Lab Report: Arduino Lab 1

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Arduino Lab 1

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Abstract

In this lab, three circuits were constructed using an Arduino microcontroller. The goal was to explore the concepts of voltage, resistance, and amperage, and understand their relationships within series and parallel circuits. The first circuit consisted of a single LED that was activated by a push button switch. The second circuit was a single LED that was activated only when two push button switches, wired in series, were pressed simultaneously. The third circuit was a single LED that could be activated by pressing either of two push button switches wired in parallel. The lab provided hands-on experience in circuit building, measuring electrical properties, and analyzing the outcomes of different component configurations. By constructing these circuits, we gained a better understanding of how series and parallel configurations affect current flow and circuit behavior.

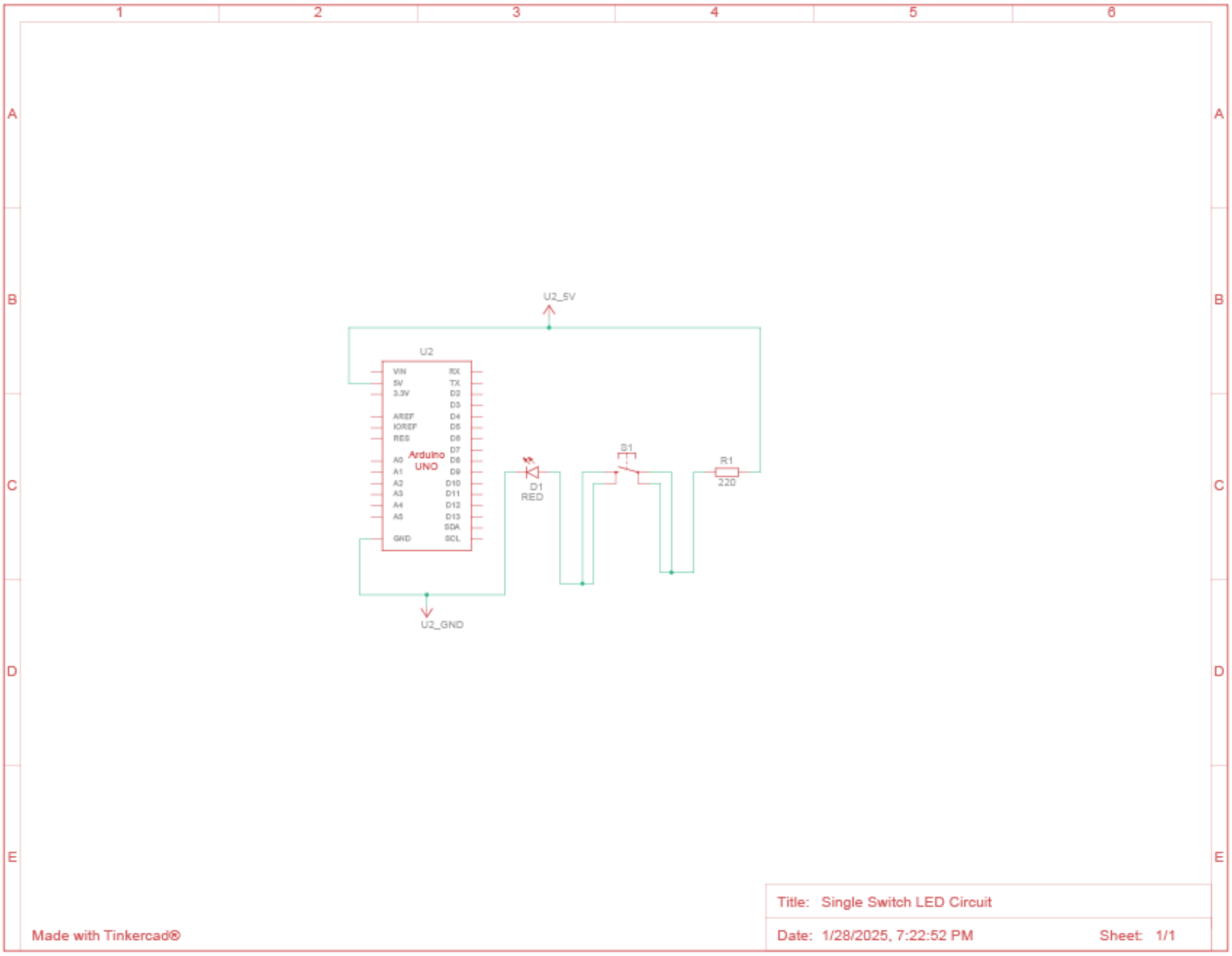
Materials

1. Arduino Uno microcontroller
2. Breadboard
3. LED
4. Resistor (220 Ω)
5. 2 Push button switches
6. Assorted Connecting wires
7. USB cable
8. Computer with Arduino IDE
9. Tweezers

Procedure

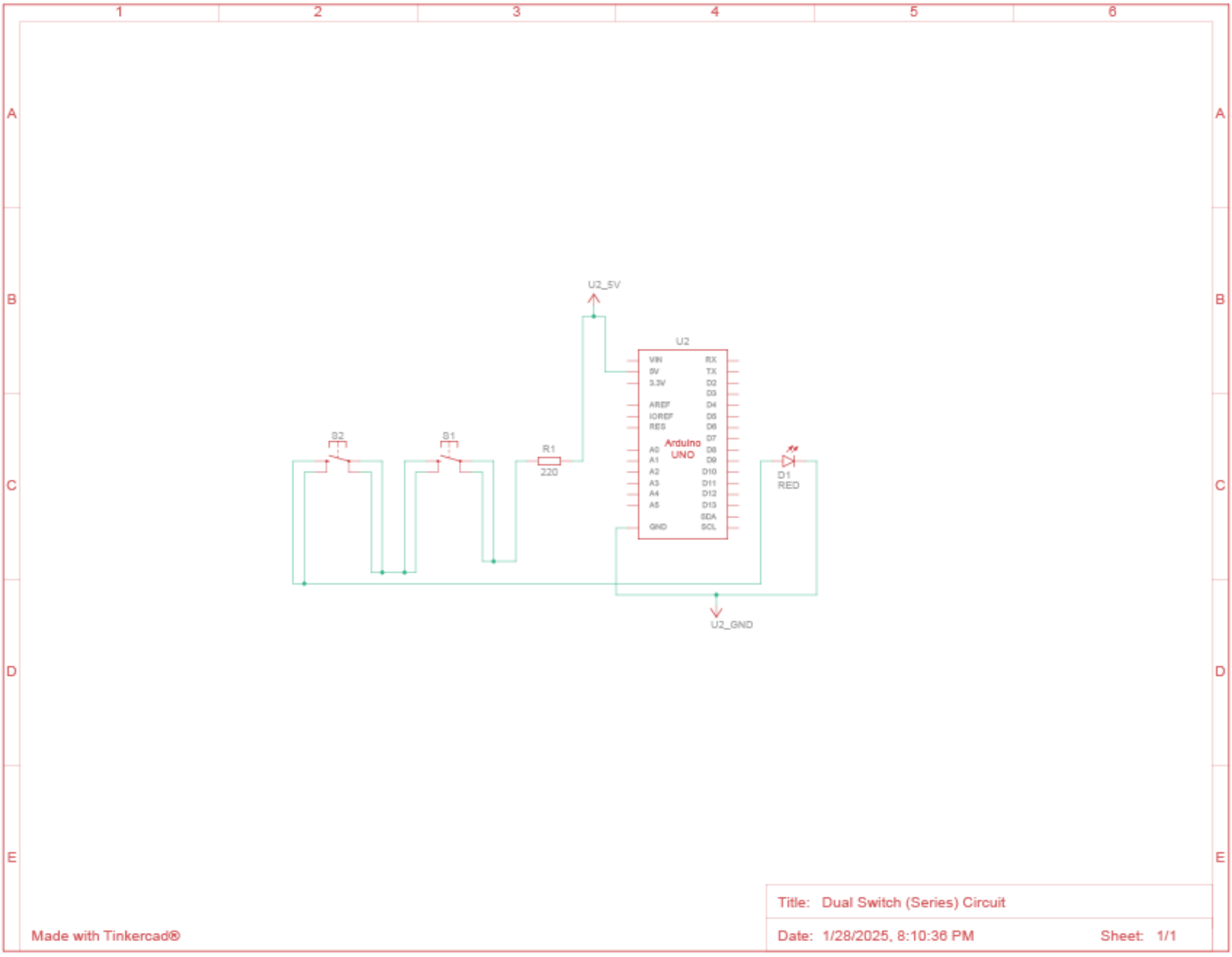
1. **Circuit 1: Single LED with Push Button Switch**
    - Used jumper wires to connect the Arduino's 5V output and ground to the breadboard power rails.
    - Inserted a 220 Ω resistor connecting the 5v power bus to the switch
    - Insert a jumper cable connecting the switch to the LED
    - Connect the LED to the ground bus bar
    - Power the Arduino using the USB cable and test the circuit is working properly

Schematic:



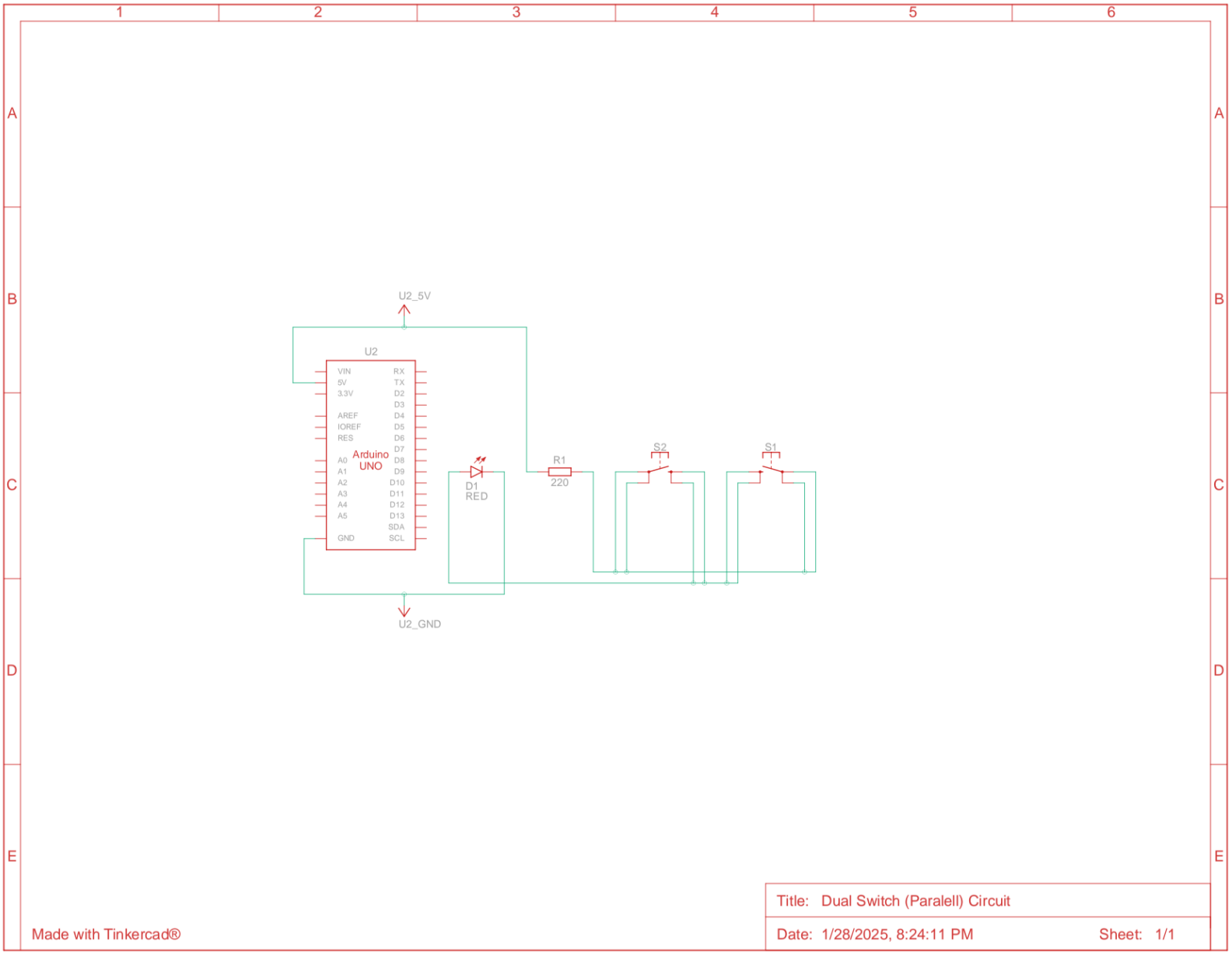
2. **Circuit 2: Single LED with Two Push Buttons in Series**
    - Used jumper wires to connect the Arduino's 5V output and ground to the breadboard power rails.
    - Added a single 220 Ω resistor connecting the 5v rail to the first switch
    - Added a jumper cable from the first switch to the second switch
    - Added another jumper cable from the second switch to the LED
    - Connected the circuit to the power and ground rails provided by the Arduino.
    - Powered the Arduino using the USB cable and tested the circuit.

Schematic:



3. **Circuit 3: Single LED with Two Push Buttons in Parallel**
    - Use jumper wires to connect the Arduino's 5V output and ground to the breadboard power rails.
    - Arrange two push button switches on the breadboard.
    - Connect each switch to both the LED and to the resistor
    - Connect the LED to the ground rail.
    - Power the Arduino using the USB cable and test the circuit.

Schematic:



Discussion

1. **Define in your own words voltage, resistance, and amperage:**

   Voltage: The electrical potential difference between two points, driving the current flow in a circuit, measured in volts (V).

   Resistance: The opposition to the flow of electric current, measured in ohms (Ω).

   Amperage: The flow rate of electric charge in a circuit, measured in amperes (A).

2. **What is a metaphor that you can use to describe voltage, resistance, and amperage?**

   Voltage is like water pressure in a pipe, resistance is the pipe's width, and amperage is the flow rate of water through the pipe.

3. **Why do you need to always use a resistor in series with an LED?**

   A resistor limits the current to prevent the LED from drawing excessive current and getting damaged.

4. **What is the difference between a series and parallel circuit?**

   In a **series circuit**, components are arranged in a single path, so current flows through each component sequentially. In a **parallel circuit**, components are arranged across multiple paths, so each component gets the same voltage but divides the current.

5. **Describe how you measure amperage using a digital multimeter.**

   Set the multimeter to the appropriate current range. Break the circuit at the point of measurement and connect the multimeter in series.

6. **Describe how you measure voltage using a digital multimeter.**

   Set the multimeter to the appropriate voltage range. Place the probes across the component or points of interest without breaking the circuit.

7. **Calculate the amperage that the LEDs draw with each series and parallel circuit in this lab.**

   Current = Voltage / Resistance

   5.0v / 220Ω ≈ 0.0227 A or 22.7 mA

8. **Calculate the voltage required to power a light given that it consumes 0.5 amps and has a resistance of 250 ohms.**

   Voltage = Current × Resistance

   0.5 A × 250 Ω = 125 V

Troubleshooting

1. **Challenge:** Getting the tiny jumper wires into the small slots on the breadboard.

   Solution: Used a pair of tweezers to carefully position and insert the wires.

Conclusion

This lab reinforced fundamental concepts of electrical circuits, including voltage, resistance, and current. By constructing and testing circuits with different push button configurations, we gained insight into how series and parallel wiring affects circuit behavior. The importance of resistors in protecting LEDs and accurate measurements using multimeters were highlighted. These skills will be essential in future labs and practical applications.