nearly twice the average rate of growth since 2010 and we also know that the human activities are mostly dependent on electrical power supply. The above fact clearly shows that the supply is not meeting the demand. As a result frequent power-cut is done and interrupted power supply is provided.

The main objective of this project is to provide uninterrupted power supply to a load, by selecting the supply source automatically from any available one out of 4 such as: solar, mains, wind power and inverter in the absence of power supply. The demand for electricity is increasing every day and frequent power cut is causing many problems in various areas like industries, hospitals and houses. An alternative arrangement for power source is thus desirable.

Four different sources i.e. mains, inverter, solar and wind power are used to provide uninterrupted power supply. Using the solar energy as one of the power source provides the solution for low energy resources since it is a renewable source of energy. The second objective of work is to provide automation which make the work faster, reliable, efficient, and reduce human efforts. Arduino Uno is used to provide automation in the switching between four different sources. The automation system used for switching requires separate source to provide an output signal which will operate the four different relays connected to sources respectively.

An Arduino Uno ATMEGA328P is used. The output of the Arduino is given to the relay driver IC, which switches appropriate relay to maintain uninterrupted supply to the load. Output is observed using a lamp drawing power from the solar initially. On the failure of the solar supply the load gets supply from the next available source i.e. mains. If the main also fails, it switches over to the next available source, and so on. The current status, like which source is supplying power to the load is also displayed on an LCD. As it is not feasible to provide all 4 different sources of supply, one source with an alternate parallel arrangement is provided to get the same function for demo purposes. However 4 different sources if available they can be used. An SMS is also sent to mobile to indicate which power supply is being used.
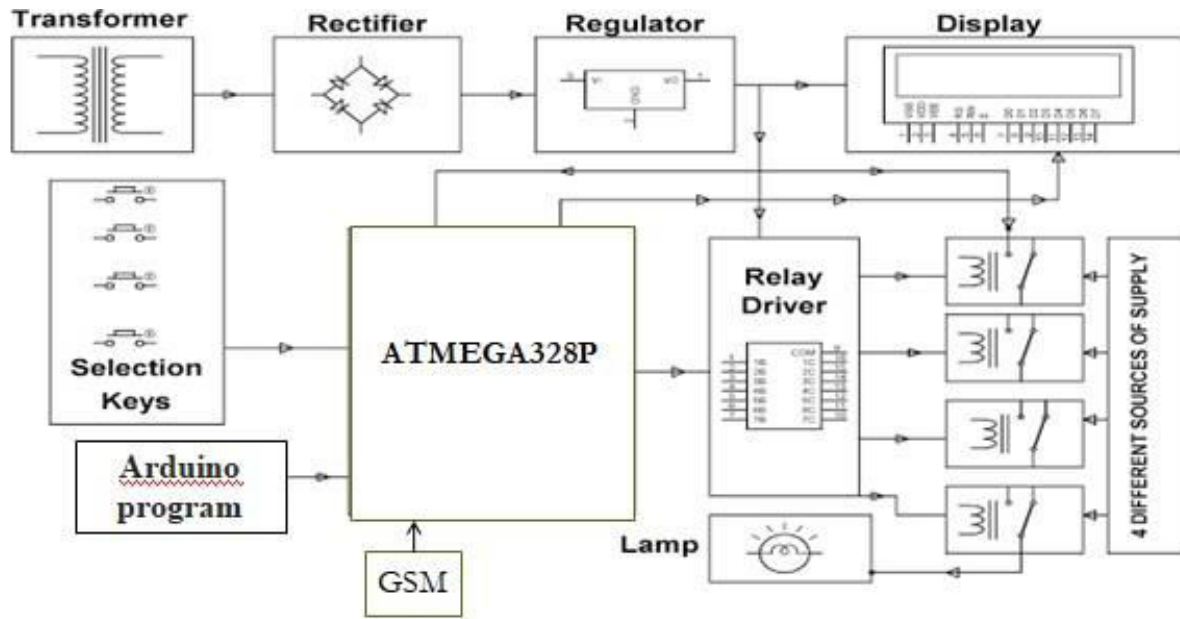
2. BLOCK DIAGRAM

Figure 1.0 Block diagram of the system

3. HARDWARE AND SOFTWARE REQUIREMENTS

HARDWARE REQUIREMENTS IN DESIGNING THE PROJECT INCLUDE:

- Transformer
- Bridge Rectifier
- Filter Capacitor
- Voltage Regulator LM7805A
- Resistors
- Switches
- Relays
- Relay Driver
- LCD
- Arduino Uno ATMEGA328P
- GSM module

Arduino Uno ATMEGA328P: In this auto power supply control system, ATMEGA 328P is used for the auto selection of the available source. It shifted the load to the other power supply source automatically without any interruption and is powered up with 5V dc voltage.

Relay driver: In this auto power supply control system, the relay driver IC ULN 2003 is used for driving the load relays. This relay receives the signal from Arduino for shifting the load on another supply source. It is powered up with 5V dc and interfaced with Arduino.

Transformer: The transformer is used for connecting this system directly to 220V AC. It steps down 220V into 12V.

Voltage regulator: The voltage regulator is used for regulating 12V DC into 5V DC voltages for supplying the power to the LED, Arduino and other components. IC LM 7805 voltage regulator is used for regulating voltages.

LCD display: LCD display is used for displaying the source of supply on which the whole system is working.

Filter: Capacitive filters are used to remove the ripples from output of the rectifier. An electrolytic capacitor of about 470μF to 1000μF to filter the output DC from the bridge rectifier is used.

Rectifier: In this work bridge rectifier is used due to its merits like full wave rectification and high stability. For a single half of the cycle only two diodes will be in forward bias condition.

GSM module SIM900D: This is a complete Quad-band GSM/GPRS module in a SMT type and designed with a very powerful single-chip processor integrating AMR926EJ-S core, allowing you to benefit from small dimensions and cost-effective solutions.

SOFTWARE REQUIREMENTS IN DESIGNING THE PROJECT INCLUDE:

- Arduino IDE
- Proteus simulation software

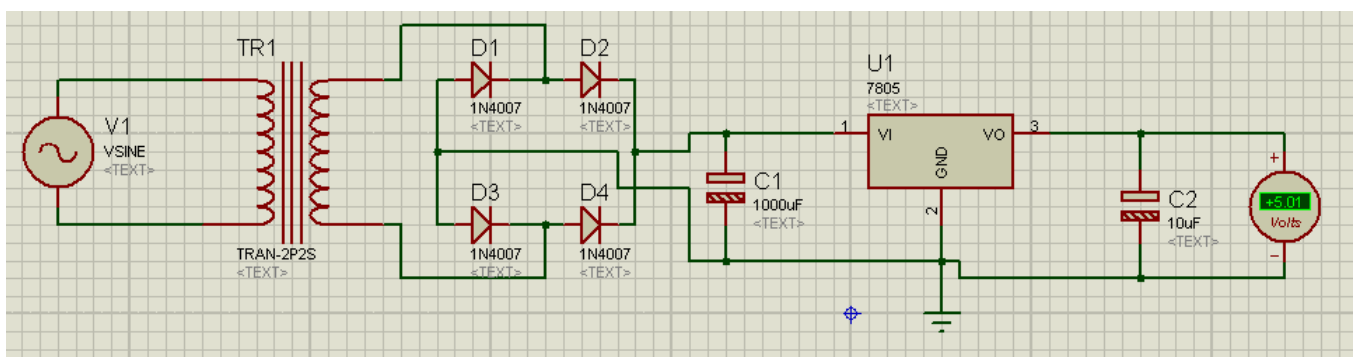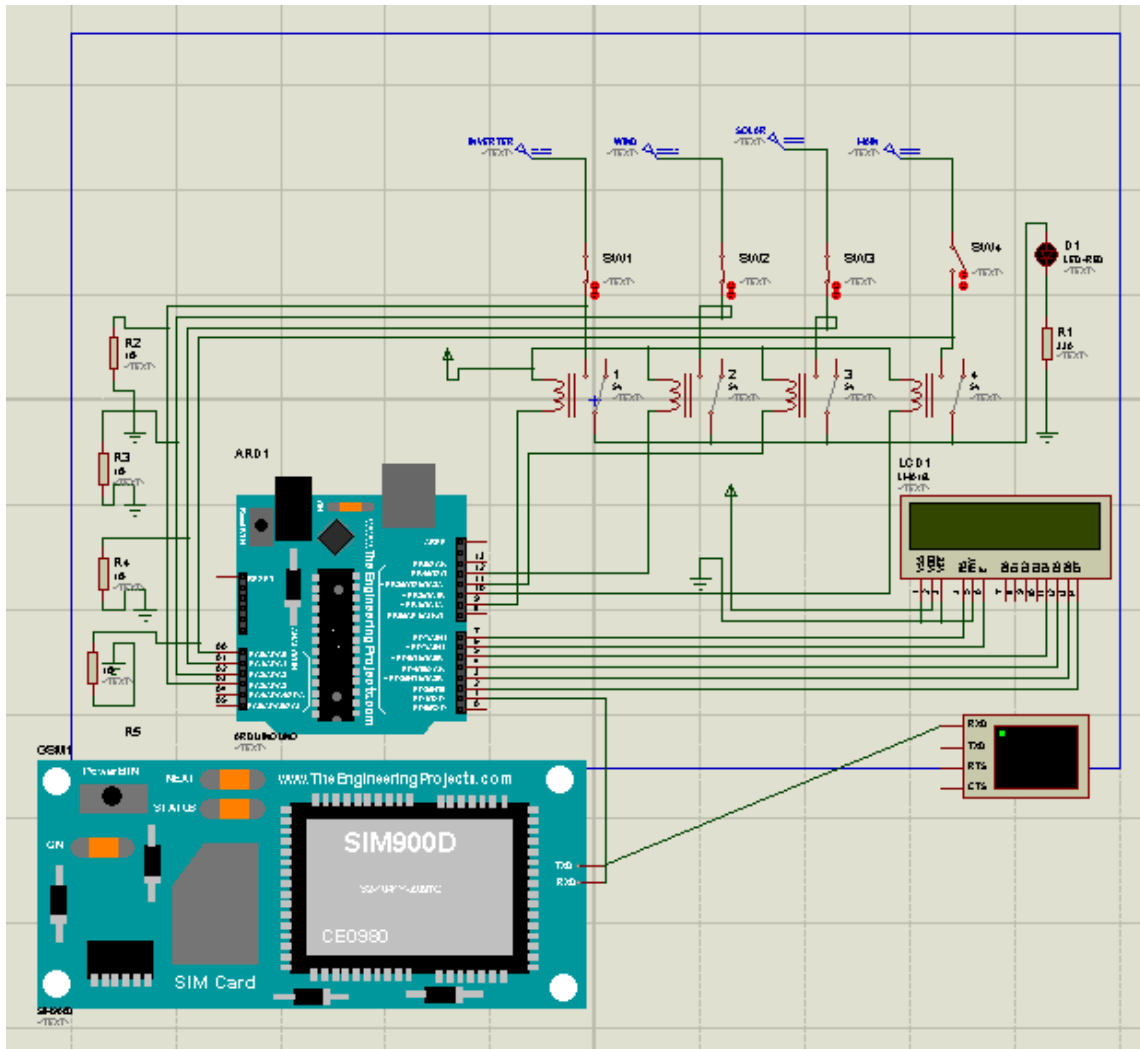## 4. STANDARD CONNECTIONS FOR POWER SUPPLY


Figure: Power supply circuit

5. SCHEMATIC CIRCUIT DIAGRAM

6. WORKING PRINCIPLE

The project employs four switches to activate respective power supply. When any of the switches is opened it demonstrates the lack of that particular supply, which is connected to Arduino as input signals. Arduino Uno ATMEGA328P is used. The output of Arduino connects to the relay driver IC, which activates an appropriate relay to keep UPS to the load. The output shall be experimental using a lamp drawing power supply from solar at first. On the breakdown of the solar supply the load acquires supply from the next accessible source, say from main supply. If the mains also fails, it activates over to the next accessible source and so on. The present status, as to which source supplies the load is displayed on an LCD and an SMS is also sent using GSM module. As it is not feasible to provide all the 4 different sources of supply, transformers are used in place of four different sources to get the same function.

7. FLOW CHART OF THE SYSTEM
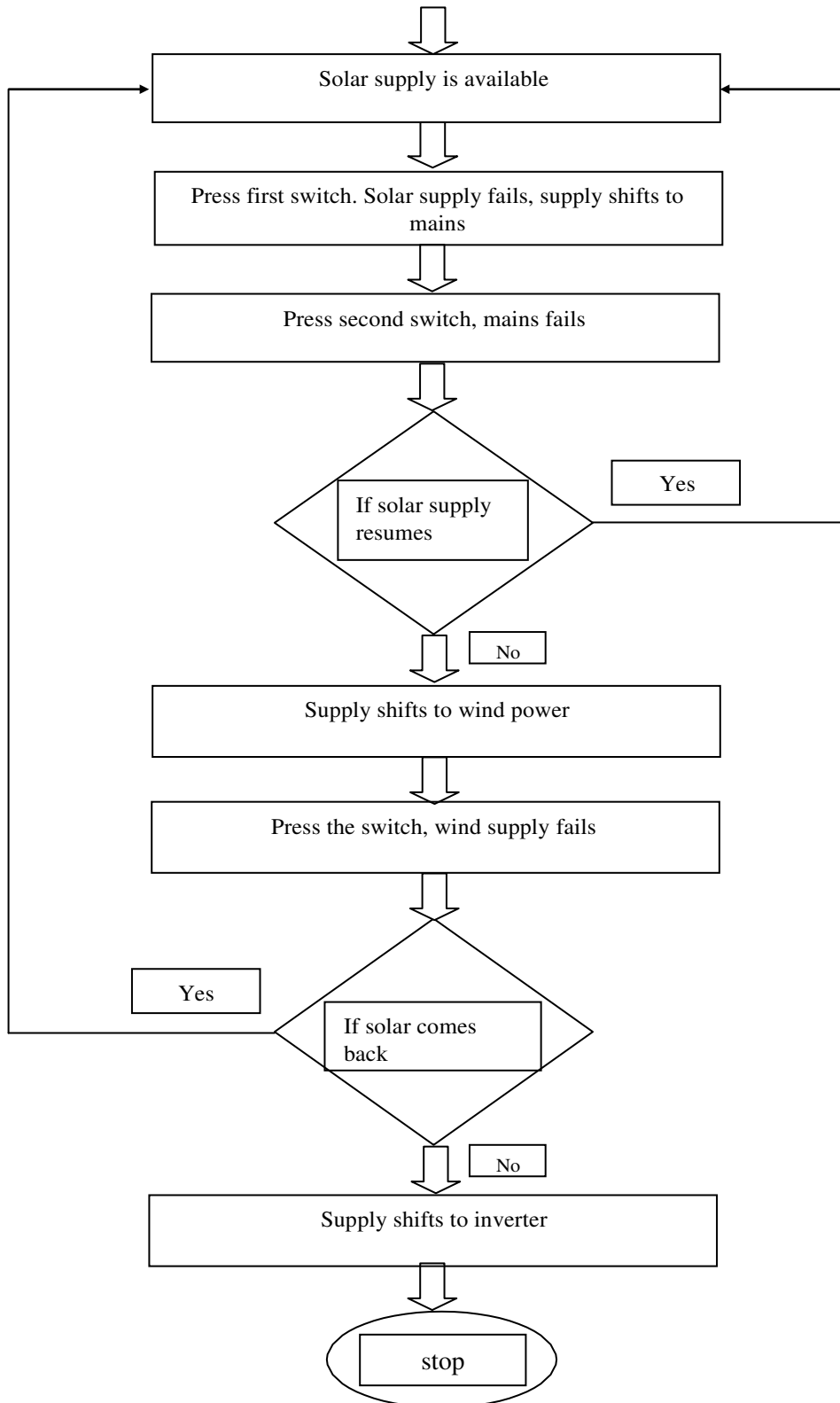
8. RESULTS AND DISCUSSIONS

Simulation of the design is performed using Proteus Design Suite. All the possible input cases are applied and respective outputs are verified.

PROTEUS DESIGN SUITE:

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.
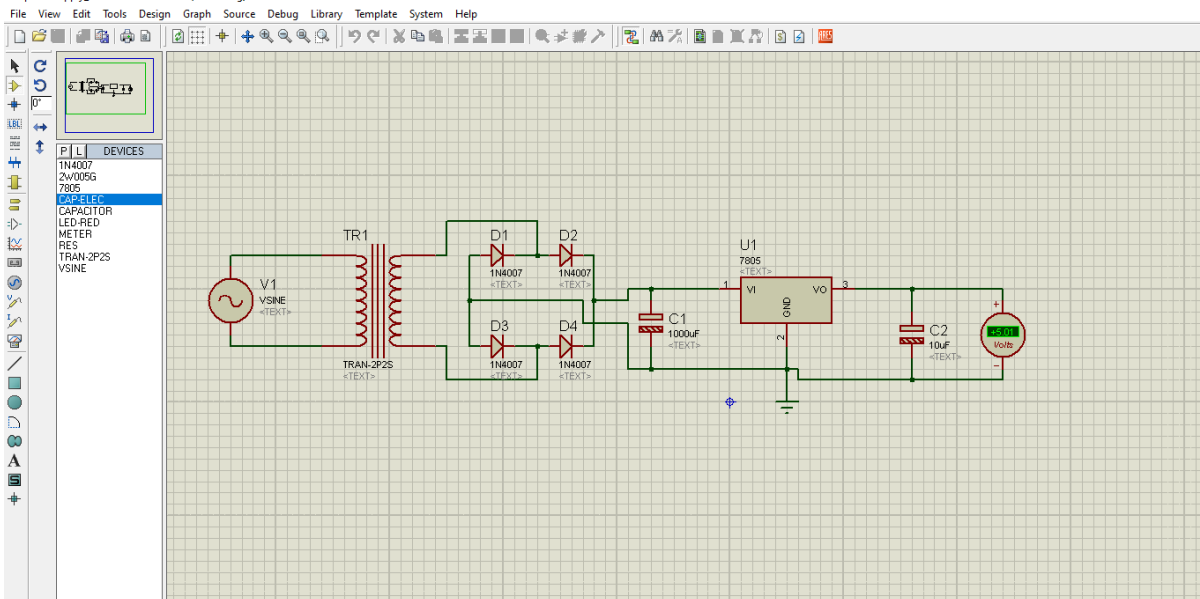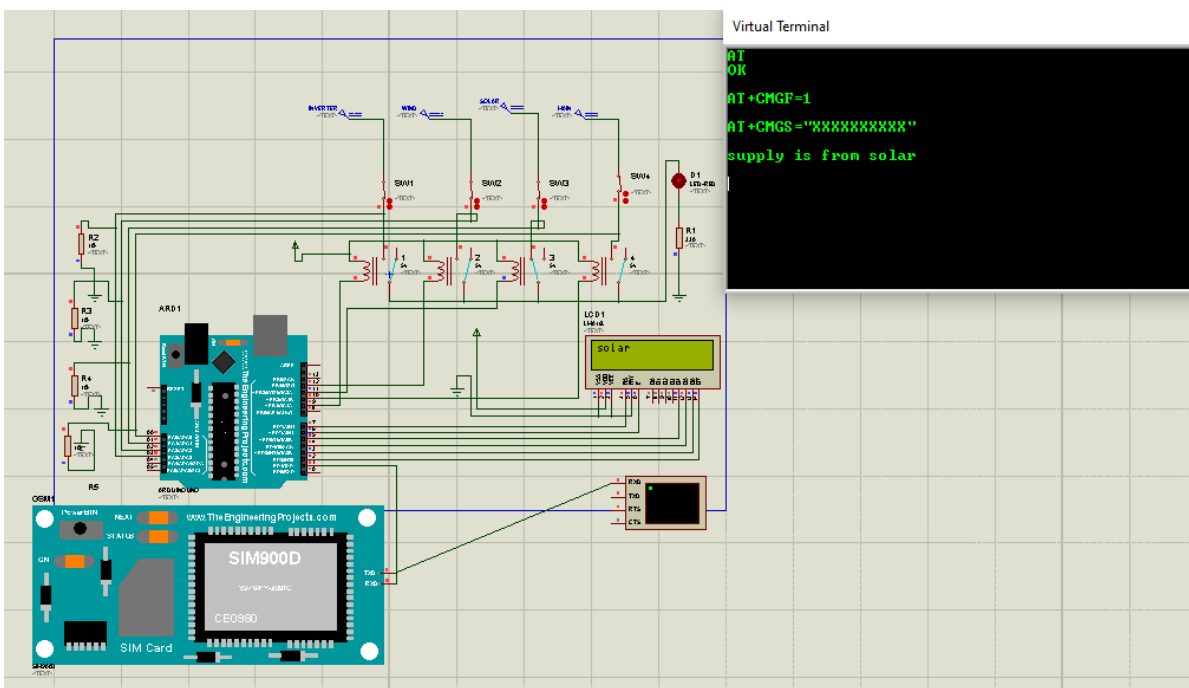
OUTPUTS:

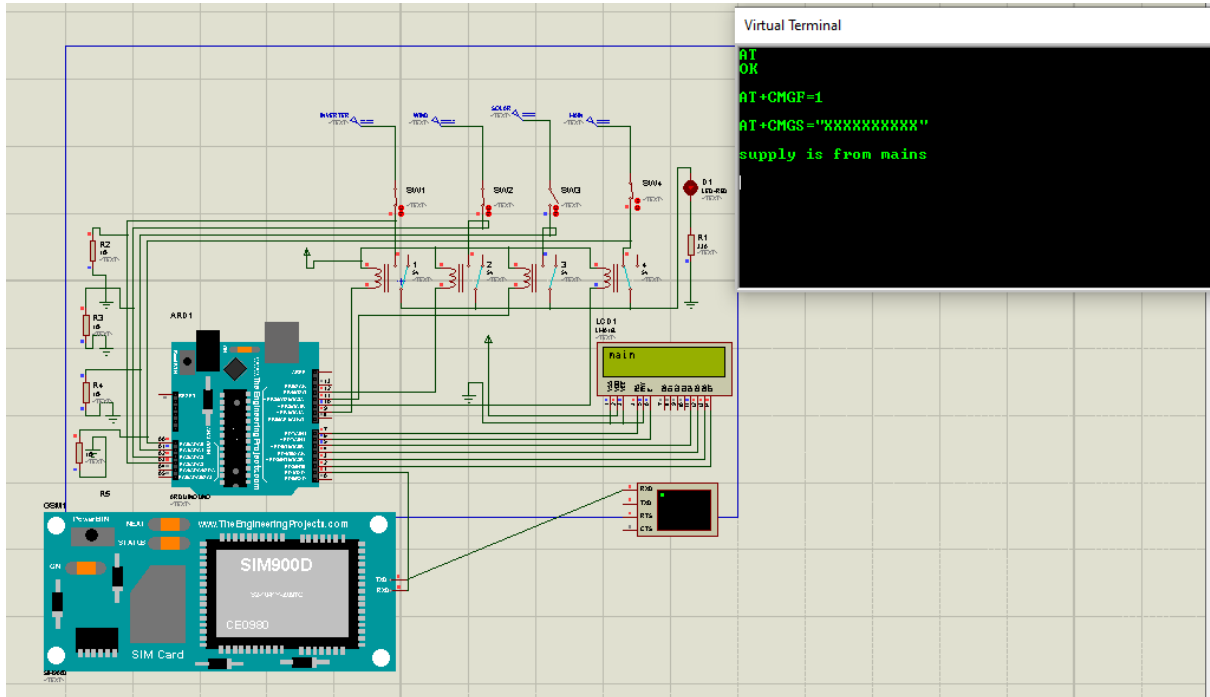**Figure 5V DC Power supply**

Figure All sources are available

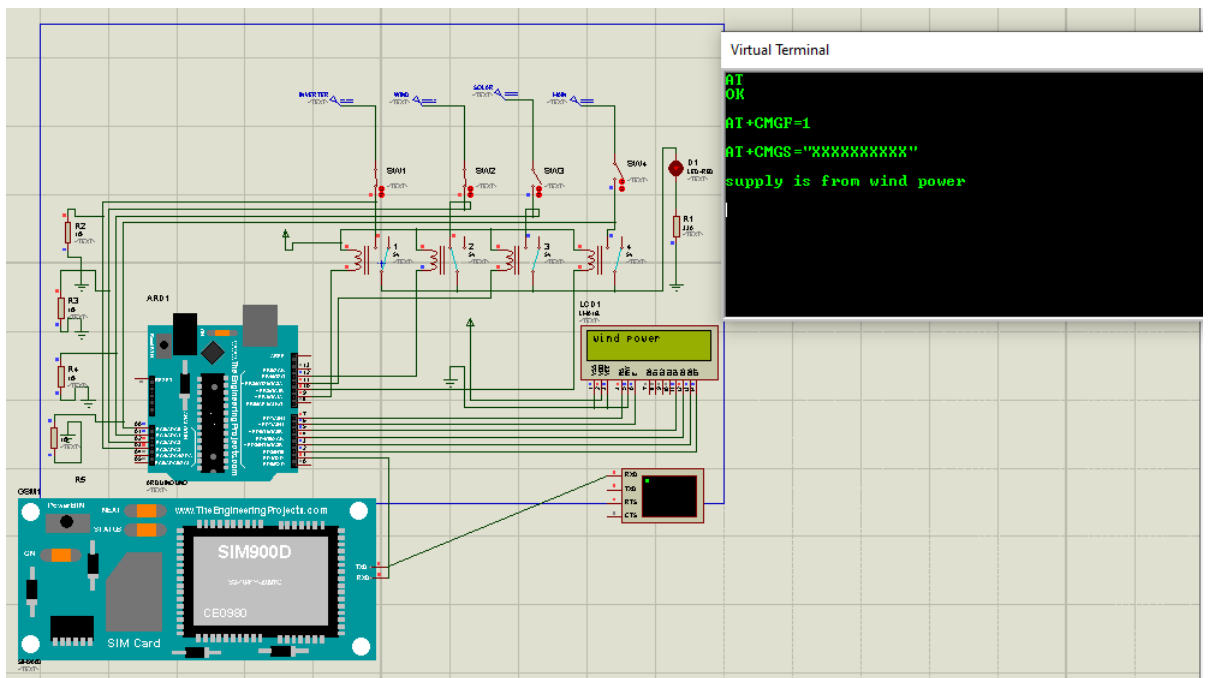**Figure Mains, Wind and Inverter are available**

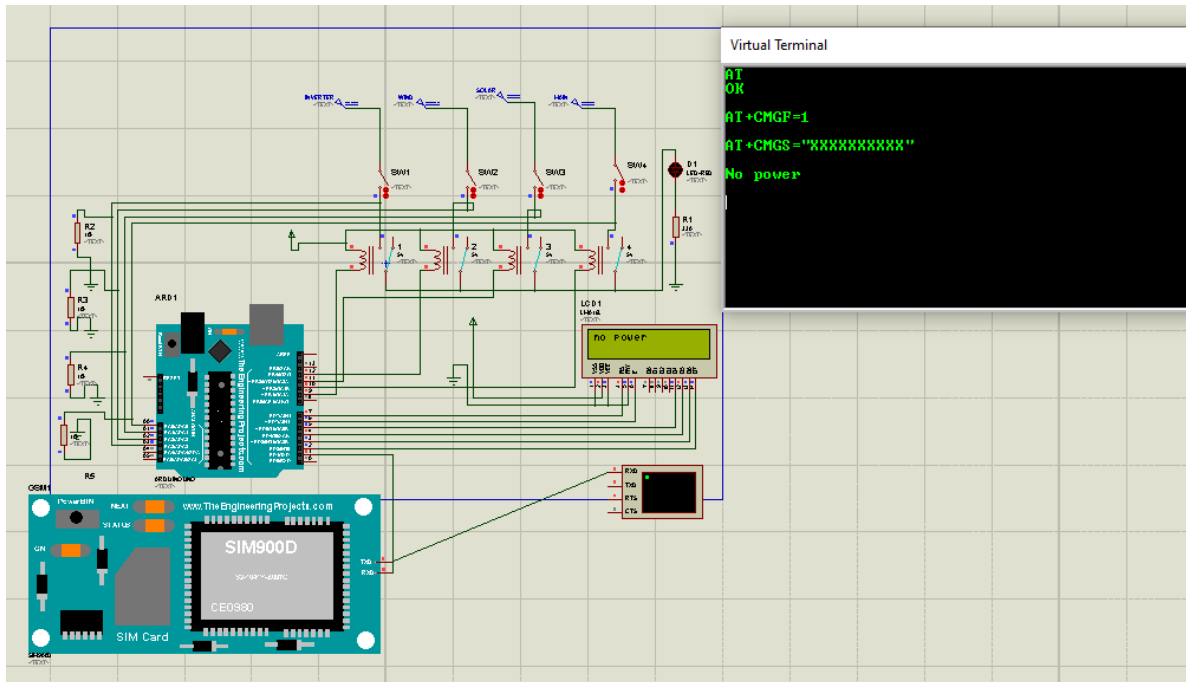**Figure Wind supply and Inverter are available**

Figure No power supply

ADVANTAGES

- This system could be used in that places where we have different sources of supply such as solar, main and wind.

- This system could be used in industries for supplying the uninterruptable power supply to the industrial machines.

- This system could be used in educational institutes and hospitals for supplying the uninterruptable power supply to the hospital or educational equipment.

- This system is more compact and reliable as compared to the electrical ATS panels.

- This system is less costly as compared to the other power control systems.

APPLICATIONS

The voltage available at the output can be used for any purpose at hospitals, industries, houses etc. one of such uses is charging car battery by adding additional circuitry required to provide sufficient voltage.

CONCLUSION

This project of **AUTO POWER SUPPLY CONTROL FROM FOUR DIFFERENT SOURCES** (Solar, Mains, Wind, and Inverter) **USING ARDUINO ATMEGA328P** to handle power supply from mains, solar, wind and inverter most effectively. The outline of the project is the selection of supply f rom mains, solar, wind and inverter automatically using Arduino. The significance of this project lies in the various and wide places of applications such as; schools, hospitals, and most especially manufacturing industries and mining industries where a continuous supply of power is vital. 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

The work can be further enhanced by using the best possible power source whose tariff remains lowest at that moment.

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