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Design And Development Of Automatic Change Over System

Pratik Jadhav, Satyajeet Sonawale, Priyanka Pawar, Pooja Desai.
Guided by: Prof Ms. Bhagyashree Patil.

Department of Electrical Engineering, Shree Santkrupa Institute of Engineering and Technology, Ghogaon, Maharashtra.

ABSTRACT:

The automatic transfer switch is helpful transfer the load from various power sources to ensure continuous operation of load. Automatic transfer switch is needed in developing countries where frequent power failure is a major problem. Industries, public and private sector organization and even domestic user cannot handle power outage due to it pushes them in loss in business disturbance in normal official work, hindrance in routine and domestic life. In this system we have highlighted the use of good border in term of switching speeds and smooth evolution. Allowable by means of an automatic connection to a network of other sources of supply in case the main source of power supply distress.

The automatic transfer switch which is a switchgear control system, provides a functional system that offers an automatic switching of power supply between a primary source and secondary source is generator. The method laboring in designing the automatic transfer switch include the use of electromechanical relay, contactor, voltage monitoring relay and delay timer relays as main component of the system.

Keywords: Arduino, D-type flip-flop, logic gates, 555 timers, 3-input AND gates, JRC 4558, IC. Voltage Sensors, Frequency Sensor, Current Sensors.

INTRODUCTION:

Industrial automation and control have contributed immensely to the high rate of the world's technological growth. Power control and automation is a part of this field which is applied in virtually anywhere electrical power is used, generated or transmitted. Manual power change-over switches have been in existence and in different forms and shapes. 1959, the advent of microelectronics has paved way to modify the manually operated change-over switches. The Changeover Switch is a device used to switch off a power

supply and subsequently switch on another power supply. 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 Changeover Switch, while selecting the appropriate size, the control of arcing has to be put into consideration. A good change over switch must have adequate insulation and must be so constructed and located as not to constitute a potential hazard. The partial contact leads to overheating of the components and may lead to fire outbreak in the entire room. It is fully automated. It can be used in residential houses, offices and most importantly, in factories that required constant power supply. It has so many advantages over the existing ones/types.

PROBLEM STATEMENT:

Nowadays securing constant power supply is becoming more important. In Nigeria, power supply for domestic use, commercial and industries is highly unstable. The applications of alternative sources are associated with challenge of switching smoothly and timely between the mains supply and the alternative sources whenever there is power failure on the mains source.

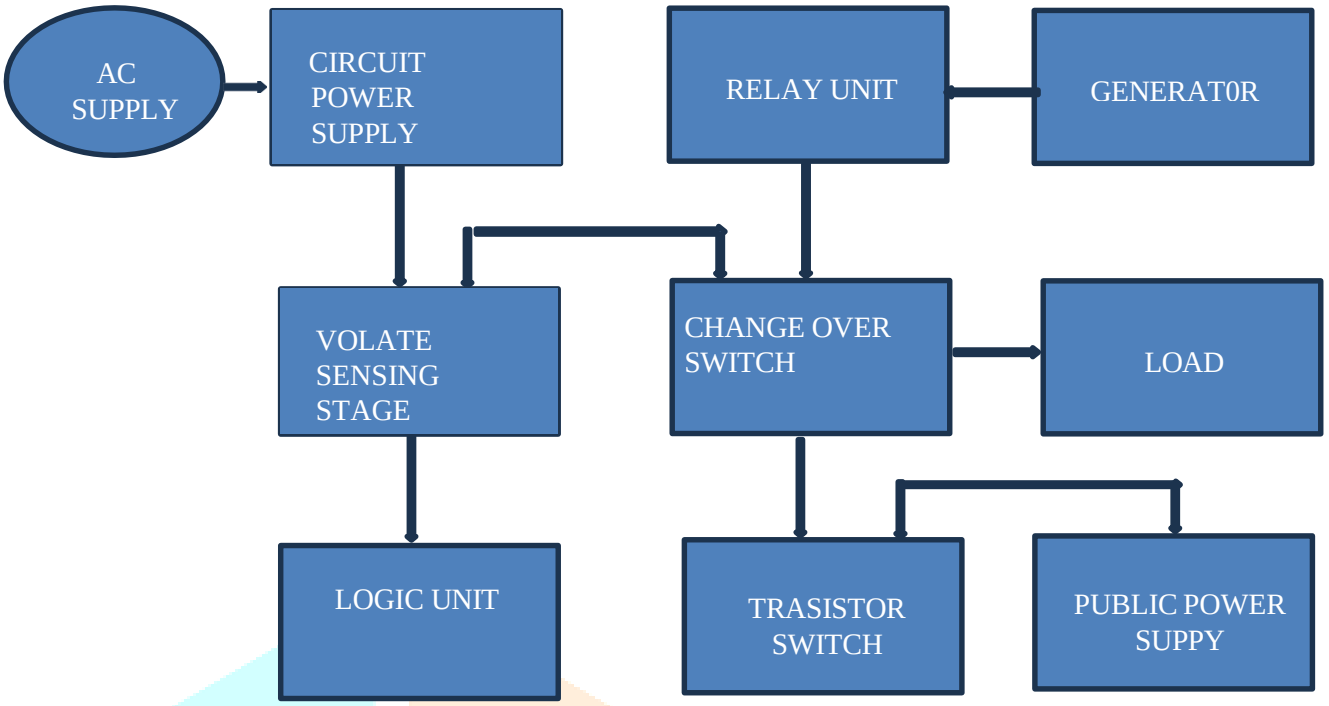
The use of an automatic changeover switch with generator cut off and starter eliminate the stress encountered when switching from mains supply to generator Vis visa and reduce time loss for increase productivity.

OBJECTIVE

This project focuses on the design and construction of an automatic change-over switch with generator cut off and starter.

Hence, the specific objectives are to provide a system that automatically switches on the generator and switch over the load to the generator whenever there is mains power failure and also to provide a device that automatically switches over to mains supply once restored and simultaneously switches off the generator.

BLOCK DIAGRAM:



BLOCK DIAGRAM DISCRIPTION:

1. Power Supply Unit:

There are two power supply unit in this project (Public Power Supply and Circuit Power Supply). The public power supply unit has a nominal three phase or phase-to-phase voltage level of 415v AC voltage under normal system condition, while the single phase-to-neutral nominal voltage is 240v. The circuit power supply is tapped from the public power supply and rectified to power the circuitry. It converts AC voltage to DC voltage. A rectifier, filter, and a regulator are used in the process of conversion.

2. Sensors:

Voltage Sensors: Monitor the voltage of both the primary and backup sources.

Frequency Sensors: Ensure frequency synchronization for proper operation.

Current Sensors: Detect load current to avoid overloading and provide feedback

3. Contactor ATS:

This kind of automatic transfer switch is used for making & withstanding short-circuit currents but not used for breaking short-circuit currents. Generally, these switches depend on 3-pole or 4-pole low voltage contactors. The contactor type ATS has a simple design, mechanically seized & operated electrically. As compared to the circuit breakers, it operates very fast and also decreases transfer time. Generally, these switches are the most economical.

4. Relays:

Voltage Relays: Detect undervoltage or overvoltage conditions in the power supply.

Time Delay Relays: Introduce a delay for switching to ensure system stability.

Overload Relays: Protect against excessive current or load conditions.

Control Relays: Trigger actions like starting the generator or initiating the transfer

5. Generator or Backup Source Equipment:

Automatic Start Module: Starts the generator automatically upon power failure.

Voltage Regulator: Maintains stable output from the generator.

Battery Bank (for inverters): Ensures uninterrupted power.

ADVANTAGES

1) Safety: - Safety concerns arise when manual switches are used, especially during adverse conditions, like storms or power outages at night. There's a need for personnel to be physically present to make the switch. This exposes them to potential hazards, like electric shocks or other environmental risks. With an ATS, these risks are minimized, if not eliminated. Since everything is automated, there's no need for anyone to be present, making it a safer option.

2) Consistency: - Some facilities, such as data centers and hospitals, cannot afford power outages. A few seconds of a power outage can cause significant data losses and endanger lives. With its automatic operations, an ATS ensures a consistent power supply, making it an indispensable tool for such establishments.

3) Speed: - An ATS stands out for its speed. It can detect power losses almost instantly and then switch to the backup generator within moments. This rapid transition minimizes downtime, which can be invaluable, especially for operations that rely on continuous power. Moreover, potential damages to sensitive equipment that might result from power interruptions are significantly reduced.

DISADVANTAGES

1) These types of switches are expensive as compared to manual switches.

2) These switches require more maintenance as compared to manual switches.

WORKING

The working of Automatic changeover switch is very simple, it is device is that automatically switch the power supply from the main source to backup source (DG). When it detects the power failure or abnormal condition it transfer load to backup source, Once the mains supply restored it switches back automatically,

In normal condition, switch monitor voltage and frequency of main supply, When the main supply stable and within limit the load connected to main power supply. In this condition backup source is “OFF”.

During Abnormal condition or power failure switch detect the under voltage / Over voltage / frequency deviation.

When main power supply fail, the switch send signal to start backup source, once back up supply stabilize (it takes few minute delay) the switch transfers the load to back up supply.

In case of restoration of power supply backup to mains, the switch is continuing monitor mains supply, when it detects mains supply is stable. The switch transfer load to mains supply and turn off back up supply

APPLICATION

1) These switches are used for protecting telecommunication & data networks, industrial processes & critical installations like financial transaction centers & health care facilities.

2) These switches are used to transfer electrical power between two power sources like primary utility & secondary backup power source.

3) These types of switches are also used in other electricity switching applications like utility to utility, the generator to generator & three-source systems.

CONCLUSION

The manual start and stop and transfer the on generator can static used after the addition of the automatic controller. It can engross the self-start generator at the start of the power failure. The total cost of the automatic transfer switch is very low. Automatic transfer switch has the capability is to control and switch between the power sources in minimum seconds. It is also relief for starting a standby power generator when there is power failure from mains without the necessity for human effort. The system work is satisfactory with respect to design specification.

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