POWER FAULT ALERT USING PLCC AND GRID CONTROLLING USING IOT

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ABSTRACT :

The fault that commonly occurs in power plants is due to various factors that affect the system outage. Power-line carrier communication (PLCC) is mainly used for telecommunication, tele-protection and tele-monitoring between electrical substations through power lines at high voltages, such as 110 kV, 220 kV, 400 kV. The modulation generally used in these system is amplitude modulation. PLCC technologies are proposed for safe, simple and effective solution of one of the most vexing problems presented to utility operators by high penetrations of Distributed Generator how to keep the ever-growing generation resource online during system disturbances, with concurrent absolute certainty that a dangerous unintentional island does not present a back feed hazard, and do so for any penetration level or combination of Distributed Generator.

Keywords *:* Current Sensor,Voltage Sensor,Rf,Plcc.

I INTRODUCTION

Electricity grids are in transition from fossil-based towards a low-carbon scenario, primarily based on renewable generation. This concept has led to the evolution of electrical grids to smart grids, dominantly focused on incorporation of renewable energy sources (RESs) into the electrical

distribution grid and the ability to enable charging of an arbitrary number of electrical vehicles. This is a significant transition from traditional electrical (power) systems in which electricity demand was met by fossil-based bulk generated energy and conveyed to loads through transmission and distribution grids. The smart grid concept requires continuous development of power grids, at the transmission and distribution levels, developing new technologies and techniques as well as repurposing the existing ones. Transmission grids remain vital also in the smart grids due to numerous reasons such as to convey energy from large renewable generation locations to demand sites, to link national markets and allow transfer of renewable electricity surpluses, and to support intermittent renewable generation to operate more efficiently. The task is to ensure the power flow by maintaining grid stability at the required power quality levels. As investments are very high, great attention is devoted to monitoring and maintaining the transmission lines. A transmission grid consists of high-voltage (HV) power lines spread over a large geographic area. In alternating current (AC) grids, electricity is transferred as three-phase voltages and currents at 50/60 Hz, which is usually denoted as the power frequency. Besides electricity transfer, HV power lines have also being utilized for communication purposes to transfer relevant operational data and protection signals (Figure 1). With this aim, high-frequency (HF) signals can be injected into power line conductors at one terminal using appropriate frequency-selective circuits (filters) and extracted at the other terminal, not interfering with power-frequency "signals". Information is superimposed into HF signals using analog or digital modulation.

This telecommunication technology founded on the HF signal transmission over HV power lines is known as power line carrier (PLC). Nowadays HV PLC doesn't provide throughput that can compete with optical fiber or fourth generation (4G) cellular systems, and its application is very limited to specific applications in power systems. On the other hand, knowledge gained in the domain of HF signal transmission over HV power lines and the phenomena accompanying it can be used for some other advanced applications such as fault detection and localization. Mathematical models primarily derived for PLC communications are fundamental for the design of such advanced systems. Technology deployed in smart transmission grids can utilize these data as input for real-time monitoring of

overhead power lines. Electrical grids are facing the incorporation of intermittent renewable energy resources and the necessity for infrastructure reinforcement [1]. Transmission system operators (TSOs) consider different power-line monitoring technologies to enhance operational efficiency of the existing HV power lines, such as Dynamic Line Rating (DLR) [2,3]. DLR is a sensor-based system that increases the transmission capacity by utilizing real-time data and information. These data include various factors that impact temperature of overhead conductors. With such an approach, the power line transmission capacity can reach 110–130% of the designed limits, under suitable weather conditions. Besides DLR sensors, information about the temperature of overhead power line conductors can be extracted from knowledge about overhead line catenary. In particular, power line sag is directly related to the weather conditions and temperature of conductors. In [4], the authors proposed the application of PLC signals for real-time sag monitoring of HV overhead power lines. The method determines the average overhead conductor height variations in real-time, correlating mathematical models with the processed PLC signals captured at power-line terminals. Ice load can cause severe damage on overhead power lines. The number of icing disasters on overhead power lines is increasing due to prevailing macroclimate, micrometeorological, and microtopography conditions [5]. There are several complex methods to obtain information about the state of ice accretion based on real-time measurements with specific sensor systems [6]. Another approach for icing thickness monitoring is based on image recognition algorithms [5]. Ice load on overhead line conductors causes PLC signal propagation changes, which can be utilized for the detection of ice loads [7]. In other words, ice load detection can be implemented through processing of PLC signals propagated over the HV power line.

II. LITERATURE SURVEY

1. Power Line Carrier Communication:

This Specification Provides For Frequency Planning, Co-Ordination With Other Suppliers' Equipment, Design, Manufacture, Inspection, Testing At Manufacturers Works Packing And Supply At Site Including Transportation, Erection, Testing And Commissioning Of Equipment As Specified Herein For Power Line Carrier Communication Equipment Complete For Speech Communication In Dialing Mode

And / Or Through 4 Wire Express Telephone, Data Communication And Transmission Line Protections Including Coupling Equipment, Battery & Battery Charger For For 400 Kv, 220kv& 132kv Transmission Lines As Mentioned In Annexure-Ai And As Per Schematic/Layout Drawing. All Communication Equipment Shall Be Suitable For Good Quality Voice Communication Among All New & Existing Sub- Stations & Sldc Howrah And Also Data Communication With Sldc Howrah. Brief Scope Of Work As Mentioned In Annexure Ai Is Also Under Scope Of Work Of Vendor.Regarding The Stations Where Plcc Equipment Are Already In Operation, The Contractor Shall Be Responsible For Co-Ordinating The Equipment Supplied By Them With The Existing Plcc Equipment In The Said Stations. However, Any Other Work Not Specified But Felt Necessary For Successful Commissioning Of Trouble Free Operation Of Carrier Aided Protection, Speech & Data Communication System As Per Approved Scheme Are Also Within The Scope Of The Work.

2. Fault Detection And Location Of Broken Power Line Not Touching The Ground:

Occurrences Of High Impedance Faults Are Common In Power Distribution Between Substation To Substation,Substation To Rural Area And Within Rural Area. High Impedance Faults Are Detected Based On Fault Currentmeasured By Fault Detection Devices But An Important Fault Is The Downed Or Broken Power Line Fault Nottouching The Ground Cannot Be Detected When There Is Not Enough Faults Current To Operate Fault Detectiondevices In Over Head Power Distribution. Many Methods To Find High Impedance Faults Exist. However, Noproper Method Exists To Find The Detection And Location Of Downed Or Broken Power Line Fault Not Touching Theground .Such A Condition Represents No Electrical Abnormality And Till Now Its Detection Would Probably Haveto Depend On Visual Sighting. This Paper Proposes Methods F-Plccg And Hybrid Ad Method Going To Solveabove Problem.

3, Monitoring And Fault Detection System For Power Transmission Using Gsm Technology:

The Efficiency Of Power Systems Is Largely Determined By The Effectiveness Of The Inbuilt Power Equipment. Monitoring Transmission Parameters For Faults And Quick Isolation Of The System From Faults

Helps To Improve The Efficiency Of The Power Systems Reliability. Current Conventional Method Has Its Own Limitations Due To The Reliance On Technical Team To Carrying Out Visual Inspection In Order To Identify Any Fault. Technologies Such As Power Line Carrier Communication And The Use Of Internet Based Communication Systems Have Their Respective Demerits. In This Paper The Scholars Presents The Study Of The Use Of Gsm Technology, To Provide A Reliable Monitoring And Fault Detection System. Appropriate Designed Specific Sensors Were Used To Monitor The Changes In Transmission Parameters Such As Voltage, Current, Temperature And Frequency. Whenever Fault Occurred The Data Acquired Were Transmitted To The Utility Mobile Phone As Sms Via The Gsm Wireless Network. The System Hardware Was Modeled Using Proteus Simulation Tool While Mikro-C Was Used For The Software. With This System, Power Transmission Fault Can Be Detected And Isolated At The Shortest Possible Time.

III METHODOLOGY

BLOCK DIAGRAM:

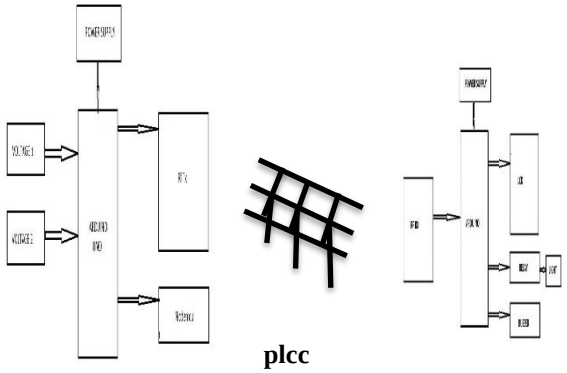


Fig 1. Block Diagram

Existing system:

This paper represents the design of a system which can detect the phase of disconnected wire. Whenever the line is disconnected, master near to Transformer stops receiving the signals from the slave unit which is mounted on the pole. As soon as the master receives no signal response from slave, it immediately turns off the relay of that respective phase with remaining phases in ON condition. After detection of faulty phase GSM module initiate the message to the area lineman and the Control Station stating the exact pole location of line failure with faulty phase. After clearing the fault, to initiate

power supply again, Lineman / Control Station need to send message to the master unit. That means the authority to initiate the power supply is given only to the corresponding area lineman OR the Control Station / main office.

Proposed system:

A fault detection system enabled by the use of the GSM wireless network for communication was achieved. The fundamental objectives of this research work were achieved as the system designed was able to detect transmission fault. The occurrences of faults were displayed and the message was sent through the GSM network over to the utility mobile phone. A bi-directional communication was established as the system was able to receive command from the utility phone to set a short circuit limit.

IVCOMPONENTS DISCRIPTION

ARDUINO BOARD

It consists of PCB (Printed Circuit Board) which could be programmed with the help of software or sometimes IDE (Integrated Development Environment) through which we can actually write the code and dump the code to the arduino board. This arduino board is most popular among students who are starting out with electronics. This board is more advantageous over the normal programmable PCB"s since it does not require any separate programmer hardware to load the new code. In this case we can simply use a USB cable to actually load the programmed code into the board. This ID can be programmed using C++ language This board is very useful by providing a easily accessible functions of microcontrollers.

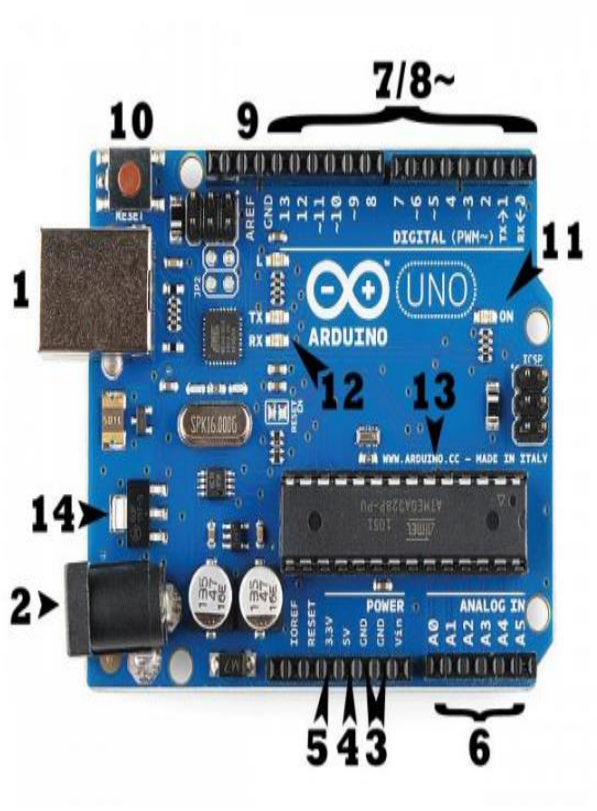


Fig 2. Pin Diagram of Arduino Board

CURRENT SENSOR

The invention of electricity has led to a revolutionary change in the life of humans. We invented many innovative applications of electricity to make our daily life easier. Today almost all of our equipment runs on electricity. The flow of charge is known as Current. Different devices need a different amount of current based on their functional requirements. Some devices are so sensitive that they get damaged when a high amount of current is delivered to them. So, to save such a situation and monitor the amount of current required or being used in an application, measurement of current necessary. This is where the Current Sensor comes into play. One such sensor is the ACS712 Current Sensor.

Current flowing through a conductor causes a voltage drop. The relation between current and voltage is given by Ohm's law. In electronic devices, an increase in the amount of current above its requirement leads to overload and can damage the device.

Measurement of current is necessary for the proper working of devices. Measurement of voltage is Passive task and it can be done without affecting the system. Whereas measurement of current is an Intrusive task which cannot be detected directly as voltage.

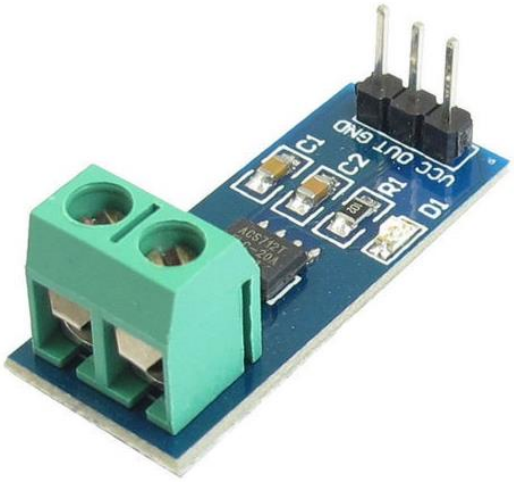


Fig 3.current sensor

POWER SUPPLY

The input to the circuit is applied from the regulated power supply. The a.c. input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating d.c voltage. So in order to get a pure d.c voltage, the output voltage from the rectifier is fed to a filter to remove any a.c components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.

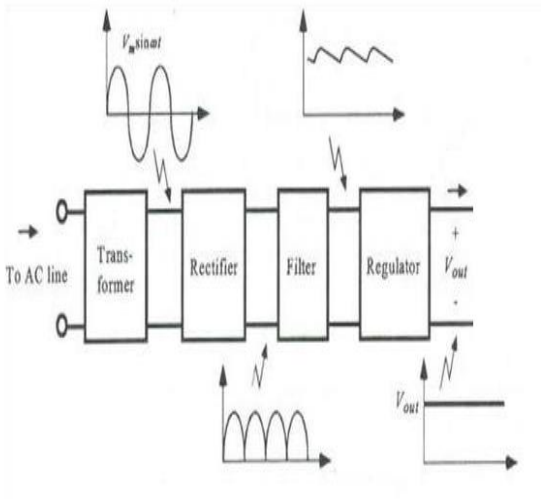


Fig 4. Block Diagram of Power supply

LCD DISPLAY LCD

(liquid crystal display) modules are most commonly used electronic display system. The 16×2 LCD display is very simple and most reliable one which is commonly used in DIYs and circuits‟ .The display has 2 rows and 16 columns, that is it can display 16 characters in each of the lines. These LCD modules are used for embedded projects because they are cheap, easily available and programmer friendly.

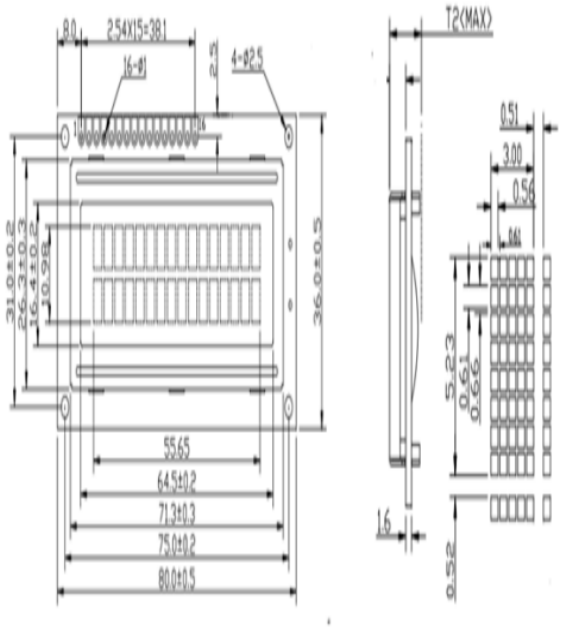


Fig 5. Circuit Diagram of LCD

VOLTAGE SENSOR

A voltage sensor is a sensor used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine the AC voltage or DC voltage level. The input of this sensor is the voltage, whereas the output is the switches, analog voltage signal, a current signal, or an audible signal.

Sensors are devices that can sense or identify and react to certain types of electrical or optical signals. The implementation of a **voltage sensor** and current sensor techniques have become an excellent choice for the conventional current and voltage

measurement methods. In this article, we can discuss a voltage sensor in detail. A voltage sensor can determine, monitor, and measure the supply of voltage. It can measure the AC level and/or DC voltage level. The input to the voltage sensor is the voltage itself, and the output can be analog voltage signals, switches, audible signals, analog current levels, frequency, or even frequency-modulated outputs.

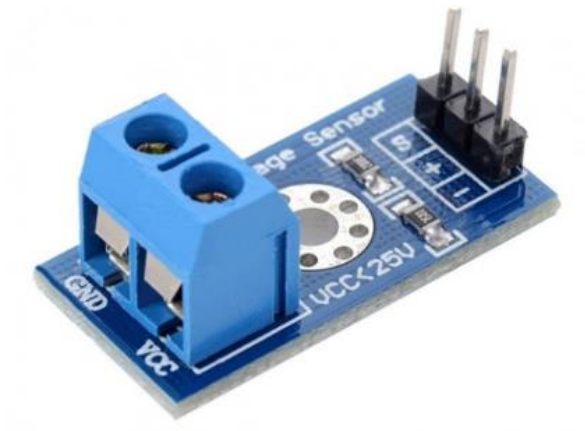


Fig.6 voltage sensor

LED

The actual concepts of these scrolling led displays are the presence of the LED in it. They use the Red led in most of the cases because the Red color will attract the attention of the visitors a lot. The LED's will '**ON**'at a particular time period and '**OFF**' on a specific time.

There is an electronic circuit in the internal part of the device which consists of the **Integrated Circuits(IC's)**. The circuit works by power supplied. According to the program written in the circuit, this will work. It gives supply to specific led's present in the scrolling led display such that, they will **ON** and **OFF** for a particular time intervals.

The circuit has the sense to display all types of alphabets on the scrolling led display. There will be some particular information to display. If this information once displays on the scrolling led display immediately after a mean time the LED's light pattern is will shift off to the next segment of the led column.

This will occur in a fraction of a second. Our eyes can't detect this movement. This principle is called "Persistence of vision **(P_0V)**". Thus, the information displayed on the screen will move so we called it as scrolling led display.

On the field of Digital electronics the use of Matrix display is very huge. This unit consist a Matrix form display of LEDs. LEDs are arranged in matrix form with equal-spaced. The LEDs are connected with

Register output pins (Qa - Qh). The advantage of Using this display is that Massage Moving speed, direction can be controlled with sufficient logical operation. This type of display provides very small power consumption facility.

The massage is displayed on the display by configuring each and every LEDs of the display. This configuration is done by a logical device e.g. Microcontroller, Microprocessors etc.

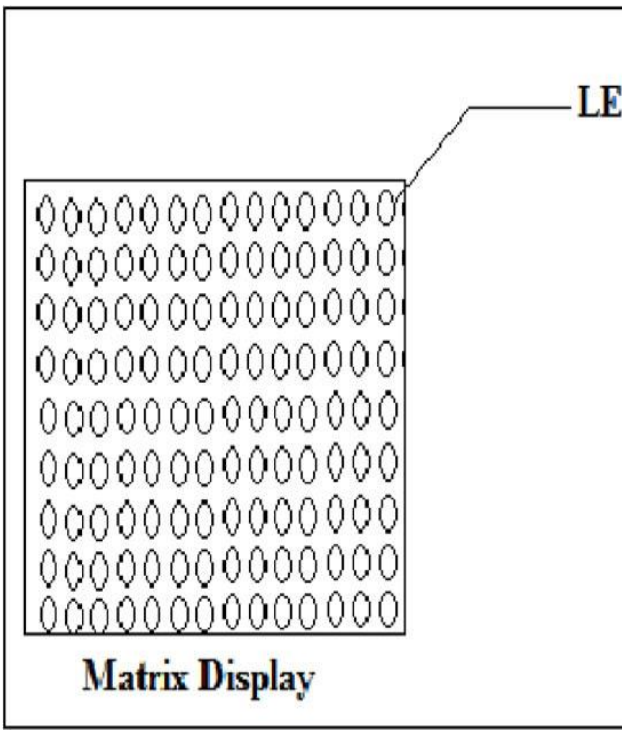


Fig.7 LED

It consists of mainly power supply unit, register unit, control unit (microcontroller & timer) and display unit.

BUZZER

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

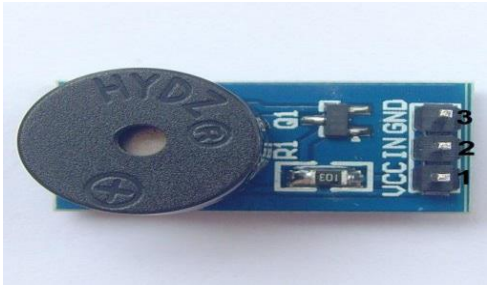


Fig.8 Buzzer

Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the

board in combination, can complete a simple circuit design, to "plug and play."

Specifications:

• On-board passive buzzer

• On-board 8550 triode drive

• Can control with single-chip microcontroller IO directly

• Working voltage: 5V

• Board size: 22 (mm) x12 (mm)

Pin Configuration:

1. VCC
2. Input
3. Ground

RF COMMUNICATION

RF refers to the frequencies that fall within the electromagnetic spectrum associated with radio wave propagation. RF current creates electromagnetic fields when applied to an antenna that propagates the applied signal through space. Electromagnetic wave-based communications have been utilized for many decades especially for wireless voice communications and data communications. The frequency of the RF signal is inversely proportional to the wavelength of the field. The rate of oscillation for the radio frequencies is in the range of about 30 kHz to 300 GHz.

RF waves that have been modulated to contain information are called RF signals. These RF signals have some behaviors that can be predicted and detected and they can interface with other signals. Antennas must be used for receiving the radio signals. These antennas will pick up more number of radio signals at a time. By using radio tuners particular frequencies can be picked up. There are some free bands available that are used for remote controlling applications. These are also called ISM (Industrial, Scientific, and Medical) bands. The most attractive frequency band is 434 MHz.

The payload data needs to be modulated on the RF carrier. Two simple modulation

techniques Amplitude shift Keying (ASK) and Frequency shift keying (FSK) are popular for this. For power consumption reasons, ASK is mostly implemented as ON-OFF keying (OOK). The challenge is finding an antenna design or concept which represents a perfect compromise between cost and performance. A clear RF design is necessary for meeting regulations.

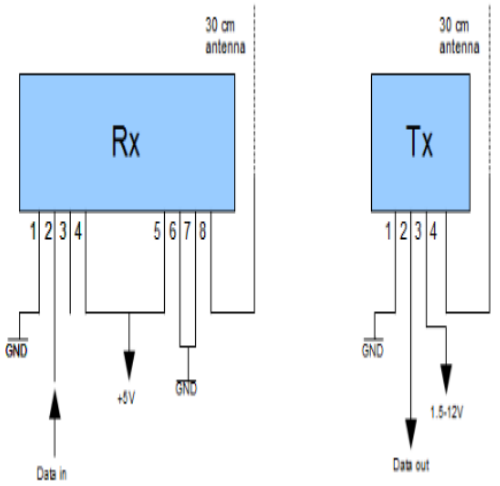
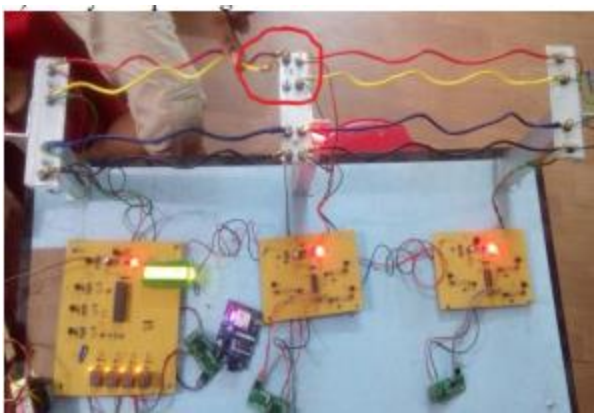


Fig.8 RF communication.

V RESULTS



VI CONCLUSION AND FUTURE WORK

In this paper we have presented the model of a faulted HV power-line in the low radio frequency range The model is derived from the multiconductor system analysis and electromagnetic wave propagation described by telegrapher's equations in a matrix formulation. Analysis is done for typical HV power line faults, short circuits and series faults. The developed model is validated for the HV power line in normal operation using 400 kV HV power line measurements. The presented model is further extended for HV power line under faulted conditions. The main focus is placed on determination of HV power-line characteristics when one phase conductor is faulted for which an adequate model is derived. The phase conductor break-down (series or hybrid fault) is interesting for

analysis since handling such faults is demanding and time consuming while it is desired to maintain reliable communications over the HV power line. The conclusion is made that faulted operating phase causes serious degradation of power-line high-frequency characteristics while fault on a non-operating phase can be neglected. Presented simulation results describe the impact of different faults on frequency response of the high voltage overhead power lines. Beside the design of PLC communication systems resilient to power line faults, analysis presented in this paper is useful for the design of smart systems for fault classification and localization, utilizing low radio frequency signal propagation over the power lines

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