TRANSMISSION LINE MONITORING SYSTEM USING IOT

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ABSTRACT

The electrical power system is growing and complexity in all sectors such as generation, transmission, distribution, and load systems. The detection and location of faults on power lines is essential to the protection and maintenance of a power system. In an electrical power system, a fault current is an abnormal electric current. In this system, some device uses like sensors to sense the current (in amp) and voltage (in volt) continuously of transmission line. Our system will detect if any voltage drops or overload on transmission line, if any these types of faults occur it can detect it and trip the line by using relay. Furthermore, if there are thefts occurs on line it can be detected automatically and intimated to the authority person with location by using Internet of Things. Location of theft is essential in case of power system. Detection of fault in the transmission line has been proposing by programming Arduino UNO and Arduino MEGA. Arduino senses the change in current and voltage as per programming and provides information to LCD. The device is measures incoming and outgoing values and find abnormalities with the help of sensors. Fast monitoring can help to protect power system. This is the concept of impedance method fault detection system. This fault and detection of theft is very fast.

Keywords: Internet Of Things, Arduino UNO, Arduino Mega.

I. INTRODUCTION

Modern electric system is growing up exponentially [1]. Electrical power transmission line is a critical link between power generation plants and distribution to all electricity users. Length of transmission line is long and there is a possibility of fault occurrence. These faults cause giant damage to expensive equipment and damage stability [2]. So, fault should monitor quickly and isolate faulty line. It is important to protect the transmission system. Sensors can take accurate measurement of an electrical parameters and transfer information to IOT. Sending information to control room in appropriate time is a difficult challenge [3]. The theft of electricity is a big problem of power system. Theft is the major concern of the transmission and distribution losses in the supply of electricity [4]. All electricity companies face this issue and losses money every year due to theft. Electricity is being stealing with bypassing. This system is utilizing to overcome this type of losses of electricity, and it is very beneficial for the authorized agency to control its revenue loss. Proposed system is uses for identifying faults, thefts and if there is any fault occurs line will trip or isolate immediately, this work is complete by relay operation. It will protect transmission line against damage. Recommended system also detect theft, if there is any taping online for electric power theft it will intimate to the authority person of control room with location by using Internet of Things (IOT) system. Detection of theft is integrating with IOT mechanism. Thus, we must take care of transmission line to reduce losses for efficient system, this proposed work, i.e., IOT based transmission line fault detection system may be the solution [5]. Most methods of fault detection and location based on measurements of electrical quantities provided by current and voltage transformers [6].

II. METHODOLOGY

a) Current methods-
1) Impedance based fault location method

In the impedance-measurement-based technique, the voltage and current during pre-fault and post fault are analyzed. Parameters of the line can be calculated with the transmission line model. Impedance-based methods required the following approach.
2) Travelling-wave-based fault location

A fault occurring on a power cable will generate voltage and current travelling waves with wideband signals which cover the entire frequency range. Then, at this point, both a reflection and a refraction of the wave will occur. This generates additional waves which will propagate through the power system. In the travelling wave technique, either the transient created by a fault is captured or impulses are injecting into the line. And the reflected travelling wave is detecting with time domain reflectometry. The fault location is then determining by timing analysis of the travelling wave.

In this paper, the proposed model monitors parameters like current and voltage. Also detect theft and faults like under voltage and overload. In this monitoring system, flow of charge sense by current sensor and voltage sensor. From these sensors, fault, and theft will detect. It will detect by taking difference of current between two transmission poles, input, and output current reading. All system is work by programming in Arduino.

b) Block Diagram

![Proposed system Block diagram](image)

Figure 1: Proposed system Block diagram

c) Circuit Diagrams of Slave circuit and Master circuit

![Circuit Diagram of Slave Circuit](image)  ![Circuit Diagram of Master Circuit](image)

Figure 2: Circuit Diagram of Slave Circuit  Figure 3: Circuit Diagram of Master Circuit
d) System Flowcharts

**Flowchart of Slave Circuit**
Firstly, power supply on then microcontroller will initialize. Then RF module and LCD will initialize. LCDs all sensed values by sensor. And then transmit the all values through RF module to Mater. After that, all slave circuit will work.

**Flowchart of Master Circuit**
Power supply on then, initialization of LCD is done. Read and display all sensors values of master circuit. And receives all values from slave circuit through RF module and read. Then compare the master and slave reading. And transmit to IOT module. After that, master circuit will work.

e) Actual working
Designed work divided in two parts. One part is called the “Slave system” and the other part is called the “Master system”. In the actual system there will be many slave systems in a particular area but a single Master system that will control all the slaves. All the systems will be mounted on each of the electricity distribution pole. The master system will be located at the central pole and slaves will be on the surrounding poles. The purpose of the slave is to monitor the current flow on the transmission line for that particular pole. We will use the current sensors for this. It will measure the current flow on the transmission line in two parts, one is incoming current to the pole and the other is outgoing current from the pole. Both the currents values may be different as there may be authorized electrical connection going to a consumer from that pole. Another task of the slave is to transmit those current values to the Master system over a wireless RF link. For this purpose, we are going to use RF trans-receiver modules. The master system will also measure the incoming and outgoing current on the master pole. It will also collect the current values coming from all the slaves over the RF links and also monitors voltage of all three phases (R, Y, B). The master system will arrange all those current values in a sequence in which the actually current flows through each of the current sensors. The main task of the master is to find out difference between outgoing current of each pole and the incoming current consecutively next pole for every phase wire. Like this it will detect the leakage/theft of the power in the transmission line. A IoT modem can be used to send the message to the area supervisor of that particular area using the WIFI system. This data can be viewed on the website by anyone. There will be 6 CTs on each pole in total, 3 for incoming current measurement of each phase (R Y B) and 3 for outgoing current measurement.
f) Implementation

![Implementation Image]

**Figure 6: Implementation**

### III. RESULTS AND DISCUSSION

**Fault Detection**

1. **Normal Condition of Voltage of Transmission Line**

   ![Voltage Readings of phase R, Y, B.]

   **Figure 7: Voltage Readings of phase R, Y, B.**

   Above diagrams displays the value of voltage of phases. It shows that Transmission line is in normal conditions. These all values are displayed on thingspeak website. There is voltage R is value of phase R in volt, voltage Y is value of phase Y in volt and voltage B is value of phase B in volt. If any fault occurs like Under voltage or over voltage this system will indicate that with help of thingspeak.

2. **Under voltage fault detection**

   2.1 **R phase Under Voltage**

   ![R phase Under Voltage]

   **Figure 8: R phase Under Voltage Fault detection**

   2.2 **Y phase Under Voltage**

   ![Y phase Under Voltage]

   **Figure 9: Y phase Under Voltage Fault detection**
2.3 B phase Under Voltage

![Image of B phase Under Voltage](image)

Figure 10: Y phase Under Voltage Fault detection

3. Normal Condition of Current in Transmission line

![Image of Normal Current Readings](image)

Figure 11: Normal Current Readings

4. Overload Fault detection

4.1 Overloading on R phase

![Image of Overload R phase](image)

Figure 12: overload fault detection of R phase

4.2 Overloading on Y phase

![Image of Overload Y phase](image)

Figure 13: overload fault detection of Y phase.

4.3 Overloading on B phase

![Image of Overload B phase](image)

Figure 14: overload fault detection of Y phase.
5. **Theft Detection**

5.1 **Normal condition**

All of above figures shows the overload fault detection on LCD of master circuit and on Thingspaek website. If the load of transmission line increases (by 100watt in this model system), system will indicate values of current in milli ampere. When 100watt load is connected to load side then value of current in 0.4 ampere. All values of current are shown is accurate. After fault occurrence system will trip transmission line automatically.

5.2 **Theft on R phase**

If there is tapping on any phases, it will automatically intimate to the authorized person. With indicator glowing. If there is any tapping on line, it can be automatically detected and intimated to the authority person with location of theft by using IOT. There is we used switch and 60-watt bulb for theft.
5.3 Location of Fault and Theft

![Channel Location](image)

**Figure 17:** Fault and theft location

IV. OBJECTIVES

- Transmission line faults are very dangerous and due to fault losses increases. So, this system may help to solve this problem.
- For security of expensive appliances under power system.
- The under voltage and over current fault and theft detection.
- To find exact fault location where fault or theft occur.
- To minimize the time require finding location.
- Decreases the overall maintenance cost by providing instant information about fault.

V. CONCLUSION

Designed model will easily detect the fault and theft. It is very fast system. All monitored data will update to cloud and records all data. Proposed system is integrated with IOT. So, it will use for avoiding future problems. We can also message to authorized person or consumer in case of theft or any fault occurs on line by using GSM. And by using different loads like capacitive load and inductive load, we can measure active power and reactive power.

VI. REFERENCES