LASER SECURITY ALARM SYSTEM

Course: Analog Electronic Circuit

Course Code: ECE2002

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Lab Slot: L41+L42

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Vellore Institute of Technology

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OBJECTIVE:

To design a circuit that will function as a security alarm system by exploiting the properties of a laser beam.

INTRODUCTION:

A security alarm is a system designed to detect intrusion – unauthorized entry – into a building or area. The word LASER stands for Light Amplification by Stimulated Emission of Radiation.These are available in different types like semiconductor, infrared, Ga As laser diode. This has an energy wavelength of approximately 900 nanometers with a beam divergence of 3 million radians i.e. equal to a beam width small beam width.Security alarms are used in residential, commercial, industrial, and military properties for protection against burglary (theft) or property damage, as well as personal protection against intruders. Car alarms likewise protect vehicles and their contents. Prisons also use security systems for control of inmates

So me alarm systems serve a single purpose of burglary protection; combination systems provide both fire and intrusion protection. Intrusion alarm systems may also be combined with closed-circuit television surveillance systems to automatically record the activities of intruders, and may interface to access control systems for electrically locked doors. Systems range from small, self-contained noisemakers, to complicated, multi-area systems with computer monitoring and control.

INNOVATION COMPONENT:

LASER-Ray goes through long distance without scattering effect and the Ray is almost invisible. Only the radiation point and incident point is visible. So by this security project we can make an invisible boundary of a sensitive area.

Even though there are several LASER security alarms available in the market, they are very expensive and thus are suitable only for huge establishments. So we wanted to make a security alarm system that is cost effective, efficient and affordable by normal household for our safety.

TECHNICAL APPROACH:

Security is a most important factor today. Technology develops day by day in the world. The crime gang also improves their technology to perform their operation. So technology of security should be modern with time to protect the crime works. In this project we have used laser light to cover a large area. We know laser light goes through long distance without scattering effect. It's also visible only at source and incident point, otherwise invisible. These two properties help us to build up a modern security system, which may name as "laser security". When any person or object crossover the laser line the security alarm will ringing and also the focus light will "on" to focus the entrance of unauthorized person, moreover with help of Bluetooth, user will be notified. We can make a security boundary of single laser light by using mirror at every corner for reflection. The automatic assumption that a beam of light whose beam diameter is of the order of magnitude of the collector mirrors is "secure" in principle is strictly true only for propagation in empty space.It is manually switch dependent sensors and a basic alarm unit.

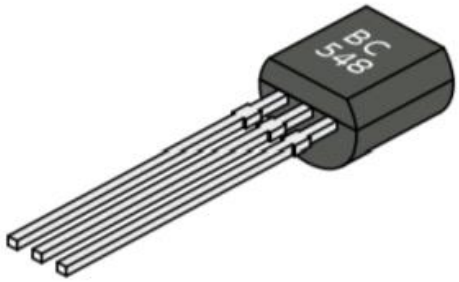
COMPONENTS REQUIRED:

- LDR
- BC548 NPN transistors (2 Nos)
- Resistors (100 Ω , 4 Nos)
- LEDs • Buzzer
- Switch
- Battery
- Breadboard and jumper wire
- Arduino Uno
- Laser Light

COMPONENT DESCRIPTION:

1. TRANSISTOR-BC548

The BC548 is a general purpose NPN bipolar junction transistor found commonly in European electronic equipment and present-day designs in Australian and British electronics magazines where a commonly-available low-cost NPN transistor is required. It is a part of a family of NPN and PNP epitaxial silicon transistors that include higher-quality variants, originating in 1966 when Philips introduced the metal-cased BC108 family of transistors which became the most used transistors in Australiaand taken up by many European manufacturers. The BC548 is the modern plastic packaged BC108, and can be used in any circuit designed for the BC108 or BC148, which includes many Mullard and Philips published designs.



2. LDR

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 lightsensitive 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 megohms (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.

3. RESISTORS

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.

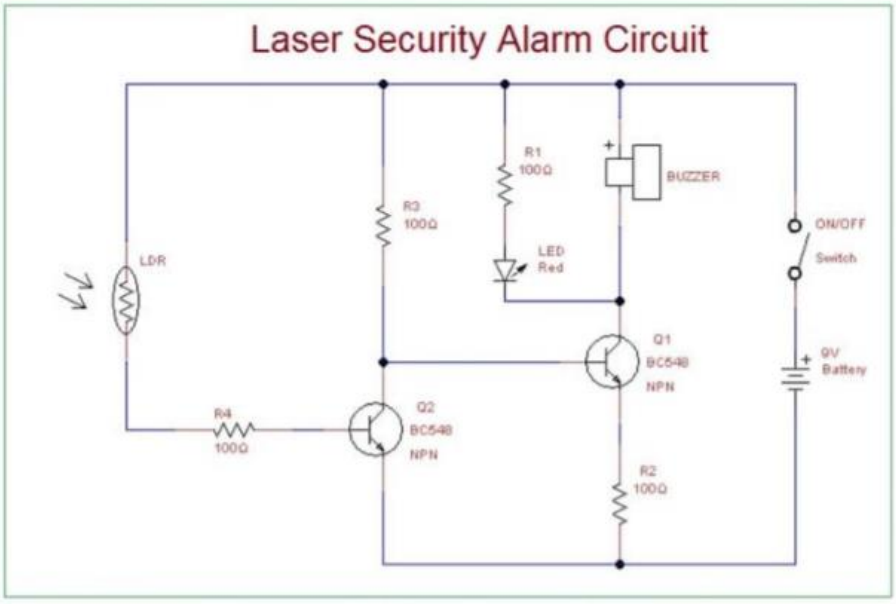
4. BUZZER

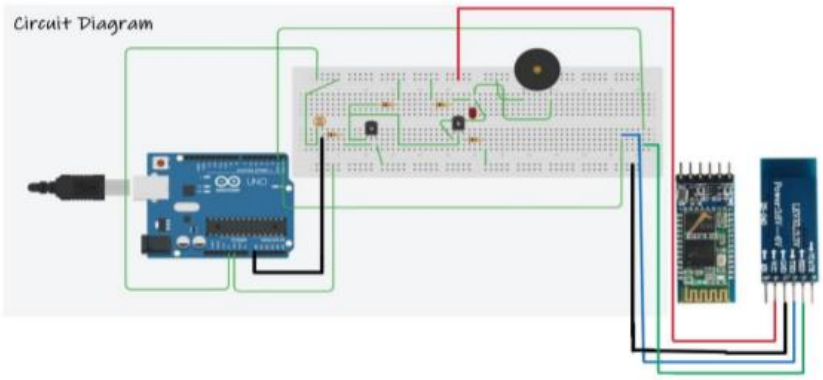
A buzzer or beeper is an audio signaling device, which maybe mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.Early devices were based on an electromechanical system identical 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. piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.

5. LED

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of lightemitting phosphor on the semiconductor device

CIRCUIT DIAGRAM





WORKING METHODOLOGY:

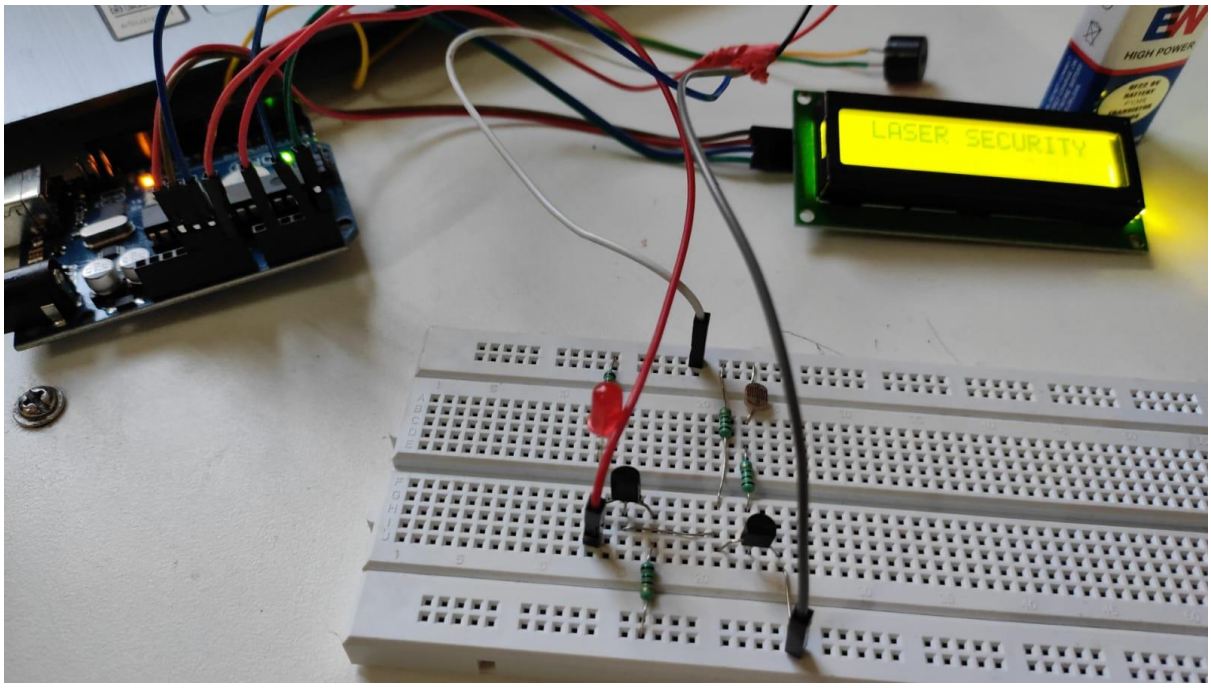
Two NPN (BC548) transistors implemented in this security alarm circuit act as a switching device. An LDR (Light Dependent Resistor) is connected to the base terminal of Q2 transistor through R4 resistor and this LDR gives low resistance when the laser light falls on it and gives high resistance

when there is no laser light. Due to that supply voltage to the Q2 transistor varies depending upon the LDR resistance.

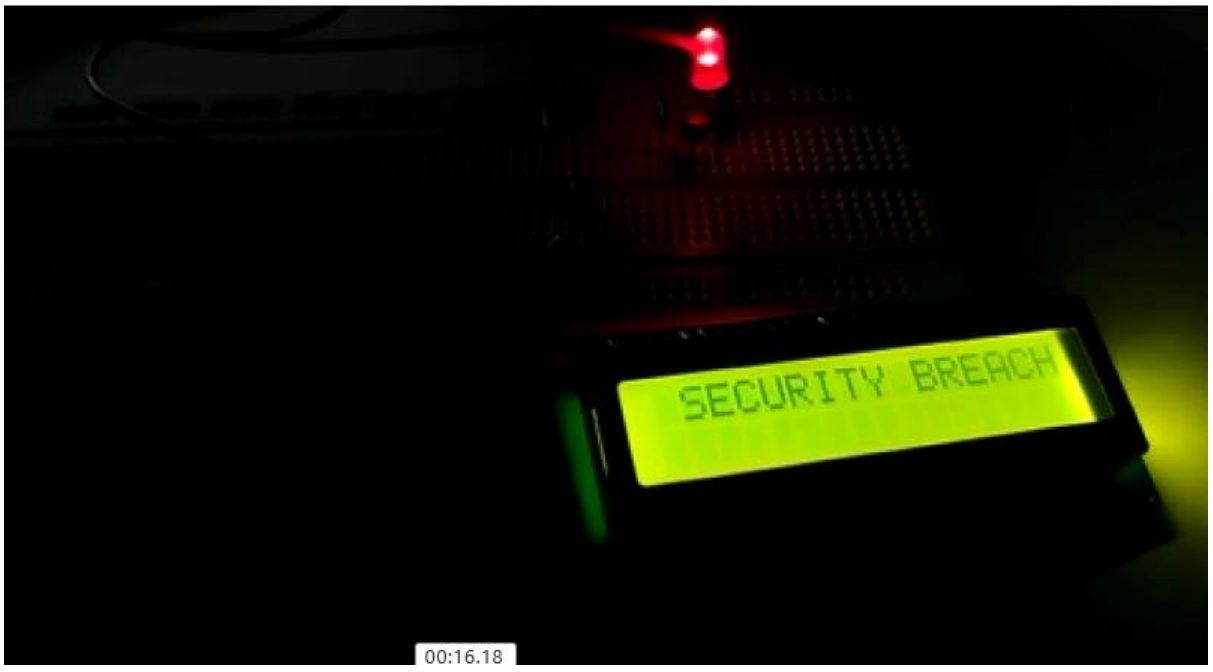
The Q1 transistor's collector terminal is connected with a buzzer and an indicator LED and then base terminal of Q1 transistor is connected to the Q2 transistor's collector terminal and one end of the LDR is connected to Arduino analog pin using signals of which hc-05 module will send message to the android device application stating either "Danger!" or "Safe!". Each transistor needs some threshold voltage to be switched ON, If the laser light falls on LDR it allows supply to the Q2 transistor's base hence it turns ON so the Q1 transistor's base doesn't get any bias, due to that Q1 transistor stays in OFF condition so the buzzer and LED also in OFF condition.

When the laser light is blocked then the LDR is turned to high resistance and there is no voltage flow to the Q2 transistor's base, so Q2 turns OFF but Q1 transistor's base gets supply through R3 resistor and Q1 turns ON, so the buzzer and LED also turns ON and gives an alert sound and indication.

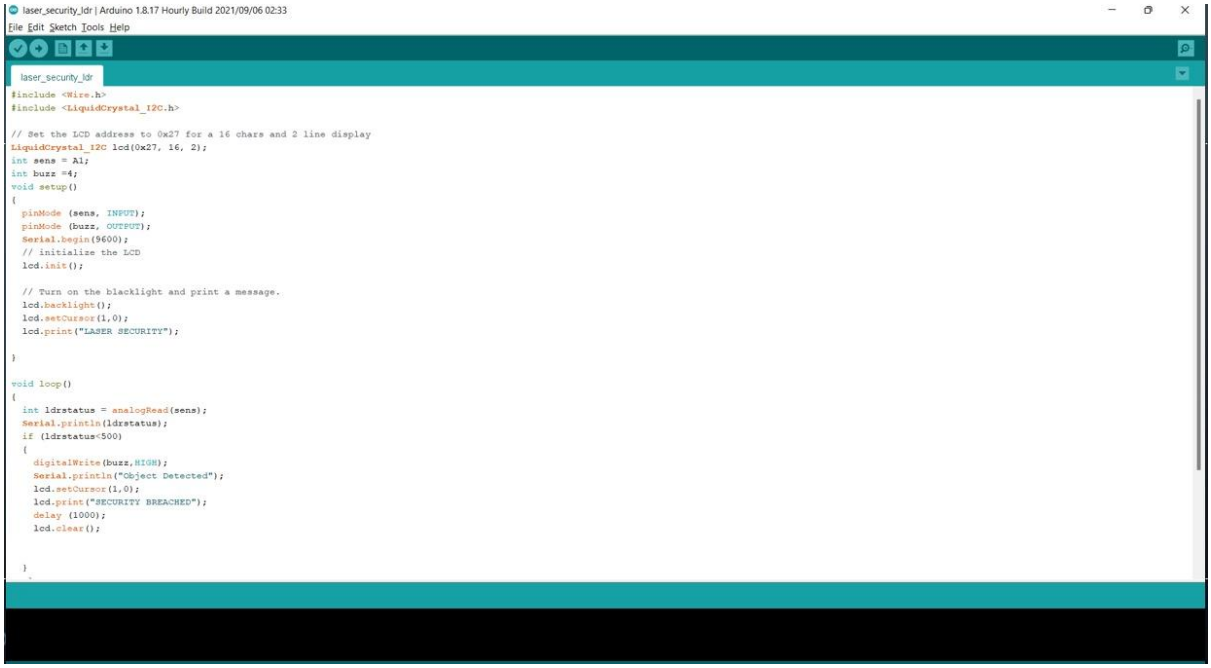
RESULTS:




LASER SECURITY
00:14.22


SECURITY BREACH
00:16.18

AURDINO CODE



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laser_security_ldr

#include <Wire.h>
#include <LiquidCrystal_I2C.h>

// Set the LCD address to 0x27 for a 16 chars and 2 line display
LiquidCrystal_I2C lcd(0x27, 16, 2);
int sens = A1;
int buzz =4;
void setup()
{
  pinMode (sens, INPUT);
  pinMode (buzz, OUTPUT);
  Serial.begin(9600);
  // initialize the LCD
  lcd.init();

  // Turn on the blacklight and print a message.
  lcd.backlight();
  lcd.setCursor(1,0);
  lcd.print("LASER SECURITY");

}

void loop()
{
  int ldrstatus = analogRead(sens);
  Serial.println(ldrstatus);
  if (ldrstatus<500)
  {
    digitalWrite(buzz,HIGH);
    Serial.println("Object Detected");
    lcd.setCursor(1,0);
    lcd.print("SECURITY BREACHED");
    delay (1000);
    lcd.clear();


  }
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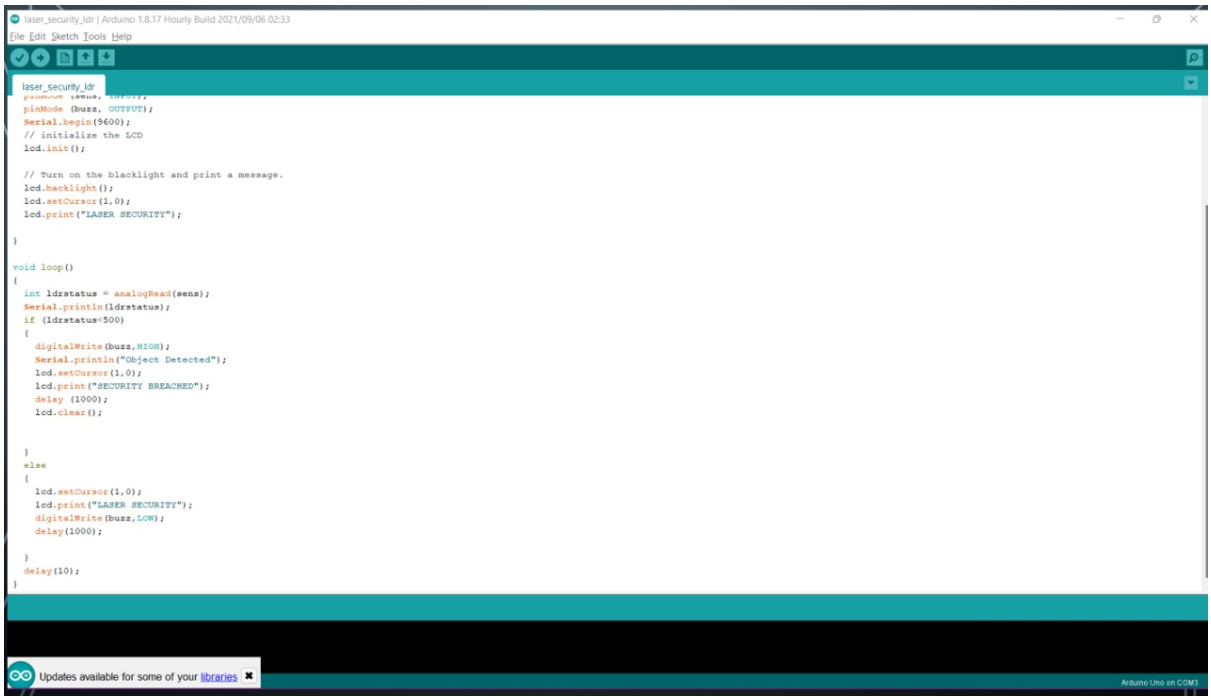

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laser_security_ldr

  pinMode (buzz, OUTPUT);
  Serial.begin(9600);
  // initialize the LCD
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  // Turn on the blacklight and print a message.
  lcd.backlight();
  lcd.setCursor(1,0);
  lcd.print("LASER SECURITY");

}

void loop()
{
  int ldrstatus = analogRead(sens);
  Serial.println(ldrstatus);
  if (ldrstatus<500)
  {
    digitalWrite(buzz,HIGH);
    Serial.println("Object Detected");
    lcd.setCursor(1,0);
    lcd.print("SECURITY BREACHED");
    delay (1000);
    lcd.clear();


  }
  else
  {
    lcd.setCursor(1,0);
    lcd.print("LASER SECURITY");
    digitalWrite(buzz,LOW);
    delay(1000);

  }
  delay(10);
}

Updates available for some of your libraries

Arduino Uno on COM3
```

CONCLUSION

Home security is a rapidly growing field and there are new and improved burglar alarms popping up everyday.

Laser security alarms found in the markets are usually very expensive and mostly suited for big establishments.

So in this project we designed a low-cost laser security alarm system that can be installed in our homes and offices to ensure increased safety.

It is compact and easy to install and use thus making it very suitable for any household.

FUTURE WORK

In the future, we may expect that the LDR will be more sensitive and will give more accurate results while working with LASER rays.

It may also be possible to reduce the size of the circuit to make it even more compact.

REFERENCES

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http://electronicsforu.com/electronics-projects/prototypes/laser-light-security-alarm

https://www.theorycircuit.com/lser-security-alarm-circuit/