ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 7, Issue 8, August 2020

Transmission Line Induction Effect Detector

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ABSTRACT: Usually EB people will cut the supply in the transformer to attend a fault or for maintenance purpose. When they attend the fault they should use proper earth rod to avoid supply feedback or induction effect from nearby HT lines. But most of then attend the fault without earth rod. Many time due to induction effect from nearby transmission line leads to fatigue. To avoid this and save the life of the workers we have designed a project as per the request from TNEB gudiyatham, a small module which is compact and used friendly handset to check the HT or LT interference. The circuit is designed with easily available components to give a buzzer or to give indication during night time.

KEYWORDS: Buzzer, Earth rod, Induction effect, TNEB, Buzzer indication, HT or LT interference.

I. INTRODUCTION

The alternate current non- touchable detector is a safety device used to verify that our distribution line are energized or not, before prior to earthing. Reliably detecting and measuring of high voltage on distribution system voltage power line is critical jobs is performed by our field staff's. These jobs like HG – fuse renewal, fuse of call attending, blink for opening DP's etc., are get done more quickly and safety when the voltage detector device with our field staff's device is easy to use .Electricity can cause serious injury or even death which is why safety must come first when working with electricity in distribution system. In order to avoid electrical accident, prior to starting work lineman must first verify there is no AC voltage (HT or LT). Now the device is very essential to ensure the lineman safety. There are several devices options available on the market and their sensing range of detection is very low compared with this device.

II. LITERATURE SURVEY

Surabhi Jain and Ranjana Singh [8] This study is based on a real distribution feeder in Madhya Pradesh (M.P.) state. The paper presents comparative analysis between the LT- distribution system and proposed HT- distribution system in terms of technical and non-technical losses. The major intention for high I2R losses (i. e. technical losses) is the use of low voltage in current LT- distribution system. On the other hand, non-technical losses caused majorly include electricity theft which is done by direct hooking of illegal loads in LT lines. In this paper, current LT- distribution system is changed into proposed HT- distribution system to reduce technical and non-technical losses. Under this proposed HT- distribution system, HT (11KV) lines are extended nearer to the loads as possible and release supply to 4 or 5 consumers with inevitable least (or virtually nil) LT lines; If possible with insulated overhead cables. Bhat, Veena [2] This paper presents the comparison of current low voltage distribution system with planned high voltage distribution system. The study is created on a actual low voltage feeder in J&K state. The study is carried out to control the losses in the current low voltage (LT) distribution system and then converting this low voltage distribution system to planned high voltage distribution system (HVDS) including junction of load and substituting the one sizable transformer with various transformers of small rating. Gao Can, Wang Jingang, Yu Mengting, Peng Hu and Ma [4] This paper represents a capacitively coupled non-contact voltage sensor, which is specially optimized for observing line voltages ranging from wad level to spreading levels at thousands of volts. The sensor uses a latest preparation of electrostatic pickups to calculate the rate of change of an unidentified potential, and digitally integrates that the rate of change in order to recover the original signal. Somangshu Bagchi , Subhadip Ghosh , Deepak Nandi [3] This study proposes a new method of voltage capacity in High Voltage (HV) grid. Modern power system has been increasing to possess of large capacity, high voltage, miniaturization, digitalization and the features of transmission and distribution system computerization. The conventional

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ISSN 2394-3785 (Online)
Available online at www.ijartet.com

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electromagnetic voltage transformer can not meet the capacity necessities of the smart grid, since of these problems of low precision in static and dynamic range, ferromagnetic resonance occurring by reason of the over-voltage and output short-circuit Lawrence .D, Donnal .J .S, Leeb and He .Y [5] The magnetic fields produced by the primary coil can be decided to interact dynamically with complemented secondary coil in distant equipment. The inductive coupling WPT works with electromagnetic induction principle, which is based on the principle of a primary coil producing a main magnetic field and a secondary coil being enclosed by that field thereby producing current within its coils.

III. OPERATION

BLOCK DIAGRAM

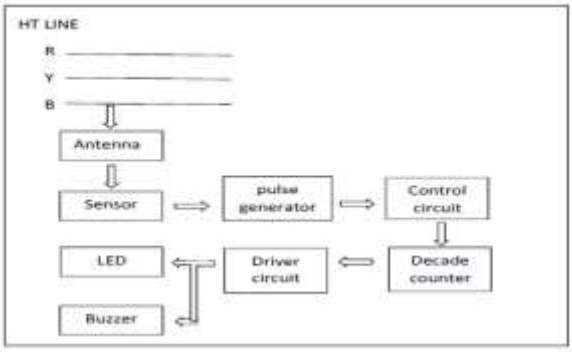

Fig3.1 block diagram of transmission line induction effect detector

CIRCUIT DIAGRAM

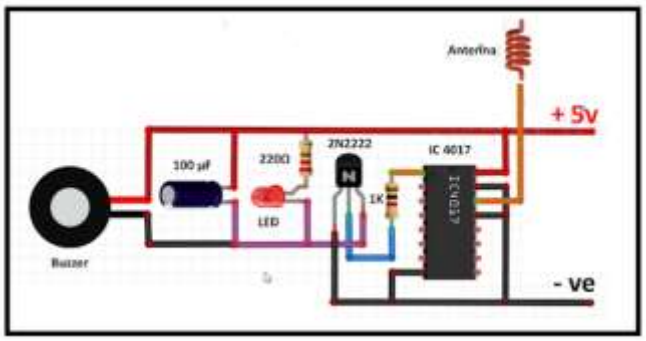

Fig3.2 circuit diagram for transmission line induction effect detector

3.1 IC 4017

Most folks are easier with 1, 2, 3, 4… instead of 001, 010, 011, and 100. We mean to mention that we'll need a decimal coded output in many cases instead of a raw binary output. We have many counter IC's available but most of them produce binary data as an output. We will again be got to process that output by using decoders or the other circuitry to make it usable for our application in most of the cases. Let us now introduce you a replacement IC named IC 4017. It's a CMOS decade counter cum decoder circuit which may compute of the box for most of our low range counting applications. It can count from zero to 10 and its outputs are decoded.

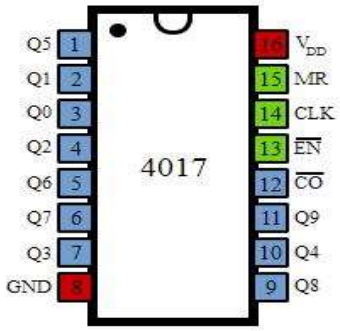

Fig3.3 IC 4017 Pin Diagram

It has 16 pins and thus the functionality of every pin is explained as follows:

- Pin-1: It's the output 5. It's goes high when the counter reads 5 counts.
- Pin-2: It's the output 1. It's goes high when the counter reads 0 counts.
- Pin-3: It's the output 0. It's goes high when the counter reads 0 counts.
- Pin-4: It's the output 2. It's goes high when the counter reads 2 counts.
- Pin-5: It's the output 6. It's goes high when the counter reads 6 counts.
- Pin-6: It's the output 7. It's goes high when the counter reads 7 counts.
- Pin-7: It's the output 3. It's goes high when the counter reads 3 counts.
- Pin-8: It's the bottom pin which might be connected to a coffee voltage (0V).
- Pin-9: It's the output 8. It's goes high when the counter reads 8 counts.

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- Pin-10: It's the output 4. It's goes high when the counter reads 4 counts.
- Pin-11: It's the output 9. It's goes high when the counter reads 9 counts.
- 12. Pin-12: this is often often divided by 10 output which is employed to cascade the IC with another counter so on enable counting greater than the range supported by one IC 4017.
- 13. Pin-13: This pin is that the disable pin. In normal mode of operation, this is often connected to ground or logic LOW voltage. If this pin is connected to logic HIGH voltage, then the circuit will stop receiving pulses then it'll not advance the count regardless of the amount of pulses received from the clock.
- 14. Pin-14: This pin is that the clock input. this is often the pin from where we wish to often the input clock pulses to the IC so on advance the count. The count advances on the rising fringe of the clock.
- 15. Pin-15: this is often the reset pin which should be kept LOW for normal operation. If you'd with to reset the IC, then you'll connect this pin to HIGH voltage.
- 16. Pin-16: this is often the power supply (VCC) pin. this might tend a HIGH voltage of 3V to 15V for the IC to function.

Clock pulse	Outputs			
	Q_3	Q_2	Q_1	Q_0
Reset	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	0	0	0	0
11	0	0	0	1

Fig3.4 Truth table

3.2 TRANSISTOR

Transistors make our electronics world go around. They're critical as an effect source in only about every modern circuit. Sometimes you see them, but more-often-than-not they're hidden deep within the die of an micro-circuit. During this tutorial we'll introduce you to the fundamentals of the for most common transistor around. The bi-polar junction transistor (BJT) In small, discrete quantities, transistors are often accustomed to form simple electronic switches, digital logic and signal amplifying circuits. In quantities of thousands, millions, and even billions. Transistors are interconnected and embedded into tiny chips to form computer memories, microprocess 2N2222A –NPN Transistor. 2N2222A could be a NPN transistor, therefore the collector and emitter are left open (Reverse biased). In this transistor when the base pin is held at ground and will be closed (Forward biased) when a symbol is provided to base pin. 2N2222A features a gain value of 110 to 800, this value decides the surge capacity of the transistor.

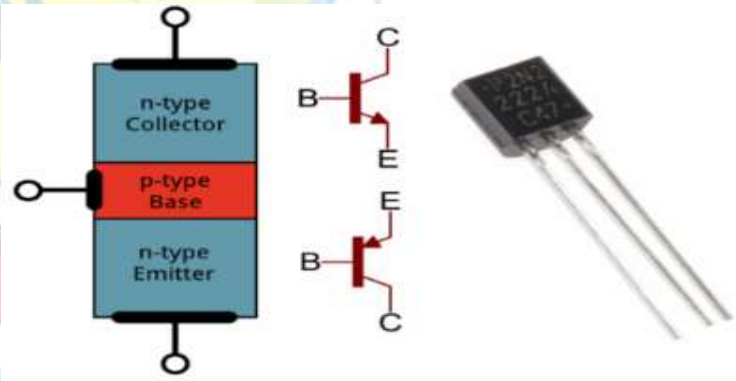

Fig3.5 Transistor

3.3 RESISTOR

A resistor is a passive component. It's implements electrical resistance as a circuit element. In electronics circuits, resistors are used to decrease or reduce the flow of current, vary the signal levels, to divide voltages, bias active elements and terminate transmission lines, among other uses. Power resistors are producing many watts of electric power as heat. It can be used as a part of motor controls, in electrical power distribution systems and also test loads for generators. Fixed resistors have resistances that only slight change with temperature, depends upon time or

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International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 7, Issue 8, August 2020

operating voltage. Variable resistors are used to modify circuit elements (such as a lamp dimmer or volume control), or as sensing devices for light, humidity, heat, force, or chemical activity.

Fig.3.6 Symbol of resistor

3.4 CAPACITOR

Design of capacitor depends on the proper dielectric material with specific type of application. The dielectric material used for capacitors may be grouped in different classes such as Mica, Glass, air, ceramic, paper, Aluminum, electrolyte etc. The value of capacitance never remains constant. It changes with temperature, frequency and aging. The capacitance value noticeable on the capacitor strictly applies only at specified high temperature and at low frequencies. The basic relation for the capacitance between two flat plates separated by a dielectric material is given by: -

C=0.08854KA/D

Where: -

C= capacitance in pf.
K= dielectric constant.
A=Area per plate in square cm.
D=Distance between two plates in cm.

Fig3.7 Symbol of capacitor

3.5 LED

LED (A light emitting diode) is a semiconductor device that created light from electricity. LEDs are do not break easily and last a long time. They can manufacture many colors. Most of the energy turns into light, not heat and also, they are efficient. An LED was a type of diode that makes one color of light when electricity is go through it in the expected direction (electrically biased in the forward direction). This effect is a kind of electroluminescence. The color of the light depends on the chemical composition of the semiconducting material spent, and can be near-ultraviolet , visible or infrared. The color affects how much electricity is consumed by the LED. A white LED has either two or three LEDs inside, of various colors. Some white LEDs have one single-color LED inside (commonly blue), mixed with a phosphor that converts that single coloring to white.

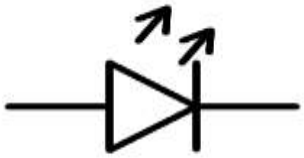

Fig3.8 Symbol of diode

3.6 BUZZER

A buzzer is an audio signaling device, which may be piezoelectric, electromechanical or mechanical . Typical usages of beepers and buzzers include meters, alarms and confirmation of user input form of a keystroke.

Piezoelectric - Piezoelectric buzzers or piezo buzzers as they're occasionally called, were designed by Japanese manufactured and developed often a decent array of products during the 1970s to 1980s. This advancement mainly came about since of co-operative efforts by Japanese manufacturing companies. In 1951, they recognized the Barium Titanite Application Research Committee, which allowed corporations companies to be "competitively co-operative" and convey about several piezoelectric innovations and inventions.

Electromechanics - The electricbuzzer was designed in 1831 by Joseph Henry. They were mainly used in early doorbells until they were phased out in the early 1930s in service of musical chimes, which had a smooth tone.

Fig3.9 Symbol of buzzer

3.7 PHUSH BUTTON SWITCH

A pushbutton is a simple switch mechanism to controller some aspect of a device or a process. Buttons are

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Available online at www.ijartet.com

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typically made out of hard material, usually metal or plastic. The surface is usually shaped or flat to accommodate the human hand or finger, so as to be easily pushed or depressed. They are most often biased switches, even though many unbiased switches (by reason of their physical nature) still need a spring to return to their un-pushed state. Terms for the "pushing" of a button include hitting, depressing, slapping, mashing, swiping, pressing and stamping. In commercial and industrial applications, push button switches may be connected together by a mechanical linkage so that the act of pushing one switch button they are causes the other switch button to be released. In this way a start button to be released , a stop button can "force". This method of linkage is used to process has no electrical circuits for control or used in simple manual operations in which the machine.

3.8 BATTERY

The 9 - volt battery (or nine-volt battery), is a communal size of battery that was announced for the early transistor radios. It has a rectangular prism shape with a polarized snap connector at the top and rounded edges. This type is commonly used in walkie-talkies, smoke detectors and clocks. The size, irrespective of chemistry, is usally designated PP3—a designation originally reserved solely for carbon-zinc, or in some countries, *E* or *E-block*. The 9-volt battery arrangement is usally available in primary carbon-zinc and alkaline chemistry, in primary lithium iron sulfide, and in rechargeable procedure in nickel-cadmium, nickel-metal hydride and lithium-ion. Mercury-oxide batteries of this arrangement, once common, have not been produced in many years by reason of their mercury content. Designations for this format include MN1604 6LR61 (for alkaline) or *NEDA 1604* and *IEC 6F22* (for zinc-carbon).

IV. IMPLEMENTATION SETUP

The 1K resistor, first terminal is connecting to the pin-1 of the IC. Another terminal of the resistor connects to the base of the transistor. Next connect the collector pin to the -ve legs of the light emitting diode, transistor and the buzzer. The +ve legs connects to the +ve rail of the circuit connection. The negative rail get along to the Emitter, through Pin-8, Pin-13 and also the Pin-15 of the IC. The pin 14 is the clock input.so connect pin 14 of the IC to the antenna. When the antenna receives input clock pulses it advances the counter and the LED flashes also, it's given a buzzer sound. Next connect the cable connected to Pin-1 to any one of the Outputs pins of the IC. If you wish you'll be able to also connect 4 or 5 LEDs to the Output Pins to provide it a chaser like effect.

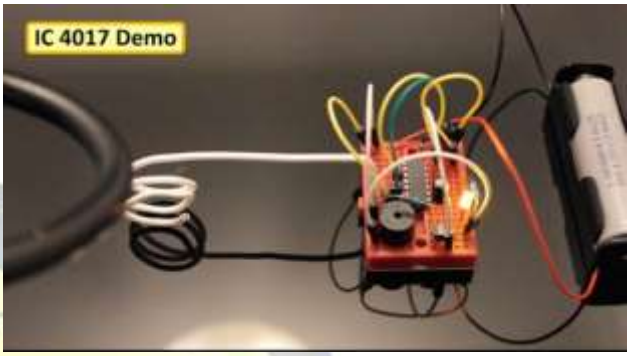

Fig4.1 Implementation setup

V. WORKING PRINCIPLE

A conductor is energised with alternating current. A magnetic flux is formed around a current carrying conductor. The magnetic field produced, varies periodically. The AC NT line voltage detector detects the changing magnetic field around AC energised objects. The AC NT line voltage detector using IC 4017 decade and NPN type transistor in order to detect voltage. In order to detect voltage in our circuit, an antenna (copper wire) is connected to IC 4017 which sense the voltage. When we place this antenna near an HT or LT line that is AC energised, a small current gets induced into the antenna due to electromagnetic induction. This current trigger the IC 4017 decade and output of base current triggers the NPN transistor.

A transistor has three terminals. The terminals are emitter, collector and base. Collector to emitter circuit, no collector to emitter current flows. When there is base current, no collector to emitter current flows. When there is base current from IC 4017-decade, transistor circuit's current flows from collector to emitter which switches ON the LED and buzzer circuit, indicating that ac voltage is present in the conductor.15^{th} pin and 13^{th} pin of decade counter IC4017 is shorted and grounded will give continuous output which is connected to Q. If 15^{th} and 13^{th} pin are not shorted and grounded, LED of output will be indicating for very long time, because for each pulse input,

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we will get an output. In this circuit we use only one LED in output, so that after some long time LED will indicate.

5.1 INDUCTION PRINCIPLE

In inductive transducer, the mutual inductance of a pair of coils or the self-inductance of a coil is altered in value by reason of variation in the value of the quantity under measurement. Transducer based on above principle are considerable sensitivity and scope of application for thickness and displacement measurand. Detection of changes in inductance can be done only by using the inductors AC circuits. If the coils are air-cored, they act as a source of alternating magnetic fields that would interfere with all the nearest circuits while the coils themselves link with the outside magnetic fields. Inductive transducers may be either the self-generating type a motion between a conductor and magnetic field induces a voltage in the conductor (generator principle). The relative motion between the field and the conductor is supplied by changes in the measured.

An inductive transducer is a device that convert physical movement into a change in inductance. These inductive transducers work upon one of the following principles.

- Number of turns.
- Geometric configuration.
- Permeability of the magnetic material of magnetic circuit.

5.2 SIGNAL CONDITIONING

The measurand is basically a physical quantity. It is measured by the detector transducer stage, acts as the first stage of the instrumentation system.The output of the first stage is modified by the second stage, called as intermediate or signal conditioning stage.The last stage is the measured system consisting of indicating, recording, displaying, data processing elements or may consist of control element. Quantity of dynamic physical quantities requires correct representation of the digital or analog output got from the intermediate (signal conditioning) stage.The signal conditioning equipment may be required to do linear processor like amplification, attenuation, integration, differentiation, addition and subtraction.They are also required to do non-linear processor like modulation, demodulation, sampling, filtering, clipping and clamping, linearing or multiplication by another function etc.

VI. CONCLUSION

By using a simple electronic circuit a very useful project is completed which is very much essential for the workers in EB. While doing this project we have understood how to use electronic circuit.

To detect electrical parameter we also got experience in the following areas.

- Purchasing the components.
- Designing PCB board.
- Checking and soldering the components.
- Testing the stage by stage.
- Making the circuit for ready usage(protect).
- Preparing report(referring various books and internet).
- Team work.
- The circuit can be modified some other purpose depends upon the requirements.
- Smooth interaction with guide.

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ISSN 2394-3777 (Print)
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