AUTO POWER SUPPLY CHANGE OVER FROM DIFFERENT SOURCES TO EMERGENCY PANEL AT THERMAL POWER STATION (TPS)

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Abstract -Electricity is most needed in our day to day life. Now a day's electrical energy is generated by the conventional sources like coal, diesel, nuclear etc. and soon they will be exhausted and then we will need other alternatives to generate electricity. But we can extend the life of fossil fuels by managing our demands and using other sources to fulfill our need of electricity. There are many nonconventional energy sources like solar, wind etc. These non-conventional energy sources are costlier than the conventional sources so, completely replacing the use of conventional sources is not the best option. Not only we need to use both of the sources of electricity, we also need to prioritize the selection of sources prudently. The project is based on the idea that power demands will always increase and we need uninterrupted power supply. Since every source of electricity has its limitation as far as their availability is concerned. Arduino based programming is used to shift between different sources of electricity.

***Key Words*:**Power sources, Supply failure, Change over, Arduino UNO.

1.INTRODUCTION

The project is designed to automatically supply continuous power to a load through one of the four sources of supply that are: Solar, main supply, inverter and diesel generator when any one of them become unavailable. These are connected to Arduino ATmega 328p that provides input signals to it. Whenever a switch pressed it shows the absence of that particular source. A relay driver is used that receives arduino generated output and switches that particular relay to provide continuous power supply. A lamp is used as a load for demonstration purpose which draws supply from main. When main fails to supply power, automatically next available source is used say inverter. If inverter fails, then the next source is used and so on. An LCD also used to display which source is being currently used for power supply.

Therefore, this project provides an effective solution to provide an alternate power supply during frequent power cuts. In this project we use four switches to demonstrate the respective failure of the power supply. When any of the switches pressed, it shows the absence of the particular source, switches are connected to microcontroller as input signals. The output of the microcontroller is given to the relay driver IC, which switches appropriate relay to maintain uninterrupted power supply to the load. The output shall be observed using a lamp during power supply from mains initially. On failure of the main supply the load gets supply from the next available source, say inverter. If the inverter also fails, it switches over to the next available source and so on. The current status as to which source supplies the load is also displayed on a 16X2 LCD display

2. PHASE SEQUENCES

In a three-phase system, the order in which the voltages attain their maximum positive value is called Phase Sequence. There are three voltages or EMFs in the three-phase system with the same magnitude, but the frequency is displaced by an angle of 120 deg electrically.

Taking an example, if the phases of any coil are named as R, Y, B then the Positive phase sequence will be RYB, YBR, BRY also called clockwise sequence and similarly the Negative phase sequence will be RBY, BYR, YRB respectively and known as an anti-clockwise sequence.

It is essential because of the following reasons:

- The parallel operation of the three-phase transformer or alternator is only possible when its phase sequence is known.
- The rotational direction of the three-phase induction motor depends upon its sequence of phase on three-phase supply. And thus, to reverse its direction the phase sequence of the supply given to the motor has to be changed.

A. PARALLEL OPERATION

Parallel operation is the connection of two or more power sources of the same size and output volt-age to obtain a higher output current. When connecting in parallel the outputs must be connected together keeping polarity in mind. The output voltage remains the same, but the current increases.

Conditions for parallel operation:

i. The phase sequence of the Busbar voltages and the incoming machine voltage must be the same.
ii. The Busbar voltages and the incoming machine terminal voltage must be in phase.
iii. The terminal voltage of the incoming machine and the alternator which is to be connected in parallel or with the Busbar voltage should be equal.
iv. The frequency of the generated voltage of the incoming machine and the frequency of the voltage of the Bus bar should be equal.

B. VECTOR GROUP

In electrical engineering, a vector group is the International Electro technical Commission (IEC) method of categorizing the high voltage (HV) windings and low voltage (LV) winding configurations of three-phase transformers.

The vector group designation indicates the windings configurations and the difference in phase angle between them. For example, a wye HV winding and delta LV winding with a 30-degree lead is denoted as Yd11.

The phase windings of a polyphase transformer can be connected internally in different configurations, depending on what characteristics are needed from the transformer. In a three-phase power system, it may be necessary to connect a three-wire system to a four-wire system, or vice versa. Because of this, transformers are manufactured with a variety of winding configurations to meet these requirements.

Different combinations of winding connections will result in different phase angles between the voltages on the windings. Transformers connected in parallel must have the same vector group; mismatching phase angles will result in circulating current and other system disturbances.

Table 1 describes about the types of two winding three phase transformers' connections. There are four general configurations in the connection of the windings of a three phase transformer.

Table -1: Types of Two winding Three Phase Transformer

Grou	O' Clock	TC
Group I	0 o' clock, 0º	Delta/ delta, Star/ Star
Group II	6 o' clock, 180º	Delta/ delta, Star/ Star
Group III	1 o' clock, -30º	Star/ delta, Delta/star
Group IV	11 o' clock, +30º	Star/delta,Delta/star

Minus indicates LV lagging HV, plus indicates LV leading HV

C. 86 MASTER TRIP CIRCUIT

It is the contact multiplication or an auxiliary relay which operates on the command from multiple protection relays and gives a single command to the breaker trip coil.

In Thermal Power Station-1 expansion, there are two main buses namely bus A and bus B. They are interconnected through a bus coupler. If there is 86 master trip detected on any bus the bus coupler should not be closed if and only if under voltage detected in any one of the buses the bus coupler should be kept in NC condition. We know that earth fault causes severe variation in fault current flow in the system. Under this condition also the bus coupler should be kept at NO condition since the fault current will flow in the healthy part if the system also. So, the bus coupler between bus A and bus B should be closed under the undervoltage condition. This changeover is called as violation. Another important condition is that the loads connected to the under voltage occurred bus, should not be cut out during this change over.

If 86 acted, the relay driver cannot change over from one source to another source. It is mandatory to check all the lines for proper earthling using meggers. Resetting it and further processing without checking lines for loose connection, over voltage will cause a huge damage to the system.

D. EMERGENCY MCC PANEL

In case of total grid uncertainly tripped or pulled out, the temperature of shaft will be around 500 ºC and the speed suddenly fell down from 3000 RPM to 0 RPM and comes to stand still position. This standstill condition in 500 ºC never allowed in Engineering Material Science. Because it will freeze in bearing side and turbine blade side. So, to avoid this, it is proposed to rotate the turbine at 19 RPM by using turning gear motor, for 72 hours or until the temperature falls below 125 ºC.

In all the rotating equipments, if sudden lubrication failure, it will cause a severe motor damage. So, in TPS 1 Expn, at emergency panel, source supplied to important equipments like turning gear motor, AC oil pump, Jack oil pump, IDFD lube oil pump, boiler furnace scanner, RAPH, emergency lighting, seal oil pump continuously. The above mentioned equipments operations are controlled by the emergency panel. So, we have to ensure uninterrupted power supply to the panel for effective protection. Fig 1 shows the single line diagram of existing system in the thermal power plant at Neyveli Lignite Corporation India Limited (NLCIL).

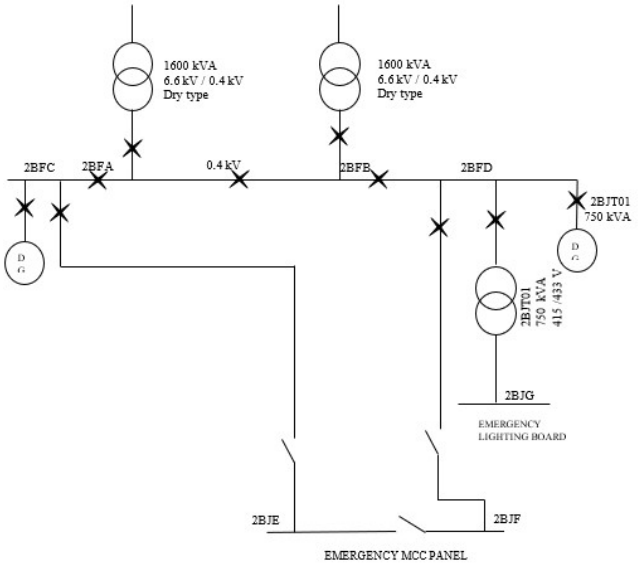

Fig -1: Single line diagram of existing system

In the existing system, if the under voltage detected by the under-voltage relay i.e., if the supply voltage decreased below 60 % of the rated value, the source change from main bus to DG set having the capacity of 750 kVA. Then the DG set compensates the under voltage. It takes 48 seconds to compensate the under voltage. For this while, DC oil pump and DC seal oil pump supplied with DC source of 1395 Ah. If the undervoltage occurs in slow transfer, it will cause a severe damage to the system. So, we have to ensure fast transfer (FT) to avoid such huge damage and loss.

3. PROPOSED SYSTEM

To eliminate the dependence of the emergency panel on DC supply and to eliminate the time delay taken to turn on the diesel generator which take about 48 seconds for complete operation, in our project, the same healthy AC motor kept in operation by changing supply to the next available AC source.

Fig 2 shows the block diagram of the proposed system.

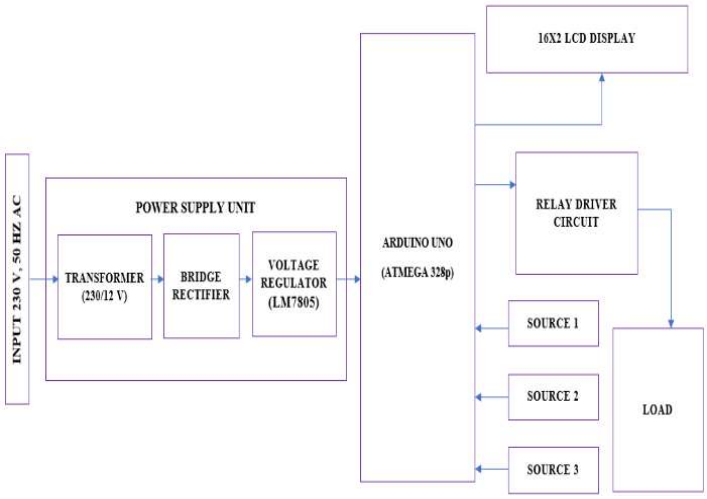

Fig -2: Block diagram of proposed system

In this proposed system, three sources connected in a pooled system where the loads can draw continuous power supply. If any one source failed in the pooled system, the next source come in line and gives supply to the load without interruption. The selection of source controlled by Arduino microcontroller and relay circuit.

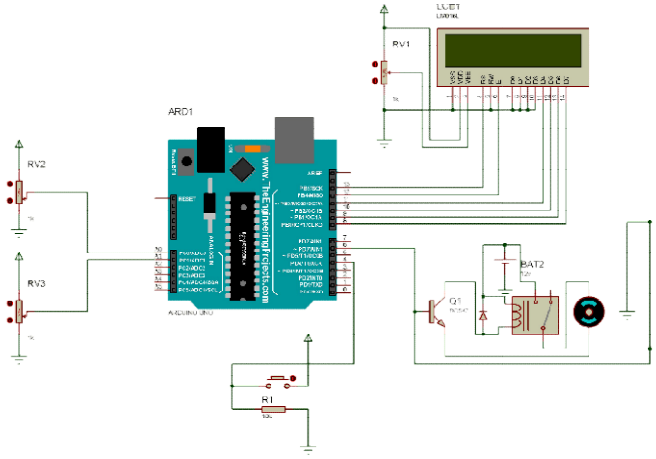

Fig -3: Simulation diagram of proposed system

Fig 3 shows the schematic simulation diagram of the proposed system. In this system, there are three power sources namely Grid supply, Solar power and DC battery. At starting the load connected with the grid supply. If the power supply fails due to any reasons, immediately the controller gives command to the relay driver and the relay driver changes the power supply to the solar supply. If the solar supply unavailable, then the source changes to battery source. If all the three sources failed, the loads connected to diesel generator and remains connected with that until main supply comes in connection.

Fig 4 shows the operational flow of the proposed system.

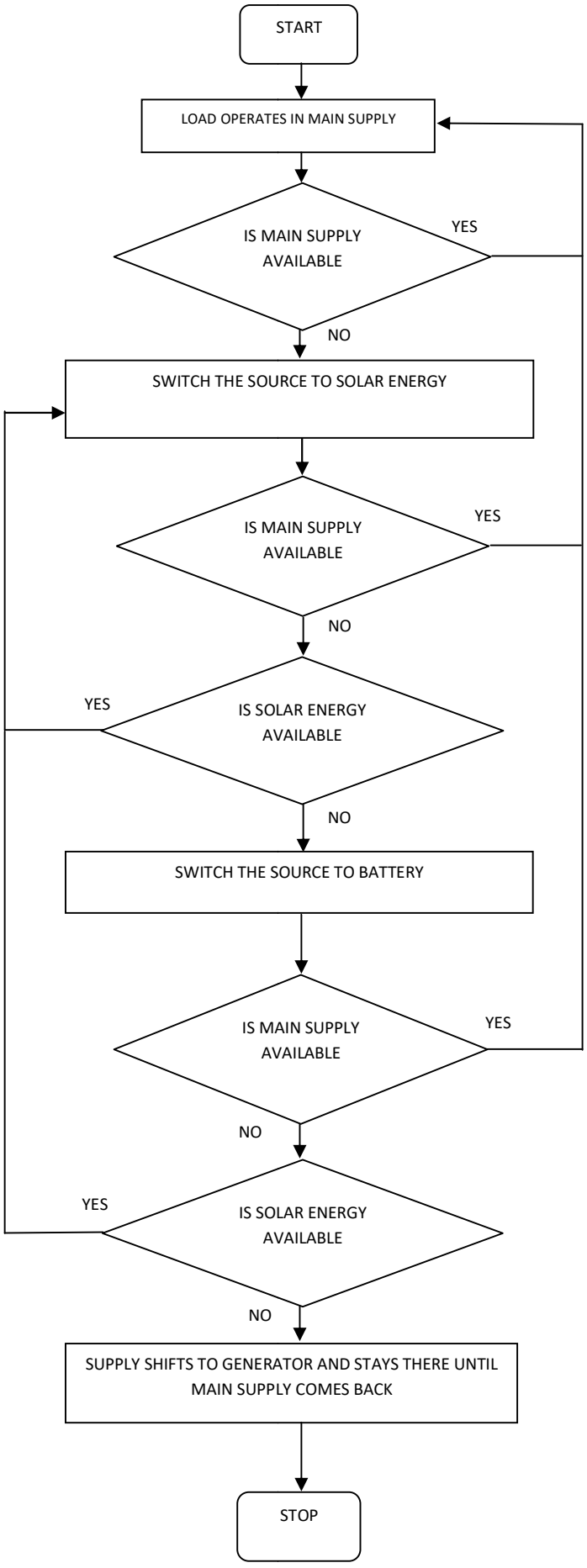

Fig -4: Operational flow of proposed system.

4. OTHER APPLICATIONS

- On 21st June 2017, at Kurnool Government General Hospital, power cut lasted for around 12 hours. Due to this power cut, 20 patients including 8 children died and many others had a harrowing experience. If this project implemented in hospitals, such these accidents prevented and ensure uninterrupted power supply.
- This project can be implemented wherever continuous power supply is prominent such as hospitals, manufacturing industries and mining industries, parliament, railways etc.,

5. RESULT

Fig 5 shows the output of the proposed system. in this the main supply from the grid connection has cut out, so the next available source of solar energy comes in line and connected to the grid. Therefore, the load remains working without any interruption. The connected source and the status of load is displayed in the LCD display.

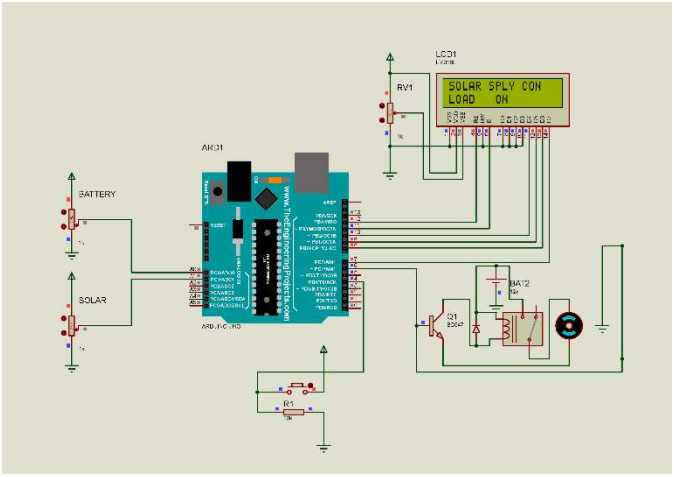

Fig -5: Output result of proposed system

6. CONCLUSION

In existing system of TPS 1 Expansion, if the AC source fails, instead of AC oil pump and AC seal oil pump, DC oil pump and DC seal oil pump with DC battery source of capacity 1395 Ah, came in service when trip occurred in the unit. After 48 seconds, DG set of 750 kVA supplies the required voltage to the emergency panel. Thus, in our project the time delay of 48 seconds and keeping double equipments for a same work are eliminated by keeping the healthy AC equipment continuously in service, but the source to the equipments changed by a relay driver. Thus, the equipment maintenance cost is reduced.

This project can be implemented wherever continuous power supply is prominent such as hospitals, manufacturing industries, etc.,

7. FUTURE SCOPE

The Future Scope of the project is the addition of the supply for extra availability of the project and the convenience of the working operation would become easier if there is an extra source to the project. The higher specification of the components used would be a better idea for the durability of the project and project lies for the longer period. The main scope of this paper is to provide a continuous power supply to the output load through any of the source in the absence of any of the source. The paper can be further enhanced by taking into consideration for using the best possible power whose cost remains lowest at that moment.

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