Microcontroller based Monitoring and control of Fault Detection in Transmission Line using Proteus software

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Abstract— The electric power system is becoming more complex with increasing demand in electricity. Hence there is a need of effective control system to make the power system safer, efficient and reliable. This power is being carried by the transmission lines. These lines travel very long distances so while carrying the power, fault occurring is natural. These faults damage much vital electrical equipment like transformer, generator, and transmission lines. For the uninterrupted power supply we need to prevent these faults as much as possible. So we need to detect faults within the shortest possible time.

Microcontroller based systems used for these fault detection have been advancing rapidly. The main aim of this system is to monitor and protect the transmission lines through wireless system. This research project gives remedies by providing warning from the faults occurring in transmission line such as over current fault, overvoltage fault, under voltage, over temperature and it overcomes the drawbacks of traditional monitoring. The project proposes a modern information technology by using clouds up ported IOT (Internet of things)-based monitoring system which provides real-time information of a transmission line. The proposed system was tested using Proteus software and simulate Microcontroller based Monitoring and control of Fault Detection in Transmission line. The results are thus obtained.

Index Terms— smart grid, fault detection, microcontroller PIC16F877a, proteus software.**INTRODUCTION**

Transmission line is used for the transmission of electrical power from generating substation to various distribution units. A variation in the electrical parameters of the line which damages the power grid is known as fault. In the smart grid system, power transmission is related and is essential and important. In the domestic electric industry, the management of the transmission line is still in the stage of patrolling foot, which is a relatively initial state. So it is difficult to meet the increasing reliability requirements and the need of smart grid's development. The whole line may be in different meteorological areas, which brings certain difficulties for the management of the line. In recent years, the occurrences of severe weather become more frequent, which caused severe collapse of power towers and broken of the power lines.

The project on the monitoring of the transmission lines is one of the directions for the smart grid technologies. The proposed system is designed to offer the meteorological data, which can help to make forecast and alarm before the accident, so also lessen the loss of the power grid. Therefore, a smart system for the meteorological monitoring of transmission line based on IOT system. The wireless sensor network provides access over remote location with centralized monitoring on different channels that can be utilized for electric transmission line.

In [1] paper it is assumed that time synchronized measurements will be ubiquitously available at all high-voltage substations at very high rate and examined how this information can be utilized more effectively for real-time operation as well as for subsequent decision making. This new information available in real time is different, both in quality and in quantity, than the real-time measurements available today. In [2] it paper can perform four different operations simultaneously in a single GUI platform. For this purpose a novel data transfer protocol was designed and as well as suitable management for raising events was made. In [3] ZigBee is a new wireless network communication technology; it can be used in the fields of automatic control, sensing network, monitoring and remote control .This novel application to the transmission line temperature measurement system can breakthrough traditional restrictions such as Power Line Carrier (PLC), Microwave relay, etc.

In [4] this paper it is designed and developed remote electric transmission line monitoring and control system where autonomous system fixed at every electric pole will look at the power supply state and control its supply on command. Along with the pole fixed device there are base stations which will monitor pole status by communicating

with pole device through wireless medium. In [5] explains how IOT can connect a variety of physical objects, through unique addressing schemes, to an Internet-like structure, which enables the objects to interact and cooperate with each other to reach common goals. In [6] this paper compares the result of concurrent Neuro-fuzzy technique applied in different power transmission lines to predict the detection faults and their location over two long and short PTL.

I. PROPOSED METHODOLOGY

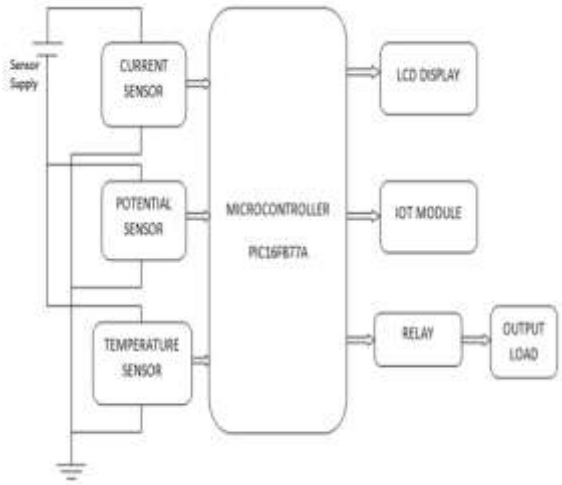

Figure 1: Software Simulation block diagram of proposed system

The system consists of various modules like Wi-Fi module, relay module, Transformers, Microcontroller, display etc. The proposed fault monitoring and detection system for transmission line also comprises of current transformer, voltage transformer temperature sensor and load. Current transformer connected to transmission line is used for measuring current and potential transformer is used for measuring voltage of transmission line and temperature sensor to detect the temperature values. If the value of current, voltage or temperature increases beyond threshold value the microcontroller sends the alert to the cloud. If fault occurs at any stage of transmission line the PIC16F877a microcontroller detects and send breakdown message via Wi-Fi module. Wi-Fi module acts as a network provider.

The Wi-Fi module used to send information over clouds. The internet of things refers to ever-growing network of physical objects that feature on IP address of internet connectivity and the communication that occurs between these objects and other internet enabled devices and system. The internet of things has external internet connectivity beyond traditional devices like desktop computer, laptop, Smartphone's to different range of devices and everyday things that utilize Embedded Technology to communicate and interact with external environment. The ThingSpeak is an open-source Internet of things application and API to store and retrieve data from things using the HTTP and MQTT protocol over the internet or via Local Area Network. Hence by using this we can watch the parameters and obtain the results in form of data sheets, charts and graphs etc.

II. SOFTWARE REQUIRMENT

An Embedded System can be best described as a system which has both the hardware and software and is designed to do a specific task. Embedded Software or Program allows Hardware to monitor external events (Inputs) and control external devices (Outputs) accordingly. During this process, the program for an Embedded System may have to directly manipulate the internal architecture of the Embedded Hardware (usually the processor) such as Timers, Serial Communications Interface, Interrupt Handling, and I/O Ports etc. Embedded C Programming Language, which is widely used in the development of Embedded Systems, is an extension of C Program Language. RTX framework is described in [7] for development of real-time applications on embedded systems. It allows the programmer to build and execute real-time applications from a Graphical User Interface (GUI) inspired in the Arduino environment, in the same way, an Application Programming Interface (API) is provided through a functions library for the C ++ programming language. The Embedded C Programming Language uses the same

syntax and semantics of the C Programming Language like main function, declaration of data types, defining variables, loops, functions, statements, etc.

The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB (Printed Circuit Board) layout design. It can be purchased in many configurations, depending on the size of designs being produced and the requirements for microcontroller simulation. A grid connected module is developed [8] using a converter and conventional H - bridge inverter. The aim of the proposed methodology is to reduce the size of the filter used across the inverter and it is achieved. All PCB Design products include an auto router and basic mixed mode SPICE simulation capabilities. Schematic capture in the Proteus Design Suite is used for both the simulation of designs and as the design phase of a PCB layout project. It is therefore a core component and is included with all product configurations.

Proteus environment is used [9] for the study of Arduino-driven sensor circuits, designed to support electronics student education. A simulation model of sensor circuit has been developed, including a PIR Motion Sensor, a Flame Sensor and Humidity and a Temperature Sensor controlled by the Arduino Uno microcontroller. Also a display of liquid crystal, buzzer and LEDs on the board is included.

Peripheral Interface Controller (PIC) is microcontroller developed by Microchip, PIC microcontroller is fast and easy to implement program when we compare other microcontrollers like 8051. The ease of programming and easy to interfacing with other peripherals PIC became successful microcontroller. When we see in the programmer point of view interfacing is very easy, also we can connect analog devices directly without any extra circuitry and use them.

The micro-controller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic. It is then co-simulated along with any analog and digital electronics connected to it. This enables its use in a broad spectrum of project prototyping in areas such as motor control, temperature control and user interface design. PIC Micro controller contain an inbuilt ADC which is advantage to use them in many applications and also has fast operation and easy to program. The work [10] attempts to build up some novel calculations for programmed recognition of eyes influenced with glaucoma utilizing picture preparing separating and change strategies and actualize the same on equipment utilizing a PIC micro-controller, which is used for the hardware implementation. The software simulation was also carried out to validate the simulation results.

The PCB Layout module is automatically given connectivity information in the form of a net list from the schematic capture module. It applies this information, together with the user specified design rules and various design automation tools, to assist with error free board design. PCB's of up to 16 copper layers can be produced with design size limited by product configuration.

III. RESULTS

Figure 1 depicts the software simulation of the proposed methodology as detailed in the section. This used embedded C programming to write the software code and it is converted to hex file. The various components used for the system are available in Proteus software in the form of active mode. This helps us to visualize the system easily. The circuit connection is made as shown in the figure 2. Here the sensor supply input is 5 V DC. The threshold values are fed in the embedded program. For current it is 5 Amps, for voltage it is 230 Volts and for temperature the value is 50 degree. Before execution of the simulation we need to first add the hex file to the Microcontroller and then execute the simulation. The output load is in ON condition for the normal values of current, voltage and temperature.

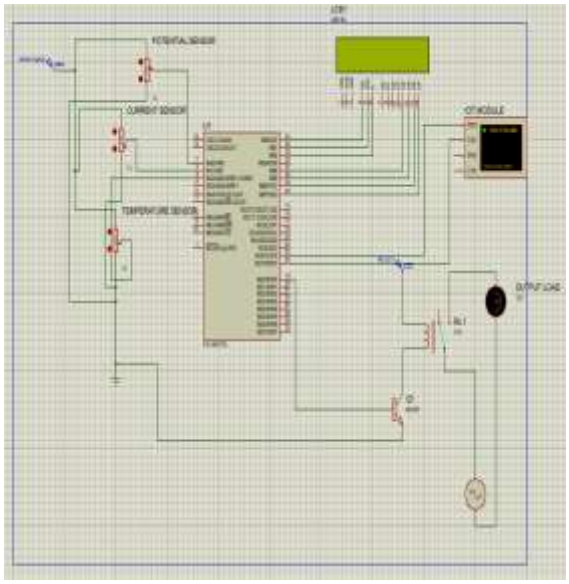

Figure 2: Software simulation of the proposed system

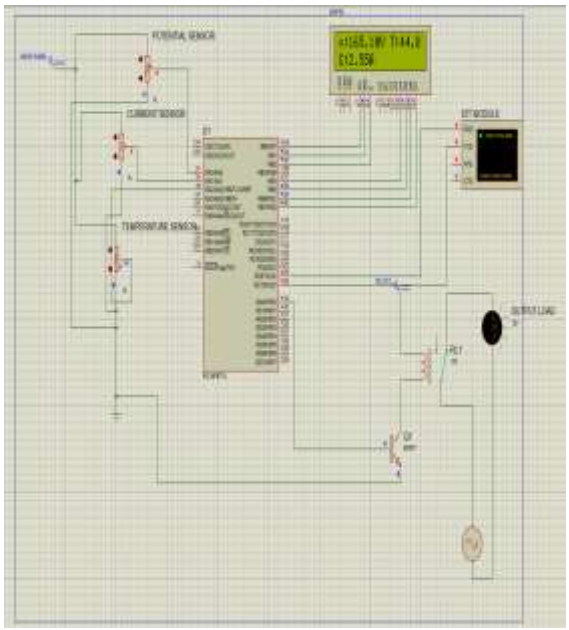

Figure 3: After execution, the normal conditions of the parameters hence output load in ON

The simulation software as shown in figure 2 is executed using the Proteus simulation software. The results are derived for current, voltage and temperature values separately. Here we prepare the faults in order to see the variations in the parameters and the detection of the faults accordingly using the sensors available .The figure 3 shows the result for the current value. If the value of the current increases above the threshold value then the microcontroller sends signal to transistor which opens the relay circuit and the output load is OFF and it is displayed in the LCD display and also in the IOT module, hence the line is protected. The same is for the voltage and temperature values as well and shown in the figure 4 and 5 respectively.

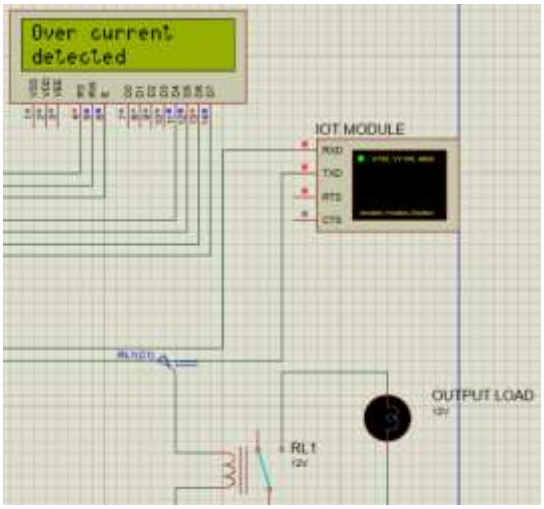

Figure 3: After the execution, over current is detected when the current value is reached beyond its threshold value and load is tripped off.

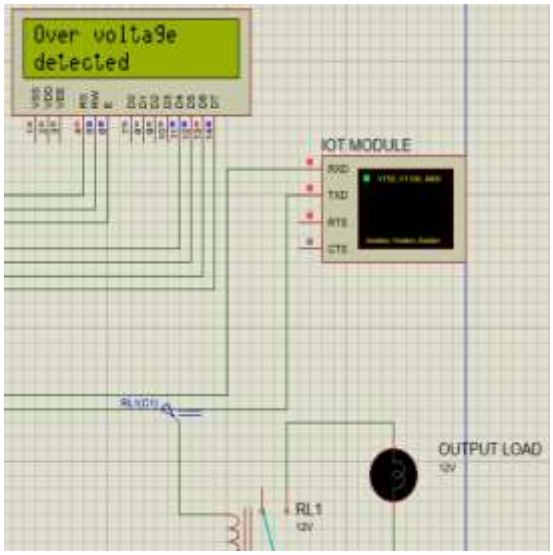

Figure 4: After the execution, over voltage is detected when the voltage value is reached beyond its threshold value and load is tripped off

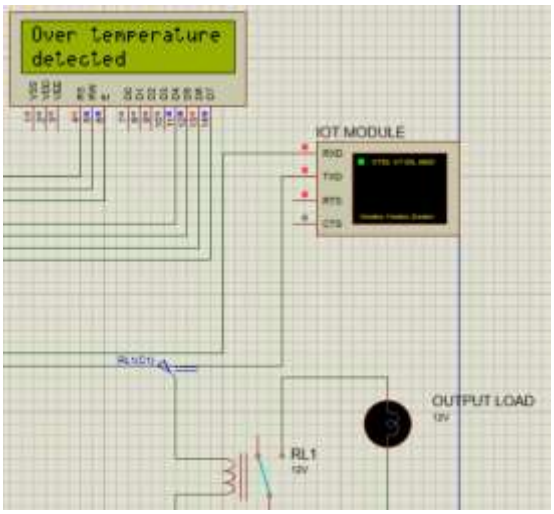

Figure 5: After the execution, over temperature is detected when the temperature is reached beyond its threshold value and load is tripped off.

PARAMETERS	VALUES	RESULT
CURRENT	5 A	Loads in ON condition
	5.5 A	Loads Tripped OFF
VOLTAGE	230 V	Loads in ON condition
	245 V	Loads Tripped OFF
TEMPERATURE	50^0	Loads in ON condition
	55^0	Loads Tripped OFF

Table 1: Output table

IV. ADVANTAGES

Data is obtained in digital form and it can be seen through online communication. It monitors and protects wide area. Large number of data aggregation is possible in every short span of time. It has predictive analysis and it is time saving, highly effective and reliable. It overcomes the load damage .It avoid blackouts and outages. It has higher resolution and provides accurate results. This system can be implemented for transmission lines.

V. CONCLUSION

An effective monitoring and control system using PIC16F877a microcontroller is proposed to make the power system safer, efficient and reliable. Here the faults are detected within the shortest time possible. The main aim of this system was to monitor and protect the transmission lines through wireless system. It monitors voltage, current and temperature. Proteus Software was used to demonstrate the software simulation of the proposed system. This used the embedded C programming language for the coding part for the microcontroller using CCS complier. Hence after execution of the simulation, results show that the faults are detected and protected using the relay.

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