Scientific Calculator Experiment

M.Ranjith

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1 Introduction

This experiment aims to design a scientific calculator using a 16x2 LCD display, push buttons, and a voltmeter as input components. The calculator will be capable of performing basic arithmetic operations such as addition, subtraction, multiplication, and division, along with advanced mathematical functions like trigonometry and logarithms.

1.1 Objective

The primary objectives of this experiment are:

- To interface a 16x2 LCD display with a microcontroller.
- To use push buttons for selecting mathematical operations.
- To utilize a voltmeter for inputting values.
- To program the microcontroller for performing scientific calculations.

Solution

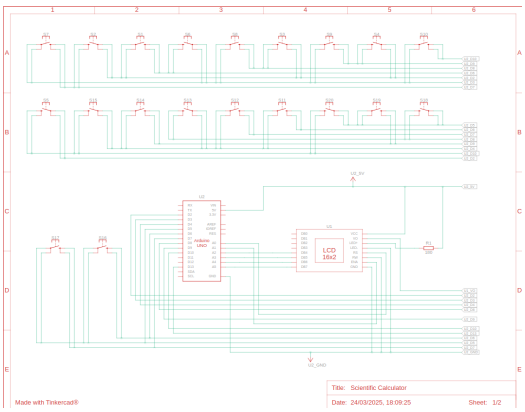

Figure 1:

2 Required Materials

The following components are required for the experiment:

- Microcontroller (Arduino Uno/Nano)
- 16x2 LCD display (for result display)
- Push buttons (for operation selection)
- Voltmeter (for numerical input)
- Resistors (1k, 10k)
- Jumper wires
- Breadboard
- 5V Power Supply (from Arduino or external source)

Component	Arduino Pin
Button Matrix	
Row 1	2
Row 2	3
Row 3	4
Row 4	5
Column 1	6
Column 2	7
Column 3	8
Column 4	9
Column 5	10
Shift Button	
Shift Button	13
GND	GND
LCD Display (16x2, Non-I2C)	
LCD RS	A0
LCD EN	A1
LCD D4	A2
LCD D5	A3
LCD D6	A4
LCD D7	A5

Table 1: Circuit Connections of the Scientific Calculator

3 Procedure

3.1 Step 1: Circuit Connections

1. Connect the 16x2 LCD display to the microcontroller:
   - RS, E, D4-D7 pins → Arduino digital pins 7, 8, 9, 10, 11, 12.
   - VSS to GND, VDD to 5V.
2. Connect the push buttons:
   - One button for each operation (+, -, ×, ÷).
   - Connect one terminal to Arduino digital pins (2–5) and the other to GND using pull-down resistors (10k).
3. Connect the voltmeter to an analog input pin (e.g., A0) to read voltage values.

3.2 Step 2: Programming the Microcontroller

1. Write and upload an Arduino program to:
   - Read voltage values as input numbers.
   - Detect button presses to determine operations.
   - Perform calculations and display results on the 16x2 LCD.
2. Ensure the program updates the display after each operation.

3.3 Step 3: Testing and Observations

1. Input numbers using the voltmeter and verify correct readings.
2. Press the operation buttons and confirm calculations.
3. Ensure accurate results are displayed on the LCD.

4 Conclusion

In this experiment, a scientific calculator was successfully built using a 16x2 LCD display, push buttons, and a voltmeter. The microcontroller effectively handled arithmetic and scientific calculations based on user inputs. This experiment provided insights into:

- Interfacing LCD displays and push buttons with a microcontroller.
- Using a voltmeter as an input device.
- Implementing real-time mathematical computations in embedded systems.

Future improvements could include adding a keypad for direct numerical input and incorporating more advanced mathematical functions.

code reference-koushik muthyala