



Overhead Line Fault Detection and Control using Internet of Things (IoT)

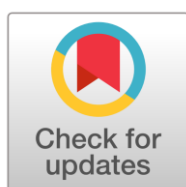
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Abstract: In the modern era transmission line is the most important part of the power system. Its allegiance and requirement of power is grown up exponentially. The major role of transmission lines is to transmit electric power from the source area to distribution network. Transmission line protection is an important issue in power system because 85-87% of power system faults are occurring in transmission line. Energy leakage is one of the major problems that corporates faces in recent times. Only way to solve this problem is to come up with a mechanism that can detect the fault in transmission line automatically and intimate the authorities with a specific location. In this work the device uses the sensor to sense the voltage flow in the transmission line and detect if there is a variation in the voltage flow. If fault is detected, it can be automatically controlled by using relay and the system is also integrated with IoT mechanism, to intimate the responsible person with location information.

Keywords: Fault detection, Power monitoring, transmission line failure

1. Introduction

Transmission line plays a major role in the power system to transmit the electricity from the point of generation to the end user. An interconnected network of electric grid is used for supplying power from the producers to consumers where electric grid consist of countable number of generating station, transmission line and distribution lines are connected to the individual consumers. When a low voltage is transmitted over a long distance, there will maximum power loss. To reduce power loss, electricity generated from various sources to be stepped up or stepped down before the transmission is best. There are many types of transmission lines according to the voltage ranges they are used for transmitting power. In developing countries about 70% of

the power is transmitted by transmission line. So, it is necessary to protect the transmission line. Due to the overvoltage, short circuit, breakage of overhead lines leads to many faults. It is very difficult to find fault in overhead lines. To detect the faulty section in transmission line many power transmission companies depends on circuit indicators.

Still it is a complex task to locate the fault detection. Although fault indicator device has provided a reliable means to identify the fault, still the fault should be detected for long hours by manually. Wireless sensor-based monitoring of transmission lines provides the accurate fault diagnosis, reduce the energy consumption effectively.

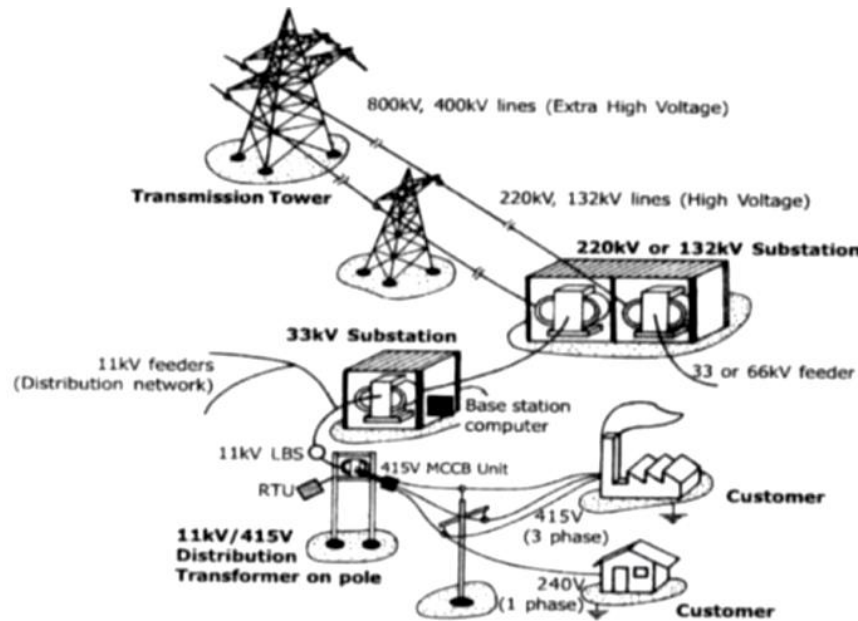


Fig.1 Power Transmission Flow

The real time sensor provides to monitor the power system if failure or fault occurs [1]. A sensor like flame, smoke, UV are used for the identifying the symptoms that leads to network failure. [2, 3] Multiple faults of transmission line can be detected by monitor the temperature, current, voltage through temperature sensor, current sensor and voltage sensor. [1, 2] The sensors connected to the microcontroller 8051 [1-3] uses a GSM based monitoring that sends fault information via SMS to electricity board [4]. Faults can be classified based on symmetrical component algorithm for only positive and negative components by following techniques depending on impedance and torque techniques for some tower specification. Detection of fault is done by distance protection strategy with their phase angle and current. [5] Both underground and overhead faults are detected by connecting microcontroller PIC16F877, RS232, GSM modem and location can be identified by using impedance-based algorithm for calculating fault distance. [3] In this paper [6] speed sensor, buzzer, LCD is connected same as [5].

In our proposed system overvoltage, fire detection and line breakage in the transmission line can be detected using sensors where relay is used for isolating the faulty section and location can be identified using GPS hence, it minimizes fault detection time. The proposed fault detector and locator were trained using various sets of data available from a selected power network model and simulating different fault scenarios (fault types, fault locations, fault resistances and fault inception angles) and different power system data (source capacities, source voltages, source angles, time constants of the sources).

Architecture of Proposed System

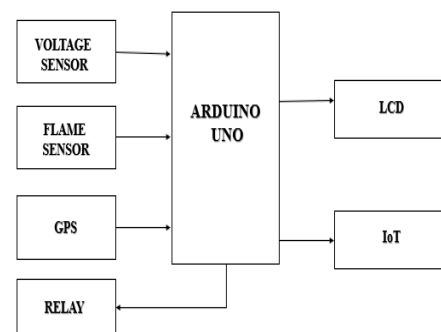


Fig 2. Architecture

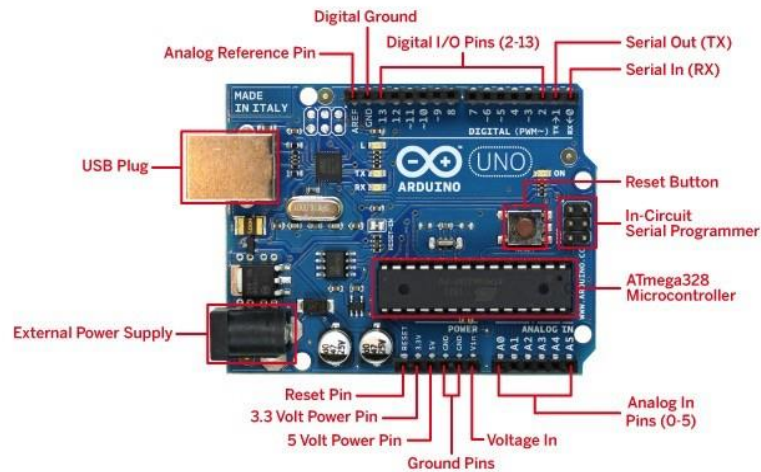


Fig 3. Microcontroller Board

A. Arduino Uno

Arduino Uno is a microcontroller board and acts as a brain of the many projects, It has 14 digital input /output pins, 6 analog inputs, a 16 MHZ quartz crystal, a USB connection, a power jack, an ICSP header and a reset button (see fig 2). It is easy to communicate with another device. Arduino IDE is dumped in a microcontroller (see fig 3). It is inexpensive, cross platform. It is simple and clear programming environment, and extensible software and hardware.

B. LCD

LCD is liquid crystal display. Here we used a 16*2 LCD which means 16 columns and 2 rows (see fig 4). It is combination of solid and liquid to produce a visible image and works on the principle of 'blocking light'. Here we using LCD to display the multiple fault detection when there is a fire detection, line breakage, overvoltage happens.

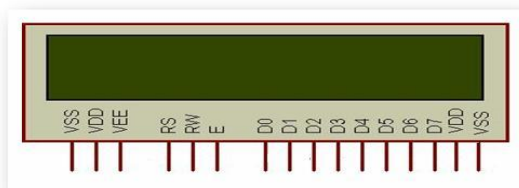


Fig 4. LCD Display

C. Internet of Things

The ESP8266 is one of the micro controller-based design (see fig 5). ESP8266 is a Wi Fi which sends data to the system through Wi Fi networking.



Fig 5. Micro Controller

D. Relay

Relay is a switching device which is used to isolate the circuit by sending trip signal to the circuit breaker. Relay can be classified in too many types. Here we are using protective relay for continuously monitoring the voltage, power and current (see fig 6). If there is any variation in this parameter it starts to isolate the particular circuit.



Fig 6. Switching Device

E. Flame Sensor

The Flame-sensor is used for detecting as well as responding to the occurrence of a fire or flame (see fig 7). This sensor can be easily damaged to high temperature so this sensor can be placed at a certain distance from the flame. The flame detection can be done from a 100cm distance. The output of this signal is an analog signal or digital signal. These sensors are used in firefighting robots like as a flame alarm.



Fig 7. Flame Sensor

F. Voltage Sensor

It is a sensor to sense or identify if there is any variation in optical signal to measure the voltage based on the voltage divider (see fig 8).



Fig 8. Voltage sensor

G. Global Positioning System

It is used to determine the location of the fault where it has occurred. GPS is used for the continuous measurement of the location in real time (see fig 9).



Fig 9. GPS Device

H. Embedded Systems

The work is to detect the fire detection, line breakage overvoltage in the transmission line using voltage sensor, flame sensor. If there is any variation in the voltage flow, voltage sensor which is connected to the controller to sense the voltage whether it is beyond the limit in the transmission line. If it is beyond the limit relay is used to trip circuit. Similarly, fire is detected by flame sensor. Arduino Uno is the microcontroller and the entire system program instruction is stored in it. The exact location of the fault is determined through GPS which is also connected to the microcontroller. All the operation is displayed on the LCD display and data are updated to cloud so that the entire system can be monitored using IoT for future purposes.

Simulation

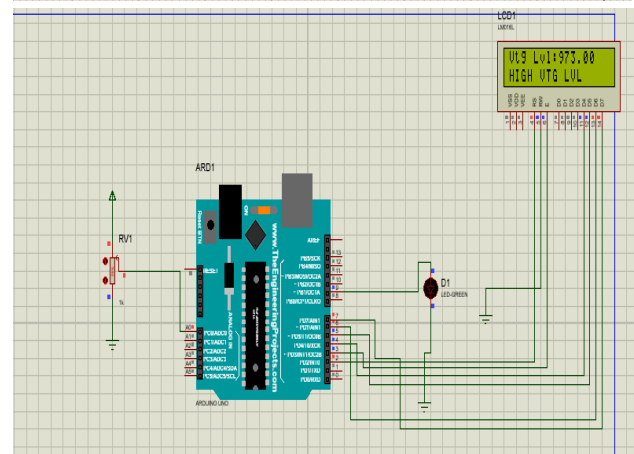
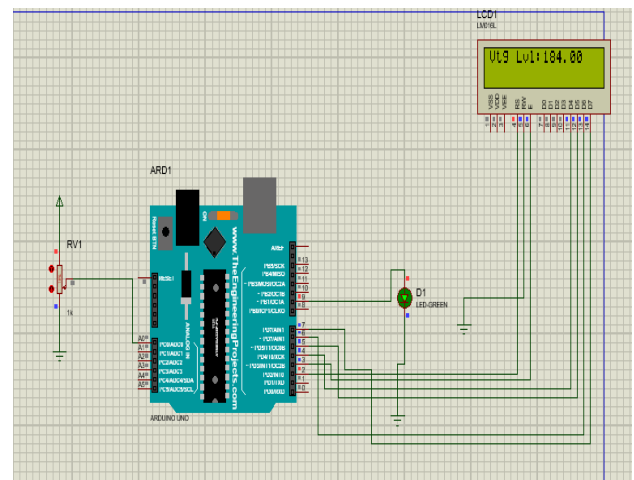


Fig 11. Simulation

Conclusion

In this paper, a novel approach for detecting faults in transmission line by using various sensors are used for the symptoms that leads to network failure and location can be updated to the system. The detected information is updated to the cloud so that entire system is integrated with IoT.

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