NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL

LASER SECURITY SYSTEM WITH REMOTE ACSESS

Submitted in partial fulfilment of the requirements of the course

ELECROMAGNETIC THEOREY
COURSE CODE – EE207

By

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We would also like to thank our department for providing the necessary equipment and knowledge to carry out experiments and simulations for our project.

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ABSTRACT

This project deals with a design model of a laser security alarm system. Previously, laser security systems were difficult to install and were available only to the ultra-wealthy. There are a variety of security systems on the market today that use lasers and can effectively protect everything from small homes and businesses to large facilities.

Most home laser security systems consist of two parts: Basic alarm unit and its access. A laser-based security system is a type of security and alarm system that uses laser light and light sensors. Why Use Lasers? Laser light is known to travel long distances without scattering effects (interference) and is visible only at the source and target points, so it can be used as an intermediary between the source and the target, but analysing the source requires a sensor. The use of LDR applies here. Analysis alone is not enough. Alerts should be made generically. The alert is a sound effect, so the buzzer acts as an alert here. We use this to design a laser safety system.

There is a laser diode that produces a laser beam that continuously hits a light-dependent resistive sensor. When a person crosses the road, the laser is blocked from reaching the LDR, causing the sensor to produce a low signal. This signal is read by the controller and turns on the buzzer.

But there is one more thing that we should take into consideration here. The people who belong to the facility that’s protected by laser security system also move in and out; which causes the alarm to go on. Now that’s where the access part comes in. The access of our security system is given to all those who need, using an IR receiver and a transmitter circuit which can toggle our security system. This adds some weight to the efficiency of model too.

INTRODUCTION

Need of security is the necessity of any individual. The feeling that we are safe and everything around us is all right is imperative for a peaceful living. Laser security system provides us with an assured security 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: starting from the security of simple house hold material to a very high valued material of an organization. This form of security system is becoming more affordable.

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. Because laser light doesn't spread much, it can be sent it a long way and still have enough energy in a small area to trigger the security system detector. Because it's a single wavelength, it can put a blocking filter on the detector to let laser light through without letting background light onto the detector.

Laser light travels in a straight line. For instance, to protect the front of the yard, putting the laser at one comer and the detector at the other corner would do the job. That's not a very practical configuration, though. More typically, if it is needed to protect the perimeter of a room, or at least the enhances. So, laser security systems start with a laser 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 electronics will put the warning signal.

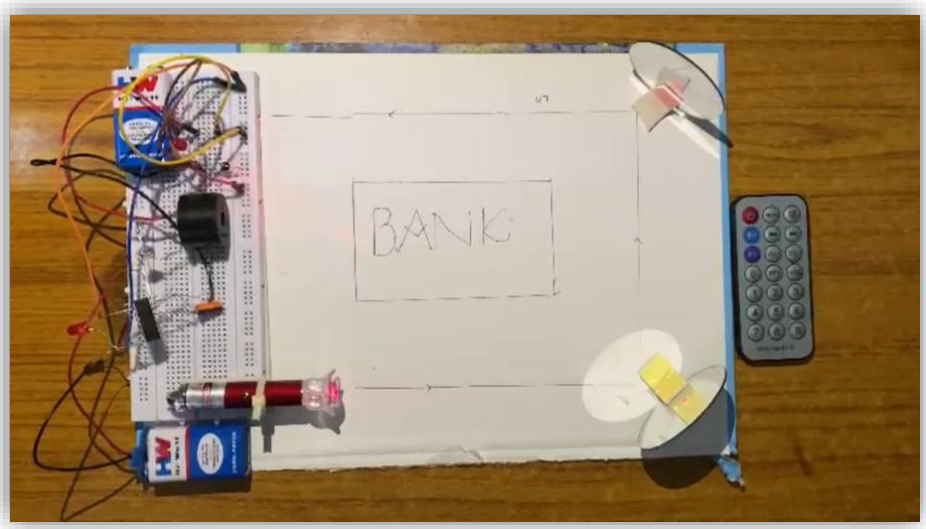

FIG 01 : LASER SECURITY SYSTEM

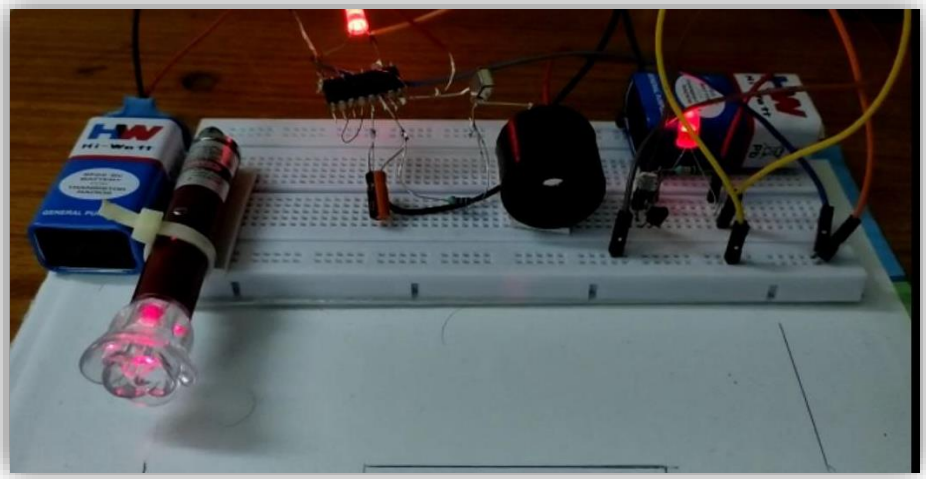

FIG 02 : LASER SECURITY SYSTEM WITH REMOTE ACCESS

PRINCIPLE

There are three essential components to a laser security system: a laser, a detector and sensing circuit. The laser is a concentrated light source that puts out a straight line, 'pencil beam, of light of a single colour. The detector is sensitive to light and puts out a voltage when the laser light hits it. The detector is connected to the sensing circuit. When the laser beam is interrupted and cannot reach the detector, LDR sensor transmits a signal and switches the buzzer on and gives out an alarm.

Second part of our project includes an IR receiver and transmitter circuit. The transmitter circuit consists of an LED which emits IR radiation which will be sensed by IR receiver. The signal sent out by transmitter is unique (coded in binary using combination of high and low outputs. Thus, any random transmitter cannot set out same signal and toggle security system circuit.

RELATION WITH EMT

Electromagnetic waves, which is treated as one of the most important outcomes of EMT is related majorly to the scope of this project. Two waves i.e., Laser and IR which are produced due to time varying electric and magnetic fields propagating perpendicular to each other is used to build a security system with remote access in simplest of ways.

LASER is an acronym for Light Amplification by Stimulated Emission of Radiation. It's constructed from 3 basic components: a lasing medium, an energy source and an optical resonator. The principal dangers of lasers are damage to the eye, burns and flammability. Laser wavelengths are usually in the Ultraviolet, Visible or Infrared Regions of the Electromagnetic Spectrum.

IR LED is a special type of LED that emits Infrared rays of the Electromagnetic Spectrum. The wavelength of Infrared Rays is greater than that of Visible light and hence they are invisible to human eye. A typical IR LED emits infrared rays in a wavelength range of 740 – 760 nm. There are many sources of infrared light like sun, light bulbs, all hot items and even human body. So, in order to prevent interference and false triggering, we will modulate the infrared light. The modulated signal can only be demodulated by the appropriate IR Receiver.

COMPNENTS

1. Laser
2. LDR (Light Dependent Resistor)
3. Buzzer (5V)
4. Battery
5. Resistor (1k , 100k ohm)
6. Transistor (BC547)
7. Capacitor (10macroF, 63V)
8. LED lights
9. Bread board
10. IC (CD4017)
11. IR Receiver
12. Remote
13. Connecting wires (Jumper wires)

14. Mirrors

COMPNENTS EXPLAINED:

1. **LASER:** A laser is a device that emits light through a process of optical amplification based on stimulated emission of electromagnetic radiation. A laser differs from other sources of light in that it emits light coherently.

2. **LDR SENSOR (LIGHT DEPENDENT RESISTOR**) : The Laser & LDR system is highly sensitive with a great range of working. The system senses the light emitted by the Laser falling over the LDR connected with the circuit. Whenever the beam of light is interrupted by any means, it triggers the alarm or siren. This highly reactive approach has low computational requirement; therefore, it is well suited to surveillance, industrial application and smart environments. Photo resistors work based on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the materials conductivity is increased when light is observed by the material.

3. **BUZZER**: A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, and piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

The buzzer consists of an outside case with two pins to attach it to power and ground. When current is applied to the buzzer it causes the ceramic disk to contract or expand. Changing this then causes the surrounding disc to vibrate. That's the sound that you hear. Adjust the potentiometer to increase or decrease the resistance of the potentiometer. If you increase the resistance of the potentiometer then it will decrease the Volume of the buzzer. If you decrease the resistance of the potentiometer then it will increase the Volume of the buzzer.

Fig 3 : Buzzer

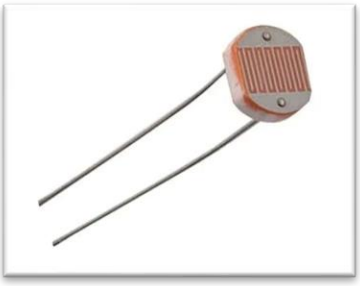

Fig 4 : LDR Sensor

4. IR RECEIVER: IR receiver receives the modulated Infrared waves and changes its output. Like for example TSOP1738 reacts when it receives the IR radiation modulated at 38Khz. Means it detects the IR which is switching On and Off at the rate of 38Khz. TSOP's output is active low, means its output is remains HIGH when there is no IR, and becomes low when it detects IR radiation. TSOP operates on a particular frequency so that other IRs in the environment can't interfere, except the modulated IR of particular frequency. It has three pins, Ground, Vs (power), and output pin.

Fig 5 : IR Receiver

WORKING

The basic sensing component of a modern laser security system is an infrared motion detector. The motion detector contains four parts: the laser, the mirrors, the detector and the sensing electronics. An infrared motion detector works by projecting a beam of light that shoots across a space into a series of mirrors and finally into a detector, which emits a particular voltage into the sensing electronics as long as the laser hits it. When the beam of light is broken, the detector changes its voltage output into the sensing electronics, which then trigger an alarm.

The LDR must be placed in dark place or inside a case so that the other source of light except the laser beam does not affect the LDR. This helps the circuit to work faster and properly.

The principle of Infrared (IR) communication using IR Transmitter and Receiver is explained here. The working of the project is as follows. As mentioned earlier, the circuit is divided into IR transmitter and IR receiver circuits. The infrared rays emitted by the IR Transmitter i.e., IR LED must be detected by the IR Receiver, timer is designed to operate in.

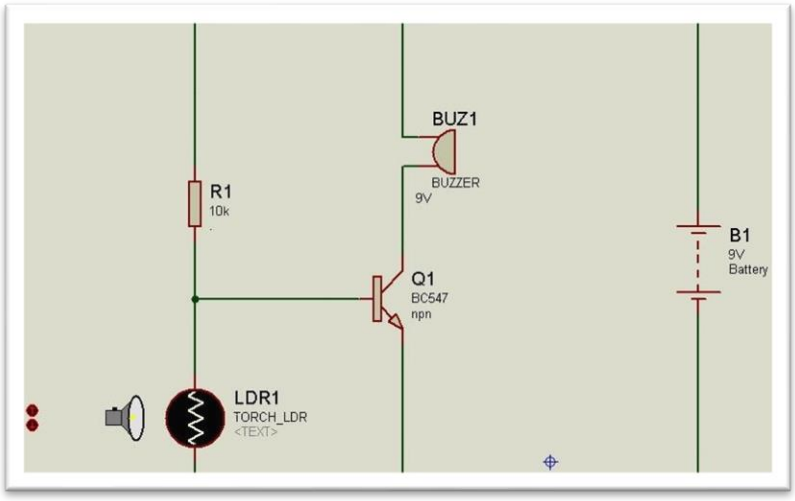

Fig 6 : Circuit Diagram

The output from IR receiver is programmed in binary and is modulated with is high frequency wave. As the transmitted wave is unique, it can never mix with other signals. Thus, any other random remote cannot turn our security system on or off. The access remains only with the people who actually own the secured facility.

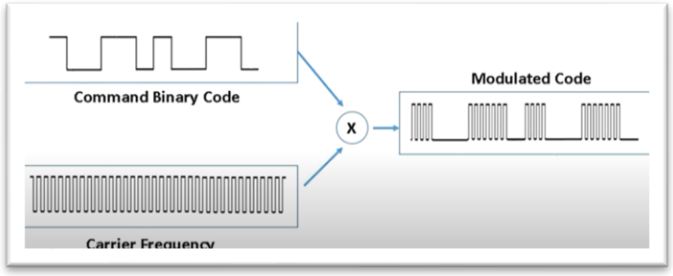

Fig 7: Unique modulated wave

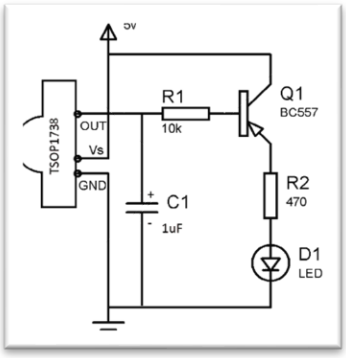

Fig8: IR Receiver circuit diagram

PROS

- These are easy to install and work at both within as well as outside houses. These are very effective perimeter alarm systems around properties. In indoor systems can utilize the normal power outlets and jacks making them inconspicuous. At outside these can be easily be hidden behind the bushes or plants without causing any damage. They consume less power when compared to the laser system as the whole, which is expensive.
- These laser systems can be installed in homes either by self or by hiring a technical person.
- Security systems has been cut to a large extent. So, making laser systems one among affordable security system options can be very safe.

- Lasers are strong in beam width and can be focused on the perfect target. By using laser security system one can be safe in the case of harmful effects to the body. As the beam width used in the laser security systems are not strong beam widths.
- The circuit, construction and setup for the Laser Security System are very simple. If used with a battery, the laser security system can work even when there is a power outage.

CONS

- The laser security system works only if the laser is obstructed. If the intruder passes without obstructing the laser, it is considered as a failure.
- In order to secure a larger area, we need more lasers and corresponding sensors.

APPLICATIONS

- Laser Security System can be used in safety lockers in our homes, where even if the locker's code is hacked, it acts as an additional layer of security.

- Apart from security systems, this laser-based setup can also be used to check if pets or babies crossed a certain boundary.

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CONCLUTION

Laser security system provides us the security against any crime, theft in our day-to-day life and so people are installing them in order to stay safe, secure and sound. Various electronic security systems can be used at home and other important working places for security and safety purposes. It is a great opportunity and source of saving man power contributing no wastage of electricity. The "Laser Security System" is an important helping system. Using this system robbery, thefts & crime can be avoided to large extend. Avoiding thieves' results in the safety of our financial assets and thereby this system provides us protection against all.

The Laser & LDR system is highly sensitive with a great range of working. The system senses the light emitted by the Laser falling over the LDR connected with the circuit. Whenever the beam of light is interrupted by any means, it triggers the alarm or siren. This highly reactive approach has low computational requirement; therefore, it is well suited to surveillance, industrial application and smart environments.