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Simple Electronic Letter Box for Mail Notification System

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Abstract: **This paper presents the design and development of a novel electronic letter box that provides a visual notification of mail presence. The system utilizes a readily available 555 timer IC configured as a comparator to analyze the signal from a Light Dependent Resistor (LDR). When mail is inserted, it disrupts the light path between an LED and the LDR, triggering a change in the LDR's resistance. This change in resistance is detected by the 555 timer, which subsequently illuminates the LED, signifying the presence of mail. The design offers a simple, energy-efficient, and user-friendly solution to the common inconvenience of checking for mail in a traditional mailbox. This innovative application of electronics enhances convenience in our daily lives by eliminating the need for physical inspection of the mailbox.**

Keywords*— IC *555 Comparator, LDR, LED Indication, forward biased, Electronic letter box

1. **Introduction:** In an age marked by technological innovation, even the most time-honored practices can benefit from a touch solution to a perennial question: has physical mail been delivered? Central to this ingenious system is the venerable 555 timer IC, a versatile component configured here as a corporator [1]. By strategically connecting pin 6 to the positive supply, the circuit triggers a change in output state when the voltage at pin 2 crosses the 1/3 threshold of the supply voltage. The result is a binary response, promptly indicating the presence of a letter. At the heart of this innovation lies the Light Dependent Resistor (LDR), a unique component whose resistance varies with the intensity of incident light. In total darkness, the LDR registers an impressive 1 mega-ohm of resistance, whereas it plummets to a mere 2-5 kilo-ohms when fully illuminated. This responsiveness to a broad spectrum of light wavelengths is harnessed within the project. When the box is empty, light directly bathes the LDR[2]. However, with the insertion of a letter, this beam of light is obstructed, casting the LDR into darkness. This transition is then translated into a change in voltage at pin 2 of the 555 timer IC. In response, the LED, acting as a visual indicator, is activated, clearly signaling the presence of a letter[3].Optionally, the system can be augmented with two LED's to further enhance its functionality. One LED, set up as forward-biased[4], signifies the presence of a letter, while the other, configured in reverse bias, denotes its absence. By carefully controlling the current through series resistances, this dual LED setup provides a nuanced visual feedback system. With versatility in mind, the choice of LED colors allows for

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customization, catering to individual preferences. Whether in classic red or vibrant green, these indicators offer a user-friendly interface for discerning the status of the letter box. The Electronic Letter Box project not only showcases the technical prowess of its components but also demonstrates the ingenious marriage of tradition and modernity[5]. Its economic power consumption, portability, and reliable functionality make it a promising addition to the realm of electronic applications.

2. Design and Simulation, Parameters:

2.1.1.Design and Simulation The LDR and a light source are strategically positioned within the letter box. Light directly illuminates the LDR in normal conditions. When a letter is inserted, it obstructs the light beam, causing the LDR to be in darkness. The LDR and 100 Kilo-ohm variable resistance are connected in series. The voltage across the LDR is directly proportional to its conductor ,which in turn is determined by the brightness of light.

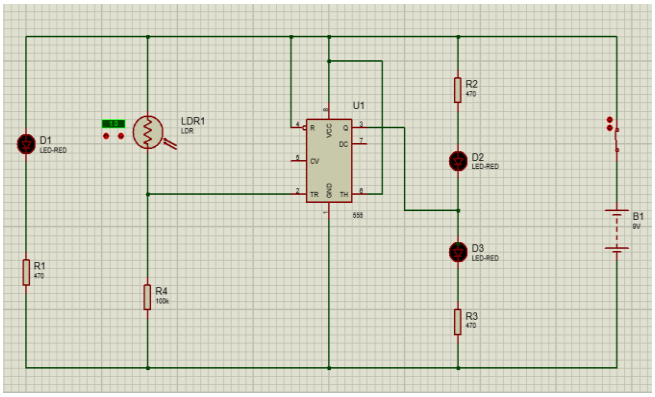

Figure 1: circuit diagram of letter box

Pin 2 (trigger) is compared with 1/3 of the supply voltage. In pin 2 voltage is lower than 1/3 of supply of voltage, output at pin 3 goes high (1); if higher, output goes low (0).Pin 6 is connected to positive supply, while pins 4, 6, and 8 are connected to positive supply, and pin 1 is grounded. The divided voltage from the potential divider circuit is fed to pin 2 of the 555 timer IC. When the LDR is in darkness (indicating the presence of a letter), the voltage at pin 2 drops below 1/3 of the supply voltage. This triggers pin 3 to go high (1), causing the LED to light up. Two LED's can be used at output pin 3 for enhanced feedback. One LED is connected as forward-biased and indicates the present of a letter, while the other is connected as reverse-biased and denotes its absence .Series resistors are used to limit LED current .For the source light, it's recommended to use a Red or Yellow

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LED.LED's 2 and 3 can be of different colors like green, red, yellow, or blue. When the LDR receives light, the circuit remains off as the voltage at pin 2 of the 555 IC remains above the 1/3 threshold. When a letter is inserted, blocking the light, the LDR resistance increases, causing the voltage at pin 2 to drop below the 1/3 threshold. This change triggers pin 3, making it go high and subsequently illuminating the LED.

2.1.2Comparison of Parameters:

Table l: Parameters

Sl. No	Parameters
1	Resistor: It controls the flow of electrons.
2	IC 555: The ic555 is an integrator circuit used to timer
3	LED: A light emitting diode

3.Result Analysis

The primary goal of testing the Electronic Letter Box project was to ensure that the circuit functions correctly and reliably before final implementation. This step helps identify and rectify any potential issues or errors. A "Breadboard" was employed for testing. A breadboard is a flat board with holes for inserting electronic components and connecting wires.

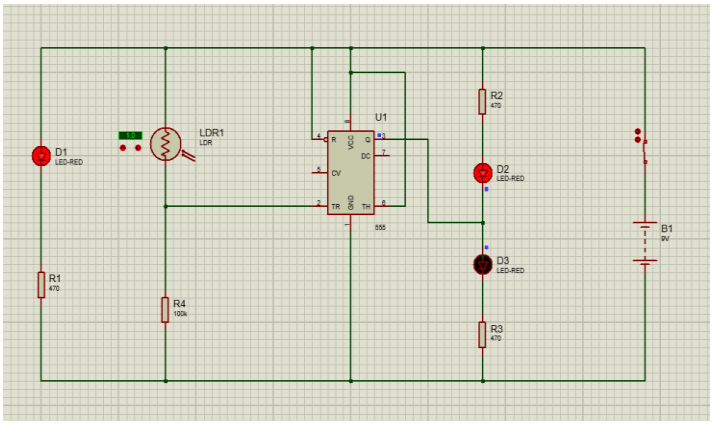

Figure-2 : circuit diagram of letter box output

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It allows for temporary assembly and testing of circuits. All the components of the Electronic Letter Box circuit, such as resistors, capacitors, IC's, LED's, LDR, and connecting wires, were correctly connected on the breadboard. This involved placing each component into the designated holes on the breadboard and ensuring proper connections were made. Once the circuit components were connected, a thorough check was conducted to ensure that each component was in its correct position and that all connections were secure and accurate.

After the initial setup, the circuit was powered up using an appropriate power supply. The behavior of the circuit was observed to confirm that it performed its intended function. The circuit was closely monitored to check for any abnormal behavior, such as unexpected LED illumination or incorrect responses to input signals. Any discrepancies or issues were noted. It was confirmed that the circuit operated as expected. This means that when a letter was introduced into the simulated letter box, the LED responded accordingly, indicating the presence of the letter. This successful test provides confidence in the functionality of the circuit.

4.Conclusion

This document explores an electronic letter box designed to eliminate the need for constantly checking an empty mailbox. The system employs a clever setup that utilizes a Light Dependent Resistor (LDR) and an LED to indicate the presence of mail. When mail is inserted, it blocks the light path between the LED and the LDR. This change in light triggers a response in the LDR, which in turn signals the presence of mail by illuminating the LED. This innovative design offers a practical solution for everyday use, saving time and effort by visually indicating mail arrival. The electronic letter box demonstrates a practical application of electronics to enhance a commonplace item. This design offers a simple and efficient solution to the inconvenience of checking for mail, utilizing readily available components for low-power operation. The combination of a 555 timer and LDR sensor effectively translates mail presence into a visual LED notification, promoting user convenience in both homes and offices. This project exemplifies the potential of electronics to seamlessly integrate with everyday objects, fostering innovation for a more convenient future.

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