DESIGN OF THREE PHASE POWER CHANGEOVER SWITCH USING MICROCONTROLLER WITH SINGLE PHASING PREVENTOR

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Abstract:

Power failure or outage in general does not promote development to public and private sectors. This paper presents the design and construction of an automatic power change-over switch that switches Power supply from main supply to another standby supply and it does this automatically using microcontroller. This device eliminates the challenge of a manual change-over system. A voltage sensing circuits, relay, LCD, were all coordinated using a microcontroller. Also the advancement in this paper is prevention of single phasing. An automatic power changeover system designed and implemented basically disconnects load from its power source and transfers it to a standby power source, in the advent of a power failure. This transfer is done at a very high switching speed such that minimal change occasioned by the transfer process goes unnoticed. It also incorporates a generator shutdown terminal that switches off the generator after the Mains power supply has been restored. This process is controlled by a microcontroller that keeps sensing to detect the availability of power supply on the Main supply line. The system is also fitted with an AC voltmeter that correctly reads the analogue voltage supplied by the power source and displays it on a seven segment display module.
Key words: Single Phase Preventing, Switching, Microcontroller.

INTRODUCTION:

An automatic power changeover system designed and implemented basically disconnects load from its power source and transfers it to a standby power source, in the advent of a power failure. This transfer is done at a very high switching speed such that minimal change occasioned by the transfer process goes unnoticed. It also incorporates a generator shutdown terminal that switches off the generator after the mains power supply has been restored. This process is controlled by a controller that keeps sensing to detect the availability of power supply on the Main supply line. The system is also fitted with an AC voltmeter that correctly reads the analogue voltage supplied by the power source and displays it on a seven segment display module. The power change-over switch is a device that detects when the electrical energy from the mains power supply is cut off and subsequently switching on the power generator. Basically it is aimed at switching on a more convenient power supply to the load. Since it switches on power to the load, precautions has to be taken while choosing the type of change-over switch, of power generator to supply electrical energy that would power their homes whenever the supply from the electricity company is cut off. A power change-over switch enables this transfer. Power change-over switches can be operated manually in order words whenever there is power failure, an individual can shift a handheld lever that would open contact on the main power supply line and close contact on the power generator line. This process consumes time and puts such an operator at risk of electrical hazards.

I. CONSTRUCTIONAL DETAILS:

The above figure shows the block diagram of an automatic power supply changeover using a microcontroller. It consist mainly three power supply sources solar, MSEB, and generator also voltage sensor, transfer switch, controller, relay driver. AC Voltage sensor measures AC voltage levels. They receive voltage inputs from the respective power source and provide output as analog voltage signals. This analog signal is converted into DC by rectifier circuit and given to the microcontroller. The controller is use for control section is responsible for carrying out the desired control via the output bit of controller. The controller computed program according to the designed algorithm using assembly language program, and executes the required action as it receive the corresponding input digital signals from the input interface. The output interfaces of controller drive the transistor directly which in turn drive the relay. Three relays are responsible for the power changeover. The LCD display is used to display the respective available power supply.

Automatic power changeover switch consists of:

1] Voltage sensor
2] Adriano-Uno
3] Relay driver

4] Display unit

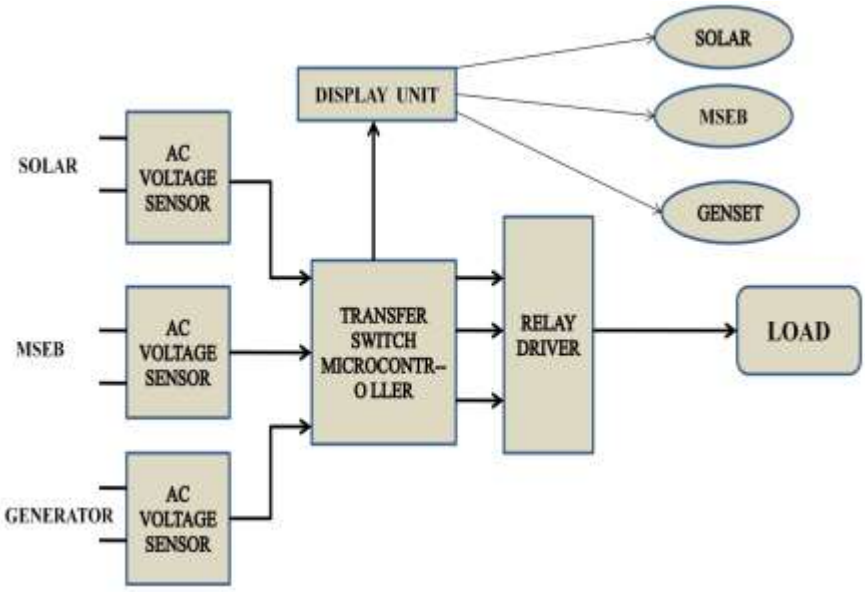

Figure 1-Block dig of Automatic power change over switch

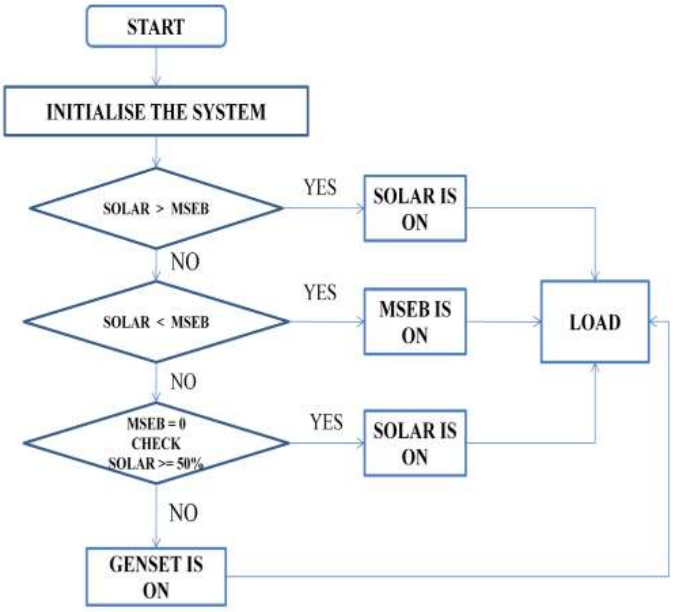

Figure 2-Flowchart

A] Voltage Sensor

Voltage sensor measures AC voltage levels. They receive voltage inputs and provide output as analog voltage signals analog current levels. The voltage sensor consist of four diodes, one variable resistance which is called as varister, capacitor and Zener diode, the variable resistance is set by manually with respective to the voltage ratio.

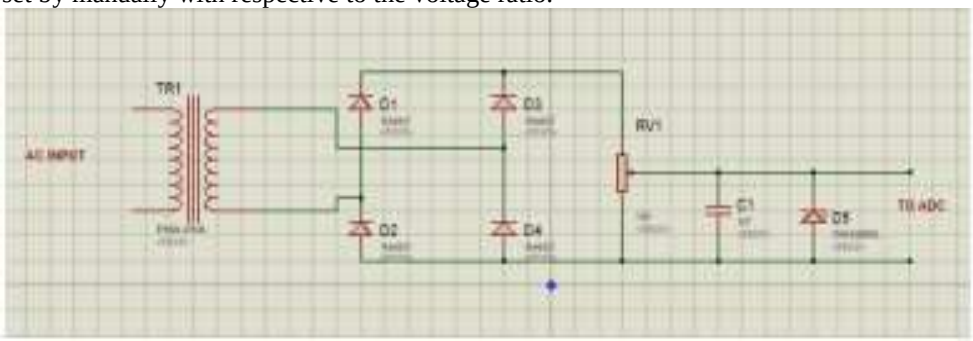

Figure 2-Voltage Sensor

B] Arduino-Uno

The Arduino Uno R3 is an open source microcontroller board based on the ATmega328 chip. This Board has 14 digital input/output pins, 6 analog input pins, Onboard 16 MHz ceramic resonator, Port for USB connection, Onboard DC power jack, An ICSP header and a microcontroller reset button. It contains everything needed to support the microcontroller. Using the board is also very easy, simply connect it to a computer with a USB cable or power it with DC adapter or battery to get started.

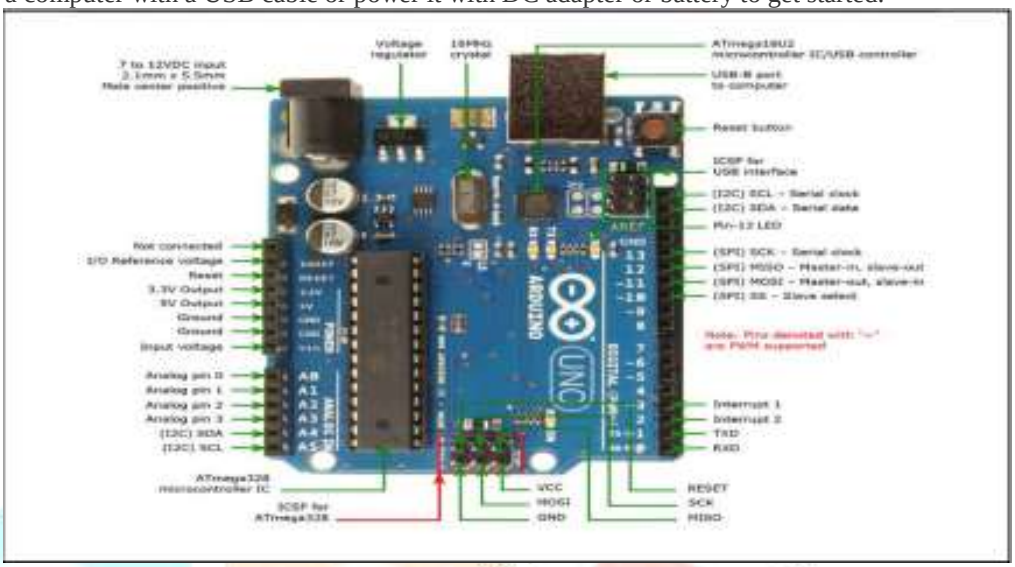

Figure 3-Arduino-Uno

II. DESIGN& IMPLEMENTATION:

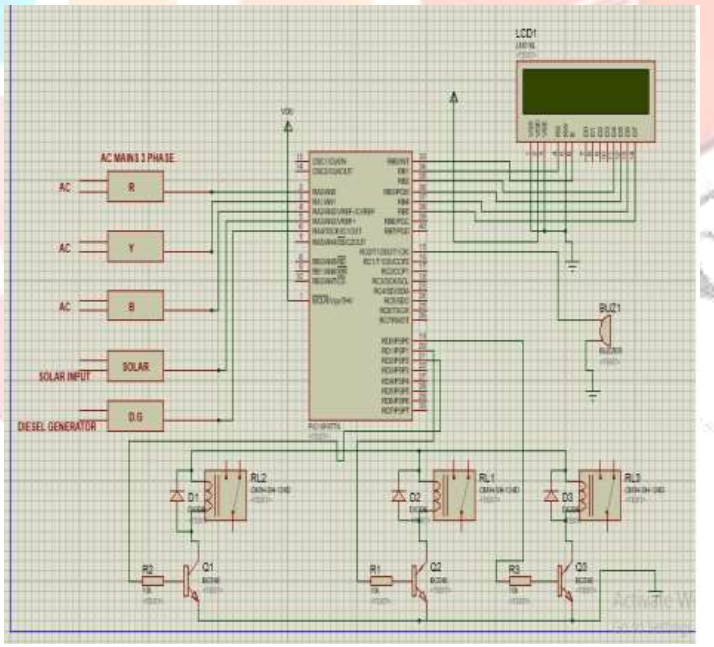

Figure 5-Simulation of Circuit Diagram

The circuit diagram is divided into four sections such as AC voltage sensor, power supply, arduino-uno interfacing control, and LCD display.

Voltage sensor interface:-

Voltage sensors include the transformer, capacitor, variable resistor (pot), Zener diode, bridge IC etc.
Transformer secondary is connected to W10 Bridge IC for rectification purpose.
The capacitor is connected across the bridge IC.
The variable pot connected in series with supply.

Adriano-Uno interfacing:-

There are six sensors connected to analog port pins A0 to A5 of arduino-uno.
Power supply terminal connected to 5V and ground.

Relay driver which connected to pin number 8,9,10. LCD connected to digital pins 2 to 7.

Relay Circuit:-

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

Figure 6-Hardware setup of proposal system

III. ADVANTAGES:

- Ideal for efficiently switching to generator power.
- Necessary for uninterrupted electrical power supply.
- Ideal for less accessible generators.
- The device is cheap, reliable and easy to operate.
- Whenever there is power outage, it reduces manpower stress.
- Safety for operator from the risk of shock.

IV. FUTURE SCOPE:

1. Where electricity is highly needed for small and medium entrepreneurs that use a technique of automatic change over switch with generator shut down facility. With external electrical power use alteration will gives more wide area to application area.
2. Industries
3. Hospital
4. Bank

V. CONCLUSION:

This project deals with solving industry related problems. At the end of this project
Following results were achieved**:-**

- The system became fully automated.
- Upon the restoration of utility power, the system commutes the load back to utility and shutdown the generators.
- This system to automatically changeover when the voltage, current rises above its rating, to protect the equipment from damage.
- Time required to switch the power supply from one source to another sources is near to the expected result which is less than0.25sec.
- Automatic transfer switch which has to be accurately monitor the power supply.

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