SCIENTIFIC CALCULATOR

Sruthi Bijili
EE24BTECH11060

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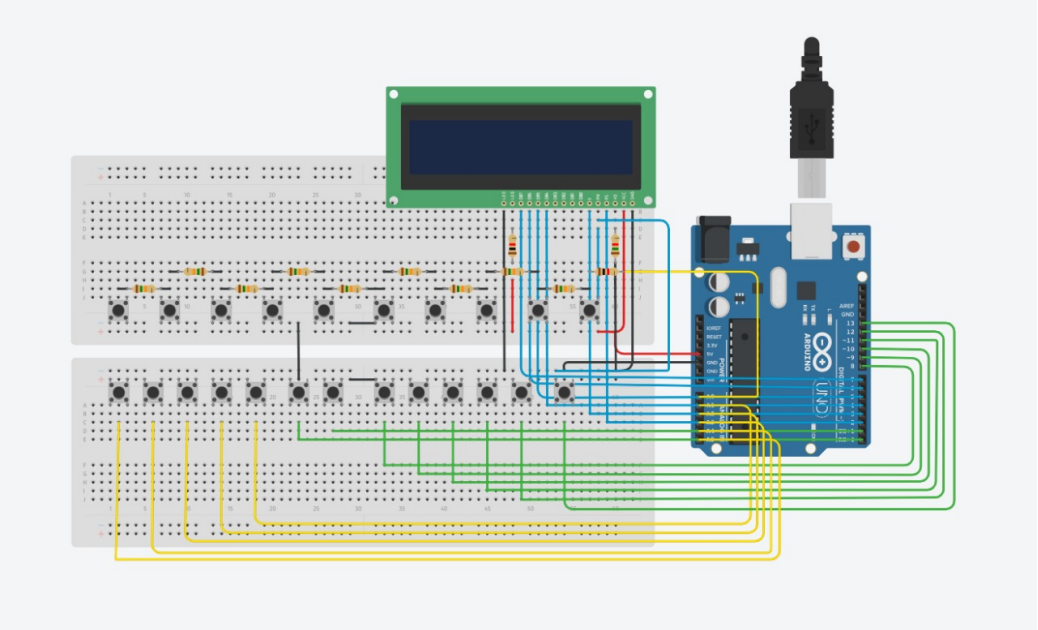
This project develops a scientific calculator using an Arduino UNO, a 16x2 LCD display, and push buttons. It supports arithmetic, trigonometric, and logarithmic operations with real-time computation and display. The system ensures accuracy using floating-point arithmetic and efficient input handling. Challenges like input management and display optimization were addressed to enhance usability. Future enhancements may include a touchscreen interface, additional functions, and memory storage.

1 Introduction

A scientific calculator is an essential tool for performing mathematical computations. This project focuses on implementing a calculator using an Arduino UNO that supports basic arithmetic, trigonometric, and logarithmic functions. The system uses a button-based input mechanism and an LCD for output display.

2 Hardware Components

- Arduino UNO
- 16x2 LCD Display
- Push Buttons
- Breadboard
- Jumper Wires
- Power Supply
- Resistors (1kΩ ,15kΩ,2kΩ)



3 Circuit Connections

The connections for the components are as follows:

1. Connect 5V and Ground from the Arduino onto the breadboard.
2. Connect the push buttons in 2 rows (each from grid to power lines not connected to Ground or 5V). The first row must have 10 buttons (for digits), and the second row must have 13 buttons (for functions). Connect one terminal of each button to Ground.
3. Make the following connections to establish the required circuit:

Table 1: Connections

First end of jumper wire	Second end of jumper wire
Arduino digital pin 0	Push button no. 16
Arduino digital pin 1	Push button no. 17
Arduino digital pin 2	LCD pin 4
Arduino digital pin 3	LCD pin 6
Arduino digital pin 4	LCD pin 11
Arduino digital pin 5	LCD pin 12
Arduino digital pin 6	LCD pin 13
Arduino digital pin 7	LCD pin 14
Arduino digital pin 8	Push button no. 18
Arduino digital pin 9	Push button no. 19
Arduino digital pin 10	Push button no. 20
Arduino digital pin 11	Push button no. 21
Arduino digital pin 12	Push button no. 22
Arduino digital pin 13	Push button no. 23
Arduino analog pin A1	Push button no. 15
Arduino analog pin A2	Push button no. 14
Arduino analog pin A3	Push button no. 13
Arduino analog pin A4	Push button no. 12
Arduino analog pin A5	Push button no. 11
Arduino analog pin A0	Push buttons no. 1-10 (digit buttons)
LCD pin 1	Ground
LCD pin 2	5V
LCD pin 15	5V via 1kΩ resistor
LCD pin 16	Ground
LCD pin 3	Ground via 1.5kΩ resistor
LCD pin 5	Ground
LCD pin 5	All push buttons

Note: Connections designed with the help of Akshara EE24BTECH11003,Teja vardhan EE24BTECH11034, Akshita EE24BTECH11054

4 Software Implementation

The Arduino code reads button inputs, processes mathematical operations, and displays the results on the LCD. The program initializes the LCD, manages user input, and executes the required functions using mathematical libraries. The key features of the software implementation include:

- Reading input from push buttons and mapping them to corresponding mathematical functions.
- Displaying user inputs and results dynamically on the LCD.
- Performing calculations using predefined mathematical functions in Arduino's library.
- Handling errors such as invalid inputs or operations.
- Implementing a real-time response mechanism to ensure smooth functionality.
- Allowing easy modification of the code to add more functions in the future.

5 Working Principle

- The push buttons send signals to the Arduino, which interprets the input and processes the mathematical operations.
- The LCD module displays the entered values and computed results.
- The calculator follows a sequential operation mechanism where expressions are evaluated as they are entered.
- Predefined mathematical functions such as trigonometric and logarithmic calculations are executed using Arduino libraries.
- The system ensures accuracy by using floating-point arithmetic for precise calculations.
- Error handling mechanisms prevent invalid inputs from disrupting calculations.

6 Push Button Functions

Table 2: Push Button Designations

Button Number	Function
1 - 10	Digits 0 - 9
11	Clear
12	$\ln(x)$ and $\log(x)$
13	Right Parenthesis
14	$\sin(x)$, $\cos(x)$, and $\tan(x)$
15	e and π
16	Backspace
17	Decimal Point
18	Equal To
19	Left Parenthesis
20	Division
21	Multiplication
22	Subtraction
23	Addition

7 Results

- The scientific calculator built using Arduino UNO performs mathematical operations accurately, displaying results clearly on the LCD.
- The system successfully handles trigonometric, logarithmic, and arithmetic functions with reliable input from push buttons.
- The calculator operates efficiently with minimal lag, and future improvements could include additional features like memory storage and touchscreen integration.

8 Conclusion

The scientific calculator using Arduino UNO successfully performs a range of mathematical operations, including arithmetic, trigonometric, and logarithmic functions. Future enhancements may include additional functions and an improved user interface. This project demonstrates the capability of Arduino for mathematical computing and provides a functional model for educational

and practical applications. The successful implementation of this calculator showcases the feasibility of using microcontrollers for computational tasks in various fields.