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EFFICIENT ENERGY MANAGEMENT SYSTEM FOR DC MICRO GRID INCLUDING ELECTRIC VEHICLE CHARGING STATION

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ABSTRACT- This project's primary goal is to supply a continuous load by automatically choosing the supply from any of the four sources solar, inverter, main, and generator in the event that one of them is unavailable. The need for energy is growing daily, and frequent outages are creating several issues in a variety of locations, including banks, schools, hospitals, homes, and businesses. Therefore, a different power supply configuration is needed. The Arduino microcontroller and relays can be used to construct this configuration. When a source, say mains fails the supply automatically shifts to next priority source generator and so on. LED's (Light emitting diodes) can be used to show that which source is used to provide the supply.

Key Words- Relay Driver IC, LCD, switching circuit, Arduino.

I.INTRODUCTION

The project's outline uses a microcontroller concept to automatically pick supplies from the mains, generator, inverter, and solar. One source is provided with other switches to achieve the same purpose because it is not practical to provide all four sources of supply. We have four switches in this project, which we think of as four distinct supply sources. Any switch that we press indicates that the specific source that is attached to the microcontroller as input signals is not there. Microcontrollers from the 8051 series are used here. The ULN2803 receives the microcontroller's output and functions as a relay The relays which are used hear are 12V relay. The output can be observed using lamp which is getting uninterrupted power supply from other means if main supply is cut off. The power supply consists of a step-down transformer 230/12V, which steps down the voltage to 12V AC. The bridge rectifier is used to convert this to DC. A capacitive filter is used to eliminate the ripples, and a voltage regulator 7805 is used to regulate the voltage to +5V, which is necessary for the microcontroller and other components to function. These days, automating features is essential. It is simple to use and intuitive. It also saves time. Additionally, this project is a system automation prototype. . In the earlier days (even today at some places) the manual operations are frequent. When the main supply goes off the person manually turn on the generator. In case of the electrical appliance control using automation causes more safety. This project is a prototype for the same which is auto change over to generator when main supply fails. In this system we are designing an embedded circuit to control this. In case there are four phases, then the switching will be in the default phase. Four relays are there to control the switching.

The phases will be shown by the operation of switch that is on /off. According to the conventional model of current flow originally established by Benjamin Franklin and still followed by most engineers today, current is assumed to flow through electrical conductors from the positive to the negative pole. In actuality, free electrons in a conductor nearly always flow from the negative to the positive pole. In the vast majority of applications,

however, the actual direction of current flow is irrelevant. Therefore, in the discussion below the conventional model is retained. Terminal to the right along the red (positive) path to the output, and returns to the lower supply terminal via the blue (negative) path. In each case, the upper right output remains positive and lower right output negative. Since this is true whether the input is AC or DC, this circuit not only produces a DC output from an AC input, it can also provide what is sometimes called "reverse polarity protection".

In the diagrams below, when the input connected to the left corner of the diamond is positive, and the input connected to the right corner is negative, current flows from the upper supply Switches it shows the absence of that particular source which is connected to microcontroller as input signals. Here we are using 8051 family microcontroller. The output of microcontroller is given to the ULN2003 this acts as a relay driver. This can drive up to 7 relays.

The relays which are used hear are 12V relay. The output can be observed using lamp which is getting uninterrupted power supply from other means if main supply is cut off. The power supply consists of a step down transformer 230/12V, which steps down the voltage to 12V AC. This is converted to 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. Automating feature is now the need of the day. It is user friendly and easy to use. It saves time too. In the earlier days (even today at some places) the manual operations are frequent. When the main supply goes off the person manually turn on the generator. In case of the electrical appliance control using automation causes more safety.This project is a prototype for the same which is auto change over to generator when main supply fails

II.SYSTEM DESCRIPTION

Due to its benefits for EVCSs over AC microgrids, particularly in terms of enhancing public grid peak performance without expanding grid capacity, a DC microgrid is taken into consideration in the study. Additionally, since installing wind turbines requires the availability of suitable locations and spacious spaces, which is a significant difficulty in urban settings, PV arrays are used as distributed generation units in the proposed construction. Also, the prospects of using PV power for charging applications are very diverse as the power production from PV arrays offers greater flexibility for the integration with the EVFCSs while the unstable nature of wind speed makes it less granulated for charging applications as compared to PV systems. In addition, a diesel generator connected to the PV source is used to provide the necessary means of support to the PV system at various time intervals. The coordinated operation of the PV-diesel generator offers a reasonable way to eliminate the need for energy storage device in terms of the system economics. In this study, a low-voltage DC microgrid including EVCS and distributed generation units is considered . The proposed system uses a solar PV array with standard conditions , a diesel generator set and grid energy to charge the EVs connected to EVCS.

The detailed model of PV arrays and diesel generator can be found . In the proposed model structure, the PV string is connected to the DC link through a DC/DC converter and the EVFCS is linked to the DC bus through bidirectional DC/DC charger. The electrical grid, diesel generator and other loads are connected to the DC link through individually controlled AC/DC inverters. The inverters' control is modulated in this system through the pulse width modulation (PWM) signals generated by the inner current and voltage loop PI controller based on the design introduced . It is noted that a PWM-PI controller is used in the proposed model structure since it is one of the most widely used methods in the control of inverter-based microgrids; however, any improved method such as model predictive control can be easily implemented for different
objectives.

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Circuit diagram

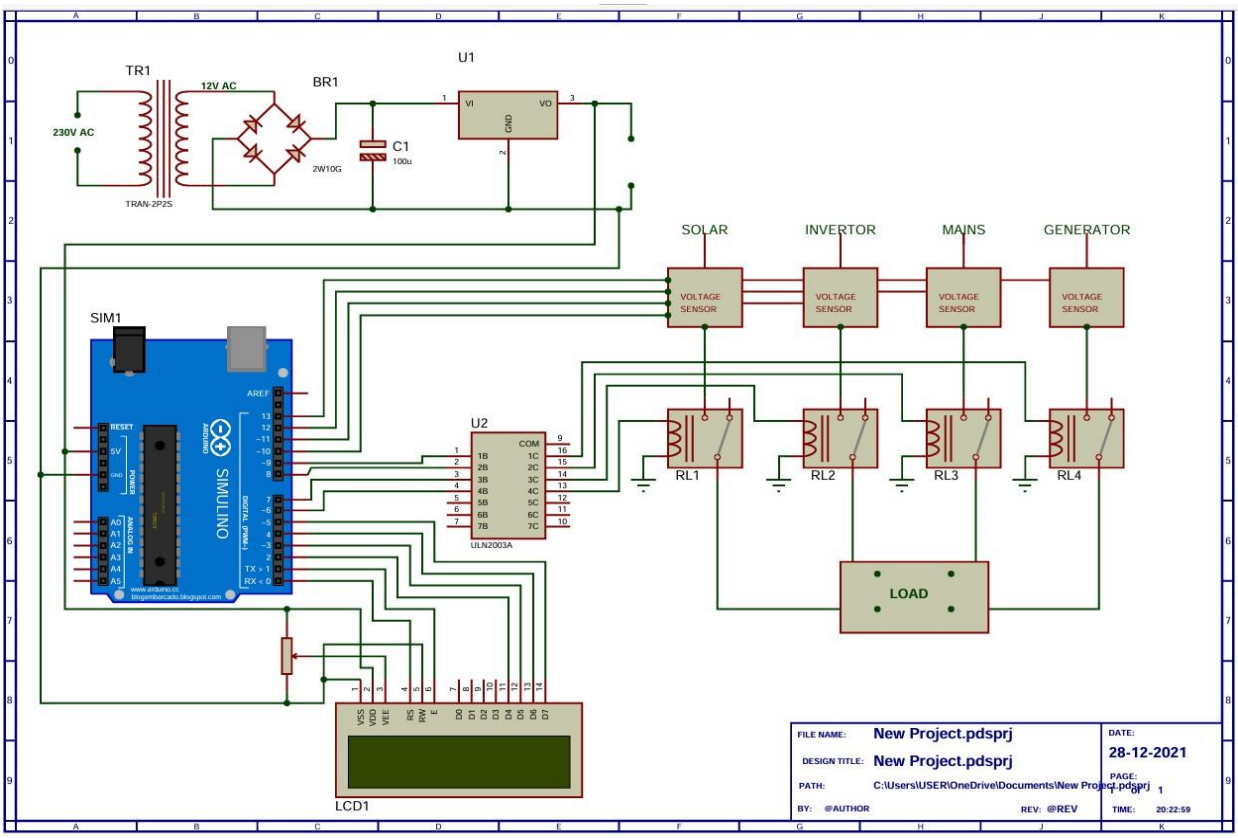

Fig-1 Circuit dig of Efficient Energy Management System For DC Micro Grid Including Electric Vehicle Charging Station

III.DESIGN ARCHITECTURE

A. Working:

In this project, we provide a 328p microcontroller to construct our project control. The controller's signal is utilised to switch the charging and discharging management relay. The microcontroller is the project's brain.

There are switches to represent the power source and their on/off condition shows the availability or unavailability of the power source. This signal is given to the microcontroller and it is programmed to fulfil the above requirements. The output of the microcontroller is given to ULN2003 relay driver. The relay finally selects the phase in terms of ac voltage. if EV charging get fully charged then its get signal to microcontroller high logic through the auto cutoff circuit of battery. Due to this saves the battery from damage. If Battery used for EV over heated due to over load or over charging then vehicle stop working and give signal and buzzar to secure the person and system of vehicle.

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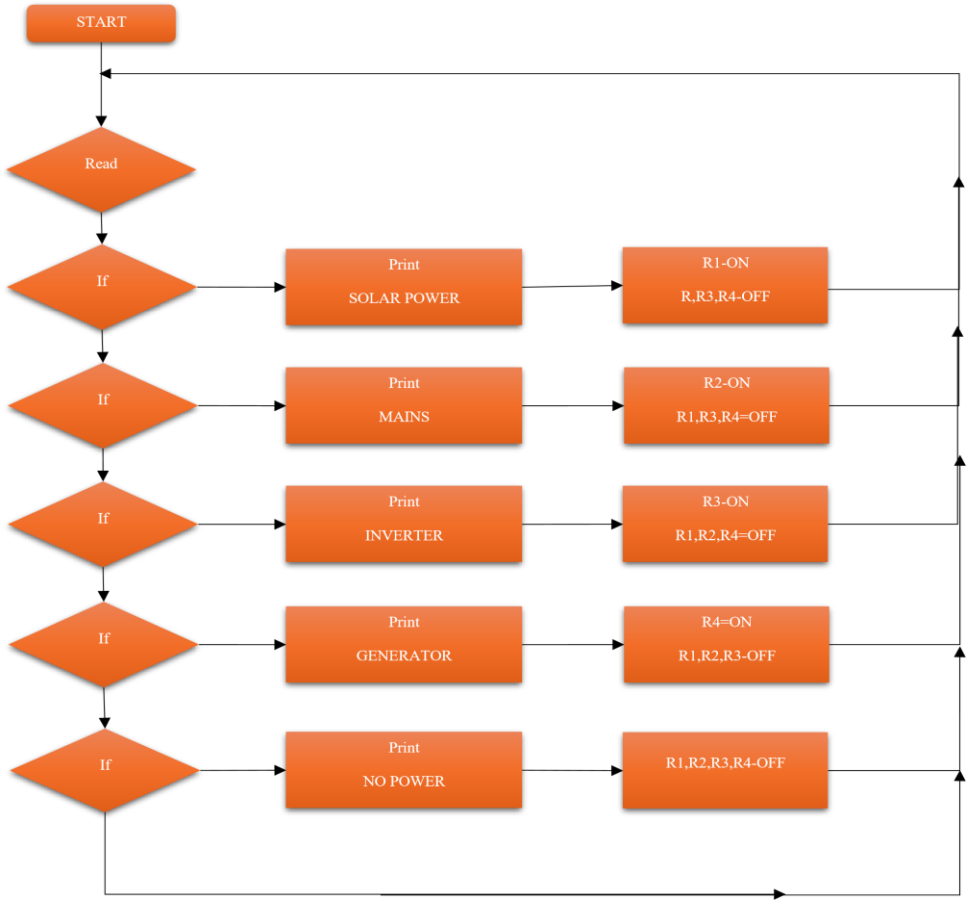
B Methodology



C Technically specification:

Microcontroller ATmega328
Operating Voltage 5V
Input Voltage (recommended) 7-12V
Input Voltage (limits) 6-20V
Digital I/O Pins 14 (of which 6 provide PWM output)
Analog Input Pins 6
DC Current per I/O Pin 40 mA
DC Current for 3.3V Pin 50 mA
Flash Memory 32 KB of which 0.5 KB used by boot loader SRAM 2 KB EEPROM 1 KB
Clock Speed 16 MHz

IV.Hardware Required

1 Arduino board:

The ATmega328 serves as the foundation for the Arduino Uno microcontroller board (datasheet). A 16 MHz crystal oscillator, six analogue inputs, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button are all included. Everything required to support the microcontroller is included; to get started, just use a USB cable to connect it to a computer or power it with a battery or AC-to-DC

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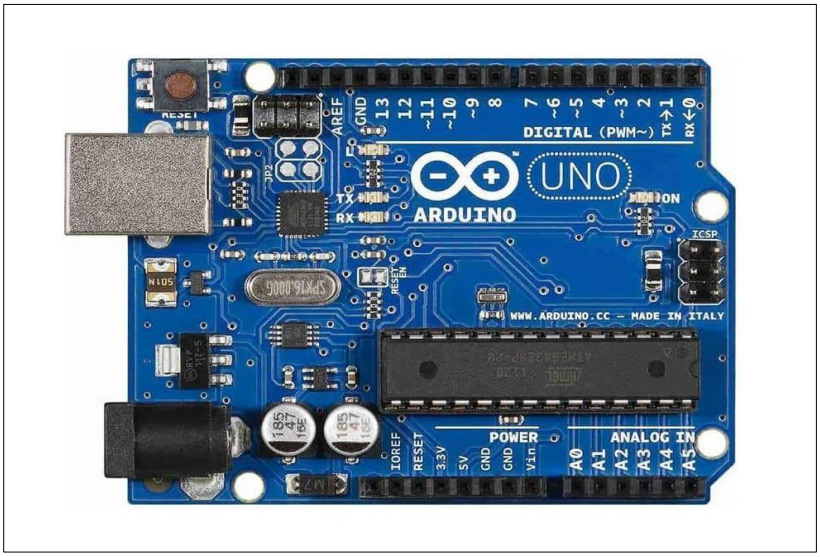
adapter.

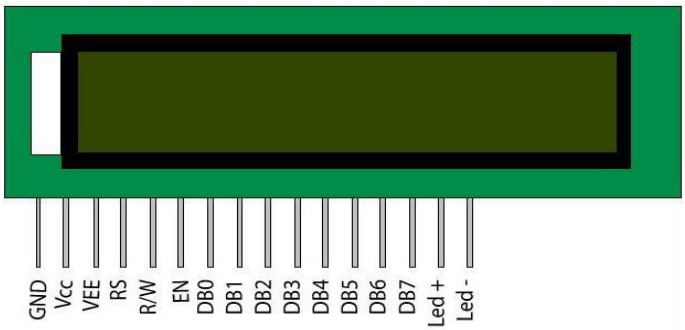
The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0.



2 LCD(16x2)

2x16 LCD is the type of liquid crystal display (LCD) that has been utilised. That is, two lines of sixteen characters each. Eight data lines are needed because the LCD is in 8bit mode. In addition to eight data lines, one RS, one RW, and one enable line are needed.

The RS line is used to select whether the data or instruction is being transferred between the controller and the LCD. The RW line is used to indicate if data is read from the LCD or written into the LCD. The RW pin is pulled low when data is being sent to the LCD. The enable pin is basically a latch pin which tells the LCD that the data is available on the data lines. The resister R7 is used to set the intensity of the BACKLIGHT.



3 Relay

Relays that work on the basis of electromagnetic attraction are known as electromagnetic relays. It is a kind of magnetic switch that generates a magnetic field using a magnet. The switch is then opened and closed and mechanical operations are carried out using the magnetic field.

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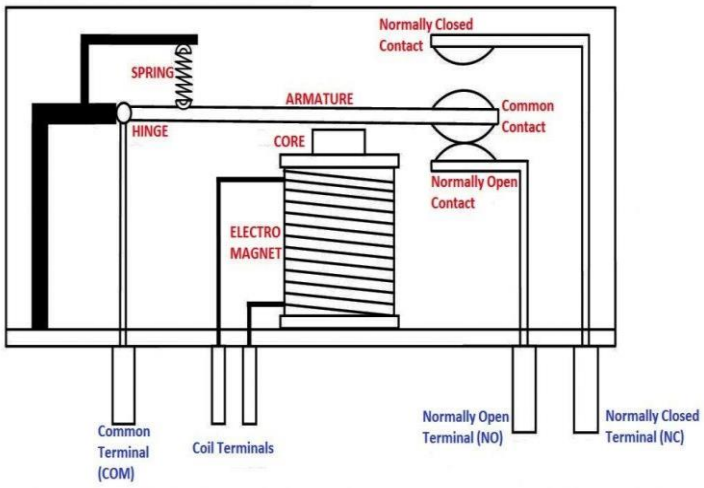

4 Toggle

The toggle switch is a type of electrical switch that is identified by the presence of handle or lever that makes it possible to control the flow of electric current/signal from a power supply to a device or within a device. It is a hinged switch that can assume either of two positions i.e. ON or OFF. It is used to switch between two conditions in a circuit. Toggle Switches employ rocker-type contact mechanism.

1 Advantages:

- Uninterrupted power
- Continuity of operation
- Save time

2 Disadvantages:

- Relatively complex than existing systems.
- Switching losses are relatively higher

3 Application:

- Use in industry
- Commercial complex, hospitals
- Inverter system in residential

Future Scope

- To As the number of EVs increases, the capacity of microgrid charging stations (MGCS) will also need to increase.
- To Integrating renewable energy sources (RES) like solar and wind power into the microgrid can help with this.
- To Using the EV battery as a DC source can help improve voltage quality and reduce charging durations.
- To An EMS can limit grid power usage by controlling the charging and discharging of battery energy.
- To An EMS can use optimization methods to lower the cost of used energy and minimize stress on the power grid.

V.CONCLUSION

In order to lessen reliance on the grid and reduce pollution in the system, this study proposes the use of a simpler model of decentralized micro control with renewable energy for charging modes. Four system components' converters are separately controlled by the microcontrollers to produce a synchronized action.

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