IMPLEMENTATION OF LIGHT SENSITIVE ALARM SYSTEM USING IC 555 TIMER

ECB1204 - ANALOG INTEGRATED CIRCUIT

A PROJECT REPORT

Submitted by

RAHAMATHULLA A

RAMANATHAN P

THARUN KUMAR M

in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

ELECTRONICS AND COMMUNICATION ENGINEERING

K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University Chennai and Approved by AICTE, New Delhi)

SAMAYAPURAM, TIRUCHIRAPPALLI – 621 112

NOVEMBER, 2024

K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY (AUTONOMOUS)

SAMAYAPURAM, TIRUCHIRAPPALLI– 621 112

BONAFIDE CERTIFICATE

Certified that this project report titled **“IMPLEMENTATION OF LIGHT SENSITIVE ALARM SYSTEM USING IC 555 TIMER”** is the bonafide work of **RAHAMATHULLA A (2303811710621083), RAMANATHAN P (2303811710621086), THARUN KUMAR M (230381171062114)** who carried out the project under my supervision. Certified further, that to the best of my knowledge the work reported herein does not from part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE	**SIGNATURE**
Dr. S. SYEDAKBAR, M.E., Ph.D.,	Mrs. G. KEERTHANA, M.E.,
HEAD OF THE DEPARTMENT	**SUPERVISOR**
Assistant Professor	Assistant Professor
Department of Electronics and Communication Engineering	Department of Electronics and Communication Engineering
K Ramakrishnan College of Technology (Autonomous)	K Ramakrishnan College of Technology (Autonomous)
Samayapuram – 621 112	Samayapuram – 621 112

Submitted for the viva-voce examination held on ………………

INTERNAL EXAMINER **EXTERNAL EXAMINER**

DECLARATION

We jointly declare that the project report on **“IMPLEMENTATION OF LIGHT SENSITIVE ALARM SYSTEM USING IC 555 TIMER”** is the result of original work done by us and best of our knowledge, similar work has not been submitted to **“ANNA UNIVERSITY CHENNAI”** for the requirement of Degree of **BACHELOR OF ENGINEERING**. This project report is submitted on the partial fulfillment of the requirement of the award of Degree of **BACHELOR OF ENGINEERING**.

SIGNATURE

RAHAMATHULLA A

RAMANATHAN P

THARUN KUMAR M

Place : Samayapuram

Date : 03.12.2024

ACKNOWLEDGEMENT

It is with great pride that we express our gratitude and in-debt to our institution “**K. Ramakrishnan College of Technology (Autonomous)**”, for providing us with the opportunity to do this project.

We are glad to credit honorable and admirable chairman **Dr.K.RAMAKRISHNAN**, **B.E.,** for having provided the facilities during the course of our study in college.

We would like to express our sincere thanks to our beloved Executive Director **Dr. S. KUPPUSAMY, MBA, Ph.D.,** for forwarding our project and offering adequate duration in completing our project.

We would like to thank **Dr. N. VASUDEVAN, M.Tech., Ph.D.,** Principal, who gave opportunity to frame the project with full satisfaction.

We whole heartedly thank **Dr. S. SYEDAKBAR, M.E., Ph.D.,** Head of the Department, Department of Electronics and Communication Engineering for providing his encouragement in pursuing this project.

We express our deep and sincere gratitude to our project guide**, Mrs.G.KEERTHANA, M.E.,** Assistant Professor, Department of Electronics and Communication Engineering, for her incalculable suggestions, creativity, assistance and patience which motivated us to carry out this project.

We wish to express my special thanks to the officials and Lab Technicians of our departments.

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CHAPTER 1
PROBLEM STATEMENT

In many environments, managing light intensity is crucial for safety, efficiency, and convenience. However, traditional manual systems for monitoring and adjusting light levels are inefficient and prone to human error. There is a need for an automated system that can detect varying light levels and respond accordingly to optimize illumination or trigger specific actions based on ambient light conditions.

This project aims to design and implement a Light Sensor and Darkness Detector system that automatically detects light intensity and determines the presence or absence of light. The system should be able to activate or deactivate devices (e.g., lights, alarms, or security systems) based on predefined light thresholds. Such a system could be applied in various contexts, including street lighting, indoor automation, agriculture, and security systems, enhancing energy efficiency and operational reliability.

The challenge lies in ensuring the sensor's accuracy, responsiveness to changes in ambient light, and adaptability to different environments while maintaining cost-effectiveness and ease of integration.

1.1 BACKGROUND OF THE WORK

Light plays a fundamental role in various aspects of daily life, from maintaining visibility and security to supporting plant growth and ensuring energy efficiency. Historically, light management relied heavily on manual systems, where human intervention was necessary to switch lights on or off or adjust their intensity. However, this approach is inefficient, especially in large-scale or dynamic environments such as public lighting, indoor spaces, and agricultural settings.

With advancements in sensor technology and automation, the need for intelligent systems that can monitor and respond to light conditions has grown significantly. Light sensors and darkness detectors are essential components in modern automation systems, offering a reliable and efficient means of managing illumination without human intervention. These systems work by detecting light intensity and triggering actions when certain thresholds are met.

For example:

Automatically switching on lights at dusk and turning them off at dawn.

Controlling indoor lighting to reduce energy consumption.

Monitoring light levels in greenhouses to ensure optimal plant growth conditions.

Activating alarms or lights in the absence of light to deter intruders.

This project leverages basic principles of photoresistive and photodiode technology to design a system that can accurately detect changes in light levels. The goal is to create a device that is not only responsive and accurate but also adaptable to different environmental conditions. By automating light control, the system can contribute to energy savings, reduce human effort, and enhance operational efficiency in various applications.

Early methods of light detection relied on manual observation and control, limiting accuracy and efficiency. With the advent of electrical and electronic technology, light detection became automated through the development of sensors such as photodiodes, photoresistors (LDRs), and phototransistors. These devices convert light intensity into electrical signals, enabling precise measurement and control.

These light-dependent resistors change their resistance based on light intensity, making them suitable for simple, cost- effective applications.

These components offer faster response times and higher sensitivity, ideal for more sophisticated systems.

Modern light detection systems often include microcontrollers (like Arduino or Raspberry Pi) that process sensor data and control devices in real-time. Integration with IoT platforms allows remote monitoring and control via mobile apps or web interfaces.

This project bridges the gap between advanced security systems and cost- effective alternatives, emphasizing the importance of leveraging simple technologies to address real-world challenges. It provides a stepping stone for further advancements, such as integrating wireless communication, camera systems, or remote monitoring capabilities for enhanced functionality.

CHAPTER 2
DESIGN PROCEDURE

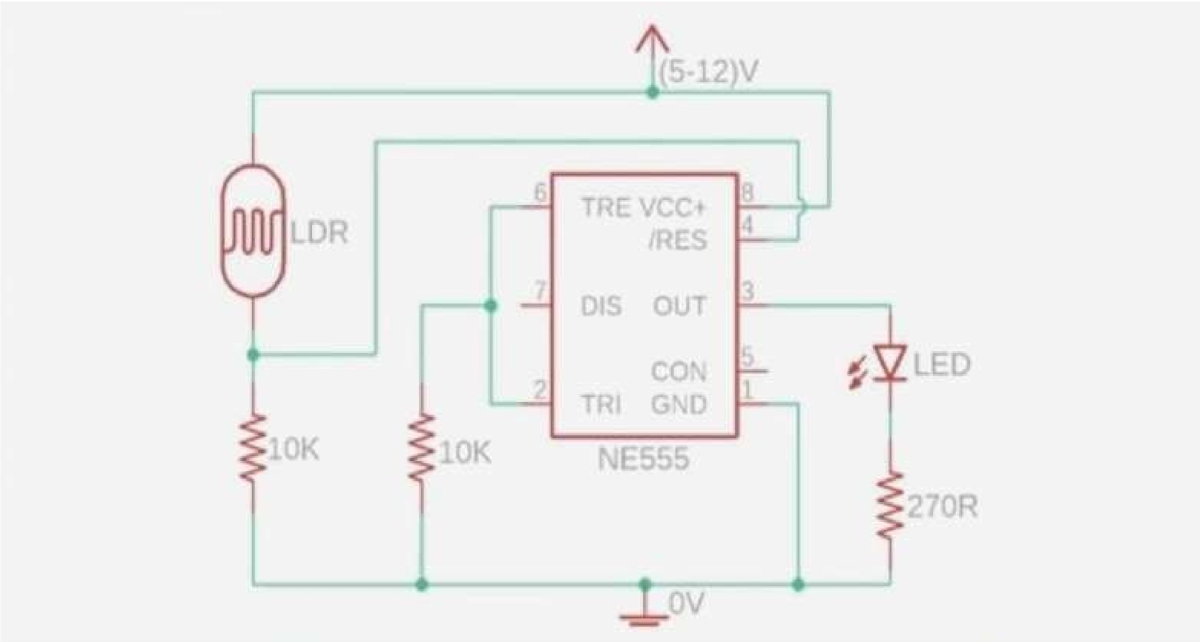

FIGURE 2.1: CIRCUIT DIAGRAM OF IMPLEMTATION OF LIGHT SENSITIVE ALARM

2.2 CIRCUIT COMPONENTS

2.2.1 RESISTOR

When incorporating a **Light Dependent Resistor (LDR)** into a circuit, resistors like **10kΩ** and **270Ω** are commonly used to create a **voltage divider** or to limit current through components such as LEDs or transistors. A **10kΩ resistor** is often used in series with an LDR to form a **voltage divider**. This configuration converts changes in light intensity into corresponding voltage changes. A **270Ω resistor** is commonly used as a **current-limiting resistor** in circuits with LEDs or transistors, especially when an LDR controls these components.

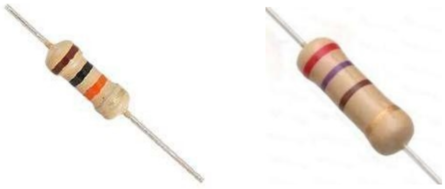

FIGURE 2.2: 10 K AND 270 OHM RESISTOR

2.2.2 LDR (Light Dependent Resistor)

A Light Dependent Resistor (LDR), also known as a photoresistor, is an electronic component whose resistance varies with the intensity of light falling on it. It is one of the simplest and most widely used light sensors in electronics, especially in applications where detecting light levels is crucial.

FIGURE 2.3: LDR

2.2.3 NE555 (IC 555)

IC 555 is a precision timing IC that provides time delays or oscillations. 555 Timer IC has three modes of operation: Astable, Monostable and Bi-stable. In this project, we are going to use the IC 555 in Bi-stable mode.· cts as a one-shot timer that produces a single pulse when triggered. Operates as an oscillator, generating a continuous square wave. Bistable Mode: Acts as a flip-flop, toggling between two stable states.

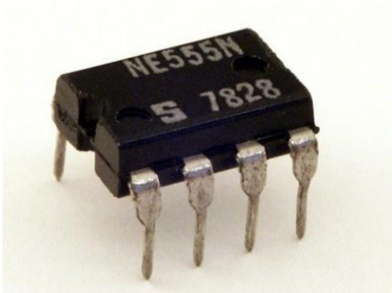

FIGURE 2.4: NE555

2.2.4 LED:

light-emitting diode (LED) is a semiconductor device that emits light when an electric current is passed through it. Light is produced when the particles that carry the current (known as electrons and holes) combine together within the semiconductor material.

FIGURE 2.5: LED

2.2.5 BUZZER

A buzzer is often used in a light sensor and darkness detector system to provide an audible alert when certain light conditions are met. It enhances the system's functionality by offering immediate feedback in various applications

FIGURE 2.6: BUZZER.

2.2.6 9V BATTERY

A 9V battery serves as the power supply for the entire circuit. It provides the necessary electrical energy to operate components like the Light Dependent Resistor (LDR), microcontroller (if used), buzzer, LEDs, and any other circuitry.

FIGURE 2.7 : 9V BATTERY

2.2.7 CAPACITOR

In a light-sensitive alarm, a 100 μF capacitor ensures stable operation by smoothing power supply fluctuations, stabilizing signals from the light sensor, and working in RC circuits to control response time. It prevents false alarms caused by brief light changes and may also block unwanted DC components, ensuring reliable and accurate performance.

FIGURE 2.8: 100UF CAPACITOR

2.3 CALCULATION

Value of Resistor 10k ohm

Using Ohm's Law:

$$R = \frac{V}{I}$$

Where:

- V = Voltage across the resistor
- I = Current flowing through the resistor

Example:

If a circuit provides $V = 5\,\mathrm{V}$ and the current $I = 0.0005\,\mathrm{A}(0.5\,\mathrm{mA})$:

$$R = \frac{5}{0.0005} = 10,000\,\Omega\;(10\,k\Omega)$$

This confirms the resistor's value.

Value of 270 ohm Resistor

The formula is:

$$R = \frac{V}{I}$$

Where:

- V = Voltage across the resistor in volts (V)
- I = Current through the resistor in amperes (A)

Example:

If $V = 5\,\mathrm{V}$ and $I = 0.0185\,\mathrm{A}$ (18.5 mA):

$$R = \frac{V}{I} = \frac{5}{0.0185} \approx 270\,\Omega$$

This confirms the resistor value is $270\,\Omega$.

Value of Capacitor

The energy (E) stored in a capacitor is:

$$E = \frac{1}{2}CV^2$$

Where:

- C is the capacitance in farads.
- V is the voltage across the capacitor (in volts, V).

For example:

- If $C = 100\,\mu\text{F}$ and $V = 10\,\text{V}$,

$$E = \frac{1}{2} \times 100 \times 10^{-6} \times 10^2 = 0.05\,\text{J}$$

CHAPTER 3
COST OF COMPONENTS

COMPONENT	QUANTITY	COST (APPROX.)
LED	2	10
NE555 (Timer IC)	1	15
LDR	1	15
10 KΩ Resistors	2	6
270 Ω Resistor	1	1
Buzzer	1	25
9V Battery	1	25
Connecting Wires	As Required	15
Breadboard	1	80


NADIYAMMAN ELECTRONICS
Keelaraja street,
Pudukkottai -622001
Customer name: Rahamathulla
Customer ID : 234IF34
8610718413

S.No.	Products	Quantity	Rs.
1.	LED	2	10
2.	IC555	1	15
3	LDR	1	15
4.	Resusters 10k	2	6
5.	Resister 270	1	1
6	Buzzer	1	25
7.	9v battery	1	25
8.	Connecting wires	–	15
9.	Breadboard	1	80
		Total	192

Figure 3.1: Components Bill

CHAPTER 4

RESULT AND DISCUSSION

4.1 WORKING PRINCIPLE

The working principle of a **Light Sensor and Darkness Detector** relies on the use of a **Light Dependent Resistor (LDR)**, which changes its resistance based on the amount of light falling on it. In the presence of light, the resistance of the LDR decreases, allowing more current to pass through. Conversely, in darkness, the resistance of the LDR increases, restricting the flow of current. This property makes the LDR an effective sensor for detecting changes in light levels.

To convert the changing resistance into a usable signal, the LDR is typically part of a **voltage divider circuit**. The LDR is connected in series with a fixed resistor, and the voltage across the LDR is measured. When the light intensity changes, the voltage at the junction of the LDR and the fixed resistor changes as well. A microcontroller or comparator is used to process this voltage, comparing it to a predefined threshold to determine whether the environment is bright or dark. The system is designed to trigger a response based on whether the light level is above or below the threshold.

When the system detects darkness (low light levels), the microcontroller or comparator activates the **buzzer**, which provides an audible alert to notify the user of the change in light conditions. This system is typically powered by a **9V battery**, which supplies the necessary voltage for the components, including the LDR, microcontroller, and buzzer. The circuit works autonomously, making it ideal for applications such as security systems, automatic lighting, or other environments where monitoring light levels is important

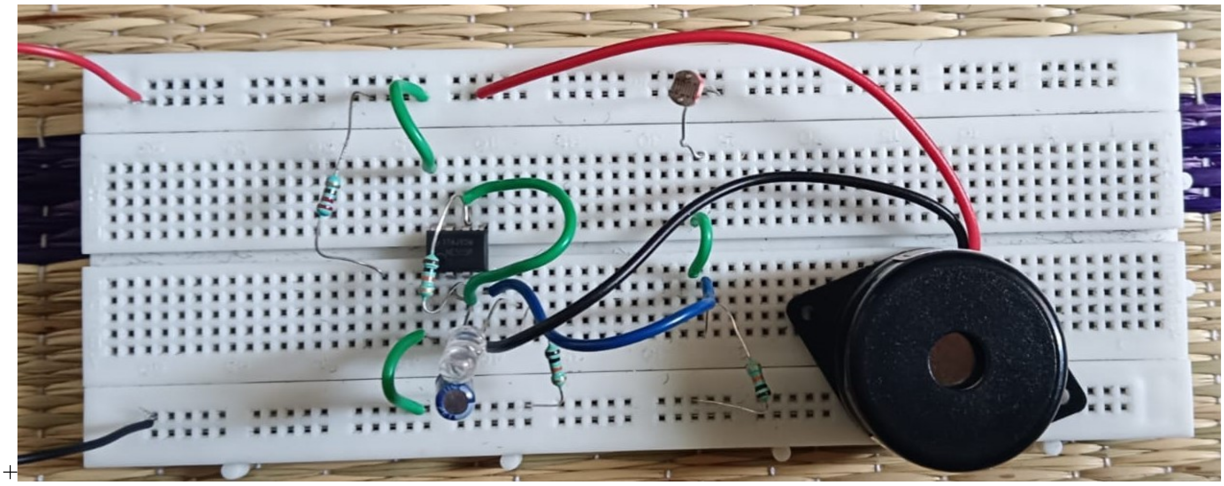

Figure 4.1: DEMO OF IMPLEMENTATION OF LIGHT SENSITIVE ALARM USING IC 555 TIMER

The Light Sensitive alarm using IC 555 timer was successfully implemented and tested. The key observations and results are as follows:

4.1 ADVANTAGES:

The system automatically detects changes in light intensity and provides real-time feedback (e.g., activating a buzzer), reducing the need for manual intervention.

The light sensor only operates when needed, ensuring that the system doesn't consume excessive power. It can be used in energy-saving applications, such as automatic street lighting.

4.3 APPLICATIONS:

The system can be used in street lighting, where lights automatically turn on when it gets dark and off when daylight returns. This helps conserve energy by ensuring lights are only on when needed.

In smart homes, the system can control indoor lights, automatically turning them on when rooms are dark, or adjusting lighting based on ambient light levels