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Original Research Paper

Fault Detection in Three Phase Electrical Distribution Systemusing Microcontroller

Engineering

KEYWORDS : microcontroller, relay driver, Rectifier.

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ABSTRACT

The Power instability in developing countries creates a need for automation of alternative sources of power to back up the utility supply. This automation is required as the rate of power outage becomes predominantly high. Most industrial and commercial processes are dependent on power supply and if the processes of change-over are manual, time is not only wasted but also creates device or machine damage of human error during the change-over connections, which could bring massive losses. Automatic phase change over solves this problem. Under the phase failure condition of any phase, this system detects and automatically transfers to the other active phase by switching the corresponding relay .In the event of all three phase failure or main outage, the system delivers uninterrupted power to the loads from inverter source or any other auxiliary supply. In this way uninterrupted power is delivered to the load irrespective of the faults. It finds wide application wherever continuity of supply is necessary, for switching from one phase to another phase in case of phase failure.The microcontroller continuously checks the condition of the phases connected to the loads and correspondingly changes the supply source using relays. A relay driver is used to drive transistor in order to energize the relay coils.

I.INTRODUCTION

In developing countries power instability and phase failure has posed serious threat to their economic development. That is to say, where there is an erratic power supply, there is no development. [1-4]This is because one of the factors that boost economic of a country is the availability of steady and stable power supply Hence, there is need for automation of phase change during phase failure or total power failure in order to safe guard consumer appliances from epileptic power supply. Embedded systems are electronic devices that incorporate microprocessors with in their implementations. The main purposes of the microprocessors are to simplify the system design and provide flexibility. Having a microprocessor in the device helps in removing the bugs, making modifications, or adding new features are only matter of rewriting the software that controls the device.

Micro-controllers are useful to the extent that they communicate with other devices, such as sensors, motors, switches, keypads, displays, memory and even other micro-controllers. Many interface methods have been developed over the years to solve the complex problem of balancing circuit design criteria such as features, cost, size, weight, power consumption, reliability, availability, manufacturability.A relay is a switching device as it works to isolate or change the state of an electric circuit from one state to another. These are found in all sorts of devices. Relays allow one circuit to switch over to a second circuit that can be completely separated from the first. There is no electrical connection inside the relay between the two circuits – the link is magnetic and mechanical only. Basically a relay consists of an electromagnet coil, an armature, a spring and a series of electrical contacts. The electromagnet coil gets power through a switch or a relay driver and causes the armature to get connected such that the load gets the power supply. The armature movement is caused using a spring. Thus, the relay consists of two separate electrical circuits that are connected to each other only through a magnetic connection, and the controlling the switching of the electromagnet. The contacts are usually common (COM) – normally open (NO) and normally closed (NC). The normally closed contact is connected to the common contact if power is not applied to the coil. The normally open contact is opened if power is not applied to the coil. When the coil is energized, the common contact is connected to the normally open contact, and the normally closed contact is left floating. The double-pole versions are same as the single-pole version except when the two switches open and close together.

III. HARDWARE IMPLEMENTATION

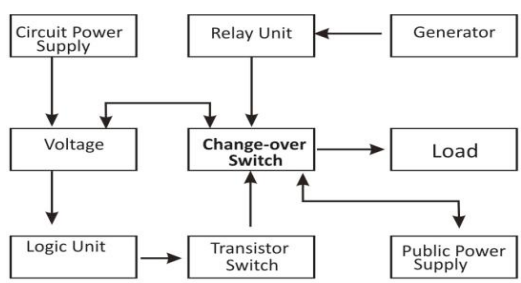

Figure.1 ***Change over Automatic Switch***

The circuit is built around a transformer, bridge rectifier, microcontroller and relay. Three identical sets of power supply unit, each set for three phases, are used. Here we used a step down transformer and a microcontroller unit**. [5]**

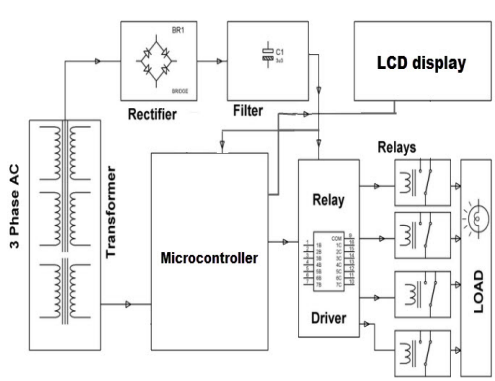

Figure.2 Block Diagram of Automatic Phase Changer

The microcontroller continuously checks the condition of the phases connected to the loads and correspondingly changes the supply source using relays. A relay driver is used to drive transistor in order to energize the relay coils.

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Under the phase failure condition of any phase, this system detects and automatically transfers to the other active phase by switching the corresponding relay.

IV.PROPOSED SYSTEM

This project is designed to check the availability of any live phase, and the load will be connected to the live phase only. This feat is achieved with AT89C52 MCU. This controller continuously checks for live condition of all the phases connected to it, and the controller connects the load the load to the active phase Relay, live phase, controller, rectifier, using a relay. The relay is driven with a transistor. If two or three phases are live, the phase will be connected to the phase that is ON only and automatically transferred to the phase that is ON in the event of a main outage or from generator back to main when restored. An LCD is provided to display the status of the phase condition. Contrast control pre-set is given for LCD contrast control[6-7].

The voltage regulators 7805 and 7812 provides the required voltage for micro controller and relay driver. The LM 78XXX series of the three terminal regulations is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation. By interfacing LCD to the microcontroller power failure on the phase is displayed on the LCD. This is the first interfacing example for the parallel port. We will start with something simple. This example does not use the Bi-directional feature found on newer ports, thus it should work with most, if no all Parallel Ports. It however does not show the use of the status port as an input. So what are we interfacing A 16 Character X 2 Line LCD Module to the Parallel Port. These LCD Modules are very common these days, and are quite simple to work with, as all the logic required running them is on board. In the below table Vcc and Vss are supply pins and VEE (Pin no.3) is used for controlling LCD contrast. Pin No.4 is Rs pin for selecting the register, there are two very important registers are there inside the LCD. [8-9]The RS pin is used for their selection as follows. If RS=0, the instruction command code register is selected, allowing the user to send data to be displayed on the LCD. R/W is a read or writes Pin, which allows the user to write information to the LCD or read information from it. R/W=1 when reading R/W=0 when writing. The LCD to latch information presented to its data pins uses the enable (E) pin. The 8-bit data pins, D0-D7, are used to send information the LCD or read the contents of the LCD's internal registers[11]. To display letters and numbers, we must send ASCII codes for the letters A-Z, and number 0 -9 while making RS=1.

The Power Supply is a Primary requirement for the project work. The required DC power supply for the base unit as well as for the recharging unit is derived from the mains line. For this purpose center tapped secondary of 12V-012V transformer is used. From this transformer we getting 5V power supply. In this +5V output is a regulated output and it is designed using 7805 positive voltage regulator.Rectification is a process of rendering an alternating current or voltage into a unidirectional one. The component used for rectification is called 'Rectifier'.A rectifier permits current to flow only during positive half cycles of the applied AC voltage. Thus, pulsating DC is obtained and to obtain smooth DC power additional filter circuit is used.

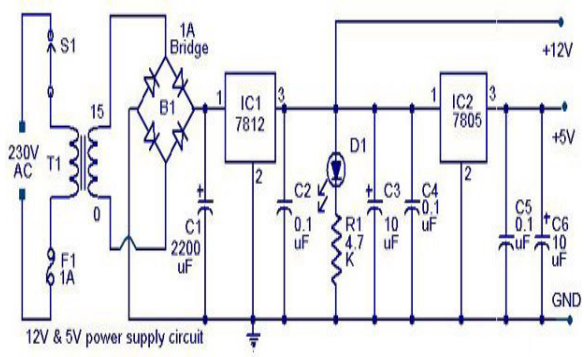

Figure.3 ***Block Diagram of Power Supply***

A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices, and are increasingly based on the semiconductor diode.

When a diode is forward biased (switched on), electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electroluminescence (corresponding to the energy of the photon) is determined by the energy gap of the semiconductor. An LED is usually small in area (less than 1 LEDs present many advantages over incandescent light sources including lower energy consumption, longer lifetime, improved robustness, smaller size, faster switching, and greater durability and reliance. However, they are relatively expensive and require more precise current and heat management than traditional light sources

Microprocessors and microcontrollers are widely used in embedded systems products Microcontroller is a programmable device. A microcontroller has a CPU in addition to a fixed amount of RAM, ROM, I/O ports and a timer embedded all on a single chip. The fixed amount of on-chip ROM, RAM and number of I/O ports in microcontrollers makes them ideal for many applications in which cost and space are critical. The Intel 8052 is Harvard architecture, single chip microcontroller (μC) which was developed by Intel in 1980 for use in embedded systems. It was popular in the 1980s and early 1990s, but today it has largely been superseded by a vast range of enhanced devices with 8052-compatible processor cores that are manufactured by more than 20 independent manufacturers including Atmel, Infineon Technologies and Maxim Integrated Products. 8052 is an 8-bit processor, meaning that the CPU can work on only 8 bits of data at a time. Data larger than 8 bits has to be broken into 8-bit pieces to be processed by the CPU. 8052 is available in different memory types such as UV-EPROM, Flash and NVRAM.This project is implemented on Kiel μVision. In order to program the device, preload tool has been used to burn the program onto the microcontroller.

V .RESULTS

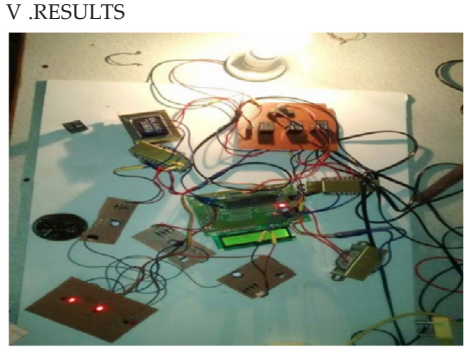

Figure.4 Running snapshot when fault in one phase

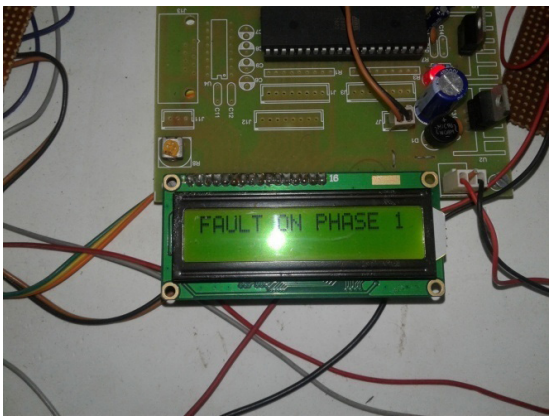

Figure.5 Running snapshot when fault on phase one

In this paper "fault detection in three phase electrical distribution system using microcontroller" has been successfully programmed using keil & proteus software and the output is tested for providing an uninterrupted power supply to the load when a power failure takes place in that phase.

VI.CONCLUSIONS

This paper proposed with the automatic phase change over in a three phase electrical distribution system by using Microcontroller 8051. Whenever there is a power interruption or fault occurs in phase connected to the load, then the phase change over takes place automatically to another phase connected to it and thus uninterrupted power supply is provided to the load. At the same time Microcontroller sends the signals to LCD monitor which displays the faulty phase.

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