High Voltage Transmission line Monitoring and protecting using Smart Apps of Internet of Things (IoT)

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ABSTRACT: In power transmission, High Voltage transmission line is the key equipment. The online monitoring devices are very important for the reliable operation of these High voltage transmission lines. The internet of things (IoT) is a new innovative paradigm that enhances the reliability of the present system with various technologies. This paper proposes an IoT based smart module for monitoring and controlling of Power Transmission line, with low power consumption with high reliability.

KEYWORDS: Internet of Things(IoT), ThingSpeak, Thingsview ,UBIdots, Blynk

I. INTRODUCTION

Energy can neither be created nor destroyed. It can be transformed from one form to another. It also transfers energy from one device to another device. In Electrical power system, Transmission line is the main vein while the power is being transferred from generating stations to the consumers. Most of the power transmission lines are used in a highly unguarded environment, which reduces the reliability and efficiency of the power system. Hence the transmission process can be improved by utilizing good monitoring networks for the current power system. For reliable monitoring the most advanced technology is Internet of Things (IoT) [2].

The Internet of things (IoT) is a new innovative smart paradigm that enhances the present system with various technologies. By using World Wide Web (WWW), IoT enables the physical devices to communicate with each other. IoT has many advantages like easy communication, Automation and control, fast monitoring, Time and money saving. IoT is a smart technology that senses the data from the system to be controlled and transfers the sensed signal to the network layer and then to the application layer. IoT enhances the lifestyle of every individual because it has wide range of applications like health care [3], smart cities [4], agriculture [5], smart building [6] and intelligent traffic system [7] and more.

In this paper, we propose IoT power transmission line, which aims to carefully monitor the abnormalities in the transmission line. By this monitoring we can protect the device from severe damage and power interruption. This can be done by placing the sensor devices at every pole of transmission line. It collects the information like voltages and currents of the line from the sensors. These sensors gives the sensed signal to the Wi-Fi router and then to the cloud. This cloud gives the information to the controlling environment [1]. This controlling environment gives the information to the one whose has to give controlled signals through software applications. It also gives information regarding the abnormalities through E-mails. It is one of the smartest advantages of using IoT.

II. IoT AND BASIC ARCHITECTURE

The Internet of Things (IoT) is a new technology of Internet services which enables hardware and software devices to communicate with each other using web. In this paper, the work is implemented in two parts. First one is Hardware

implementation and the second one is Software implementation. The Hardware used is AC Voltage Sensors, Current Sensors, Arduino UNO, ESP8266Wi-Fi chip, Relays, LCD Display. The Software used is Arduino IDE, ThingSpeak, UBI Dots, and Blynk.
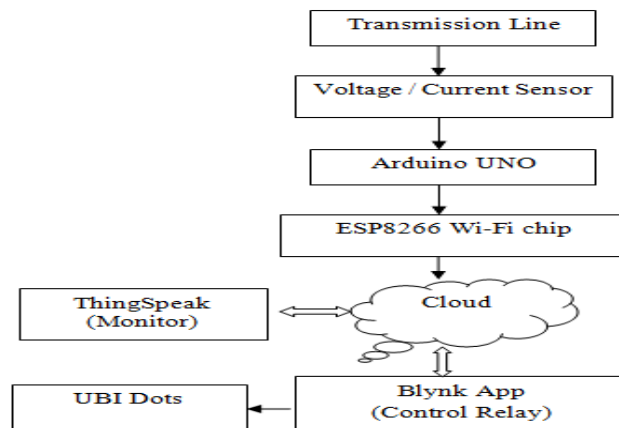

Fig 1 Block Diagram

III. CIRCUIT DIAGRAM AND ITS WORKING
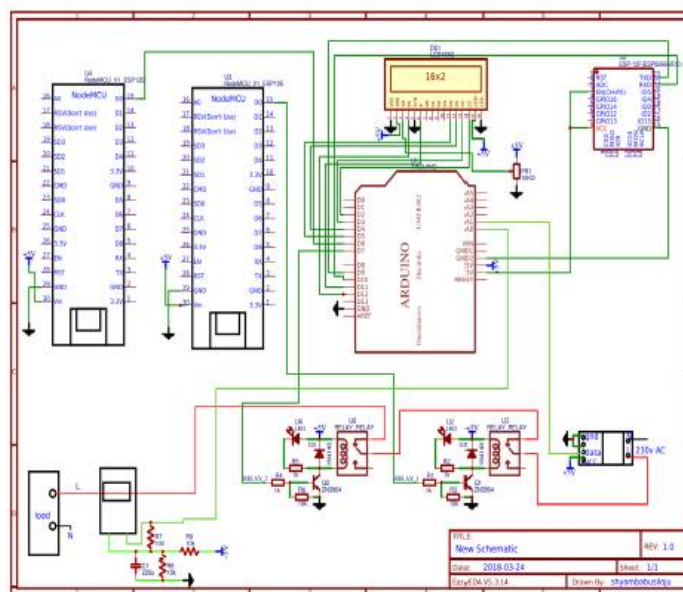
a)   The Circuit diagram is shown below

Fig.2 Connection Diagram of Prototype

b)   Working

The prototype of the work consists of two parts
i) Monitoring and

ii) Controlling.

i)   Voltage/Current sensors sense the electrical quantity of the transmission line and convert this quantity to digital signals. These signals are passed to the arduino UNO board. This programmed arduino UNO is linked with ESP8266cWi-Fi chip using arduino IDE(Integrated Development Environment).The received digital signals is sent or uploaded to cloud by Wi-Fi chip. By using ThingSpeak which is an open source IoT application, we can monitor the status of the transmission line online by creating login ID and password through site called www.thingspeak.com.The user can also see the data in app called "Thingview free".

ii) The Controlling can be done in two ways - automatically and manually. A special cloud environment UBIdots is used to connect the hardware and software equipment. This site sends an email notification every time, as the line experiences an abnormal voltage. If the range of normal voltage is set in the program and number of times is set according to the user's choice, then the line trips automatically when the user ignores the notification send by UBI dots site for the number of times given by the user. If the next value is within the normal voltage range then the line operates as usual. Manual opening and closing can be done by using an app called "blynk".

IV. RESULTS

In this work we developed 3 useful features of smart monitoring of transmission line. They are:
1. Live Monitoring of voltage, current and power
2. Email notifications on abnormal voltage
3. Disconnection of line

1. Live Monitoring of voltage, current and power
By using ThingSpeak IoT platform we are able to monitor the voltage, current and power levels of the transmission line in real-time from your mobiles, laptops, PCs etc.We can view these parameter variations easily by understandable graphs between the respective parameter and the time in 24-hour format as shown below. These are automatically generated graphs by ThingSpeak

Fig..3 Live Supply Voltage value in ThingsView app

Fig.4 Live Current drawn value in ThingsView app

Fig.5 Live power value in ThingsView app

2. E-mail notifications on abnormal voltage

When the voltage levels of the transmission line reach certain high or low values, as specified by us in program written and dumped in node MCU, an additional feature is added i.e. Email warning by using UBI dots. When abnormal voltage occurs notifications will be sent through email to one or more email addresses specified by us. The Email notifications in UBIdots, IoT environment is shown below
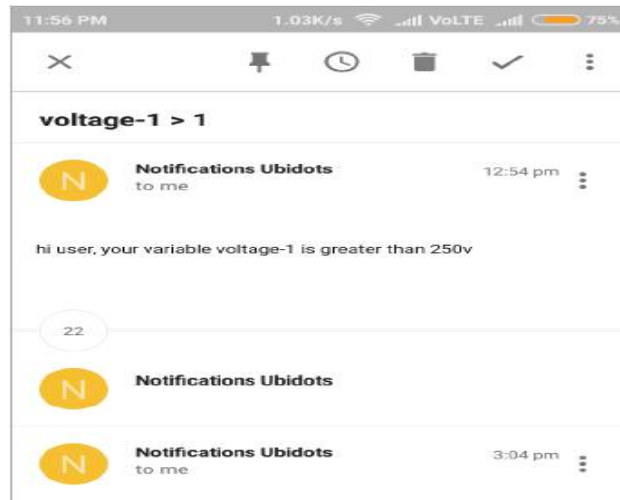
Fig.6 Abnormal voltage value notifications sent to Email address of person in-charge by UBI dots

3. Disconnection of Line

These abnormal values are to be controlled. Here we used two ways to disconnect the line from the transmission line from the abnormalities.

a) open/close the line using Blynk

b) Automatic tripping

a) open/close the line using Blynk

Here we used another IoT platform called Blynk. It is another mobile app, where we use programming node MCU in which special C-libraries are used to connect Blynk cloud to the Wi-Fi network. By using Blynk mobile app we can give ON/OFF command. Based on the command given, transmission line gets disconnected with the help of relays. The figure below shows the Blynk app environment to give ON/OFF command.
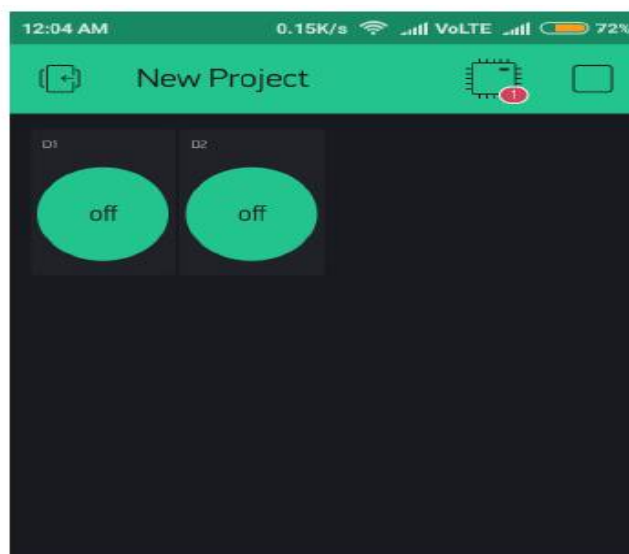

Fig.7 Open/Close a Transmission line using Blynk android app

b) Automatic Tripping

For automatic tripping we use UBIdots platform. UBIdots not only gives the email notifications, it also trips the transmission line. The range of normal voltage is set in the program and the number of times is set according to the user. If the user ignores the email notifications send by UBI dots site then the transmission line trips automatically. If the next value of the line is within the normal range then the line operates as usual.

V.CONCLUSION

In this paper, we proposed a new innovative smart trending technology to monitor and control the transmission line with the smart IoT platform. IoT is a new smart upcoming technology which enhances the present systems into smart systems. This method of monitoring and controlling makes the system reliable with low power consumption. This method of monitoring and controlling, is not only used for the protection of transmission lines, but can also be used for the protection of transformers and also alternators.

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