

Low-Cost Laser Security System with Intrusion Detection and Alert Mechanism

Sujan Banerjee, Lecturer, Swami Vivekananda School of Diploma, Durgapur-713212
Priyanka Dutta, Sr. Lecturer, Swami Vivekananda School of Diploma, Durgapur-713212
Sudip Kr. Bid, Sr. Lecturer, Swami Vivekananda School of Diploma, Durgapur-713212
Debabrata Sarkhel, Lecturer, Swami Vivekananda School of Diploma, Durgapur-713212
Kailash Bauri, Lecturer, Swami Vivekananda School of Diploma, Durgapur-713212

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Abstract

Security becomes necessary factor nowadays. The crime gang improves their technology to perform their operation along with the development of technology. Hence, technology of security should be more improved to protect the crime works. We have decided to make a security project. In this project we have used laser light for security purpose. We know laser light goes through long distance. When any person or object passes through the laser line, the security alarm will start to ring. There are two parts of the system. One is transmitter and other is receiver. The transmitter side consists of a pair of dry cell batteries and an on-off switch. The receiver side, there is a focusing LDR (Light Dependent Resistor) sensor to sense the laser ray. It is connected with the main driver circuit which has two parts. One is signal of discontinuity ray and other is alarm circuit. When anybody passes through the ray, the main circuit sense the discontinuity and turn on the alarm circuit. The alarm will be ringing until the off button is pressed. There are two methods of ringing. One is the duration of ringing depends on preset timer and another is reset manually. Any option can be set by DPDT switch. We have used second method for our project. Mirrors are attached at every corner to reflect the ray coming from the laser. The reflected ray coming from the last mirror will hit the LDR directly. The system has built with low cost and high performance. The power consumption of the system is very low.

Keywords: Laser, LDR, Alarm circuit, DPDT Switch

1. Introduction

Need of security is the basic necessity of any individual. The feeling that we are safe and everything around us is all right which is imperative for a peaceful living. But in this unsafe world, when crime, terror and threats are on their peak, how can one attain that sense of security? Here, laser security system provides us with a solution and for this reason more and more people are installing them in order to stay safe and secure. Various electronic security systems can be used at home and other important working places for security and safety purposes. Laser Security alarm is a device used for security purposes. It has a wide application in fields of security and defence starting from the security of simple house hold material to a very high valued material of an organization. Lasers differ from other light sources in a few significant ways. There are two features that are important for security systems. Unlike a light bulb or flashlight, laser light doesn't spread out, it is a narrow beam. And laser light is essentially a single colour. As laser light doesn't spread much, it can be sent a long way and still have enough energy in a small area to trigger the security system detector. Laser light travels in a straight line. Laser security systems start with a laser ray pointing to a small mirror. The first mirror is angled to direct the beam to a second small mirror, and so on until the final mirror directs the beam to the detector. If the beam is interrupted anywhere between the laser and the detector, the alarm circuit will give the warning signal.

2. Literature Review

Rogers & Tonnyy have developed laser security system to alert the home owner remotely via GSM module in case intrusion is detected. In addition, an alarm has also been implemented to signal home intrusion. An LDR sensor, GSM modem and buzzer have been interfaced with Arduino microcontroller [1]. A. Anitha have used IoT to create an inexpensive security system for homes as well as industrial use. The security system will use a microcontroller known as Arduino Uno to interface between the components, a magnetic Reed sensor to monitor the status, a buzzer for sounding the alarm, and a WiFi module, ESP8266 to connect and communicate using the Internet [2]. Hemane et.al have used laser light for security system to cover a large area. Laser light goes through long distance without scattering effect. It's also visible only at source and incident point, otherwise

invisible [3]. AB Arjona have used laser as a major component to provide protection in a certain area. A laser works as a result of resonant effects [4]. Ashis Rai et.al have used LDR as a sensor which can detect the moving object whenever it pass or cross the beam of laser light and it can also occupy small area as well as it covers longer distances [5]. K. Raviraj et.al have designed a Laser & LDR based Security system. This is based on the principle of voltage divider circuit. when the laser beam continuously falls on the LDR, the voltage drop across it is very low as the resistance of LDR becomes less. And as soon as the laser beam is interrupted by any means of object or a barrier the voltage drop across it becomes high due to change in the LDR's resistance. This triggers the alarm or siren in the circuit [6]. V. Lusterio et.al have proposed using a multi-laser alarm system by mainly using Arduino Uno board. Like laser systems common in action films, the project makes use of multiple lasers to detect motion on the location. The device is programmed to produce noise when all the LDR receive zero light from the lasers. The researcher thinks of using multiple lasers to increase the detection of human movement [7]. Rahul Thodupunoori have worked on a wireless security system that can be controlled through a wireless remote or a touch tone phone from any place. The main component of this system are the infrared motion sensors and basic alarm unit. It works on detecting heat of any human body when there is any technical fault, in turn the alarm unit is triggered [8]. Nagalakshmi P, N., and J. Senthil Kumar P have proposed a idea to provide a solution by constructing a cost efficient electronic system that has the capability of sensing the motion of the intruders and setting off the alarm. The basic idea behind this project is that all the bodies generate some heat energy in the form of infrared which is invisible to human eyes. But it can be detected by electronic motion sensor [9]. MN Lafta have proposed a new security system which is based on a multi-laser alarm system and Light Dependent Resistors (LDRs). Multiple lasers are used to find movement in the location, just like the laser systems in action movies [10].

3.Methods and Model Specifications

3.1. Methodology

The methodology of a laser home security system is based on the concept of light obstruction. The system consist of three essential components: a laser, a detector, and sensing electronics. The laser emits a concentrated beam of light which is directed at the detector. The detector is sensitive to light and produces a voltage when the laser light hits it. The detector is connected to the sensing electronics, which monitor the voltage output from the detector. When the laser beam is interrupted the voltage output from the detector changes. The sensing electronics detect this change in voltage an trigger an alarm.

3.2. Circuit Diagram

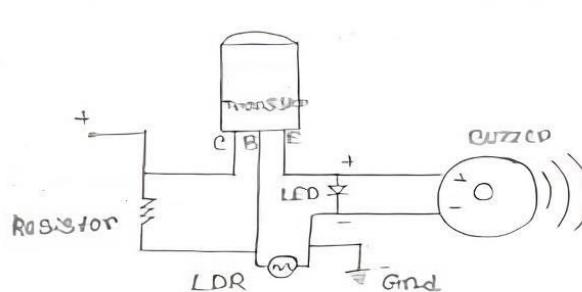


Figure 1. Circuit diagram of laser security system

3.3. Model Specifications

LED:- A light-emitting diode (LED) is a semiconductor device that emits light when an electric current flows through it. When current passes through an LED, the electrons recombine with holes emitting light in the process. LEDs allow the current to flow in the forward direction and blocks the current in the reverse direction.



Figure 2. LED

Battery:- An electric battery is a device consisting of two or more electrochemical cells that convert stored chemical energy into electrical energy. Each cell contains a positive terminal, or cathode, and a negative terminal, or anode.



Figure 3. Battery

Switch:- Switch is an electronic device that is used to make or break an electrical circuit. The primary application of switch is to ON-OFF any circuit.



Figure 4. Switch

Connecting Wire:- Connecting wire allows an electrical current to travel from one point on a circuit to another, because electricity needs a medium through which to move.



Figure 4. Connecting Wires

Resistance:- A resistor is a passive electrical component with two terminals that is used to obstruct the flow of electric current. Resistors have a variety of applications in electronic circuits, including lowering current flow, adjusting signal levels, dividing voltages, biasing active components, and terminating transmission lines.



Figure 6. Resistance

Transistor:- A transistor is a semiconductor device that is used to switch or amplify electrical power and electronic signals. It contains at least three terminals for connecting to an external circuit and is constructed of semiconductor materials, most often silicon or germanium.



Figure 7. Transistor

Buzzer:- An auditory signaling device, such as a buzzer or beeper, can be piezoelectric, electromechanical, or mechanical. Buzzers and beepers are commonly used in alarm systems, timers, and to confirm user input, such as mouse clicks and keystrokes.



Figure 8. Buzzer

Laser:- A laser is a device that uses optical amplification, which is based on the stimulated emission of electromagnetic radiation, to emit light. The phrase "light amplification by stimulated emission of radiation" is where the term "laser" first appeared.



Figure 9. Laser

LDR:- A light-controlled variable resistor is called a photo resistor, light-dependent resistor (LDR), or photocell. A photo resistor demonstrates photoconductivity when its resistance drops as the intensity of the incident light increases. Light-sensitive detector circuits and light-and dark-activated switching circuits can both benefit from the use of photo resistors



Figure 10. LDR

3.4. Hardware Model



Figure 11. Hardware Model and Design

3.5 Budget

SL. NO.	EQUIPMENTS DETAILS	BUDGET (Rs)
1	LED	5/-
2	BATTERY	65/-
3	SWITCH	25/-
4	CONNECTING WIRE	30/-
5	RESISTANCE	10/-
6	TRINISITOR	20/-
7	BUZZER	25/-
8	LASER	60/-
9	LDR	10/-
TOTAL AMOUNT		250/-

4. Empirical Results

Laser security systems start with a laser ray pointing to a small mirror. The first mirror is angled to direct the beam to a second small mirror, and so on until the final mirror directs the beam to the LDR. If the beam is interrupted anywhere between the laser and the LDR, the alarm circuit will give the warning signal.

5. Conclusion

Laser security system is mainly switch dependent sensors and a basic alarm system. If a person is in front of the sensor, that person's body touch the laser's heat, which triggers the system's alarm, hence creating an alarming situation.

6. Future Scope

- **Cyber security:** - Laser security system can be used to detect cyber threats, such as hacking attempts, by monitoring network activity and detecting anomalies.
- **Smart cities:** - Laser security systems can be integrated into smart city infrastructure to provide enhanced security.
- **Border control:** - Laser technology can be used to monitor and secure borders, detecting and preventing illegal crossing and smuggling.
- **Research and Development:** - The use of laser technology in security system can drive innovation and advancements in fields such as materials science, optics and computer vision.

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