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"Automatic Fault Detection in Transmission Line Using IOT"

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ABSTRACT

The IOT market is expected to the next big thing in the coming years. The number of connected devices is increasing day by day and this motivates us to develop a solution for monitoring and security using IOT. Detecting and Locating faults in in power is very necessary for health operation of power system. In electrical power line fault often occur many times making the power system unreliable.in this paper a novel concept using wireless sensor for detecting fault which includes phase to phase, short circuit and mainly line to ground fault in power line for better reliable and optimum operation of the system is presented. In the proposed concept power line is divided by (WNS) wireless sensor network nodes that could sense the faulty condition in power line, display to operator as well as send SMS through GSM modern to service engineer. This is well demonstrated with the help of hardware model and the results obtained shows that WNS have several features that make them an attractive instrumentation solution in electrical distribution network and also a viable tool for detecting fault in power transmission line for its accurate fault detection. Technical losses in Transmission & Distribution are computed with the information about total load and the total energy bill. While technology in the raising slopes, we should also note the increasing immoral activities. The system prevents the illegal usage of electricity. At this point of technological development, the problem of illegal usage of electricity can be solved without any human control using IoT. With the implementation of this system will save large amount of electricity, and there by electricity will be available for more than number of Consumer then earlier, in highly populated country such as India, China. Power theft can be defined as the usage of the electrical power without any legal contract with the supplier.

Keyword: *Automatic Fault Detection, IOT Technology, Transmission line, Fault Detection, Microcontroller.*

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I. INTRODUCTION

The development of the nation's power sector provides one of the most important input especially in moderately developing nations. In India the consumption of electricity is increasing at a much faster rate. Therefore, a need has aroused to generate, transmit & distribute electric power in the most economical way. Electrical power systems are divided into generation, transmission & distribution. Losses in the distribution system are much higher than losses in transmission side and also faults are more frequent in distribution side. In the distribution system most of the losses are caused by fault and theft. In this project the focus is on a three phase, fault in the power line. When a phase to phase or phase to ground fault occurs, it becomes significant to detect fault quickly using IoT. We also try to detect fire faults and Over current faults in the system. It becomes challenging for the power company to detect and repair the fault as quickly as possible. Protection systems are designed to identify the location of faults by SMS and IoT means by saying the transformer location number and Isolate only the faulted section in order not to damage the whole equipment in the power system. In the proposed concept with the use of wireless sensor networks the location of fault can be diagnosed. There by providing optimum operation of electric power. The objective of this project is to provide a simple way to detect the fault and show it on IOT as well as by SMS the fault which will ultimately lead to optimum operation of the whole system and to improve the reliability of the distribution network. Sending this information to the control centre in a cost efficient and appropriate time is a critical challenge to be addressed in order to build an intelligent smart grid.

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. Electromagnetic impulses called travelling wave which propagate along the transmission line in both directions away from the fault point. The electric power

infrastructure is highly end angered against many form natural and spiffy physical events. Which can sceptically, affect the overall performance and stability of the grid. The fault impedance being low.

A. Single Line to Ground fault The most common type of shunt faults is Single Line-to-ground faults (SLG). This type of fault occurs when one conductor falls to the ground or gets into contacts with the neutral wire. It could also be the result of falling trees in a rainy storm. This type could be represented as shown in Fig 1 below.

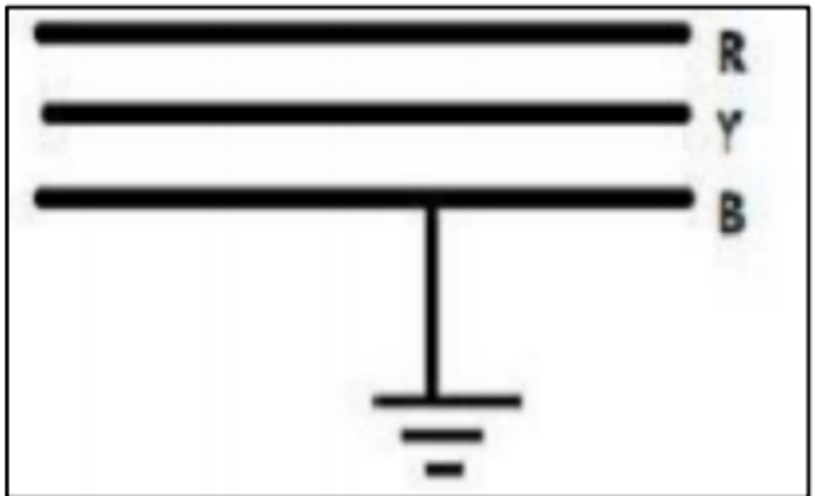


Fig1. Single Line to Ground Fault

B. Line to Line Fault- The second most occurring type of shunt faults is the Line-to-Line fault (LL). This is said to occur when two transmission lines are short-circuited. As in the case of a large bird standing on one transmission line and touching the other, or if a tree branch happens to fall on top of two power transmission lines.

Fig. 2 Line to Line Fault

C. Line-to-Ground Fault The third type of shunt fault is the Double Line-to-Ground fault (DLG) in figure below. This can be a result of a tree falling on two of the power lines, or other causes.

Fig. Line to-Ground Fault

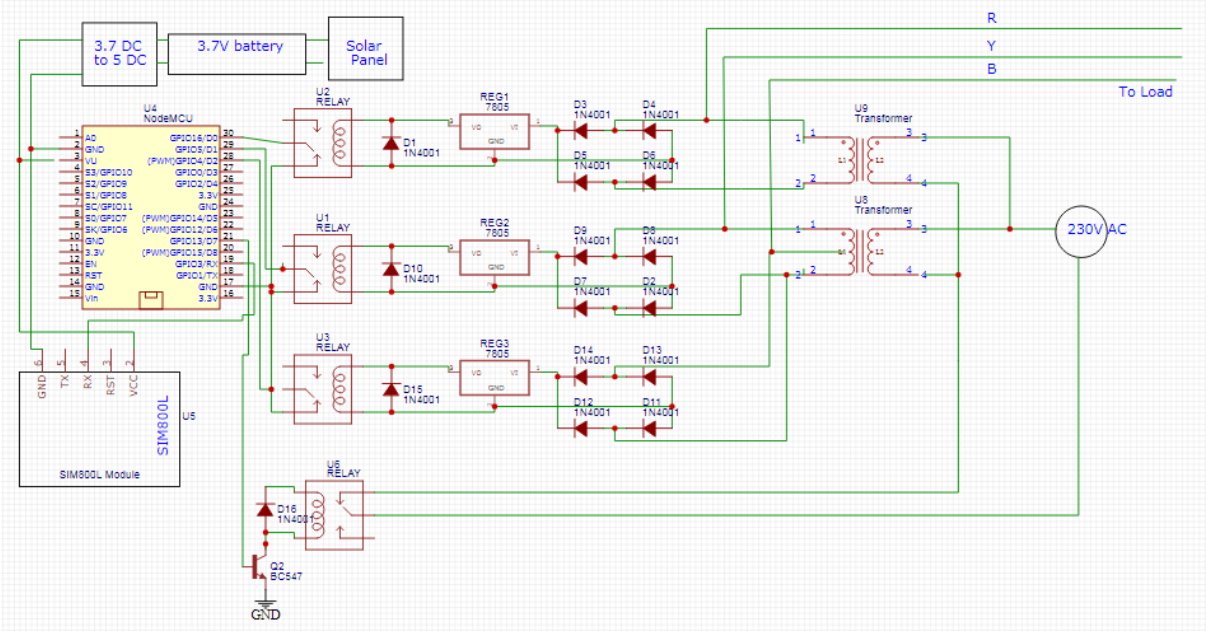
The Internet of Things or IOT, is a system which is connected between the devices, Analog, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to send data over a network without requiring human-to-human or human-to-computer interaction. The Internet of Things is simply Defines, "A network of Internet connected object able to collect and transfer data''.

II. PROJECT METHODOLOGY

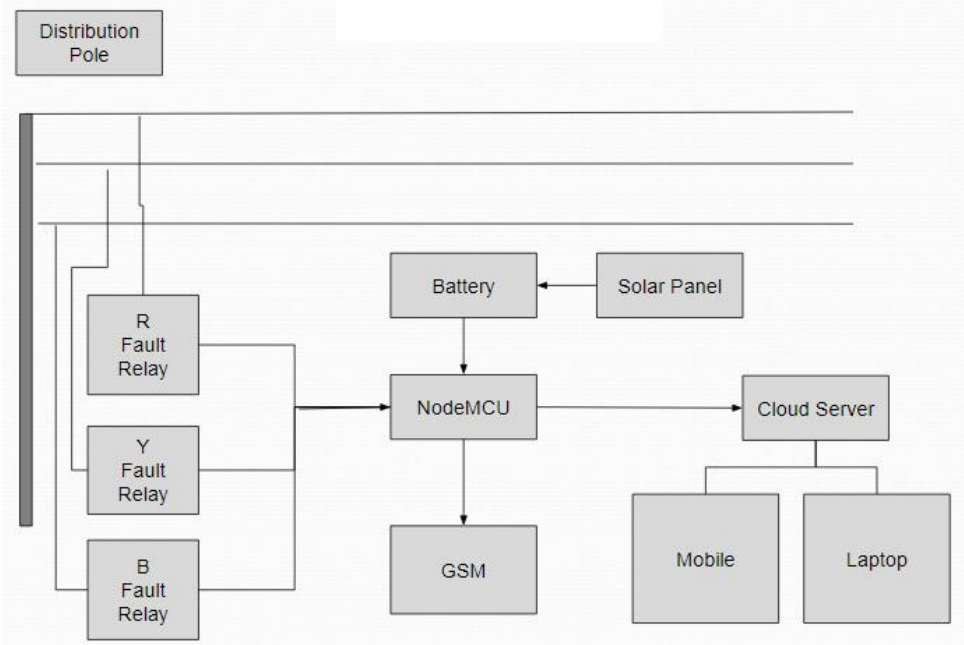
The data will be stored online on a cloud server w.r.t data and time and the fault type. The system we are using in the project is Node MCU-based controller which is a wi-fi 2.4GHz microcontroller and programmed for the same. For SMS GSM module is used. For the demo transmission line, we use a 12V AC transformer and we show its output as overhead lines and provide to the load via current sensor.

As shown in the diagram, Node MCU is an ESP32 controller having inbuilt Wi-fi to connect to the internet. The 3 phases we connect fault relays which are triggered when the line is shorted with ground/ neutral or line to line short. Current sensor Use to detect the load current fault. As soon as anyone phase shorted the signal goes to Node MCU and SMS is sent to the concerned person via GSM. Also we can see the status of each phase online using an IP address on the web browser.

CIRCUIT DIAGRAM



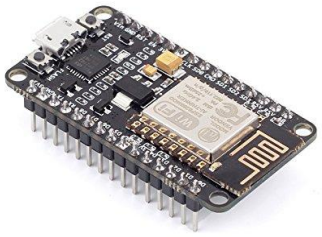
BLOCK DIGRAM



Hardware

Node MCU

ESP12 Based Microcontroller
4KB memory 8bit controller
2.4GHz wifi connectivity
1 Analog pin
9 Digital Pin
Program via Arduino IDE



Relay

SPDT
5V DC
230V / 7A - AC support switching
28V / 10A - DC support switching

LCD

Arduino IIC/I2C interface was developed to reduce the IO port usage on Arduino board
16 characters wide, 2 rows
Single LED backlight included can be dimmed easily with a resistor Supply voltage:5v

GSM
Quad-band 850/900/1800/1900MHz - connect onto any global GSM network with any 3G/4G SIM
Operating Voltage 3.7V & Operating Current 800mA
Serial Interface with Microcontroller

Battery
3.7V 2000mAh with Charge Protection
Maximum charging voltage 4.2V & Maximum charging current: 1000mA

Solar Panel
DC Output Voltage 5V & Output Current (Amp) 100mA
Max Power Output 0.5W

Software
Arduino IDE for Node MCU Programming

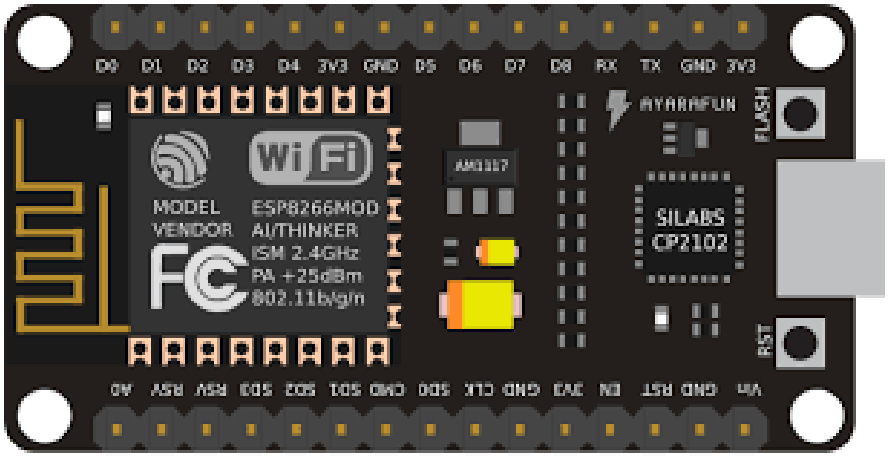
III. LITERATURE SURVEY

Arduino Based Overhead Cable Fault Detection, International Journal of Engineering and Information Systems (IJEAIS) ISSN: 2000-000X Vol. 1 Issue 9, November – 2017, Pages: 63-69. this Paper represents that to compute the distance of the underground and overhead transmission cable from fault location to the base station using Arduino. In this paper, a smart Technology based fault detection and location system was used to adequately and accurately indicate and locate the exact spot where fault had occurred. This will ensure a shorter response time for technical crew to rectify these faults and thus help save transformers and other electrical equipment from damage and disasters. The set of Resistor representing cable length (in meters) and fault is created by the set of suitable at every instant in meters, to verify the accuracy. The fault is displayed on Liquid Crystal Display (LCD) interfaced to Arduino. For overhead cables (OC) fault detection, when the open circuit and short circuit fault occur, our sensing device i.e. relay sense the fault and send information to the microcontroller. A smart GSM based fault detection and location system was used to adequately, and accurately indicate and locate the exact spot where fault had occurred This will ensure a shorter response time for technical crew to rectify these faults and thus help save transformers from damage and disasters. The system uses a current transformer, a voltage transformer, PIC 16F877 Microcontroller, RS-232 connector, and a GSM modem. The system automatically detects faults, analyses and classifies these faults and then, calculates the fault distance from the control room using an impedance-based algorithm method. Finally, the fault information is transmitted to the control room. In conclusion, the time required to locate a fault is drastically reduced, as the system automatically and accurately provides accurate fault location information.

The aim of this paper is that, In India, plug load devices in building sectors are consuming close to 40 percent of the total electricity consumption. Though the share of plug load in building energy is increasing, very few studies exist on the plug level energy usage and consumption. In order to address the growing energy use of miscellaneous and electronic load (e.g. water heater), some measures need to be taken. Hence identifying needs, this project focuses on designing the devices that have built-in capability to measure and report the energy use or receive control input over the network. This study will help in creating energy awareness devices. Current sensor measures the current flowing through device then controller performs necessary calculations on the data and puts that data on the internet. By measuring current and voltage, they can Analyse energy consumption, make the world smarter place and make better decisions using Internet of Things. In this paper, they design and implement a low-cost IoT energy monitoring system that can be used in many applications, such as electricity billing system, energy management in smart grid and home automation. The design is based on a low-cost PZEM-004T, using non-invasive CT sensors, SD3004 electric energy measurement chip and ESP8266wemos D1 mini microcontroller for retrieving data from sensor nodes and sending data to server via internet. The experimental results showed that the developed energy monitoring system can successfully record the voltage, current, active power and accumulative power consumption.

Node Microcontroller ESP8266

The board we are using is called "Node MCUI" and has an ESP8266 module on it, which we will be programming. It comes with the latest version of Micro Python already setup on it, together with all the drivers we are going to use. The D0, D1, D2, … numbers printed on the board are different from what Micropython uses – because originally those boards were made for a different software. Make sure to refer to the image below to determine which pins are which.



It has a micro-USB socket for connecting to the computer. On the side is a button for resetting the board. Along the sides of the board are two rows of pins, to which we will be connecting cables.

RELAY

Relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays". Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts. When the coil is energized with direct current, a diode is often placed across the coil to dissipate the energy from the collapsing magnetic field at deactivation, which would otherwise generate a voltage spike dangerous to semiconductor circuit components. Such diodes were not widely used before the application of transistors as relay drivers, but soon became ubiquitous as early germanium transistors were easily destroyed by this surge. Some automotive relays include a diode inside the relay case. If the relay is driving a large, or especially a reactive load, there may be a similar problem of surge currents around the relay output contacts. In this case a snubber circuit (a capacitor and resistor in series) across the contacts may absorb the surge. Suitably rated capacitors and the associated resistor are sold as a single packaged component for this commonplace use.

IV. RESULT

The analysis of fault detection and location system of transmission line. Whether it is any type of fault that can be detected and located. When fault occurs on the transmission line the signal is send to the control room or mobile phone through a GSM modem. The message Receive on the mobile that is the fault between pole 1and2 and the fault which is symmetrical or unsymmetrical like L-G, L-L, L-L-G, L-L-L, L-L-L-G. The single that appears on the control room or mobile phone is that L*G or any type of fault occurred on transmission line.

V. CONCLUSION

Through this project we simplified the actual problem of the detecting fault in underground area.

We discover the position or location were the fault will be occurring and also find accurate distance of breaker point.

The line to line, single line, Line to ground fault in underground cable is located to rectify fault efficiently using simple concepts of ohms law.

The work automatically displays the phase, distance and time of occurance of fault with the help of PICI8F4550 and PSP8266 Wi-fi module in webpage.

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