



# COST-EFFECTIVE 3-WAY LASER SAFETY SYSTEM FOR AGRICULTURAL FIELD SECURITY

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## Abstract:-

We all know that safety or protection is most in private property. Agriculture fields are often vulnerable to unauthorized entry, leading to crop damage, theft and financial losses. Traditional fencing can be costly and difficult maintain across large area. There's a critical need for an affordable, reliable, and easily deployable security solution.

This project introduces an innovative security system designed to protect agricultural fields. This system forms a continuous, three-way path detection around a farm boundary, immediately alerting farmers to any intrusion and is designed to provide a low-cost and efficient protection for restricted areas without the use of microcontroller. This system consisting of laser diodes, mirrors and LDR (Light Dependent sensor). When the laser beam of diode falls on mirror it reflects in other direction where another mirror is place in other corner finally, it reflects back to LDR sensor. when any of the beams are interrupted, the change in light intensity across the LDR alert it's resistance, which in turn triggers a transistor-based switching circuit connected to a buzzer .

**Keywords:** Laser module, LDR, Arduino, buzzer, intrusion detection

## I. INTRODUCTION

With the advancement of embedded systems and sensor technology, automated security systems have become widely used for monitoring boundaries and restricted areas.

Traditional security methods often require manual supervision or complex infrastructure, which may not always be practical.

Laser-based security systems offer accurate detection and quick response. By creating an invisible boundary using laser beams, any interruption can be easily identified. The 3-Way Laser Security System is designed to monitor intrusion from multiple directions, increasing coverage and reliability. This system can be applied in various scenarios such as perimeter security, restricted access monitoring, and experimental demonstration of intrusion detection techniques.

## Problem Statement

Manual monitoring of secured areas is inefficient and prone to human error. There is a need for an automated system that can detect intrusion from multiple directions and provide immediate alerts using simple and affordable hardware.

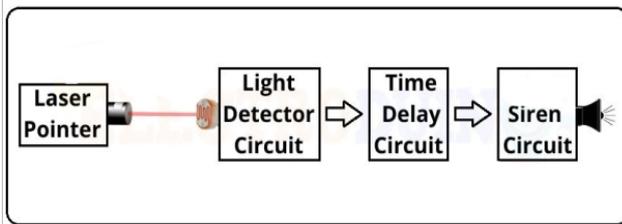
## Description about the work

The proposed system consists of three laser-sensor pairs placed in different directions. Each laser module is aligned with a corresponding LDR sensor. These sensor outputs are connected to a buzzer

- Laser path 1 monitors one direction
- Laser path 2 monitors a second direction
- Laser path 3 monitors a third direction

When any of the laser beams is interrupted, the intensity of light falling on the LDR changes.

## 2. Architectural Design for Proposed System



**Fig 2.1. Proposed system block diagram**

Fig 2.1 The system architecture consists of a power supply, laser modules, light-sensitive sensors, a control unit, and an alert mechanism. The laser and sensor combinations act as input units, while the alert device acts as the output unit.

The power supply provides the required voltage to all components. The control unit continuously monitors the sensor signals and triggers the alert whenever an interruption is detected.

### Working Principle

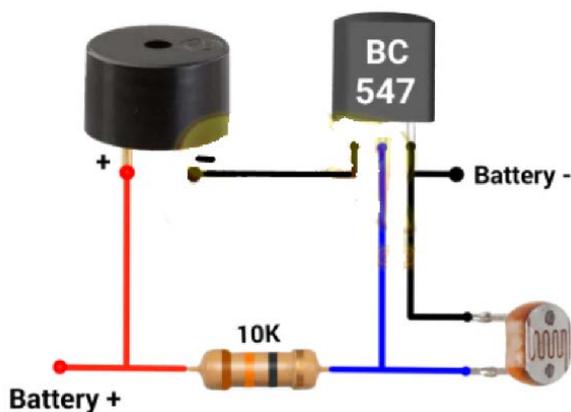


Fig 2.2 When the power supply is switched ON, the laser modules emit continuous light beams directed toward the sensors. The sensors receive constant light intensity and generate a stable electrical signal.

If any object interrupts the laser beam, the light intensity on the sensor decreases. This change in intensity results in a variation in the sensor output. The control unit detects this variation and Once the obstruction is removed, the laser beam reaches the sensor again, and the system returns to its normal operating condition

### Hardware and Software Requirements

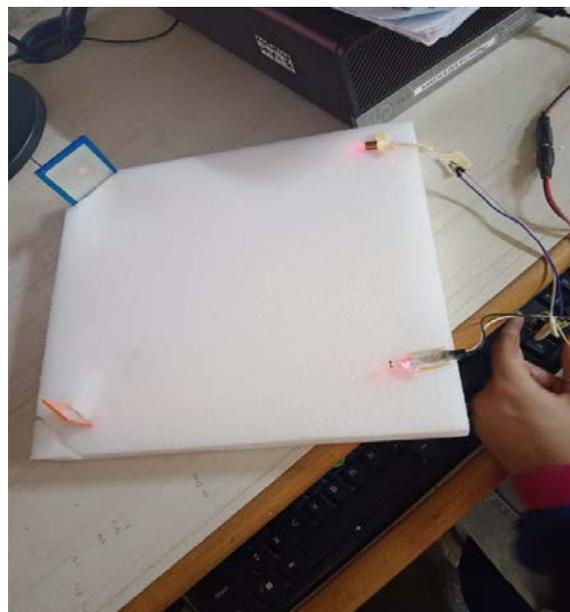
Hardware Components required for the project are:

1. Laser Module
2. Light dependent resistors
3. Alert device
4. Power supply
5. Connecting wires

## 3. Interfacing and Testing

The interfacing process involves connecting the laser modules, light-sensitive sensors, control unit, and alert mechanism in a systematic manner. The laser modules are powered using a regulated power supply and are fixed firmly on the thermocol board to maintain proper alignment. Each laser module is positioned such that its emitted beam directly falls on the corresponding light-dependent resistor (LDR).

The LDR sensors are connected to the control circuit through appropriate resistors to form a voltage divider network. This arrangement allows the sensor to produce a measurable voltage variation based on the intensity of light received. The output from each LDR is interfaced to the input pins of the control unit, which continuously monitors the sensor values.



**Fig3.1 Laser arrangements**

An alert device such as a buzzer or LED is interfaced to the output pin of the control unit. This alert mechanism is activated whenever the sensor output crosses a predefined threshold due to interruption of the laser beam.

During testing, the system is powered ON and the laser alignment is verified. When the laser beam continuously falls on the LDR, the system remains in an idle condition, and the alert device stays OFF. To test the system, the laser beam is manually obstructed using an object. Upon interruption, the sensor output changes immediately, and the alert device is activated. The ensure consistent detection and reliable performance. Proper functioning of the system confirms correct interfacing of all hardware components and effective signal processing by the control unit.

#### **4.Result**

The implemented prototype successfully demonstrated the working of a laser-based intrusion detection system. The system was able to detect interruption of the laser beam accurately and generate an alert without any noticeable delay.

When the laser beam was uninterrupted, the sensors maintained stable output levels, and no false alerts were observed. Upon obstruction of the laser path, the alert mechanism was triggered instantly, indicating effective detection. Once the obstruction was removed, the system returned to its normal monitoring state automatically.

The use of multiple laser paths enabled detection from different directions, improving the overall coverage of the system. The prototype showed reliable operation during repeated testing and maintained consistent performance throughout the experiment. The results confirm that the proposed system is simple, efficient, and suitable for demonstrating laser-based detection concepts in academic and experimental environments.

#### **5.Conclusion**

The 3-Way Laser Security System effectively demonstrates the principle of intrusion detection using laser beams and light-sensitive sensors. The system is simple to design, easy to implement, and suitable for academic projects and experimental demonstrations. With further enhancements, it can be extended to more advanced monitoring applications .

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