

# **REPORT**

## **Project Based Learning**

Arduino based Scientific Calculator

Equation = -  $\sin x / \cos x$

## **Aim:**

To design an arduino based scientific calculator (Add, Sub, Mul, Div, Sin, Cos, Tan) for implementing equation

$$y = \frac{-\sin x}{\cos x}$$

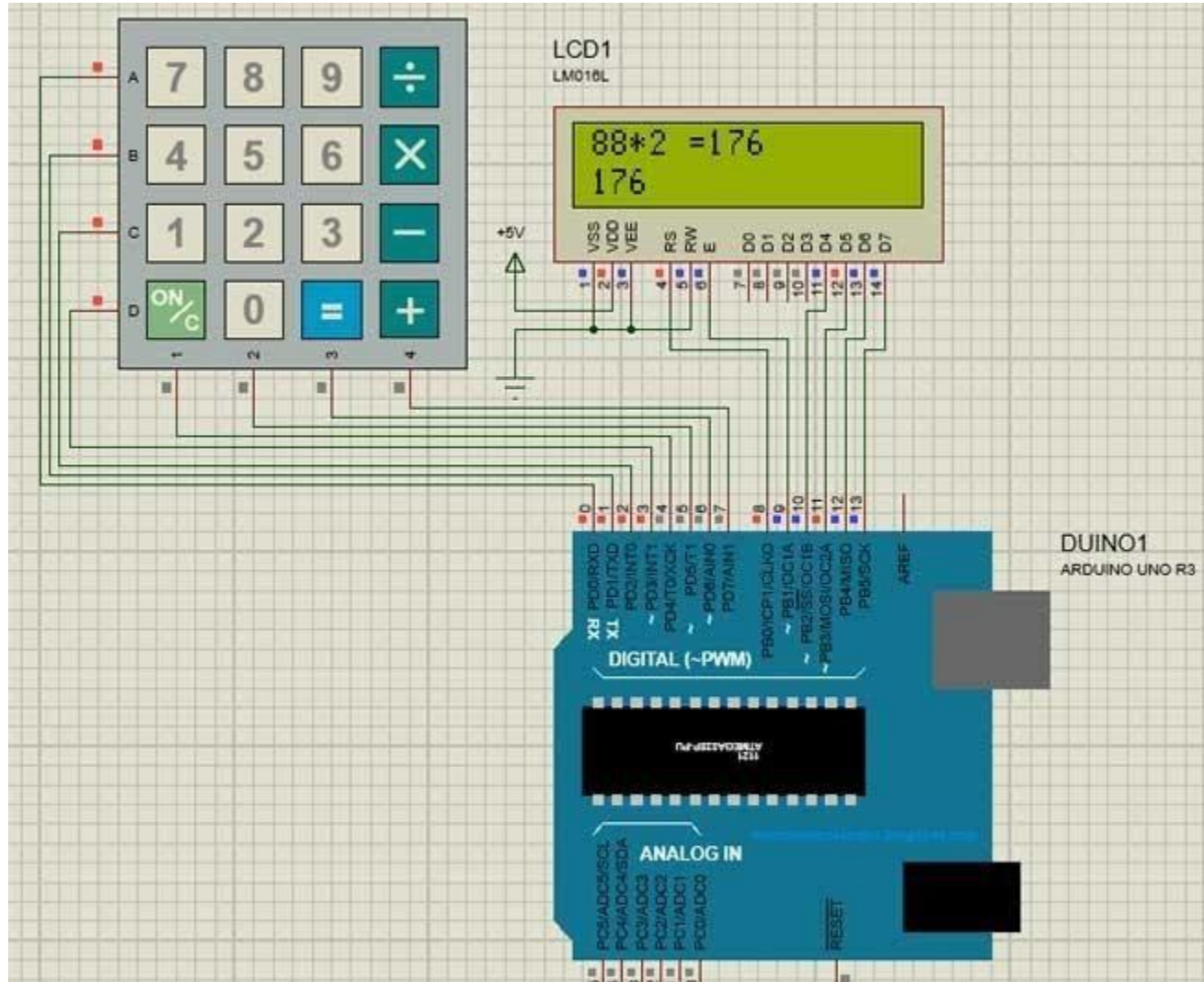
## **Materials Required:**

1. Arduino Uno (Any version will work)
2. 16×2 LCD Display
3. 4×4 Keypad
4. Jumper Wires
5. Breadboard and Connecting wires
6. Potentiometer (1kΩ)
7. Resistor (1kΩ) 8. Arduino IDE (Software)

## **Abstract:**

Calculator is a device, which is used to perform simple Arithmetic Operations. Apart from small calculators, this comes in complex scientific outlook that can perform various mathematical operation and functions. All the mathematical operation in this calculator support continuous calculation using previous result.

## Circuit Diagram:



## **Theory:**

The Arduino Uno is a microcontroller board based on ATmega328. It has 14 digital input/output pins. To build a scientific calculator the values can be sent in through a keypad (4×4 keypad) and result can be viewed on a LCD screen (16x2 Dot-matrix). This calculator could perform simple operations like Addition, Subtraction, Multiplication, Division, Absolute, Trigonometric, Modulus, Logarithmic, Square, Square root, Power and Exponential functions.

## **Specification of components:**

### **Arduino UNO:**

The Microcontroller part of the project is the Arduino UNO. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts.

### **16 x 2 LCD Display:**

16 x 2 LCDs are economical, easily programmable, have no limitation of displaying special & even custom characters. 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The data is the ASCII value of the character to be displayed on the LCD.

## **4 x 4 Matrix Keypad:**

Matrix Keypads are commonly used in calculators, telephones etc. where a number of input switches are required. This 4x4 matrix membrane keypad provides a useful human interface component for microcontroller projects. Convenient adhesive backing provides a simple way to mount the keypad in a variety of applications.

## **Resistor:**

Resistor is a passive component used to control current in a circuit. Its resistance is given by the ratio of voltage applied across its terminals to the current passing through it.  $1\text{k}\Omega$  resistor is used to limit the current supply to the LCD display.

## **Potentiometer:**

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat.  $1\text{k}\Omega$  potentiometer is used to set the contrast of the LCD display.

## Working:

### Microcontroller ATmega328

Operating	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

Vin is connected to the LM385D chip which contains two op amps. One of the opamps is used as a comparator and the other is not used at all. 3V3 is compared to  $V_{in}/2$  if  $V_{in}/2 > 3V3$  then the output is 5v and that is used to turn off the supply from the USB. The 5v generated is then connected to the LP2985 chip which is a voltage regulator that takes in 5v and outputs 3v3. If instead  $V_{in}/2 < 3.3$ , the mosfet is turned on and the USB power is used instead. USB provides the 5v to the LP2985 chip. The USB controller is implemented with the ATMEGA8U2-MU. It contains the bootloader code which is used to load the code unto the ATMEGA328P. The ATMEGA328P is the main controller. The code you write for the arduino is executed by this controller. And it is directly connected to the I/O pins. The controller is programmed via the TX, RX pins connected to the USB to serial controller.

## Features:

This calculator can do various mathematical operations, they are as follows.

1. ADD
2. SUB
3. MULT
4. DIV
5. ABS
6. SIN
7. COS
8. MOD
9. COT
10. SEC
11. COSEC
12. MOD
13. SQRT
14. Loge
15. Log10
16. exp
17. pow

18. square of number

19.  $-\sin/\cos$

20.  $-\sin x/\cos y$

### **Advantages:**

- Easy to use.
- Reduces complexity of solving problems.
- Enough number of problems can be solved repeatedly without any difficulty.
- Supports continuous operation with previous result.
- Offers a wide range of conversion data.
- It makes the counting process faster.

### **Disadvantages:**

- People will be unable to memorize the process of problem solving.
- Complex connection procedure.
- Expensive
- Consumes more space



## **Conclusion:**

A scientific calculator was created using Arduino uno and our equation was implemented successfully. From this project we also studied the Arduino and its uses. Various operations and functions were implemented in our scientific calculator which were perform their tasks successfully.