IoT Based Transmission Line Cable Fault Detection

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Declaration

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.

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Certification

This is to certify that this project entitled **"IoT Based Transmission Line Cable Fault Detection"** is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Sonargaon University (SU) in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

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Abstract

Power supply networks are growing continuously and their reliability getting more important than ever. The complexity of the whole network comprises numerous components that can fail and interrupt the power supply for end user. For most of the worldwide operated low voltage and medium voltage distribution lines, transmission line cables have been used for many decades. transmission line high voltage cables are used influenced by weather conditions, heavy rain, storm, snow and pollution. Even though the cable manufacturing technology is improving steadily; there are still influences which may cause cable to fail during test and operation. A cable in good condition and installed correctly can last a lifetime of about 30 years. However cables can be easily damaged by incorrect installation or poorly executed jointing, while subsequent third party damage by civil works such as trenching or curb edging.

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List of Abbreviations

01	PWM	Pulse Width Modulation
02	IoT	Internet of Things

Chapter 1
Introduction

1.1 Introduction

Transmission cables are prone to a wide variety of faults due to conditions, wear and tear, etc. The project work is intended to detect the location of fault in transmission line cable lines from the base station in km using a Node MCU controller. To locate a fault in the cable, the cable must be tested for faults. This prototype uses the simple concept of Ohms law. The current would vary depending upon the length of fault of the cable. In the urban areas, the electrical cables run in overhead lines. Whenever the fault occurs in transmission line cable it is difficult to detect the exact location of the fault for process of repairing that particular cable. The proposed system finds the exact location of the fault. The prototype is modeled with a set of resistors representing cable length in km and fault creation is made by a set of switches at every known distance to cross check the accuracy of the same. In case of fault, the voltage across series resistors changes accordingly, which is then fed to an ADC to develop precise digital data to a programmed Node MCU controlled that further displays fault location in distance.The fault occurring distance, phase, and time is displayed on a 20X04 LCD interfaced with the microcontroller. IoT is used to display the information over Internet using the Wi-Fi module ESP8266. A webapp is conferred using coding and the information about occurrence of fault is displayed in a webapp. The overhead cables are replaced with transmission line cables for the transmission of electricity by the transmission line method.Overhead cables are generally used as maximum of the insulation is provided by air and this reduces the amount of power transmission for huge quantities of electrical energy. The installation cost of overhead cables can be less but the operational cost is too large. But in case of apply our sysytem of electrical transmission lines, even though the initial cost is more the operational cost ofthe cables will reduce over the lifetime.

The linemen are to be ready during the days when failure occurs, to figure on the lines as fault may occur at any point of your time for any cause. The most of the reason for the fault is either the low quality of conductors/cables used for transmission/distribution or electrical theft.

We might have been observed the negligence of power lines handled by the electricity department or by some linemen. When the fault is occurred due to the civil works on the road causes breakage, then the fault is cleared just by twisting lines rather than providing a joint.

In some situations, the conductors are required to get replaced with the new ones during fault, at that point the inferiority conductors are placed, this might cause fault in future.

Techniques to spot the precise location of fault on the road are possible as they can be seen to the bare eyes and we can find the specific distance where the flaw has occurred and so it can then easily repair it within less time.

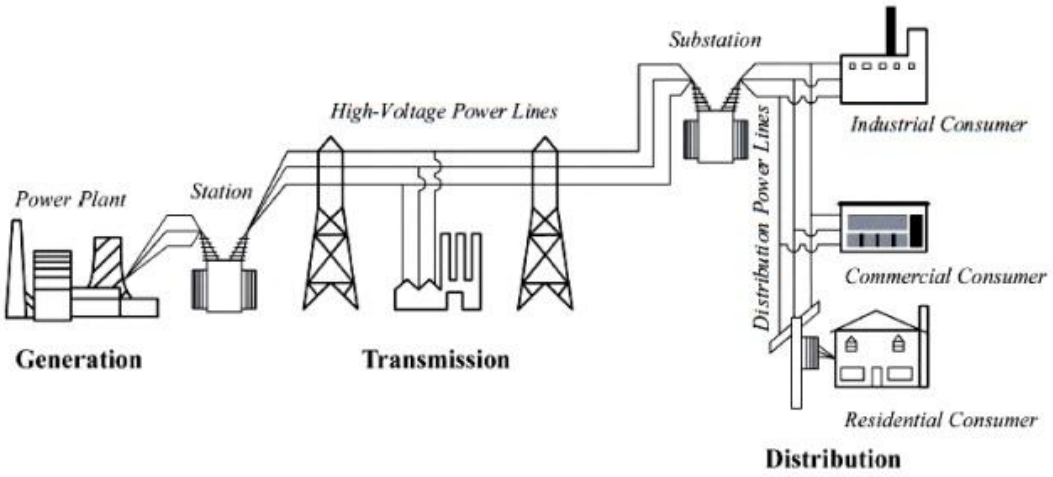


Fig-1.1: Basic Structure of the Electric system

The system needs to be investigated for the electrical theft in the supply lines and so at the distribution lines and at feeders. This can be really not an easily handled straightforward work. It will be a good choice of an undergrounding, if we want a replacement of the system. The electrical accident may happen either while performing a work on the lines or unidentified broken lines laid on the bottom. The death rate of electrical accidents may be reduced by proper installation of undergrounding of cables.



Fig-1.2: Underground Cable Laying

However, the undergrounding of cables can be constructed, during that time each and every materials used for construction and for all the requirements including the manhole utmost care needs to be taken. If the entire system is constructed with high

quality materials and with all positive intension, then this system will work for a longer duration of time and it lives healthy for an extended period of your time.
The long term India with underground electric power lines will avoids electrical theft, reduces the interruption of power supply to the patron, reduced cost requirement of maintenance, enlarges the sweetness of the state, reduces the death rate of electrical accidents, it also acts as a step to be a developed nation.
Process of finding the flaws periodically will be defined as fault identification.The damage to the line or conductor of power transmission is called by name line faults and this is due to its effect on its resistance. If permitted for tolerance it will results in breakdown of voltage.
The various kinds of cable faults can occur and it depends on the reason of the fault.So first they should be categorized before it iscleared. For this the important action is of the insulation of the conductor. Whereas some kind of cables are at high risk because of effect of thermal effects from external sources and also of the chemical reaction, and such effects can be seen generally in high voltage cables, in those affected part is the conductor's insulation. Finding the underground cable are often a posh job, it is even tougher task because the underground plant is static and it is fixed.

1.2 Objective of the Project

The main objective of this project is to **"IoT Based Transmission Line Cable Fault Detection''** Project for The main purpose is to create a smart system so that we can take many benefits from one project.

- To review and classify faults in underground transmission line cable.
- To design and construct an affordable transmission line cable fault detector.
- To proposed system finds the exact location of the fault.

1.3 Background of the Project

Cables are put transmission line cable to stay away from pointless obstruction. These force cables convey electrical force and when these cables are put transmission line cable it is extremely hard to decide the specific area of the deficiency happened. There are numerous elements or purposes behind a deficiency to happen as, for example, burrowing, tremor, development work and so forth. As it don't have a clue about the specific area of the issue happened to the cable the fixing procedure identified with that cable is troublesome.transmission line cable framework is a most basic practice followed in the urban zones. This paper is expected to find the flaw in an transmission line cable lines from the base station to a precise area in kilometres.The framework identifies flaw with the assistance of potential divider organize laid over the cable. When a defect is found in a cable line, a voltage gets produced according to the resistors organize blend. This voltage is detected by the microcontroller and is refreshed to the client.

1.4 Earlier Research

The vast majority of the systems in our project are computerized systems. Programmed system work is once in a while required. Considering work pay, the system will profit a great deal (Internet of Things).In this system, IoT Based Transmission Line Cable Fault Detection and Location System. A man can see cable fault detection and furthermore checking system. What's more, The line fault can be found in a LCD show on the project. In addition, this information can be checked from anyplace on the planet through the internet.

1.5 State of the Art Technology

IoT system Methods IoT based cable fault detection and monitoring system varies in different ways throughout the year It is important to consider properly that the use of cable fault is being given priority in developing countries in different countries.

1.6 IoT System

The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. The definition of the Internet of Things has evolved due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems.

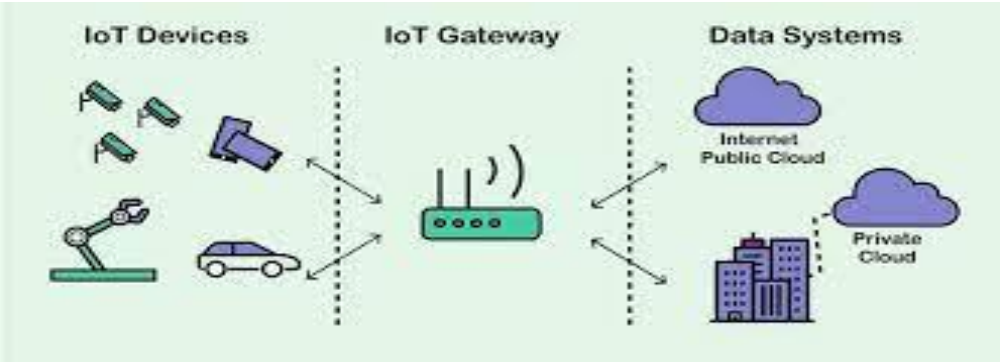


Fig-1.3: IoT System

Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of Things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the **IoT Based Transmission**

Line Cable Fault Detection and Location System", covering devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as

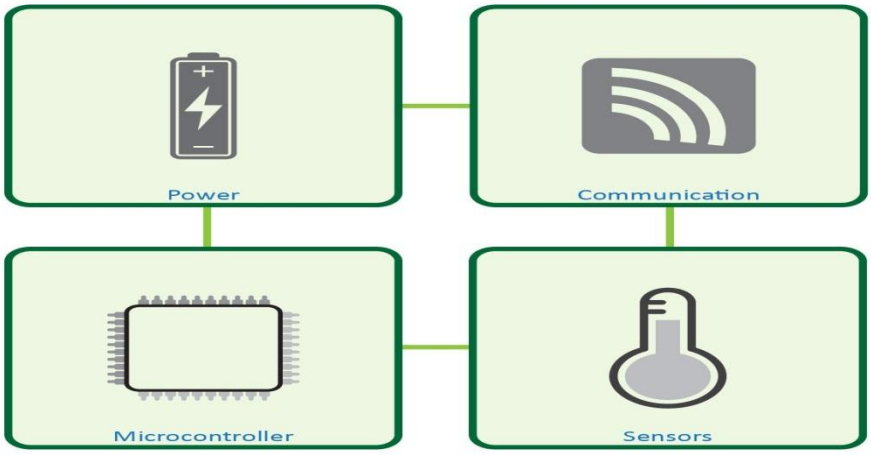


Fig-1.4: Block Diagram of IoT

Smart phones and smart speakers. There are a number of serious concerns about dangers in the growth of IoT, especially in the areas of privacy and security; and consequently industry and governmental moves to begin to address these.

1.7 Methodology

Transmission line cables are prone to a wide variety of faults due to transmission conditions, wear and tear, etc. So here we propose an cable fault detection over IoT that detects the exact fault position over iot that makes repairing work very easy. The repairmen know exactly which part has fault and only that area is to be dug to detect the fault source. This saves a loT of time, money and efforts and also allows to service transmission line cables faster. We use IoT technology that allows the authorities to monitor and check faults over internet. The system detects fault with the help of potential divider network laid across the cable. Whenever a fault gets created at a point shorting two lines together, a specific voltage gets generated as per the resistors network combination. This voltage is sensed by the microcontroller and is updated to the user. The information conveyed to the user is the distance to which that voltage corresponds to. The microcontroller retrieves the fault line data and displays over LCD display, also it transfers this data over internet to display online. We use IoT blynk to develop the online system that links with the system to display the cable faults online.

- Collection of data from books and internet.

- Collection of required components from local market and online shop.
- The concept of the design is based on using a microcontroller for processing.
- Designing a schematic for creating the circuit board.
- Programming for the microcontroller (Node MCU).
- Setting all the components in a PCB board, Car Chassis and soldering.
- Turn on the device experimental.

1.8 Motivation for Project

A poorly motivated team has been known to unravel even the best project plan. A good project manager needs to know how to harness the initial excitement that comes with starting a project and use it to maintain motivation – leading to success throughout the project's lifecycle. We now know that contemporary project managers need to be more than just schedulers and contract managers. They need excellent skills in managing those complex human elements that have the potential to bring any project down.

1.9 Project Management

Management of any project can be briefly disintegrated into several phases. Our project has been decomposed into the following phases:

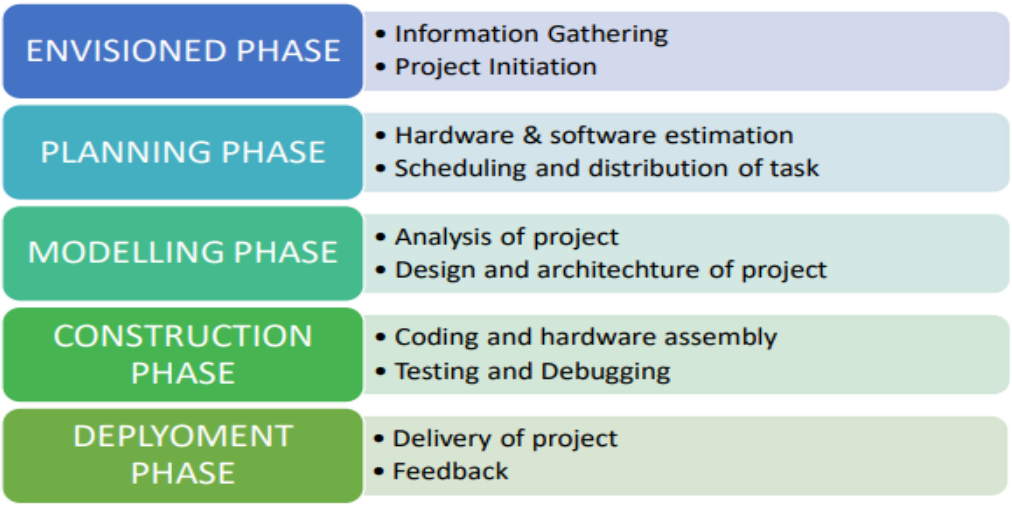


Fig-1.5: Project Management

Experimentation: This phase involved discussions regarding necessary equipment regarding the project. The study of related already existing projects, gathering required theoretical learning. It also included figuring out the coding part, by developing simple algorithms and flowcharts to design the whole process

Design: This phase was, designing layout of the application, and the necessary features to be included. This involved the complete hardware assembly and installing

the Calibration for the Pixhawk Flight Controller. The power strip was designed to connect the home appliances that can be controlled via GPIO pins.
Development and Testing: This phase had the development of the application. The remote device was connected to the Pixhawk Flight Controller via wireless network and the whole prototype was tested for identification and removal of bugs.
Real world Testing: The prototype was ready to be tested into the real world and integrated with variousreal time electrical appliances.

Chapter 2
System Design

2.1 Introduction

The project work is for the purpose of detecting the fault location of the underground cable line from the base station in kilometers using the Node MCU controller. To detect an error in the cable, the cable must be checked for faults. This prototype uses the general concept of Ohms law. Depending on the cable's length, the current will vary. In urban areas, electric cables run transmission line instead of overhead lines. Whenever the fault occurs within the transmission line cable, it is difficult to identify the exact location of the fault in order to repair that particular cable. The proposed system finds the exact location of the error.The prototype is made with a set of resistors that represent the length of the km, and the fault cream is made by a set of switches at each correct distance whose accuracy tests. In case of error, the voltage across the series resistor is changed accordingly, which is then fed to develop precise digital data in a programmed microcontroller that further shows the fault location. The fault that occurs in the distance is displayed on a 20X04 LCD interfaced with a microcontroller. The IoT Wi-Fi module is used to display information on the Internet using ESP8266.A webapps is configure using coding, and information about the error type is displayed on a webapps.

2.2 Faults

1) Open circuit fault: Open circuit faults are better than short circuit fault, because when this fault occurs current flows through cable becomes zero. This type of fault is caused by break in conducting path. Such faults occur when one or more phase conductors break.

2) Short circuit fault: Further short circuit fault can be categorized in two types:

a) Symmetrical fault: Three-phase fault is called symmetrical fault. In this all three phases are short circuited.

b) Unsymmetrical fault: In this fault magnitude of current is not equal¬ displaced by 120 degree. Fault location method: Fault location methods can be classified as:
1)Online method: This method utilize process the sampled voltages& current to determine the fault points. Online method for underground cable is less than overhead lines.

2) Offline method: In this method special instrument is used to test out service of cable in the field. There are two offline methods as following.

a) Tracer method: In this method fault point is detected by walking on the cable lines. Fault point is indicated from audible signal or electromagnetic signal.It is used to pinpoint fault location very accurately.

2.3 Internet of Things (IoT) Basic Concept

The intercommunication between gadget to gadget or AI associated through the web with inserted innovation frameworks utilizing remote sensors, actuators which is distantly controlled, screen and upgraded by the client for mechanization is alluded as Internet of things (IoT). Here the expression "Things" signifies actual gadgets, for example, chips, cameras, sensors and other such gadgets.

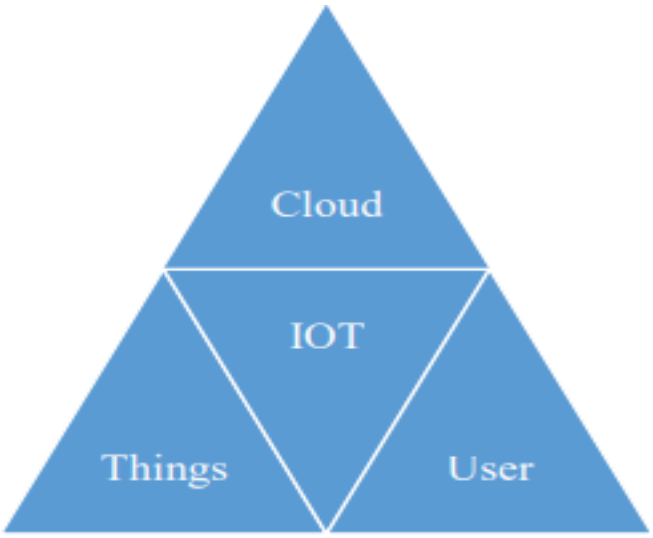


Fig-2.1: IoT Basic Concept

These actual gadgets are capable to impart, gather data and trade information by interfacing an organization. The implanted innovation of these actual gadgets makes this trade of data each other conceivable. There are an arrangement of modern robotization incorporates that can help making life at mechanical progressively invaluable and less difficult to administer, especially for involved, immense families. Assume you could therefore oversee and control the contraptions that you usually turn on and off every day. With a modern computerization structure, you can oversee apparatuses when you're out of the house and contemplating whether you made sure to kill light or not, savvy framework will be there to address the inquiry. The creating proximity of the Internet of Things in person's lives has made turn of events and progression in the clever mechanical space, empowering customers to relate their devices through the web to their telephones and tablets, and improve than at any other time benefits for nuclear families. Also, as house proprietor are changing their devices to one central application, device or focus, they further comprehend the value these modern robotization things can bring to a family. It is the network separated from the

regular gadgets utilizing web, for example, work area, PCs, Smartphone, tablets and so on.

2.4 Software Tools

The software that is used to program the microcontroller is open-source-software and can be downloaded for free on www.arduino.cc. With this “Arduino software” we can write little programs with the microcontroller. These programs are called “Sketch”.In the end the sketches are transferred to the microcontroller by USB cable. More on that later on the subject “programming”.

- **Installation**

Now one after another the Arduino software and the USB driver for the board have to be installed.

- **Installation and setup of the Arduino software**

1. We have downloaded the Arduino software from www.arduino.cc and installed it on the computer (This was NOT connected to the PC). After that we opened the software file and installed the program named arduino.exe.

Two set ups on the program are important and should be considered.

a) The board that we want to connect has to be selected on the arduino software. The “Arduino Uno” is here known as “Arduino / Genuino Uno”.

b) We have to choose the right “Serial-Port”, to let the Computer know to which port the board has been connected. That is only possible if the USB driver has been installed correctly. It can be checked this way:

At the moment the Arduino wasn’t connected to the PC. If we now choose “Port”, under the field “Tool”, we will already see one or more ports here (COM1/ COM2/ COM3…). The quantity of the shown ports doesn't depend on the quantity of the USB ports on the computer. When the board gets connected to the computer, we will find one more port.

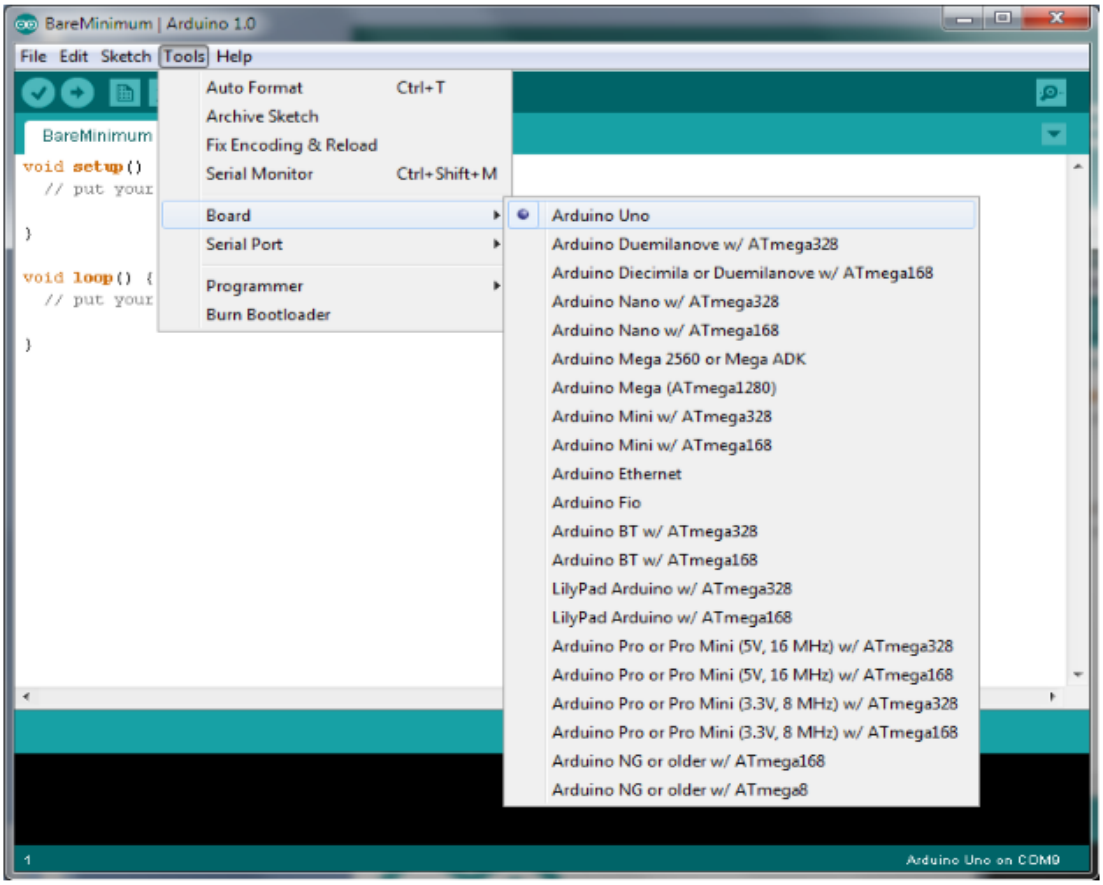


Fig- 2.2: Program Installation Process

2.5 Programming

The development cycle is divided into 4 phases:

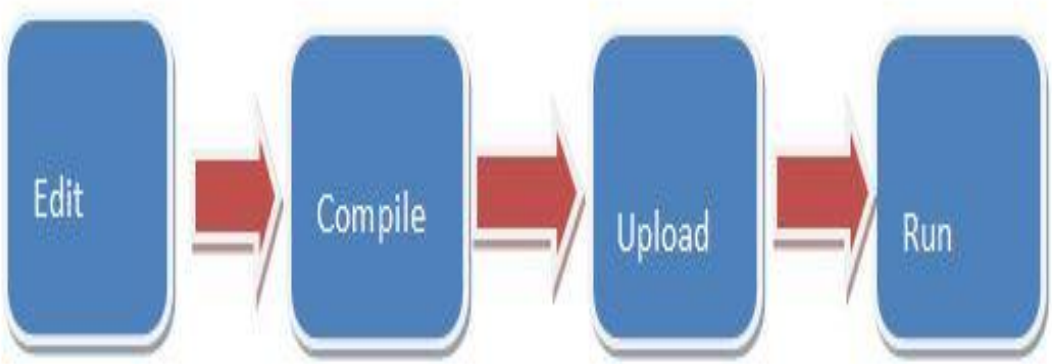


Fig-2.3: Flowchart of the Compiling Process

Compile: Compile means to translate the sketch into machine language, also known as object.

Code Run: Arduino sketch is executed as soon as terminates the step of uploading on the board.

2.6 Arduino Program Development

- Based on C++ without 80% of the instructions.
- A handful of new commands.
- Programs are called 'sketches'.
- Sketches need two functions:
- void setup ( )
- Void loop ( )
- Setup ( ) runs first and once.
- loop ( ) runs over and over, until power is lost or a new sketch is loaded.

2.7 Android Apps

The Blynk software is mainly operated over the Internet. This software has a specific server for sending data. This software has to be registered on the specified server, then login to the software with user name and password. Data is passed to the server through the controller's Internet head, the server sends software data, which we can monitor from anywhere.

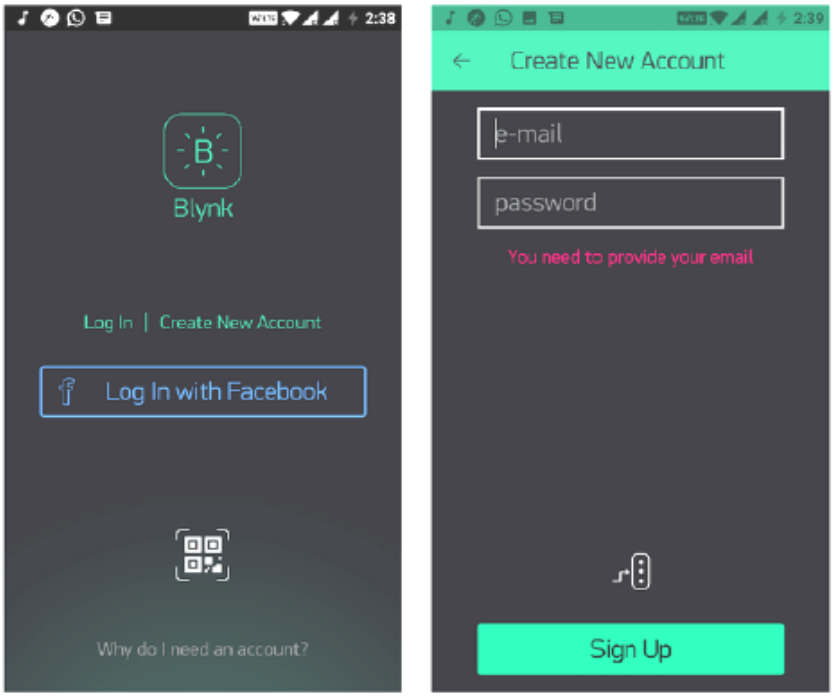


Fig-2.4: Blynk Android Webapps

2.8 Proposed Project in Proteus 8.9

Proteus 8 is best simulation software for various designs with microcontroller. It is mainly popular because of availability of almost all microcontrollers in it. So it is a handy tool to test programs and embedded designs for electronics hobbyist. You can simulate your programming of microcontroller in Proteus 8 Simulation

Software.After simulating your circuit in Proteus 8 Software you can directly make PCB design with it so it could be a all in one package for students and hobbyists. So I think now you have a little bit idea about what is proteus software.Proteus 7.0 is a Virtual System Modeling (VSM) that combines circuit simulation, animated components and microprocessor models to co-simulate the complete microcontroller based designs. This is the perfect tool for engineers to test their microcontroller designs before constructing a physical prototype in real time. This program allows users to interact with the design using on-screen indicators and/or LED and LCD displays and, if attached to the PC, switches and buttons. One of the main components of Proteus 7.0 is the Circuit Simulation -- a product that uses a SPICE3f5 analogue simulator kernel combined with an event-driven digital simulator that allow users to utilize any SPICE model by any manufacturer.Proteus VSM comes with extensive debugging features, including breakpoints, single stepping and variable display for a neat design prior to hardware prototyping. In summary, Proteus 7.0 is the program to use when you want to simulate the interaction between software running on a microcontroller and any analog or digital electronic device connected to it.

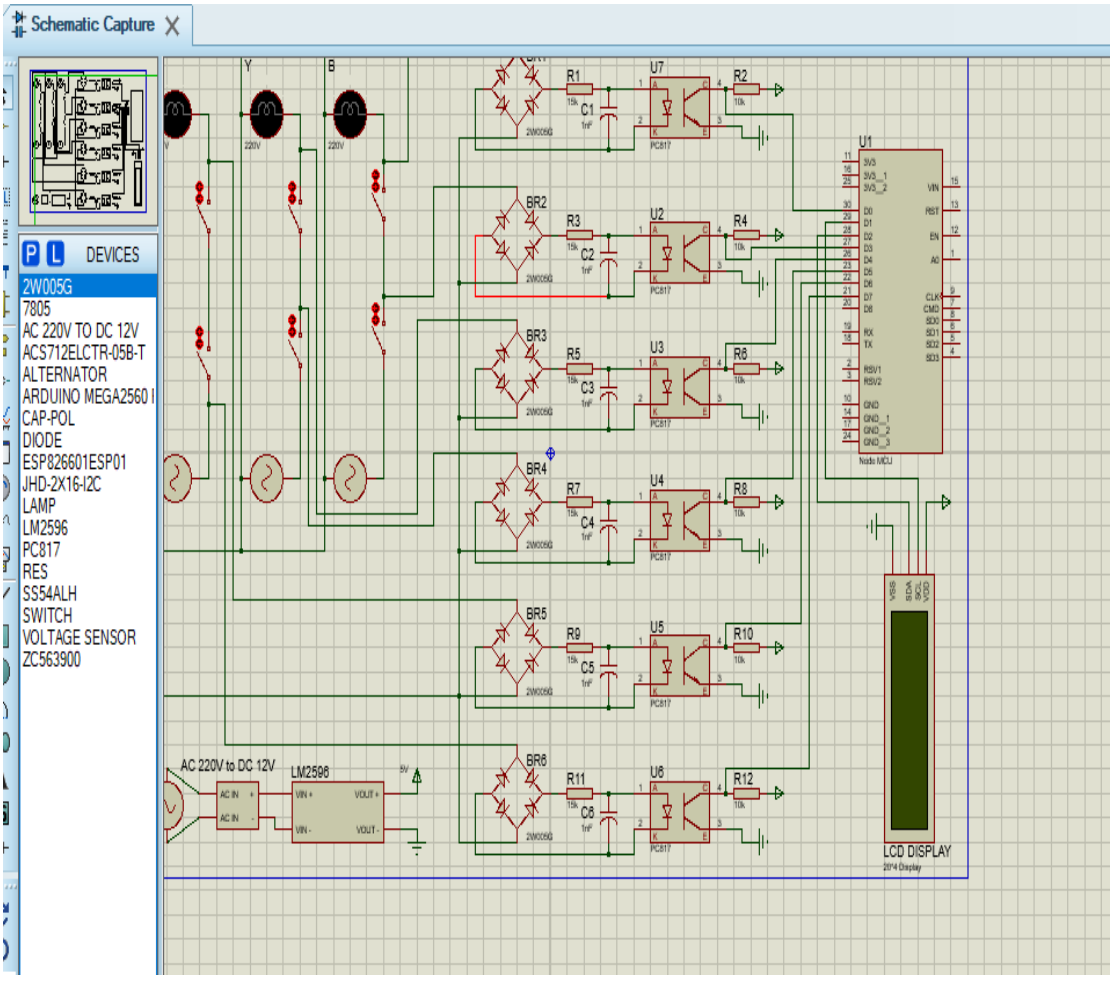


Fig-2.5: User Interface of Proteus 8.9

2.9 Literature Survey

A broad deficiency area model for underground force cable in conveyance framework utilizing voltage and current estimations at the sending-end has just been proposed by Yang, Xia, in a paper distributed in November 2008. The paper presents an investigation of a proportional circuit that models a blamed underground cable framework utilizing circulated parameter approach. Investigation of succession organizes in three-stage arrange by applying the limit conditions is additionally introduced. Utilizing the examination, the area of the issue is resolved with the assistance of current and voltage conditions [1].

Westrom distributed in February 1997, clarifies how infusing a progression of tweeted beat streams into the blamed cable, soon after the event of the cable flaw utilizing a heartbeat generator unit can be utilized for an exact count of the area of the cable deficiency. It has been named as 'shortcoming separation locator'. [2].

Zhao, W in August 2000, proposed a superior way to deal with cable flaw area framework, basically comprising of synchronized testing method, wavelet investigation and voyaging wave standard.Alongside the prologue to three significant methods and a blueprint of the new plan, this paper presents a definite wavelet examination of broken transient waveforms and consequently decides the best wavelet levels for this specific application. [3]

Gilany et.al distributed in January 2007, introduced a wavelet-based issue area conspire for matured cable frameworks when synchronized advanced deficiency recorded information are accessible at the two terminals of the cable. The wavelet peculiarity identification hypothesis is utilized as an amazing sign handling device to appraise the area of the issue in multiend-matured cable frameworks. [4].

Schulze, Member, IEEE et.al Peter Schegner, "Two Terminal Fault Location on Unsymmetrical Transmission Lines",IEEE,2010 , introduced the blackout of a line because of an issue can be costly, subsequently the issue must be cleared as quick as could be expected under the circumstances. Computerized security transfers comprise of shortcoming locators dependent on a few strategies [5].

Xu Sun, Wing Kin Lee1, Yunhe Hou1, et al, Philip W. T. Pong1" Underground Power Cable Detection and Inspection Technology Based on Magnetic Field Sensing at Ground Surface Level ",IEEE ,2014 introduced that IOT based underground cable line shortcoming

discovery framework being useful to discover flaws and its area in simple way .Underground cables have been broadly utilized with the advancement of intensity framework lattice. [6].

Manish Paul et.al, Raj Kamal Kakoti on, 'Underground Cable Fault Locator 'says that before endeavoring to discover underground cable blames on direct shrouded essential cable, it is basic to realize where the cable is arranged and what course it takes. On the off chance that the issue happens on the auxiliary cable, at that point realizing the specific course is much progressively basic. Since it is very hard to

locate a cable deficiency without realizing where the cable is, it bodes well to ace cable finding and following before start the shortcoming finding process [7].
Ms Pradnya introduced paper on IoT based innovation visit deficiency in underground cables because of the cessation of paper plastic protection because of compound response or poor workmanship during establishment and the challenges in finding the inexact shortcoming territory have been a major issue. Most Underground Faults are situated by means of uncovering the whole section of cable to empower visual aid review to be completed. On the off chance that where visual examination isn't useful then the whole size of cable is supplanted. This manual strategy isn't just costly yet in addition brings about substantial loss of income to the force dispersion organization [8].
Snehal R. Shinde, A. H. Karode et.al Dr. S. R. Suralkar states that this paper audits on IOT based condition checking framework.The primary target of proposed framework is to give ecological parameters at remote area utilizing web.The proposed framework gives a feasible and direct answer for natural and surrounding checking applications.[9].

2.10 Time Plan

The following tables define the main tasks in the project introduction and project itself.

T1	Project Definition	1 Week
T2	Collecting data	11 Weeks
T3	Analysis	7 Weeks
T4	Theoretical calculation	4 Weeks
T5	Documentation	10 Weeks
T6	Prepare for presentation	2 Weeks

Table- 01: Time Scheduled Table for Project Introduction

The time of the project introduction is scheduled over 16 weeks, table 2 shows how the work was scheduled over this time:

Week / Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
T1																
T2																
T3																
T4																
T5																
T6																

Table-02: Time Plan Table for Project Introduction

The following table defines the main tasks in the project:

T1	Collecting data	3 Week
T2	Implementation	10 Weeks
T3	Analysis	5 Weeks
T4	Building and testing the system	8 Weeks
T5	Documentation	10 Weeks
T6	Prepare for presentation	2 Weeks

Table-03: Time Scheduled Table for Project

The time of the project is scheduled over 16 weeks, table 4 shows how the work was scheduled over this time:

Week / Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
T1																
T2																
T3																
T4																
T5																
T6																

Table-04: Time Plan Table for Project

Chapter 3
Hardware Implementation

3.1 Introduction

Transmission Line cables have been widely used with the development of power system grid. Till last decades cables were made to lay overhead & currently it is to lay overhead or underground which is superior to earlier method. But when any fault occur in transmission line cable, then it is difficult to locate the exact location of fault.Today the world is become digitalized so this paper is intended to detect the location of fault in digital way. The transmission cable system is more common practice followed in many urban areas. While faults can occur for different reason in cable line, the repairing process related to that particular cable is difficult due to not knowing the exact location of cable fault. As it is very difficult to find the exact location or faulty location maually, which suddenly affects the efficiency of the cable wire due to losses occurred. Nowadays many techniques had already been implemented in order to detect cable line fault. But the problem came up is how to detect fault in cable wire when it is overhead and under grounded and how to access or retrieve those data related to fault location whenever it is required.

3.2 Block Diagram of This Project

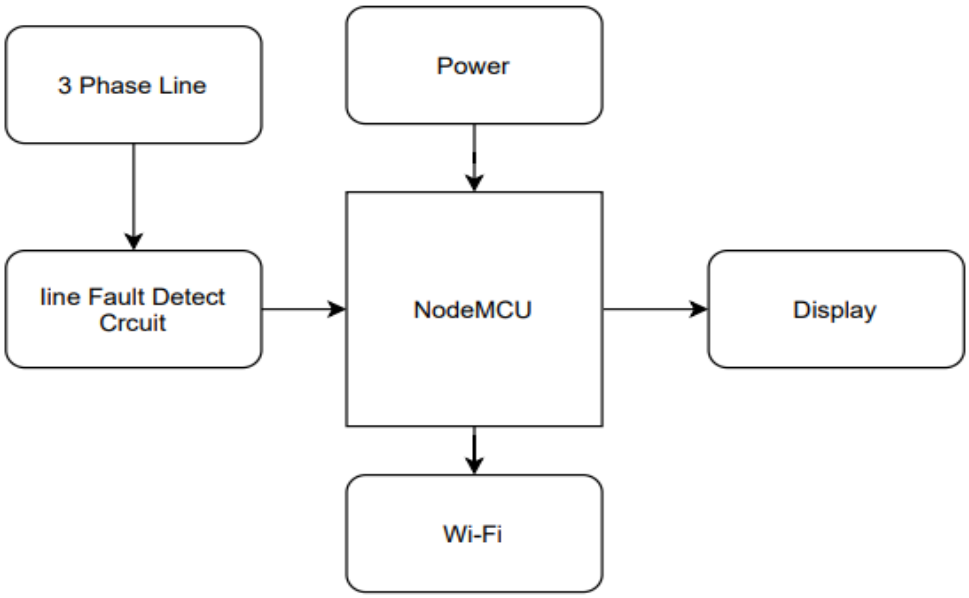


Fig-3.1: Block Diagram

3.3 Circuit Diagram of This Project

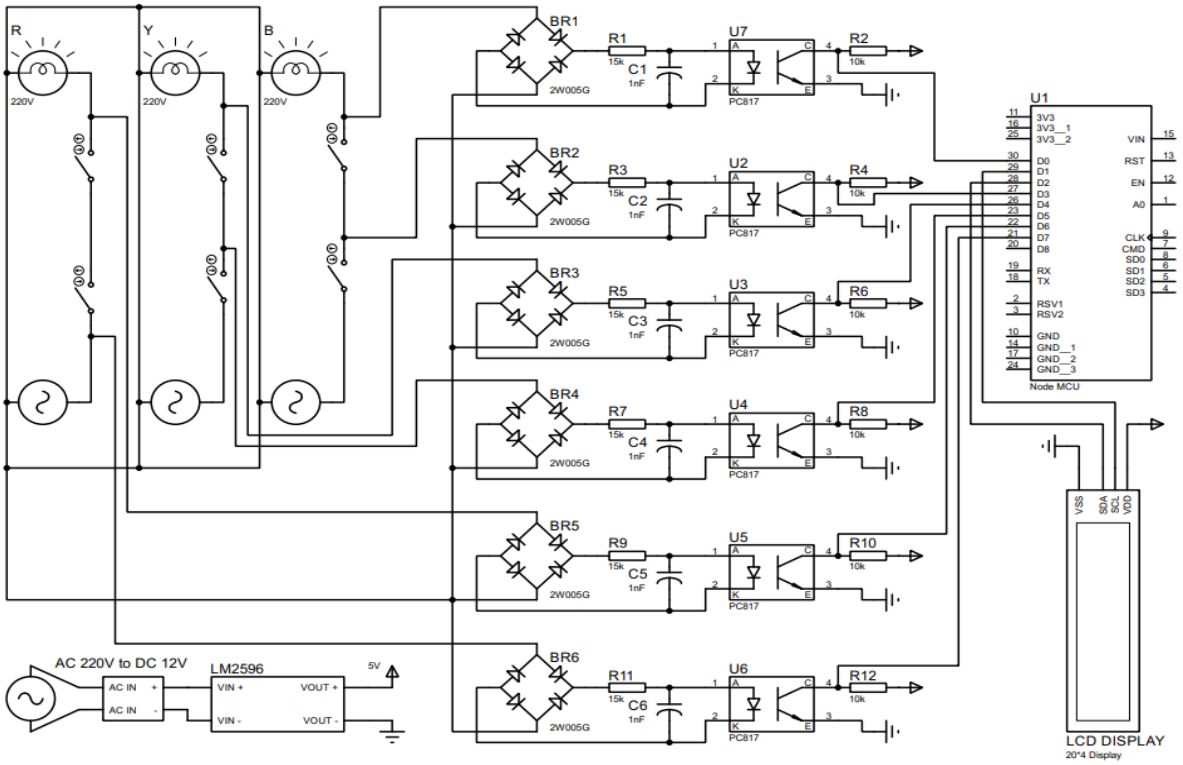


Fig-3.2: Circuit Diagram

3.4 The list of Devices used in the Project is Given Below

- Node MCU.
- Buck Module.
- Adaptor.
- LCD Display.
- Opto-coupler.

3.5 Node MCU

NodeMCU is an open source IoT platform.It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS.

NodeMCU was created shortly after the ESP8266 came out. On December 30, 2013, Espressif Systems began production of the ESP8266.The ESP8266 is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core,[citation needed] widely used in IoT applications (see related projects). NodeMCU started on 13 Oct 2014, when Hong committed the first file of nodemcu-firmware to GitHub.Two months later, the project

expanded to include an open-hardware platform when developer Huang R committed the gerber file of an ESP8266 board, named devkit v0.9.

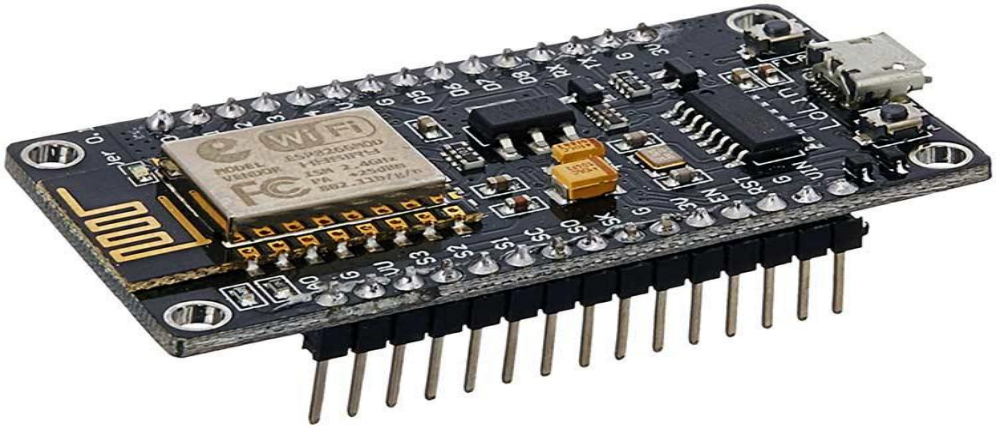


Fig-3.3: Node MCU

3.5.1 Technical Specifications

- Power input: 4.5V ~ 9V (10VMAX), USB-powered
- Transfer rate: 110-460800bps
- Support UART / GPIO data communication interface
- Support Smart Link Smart Networking
- Working temperature: -40°C ~ + 125°C
- Drive Type: Dual high-power H-bridge
- Don’t need to download resetting
- A great set of tools to develop ESP8266
- Flash size: 4MByte
- Lowest cost WI-FI

3.6 Buck Module

The LM2596 series of regulators are monolithic integrated circuits that provide all the active functions for a step-down (buck) switching regulator, capable of driving a 3-A load with



Fig-3.4: LM2596 Voltage Converter

excellent line and load regulation. These devices are available in fixed output voltages of 3.3 V, 5 V, 12 V, and an adjustable output version. Requiring a minimum number of external components, these regulators are simple to use and include internal frequency compensation, and a fixed frequency oscillator. The LM2596 series operates at a switching frequency of 150 kHz, thus allowing smaller sized filter components than what would be required with lower frequency switching regulators. Available in a standard 7-pin TO-220 package with several different lead bend options, and a 7-pin TO-263 surface mount package.

3.7 Adapter

12V 5A Micro Power Adpater. For using with Arduibo /Raspberry Pi 3 Model A+/B/B+/Zero and running any other high current devices.

3.7.1 Specifications

- Input: 100V - 240V AC, 50Hz/60Hz.
- Output: 12V 5A.



Fig-3.5: Adapter

3.8 LCD Display

A Liquid crystal display (LCD) is a flat display that uses the light modulating properties of liquid display. They are common in consumer devices such as video players, gaming devices, clocks, telephones, computers, calculators etc.
A (16×2) LCD panel consists of 16 coulums and 2 rows.It can show upto 16 characters in 2 lines.
You may want to have a look on these similar products:
1. LCD Display 16X2 with Header soldered
2. LCD display module 16X2

3. LCD display module advanced 16X2
4. 3 wire LCD module 16X2
5. I2C LCD Display 16X2
6. Arduino LCD keypad shield
7. LCD Display (16X2)

Pin	Function
VSS	connected to ground
VDD	connected to a +5V power supply
VO	to adjust the contrast
RS	A register select pin that controls where in the LCD's memory you are writing data to. You can select either the data register, which holds what goes on the screen, or an instruction register, which is where the LCD's controller looks for instructions on what to do next.
R/W	A Read/Write pin to select between reading and writing mode
E	An enabling pin that reads the information when High level (1) is received. The instructions are run when the signal changes from High level to Low level.
D0-D7	to read and write data
A	Pins that control the LCD backlight. Connect A to 3.3v.
K	Pins that control the LCD backlight. Connect K to GND.

Table 05: LCD Display Outline

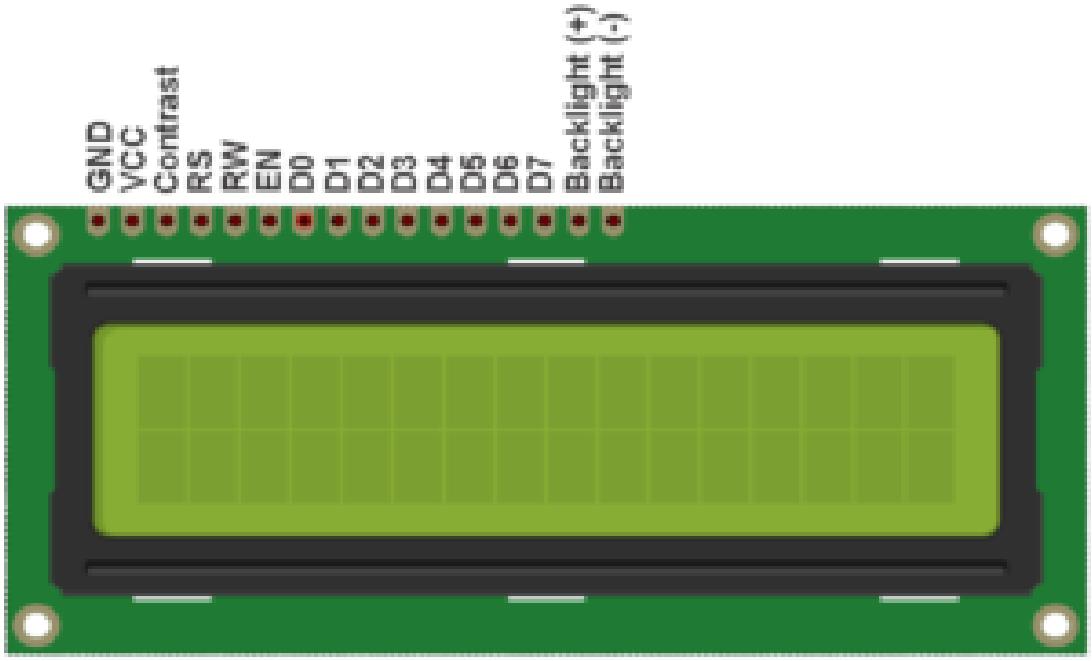


Fig-3.6: LCD Display

3.9 Opto-coupler

These are High Density Mounting Type Photocouplers used in Computer terminals,System appliances, measuring instruments,Registers, copiers, automatic vending machines,Electric home appliances, such as fan heaters etc.

- Current transfer ratio (CTR:MIN.50% at IF=5mA Vce=5V)
- High isolation voltage between input and output (Viso:5300 Vrms).



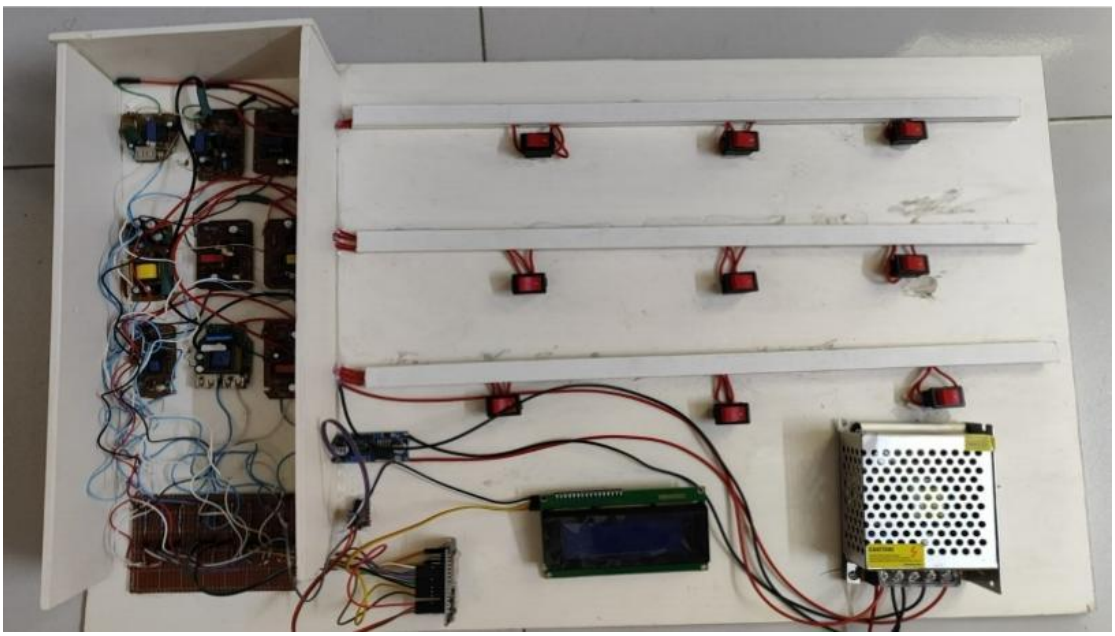
Fig-3.7: Optocoupler

Chapter 4
Experimental Results

4.1 Introduction

IoT based transmission cable line fault detection system is helpful for find out faults and its location in very easy manner .transmission cables have been widely used with the development of power system grid. Transmission cables are prone to a wide variety of faults due to overheard or underground conditions, wear and tear, etc. Detecting fault source is difficult because entire line is to be dug in order to check fault at cableline. The repairmen know exactly which part has fault and only that area is to be detect the fault source. Thus it saves a lot of time, money and allows to service overheard or underground cablelines faster. We use IoT technology that allows the authorities to monitor and check faults over internet. The system detects fault with the help of potential divider network laid across the cable. When a fault gets created in a cableline, a specific voltage gets generated as per the resistors network combination. This voltage is sensed by the microcontroller and is updated to the user.The information conveyed to the user is the distance to which that voltage corresponds to. The microcontroller detects the fault cableline data and displays this data over LCD display, it transfers this data over internet to display online. Blynk to develop the online system that links with the system to display the cable faults online.

Fig-4.1: Project Picture



4.2 Result

We have created a modern project to monitor the fault at transmission line cable. We have worked with three phase lines here. We have made fault switches for each phase separately. From this fault switch we have brought the connection to the controller which is shown on the display by programming. Here we can monitor line fault. This project is expected to find the flaw in an transmission cable lines from the base station to a precise area in kilometres.The framework identifies flaw with the assistance of potential divider organize laid over the cable. When a defect is found in a cable line, a voltage gets produced according to the resistors organize blend. This voltage is detected by the microcontroller and is refreshed to the client. We can monitor project data such as line fault and line current from anywhereon the Internet.Any fault detection that can automatically detect, alert.

Chapter 5
Conclusion and Discussion

5.1 Discussion

The paper IoT based transmission line fault detector is used for detecting any flaws in an overhead or underground cable system. This system can clearly choose the region where the fault has occurred and can send the coordinates to the user as well as displays in the LCD display screen. Hence forth the strategy used in this paper works in a consecutive way and ends up being helpful in discovery and area of deficiencies in underground cables.

5.2 Advantage

- Line fault can be monitored.
- Low cost and very easy to implement.
- The fixing process related to that particular cable is easy due to exact known location of the fault in the cable.
- The benefits of accurate location of fault are fast repair to revive back the power system.
- It improves the system performance.
- It reduce the operating expense.
- The time to locate the faults in the field.

5.3 Application

- Power Grid.
- Industry.
- Substation.

5.4 Future Scope

- Sending notifications via message as soon as a problem is created on the line.

5.5 Conclusion

The paper IoT based transmission cable line fault detection system was executed successfully. Which makes fault detection very easier. It can clearly determine the location where the fault is occurred .The repair man only need to the place where fault is occurred. This paper enables there searchers to detect and locate the faults in overhead or underground cable with the help of IoT. Hence, the method used in this paper operates in a sequential manner and proves to be useful in detection and location of faults in transmission line.

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Appendix:

Program for Node MCU:

```
#define BLYNK_PRINT Serial

/* Fill-in your Template ID (only if using Blynk.Cloud) */
#define BLYNK_TEMPLATE_ID "TMPL6C8AhLm4R"
#define BLYNK_TEMPLATE_NAME "Transmission Line Cable Fault Monitoring System"
// #define BLYNK_AUTH_TOKEN "KHWgzO-b-H6hCmHLvh24XOj51O_e6XlH"

#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x3F, 20, 4);


char auth[] = "KHWgzO-b-H6hCmHLvh24XOj51O_e6XlH";
char ssid[] = "student";     //DIU Students
char pass[] = "iotstudent";  //student2019

int l1t1 = D0;
int l1t2 = D3;
int l2t1 = D4;
int l2t2 = D5;
int l3t1 = D6;
int l3t2 = D7;
float Irmsf;
float Irmsf1;
float Irmsf2;


int l1t1data;
int l1t2data;
int l2t1data;
int l2t2data;
int l3t1data;
int l3t2data;


void setup() {
```

```
  Serial.begin(9600);
  lcd.init();
  lcd.backlight();



  pinMode(l1t1, INPUT);
  pinMode(l1t2, INPUT);
  pinMode(l2t1, INPUT);
  pinMode(l2t2, INPUT);
  pinMode(l3t1, INPUT);
  pinMode(l3t2, INPUT);

  Blynk.begin(ssid, pass);
  lcd.clear();
}


void loop() {

  Blynk.run();
  l1t1data = digitalRead(l1t1);
  l1t2data = digitalRead(l1t2);
  l2t1data = digitalRead(l2t1);
  l2t2data = digitalRead(l2t2);
  l3t1data = digitalRead(l3t1);
  l3t2data = digitalRead(l3t2);

  Serial.println(l1t1data);
  Serial.println(l1t2data);
  Serial.println(l2t1data);
  Serial.println(l2t2data);
  Serial.println(l3t1data);
  Serial.println(l3t2data);
  Serial.println("");

  //line 1 FAULT detect
  if (l1t1data == 0 && l1t2data == 0) {
    lcd.print("L1 NO FAULT");
    Blynk.virtualWrite(V0, 0);
  }
  if (l1t1data == 0 && l1t2data == 1) {
    lcd.print("L1 2KM FAULT");
    Blynk.virtualWrite(V0, 2);
```

```
  }
  if (l1t1data == 1 && l1t2data == 1) {
    lcd.print("L1 1KM FAULT");
    Blynk.virtualWrite(V0, 1);
  }

  //line 2 FAULT detect
  if (l2t1data == 0 && l2t2data == 0) {
    lcd.print("L2 NO FAULT");
    Blynk.virtualWrite(V1, 0);
  }
  if (l2t1data == 0 && l2t2data == 1) {
    lcd.print("L2 2KM FAULT");
    Blynk.virtualWrite(V1, 2);
  }
  if (l2t1data == 1 && l2t2data == 1) {
    lcd.print("L2 1KM FAULT");
    Blynk.virtualWrite(V1, 1);
  }

  //line 3 FAULT detect
  if (l3t1data == 0 && l3t2data == 0) {
    lcd.print("L3 NO FAULT");
    Blynk.virtualWrite(V2, 0);
  }
  if (l3t1data == 0 && l3t2data == 1) {
    lcd.print("L3 2KM FAULT");
    Blynk.virtualWrite(V2, 2);

  }
  if (l3t1data == 1 && l3t2data == 1) {
    lcd.print("L3 1KM FAULT");
    Blynk.virtualWrite(V2, 1);

  }

}
```