

IoT Lab Manual, Spring 2025, IIIT Hyderabad

Prompt Engineered by Suresh Purini
ChatGPT Generated

January 2, 2025

Contents

1	Exploring Basic Circuits with TinkerCAD	2
1.1	Objective	2
1.2	Lab Instructions	2
1.3	Experiments	2
1.3.1	Experiment 1: Blinking an External LED	2
1.3.2	Experiment 2: LED with Button (Pull-Up Resistor)	3
1.3.3	Experiment 3: LED with Button (Pull-Down Resistor)	3
1.4	References	4

Lab 1: Exploring Basic Circuits with TinkerCAD

1.1 Objective

The objective of this lab is to familiarize students with basic electronic circuit design and programming concepts using TinkerCAD. Students will learn how to design and simulate circuits, as well as understand the practical use of pull-up and pull-down resistors in electronic circuits.

1.2 Lab Instructions

Students must complete the following experiments using **TinkerCAD.com**. For each experiment, you are required to:

- Design and simulate the circuit.
- Write and test the corresponding Arduino code.
- Submit the circuit schematic and the code generated on TinkerCAD.

1.3 Experiments

1.3.1 Experiment 1: Blinking an External LED

Objective: Design and simulate a circuit to blink an external LED and write code to control it.

Instructions:

1. Open TinkerCAD and create a new Arduino project.
2. Add the following components to your circuit:
 - Arduino Uno.
 - External LED.
 - $220\ \Omega$ resistor.
 - Breadboard.
 - Jumper wires.
3. Connect the circuit:
 - Connect one terminal of the resistor to the longer leg (anode) of the LED.
 - Connect the other terminal of the resistor to a digital pin (e.g., pin 13) on the Arduino.
 - Connect the shorter leg (cathode) of the LED to the ground rail of the breadboard.
 - Connect the ground rail of the breadboard to the GND pin on the Arduino.
4. Write the Arduino code to blink the LED at 1-second intervals.

Expanded Challenge:

- Modify the code to make the LED blink at variable intervals (e.g., 500ms, 1s, 2s) based on a delay value.
- Experiment with adding a second LED and make it blink in an alternating pattern with the first LED.

Expected Output: The external LED blinks at regular intervals, demonstrating basic control of an output device using Arduino.

1.3.2 Experiment 2: LED with Button (Pull-Up Resistor)

Objective: Design a circuit that lights up an LED when a button is pressed, using a pull-up resistor configuration.

Instructions:

1. Add the following components:
 - Arduino Uno.
 - LED and resistor ($220\ \Omega$).
 - Push button.
 - $10\text{ k}\Omega$ resistor (for pull-up configuration).
 - Breadboard and jumper wires.
2. Connect the circuit:
 - Connect the LED and resistor as in Experiment 1.
 - Connect the button such that one leg is connected to a digital pin (e.g., pin 2) and the other leg to the ground.
 - Use a pull-up resistor to connect the button pin to the 5V pin of the Arduino.
3. Write the Arduino code to turn the LED on when the button is pressed.

Expected Output: The LED lights up only when the button is pressed.

1.3.3 Experiment 3: LED with Button (Pull-Down Resistor)

Objective: Design a circuit that turns off an LED when a button is pressed, using a pull-down resistor configuration.

Instructions:

1. Modify the circuit in Experiment 2 to use a pull-down resistor:
 - Connect one leg of the button to a digital pin and the other to 5V.
 - Connect a $10\text{ k}\Omega$ resistor between the button pin and ground.
2. Write the Arduino code to turn the LED off when the button is pressed.

Expected Output: The LED turns off only when the button is pressed.

1.4 References

Use these videos as guides to understand the experiments and concepts:

- **Complete beginner's guide to using a breadboard (optional)**
- **LEDs & Breadboards With Arduino in Tinkercad**
- **Blink an LED With Arduino in Tinkercad**
- **Pushbutton Digital Input With Arduino in Tinkercad**
- **Pull up/ Pull down resistor - explained**
- **Understanding Pushbuttons and Pull Up and Pull Down Resistors**