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## FAULT DETECTION SYSTEM OF TRANSMISSION LINE USING IOT

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### ABSTRACT:

Identification of fault source in the transmission line has been proposed in this paper by programming Arduino UNO Microcontroller. Fast fault detection protects connected equipment by detecting and suppressing the spurious signal before any significant damage. Transmission line protection is the main objective of this project in the power system about 80-85% fault suppression. LM 317 used in a circuit that provides variable output voltage for the connected load. Output voltage adjusted by rotating potentiometer. Potentiometer is used to increase clear display through LCD. Connecting the network of resistors, the Arduino measures voltage and current. Received high voltage back EMF from the relay coil switching the relay ON and OFF and protects the sensitive load.

**Index Terms - IoT, Fault localization, Relay Switch, Transmission line.**

### 1. INTRODUCTION

Currently, the electric power infrastructure is highly vulnerable against many forms of natural and malicious physical events [1], which can adversely affect the overall performance and stability of the grid [2-3]. Many electric power transmission companies have primarily relied on circuit indicators to detect faulty sections of their transmission lines. However, there are still challenges in detecting the exact location of these faults. Although fault indicator technology has provided a reliable means to locate permanent faults, the technical crew and patrol teams still has to physically patrol and inspect the devices for longer hours to detect faulty sections of their transmission lines. Network design is a critical aspect of sensor-based transmission line monitoring due to the large scale, vast terrain, uncommon topology, and critical timing requirements. Mechanical faults, cost reduction due to condition-based maintenance rather than periodic maintenance, etc. [4-6]. It is known that when a fault occurs in overhead transmission line system then instantaneous changes in voltage and current at the point of fault generate high frequency. The fault current is relatively high, during the fault. The power flow is diverted towards the fault and supply to the neighbouring zone is affected Voltage become unbalanced. Power system reliability and security has the most important requirement. And to ensure good quality and also continuous power supply to consumers. Due to Lack of monitoring system the utility does not get timely data on the health of lines. Utility comes to only when there is serious fault/damage. If there is a continuous monitoring of the lines and if the data is available on the internet, then the utility can take required actions in advance to avoid the serious damage. In our project, we demonstrated that the line parameters are monitored, and the data is uploaded on the net through IoT [7]. This is to improve the social and economic life of Power Holding capacity of distribution line. As in distribution system there is a probability of 70 to 80% faults in distribution lines, this may cause a long interruption in the service. Thus, we must take care of the line to reduce frequently interruption of service. To take care of this the proposed work i.e., Line Fault detection in Distribution System using IOT may be the solution [8].

In this paper an Arduino based IoT system proposed to identify the unwanted fluctuation of electrical quantity and protect the load from damage. A variable voltage detection circuit identifies the abnormal change in voltage displayed by the LCD display connection. A power measuring circuit protects the load by disconnecting from the voltage supply.

2.BLOCK DIAGRAM:

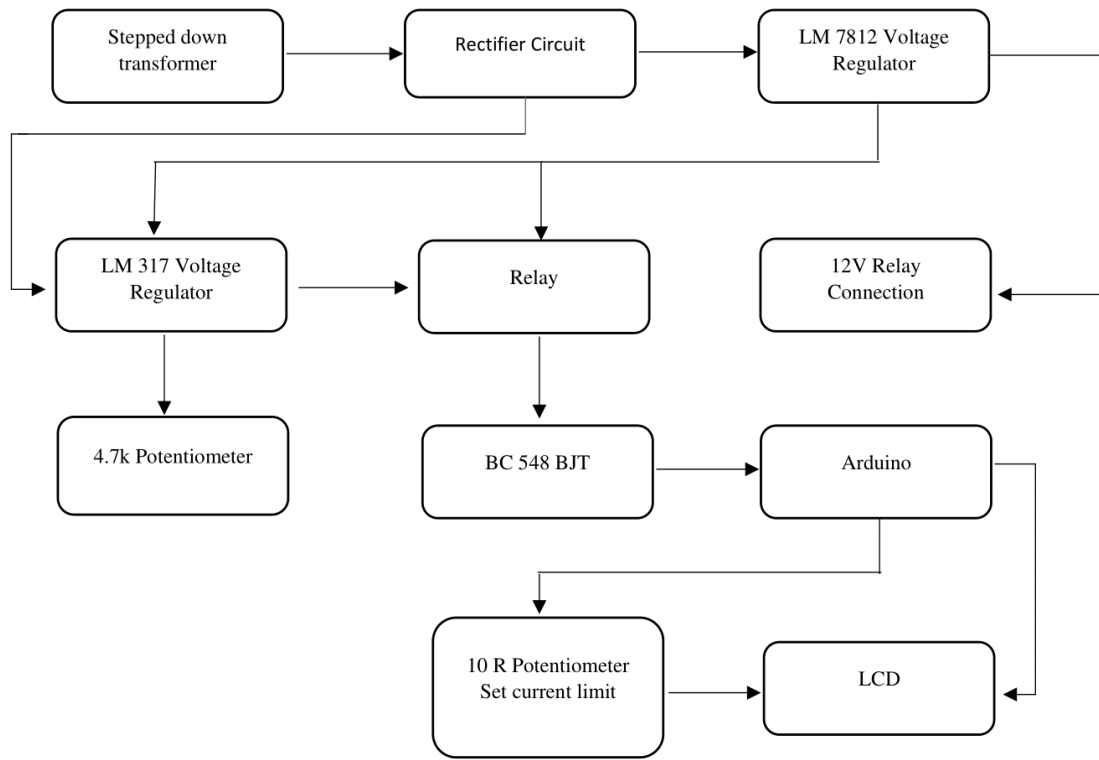


Fig. 1: Block Diagram of Circuit

3. CIRCUIT DESIGN CONFIGURATION:

To provide the over current protection a circuit has been designed using Arduino UNO, 9V Relay, LM317, Variable Potentiometer, LCD Display, Diodes, Resistors and Capacitors. Design configuration of the proposed circuit has been described in Fig. 1. The power supply has 3 potentiometers for adjusting the LCD display contrast, for adjusting the output voltage and for setting the current limit. The LCD display will update with four parameters every second: the voltage, current consumption, pre-set current limit and power consuming by the load.

The current consumption via load will be displayed in the unit of milliamps; the pre-set current limit will be displayed in milliamps and the power consumption will be showed in milli-watts. The circuit has been divided into 3 parts the variable voltage detection circuit, the LCD display connection and power measuring circuit. The 12v-0-12v / 3A transformer has been utilized for stepping down the voltage (for virtual simulation, 5V battery is used instead of the transformer). Here the 6A4 diodes will convert the AC into DC voltage and therefore the 2000uF capacitor will free the choppy DC supply from diodes. The 9V regulator LM 7809 converts the unregulated DC to regulated 9V DC supply to power the Arduino and relay. Here, DC jack has been used for Arduino's input supply.

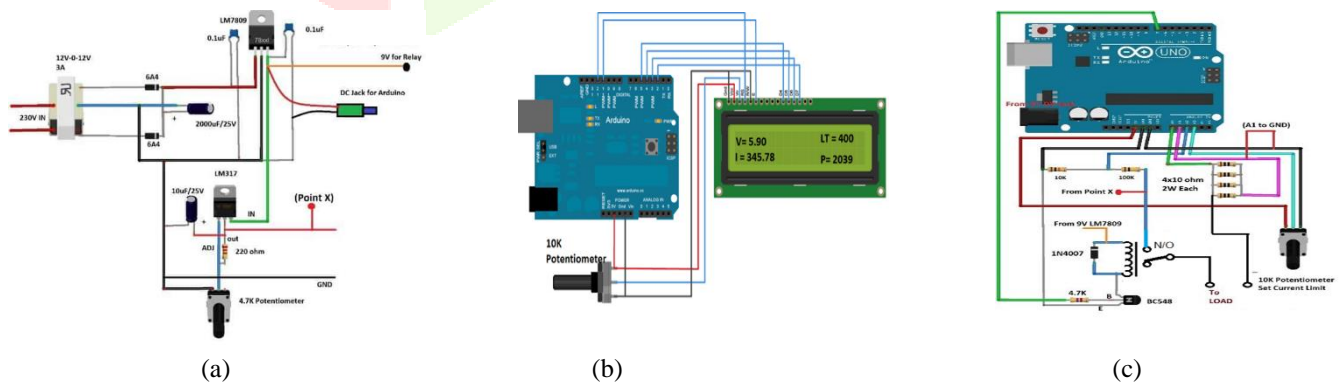


Fig. 2: Circuit diagram (a) variable voltage detection circuit, (b) LCD display connection and (c) power

4.FLOW CHART:

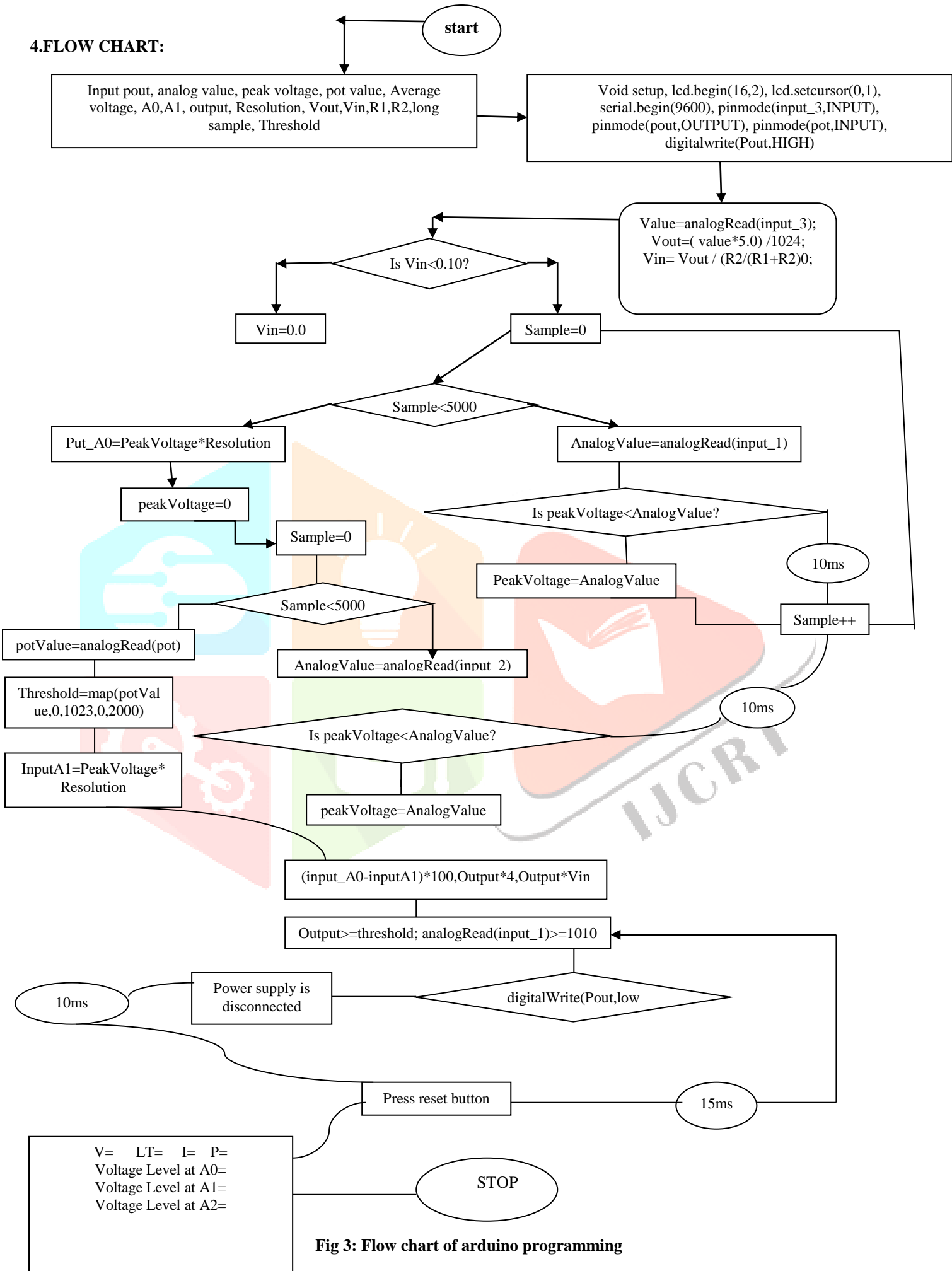


Fig 3: Flow chart of arduino programming

## 5. POWER MEASURING STEPS:

The variable voltage detection circuit comprises of voltmeter and ammeter. The voltage and current has been measured simultaneously using network of resistors interfaced with the Arduino. The four 10ohm resistors of 2 watt each have been connected in parallel to form 2.5-ohm shunt resistor. This has been used for measuring the current flow through the load. The Arduino measures load voltage through the 10k ohm and 100k ohm resistor. The 10K ohm potentiometer used for adjusting the utmost current level at the output. If the current flow through the load exceeds the pre-set current, the output supply will be disconnected. The output is turned on and off by the Arduino's pin7. When this pin is in active state, the relay is energized by the transistor which connects the common and normally open pins, which conducts the positive supply for the load. The high voltage back EMF from the relay coil is absorbed by the diode IN4007 while switching the relay ON and OFF.

## 6. CIRCUIT SIMULATION:

Proteus VM software used for the circuit design and simulation. According to the circuit configuration and proposed power measuring steps, the circuit diagram (Fig. 4) has been generated.

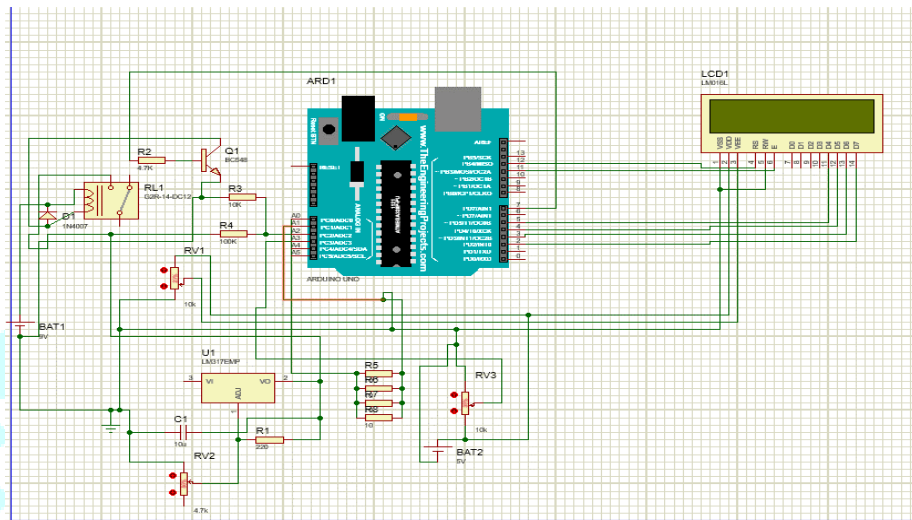


Fig. 4: Circuit in proteus

## 7. FUTURE OBJECTIVES

The model leaves a scope of further development using advanced technologies to give more accurate resolves of various critical problems. Wireless sensor network with mobile nodes can be implemented to detect the exact fault-location. With the exact fault location detected and using advance wireless network technology, transmission lines of a particular area, will be under constant surveillance which will also help to monitor the relevant problems and solve them without any time delay.

For further advancement, cloud computing can be implemented for real-time data acquisition. Even Artificial Intelligence (AI) can be added to make the model more up-to date.

## 8. CONCLUSION

The proposed circuit diagram achieves fault detection and suppression for the connected load protection. With the proposed effort, the problem of detecting the fault in transmission lines has been reduced. An IoT based model is projected for healthier recognition of fault in the overhead transmission lines. Overall control and status checking shall be made online as the remaining part of the project.

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