

# DESIGN OF AUTONOMOUS PROTECTION SCHEME BASED ON LASER MESH FOR ROAD CROSSING & AGRICULTURE FARM CROSSING TRANSMISSION LINE

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## Abstract

As overhead high-voltage lines are the most common choice for power transmission, but their planning, installation and Safety are often challenging tasks because of the surrounding public areas and of their importance as critical infrastructures. Many accidents have been observed regarding live conductor breakdown of over-head lines crossing roads and agriculture fields causing property and life damage. Laser technology has observed a great advancement over the last few decades. This technology is used for a wide range of applications including medical sciences, military, industrial manufacturing, security and much more. The idea is to provide a laser based smart system to detect such conditions and send failure & alert signal to control station. The developed system will be having LASER & LDR based sensor array to check minimum clearance for overhead conductor. In case of any abnormal condition the signal will be sent via GSM/Radio Frequency communication system. System is completely solar powered and universal to mount on different types of power transmission towers.

**Key words:** High Voltage, Live Conductor, LASER, LDR, Sensor Array, GSM Communication System, Radio Frequency Communication System

## 1. INTRODUCTION

Transmission of power is one of the main factors of grid as the plants are located near resources and away from public area hence the bulk power is transferred to consumers via most traditional way that is overhead transmission lines. This transmission lines are working at very high voltages ranging from 440V to Latest 1200KV lines. This lines in their ways often cross roadways, highways and agriculture field during their travel. The bulky conductors sometime weighing in several tons undergo structural breakdown and comes in contact to whatever is laying beneath them, this live conductor is extremely dangerous may cause high damage to surrounding. Hence a proper system is required to guard them especially in areas where living beings and properties are presents. The project is based on protection scheme for such problems using laser technology. Laser technology has observed great scientific developments and engineering improvements that make it usable for various commercial, industrial, medical and scientific applications. The lasers have already brought great benefits in photography, spectroscopy, holography, data

storage, surgery and much more. It uses the phenomenon of stimulated emission to generate a coherent optical beam that offers a wide variety of functionalities for various applications.

There are variety of lasers available in the market today with different wavelengths, spectral bandwidth, power levels, operating efficiencies and temporal characteristics. This increasing maturity of lasers and compact optical systems have enhanced their capabilities for power operations.

### 1.1 EXISTING SYSTEM

Traditional system uses protection schemes based on current, voltage and impedance measurement of online HOT transmission line if any abnormality is observed by the protection relays the system is tripped. In case of mechanical Failure of conductor in certain conditions it is observed that response to failure is sluggish and time consuming which creates dangerous conditions in nearby area surrounding live conductor. Also, these traditional systems are used for lines which are operating at very high voltage and power levels due to cost & complexity reasons.

### 1.2 PROPOSED SYSTEM

The solution on above discussed problem can be rectified by use of LASER based guard system forming a dense mesh of light array below the live conductor at minimum clearance level. Whenever the cable will either sag or breakdown below clearance level it will interrupt the laser continuity between two towers, then sensors & CPU will note abnormal condition and in result signal will be sent to the control station. There can be various type of communication system which can be used depending upon distance between respective tower and control room which are GSM/Radio Frequency/Bluetooth etc. The system is completely autonomous, solar powered, and Universal to mount on any type of towers or poles.

## 2. DESIGN AND HARDWARE

### 2.1 HARDWARE USED

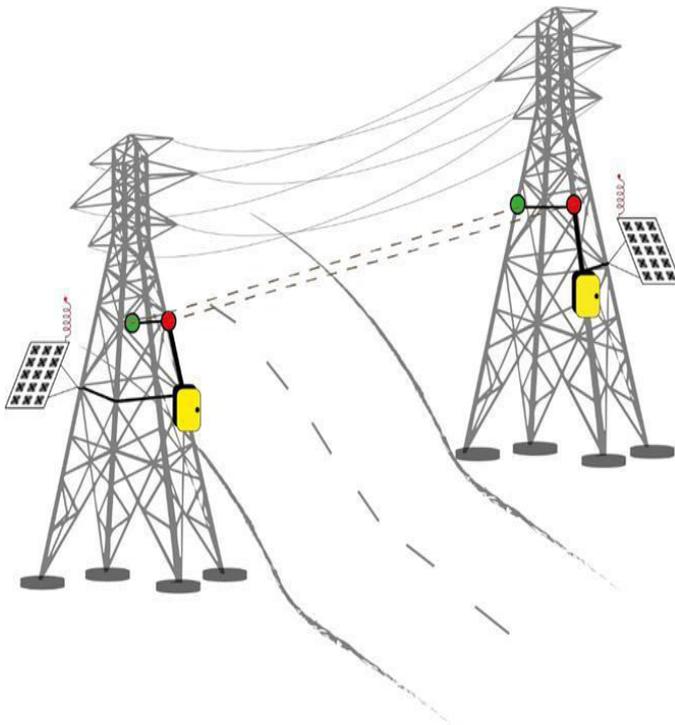
1. Iron Rods (Tower Fabrication)
2. Solar panel 50Watts

3. Aluminum (Sheet 1mm)
4. Temperature Sensor
5. ADC Voltage Sensor
6. Microcontroller Based Development Board
7. 6mW LASER Emitter Diodes
8. LDR Sensors
9. Lead Acid Battery
10. Circuit BOX & Housing Components
11. GSM Module/HC05 Bluetooth/RF Module
12. 4 Channel Relay Module
13. Buck Converters

**2.2 DESIGN**

The protection scheme is mainly designed for the transmission lines crossing roadways or agricultural land as the normal distance between two towers can be about 200 m. Hence the solar panels are mounted on the towers to give power to the system and all the microcontroller and power switching boards are placed in the box and that box is mounted on the tower.

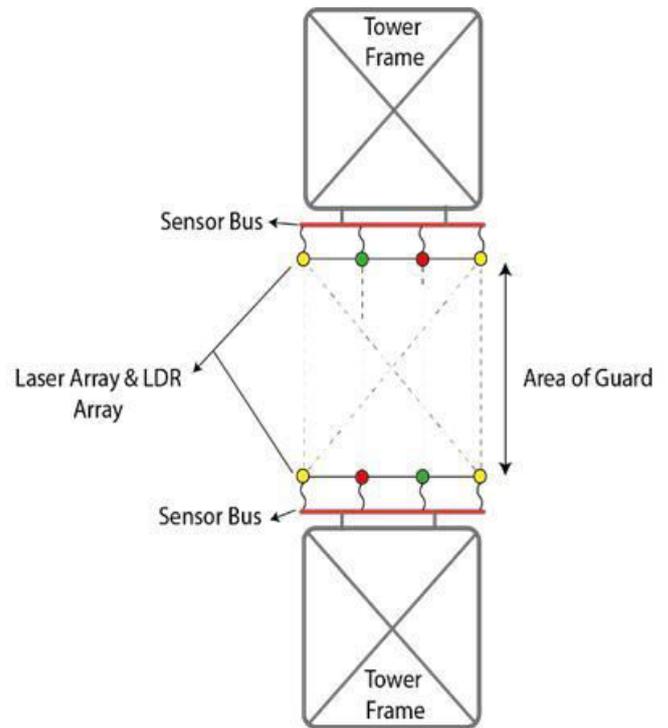
As LASER and LDR are placed under the conductors so that whenever the sagging or breaking of conductor occurs the LDR should give the faulty response to the microcontroller.



**Fig 1: Design of protection scheme**

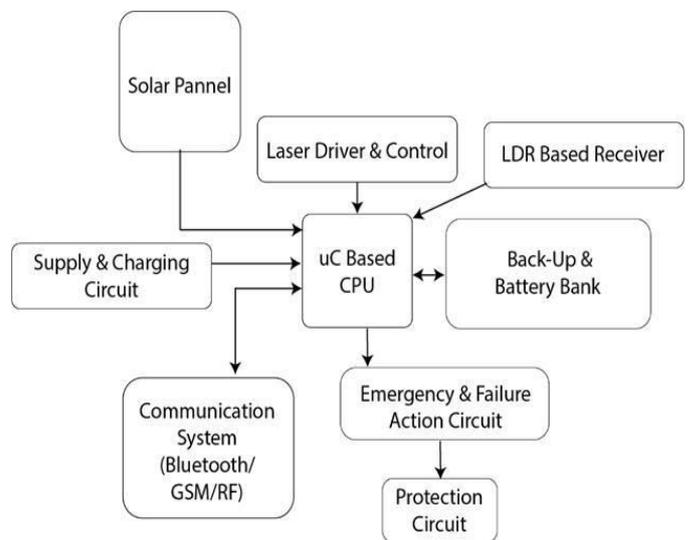
The given below is the block diagram of the protection scheme which placed on tower. The solar pannel is connected to the microcontroller development board as it will synchronize with the battery bank and charging the circuit or supply the power to the system through microcontroller. It will

start charging battery when it will supply direct power to the microcontroller when it is required.



**Fig 2: Top view of design of protection scheme**

Laser driver and control the power supply to the laser using some laser driver and it is also have pulling system which controls main microcontroller.



**Fig 3: Block diagram**

In the case of emergency and mechanical failure (breaking of conductor) LASER rays will be interrupted LDR based recievers LASER driver emitter gives signal to the microcontroller. In such condition LDR will receive the faulty signal and the emergency message will be triggered to the nearest control centre. If the conductor falls down or touches any human or animal body, the transmission system between two substations will be turned off.

### 3. METHODOLOGY

1. Material selection and design Scaled model of Transmission Tower (4-5feet).
2. Design & Fabrication of tower & universal mount bracket for sensor array.
3. Design & Fabrication of Omni-Directional Laser Adjust Mount.
4. Design & Fabrication of LASER & LDR array circuit
5. Design of main circuit with GSM/Bluetooth/RF Communication system.
6. Design & Fitting of solar panel and power supply circuit.
7. Programming complete system.
8. Assembly of circuit and battery in main box & mounting to tower.
9. Complete assembly and the testing of LASER Protection Scheme.
10. Rectifying errors if any & finding areas of improvement.

### 4. CONCLUSION

The aim of our project is design of autonomous protection scheme using LASER mesh for transmission line crossing road and agricultural farms is to design this system in such manner that it can protect human being and vehicles passing through transmission line as well as this all will help to complete our final aim i.e. to protection due to sagging of conductor.

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