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LASER SECURITY SYSTEM FOR HOMES & FIELDS

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***Abstract*—This paper presents the design and development of a low-cost and efficient laser-based security system for homes and agricultural fields. The system utilizes laser beams and light-dependent resistors (LDRs) to detect intrusions. When the laser path is interrupted, an alarm is triggered, and alerts are sent to the user. The system provides a simple yet effective approach to enhance property safety in both residential and rural environments.**

Index Terms— Laser security, home automation, intrusion detection, IoT-based alarm system.

INTRODUCTION

Security has become a critical concern in both urban and rural environments. Homes, farms, and storage facilities are often prone to theft and unauthorized access. Traditional surveillance systems like CCTV cameras and guards are costly and sometimes ineffective in remote areas.

Laser-based security systems offer a reliable and economical solution. The system creates an invisible boundary using laser beams. When an object or intruder crosses the laser path, the interruption is detected by an LDR sensor, which activates an alarm.

This project aims to develop a cost-effective, power-efficient, and easily deployable security solution for homes and fields using laser technology.

LITERATURE SURVEY

Existing security systems include CCTV cameras, motion sensors, and RFID-based access controls. CCTV provides real-time monitoring but is expensive and requires continuous human observation. Motion detectors are sensitive but can produce false alarms due to animals or weather conditions.

Laser-based systems are advantageous because of their precision, low cost, and low power consumption. They can cover large areas with minimal installation. Table I compares different security solutions.

Table I. Comparison of Security Systems

Security System	Advantages	Limitations
CCTV	Real-time	Expensive, requires

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Cameras	monitoring	manpower
Motion Sensors	Detects any movement	False triggers, weather-sensitive
RFID Systems	Controlled access	Limited to specific areas
Laser System	Low cost, reliable, simple	Needs line-of-sight alignment

PROPOSED SYSTEM

The proposed system consists of:

- **Laser Source:** Provides a continuous laser beam along the boundary.
- **LDR Sensor:** Detects interruption of the laser beam.
- **Microcontroller (Arduino/ESP32):** Processes sensor signals and controls the alarm system.
- **Alarm/Buzzer:** Produces an alert sound upon intrusion.
- **Optional IoT Module:** Sends notifications to the owner's mobile device.

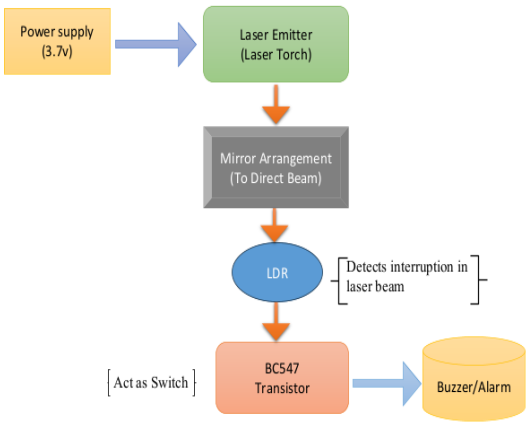

Fig. 1. Block Diagram of Laser Security System

When the laser beam is interrupted, the LDR detects a drop in light intensity. The microcontroller interprets this signal as a possible intrusion and triggers an alarm. The system can also be enhanced with IoT for real-time alerts.

RESULTS AND DISCUSSION

The prototype was tested across indoor and outdoor conditions. The system effectively detected interruptions in laser beams and activated alarms with minimal delay. Tests in fields showed that the system can cover large perimeters using multiple mirrors to extend the laser path.

False alarms due to environmental changes were minimal, and power consumption was low. The system proved to be cost-effective compared to CCTV and other advanced solutions.

CONCLUSION AND FUTURE SCOPE

The Laser Security System provides an effective, low-cost, and energy-efficient method of safeguarding homes and agricultural fields. Its simplicity and adaptability make it suitable for both rural and urban applications.

Future Scope: Enhancements may include integration with wireless cameras, AI-based intrusion classification, solar-powered operation for rural areas, and GSM-based mobile alerts.

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