Lab 1: Getting Started with the Arduino Mega

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Introduction:

The objective of this lab was to familiarize ourselves with the Arduino Mega microcontroller board and learn how to perform basic tasks such as installing the Arduino IDE, running a simple sketch, modifying code, connecting external components, and using an oscilloscope for signal measurement. By completing these tasks, we aimed to gain practical experience in working with Arduino and develop an understanding of its capabilities.

Methods and Techniques:

Part I: Intro to Arduino

Installed the Arduino IDE on the computer.
Opened the Blink example sketch and observed the error messages caused by removing a required semicolon.
Fixed the bug and built the code.
Connected the Arduino Mega to the computer via USB.
Configured the IDE for the Arduino Mega board and selected the appropriate serial port.
Uploaded the Blink sketch to the Arduino and verified the blinking LED labeled "L."

Part II: Modifying the Sketch and LED

Modified the delay values in the sketch to change the blinking speed of the LED.
Recompiled and re-uploaded the sketch to observe the faster blinking LED.
Tested the functionality of the sketch using the 120VAC power adapter.

Part III: External LED Hardware

Connected a 250 Ω resistor between the cathode of an LED and a GND pin on the Arduino.
Modified the blink.ino code to assign pin 10 for the external LED.
Compiled and uploaded the modified code to verify the blinking of the LED connected to pin 10.

Part IV: Multiple Tasks

Wired an 8 Ohm speaker between pin 2 and +3.3V on the Arduino.
Modified the blink sketch to generate clicks on the speaker by using digitalWrite on pin 2.

Added code to blink both the on-board LED (pin 13) and the external LED (pin 10) in opposite states, accompanied by speaker clicks.
Part V: Differing Periodicities

Modified the code to replace the speaker clicks with a continuous tone of 250Hz.
Ensured that the tone turned off after a few seconds while the LEDs continued flashing.

Part VI: Measuring Signals with an Oscilloscope

Explored the functioning of an oscilloscope, including vertical, horizontal, and trigger controls.
Connected the oscilloscope probe to the Arduino output and ground.
Adjusted the oscilloscope settings to obtain a stable waveform display.
Used the oscilloscope's "Measure" feature to analyze the frequency of the Arduino waveform.

Experimental Results:
The experiments were successfully conducted, and the following outcomes were observed:

The Blink sketch caused the on-board LED (pin 13) to blink at a specified rate.
Modifying the delay values resulted in a change in the blinking speed of the LED.
The external LED (connected to pin 10) blinked according to the modified sketch.
By adding code, both the on-board LED (pin 13) and the external LED (pin 10) blinked alternately, accompanied by speaker clicks.

Overall Performance Summary:
The lab activities allowed us to achieve the learning objectives by providing hands-on experience with the Arduino Mega microcontroller board. We successfully installed the Arduino IDE, executed basic sketches, modified code to control LEDs and a speaker, and utilized an oscilloscope for signal measurement. The outcomes demonstrated a solid understanding of Arduino programming and the ability to interface external components.

Teamwork Breakdown:

The lab tasks were completed collaboratively by the team members. Each team member actively participated in installing the Arduino IDE, connecting the hardware components, modifying the sketches, and testing the functionality. We worked together to troubleshoot any issues that arose during the lab and ensured that everyone had a comprehensive understanding of the concepts and procedures.

Discussion and Conclusion:
In this lab, we gained valuable experience in working with the Arduino Mega microcontroller board. The tasks performed allowed us to understand the process of installing the Arduino IDE,

uploading sketches, modifying code, connecting external components, and utilizing an oscilloscope for signal analysis. The successful completion of the lab exercises demonstrates our ability to apply theoretical knowledge to practical applications. We are now equipped with the fundamental skills required for future projects and further exploration of Arduino-based systems.