"LA

A Project Wor

of the require in

CONTROL AND INSTRU

by

NABAJYOTI NATH (CIT/12/CI/0

PRAGYAN BORDOLOI (CIT/11/CI/014)

MANISH KUMAR SINGH (CIT/11/CI/025)

Under the supervision of

MR. DIPANKAR SUTRADHAR

(Asst. Professor, Dept. of IE)

DEPARTMENT OF INSTRUMENTATION ENGINEERING

केन्द्रीय प्रौद्योगिकी संस्थान कोकराझार

CENTRAL INSTITUTE OF TECHNOLOGY KO

(A Centrally Funded Institute under Ministry of HRD, Gov

DOLAND TERRITORIAL AREAS DISTRICTS :: KOKRAJ

May 2015

A project report on

"LASER SECURITY SYSTEM"

A Project Work Submitted in Partial Fulfilment
of the requirements for the Diploma
in

CONTROL AND INSTRUMENTATION

by

NABAJYOTI NATH (CIT/12/CI/002)
PRAGYAN BORDOLOI (CIT/11/CI/014)
MANISH KUMAR SINGH (CIT/11/CI/025)

Under the supervision of

MR. DIPANKAR SUTRADHAR

(Asst. Professor, Dept. of IE)

DEPARTMENT OF INSTRUMENTATION ENGINEERING

केन्द्रीय प्रौद्योगिकी संस्थान कोकराझार

CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

(A Centrally Funded Institute under Ministry of HRD, Govt. of India)

BODOLAND TERRITORIAL AREAS DISTRICTS :: KOKRAJHAR :: ASSAM :: 783370

May 2015

DECLARATION

We hereby declare that the project work entitled "LASER SECURITY SYSTEM" is an authenticated work carried out by us under the guidance of Mr. Dipankar Sutradhar for the partial fulfilment of the award of the diploma in Control And Instrumentation and this work has not been submitted for similar purpose anywhere else except to Department of IE, Central Institute of Technology, Kokrajhar.

Date:

Place:

Nabajyoti Nath

Nabajyoti Nath

(CIT/12/CI/002)

Pragyan Bordoloi

Pragyan Bordoloi

(CIT/11/CI/014)

Manish Kumar Singh.

Manish Kumar Singh

(CIT/11/CI/025)

DEPARTMENT OF INSTRUMENTATION ENGINEERING

केन्द्रीय प्रौद्योगिकी संस्थान कोकराझार

CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

(A Centrally Funded Institute under Ministry of HRD, Govt. of India)

BODOLAND TERRITORIAL AREAS DISTRICTS :: KOKRAJHAR :: ASSAM :: 783370

Certificate of Approval

This is to certify that the work embodied in this project entitled **"LASER SECURITY SYSTEM"** submitted by Nabajyoti Nath, Pragyan Bordoloi and Manish Kumar Singh to the Department of Instrumentation Engineering, is carried out under my direct supervisions and guidance.

The project work has been prepared as per the regulations of Central Institute of Technology and I strongly recommend that this project work should be accepted in partial fulfilment of the requirement for the Diploma.

Supervisor

HoD Incharge
I.E. Department
CIT, Kokrajhar

(Mr. Dipankar Sutradhar)
Assistant Professor
Dept. of Instrumentation Engineering

DEPARTMENT OF INSTRUMENTATION ENGINEERING

केन्द्रीय प्रौद्योगिकी संस्थान कोकराझार

CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

(A Centrally Funded Institute under Ministry of HRD, Govt. of India)

BODOLAND TERRITORIAL AREAS DISTRICTS :: KOKRAJHAR :: ASSAM :: 783370

Certificate by the Board of Examiners

This is to certify that the project work entitled **"LASER SECURITY SYSTEM"** submitted by Nabajyoti Nath, Pragyan Bordoloi and Manish Kumar Singh to the Department of Instrumentation Engineering of Central Institute of Technology has been examined and evaluated.

The project work has been prepared as per the regulations of Central Institute of Technology and qualifies to be accepted in partial fulfilment of the requirement for diploma.

Project Co-ordinator

Board of Examiners

11/06/15

Dipen Deka

ACKNOWLEDGEMENT

First of all, we pay our sincere thanks to our Assistant Professor and our Project Guide, Mr. Dipankar Sutradhar for giving this wonderful opportunity to do the project.

Secondly, we want to thank all the faculty staff and Lab-technician of IE department for spending their crucial time and immensely helping us in our project.

We also thank our classmates and friends who helped us and to clear our doubts.

Finally, we acknowledge our group members as without them it would have been impossible and also we would conclude our deepest gratitude to our parents and all loved ones. Our full dedication to the work would have not been possible without their blessings and moral supports.

Date:

Nabajyoti Nath.

NABAJYOTI NATH

(CIT/12/CI/002)

Pragyan Bordoloi

PRAGYAN BORDOLOI

(CIT/11/CI/014)

Manish Kumar Singh.

MANISH KUMAR SINGH

(CIT/11/CI/025)

CONTENTS

LIST OF FIGURES:

LIST OF TABLES:

ABSTRACT

The objective of this project is to design 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. This project is very simple and helped us to learn more about the components we generally use in our labs and has increased our knowledge to a certain extend.

CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

Need of security is the basic necessity of any individual. The feeling that we are safe and everything around us is all right 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 defense starting from the security of a simple house hold material to a very high valued material of an organization. They once used to be expensive solutions for security needs. Owing to cost cutting and fast technological advancements, this form of security system is becoming more affordable.

We probably seen an old Western movie where the good guys settle down and run a string at ankle height around their camp, tying it to a can filled with rocks. When the bad guys try to sneak up in the middle of the night, they kick the wire and pull the can over, making a rattle that awakens the sleeping good guys, who win the day. A laser security system works along the same principle. Instead of a string, there's a beam of light surrounding the area, and instead of a can of rocks, there's an alarm of one sort or another.

1.1.1 The Principles of Laser Security Systems

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 can't reach the detector, its voltage output changes, and the circuit sense the change and put out a warning signal.

1.1.2 Lasers

Lasers differ from other light sources in a few significant ways. There are two features that are most important for security systems. Unlike a lightbulb or flashlight, laser light doesn't spread out, it stays in a narrow beam. And laser light is essentially a single colour. Because laser light doesn't spread much, you can send 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, you can put a blocking filter on the detector to let laser light through without letting background light onto the detector.

1.1.3 System Layout

Laser light travels in a straight line. If you just wanted to protect the front of your yard, putting the laser at one corner and the detector at the other corner would do the job. That's not a very practical configuration, though. More typically, you'll want to protect the perimeter of a room, or at least the entrances. 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 out the warning signal.

1.1.4 Warning Signal

Laser security systems are available in many configurations, with many levels of sophistication. There are do-it-yourself kits that will buzz or ring when the beam is interrupted. The electronics also can be set to trigger an auto-dialler that contacts local law enforcement or a monitoring company. The electronics can also trigger the exterior lights of the house to flash, helping police locate the house where the alarm has been triggered.

1.1.5 Movies and Reality

We all know that movies present exaggerated images of reality, and that's especially true of the way laser security systems are presented by Hollywood. The typical image will show a pattern of criss-crossing red or green shafts of light filling or outlining a room. The hero (or villain) then carefully steps through the maze, avoiding those lines of light and making it to the diamond. In reality, laser beams are not visible as they travel through the air, unless there is dust or moisture in the air. On the other hand, there will be some scattered light from the mirrors and the detector that can be a giveaway that a laser security system is installed.

1.2 LITERATURE REVIEW

The earliest security system comes from the early 1990's. They were very expansive at that time and hard to monitor an intrusion. Now the technology has developed very much more than the old days.

Laser security system are also known as burglar alarm systems. In most common security system laser and light dependent resistor are used. This system is easy to construct and install.

Now a days lots of advance security system such as PIR based security system, temperature detecting based security system, infrared security system, etc. has come into existence. Among them this system is simple and effective too.

1.3 OBJECTIVE

The core objective of this project is to design a laser security system with laser and light dependent resistor, which will protect the individuals from crime, terror and threats in unsafe world in order to stay safe and secure.

CHAPTER 2
PROJECT DETAILS

2.1 Block Diagram

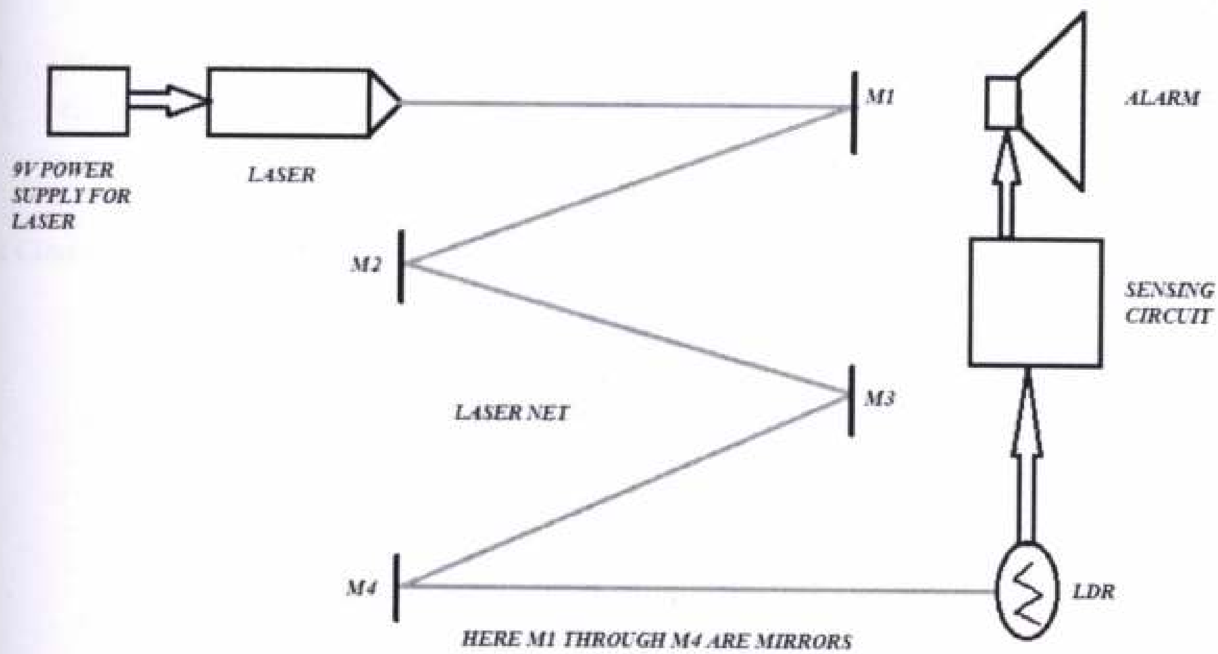

Figure 1: Block Diagram of Laser Security System

The block diagram consists of:

i) **Power supply for the Laser**

ii) **Laser**

iii) **LDR**

iv) **Sensing circuit**

v) **Alarm**

i) **Power supply for the Laser:** it consists of a 9 volt battery with a resistor of 220 ohm attached to the laser.

ii) **Laser:** this is the laser diode which acts as a light source and continuously emits light to fall on the LDR.

iii) **LDR:** light dependent resistor which acts as the detector.

iv) **Sensing circuit:** the sensing circuit consists of all the components required for the circuit such as transistors, resistors, capacitors along with 9 volt power supply connection.

v) **Alarm:** the alarm is connected to the sensing circuit, the alarm gives out the warning signal due to security failure.

2.2 Circuit Diagram

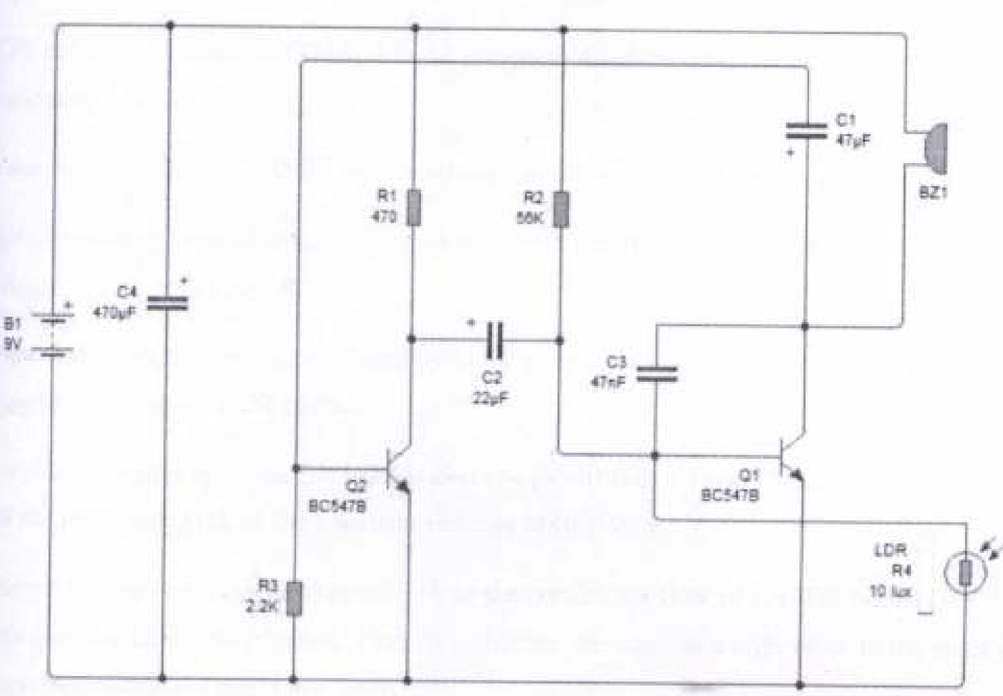

Figure 2: Circuit Diagram of Laser Security System

2.4 Components used in the circuits:

ITEMS	QUANTITY
Laser (**9v**)	1
LDR	1
LED	1
Buzzer (**9v**)	1
Transistors (**BC547**)	2
Resistors (**2.2K, 56K, 220Ohm & 47Ohm**)	1 each
Capacitors (**470uF, 47uF, 22uF & 47nF**)	1 each
Battery (**9v**)	2
PCB	1

Table 1: Components used in the circuit

CHAPTER 3
DESCRIPTION OF COMPONENTS

3.1 LASER

A laser is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation. The term "laser" originated as an acronym for "light amplification by stimulated emission of radiation".

A laser differs from other sources of light in that it emits light coherently. Spatial coherence allows a laser to be focused to a tight spot, enabling applications such as laser cutting and lithography. Spatial coherence also allows a laser beam to stay narrow over great distances (collimation), enabling applications such as laser pointers. Lasers can also have high temporal coherence, which allows them to emit light with a very narrow spectrum, i.e., they can emit a single colour of light. Temporal coherence can be used to produce pulses of light as short as a femtosecond.

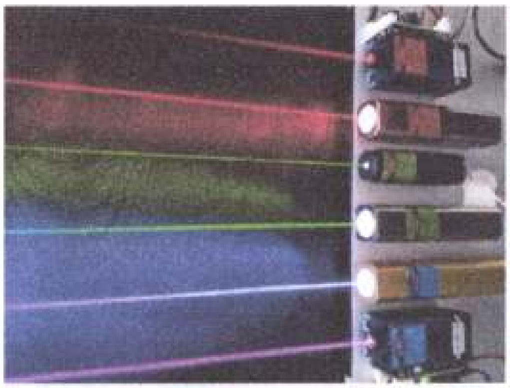

Figure 3: Red (660 & 635 nm), green (532 & 520 nm) and blue-violet (445 & 405 nm) lasers

Applications:

- Medicine: Bloodless surgery, laser healing, surgical treatment, kidney stone treatment, eye treatment, dentistry.
- Industry: Cutting, welding, material heat treatment, marking parts, non-contact measurement of parts.
- Military: Marking targets, guiding munitions, missile defence, electro-optical countermeasures (EOCM), alternative to radar, blinding troops.
- Law enforcement: used for latent fingerprint detection in the forensic identification field.

- Research: Spectroscopy, laser ablation, laser annealing, laser scattering, laser interferometry, lidar, laser capture microdissection, fluorescence microscopy.
- Product development/commercial: laser printers, optical discs (e.g. CDs and the like), barcode scanners, thermometers, pointers, holograms, bubble grams.
- Laser lighting displays: Laser light shows.
- Cosmetic skin treatments: acne treatment, cellulite and striae reduction, and hair removal.

3.2 LDR (Light Dependent Resistor)

A photoresistor or light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits.

A photoresistor is made of a high resistance semiconductor. In the dark, a photoresistor can have a resistance as high as a few mega ohms (MΩ), while in the light, a photoresistor can have a resistance as low as a few hundred ohms. If incident light on a photoresistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of a photoresistor can substantially differ among dissimilar devices. Moreover, unique photoresistors may react substantially differently to photons within certain wavelength bands.

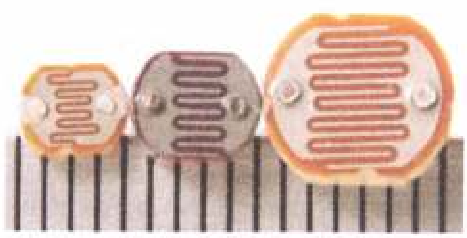

Figure 4: Three photoresistors with scale in mm

3.3 LED (Light Emitting Diode)

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a pn-junction diode, which emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the colour of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor.

An LED is often small in area (less than 1 mm^2) and integrated optical components may be used to shape its radiation pattern.

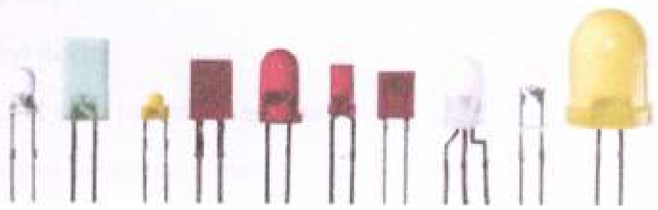

Figure 5: LEDs are produced in a variety of shapes, sizes & colour

Applications:

LED uses fall into four major categories:

- Visual signals where light goes more or less directly from the source to the human eye, to convey a message or meaning.
- Illumination where light is reflected from objects to give visual response of these objects.
- Measuring and interacting with processes involving no human vision.
- Narrow band light sensors where LEDs operate in a reverse-bias mode and respond to incident light, instead of emitting light.

3.4 BUZZER

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

Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current, causing the contacts to buzz. Often these units were anchored to a wall or ceiling to use it as a sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made.

Figure 6: Simple buzzer

Applications:

- Annunciator panels
- Electronic metronomes
- Game show lock-out device
- Microwave ovens and other household appliances
- Sporting events such as basketball games
- Electrical alarms

3.5 TRANSISTOR

A transistor is a semiconductor device used to amplify and switch electronic signals and electrical power. It is composed of semiconductor material with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal. Today, some transistors are packaged individually, but many more are found embedded in integrated circuits.

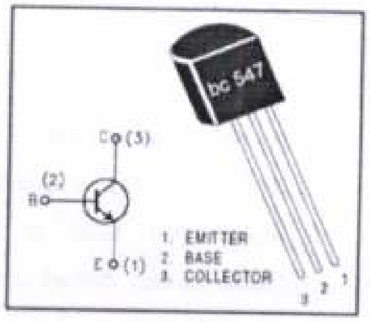

Figure 7: BC547 transistor

3.6 RESISTOR

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. In electronic circuits resistors are used to limit current flow, to adjust signal levels, bias active elements, terminate transmission lines among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implemented within integrated.

The electrical function of a resistor is specified by its resistance: common commercial resistors are manufactured over a range of more than nine orders of magnitude. The nominal value of the resistance will fall within a manufacturing tolerance.

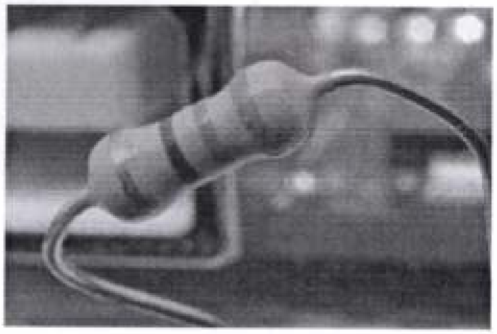

Figure 8: A typical axial-lead resistor

3.7 CAPACITOR

A capacitor (originally known as a condenser) is a passive two-terminal electrical component used to store energy electrostatically in an electric field. The forms of practical capacitors vary widely, but all contain at least two electrical conductors (plates) separated by a dielectric (i.e. insulator). The conductors can be thin films, foils or sintered beads of metal or conductive electrolyte, etc. The non-conducting dielectric acts to increase the capacitor's charge capacity. A dielectric can be glass, ceramic, plastic film, air, vacuum, paper, mica, oxide layer etc. Capacitors are widely used as parts of electrical circuits in many common electrical devices. Unlike a resistor, an ideal capacitor does not dissipate energy. Instead, a capacitor stores energy in the form of an electrostatic field between its plates.

An ideal capacitor is characterized by a single constant value for its capacitance. Capacitance is expressed as the ratio of the electric charge Q on each conductor to the potential difference V between them. The SI unit of capacitance is the farad (F), which is equal to one coulomb per volt (1 C/V). Typical capacitance values range from about 1 pF (10^{-12} F) to about 1 mF (10^{-3} F).

Capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass. In filter networks, they smooth the output of power supplies. In resonant circuits they tune radios to particular frequencies. In electric power transmission systems, they stabilize voltage and power flow.

Figure 9: Different types of capacitors

Applications:

- Energy storage
- Pulsed power and weapons
- Power conditioning
- Suppression and coupling
- Motor starters
- Signal processing
- Sensing
- Oscillators
- Hazards and safety

3.8 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. Electrolytes allow ions to move between the electrodes and terminals, which allows current to flow out of the battery to perform work.

Primary (single-use or "disposable") batteries are used once and discarded; the electrode materials are irreversibly changed during discharge. Common examples are the alkaline battery used for flashlights and a multitude of portable devices. Secondary (rechargeable batteries) can be discharged and recharged multiple times; the original composition of the electrodes can be restored by reverse current. Examples include the lead-acid batteries used in vehicles and lithium ion batteries used for portable electronics.

Batteries come in many shapes and sizes, from miniature cells used to power hearing aids and wristwatches to battery banks the size of rooms that provide standby power for telephone exchanges and computer data centres.

Figure 10: Various cells and batteries

3.9 PCB & Jump Wires

A printed circuit board (PCB) mechanically supports and electrically connects electronic components using conductive tracks, pads and other features etched from copper sheets laminated onto a non-conductive substrate. PCBs can be single sided (one copper layer), double sided (two copper layers) or multi-layer (outer and inner layers). Multi-layer PCBs allow for much higher component density. Conductors on different layers are connected with plated-through holes called vias. Advanced PCBs may contain components - capacitors, resistors or active devices - embedded in the substrate.

Printed circuit boards are used in all but the simplest electronic products. Alternatives to PCBs include wire wrap and point-to-point construction. PCBs require the additional design effort to lay out the circuit, but manufacturing and assembly can be automated. Manufacturing circuits with PCBs is cheaper and faster than with other wiring methods as components are mounted and wired with one single part. Furthermore, operator wiring errors are eliminated.

A jump wire, is a short electrical wire with a solid tip at each end (or sometimes without them, simply "tinned"), which is normally used to interconnect the components in a breadboard. PE: among others, they are used to transfer electrical signals from anywhere on the breadboard to the input/output pins of a microcontroller.

Jump wires are fitted by inserting their "end connectors" into the slots provided in the breadboard that beneath its surface has a few sets of parallel plates that connect the slots in groups of rows or columns depending on the area. The "end connectors" are inserted into the breadboard, without soldering, in the particular slots that need to be connected in the specific prototype.

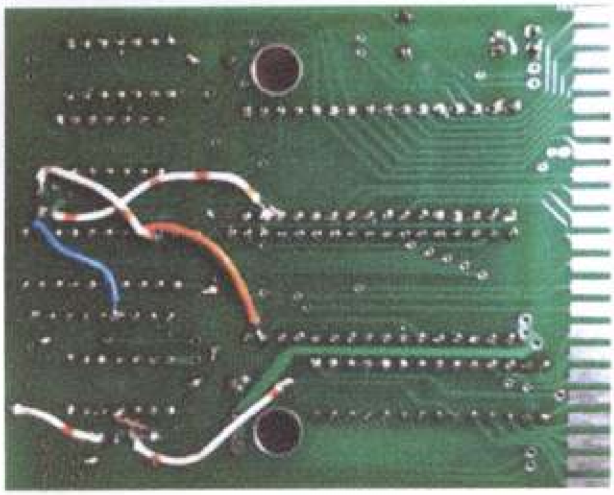

Figure 11: PCB with Jump Wires

CHAPTER 4
RESULTS & DISCUSSION

In our project Laser and LDR is the core of the laser security system. The circuit is all about when the laser beam falling over the LDR continuously is interrupted by the object in the field of laser net. Hence the LDR develops an output voltage and the alarm rings showing the sign of any intruders.

In this way it can reduce the problem of thefts and intruders in our day to day life and it also helps in reducing manual works as this circuit is automatically operating one.

The Laser Security System has been successfully designed and developed. The buzzer is turned on as the laser beam falling on the LDR is interrupted. The experimental model was made according to the circuit diagram and the result were as expected.

The LDR has to be placed in dark place or inside a case so that the other sources of light except the laser beam doesn't affect the LDR. This helps the circuit to work faster and properly.

During the operation the laser beam is allowed to reflect through mirror to mirror as shown in block diagram to create crisscross rays of laser beams. This is beneficial for the advanced protection over a very small objects.

The circuit consumes lots of energy to work and thus implanting this system with AC connection using transformer and rectifier circuit would give better performance. Also using of infrared laser could make the laser net invisible to human eye. Use of microcontroller could give better result for the laser security system.

CHAPTER 5
CONCLUSION

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.

Advantages and Disadvantages

Laser security systems have many advantages. They are simple to install and can be used effectively inside or outside a home. The systems can be used as a highly effective perimeter alarm for property boundaries or even for pools, where customers can have the lasers set to detect when small children come within a set number of feet from the edge of the water. Indoors, the sensors utilize normal power outlets and telephone jacks; outdoors, the sensors can be hidden beneath plants and bushes and will not harm lawns or other vegetation. However, laser security systems can be prohibitively expensive. While some security system plans allow for customers to target one room, plans that protect large amounts of land or an entire house will cost much more and can be difficult for many customers to afford.

Future Prospects

Future progress of this work can be identified in the areas summarized below –

- We will try to upgrade this system to an advanced level by using invisible laser or infrared light.
- We can also use microcontroller or some timer IC circuit to make the performance of this system better.
- Also with the help of sound sensing transducer, photo footage can be captured using secret camera as soon as the alarm rings.

CHAPTER 6
APPENDIX

A) Cost analysis of the project:

ITEMS	**QUANTITY**	**PRICE**
Laser (**9v**)	1	Rs. 80
LDR	1	Rs. 14
LED	1	Rs. 4
Buzzer (**9v**)	1	Rs. 60
Transistors (**BC547**)	2	Rs. 30
Resistors (**2.2K, 56K, 220Ohm & 47Ohm**)	1 each	Rs. 8
Capacitors (**470uF, 47uF, 22uF & 47nF**)	1 each	Rs. 8
Battery (**9v**)	2	Rs. 60
PCB	1	Rs. 136
Miscellaneous things		Rs. 150
Total	**Rs. 550**	

Table 2: Cost analysis of the project

B) Photograph of the prototype:

Circuit Model:

Figure 12: Circuit Model of Laser Security System

Hardware Model:

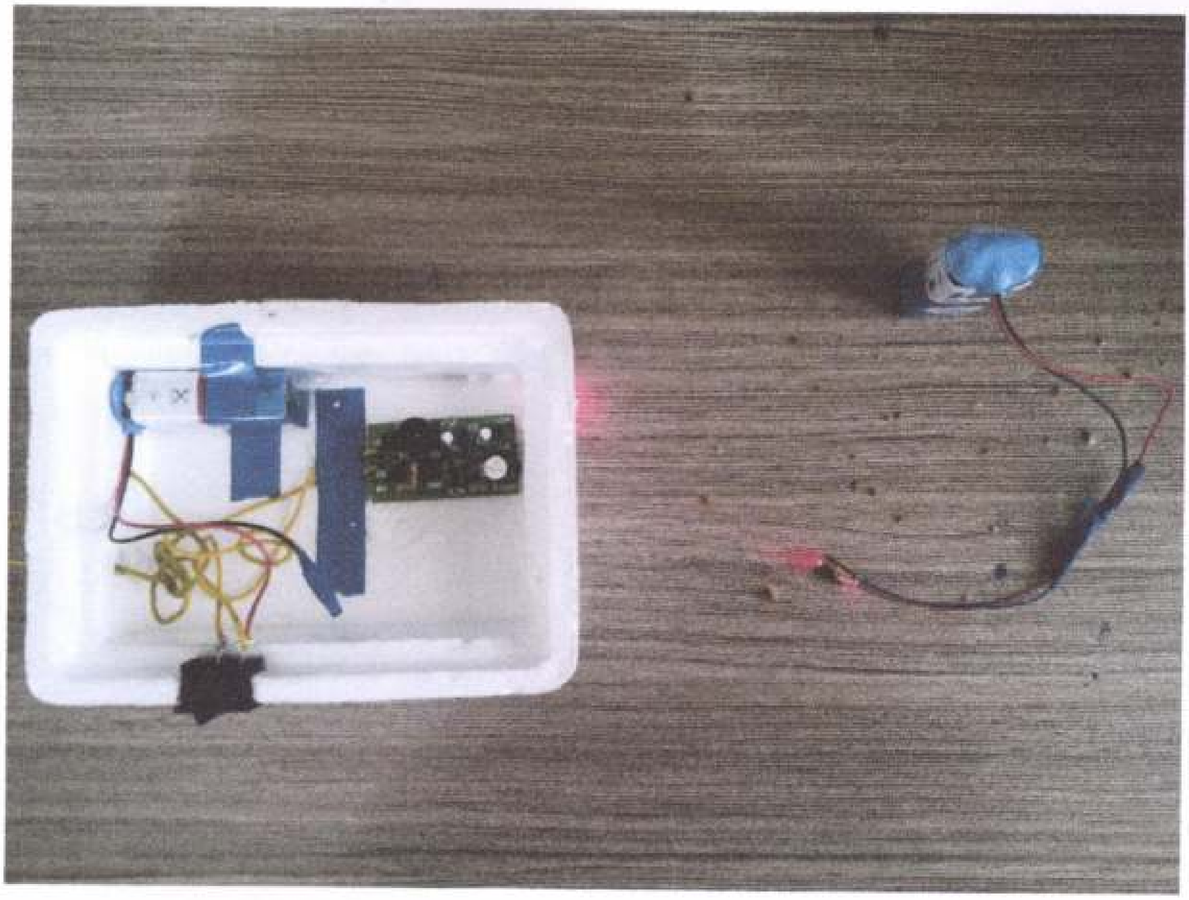

Figure 13: Hardware Model of Laser Security System

BIBLIOGRAPHY

http://en.wikipedia.org/wiki/Main_Page

http://facebook.com/groups/428951677186998/

http://science.opposingviews.com/laser-security-systems-work-1631.html

http://www.circuitsgallery.com/2012/09/home-security-alarm.html

http://www.ehow.com/how-does_5001517_laser-security-systems-work.html