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THREE PHASE FAULT ANALYSIS AND LOCATION DETECTOR WITH AUTO RESET ON TEMPORARY FAULT AND PERMANENT TRIP OTHERWISE

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Abstract: **Failure of any phase in a three-phase system will result in a loss in operating voltage, causing either the device to stop working or a three-phase motor to run at lower voltages, reducing speed and increasing vibration. Our technology is not only designed to cure this issue, but also to protect the appliance from further damage. When a phase fails, the load is immediately turned off; if the phase returns before 5 seconds, the load is switched on because the failure was detected as temporary; however, if the time of failure exceeds 5 seconds, it is treated as a permanent failure because it can cause a problem in the load connected, so it is cut off for a long time until the user presses the reset button; only when the user presses the reset button is it turned back on. As a result, in the event of a transient defect, the project's output resets, while in the event of a persistent fault, it obtains a permanent trip condition.**

The project employs the usual concept of Ohms law, which states that when a low DC voltage is provided at the feeder end via a series resistor (Cable lines), the current will be determined by the location of the cable fault. The voltage across series resistors fluctuates as a result of a short circuit (Line to Ground). This is then passed into the Adriano board's built-in ADC, which generates exact digital data for display in kilometers..

Keywords - *Adriano, Relays, Resistors, permanent fault, temporary, etc.*

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I INTRODUCTION

The goal of this project is to use an Adriano board to determine the distance of an underground cable fault from the base station in kilometers. In many urban locations, the underground cable system is widely used. When a problem occurs for any cause, the repairing process for that specific cable is tough at that moment.

The basic notion of Ohms law is used in our project, which states that when a low DC voltage is applied at the feeder end through a series resistor (Cable lines), current increases or decreases depending on the position of the cable fault If a short circuit occurs (Line to Ground), the voltage across series resistors changes, which is then transmitted to the Adriano board's inbuilt ADC, which generates precise digital data for display in kilometers.

The project is set up using a collection of resistors that represent cable length in kilometres, and faults are created by a set of switches at each known kilometre to ensure accuracy. An LCD interfaced to the Adriano board displays the fault happening at a desired distance and the associated phase. Not only does our technology fix the problem, but it also protects the appliance from further damage. When a phase fails, the load is immediately turned off; if the phase returns before 5 seconds, the load is switched back on because the failure was only temporary; however, if the time of failure exceeds 5 seconds, it is treated as a permanent failure because it can cause a problem in the load connection. It is turned off permanently at this point, and the system will only restart when the user clicks the reset button again. As a result, in the event of a transient defect, the project's output resets, and in the event of a permanent malfunction, it gets a permanent trip condition.

In the future, this project can be improved by measuring the impedance using a capacitor in an ac circuit, which can even locate the open-circuited cable, as opposed to the short-circuited fault using simply resistors in a Direct Current circuit, as shown in the above proposed project.

Problem definition

This project aims to not only reduce outage time due to defects, but also to provide customers with a higher level of service continuity. Furthermore, successful auto reclosing at high speeds. When it comes to transmission lines, circuits can be the most important aspect in maintaining system stability. Auto reclosing will reclose the circuit into a fault that has not been cleared for those faults that are forever, which may have negative consequences on system stability. The project's main goal is to improve the transmission line's reliability and eliminate the problem. Design: A transformer, voltage regulator, relay, filter, Adriano, diode, resistor, capacitor, and other components are included in the project. A step-down transformer is utilized in this circuit. Their input voltage is 220 volts, and their output voltage is 12 volts. This is due to low voltage fault testing and

detection, as well as the operation of circuit breakers and other devices to restrict the loss of service due to failure.

Motivation for project

We visited many companies and spoke with them, and we learned that when a fault develops in an industry for whatever reason, the mending process for that specific cable is challenging because the particular position of the cable fault is unknown. As a result, a large number of connected devices may be harmed. As a result, we addressed the issue with our team members and decided to create a fault analysis system to solve the problem. So we're currently working on the project to solve these issues and protect the industrial equipment. Our technology is likewise designed to alleviate this issue, preventing the appliance from being damaged. When a phase fails, the load is turned off immediately; if the phase returns before 8-10 seconds, the load is switched back on because the failure was only temporary; however, if the time of failure exceeds 8-10 seconds, it is treated as a permanent failure because it could cause a problem with the load connected, so it is switched off permanently.

II METHODOLOGIES

Timer IC base

The electrical substation that delivers power to consumers, such as industries or households, may have incorrect readings due to temporary or permanent defects. The power system component is severely damaged as a result of these problems. In India, supply system failures are widespread owing to faults that occur during transmission or distribution.

The faults in the supply systems could be LG (Line to Ground), LL (Line to Line), or 3L (Three Lines), and faults in a three-phase supply system can damage the power system. To solve this problem, a technology is being developed that can detect these failures and automatically disconnects the supply to prevent large-scale damage to the grid substation control gears.

Three single-phase transformers are wired in star input and star output, and three transformers are connected in delta connections, with input voltage of 220 volts and output voltage of 12 volts. Because it is not appropriate to create on the mains line, this notion of low voltage testing of fault circumstances is used. 555 timers are utilized to handle both short and extended duration events.

Arduino based

The power supply is 230V AC at 50 Hz. The transformer steps down the 230V voltage. The transformer's output voltage is 12 volts alternating current. The next block rectifier converts the AC voltage into DC. There is a ripple factor in rectified voltage. For +12V and +5V DC voltages, it will be removed by the capacitor and regulated by the 7812 and 7805 ICs, respectively. The project's main brain controller is Arduino. It is programmed using the Arduino programming language. The fault kind, fault distance, fault duration, and tripping type are all displayed on the LCD display.

The job of multiplexed relays is to provide and remove ground from the transmission line and its coating, depending on the fault-finding mode. The principal contactor between the transmission line and the load is the switching relay. When a failure occurs at that time, the load is disconnected from the transmission line by this contactor. With the help of relay dri, Arduino controls all relays and contactors.

III MODELLING AND ANALYSIS

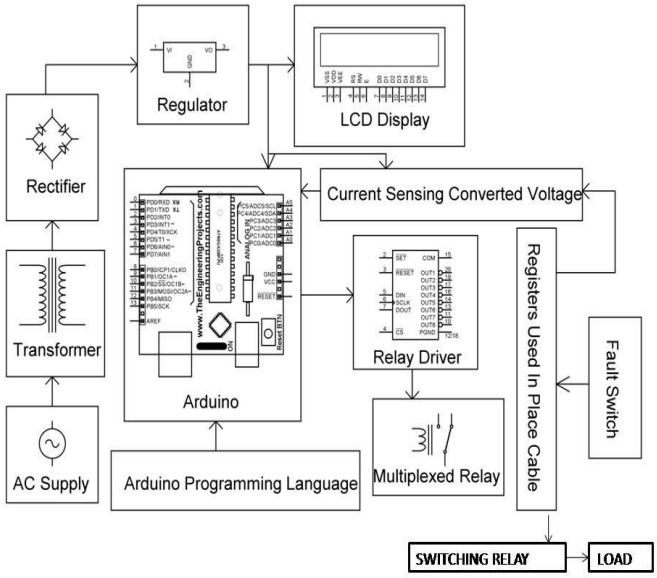

Fig. 1: Block Diagram of 3ph fault analysis

AC supply is 230V AC with 50 Hz frequency. This 230V voltage is step down by transformer. Transformer output voltage is 12V AC. This AC voltage is converting in to DC by next block rectifier. Rectified voltage has ripple factor. It will remove by capacitor and regulated by 7812 and 7805 IC for +12V and +5V DC voltages respectively.

Arduino is the main brain controller of the project. Its work on Arduino programming language. LCD display is used to show the fault type, fault distance, duration of the fault and type of tripping.

Multiplexed relays function is that providing and removing ground to the transmission line and its coating with respective mode of fault finding. Switching relay is the main contactor between transmission line and load. When fault occurs at that time this contactor cut the load from transmission line. This all relays and contactor is controlled by Arduino with the help of relay driving IC based on predefined code.

Our project is based on resistive method so for demonstration purpose we are using resistor as a cable. We are using external resistors for converting the length of the fault cable in the

proportional voltage. This all circuit block is named as current sensing converted voltage block.

Circuit Diagram

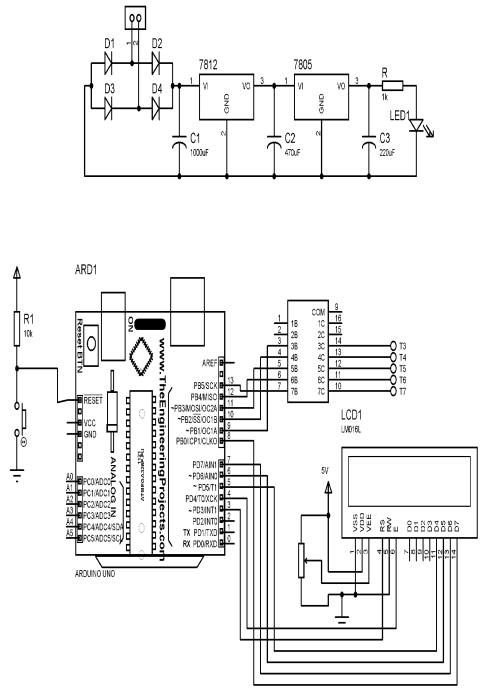

Fig. 2: Circuit Diagram and Schematic diagram

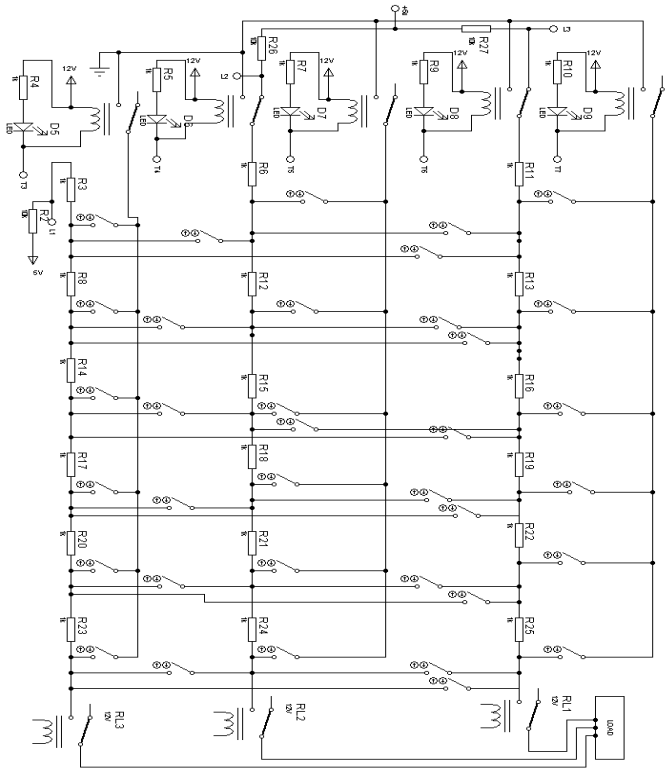

Fig.3: PCB Layout

HARDWARE REQUIREMENTS:

- Arduino
- Transformer
- Voltage Regulator
- Crystal.
- Relay Driver IC
- Relay, Diodes, Resistors, Capacitors, Push Button, and LCD Display.

SOFTWARE REQUIREMENTS:

- Arduino software which can be freely available on Arduino Forum
- http://arduino.cc/en/Guide/HomePage.

DETAILS OF COMPONENTS

Comparator

A comparator is an electrical circuit that compares the two inputs it receives and outputs a result. The comparator's output value indicates which of the inputs is higher or lesser.

Voltage regulator

A VR is meant to maintain a consistent voltage level automatically. Negative feedback control loops can be included in a VR if it is constructed as an easy "feed-forward" circuit. An electromechanical mechanism or other electronic components can be used. Its purpose is based on its architecture, and it can be used to control multiple AC or DC voltages.

Electronic VR is used in computer power supplies to keep the DC voltages that other components like processors require stable.

Arduino

The Arduino microcontroller is simple to use and incorporates a powerful single board computer that has gained popularity in both the hobby and professional markets. Because the Arduino is open-source, the hardware is inexpensive and the development software is free.

The board includes an Atmel ATmega328 MC with 2 KB of RAM, 32 KB of flash memory for storing programmes, and 1 KB of EEPROM for storing parameters that runs at +5 V. The clock speed is 16 Megahertz, which amounts to around 300,000 lines of C source code being executed every second.

The C/C++ programming language provides the foundation for the Arduino programming language.

Resistors

According to Ohm's law, a resistor is a two-terminal electronic device that ripples an electric current by creating a voltage drop between its terminals in proportion to the current:

V = IR

Electrical networks and electronic circuits are two applications for resistors. They're found in almost every piece of electrical

equipment. Various equipment can be used to make practical resistors.

Liquid Crystal Display (LCD)

16x2 and 20x2 LCDs are the most frequent LCDs attached to the MC. This translates to sixteen characters per line divided by two lines and twenty characters per line divided by two lines.

IV RESULT AND DISCUSSSION

When a phase fails (L-L, L-L-G, L-L-G, L-L-G, L-L-G, L-L-G, L-L-G, L-L-G, L-L-G, L-L

If the phase recovers after 8-10 seconds, the load is turned on because the failure was only transient.

If the failure period exceeds 8-10 seconds, it is considered a permanent failure since it may cause an issue with the load connected, thus it is turned off permanently at this point.

V CONCLUSION

This 3 phase fault analysis system is built using single phase step down transformer the input to transformer is 230v and output is 12v for introducing faults on the low voltages side, no of switches used that create line-line, line-ground, line-line-line faults. The supply returns to the load incase of short duration fault and it is treated as temporary trip. While long duration disconnection of supply shall result in permanent trip.

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