AUTO PHASE SELECTOR FOR AVAILABLE PHASE IN 3 PHASE SUPPLY

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Abstract - *Phase absence is a very common and severe problem in any industry, home or office. Many times one or two phases may not be live in three phase supply. Because of this, many times, some electrical appliances will be on in one room and OFF in another room. This creates a big disturbance to our routine work. Also load demand is increasing on daily basis; the major problem consumers are confronting is power interruption. Due to this power break, a lot of damage is caused to household appliances and occasionally to life. The problem of power pause originated from single phase faults in distribution system while power is available in other phases. While most domestic loads are connected to single phase supply and if the fault occurs in any one of the phases and the power is available in other phases, we cannot utilize that power. There is therefore a need to automatically switch from one phase to other and auxiliary supply when there is a power failure in any one or all of three phases of the power supply.*

Key Words: **Power Failure, 3 Phase Transformer, Relay Driver, Auto Phase Selector.**

1. INTRODUCTION

In developing countries like India, there is always the problem of interrupted power supply as insufficient power is being generated to provide consumers with continuous services and satisfactory quality. This leads to constant power failure which in turn affects both the public and private sectors of the economy. Industries, banks, hospitals and so many other public and private establishment all have major critical loads that needs to be powered at all times in order to carry out various processes efficiently. The introduction of some of these alternative sources of power

supply brings forth the challenge of switching smoothly in a timely manner between the mains supply and the alternative sources whenever there is a failure on the mains source. Automatic three phase selector is an integral part of the process of power generation, allowing smooth and instant transfer of electric current between multiple sources and load. The function of the automatic three phase selector is to monitor the incoming public supply voltage and detect when the voltage drops below a certain level that electrical/electronic appliances can function depending on the utility supply. The compares the automatic three phase selector voltage of the other two phases using a comparator circuit and if the voltages are not available, the system changes over from public supply to generator. When the generator is in operation, it prevents any feedback current to the load. It also ensures that the different power sources are synchronized before the load is transferred to them. The transfer switch senses when there is interruption if the mains supply remains absent.

1.2. LITERATURE REVIEW

In this section we will discuss about various existing Automatic phase selection methods.

1] *DESIGN OF AN AUTOMATIC POWER PHASE SELECTOR:* Phase selector is a mechanism used in alternating or switching between power phases with respect to the availability of power on any of the phases. Over the decades, there has been frequent phase failure in the power phases resulting to manual switching of the fuse from one phase to the other. However, this paper focuses on the design of a phase selector using automatic switching mechanism. This

during its operation transfers the consumer's loads to the available power source in the case of power failure in the power supply from the national grid and automatically detects when power is restored to the failed phase and returns the loads to this source. In the course of this design, several tests were carried out such as the continuity test of contactor and relay coils to ascertain low resistance, continuity test on the contacts of the materials used to ensure free flow of current, conductivity of the wires and the whole system was also simulated using the Proteus electronics software.

2] *AUTOMATIC PHASE SELECTOR USING MICRO - CONTROLLER 89C52:* In three phase equipment's, if supply voltage is low in any of the one phase and you if you wish to run all the equipment properly. This equipment will help you to rescue this situation. However proper rating fuse need to be used in three phase i.e. R, Y, and B inputs lines. Where the correct voltage is available at that time. Other low voltage phase shift to correct voltage in same manner, to run all the equipment on the single phase in the building. The circuit consist of relay comparator, transformer.

3] *DESIGN AND SIMULATION OF AUTOMATIC PHASE SELECTOR AND CHANGE OVER FOR 3 -PHASE SUPPLY:* This project work is on the design and construction of automatic phase selector and changeover switch for 3 -phase power supply. It provides a means of switching from one phase of AC mains to another in the case of failure in the existing phase, it also change over to generator if there is failure in all the three phases of the AC mains. The circuit also senses the restoration of any or all the three phases of the mains and change over without any notice of power outage. This project has been improved on the existing types of electro mechanical device that has being in use over the years. Hence this has been achieved by the use of 1 -of -4 analogue multiplexers (CD4052), analogue to digital converter (ADC0804), AT89C51 micro controller and relay switches.
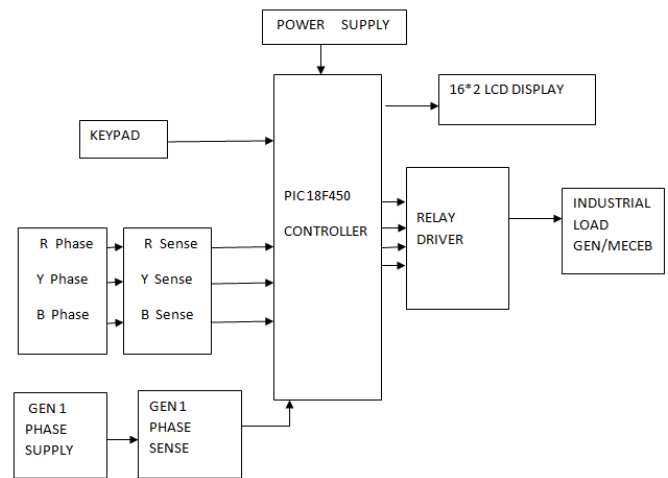
2. PROPOSED SYSTEM

Fig 1: **Block Diagram of System**

The main 3 phase supply is rectified using three bridge rectifiers which convert230V AC to 230V DC. Three sets of voltage regulators and filters follow the bridge rectifiers which regulate the DC. Using voltage divider circuit 230V is stepped down to 5V and is given to the ADC pins of microcontroller. This continuously checks the availability of all the three phases. A total of 6 loads are used in the prototype. Two relays are used to switch between 3 phases for each load. Each relay is energized or de-energized using transistors whose base is connected to the output ports microcontroller. The PIC18f4520 microcontroller is being used. AVCC of 5V is given to the microcontroller. A clock signal is given to the microcontroller using a crystal oscillator. Two capacitors are connected in parallel to crystal oscillator to stabilize the oscillations. Each load is connected to two relays to switch between three phases. The normally open (NO) and normally closed (NC) terminals of the first relay are connected to the blue phase and yellow phase respectively. Similarly the NC and NO terminals of the second relay are connected to the output of first relay and red phase respectively. When any one of the phase undergoes any fault, it is detected by the microcontroller. A signal is send to the corresponding output port. The

respective transistor connected to that port turns ON and energizes the respective relay. Hence the switching action takes place. The loads are switched according to the priority. Loads 1, 2 and 3 are given highest priority. Loads 4, 5 and 6 are given priority in the decreasing order. Current transformers are used as the current sensing element. Each load is connected to the primary ofacurrenttransformerandthesecondaryisconnectedtoavoltagedividercircuit.It is then fed back to the microcontroller which senses the condition of the load. Thus according to the condition of the load balancing of three phases is done.

A. PIC 18f4520 microcontroller:

Data Memory up to 4k bytesn Data register map - with 12-bit address bus 000-FFF

- Divided into 256-byte banks

- There are total of F banks

- Half of bank 0 and half ofbank 15 form a virtual (oraccess) bank that is accessibleno matter which bank isselected – this selection isdone via 8-bits

- Program memory is 16-bits wide accessed through a separate program data bus and address bus inside the PIC18.

- Program memory stores the program and also static data in the system.

- On-chip External

- On-chip program memory is either PROM or EEPROM.

- The PROM version is called OTP (one-time programmable) (PIC18C) The EEPROM version is called Flash memory (PIC18F).

- Maximum size for program memory is 2M n Program memory addresses are 21-bit address starting at location 0x000000

Fig -2: **PIC18f4520**

B. Transformer:

The Transformer gives outputs of 12V and 0V. ... A varying current in the primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic flux through the secondary winding. This varying magnetic flux induces a varying electromotive force (E.M.F) or voltage in the secondary winding. When a digital project has to work with AC mains a Transformer is used to step-down the voltage (in our case, to 24V or 12V) and then convert it to DC by using a rectifier circuit.

Fig -3: **Transformer**

C. Current Sensor:

Current sensors, also commonly referred to as current transformers or CTs, are devices that measure the current running through a wire by using the magnetic field to detect the current and generate a proportional output. They are used with both AC and DC current. Current sensors allow us to be able to measure current passively, without interrupting

the circuit in any way. They are placed around the conductor that's current we want to measure.

Current transformers are essential in many applications. For instance, they are often used in sub-metering to determine energy usage by separate tenants. They can also help with facility regulation by providing information on how much energy is being used and when in order to keep costs down and increase efficiency.
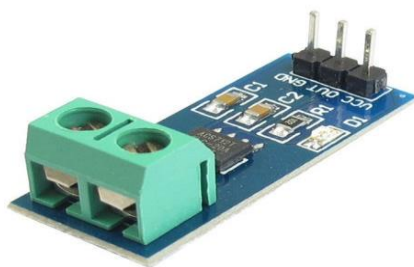

Fig -4: **Current Sensor**

D. Relay Driver Circuit:

A relay driver circuit is a circuit which can drive, or operate, a relay so that it can function appropriately in a circuit. The driven relay can then operate as a switch in the circuit which can open or close, according to the needs of the circuit and its operation. Since DC and AC voltages operate differently, to build relay drivers for them requires slightly different setup Now that we're using a transistor to drive the relay, we can use considerably less power to get the relay driven. Because a transistor is an amplifier, we just have to make sure that the base lead gets enough current to cause a larger current to flow from the emitter of the transistor to the collector. Once the base receives sufficient power, the transistor will conduct from emitter to collector and power the relay.
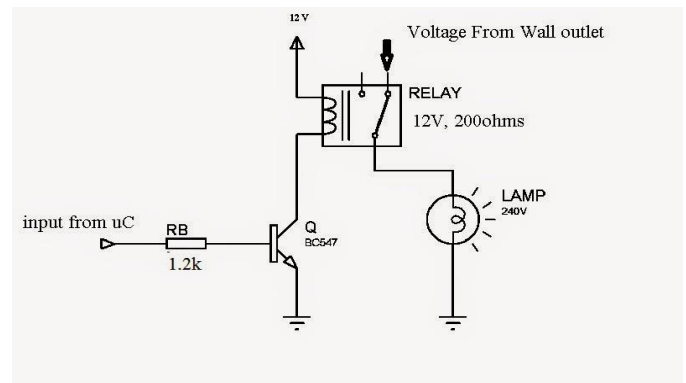

Fig -5: **Relay Driver Circuit**

E. **LCD display**:

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.
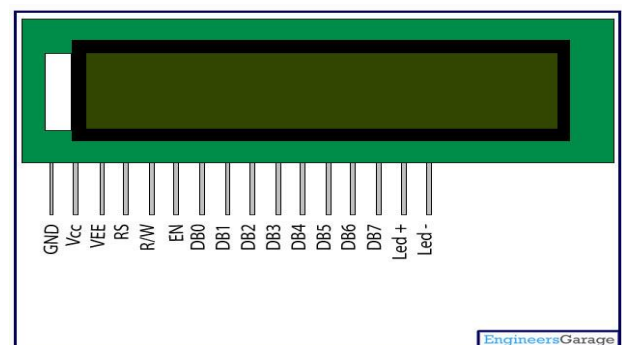

Fig -6 LCD display

3. CONCLUSIONS:

This project will improve on the overall efficiency of our power systems resident in needed areas as the downtime experienced as a result of power instability will be reduced. As a result of this, there will be a positive impact on the

social economic development of our immediate environment. From the cost analysis, it can be seen that it is economically viable and affordable when compared to its functions. By using the automatic phase changer it automatically shifts to the necessary phase where correct voltage is available. It automatically supplies voltage in up to 2 of the 3 incoming phases in case of power failure or low voltage. Automatic Phase Changer automatically cuts supply during low voltage, thus it protects the equipment from the harmful effects of unhealthily low voltage. It can be used in

1) Residential buildings

2) Commercial offices.

3) Factories operating with 1 phase machineries.

4) Hospitals/Banks/Institutions Automatic phase changer finds huge application in the modern world .This device is more cost effective, reliable and of maintenance free.

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