CS Project Documentation

CS 101

GROUP NO.-315

Advanced scientific Calculator

&

Basic Graph Plotter

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INTRODUCTION-

Calculator is not a very new thing in CS project. There've been many calculators in the past but there is something that makes our calculator different from others;"INTERFACE".

We choose calculator to do in this project because we all were new to programming and wanted to learn it and what could be a better way than writing thousands of lines of code for different functionalities.

The thing common in all previous year's projects is that most of the functions were implemented on terminal and also they all had poor interface with less or no use of graphics. We tried to make a user friendly interface and we are successful to an extent with a display and all functionalities that you expect in any calculator.

We all were new to programming and faced problems at many points of time during the project but this was our driving force for the completion of project with somewhat self satisfaction of each team member.

PROBLEM STATEMENT

The problem is quite obvious and clear.

CALCULATOR-We are to design and make a calculator that will evaluate an expression given to it and generate the correct result. The calculator can handle integers as well as decimal numbers.

- User must know the basic use of arithmetic operations and the entered expression should contain brackets at proper position.
- The intervals of domains of all operations must be known.

MATRIX SOLVER-User can solve any system of linear equations by giving the input of number of variables and all coefficients.

UNIT CONVERSION-This feature allows converting one system of unit to another. It allows conversion of properties like length, weight, volume, temperature, area, conversion of decimal to binary, octal and hexadecimal.

STATISTICS-The user must know the use of variance, standard deviation, root mean square value.

COMPLEX NUMBERS-A knowledge of argument(angle of the complex number with real line), conjugate(mirror image of number with respect to real line),magnitude(as the square root of sum of square of real and imaginary part).

GRAPH PLOTTER-User can plot any of the shown functions in same or in different as per the requirements.

MISCELLENEOUS FUNCTIONS-These include functions like calculation of simple and compound interest, greatest integer function.

REQUIREMENTS-

Software requirements

a) Compiler...............Code::Blocks 13.12

b) Operating system.......Ubuntu 14.04 LTS

c) Graphics library.......simplecpp

d) Compiler and library settings must be changed to s++(which would initially be c++).You may refer to video for further clarifications.

IMPLEMENTATION

A) Functionalites

I. Calculator – The functionality of Calculator is based on the stack and queue principle. When a user inputs numbers, they are stored in postfix form and later this postfix form is evaluated according to the design rules i.e converted to infix form.

II. MATRIX SOLVER – The principle is based on the Gaussian elimination principle to solve any system of linear equations.

III. Unit Conversion - Separate classes have been made for all types of conversion.

IV. STATISTICS – Separate functions have been made for mean, median, mode and all other things.

V. DIFFERENTIATION & INTEGRATION – Can compute derivative of all the allowed functions

VI. COMPLEX NUMBERS – Classes have been made with different members for computing things like magnitude, argument, conjugate etc.

VII. GRAPH PLOTTER – The functionality is based completely on simplecpp graphics. The graph is plotted by using penDown() command and moving the center of circle along the curve of functions like sinx, e^x, x^2 etc.

VIII. MISC. FUNCTIONS – These include greatest integer function and calculations of simple and compound interest.

TESTING STRATEGY AND DATA

The following test cases illustrated below describe the use of more or less entire buttons on the calculator.

Calculations involving arithmetic operations with trigonometric and combinatorial terms.
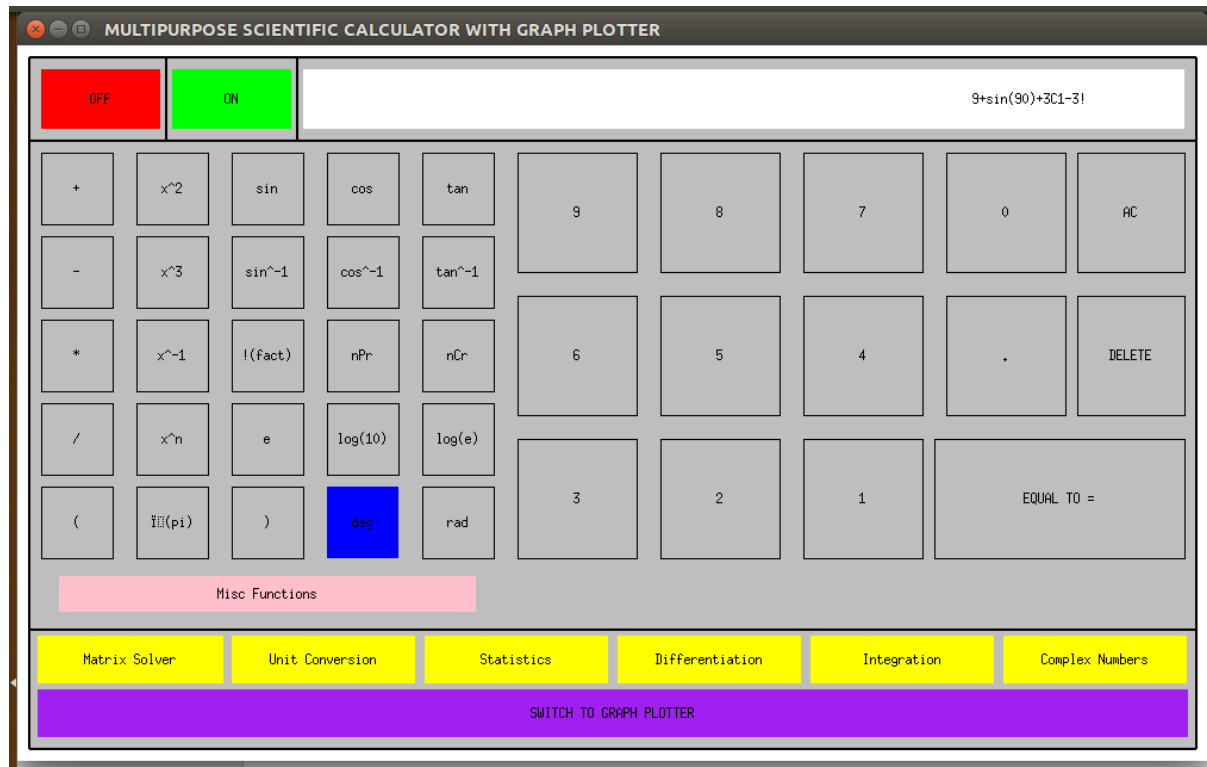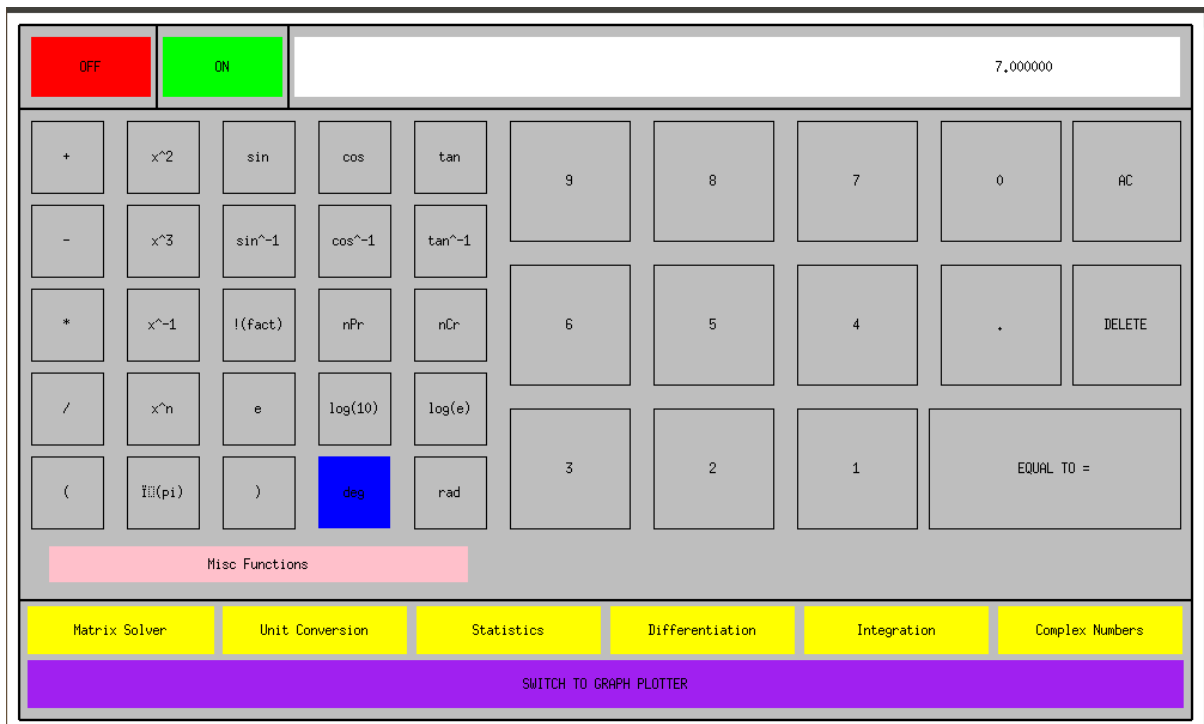

Fig 1.1 screenshot of calculator with formula

After pressing equal to we should get 7

OFF	ON								7.000000

+	x^2	sin	cos	tan	9	8	7	0	AC
-	x^3	sin^-1	cos^-1	tan^-1					
*	x^-1	!(fact)	nPr	nCr	6	5	4	.	DELETE
/	x^n	e	log(10)	log(e)					
(	ℼ(pi)	)	deg	rad	3	2	1	EQUAL TO =	

Misc Functions

Matrix Solver	Unit Conversion	Statistics	Differentiation	Integration	Complex Numbers

SWITCH TO GRAPH PLOTTER

Matrix solver solving simple 2*2 linear system.

x+y=1; x-y=0;

solution should come to (0.5,0.5)

```
MULTIPURPOSE SCIENTIFIC CALCULATOR WITH GRAPH PLOTT
⊗ ⊖ ⊡   /home/darshit/Desktop/demosubmissionprojectrevised/

Enter the no. of equations(=variables) : 2
Equation Solver (2 equations and 2 variables)
Enter the equation 1 coefficients:
Coeff. of:
x1      1
x2      1
constant: 1
Enter the equation 2 coefficients:
Coeff. of:
x1      1
x2      -1
constant: 0
The entered equations are:

(1)x1 (1)x2 =1
(1)x1 (-1)x2 =0
After Gaussian Elimination :

(1)x1 (0)x2 =0.5
(-0)x1 (1)x2 =0.5
The solution is :
x1 =0.5
x2 =0.5
Enter the no. of equations(=variables) : █
```
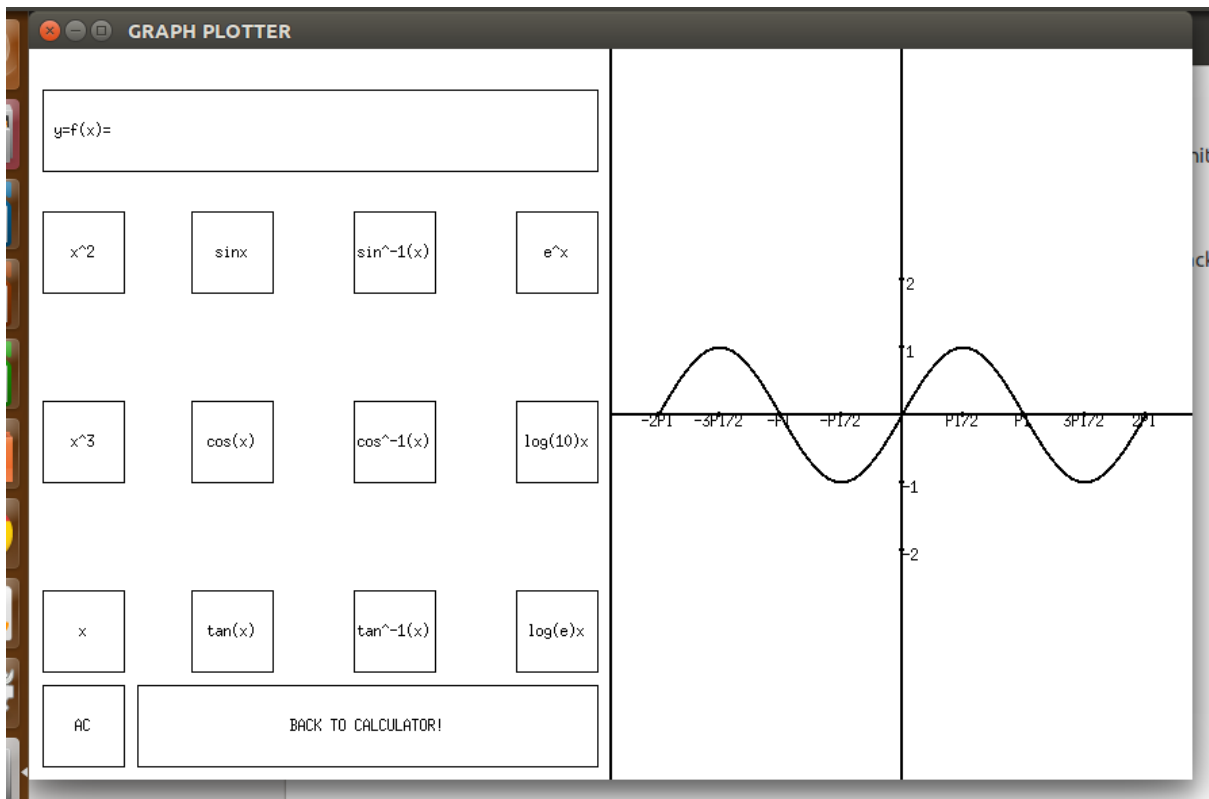
Unit Conversion for converting kms to miles.

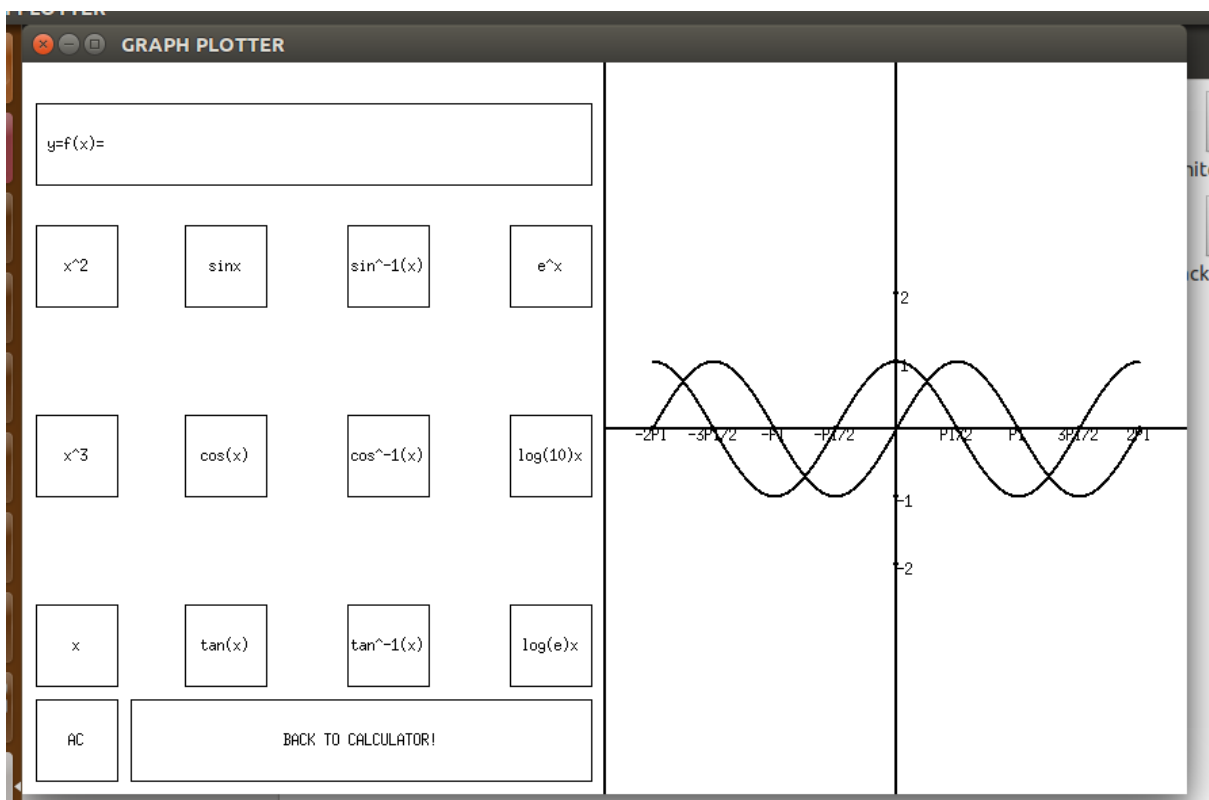Length of marathon in kms=44km;

In miles=27.3403

```
 1 : mm-m
 2 : m-mm
 3 : cm-m
 4 : m-cm
 5 : cm_km
 6 : km-cm
 7 : m-mile
 8 : mile-m
 9 : km-mile
10 : mile-km
11 : feet-m
12 : m-feet
13 : inch-m
14 : m-inch
17 : Back to The Main Menu

Please Enter Your Choice= 9

   kilometer=44

   mile=27.3403

Please Enter Your Choice=
```
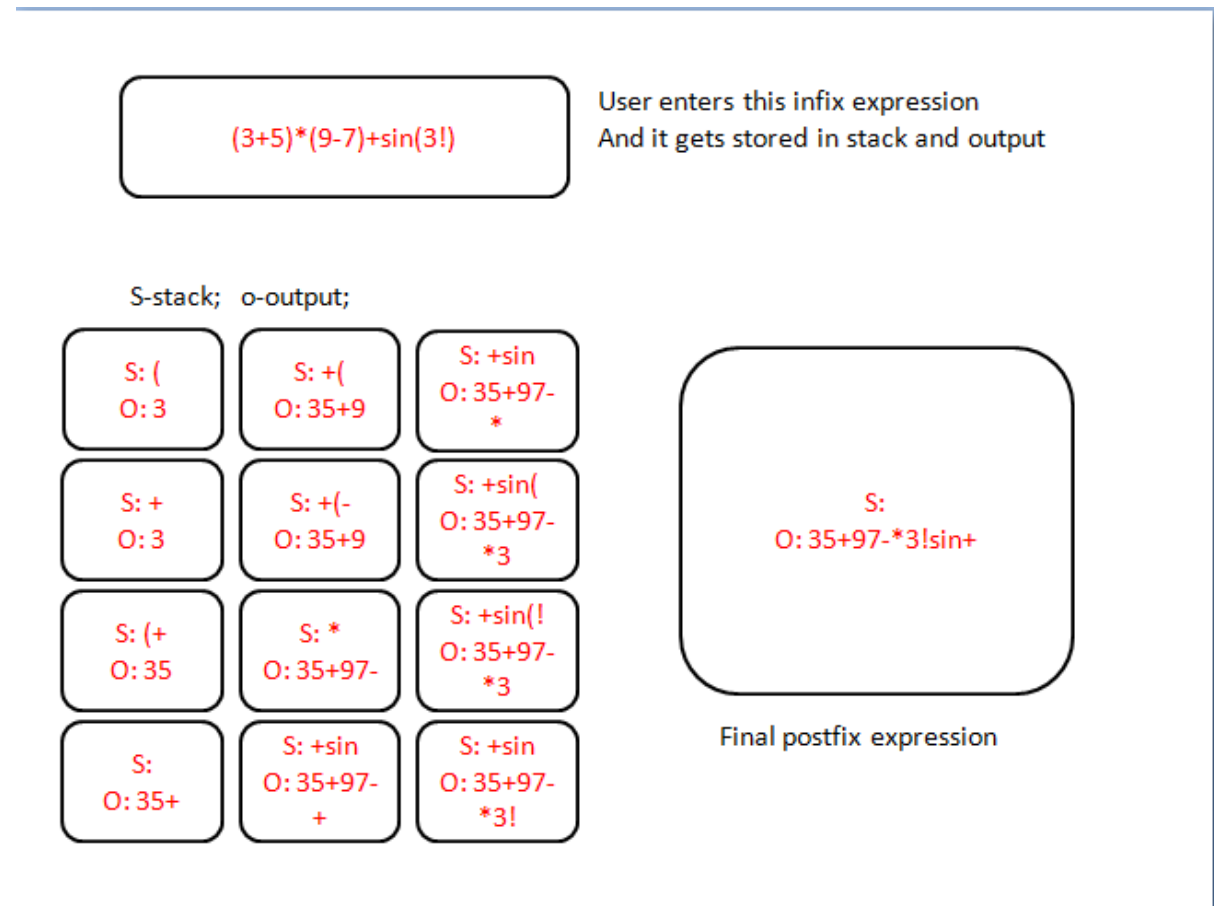
Graph Plotter

Graph of sinx;

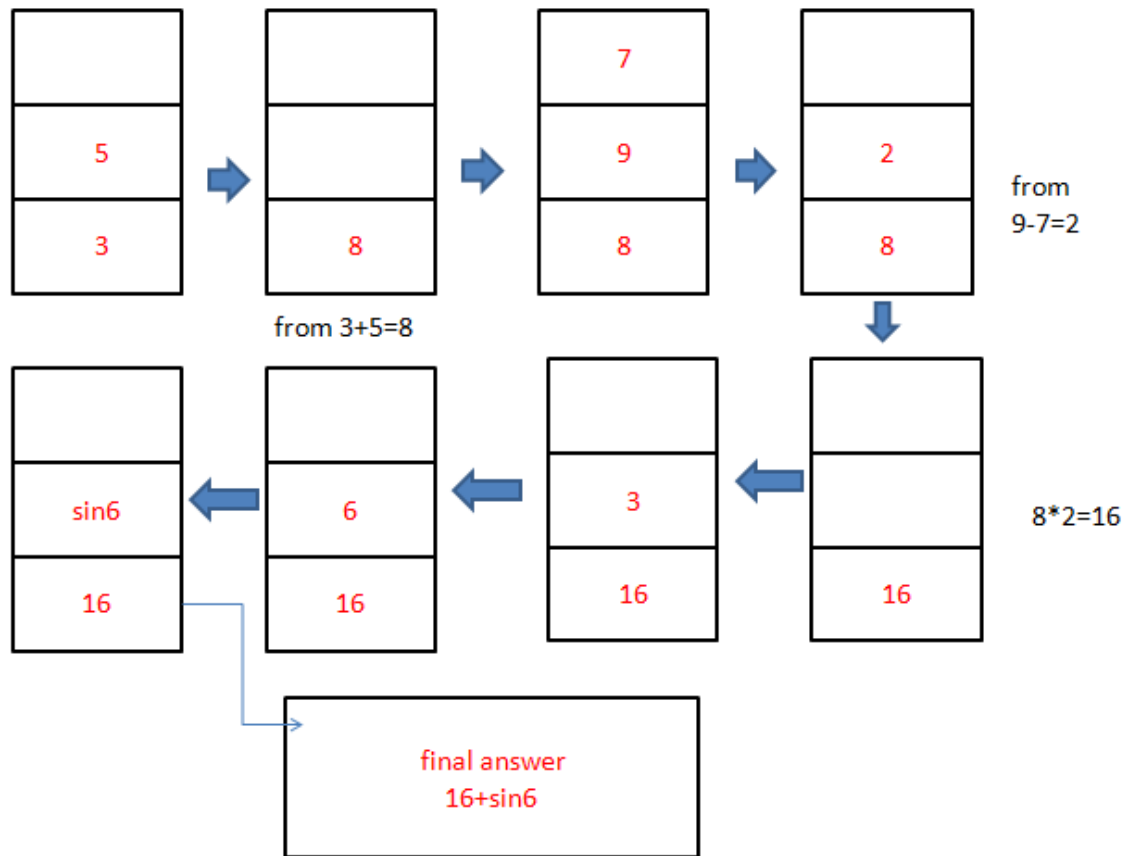Graph of cosx in same window helps in comparing the two;

A flowchart to demonstrate the final process of stacking that is being used in our calculator.

Example: for evaluating (3+5)*(9-7)+sin(3!)

Above diagram suggests how the given statement is stored in postfix format.

Below are the stacks and their evaluation

	5
	3

→

	8

from 3+5=8

→

7	
9	
8	

→

2	
8	

from 9-7=2

	16

8*2=16

←

3	
16	

←

6	
16	

←

sin6	
16	

final answer
16+sin6

DISCUSSION OF SYSTEMS

1. WORK AS PER PLAN-

    We decided to make all the functions like basic arithmetic functions, trigonometric functions, unit converter, graph plotter and all the functions promised in S.R.S. which are implemented in the calculator.

    The complete calculator was implemented using simplecpp library and graphics using initCanvas.

    We promised to provide a user-friendly   interface as mentioned in S.R.S.

2. FEATURES MORE THAN MENTIONED IN S.R.S-

    *   Multiple graphs can be plotted in the same window of graph plotter which can be erased and regenerated.
    *   We were able to complete our entire project using the graphics of simplecpp. We were not sure of doing this at the very beginning.
    *   We are also able to return back to the calculator canvas from any of the other functions like graph plotter, differentiation, integration etc.

3.CHANGES IN PLAN:

    No changes made in plan.

    The entire software was developed on CODE::BLOCKS using simplecpp library.

FUTURE WORK

a) Operations involving 3D calculus like (calculating surface area, volume bound by revolution) can be added.

b) The 3D graphs, polar graph can be included.

c) Differential equation solver can be added to calculator, and the graph plotter can include direction field plotter.

d) The help tag can be included which extends access to theories related to the topic and communication with the users using the software.

CONCLUSION

a) Our calculator can be further used in commercial and scientific purposes.

b) Normal engineering students can use our calculator for their daily calculations.

c) Doing future works in it allows its utilisation in various fields.

REFERENCE:

1.)'An introduction to programming through C++' by Abhiram G. Ranade.

2.)'Let Us C++' by Yashwant Khanetkar.

3.)Link for installing code::blocks IDE 13.12

www.cse.iitb.ac.in/~ranade/simplecpp/

Download the novice version.