VIGNAN INSTITUTE OF TECHNOLOGY AND SCIENCE

DEPARTMENT OF BASIC SCIENCE AND HUMANITIES

YEAR & SEMESTER: I-II

ACADEMIC YEAR: 2023-24

INNOVATIVE PROJECT DOCUMENTATION

1)	Durgam machender	23891A1005
2)	Kavya kotha	23891A1013
3)	Ramavath Rajesh Naik	23891A1023

GUIDE BY:
Dr.G.Madhuri ,
Asst. professor of EIE Department

Adjustable Timing Flasher Circuit Using Transistors in an Online Simulator

Introduction

The LED flasher circuit is a fundamental electronic project that demonstrates the basic principles of electronic components and their interactions. This project utilizes transistors to create a simple, cost-effective solution for making LEDs flash at adjustable intervals. The primary advantage of using transistors over more complex integrated circuits is their availability and ease of use, making this project accessible for beginners and hobbyists.

The circuit designed in this project consists of two BC547 or 2N3904 transistors, resistors, and capacitors arranged to control the blinking of two LEDs. By adjusting the values of the resistors and capacitors, the flashing rate of the LEDs can be modified. This feature makes the circuit versatile for various applications, from simple visual indicators to more complex signaling systems. The project highlights the importance of understanding component specifications and how they influence circuit behavior.

Building this LED flasher circuit provides valuable hands-on experience with electronic components and circuit assembly. It serves as an excellent educational tool for learning about the properties and functionalities of transistors, resistors, and capacitors. Additionally, the adjustable nature of the circuit allows for experimentation and customization, enabling users to explore different configurations and their effects on the LED flashing rate. This project not only reinforces theoretical knowledge but also enhances practical skills in electronics.

Using Tinkercad and EveryCircuit, users can simulate and visualize the LED flasher circuit before physical assembly, ensuring correct connections and functionality. Both platforms provide interactive environments to test and modify component values, making the design process intuitive and educational.

Objectives

The primary objective of this project is to design and construct an LED flasher circuit using transistors, which can serve as a visual indicator or signaling device. This project demonstrates how simple electronic components can be combined to create functional circuits without the need for complex integrated circuits. By focusing on transistors, resistors, and capacitors, the project emphasizes fundamental electronic principles and component interactions.

Using Tinkercad and EveryCircuit, users can simulate and visualize the LED flasher circuit before physical assembly. These platforms allow for interactive testing and modification of component values, ensuring correct connections and functionality. This project also enables users to adjust the blinking rate of the LEDs by varying the values of resistors and capacitors. This feature highlights the importance of component selection in circuit design and provides practical experience in tuning electronic circuits for desired performance. By experimenting with different component values in Tinkercad and EveryCircuit, users can gain a deeper understanding of timing and frequency control in electronic circuits.

Additionally, this project aims to provide a hands-on learning experience for individuals interested in electronics, particularly those new to the field. Building and testing the LED flasher circuit, both virtually and physically, helps reinforce theoretical knowledge through practical application. This project can also serve as a foundational exercise for more advanced electronic projects, as it covers essential concepts such as circuit assembly, troubleshooting, and component functionality.

Components List

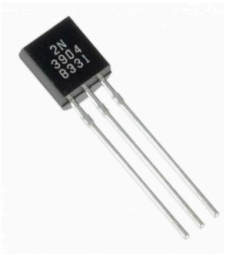
Component	Description	Quantity	Specifications/Details
Transistors	Semiconductor devices used to amplify or switch electronic signals	2	BC547 or 2N3904 (NPN) Transistors
Resistors	Components used to limit the current flow in the circuit	2	10kΩ (1/4 watt, 5% tolerance)
Resistors	Components used to limit the current flow in the circuit	2	330Ω (1/4 watt, 5% tolerance)
Capacitors	Components that store and release electrical energy in the circuit	2	100µF Electrolytic Capacitors (Voltage rating: 16V or higher)
LEDs	Light Emitting Diodes used as visual indicators	2	Standard 5mm LEDs (Red or any other color)

Power Supply	Provides the necessary voltage and current to the circuit	1	5V DC Power Supply (Battery or DC Adapter)

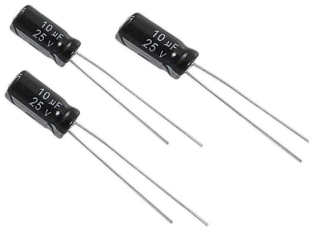
Breadboard	A board for making temporary circuits and prototyping without soldering	1	Standard Breadboard

Connecting Wires	Wires used to make electrical connections between components on the breadboard	As required	Assorted Colors, 22 AWG Jumper Wires

Components



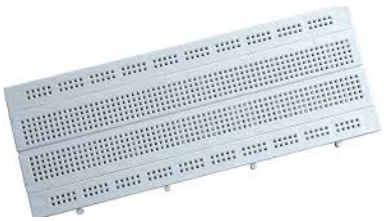
2N3904 or BC547 Transistors (2)



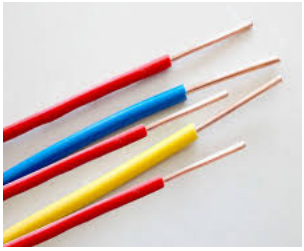
electrolytic capacitor(2*10µF)

Resistors (2 x 100kΩ and 2 x 470Ω)

LEDs (2)



Breadboard



Connecting Wires

Power Supply (5V DC)

- Detailed Description of Components:

-Transistors (BC547 or 2N3904 NPN):

- **Quantity**: 2
- **Description**: The BC547 or 2N3904 is a general-purpose NPN transistor used for switching and amplification. In this circuit, they act as switches to alternate the blinking of the LEDs.
- **Specifications**:
  - Maximum Collector Current (Ic): 100mA
  - Maximum Collector-Emitter Voltage (Vce): 45V
  - DC Current Gain (hFE): 110 to 800

-Resistors (10kΩ and 330Ω):

- **Quantity**: 2 each
- **Description**: Resistors limit the current in the circuit, protecting the LEDs and transistors from excessive current.
- **Specifications**:
  - **10kΩ Resistors**: Used to bias the base of the transistors.
  - **330Ω Resistors**: Used to limit the current through the LEDs.

-Capacitors (100µF Electrolytic):

- **Quantity**: 2
- **Description**: Capacitors store and release energy, creating the timing for the LED blinking.
- **Specifications**:
  - Capacitance: 100µF
  - Voltage Rating: 16V or higher
  - Type: Electrolytic, with polarity (positive and negative leads)

-LEDs (Light Emitting Diodes):

- **Quantity**: 2
- **Description**: LEDs provide visual feedback by lighting up when current flows through them.
- **Specifications**:
  - Type: Standard 5mm LEDs

- Colors: Red (or any other preferred color)
- Forward Voltage: Typically 2V
- Forward Current: 20mA

-Power Supply (9V DC):

- **Quantity**: 1
- **Description**: Supplies the necessary voltage and current to the circuit.
- **Specifications**:
  - Output Voltage: 9V DC
  - Source: Can be a battery pack or a DC adapter

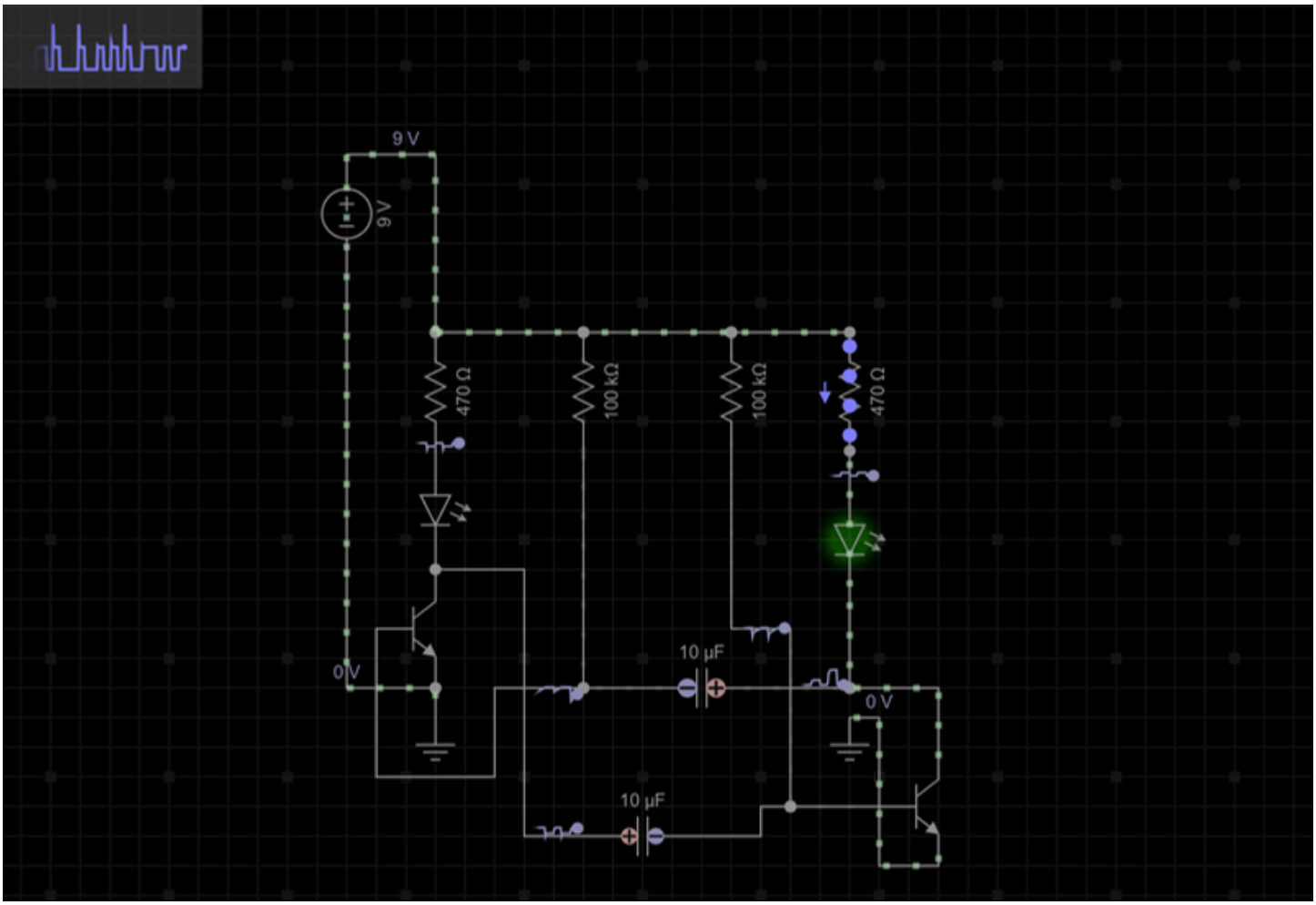
-Breadboard:

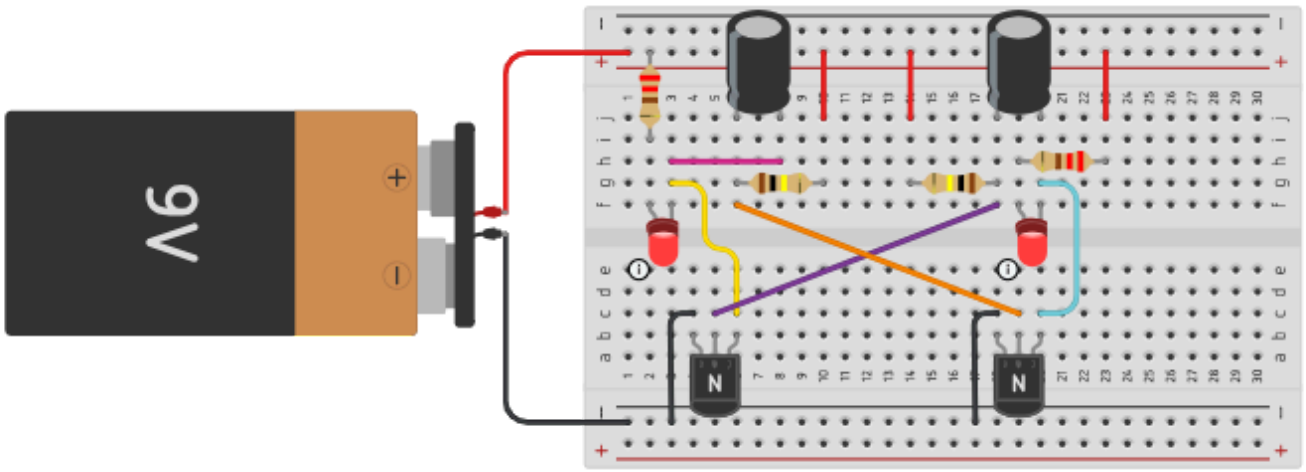
- **Quantity**: 1
- **Description**: A reusable platform for building and testing circuits without soldering.
- **Specifications**:
  - Standard size breadboard with multiple connection points

-Connecting Wires:

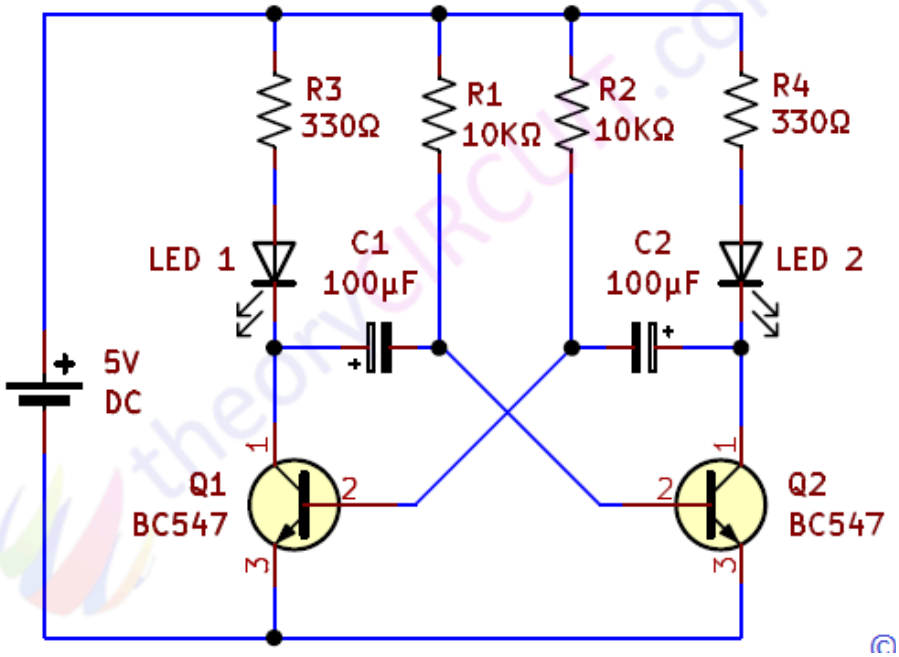
- **Quantity**: As required
- **Description**: Used to connect components on the breadboard.
- **Specifications**:
  - Assorted colors for easy identification
  - 22 AWG jumper wires suitable for breadboard use

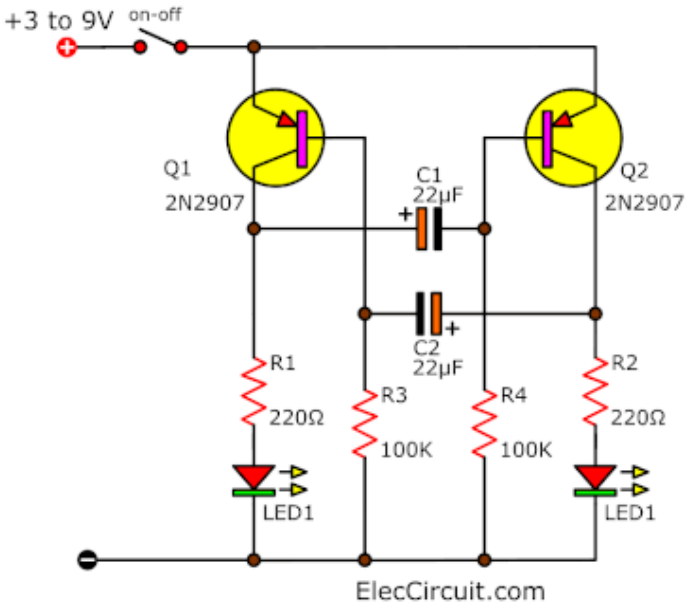
Circuit Diagram

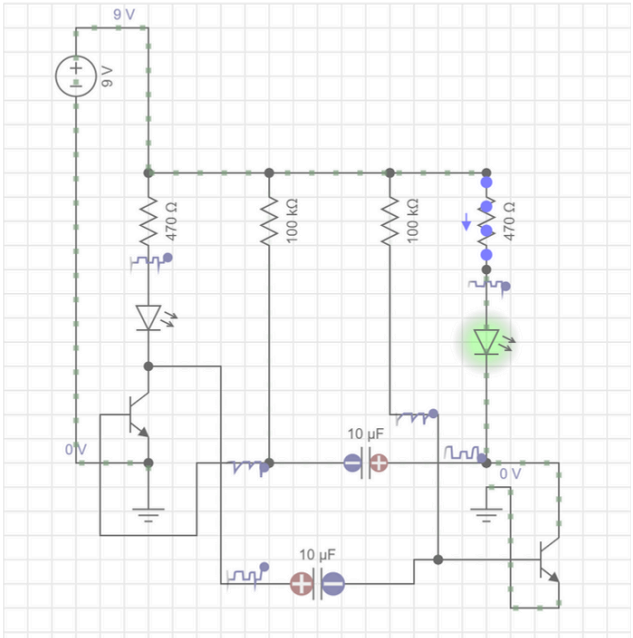

9 V
9 V
470 Ω
100 kΩ
100 kΩ
470 Ω
0 V
10 µF
0 V
10 µF



LED Flasher Circuit







Working Principle

The Adjustable Timing Flasher Circuit is designed to intermittently illuminate an LED at a variable rate, controlled by an adjustable timing mechanism. The heart of the circuit consists

of transistors, resistors, capacitors, and a potentiometer.

1. Transistor Switching Mechanism:

The circuit utilizes transistors (typically NPN type such as BC547 or similar) in a switching configuration. When power is applied, the transistors operate in either cutoff or saturation modes based on the input signal and resistor network. This switching action is crucial for driving the LED alternately on and off.

2. Capacitor Charge and Discharge:

A capacitor connected in series with resistors controls the timing of the flashing cycle. Upon powering the circuit, the capacitor begins to charge through a resistor path. The rate of charging depends on the resistance and capacitance values selected.

3. Potentiometer for Timing Adjustment:

A potentiometer is included to adjust the timing of the flashing cycle. By varying the resistance with the potentiometer, the charging and discharging times of the capacitor can be altered. This adjustment directly affects the interval between LED flashes, allowing for a wide range of flash rates from slow to rapid.

4. LED Flashing Mechanism:

An LED is connected to the output of the transistor circuit. As the transistors switch states due to the charging and discharging of the capacitor, the LED alternately turns on and off. The duration of each state (on or off) is determined by the timing set by the capacitor and adjusted by the potentiometer.

5. Control of Power Supply:

The circuit operates typically on a low voltage DC power supply (e.g., 9V battery or similar). The components are chosen to withstand the voltage and current requirements of the LEDs and transistors, ensuring reliable operation over time.

Construction Steps

Constructing the Adjustable Timing Flasher Circuit involves the following steps:

- **Component Preparation**: Gather all necessary components as per the circuit diagram and list.
- **Circuit Assembly**: Begin by placing components on a breadboard or PCB according to the circuit diagram. Ensure correct placement and orientation.
- **Soldering**: Securely solder each component onto the board, ensuring good electrical connections and avoiding solder bridges.
- **Power Connections**: Connect the power supply to appropriate points on the circuit, ensuring correct polarity.
- **Testing**: Before final assembly, conduct preliminary tests to ensure each component operates as expected. Verify LED flashing and timing adjustment using the potentiometer.
- **Final Assembly**: Once functionality is confirmed, finalize the assembly by securing components and wires, ensuring a neat and compact layout.

Constructing the Adjustable Timing Flasher Circuit involves the following steps in tinkercad:

- Set Up Components: Place two BC547 or 2N3904 transistors ensuring proper orientation. Add capacitors, resistors, and LEDs according to circuit diagram.
- Connect the Transistors: Connect emitter pin of each transistor to ground rail. Connect base to collector through appropriate value resistors.
- Add Capacitors: Place capacitors with positive lead connected to the collector pin of each transistor. Ensure negative lead is connected to the base pin.
- Connect LEDs: Insert LEDs in series with resistors, ensuring correct polarity (longer lead to resistor). Connect the other lead of resistors to ground rail.
- Power the Circuit: Connect the positive terminal of the 5V DC power supply to the power rail, and the negative terminal to the ground rail.

Constructing the Adjustable Timing Flasher Circuit involves the following steps in everycircuit:

- Set Up Components: Place BC547 or 2N3904 transistors, capacitors, resistors, and LEDs on the workspace.
- Connect Transistors: Connect emitter to ground and base to collector through resistors.
- Add Capacitors: Connect positive terminals to the collector of each transistor and negative terminals to the base.

- Connect LEDs: Insert LEDs with resistors in series, ensuring correct polarity, and connect to ground.
- Power the Circuit: Connect a 5V DC power supply, ensuring positive to power rail and negative to ground. Position components according to the circuit diagram for efficient layout and connectivity.

Adjusting Timing

The timing of the LED flasher circuit is determined by the interplay of the capacitors and resistors within the circuit. By varying the capacitance or resistance values, you can control the charging and discharging cycles, which in turn affects the rate at which the LEDs flash. Essentially, the timing mechanism relies on how long it takes for a capacitor to charge to a certain voltage level, which then triggers the transistor to switch states, turning the LED on or off.

Using Tinkercad and EveryCircuit, you can easily adjust timing by selecting different resistor and capacitor combinations. Larger capacitance values result in longer charging times, leading to slower flashing rates, while smaller capacitance values cause quicker charging and faster flashing rates. Similarly, resistance values play a crucial role: higher resistance slows down current flow, increasing the capacitor's charging time, while lower resistance speeds up the process.

These platforms also allow for the use of variable components that can be manually tuned to achieve the desired flash rate. By experimenting with different combinations in Tinkercad and EveryCircuit, and observing the effects on the LED flash rate, you can fine-tune the circuit to meet specific requirements. This flexibility allows the circuit to be used in various applications where different timing intervals are needed, providing a versatile solution for timing-based projects.

Testing and Troubleshooting

After constructing the circuit, it's crucial to test its functionality to ensure everything is working as expected. Begin by powering up the circuit and observing the LED. The LED should start flashing at a regular interval. If the LED does not light up or flash, there may be a few common issues to check.

Firstly, verify all connections. Ensure that the transistors are correctly oriented and that all components are connected according to the circuit diagram. Loose or incorrect connections are often the primary cause of malfunctioning circuits. Double-check the solder joints for any cold solder joints, which can lead to intermittent connections.

Next, inspect the components themselves. Make sure that the resistors and capacitors are of the correct values as specified in the component list. Incorrect component values can significantly affect the circuit's operation. Additionally, check the LEDs to ensure they are not damaged. Using a multimeter, you can test the continuity of the circuit and the integrity of each component to pinpoint any faulty parts.

If the LED still does not flash after these checks, consider the power supply. Ensure that the power supply provides the correct voltage and is stable. A weak or unstable power supply can cause the circuit to behave erratically.

Using Tinkercad and EveryCircuit can greatly aid in troubleshooting. These platforms allow you to simulate the circuit and identify potential issues before physical assembly. By observing the virtual LED behavior and checking connections in the simulation, you can ensure that the design is sound. If discrepancies arise, adjust the components and wiring in the virtual environment and re-test. By systematically checking each part of the circuit, both virtually and physically, you can identify and resolve issues to get your Adjustable Timing Flasher Circuit working correctly.

Precautions

- When working on the LED flasher circuit project, whether using Tinkercad, EveryCircuit, or during physical assembly, follow these safety guidelines:

- Ensure power is disconnected before making any changes to the circuit to avoid electric shock or damage to components.
- Verify all connections are correct in Tinkercad and EveryCircuit simulations to prevent short circuits or component damage.
- Use resistors of appropriate ratings to avoid overheating and potential burns.
- Handle transistors and other semiconductor devices carefully to avoid static damage.
- Double-check the polarity of LEDs and capacitors in simulations and physical assembly to ensure proper operation.
- Use a well-ventilated area if soldering to avoid inhaling fumes.
- Ensure the power supply voltage and current ratings are within the safe operating limits of the components used, both in virtual simulations and real-world applications.

Applications

- **Indicator Lights**: Use in various devices to indicate status (e.g., power on/off, battery charging status).
- **Blinking Decorative Lights**: Can be used for decorative lighting, such as in holiday lights or artistic installations.
- **Signal Beacons**: Employed in signaling devices where a regular flashing light is needed, such as in road construction signs or emergency signals.
- **Learning Tool**: Excellent for educational purposes to teach the basics of electronics, including components like transistors, capacitors, and resistors.
- **Timers**: Utilized in simple timing applications where a visual indication of time intervals is required.
- **DIY Electronics Projects**: A versatile component in various do-it-yourself electronics projects for hobbyists and makers.

Conclusion

The Adjustable Timing Flasher Circuit using transistors is a versatile and practical project that highlights the fundamental principles of electronics. By controlling the on-off cycles of LEDs, this circuit demonstrates how components such as transistors and capacitors can work together to create a timing mechanism. The design allows for flexibility in applications, from simple visual indicators to more complex signaling devices. Through this project, builders can gain hands-on experience with circuit assembly and the nuances of electronic timing control.

Using Tinkercad and EveryCircuit, users can simulate and visualize the Adjustable Timing Flasher Circuit before physical assembly. These platforms offer interactive environments for testing and modifying component values, ensuring proper functionality and correct connections. The project serves as an excellent educational tool for understanding the behavior of electronic components in a dynamic system. The circuit's adjustability makes it adaptable to various requirements, making it a valuable addition to any hobbyist's or student's repertoire.

By following the detailed construction steps and troubleshooting tips provided, both in Tinkercad and EveryCircuit, users can confidently build and customize their own LED flasher circuit. This enhances their practical skills and knowledge in electronics, allowing for experimentation and deeper learning.

Thank You