PCB WORKSHOP

CIRCUIT DESIGNING AND IMPLEMENTATION WORKSHOP

REPORTED BY : TEAM TRIAD

GROUP DETAILS:

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SIMULATION RESULTS:

1. LED ON-OFF

(A) Description of the LED On-Off Simulation:

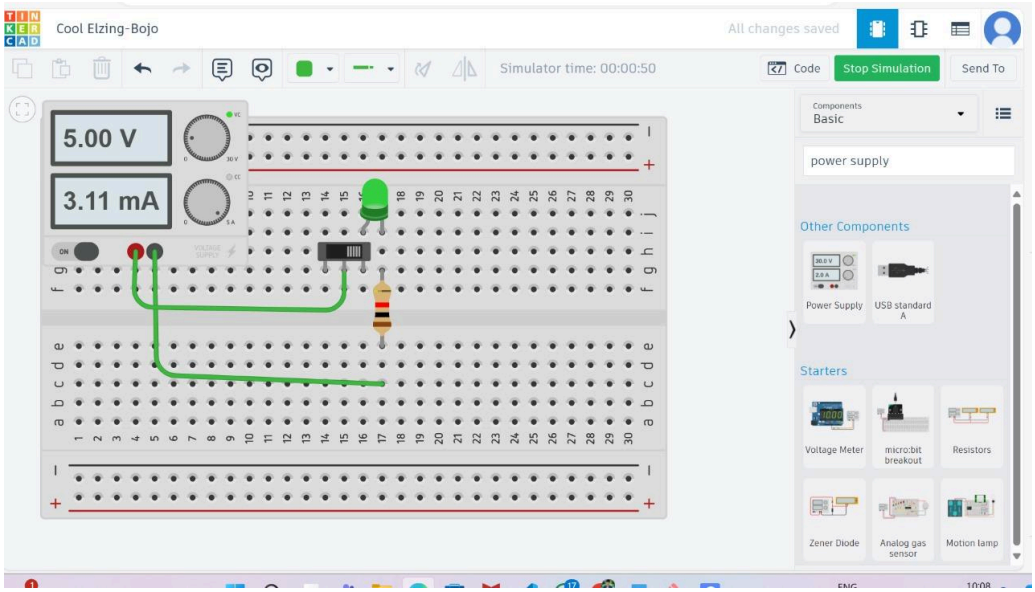
We have designed an LED on-off circuit using Tinkercad. The circuit includes the following components:

1. **Power Supply:** Set to deliver 5.00 V.
2. **Green LED:** Indicates current flow when illuminated.
3. **1kΩ Resistor:** Limits current to prevent damage to the LED.
4. **Slide Switch:** Controls the circuit, allowing it to be opened or closed.

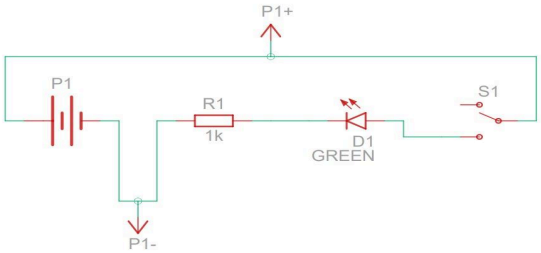
During the simulation, the power supply continuously provides 5.00 V to the circuit. The resistor is connected in series with the green LED to limit the amount of current passing through the LED, thereby protecting it from excessive current. When the slide switch is closed, it completes the circuit, allowing current to flow from the power supply, through the resistor and LED, and then back to the ground. This current flow causes the LED to light up, indicating the circuit is active. The ammeter displays a current of 3.11 mA, verifying that the circuit is functioning correctly.

(B) **TINKERCAD SIMULATION RESULT:**

CIRCUIT LAYOUT



SCHEMATIC DIAGRAM

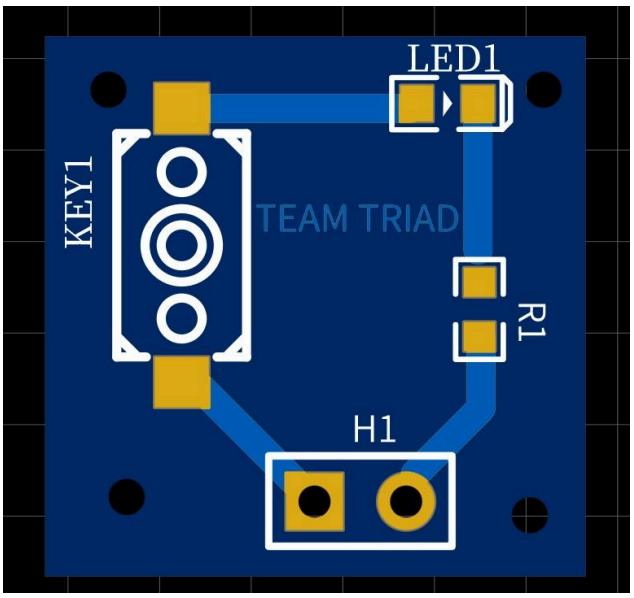


COMPONENTS

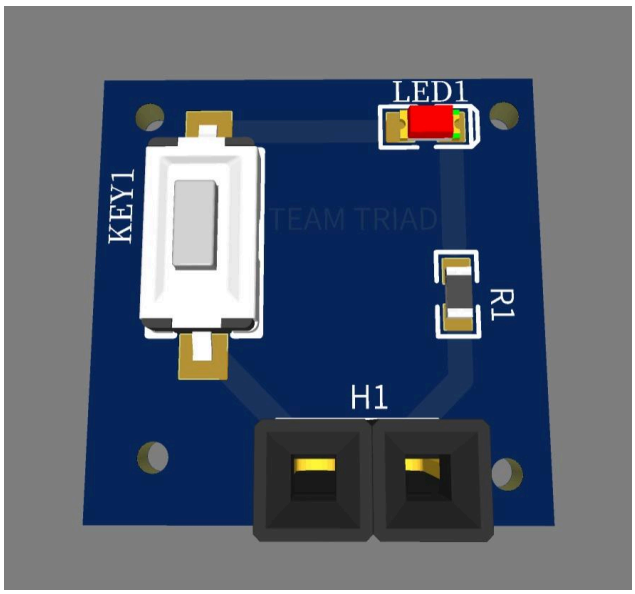
Download CSV

Name	Quantity	Component
D1	1	Green LED
R1	1	1 kΩ Resistor
S1	1	Slideswitch
P1	1	5 , 5 Power Supply

CIRCUIT BUILDING ON EASYEDA (2D AND 3D VIEW) ON PCB BOARD.



2D VIEW



3D VIEW

2. HALF ADDER

This simulation demonstrates a half-adder circuit built on a breadboard.

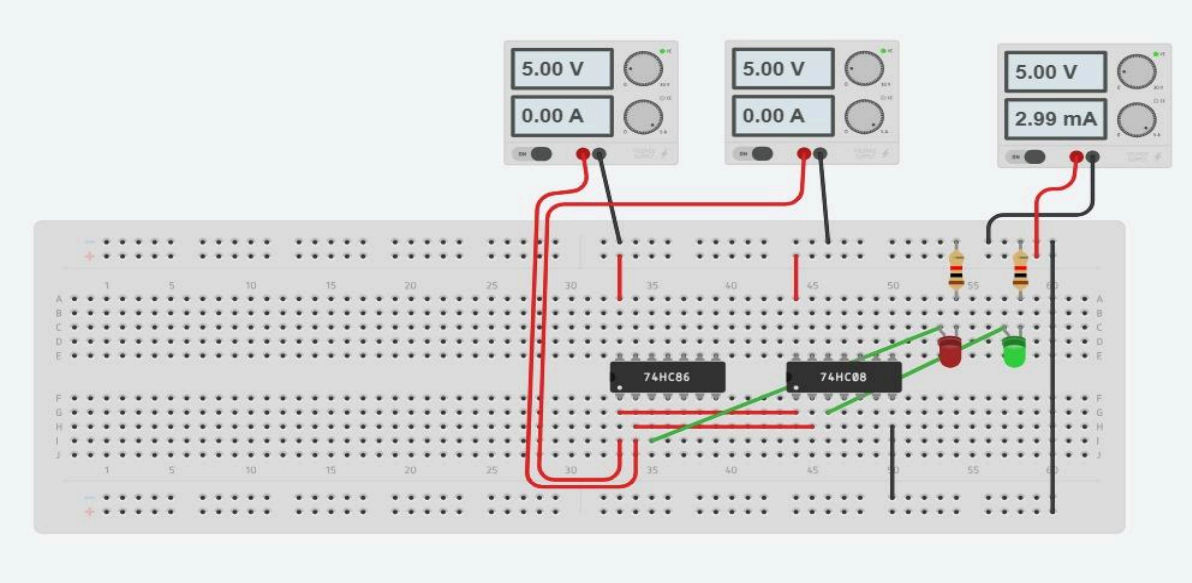
- Components:
    - Integrated Circuits (ICs):
        - 74HC86 (quad XOR gate) for calculating the sum.
        - 74HC08 (quad AND gate) for generating the carry bit.
    - Resistors (1kΩ): to limit current for the LEDs
    - LEDs (red and green): to visually represent the sum (red) and carry (green) outputs
    - Power supply (5V): to energize the circuit
- Functionality:
    - The circuit adds two binary inputs (A and B) using the XOR and AND gates.
    - The XOR gate's output determines the sum, lighting the red LED when both inputs are high (1 + 1 = 1 with a carry) and vice versa.
    - The AND gate produces a carry output (green LED) only when both inputs are high.
    - A 2.99mA current measurement indicates normal LED operation.

- Key Points:
    - The circuit faithfully replicates the schematic, ensuring accurate behavior.
    - Digital gates have inherent propagation delays and potential glitches during input changes, which are present in this circuit.

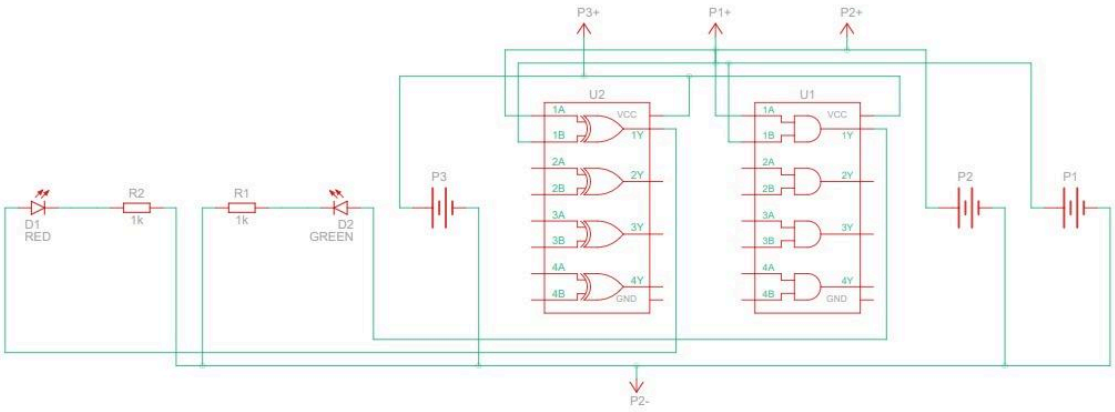
This rewrite simplifies the text, emphasizes key points, and improves readability.

(B)**TINKERCAD SIMULATION RESULT:**

CIRCUIT LAYOUT



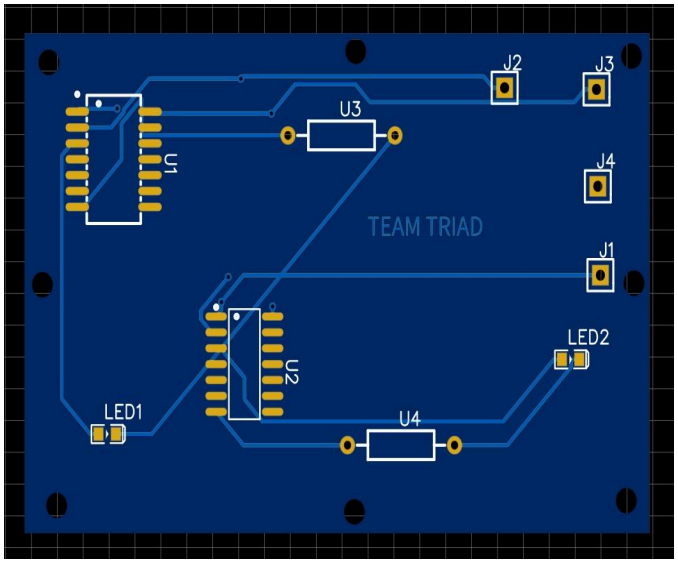
SCHEMATIC DIAGRAM

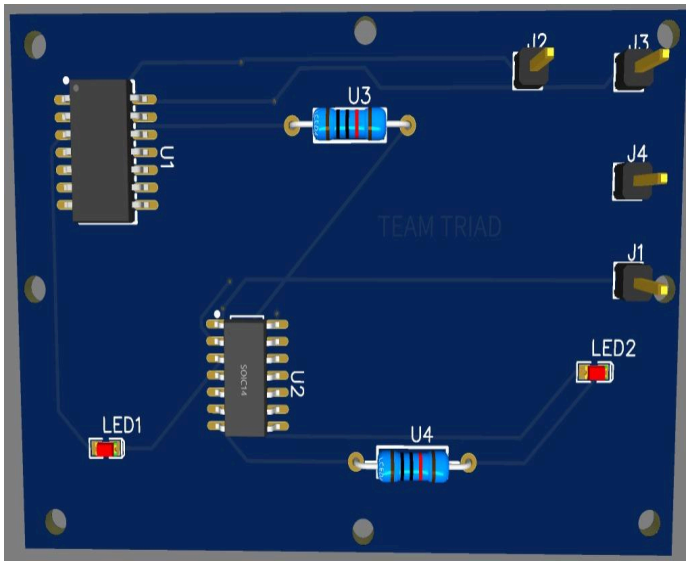


COMPONENTS

Name	Quantity	Component
P1 P2 P3	3	5 , 5 Power Supply
R1 R2	2	1 kΩ Resistor
D1	1	Red LED
D2	1	Green LED
U1	1	Quad AND gate
U2	1	Quad XOR gate

CIRCUIT BUILDING ON EASYEDA (2D AND 3D VIEW) ON PCB BOARD.





2D VIEW **3D VIEW**

Transient Response:

The half-adder's response to input changes involves three key aspects:

- Output Logic:
    - The XOR gate calculates the sum based on exclusive OR logic. The connected LED reflects this by lighting up according to the input combination (red LED = sum).
    - The AND gate generates a carry output (green LED) only when both inputs are high (carry occurs when 1 + 1 = 1).
- Propagation Delay:
    - Switching the inputs takes time for the gates to settle and produce stable outputs. This delay, typically in nanoseconds for CMOS logic like the 74HC series, is inherent to digital circuits.

- Glitches:
    - During input transitions, especially when inputs change non-simultaneously, brief voltage spikes or glitches might appear at the outputs. This is a temporary phenomenon due to the internal switching behavior of the gates.

3 . 555 TIMER IC

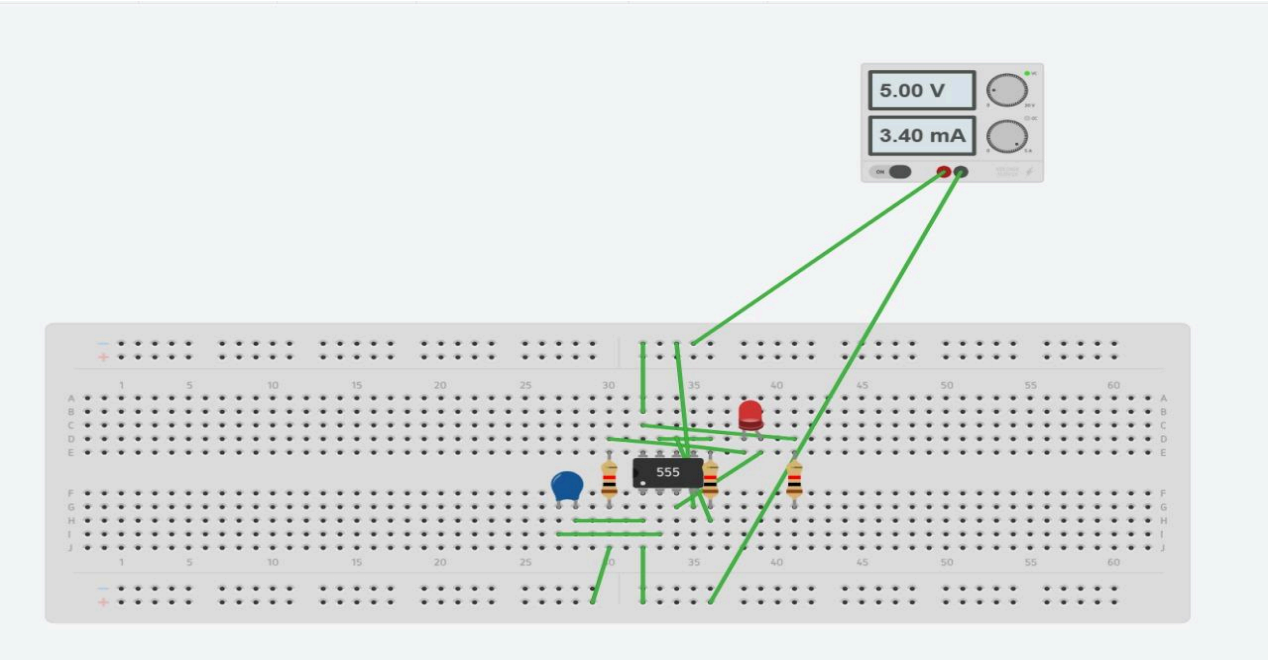
This simulation demonstrates an LED blinking circuit built with a 555 timer IC.

- **Components:**
    - 555 timer IC (U1)
    - Resistors:
        - R1 (1kΩ)
        - R2 (1kΩ)
        - R3 (1kΩ)
    - Capacitor: C1 (100nF)
    - Power supply (P1) set to 9V
- **Functionality:**
    - The 555 timer is configured with resistors and a capacitor to generate a square wave output at pin 3.
    - The frequency of the blinking LED is determined by the values of R1, R2, and C1.
    - When the output at pin 3 is high, the LED turns on (red glow for most LEDs).
    - When the output goes low, the LED turns off, creating the blinking effect.
    - The breadboard layout matches the schematic for accurate operation.

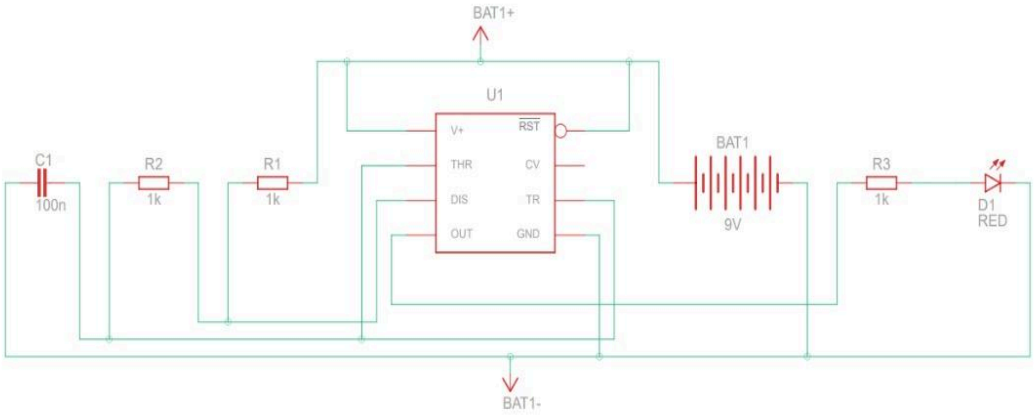
- **Measurements:**
    - The power supply voltage is 9V as expected.
    - The current measurement indicates normal LED operation.
- **Explanation:**
    - The blinking is caused by the charging and discharging cycles of the capacitor, which control the switching of the 555 timer's output, ultimately turning the LED on and off.

(B)**TINKERCAD SIMULATION RESULT:**

CIRCUIT LAYOUT



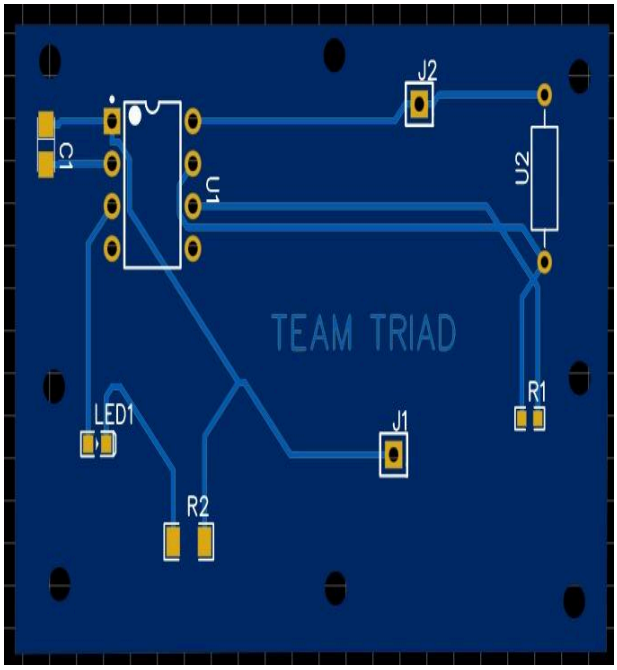
SCHEMATIC DIAGRAM

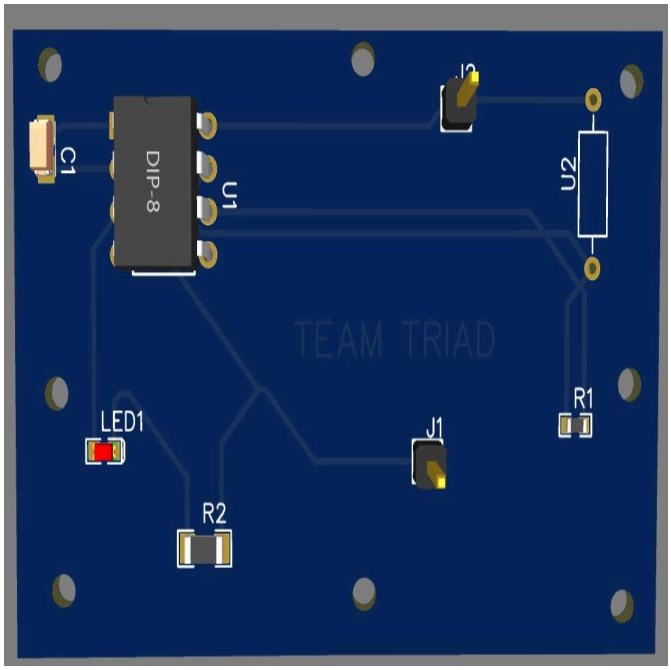


COMPONENTS

Name	Quantity	Component
U1	1	Timer
R1 R2 R3	3	1 kΩ Resistor
C1	1	100 nF Capacitor
D1	1	Red LED
BAT1	1	9V Battery

CIRCUIT BUILDING ON EASYEDA (2D AND 3D VIEW) ON PCB BOARD.





2D VIEW **3D VIEW**

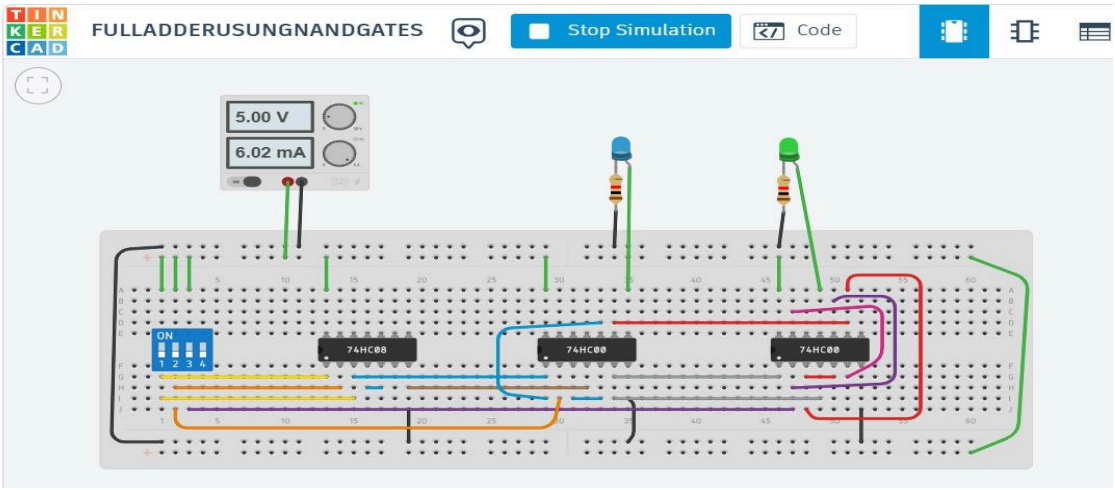
4. Student Task1:Digital:Full Adder using NAND gates

- Components:
  - ICs:
    - 74HC86 (quad XOR gate): U1 performs the XOR operation to determine the sum output.
    - 74HC08 (quad AND gate): U2 is used to generate the carry output.
  - Resistors:
    - R1 and R2 (1kΩ): Limit current flow to the LEDs.
  - LEDs:
    - Red LED: Indicates the sum output (XOR gate output).
    - Green LED: Represents the carry output (AND gate output).
  - Power Supply:

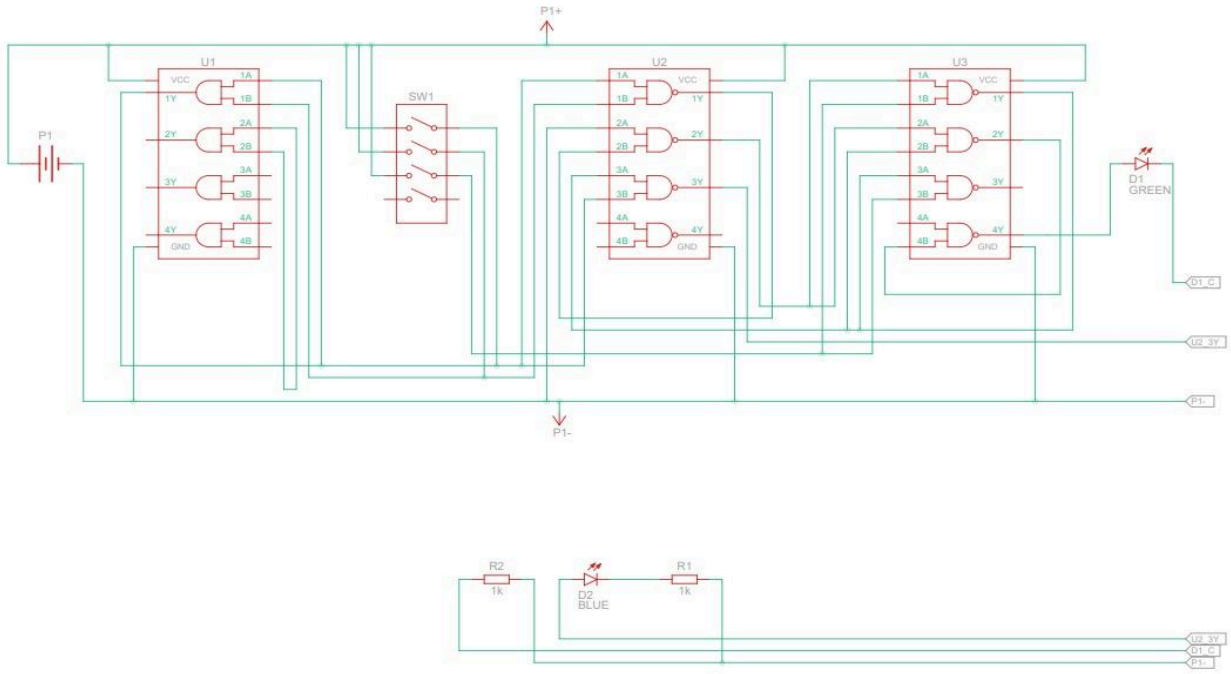
        - VCC (red): Positive power supply, likely +5V.
        - GND (black): Ground connection.
- Connections:
    - Inputs A and B are connected to the top two pins of U1.
    - The output of U1 (pin 3) goes to one input of U2 (pin 4) and the red LED (through R1).
    - The other input of U2 (pin 3) is connected to B.
    - The output of U2 (pin 6) goes to the green LED (through R2).
    - All ICs share the VCC and GND connections.
- Functionality:
    - The circuit adds two binary inputs (A and B) using XOR and AND gates.
    - The XOR gate's output determines the sum, lighting the red LED when both inputs are high (1 + 1 = 1 with a carry) and vice versa.
    - The AND gate produces a carry output (green LED) only when both inputs are high.

(B)**TINKERCAD SIMULATION RESULT:**

CIRCUIT LAYOUT



SCHEMATIC DIAGRAM



COMPONENTS

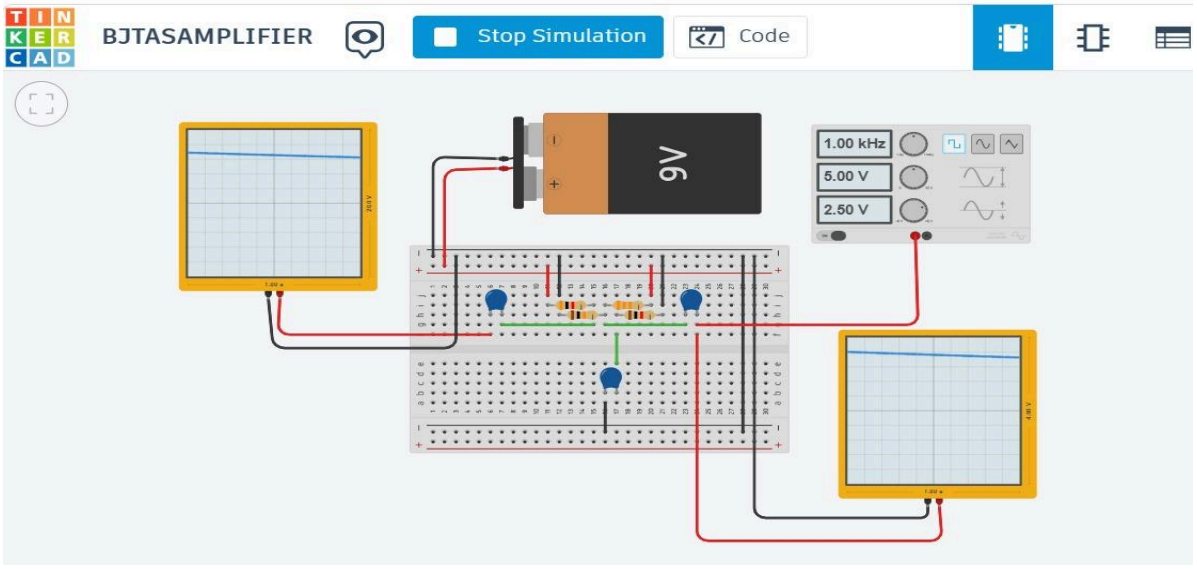
FULLADDERUSUNGNANDGA... Download CSV

Name	Quantity	Component
P1	1	5 , 5 Power Supply
U1	1	Quad AND gate
U2 U3	2	Quad NAND gate
SW1	1	DIP Switch SPST x 4
R1 R2	2	1 kΩ Resistor
D1	1	Green LED
D2	1	Blue LED

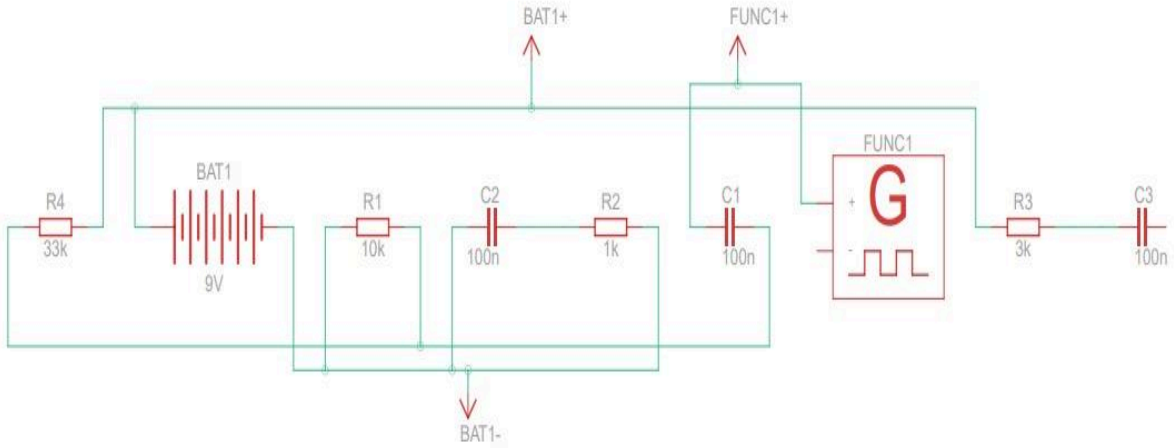
5 . Student Task2:Analog:BJT AS AN AMPLIFIER

(B)TINKERCAD SIMULATION RESULT:

CIRCUIT LAYOUT



SCHEMATIC DIAGRAM



COMPONENTS

BJTASAMPLIFIER | Download CSV

Name	Quantity	Component
FUNC1	1	1000 Hz, 5 V, 2.5 V, Square Function Generator
U1 U2	2	100 ms Oscilloscope
BAT1	1	9V Battery
R1	1	10 kΩ Resistor
R2	1	1 kΩ Resistor
R3	1	3 kΩ Resistor
R4	1	33 kΩ Resistor
C1 C2	3	100 nF Capacitor