

Research Article

Automatic Fault Detection and Location of Transmission Line using IoT

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Abstract

The three phase fault indicator and evaluate system is designed to differentiate the type of fault occur in power system, enhanced with the Internet of Things (IoT) by using the ESP8266 and Wi-Fi module. All electrical substation that supply the electric to the users like industrial or residential may have some failures due to fault that may be short circuit or open circuit in a transmission line. Only way to solve this problem is to come up with mechanism that can detect the fault in an electricity transmission line automatically and intimate the authorities with a specific location. The system will be integrated IoT mechanism. To intimate the responsible people by email and notification.

Keywords: Transmission line; Internet of Things; ESP8266 Node MCU; Blynk; Arduino.

Introduction

In power system, fault is defined as the defect in power system due to short circuit, open circuit, fire in transformer. The fault create abnormal in power system. The fault may occur by trees, lightning, Natural disaster and so on. This can directly disturb the supply to user. Then it is important to detect the fault occurred so that it will prevent from any damage of equipment and continuous supply the energy to consumers. Phase to ground fault or joining the phase together which is may occur in over headline as well as underground cable. However these faults must be cleared by finding them in line [1]. This project is proposed to analyze the type of fault that occur in power system in short time using the (IoT) system. The IoT concept is coined by a member of the Radio Frequency Identification development community in 1999, and it has recently become more relevant to the practical world largely because of the growth of mobile devices, and cloud computing [2].

By using IOT system, user can take immediate action to solve the fault problems in power system after getting notification. ESP8266 Node MCU is used in this project to improve the protection system since user can detect the fault easily by getting notification from server to mobile phone. Blynk application is used as a

server to monitor data about the fault occurred. This project can be applied at power system including in generation, transmission or distribution system because in this system, there are many apparatuses that need to be protect and users can get the supply without having disturbance. Hence, from this project, we can know and control fault occurred from the control room. Whenever the preset threshold is crossed, the microcontroller instantly initiates a message to be sent to the person in-charge and control station [3]. Transmission line infrastructure with a high performance data communication network, that supports future operational requirements like real in the time record and control necessary for smart grid integration[4]. The authors of [5] were the first to propose a two-level model specifically for supporting the overhead transmission line monitoring applications.

Fault analysis is an important consideration in power system. There are many references about this project which deal with the various guidelines regarding detection of types of fault in power system. These guidelines including the methods of detection of fault and also the controller that used to control the protection system. Fault can be defined as abnormal conditions occur in the transmission

line. This fault like short circuit, open circuit, fire on transformer. It is caused by trees, lightning, birds, Natural disaster and so on [1,6]. Short circuit fault occurs when two transmission lines are short circuited. As in the case of a birds standing on one transmission line and touching the other or if a tree branch happens to fall on top of the power transmission line [6]. Open circuit fault occurs when break in transmission line it could also be the result of falling trees in rainy storm. Transformer explosions can happen for a number of reasons. One of the most common reason is lightning strike from the storm forcing an overload of the transformer which is damage to wires or electrical equipment. The IoT is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. IoT also has evolved from the converge of wireless technologies, Micro-Electro Mechanical Systems (MEMS), micro services and the internet [7].

Proposed system

The present work project was proposed to investigate the fault that occur in grid briefly time using the IoT and wifi module. Fault is analyzed by voltage variation in line by the micro controller (ESP8266). Fig. 1 Show that schematic diagram of proposed system. The transmission lines are connected to ac to dc converter circuit which converts the ac to dc voltage for the aim of connecting microcontroller. The ability supply is connected to the microcontroller to change on the circuit. This microcontroller is send the data about fault to the wifi module. Then wifi module will receive the info and send it to the server.

Blynk which is act as server will interpret the information. When fault is occurred then automatically put off the ability supply within the line by using relay unit [8,9]. When transformer is fired then flame sensor detect the flame and send the data to the microcontroller. Then, Node MCU is employed as controller and also act as device that connect with the IoT system when fault is detected. Fig. 2 Show that block diagram of proposed system. The devices then link with the

Blynk application. User will get the notification from Blynk application when the fault is occurred. Lastly, user will get the blynk (app) messages, notification and gmail on their portable and pc displays about the fault occurred to the responsible people (EB). It is accustomed take the immediate solution [10].

Advantage are work in real time response, coverage area in large compared to existing system, cost efficient, devices enable by wireless communication, less Number of components are used and economically reliable and low cost.

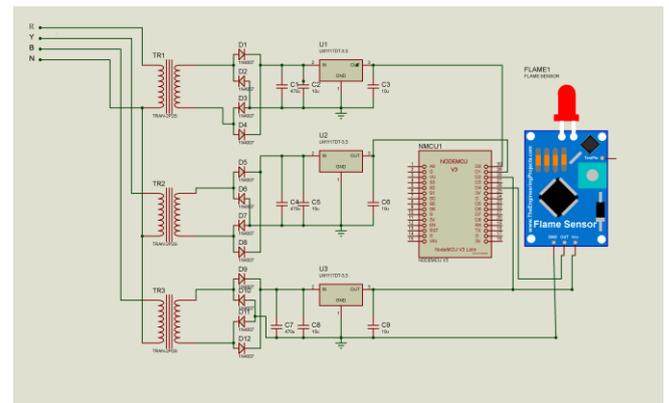


Fig. 1. Schematic diagram of proposed system

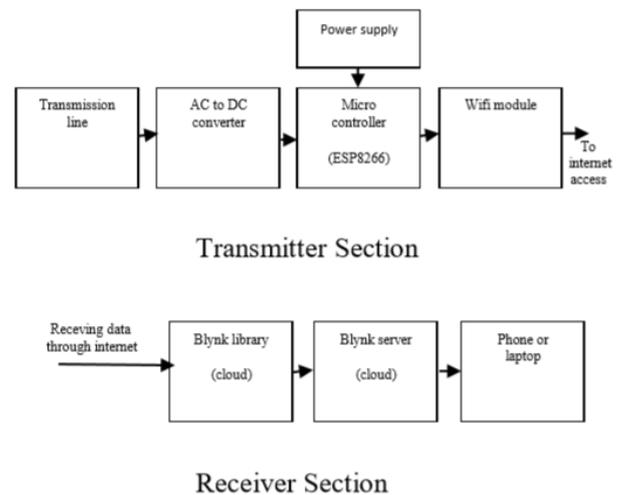


Fig. 2. Block diagram of proposed system

Power supply

Fig. 3 Show that the power supply circuit consists of step down transformer which is 230v step right down to 9v. In this circuit 4diodes are accustomed form bridge rectifier which delivers pulsating dc voltage so fed to capacitor filter the output voltage from rectifier is fed to filter to eliminate any a.c components present even after rectification. The filtered DC voltage is given to regulator to provide 5v constant DC voltage.

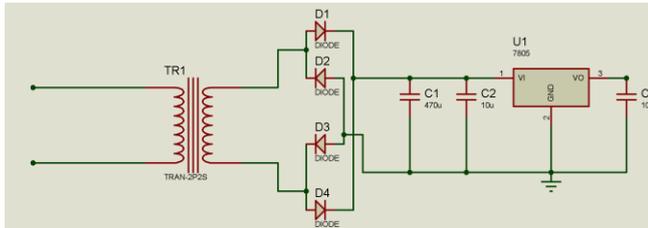


Fig. 3. Power Supply

Rectifier

The output from the transformer is fed to the rectifier. It converts A.C. into pulsating D.C. The rectifier could also be a half wave or a full wave rectifier. During this project, a bridge rectifier is employed thanks to its merits like good stability. The circuit has four diodes connected to create a bridge. A rectifier is an device that converts AC (AC), which periodically reverses direction, to DC (DC), which flows in just one direction. The method is thought as rectification. Rectifiers have many uses, but are often found serving as components of DC supplies and high-voltage DC power transmission systems. Rectification may. Serve in roles aside from to get DC to be used as a source of power [6].

Voltage regulator

In this project we use two transformer 7805 and LM1117-3.3. LM 7805 is employed in power supply to control the voltage to 5V. LM1117-3.3 is employed for a.c to d.c conversion. A transformer is an electrical regulator designed to automatically maintain a continuing voltage level. During this project, power supply of 5V and 3.3V are required so as to get these voltage levels, 7805 and LM1117-3.3 voltage regulators are to be used.

ESP8266 NodeMCU

ESP8266 is a designed by Espressif system and also a self-contained wifi networking solution offering as a bridge from existing microcontroller to wifi. This device is capable of running self-contained application. ESP8266 NodeMCU module also has built in USB connector and a rich assortment pin out. The NodeMCU can connect to the laptop and flash it without any trouble by using the micro USB cable.

Flame sensor

A flame-sensor is one quite detector which is principally designed for detecting likewise as

responding to the occurrence of a hearth or flame. The flame detection response can rely upon its fitting. It includes an device, a fossil fuel line, propane & a hearth suppression system. This sensor is employed in industrial boilers. The most function of this is often to convey authentication whether the boiler is correctly working or not. The response of those sensors is quicker likewise as more accurate compare with a heat/smoke detector thanks to its mechanism while detecting the flame.

Relay

A relay is an electrically operated switch. It consists of a collection of input terminals for one or multiple control signals, and a collection of operating contact terminals. The switch may have any number of contacts in multiple, like make contacts, break contacts, or combinations thereof. Relay is sensing device which senses the fault and sends a visit signal to breaker to isolate the faulty section. A relay is an automatic device by means of which an electric circuit is indirectly controlled and is governed by change within the same or another electric circuit. There are various kinds of relay: Numerical relay, Static relay and electromagnetic relay. Relay is housed in panel within the room.

Software

Software is one of the fundamental parts in this project since it can help us to connect one module to another. Software that is used in this project are Arduino IDE, Proteus and also Blynk.

Arduino IDE:

The Arduino Integrated Development Environment or referred to as Arduino Software (IDE) may be a software that contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. Then, it connects to the Arduino and Genuino hardware to upload programs and communicate with them. Since this project is employed Arduino Uno because the controller, this software are wont to write the code and upload it to Arduino. Fig. 4 shows the sketches of the programs written in Arduino Software (IDE) and these sketchers are written within the text editor then saved with file extension.ino.

Blynk

Blynk is meant for the IoT for control hardware remotely, display sensor data, store data, visualize it et al things. So, during this project, Blynk will act as a platform with iOS and Android that control ESP8266 and also the internet.

Proteus Software

Proteus may be a simulation and style software tool developed by Lab center Electronic and it posses by 2D CAD drawing feature. This software suite contains of schematic, simulation and also PCB designing. For drawing the schematics and simulate it in real time, ISIS software are going to be used while ARES is employed for PCB designing

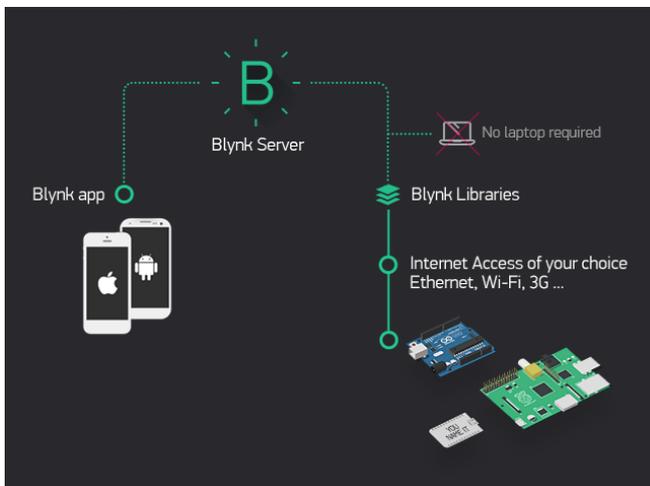


Fig. 4. Sketches of the programs written in Arduino Software (IDE)

Result and discussion

Fault can be defined as abnormal conditions occur in the transmission line. This fault like short circuit, open circuit, fire on transformer. It is caused by trees, lightening, birds, Natural disaster and so on. Open circuit fault occurs when break in transmission line it could also be the result of falling trees in rainy storm. Fig9. Shows the screenshot of the notification popped at Blynk, it is the notification of open circuit fault in the phase1 wire. Fig. 5 and 6 shows the screenshot of the notification of open circuit fault in the phase 1 and 2 wire.

Phase to ground fault or joining the phase together which is may occur in over headline as well as underground cable. however these faults must be cleared by finding them in line. This type of fault occurs when two transmission lines

are short circuited. As in the case of a birds standing on one transmission line and touching the other or if a tree branch happens to fall on top of the power transmission line.

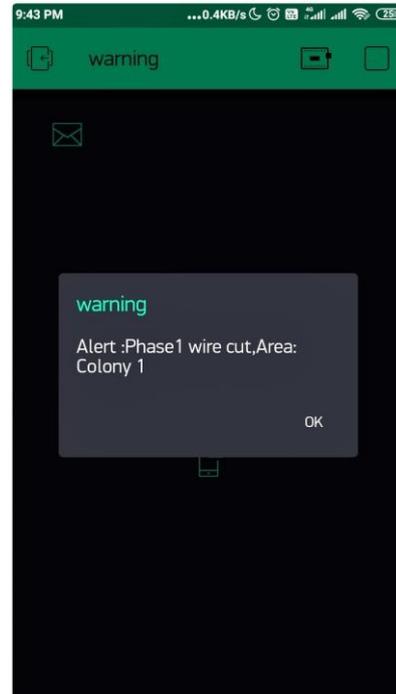


Fig. 5. Notification for phase 1 wire open circuit

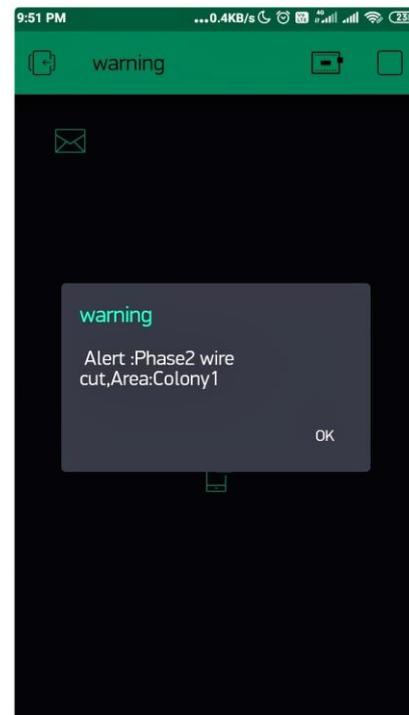


Fig. 6. Notification of phase 2 wire open circuit

Fig. 7 shows the screen short of the notification of short circuit or open circuit in phase 1 and 2 wire.

Transformer explosions can happen for a number of reasons. One of the most common

reason is lightning strike from the storm forcing an overload of the transformer which is damage to wires or electrical equipment. A flame-sensor is one quite detector which is principally designed for detecting likewise as responding to the occurrence of a hearth or flame. Fig. 8 shows the screen short of the notification transformer fire alert.

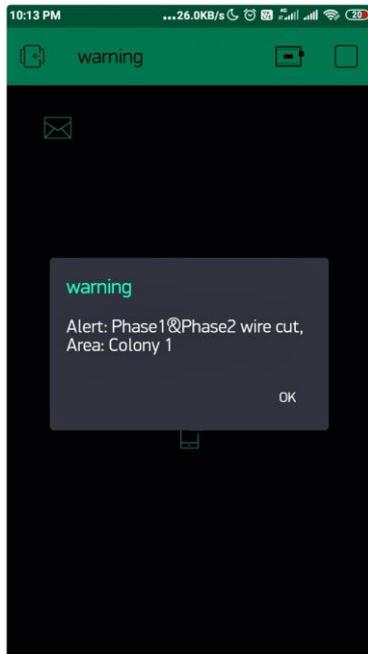


Fig. 7. Notification for phase1 and 2 wire short circuit (or) open circuit

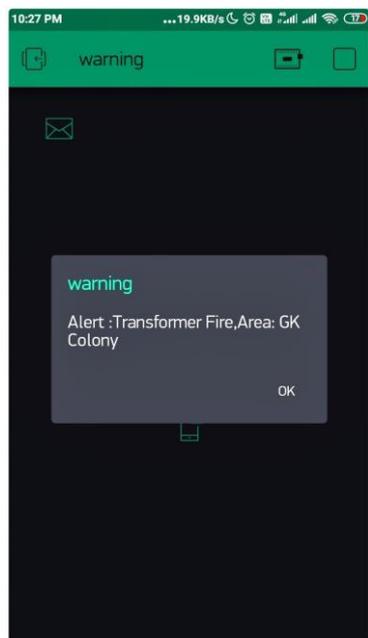


Fig. 8. Notification for transformer fire

User will get the notification from Blynk application when the fault is occurred. Lastly, user will get the blynk (app) messages, notification and gmail on their portable and pc

displays about the fault occurred to the responsible people (EB). Fig. 9 shows the screen short of the notification of Gmail.

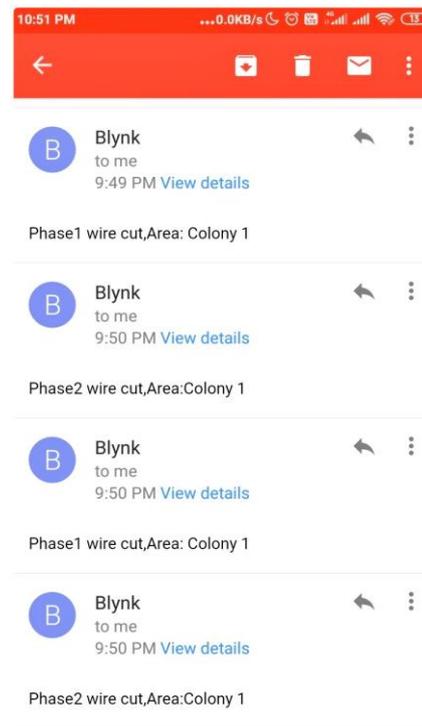


Fig. 9. Notification by Gmail

Conclusions

The model was designed in such a way to solve the problems faced by consumer. By using such method, we can easily detect the fault and resolve it. It is highly reliable and locates the fault in three phase transmission line and distribution line. It works on real time so we maintain all data sheet and avoid the future problem in transmission line. In the present work, authors detect the area of short circuit or open circuit fault in the transmission line cable from the substation. In future, this project is to detect the exact point of the fault in transmission line.

Conflicts of interest

Authors declare no conflict of interest.

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