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# Live Wire Detector

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**Abstract**

Electrical accidents caused by exposed or broken live wires are a major safety concern, especially in public areas, construction sites, and during natural disasters. This project presents a Live Wire Detector designed to identify the presence of live electrical wires without direct contact, thereby preventing electrocution and related hazards. The system operates by detecting the electromagnetic field generated by alternating current (AC) in live wires using a sensing probe. When a live wire is detected, the device immediately alerts the user through visual (LED) and audible (buzzer) indications

## Introduction

Forest guards get electrocuted in Forest due to electrical power lines and some of them lose their life by touching the electrical lines directly or when there is a leakage in supply lines. This proposed device will detect the electrical power lines and give the alert signal to the user. The proposed idea is to

- Develop as a low cost handheld/ wearable device.
- Detect the power lines before minimum distance of 10 feet
- Give alert signal through buzzer and/or vibration unit to the user
- Use an Emergency lighting system to see the Powerline in the path during night time
- Use an additional electronic circuit for battery power indicator

The proposed idea consists of a small device that can be attached to a walking stick/ patrolling stick or be carried in pocket/back packet or used as a wearable device that can generate an alarm sound when it detects a live wire (domestic power supply line) in the vicinity (maximum of 5m range).

The objectives of the proposed device are

- To detect the live wire condition and give the indication to the user before certain distance of a walk
- To avoid the loss of a human life due to electrocution
- To detect the harmful radiation from high power lines (As per studies which may lead to blood cancer)

## Brief Description of the Project

It consists of electronic circuit with an aerial and sense the A.C. Power line through electromagnetic induction process. Counter IC used in this circuit will generate the output whenever the AC power line is nearby. The proposed electronic circuit will generate the sound through buzzer arrangement whenever a live wire condition is detected. Emergency lighting system is proposed as an additional

option in wearable model structure. The additional electronic circuit has been proposed to detect the charging level of the battery (used to power the live wire detector).

The circuit design of proposed device is shown in Fig.1. It consists of following major components namely

1. Live wire detection using counter IC
2. Antenna
3. Battery level indication unit using LM3914
4. Emergency lighting unit
5. Battery over charging cutoff circuit These components are detailed in following sections.

**Live wire detection using counter IC**

The proposed device using the counter IC (CD 4017) for the live wire detection process. It using an antenna and the antenna output is connected as an input to the counter IC at its Pin number 14 (through J3). Availability of the supply can be verified by pressing the switch S1 so that it will be indicated by glowing condition of LED L1. The input (+3.7V) is applied using the battery B1 at the pin 16 of CD 4017. Whenever the antenna is nearby the power line, the counter IC will generate a clock signal at its output terminal based on the principal of electromagnetic induction. The output signal is amplified with the help of a transistor BC 547. The amplified output (available at collector terminal) is given to a buzzer and a LED. The buzzer (BUZ) sound and LED (L3) glowing condition indicates the detection of live wire. A resistor (R4) of 1KΩ is connected in series with L3 to limit the current flow. In this process, pin 13 and pin 15 of CD 4017 are connected to negative terminal of 3.7V, 3200mAh battery. Battery is selected with 3200mAh capacity to ensure long standing operating.

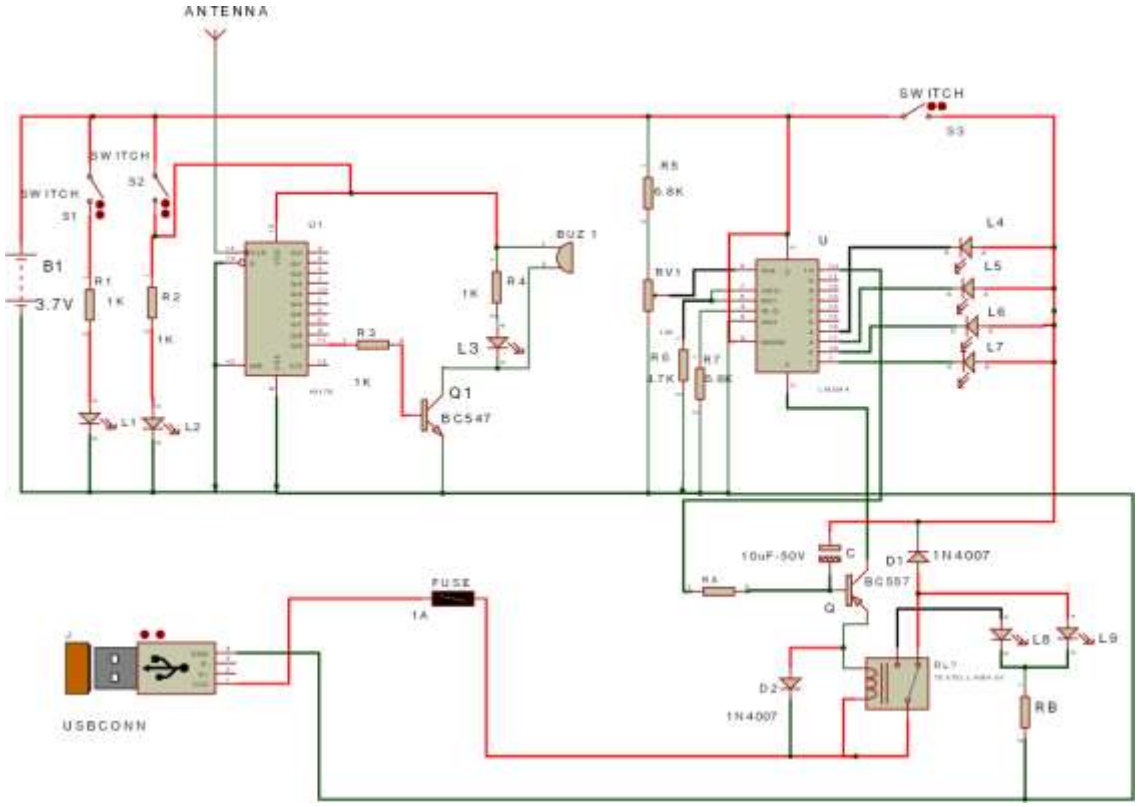


**Fig.1 Circuit diagram of Live Wire Detector**

**Antenna**

The antenna is designed by considering the copper wire of 22SWG by making more number of turns. The tail end of an antenna is connected to the CD 4017 at its pin 14. As an alternate option, the commercial antenna of Serial WIFI wireless Gain Antenna (shown in Fig. 2) can be used. With this antenna, the live wire condition can be detected before 5 meters.

**Fig 2 Serial WIFI Wireless Gain Antenna**

**Battery level Indication unit using LM3914**

The LM 3914 is preferred for the battery level indication because of following options and it helps user to understand the battery voltage level.

- Internal voltage reference from 1.2 to 12v DC.

- Programmable output current 2mA to 30mA.
- LED driver outputs are current regulated.
- No multiplexing interaction between outputs.
- It supports wide range of temperature from 0 to 70 degree Celsius.

The proposed voltage level indicator unit uses R5 (6.8KΩ), RV1 (10KΩ), R6 (4.7KΩ) and R7 (6.8KΩ) resistors to verify the battery voltage at different levels such as 25%, 50%, 75% and 100%. A push switch S3 has to be pressed when the user wants to know the voltage level.

**Emergency Lighting Unit**

This unit consists of a LED lighting unit (with refelector) to provide the lighting during emergency condition (during night time). This unit is powered via a switch S1. In this operation, a current limiting resistor (1 KΩ) is connected in series with the LED (L1) to indicate battery ON condition.

**Battery over charging cutoff circuit**

When the device is connected to power supply through an adopter device, the battery (will be connected via a relay (in normally closed operation). During this time, the D1 is in operation and the battery charging condition is indicated by L9 (LED). Once the battery is fully charged (around 4.2 V), the relay will be deactivated with the help of resistor RA (330Ω) and a capacitor of 10µF – 50V value. Once the relay is deactivated, it moves to normally open condition and L8 starts to glow (indicates the fully charged condition of battery). This circuit is used to avoid the overcharging of battery and ensures the battery safety.

The adaptor circuit can be connected to the charging circuit across using USB port with a fuse of 1A capacity to limit the current flow. The prototype model of Live Wire Detector has been developed and shown in Fig. 3

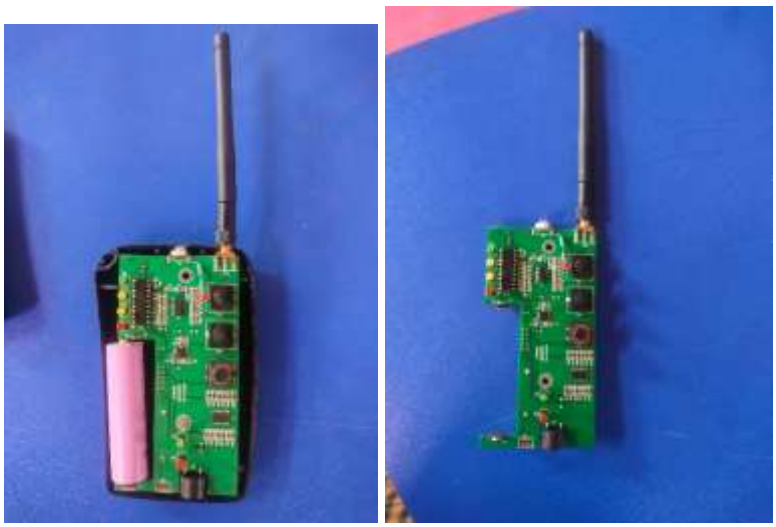

**Fig 3 Prototype model of Live Wire Detector**

The proposed prototype model operation has been verified with electrical power lines and domestic

supply lines (Power cables, Junction boxes,and etc.). The distance at which the live wire condition is detected is noticed and detailed in Table 1.

**Table 1 Distance at which detection of live wire condition details**

| Electrical point (position) to be sensed | Distance covered in Metre | Distance covered in Ft. (including walking stick length of 3 Ft.) |
|---|---|---|
| 220 V Power point/line | 1.524* | 5 |
| Transformer (440V) | 5 | 16.6 |

**Note**

The proposed idea won the first prize in the hackathon conducted by World Wide Fund (WWF) for Nation in association with Atal Incubation Centre – Sri Krishnadevaraya University (SKU) on 18-06 -2019. Later, the basic model of the proposed work has been developed as per the requirements given by the officials of World Wide Fund (WWF) for Nation, Jabalpur on December 07-08, 2019 and WWF Jabalpur head Soman Dev agreed for promoting this product across their organization.

- Used by frontline staff of the Forest Department who patrol the forest areas, National Parks & Sanctuaries, Tiger & Elephant Reserves
- Used for construction and corporation department
- Used for electricians to sense the power in the supply lines when they are in work
- Used for all common people to detect the electrical leakage/electrocution condition especially in rainy condition
- Blind people also can use this product for safety on their path during walking
- The proposed device has lot of potential usage and demand in the market. Based on the field of application, the device can be developed in different formats such as wearable model, pen type, and handheld device. The device has social responsibility in terms of saving human life from electrocution and is the motivation of this proposed work. Some of the potential areas are detailed below.
- The proposed device can detect the presence of Powerline placed inside a wall. Whenever, people doing alteration in houses, office, restaurants and etc., this device will help them to avoid the power lines, while making drill/ alterations in the wall.
- During rainy season or in certain conditions, some electrical leakage may be happening in roadside electrical poles. People who are crossing this pole are affected when they are touching the pole. By using this proposed device, people will get alert before certain distance during their walk when they are crossing this kind of electrical poles.
- The Frontline of the forest department who guard our natural heritage also risk their lives, in the past forest guards have lost their lives when they stepped onto live wires laid to kill animals in the periphery of forests and national parks. This small device can help save such lives.

- The proposed model is having lot of scope in day to day life as a safety device and it has good marketing scope too. The proposed device is planned in wrist watch model at affordable cost so that people in more numbers will come forward to purchase it for their daily usage. As the proposed model is planned in wrist watch itself, the people won't show any hesitation in using this device.