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Fault Detection in Overhead Transmission Lines and Automation using Cloud Base System

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ABSTRACT

Transmission lines plays a main role in the power system network, in many conditions the transmission line, they are susceptible to wide range of defects, hence the losses in transmission lines are very high compare to other parts in the power system. These problem are difficult to slove such that the entire cable should be replaced. Hence many researches have been taking place to utilize the recent technologies to improve the power supply to consumers. This project detects the faults in transmission lines from the base station in KM using the aurdino (microcontroller). It displays the fault location in distance, where by using ESP 32 Wifi-Module, the fault location can be traced and thus the defect type can be displayed on the 16*2 LCD, which is interfaced with the aurdino and accordingly the corresponding line load gets off through the relay connected to the aurdino. The IOT is used to display the information over the internet using the Wi-Fi module. The faults such as L-G, LL-G, and ground fault is detected and same information is displayed.

1.1 Introduction

The demand for electricity is increasing rapidly with the growth of population and industrialization. To meet the increasing demand, electricity transmission and distribution systems are being extended with more power lines and transformers. However, with the increase in the length of power lines, the probability of faults in the transmission lines also increases. Transmission line faults can cause power outages and can also lead to damage to electrical equipment. Hence, it is necessary to detect the faults in the transmission lines as quickly as possible to minimize the damage and reduce the downtime. IOT- based transmission line fault detection system is a modern approach to detect the faults in the transmission lines. It utilizes the power of IOT technology to monitor the transmission lines in real-time. The system is designed using ESP32 microcontroller, Blynk application, 16x2 LCD display, and relay modules. ESP32 is a powerful microcontroller with built-in Wi-Fi and Bluetooth capabilities. It is used to monitor the transmission line parameters like voltage, current, and frequency. The data collected by the ESP32 is transmitted to the Blynk application through Wi-Fi. Blynk is a mobile application that allows the user to monitor and control the ESP32 from anywhere in the world. The application displays the real-time data of transmission line parameters on the mobile screen. The 16x2 LCD display is used to display the transmission line parameters locally. It displays the voltage, current, and frequency of the transmission line. The relay modules are used to control the electrical equipment connected to the transmission lines. In case of a fault in the transmission line, the relay modules disconnect the faulty section of the transmission line to prevent further damage to the electrical equipment. The electric power system network consists of many parts, in which transmission lines plays an important role to transfer the power.

1.2 Methodology

Design and develop a circuit that consists of the ESP32, Blynk application, 16x2 LCD display, and relay modules. The relay modules are connected to the power supply lines of the transmission lines. Connect the ESP32 to the Wi-Fi network. This is required to transmit the data from the ESP32 to the Blynk application over the internet. Develop a Blynk application that can receive data from the ESP32 and display it on the user interface. Develop a fault detection algorithm that can detect the faults in the transmission lines. This algorithm can be based on various techniques like wavelet transform, artificial neural networks, fuzzy logic, or support vector machines. Implement the fault detection algorithm on the ESP32. The ESP32 should be programmed to continuously monitor the transmission lines for faults. Display the Fault information on the 16x2 LCD display. The display should show the fault type and location. When a fault is detected, the ESP32 should trigger the relay modules to isolate the faulted section of the transmission line. Test the system to ensure that it is working correctly. Document the system by preparing a detailed report that includes the circuit diagram, code, and test results .Evaluate the performance of the system by comparing the results obtained from the system with the theoretical values.

Working

We make the power supply input of 230v ac. Further this project can be enhanced by using capacitor in an Ac circuit to measure the impedance which can even locate the open circuited overhead line, unlike the short-circuited fault only using resistors in DC circuit as followed in the above proposed project. The objective of this project is to determine the distance of overhead transmission line fault from base station over the internet. The overhead transmission line system is a common practice followed in many urban areas. While a fault occurs for some reason, at that time the repairing process related to that particular overhead lines is difficult due to not knowing the exact location of the overhead lines fault. The proposed system is to find the exact location of the fault.The project uses the standard concept of Ohms law i.e., when a low DC voltage is applied at the feeder end through a series resistor (overhead transmission lines), then current would vary depending upon the location of fault in the overhead transmission lines. In case there is a short circuit (Line to Ground), the voltage across series resistors changes accordingly, which is then fed to an ADC to develop precise digital data which the programmed microcontroller of Arduino family would display in kilometers.

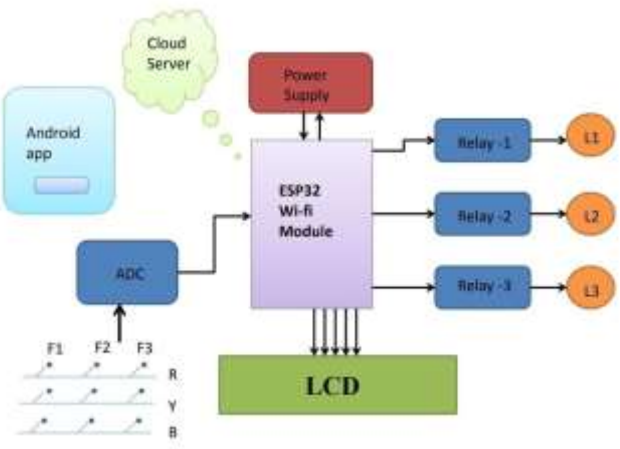
Hardware Specification :-

1. ESP 32
2. Relay
3. Resistors
4. 5v Voltage Regulator
5. Diodes
6. LED bulbs
7. 16*2 LCD display
8. 12v DC Power adapter
9. Jumper Wires
10. Bulb Holders
11. Switches
12. Capacitors
13. ADC

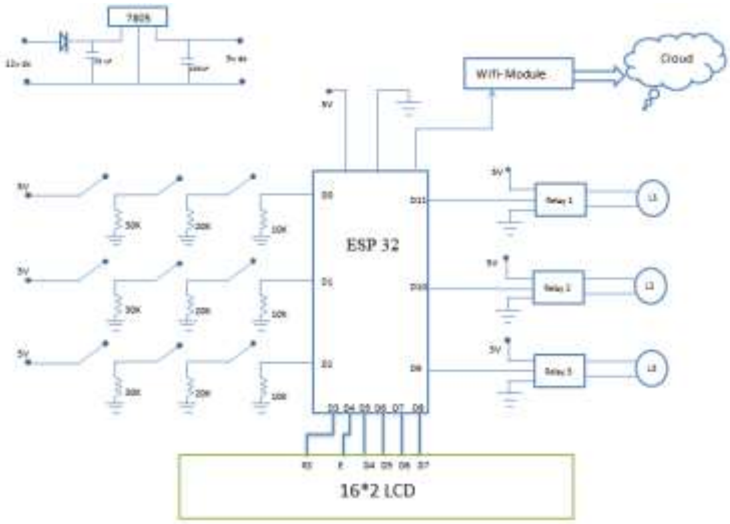
Software Requirements :-

1. Ardiuno IDE(Integrated Development Environment)
2. Language Embeded C or Assembly.

Block Diagram



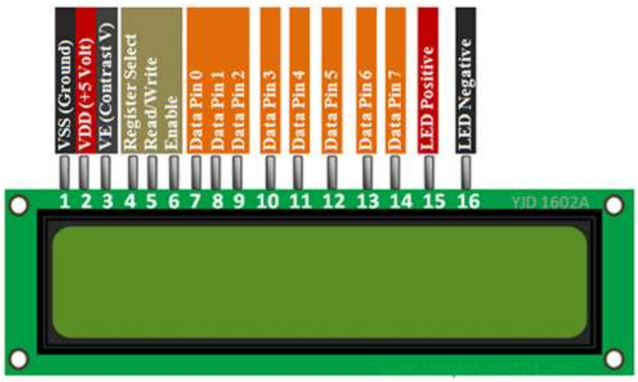
Circuit Diagram



ESP 32 Wifi-Module

ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The ESP32 series employs either a Tensilica Xtensa LX6 microprocessor in both dual-core and single-core variations, Xtensa LX7 dual-core microprocessor or a single-core RISC-V microprocessor and includes built-in antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power-management modules. ESP32 is created and developed by Espressif Systems, a Shanghai-based Chinese company, and is manufactured by TSMC using their 40 nm process**.**

LCD Display



A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other.

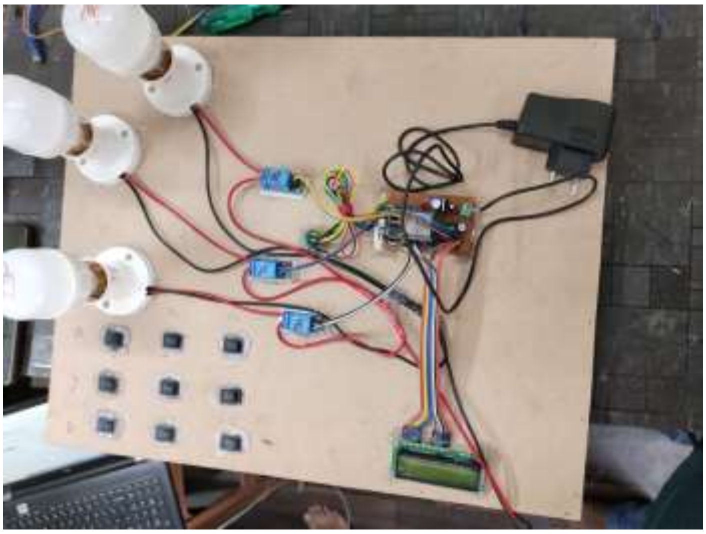
The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other. A program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to an controller is an LCD display. Some of the most common LCDs connected to the controllers are 16 X1, 16x2.

ADC (analog to digital Converter)

An ADC converts a continuous-time and continuous-amplitude analog signal to a discrete-time and discrete-amplitude digital signal. The conversion involves quantization of the input, so it necessarily introduces a small amount of error or noise. Furthermore, instead of continuously performing the conversion, an ADC does the conversion periodically, sampling the input, limiting the allowable bandwidth of the input signal.

The performance of an ADC is primarily characterized by its bandwidth and signal-to-noise ratio (SNR). The bandwidth of an ADC is characterized primarily by its sampling rate. The SNR of an ADC is influenced by many factors, including the resolution, linearity and accuracy (how well the quantization levels match the true analog signal), aliasing and jitter. The SNR of an ADC is often summarized in terms of its effective number of bits (ENOB), the number of bits of each measure it returns that are on average not noise. An ideal ADC has an ENOB equal to its resolution. ADCs are chosen to match the bandwidth and required SNR of the signal to be digitized. If an ADC operates at a sampling rate greater than twice the bandwidth of the signal, then per the Nyquist–Shannon sampling theorem, near perfect reconstruction is possible. The presence of quantization error limits the SNR of even an ideal ADC. However, if the SNR of the ADC exceeds that of the input signal, its effects may be neglected resulting in an essentially perfect digital representation of the bandlimited analog input signal.

Actual Model



Result

The results are verified that if any fault is detected in the transmission line the aurdino programmer detects the fault and with the help Ohms Law we traces the location and fault is displayed through the LCD, as shown in the below figure. And when the fault occurred the relay senses the fault and the load of the corresponding line gets off. If the ground fault occurs in the system the entire load gets detached. And as soon as fault cleared the system works normal.

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