FormCalc

Final Report

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ABSTRACT

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This is the Final Project Report submitted for the Software Engineering Project I by team **6droids.**

- "FormCalc" is a software calculator which is implemented as a Computer Program, not as a physical hardware device. "FormCalc" is different from the standard calculators. It is different because, user doesn't have to enter keys or commands each and every step in order to get the end result. It's a symbolic calculator allows user to enter the formula in symbolic forms to generate/obtain the end result at once.

- "FormCalc" in other words, reflects a combination of a standard calculator app and a mathematical software package in your desktop.

- Special features
  - Differentiation calculator
  - Integral calculator
  - Graphs creator
  - Save and reload formulas / equations
  - Quick access history recorder

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1.0 Project Specifications

1.1 Requirements

1.1.1 Programming Language (C++)

C++ is a middle-level programming language developed by Bjarne Stroustrup starting in 1979 at Bell Labs. C++ runs on a variety of platforms, such as Windows, Mac OS, and the various versions of UNIX.

C++ is a general-purpose programming language. It has imperative, object-oriented and generic programming features, while also providing the facilities for low-level memory manipulation.

1.1.2 IDE (QT Creator)

QT provides a large set of libraries as well as the GUI related things (ex XML parsing, threads, networking), all in a consistent style and all multi-platform. This means we rarely need to use other libraries, though we do use boost for some things.

1.2 Functionalities

A. **User Communication Interface**

   The user has a provision of communicate with "FormCalc" by using text window. The user can enter formulae, evaluate formulae, request a graph of a formulae, etc. User can find the previous formulas by clicking on the combo box.

   User can use a graphical interface too. With buttons and read-out strip user may interact with "FormCalc" to enter expressions to be evaluated or graphed.

B. **Formula entry and storage**

   A User can enter a formula through the text user interface and a given name to that formula. The stored expressions can be used in the recent future. If the given name of a formula already exists; "FormCalc" will ask whether the application should over-write the existing formula and associate it with the new formula.

C. **Formula Re-use**

   The user is allowed to use a formula that has been introduced before as a function in another formula. The new formula should be introduced with a different name.

D. **Formula Evaluation**

E. **Formula Integration**

   “FormCalc” can calculate the integral of any formula f() using numerical method. The integral function of a formula is indicated by the name of the formula in uppercase. That means the integral function of f() is F().

F. **Formula Graphing**

G. **Graphing Multiple Formula Simultaneously**

H. **Saving Formulae to a File**

   The user is allowed to save memory of the formulae to a disk file (.xml file) by selecting save button in the graphical user interface or typing save in text interface. A file browser window will open in either case, allowing the user to specify a filename into which the formulae should be saved.

I. **Re-Loading Formulae From a File**

J. **Saving a Graph to a File**

K. **Find Area Under Curve**

1.3 Work – Package Overview

When implementing “FormCalc” software below mentioned main tasks were identified where they were further divided into multiple tasks.

1. **Requirement Analysis**
   - Work Breakdown structure
   - Project Sprint
   - Developing Plan

2. **UI, UX and Prototyping**
   - Wireframes
   - High Fidelity
   - UX & UI Review1

3. **Architecture**
   - Flow Charts
   - High Level Architecture
   - UI Designing
   - QA Release v0.0.1

4. **Development**
   - Basic Math Functions
   - History Implementation
   - Formula Storage
   - Formula Evaluation
   - Formula Integration
   - Formula Graphing
   - Multiple Formula Graphing
   - File Handling
   - Bug Resolving

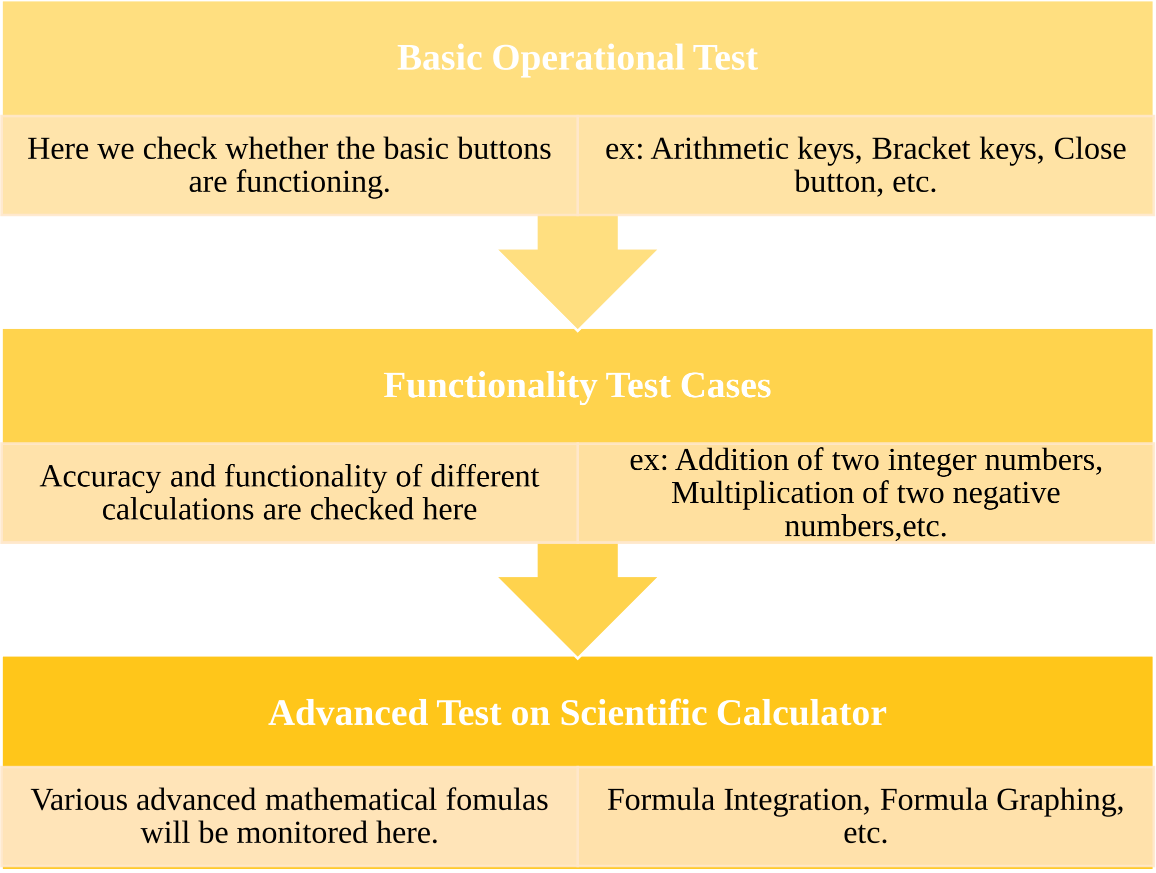
5. **Quality Assurance**
   - Create Test Scenario
   - Unit Testing
   - Component Testing
   - Integration Testing
   - User Testing

6. **Documentation**
   - Daily Scrum Notes
   - Weekly Report
   - Interim Report
   - Final Report

7. **Deployment**

1.4 Test Reports and Test Cases

Testing of the “FormCalc” will be carried out in three stages as follows. Further relevant test scenarios for each stage will be carried out.



Basic Operational Test

Here we check whether the basic buttons are functioning.

ex: Arithmetic keys, Bracket keys, Close button, etc.

Functionality Test Cases

Accuracy and functionality of different calculations are checked here

ex: Addition of two integer numbers, Multiplication of two negative numbers,etc.

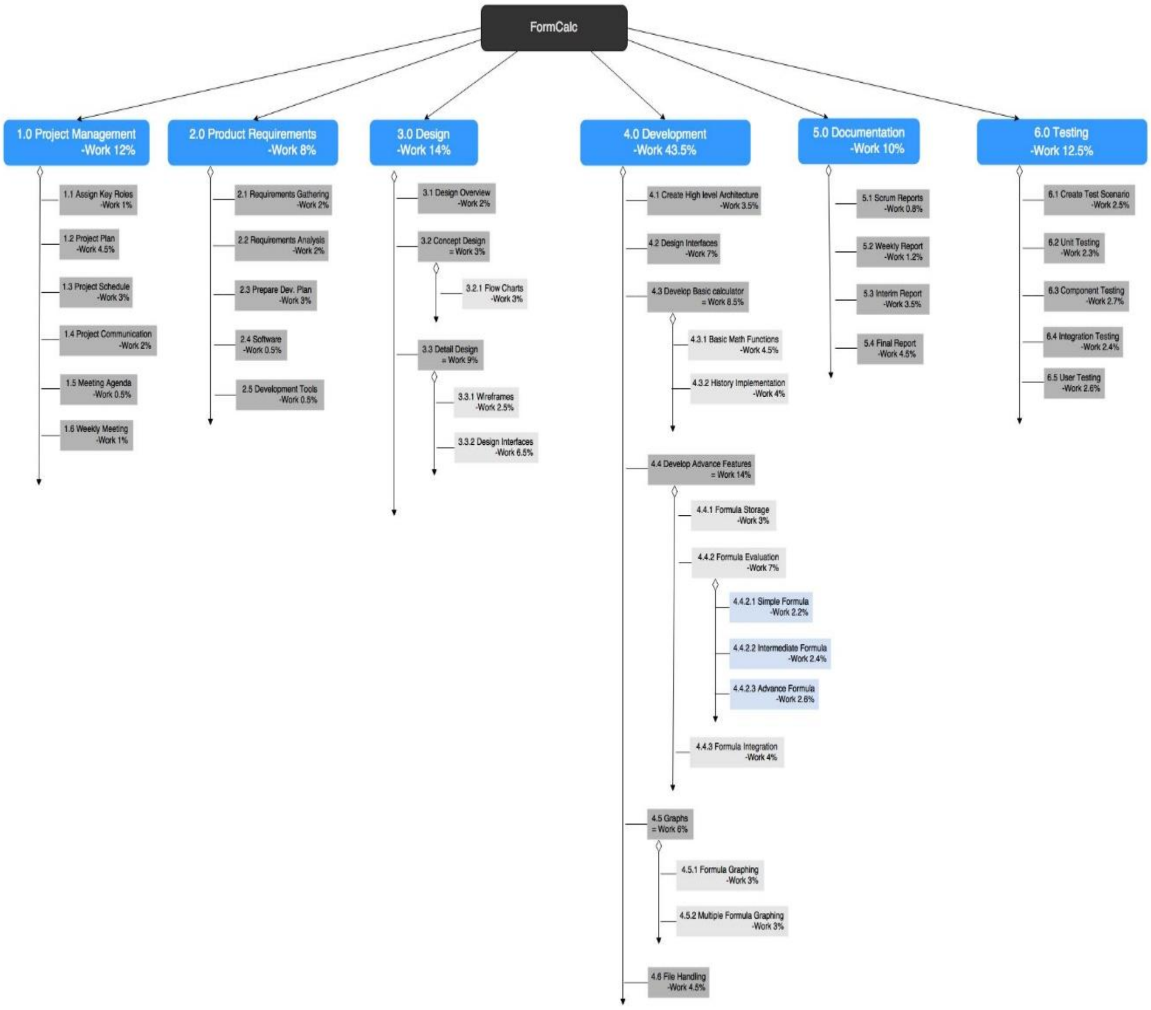
Advanced Test on Scientific Calculator

Various advanced mathematical fomulas will be monitored here.

Formula Integration, Formula Graphing, etc.

Read more - https://goo.gl/PvH6bo

1.5 Work Breakdown Structure


FormCalc
1.0 Project Management -Work 12%
1.1 Assign Key Roles -Work 1%
1.2 Project Plan -Work 4.5%
1.3 Project Schedule -Work 3%
1.4 Project Communication -Work 2%
1.5 Meeting Agenda -Work 0.5%
1.6 Weekly Meeting -Work 1%
2.0 Product Requirements -Work 8%
2.1 Requirements Gathering -Work 2%
2.2 Requirements Analysis -Work 2%
2.3 Prepare Dev. Plan -Work 3%
2.4 Software -Work 0.5%
2.5 Development Tools -Work 0.5%
3.0 Design -Work 14%
3.1 Design Overview -Work 2%
3.2 Concept Design = Work 3%
3.2.1 Flow Charts -Work 3%
3.3 Detail Design = Work 9%
3.3.1 Wireframes -Work 2.5%
3.3.2 Design Interfaces -Work 6.5%
4.0 Development -Work 43.5%
4.1 Create High level Architecture -Work 3.5%
4.2 Design Interfaces -Work 7%
4.3 Develop Basic calculator = Work 8.5%
4.3.1 Basic Math Functions -Work 4.5%
4.3.2 History Implementation -Work 4%
4.4 Develop Advance Features = Work 14%
4.4.1 Formula Storage -Work 3%
4.4.2 Formula Evaluation -Work 7%
4.4.2.1 Simple Formula -Work 2.2%
4.4.2.2 Intermediate Formula -Work 2.4%
4.4.2.3 Advance Formula -Work 2.6%
4.4.3 Formula Integration -Work 4%
4.5 Graphs = Work 6%
4.5.1 Formula Graphing -Work 3%
4.5.2 Multiple Formula Graphing -Work 3%
4.6 File Handling -Work 4.5%
5.0 Documentation -Work 10%
5.1 Scrum Reports -Work 0.8%
5.2 Weekly Report -Work 1.2%
5.3 Interim Report -Work 3.5%
5.4 Final Report -Work 4.5%
6.0 Testing -Work 12.5%
6.1 Create Test Scenario -Work 2.5%
6.2 Unit Testing -Work 2.3%
6.3 Component Testing -Work 2.7%
6.4 Integration Testing -Work 2.4%
6.5 User Testing -Work 2.6%

Read more - https://goo.gl/l6xmJ6

2.0 Software Implementation

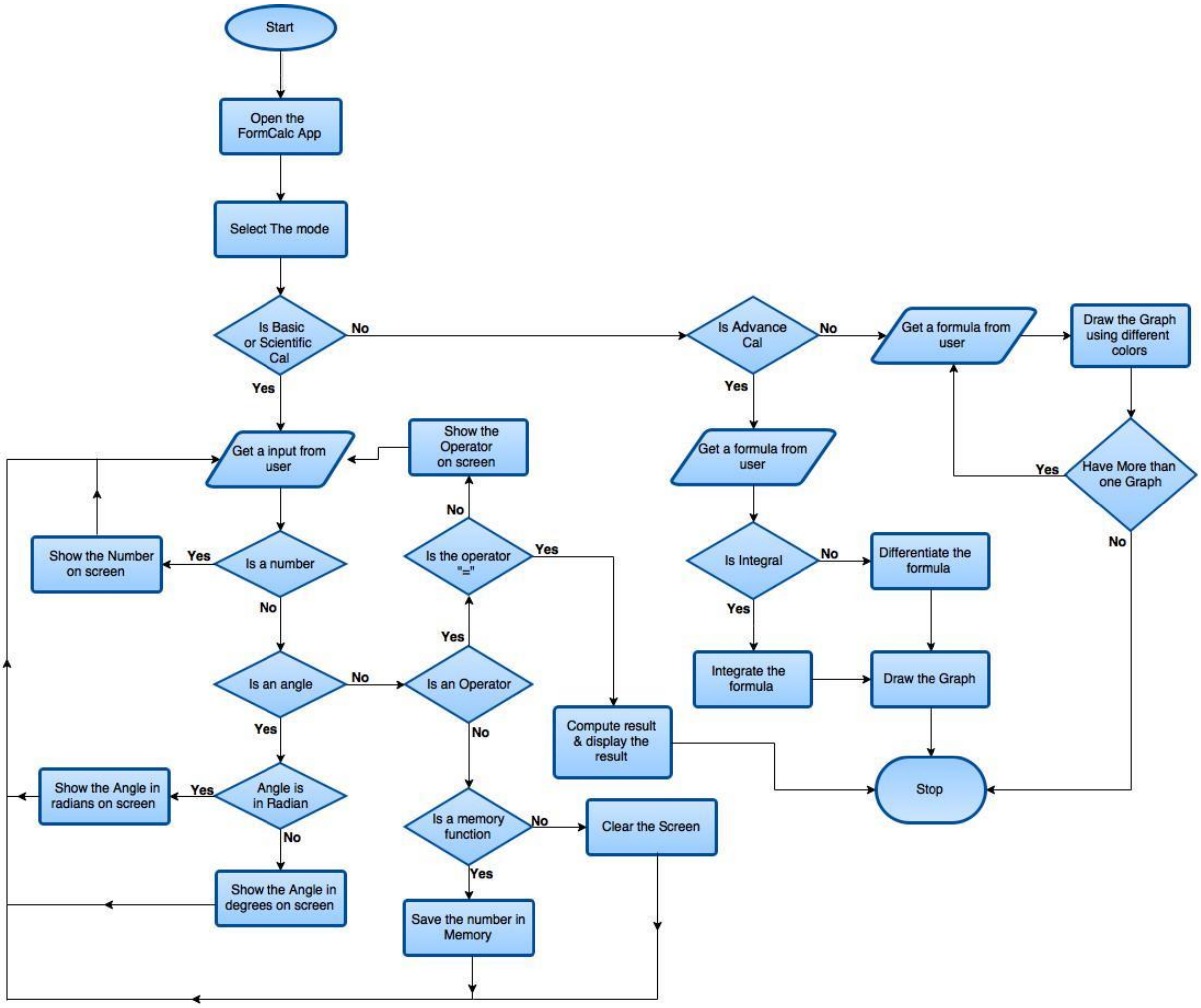
To make things easier, we divided the complete project into smaller divisions, so each member can take over one part and work on that. As we suggested, following divisions are created. We call it 3D structure.

- Designing team (Wireframes, UI)
- Dev team (Flowcharts, Development)
- Documentation, Testing and QA team (Reports, QA)

So these are the tasks which these teams must achieve by end of the project.

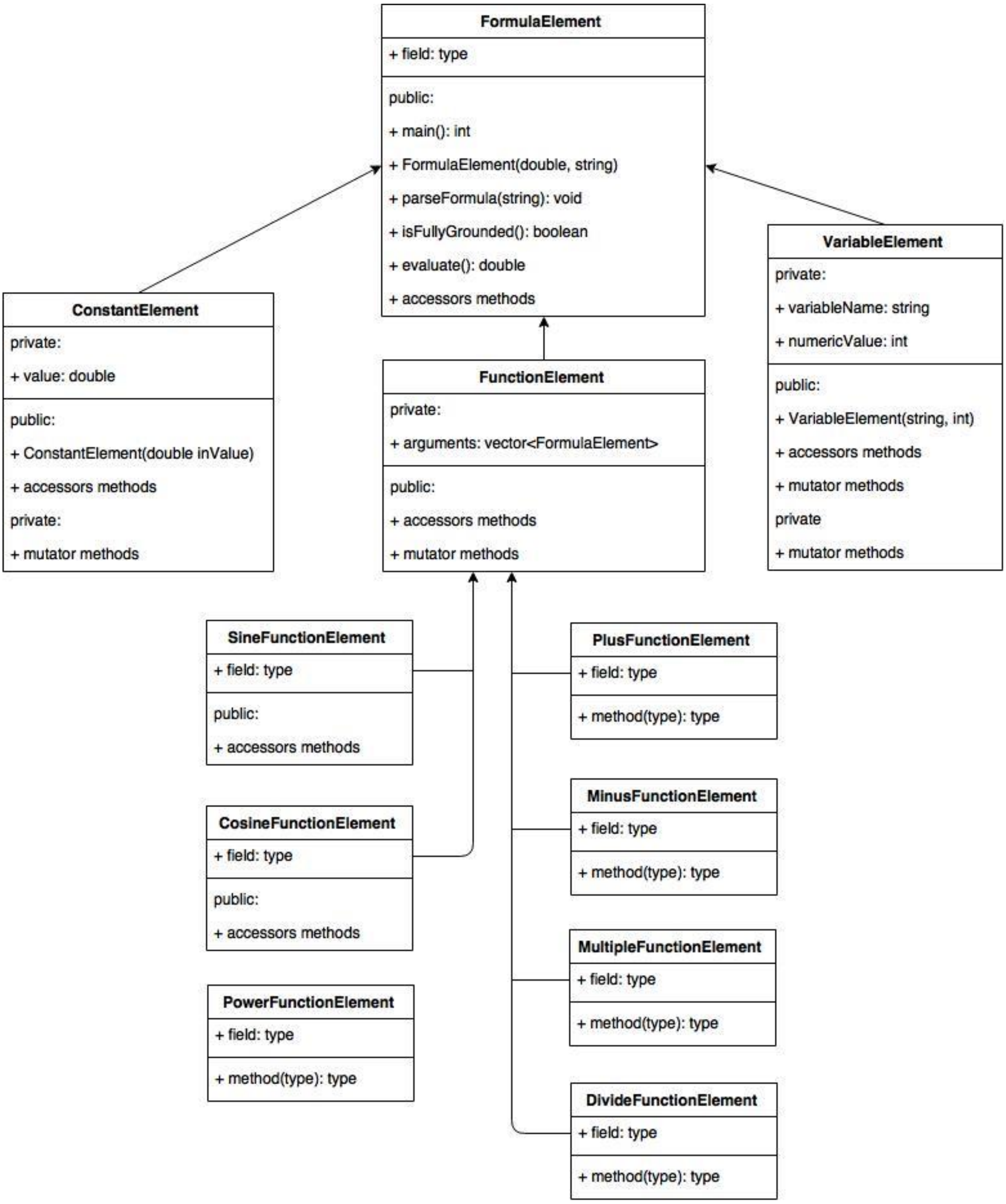
- Research and Development
- Requirement Analysis
- UI,UX and Prototyping
- Architecture
- Development
- Quality Assurance
- Documentation
- Deployment

2.1 Flowchart Diagram



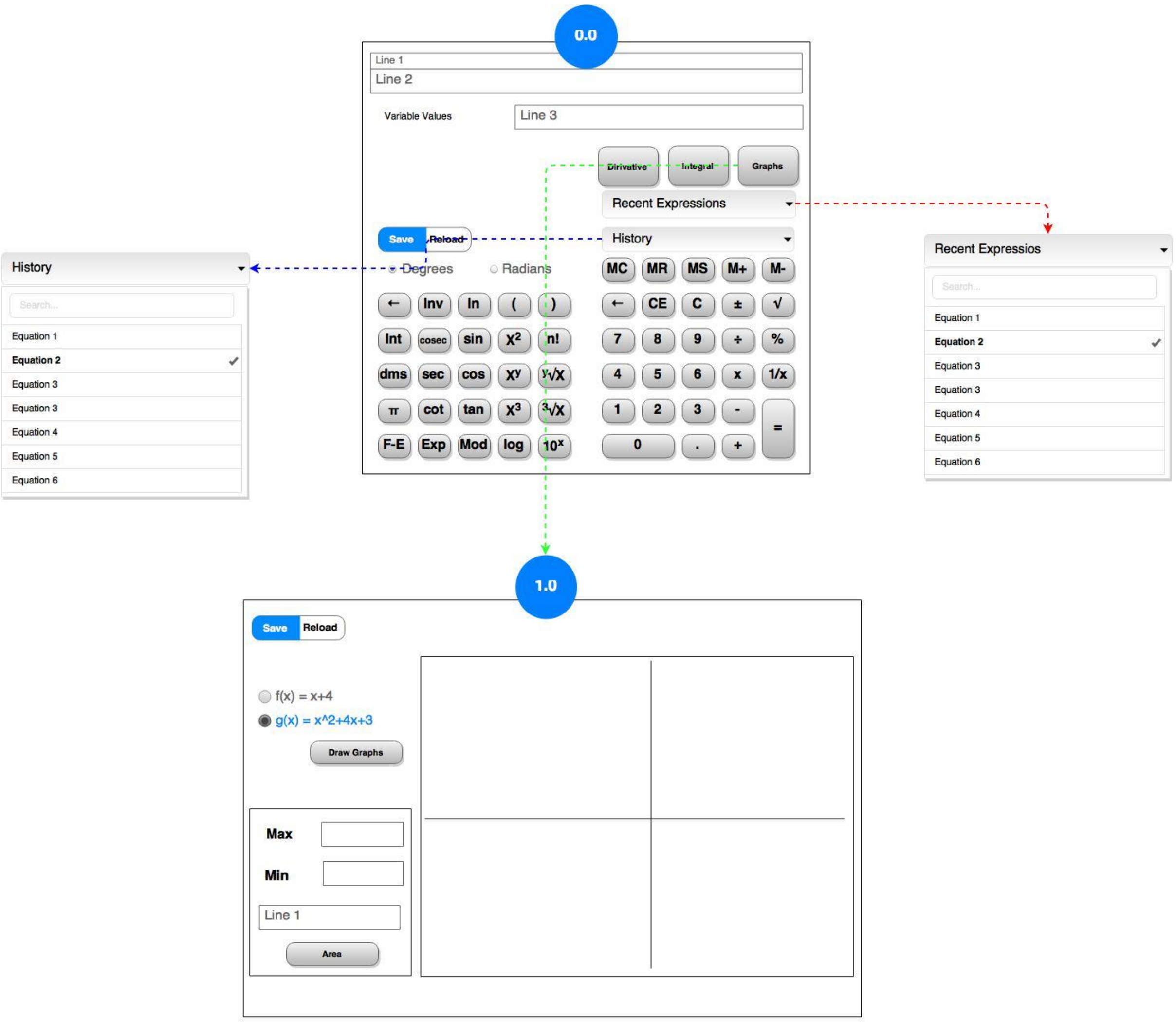
Read more - https://goo.gl/s7SNY6

2.2 Class Diagram



Read more - https://goo.gl/5OTS14

2.3 Wireframes



Read more - https://goo.gl/N5cuYy

2.4 User Interface

2.4.1 Splash Screen

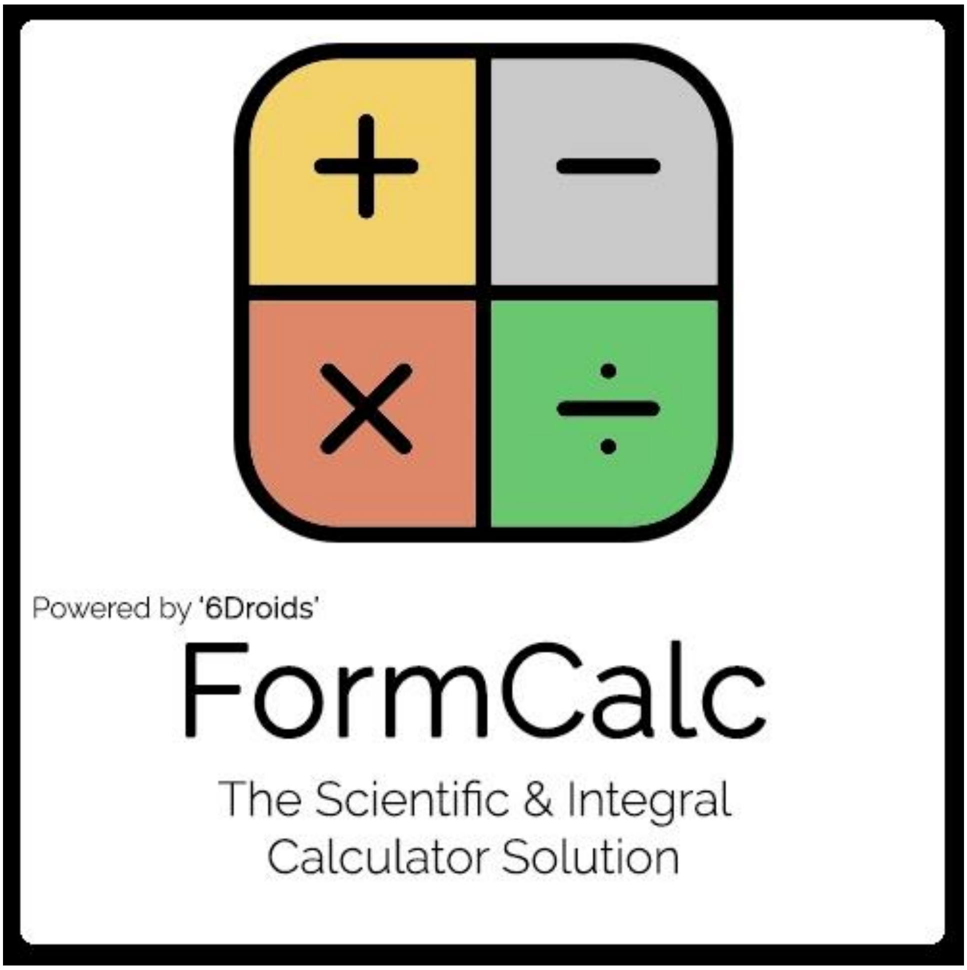


Figure 1 - Splash Screen

2.4.2 Scientific Calculator

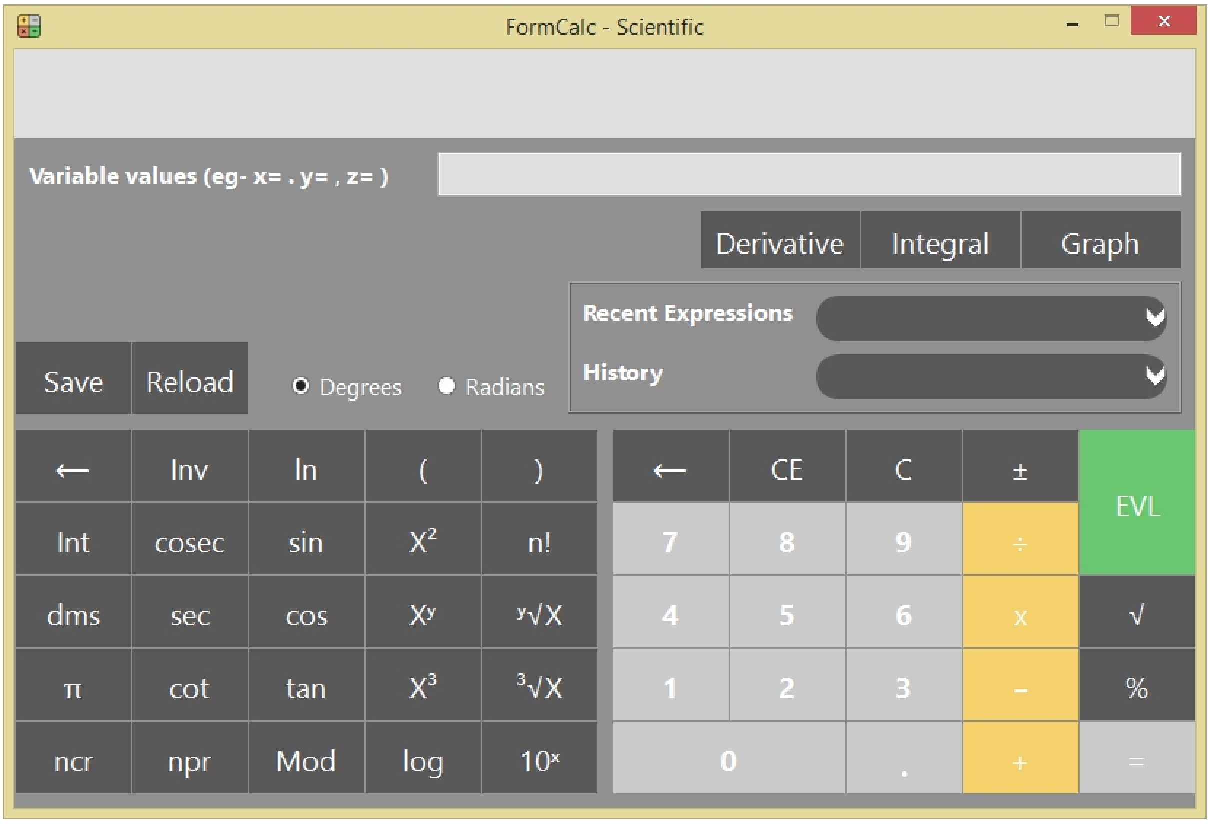


Figure 2 - Scientific Calculator

This is the main window of "FormCalc" Calculator solution. This will help the user to solve basic mathematical equations.
Using this interface, user can solve these kind of formulas.

- Basic mathematical equations
- Trigonometric equations
- Mathematical formulas
- Derivations
- Integrations

And this window also facilitate the user to save and reload equations anytime.

As a special feature, using this window the user can keep track of previous formulas and equations in the same time.

2.4.3 Graph Calculator

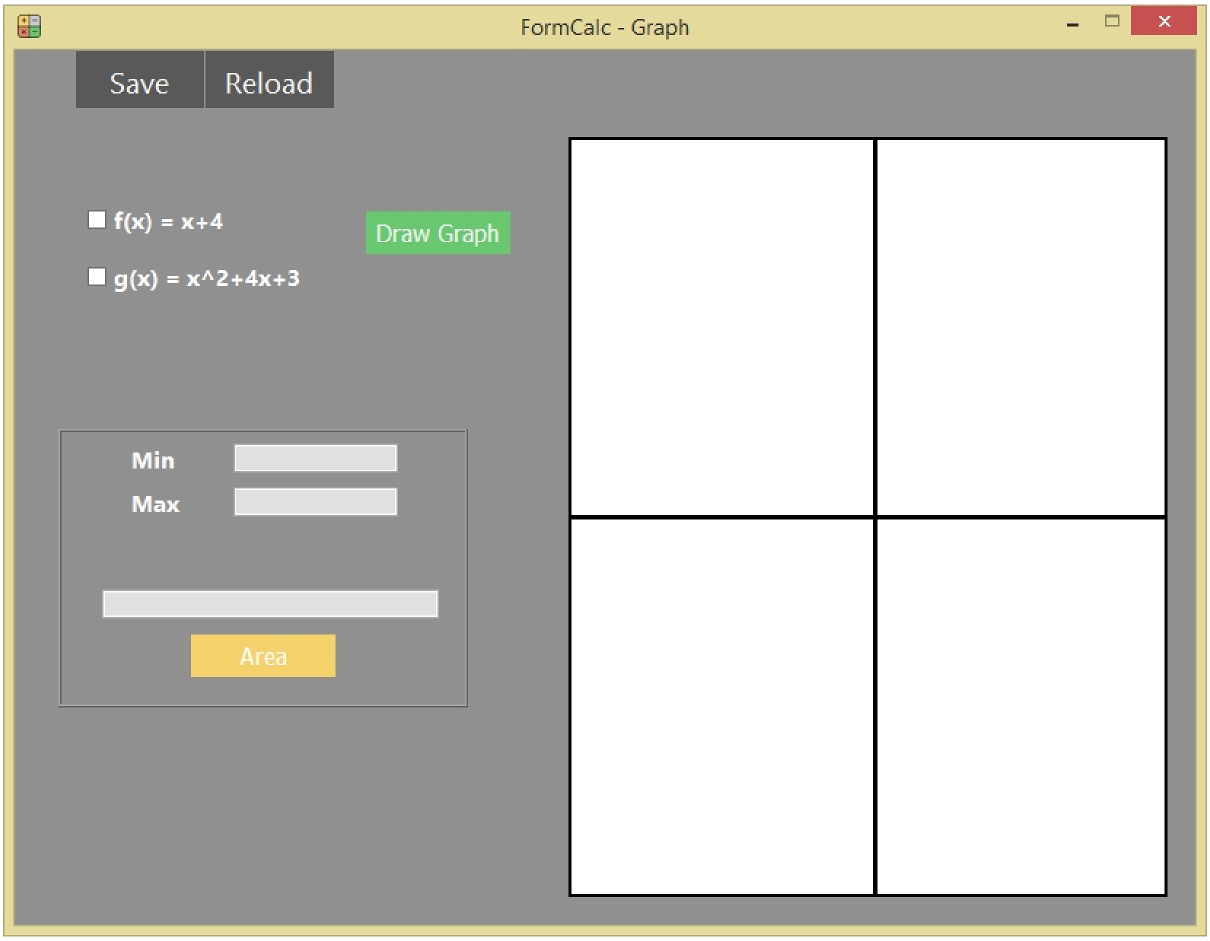


Figure 3 - Graph Calculator

This is the Graph view of the “FormCalc”. Using this, user can insert any equation such as f(x) = x+4 then the program will automatically draw the respective graph to that. And also if the user wants to compare 2 graphs such as f(x) = x+4 and g(x) = x^2+4x+3, the program will draw both graphs in the same interface, so the user can compare both.

3.0 Analysis of Success / Failure

From the day one we worked hard on our project. Sailed through so many difficult tasks and with dedication, team spirit we managed to overcome all barriers, difficulties to make it a success. Even though there were few short comings we made it a success.

Successes

- Requirement 01:
  User Interface
  Text User Interface
  Graphical "Calculator-Style" User Interface

- Requirement 02:
  Formula Entry and Storage

- Requirement 03:
  Formula Re-Use

- Requirement 04:
  Saving Formulae to a File

- Requirement 05:
  Re-Loading Formulae from a File

Failures

- It takes considerable time to develop test cases when testing software by using "Automation". On this stage spending on that is a risk.

- One of our main design concepts was to make the User Interface window layout expands or shrinks according to the designated button that clicks to view or hide buttons of the calculator. As an example when the "FormCalc" changes its layout from Scientific Calculator to Graph window it expands and unhide buttons of the Graph window. But we couldn't achieve it as it opens a new layout to do so.

4.0 Additional Features

We thought of developing “FormCalc” by adding some features where it becomes more attractive and user friendly.

- **“Flat Design” User Interface**
  “Flat Design” is a style of interface design that is focus on minimal use of simple elements and flat colors. It gives better and smart look for the “FormCalc” than a normal User Interface design.

  Few advantages of using Flat Design.
  - Flat Design is the Perfect Style for Great UX
  - Flat Design is Endlessly Adaptable

- **Recent expressions**
  User can use this option to view the recent expressions used and then invoke them.

- **History**
  Another feature is all calculations done by user saved in the history, but erases once the “FormCalc” is closed.

5.0 Team Analysis

5.1 Team Roles

First thing we did in the project was delegating roles between team members. So we created a spreadsheet in Google Drive to vote team members for their expertise. We voted team members for their areas of expertise and at the same time vote ourselves for our strong areas. Through that we selected the best for their strengths accordingly.

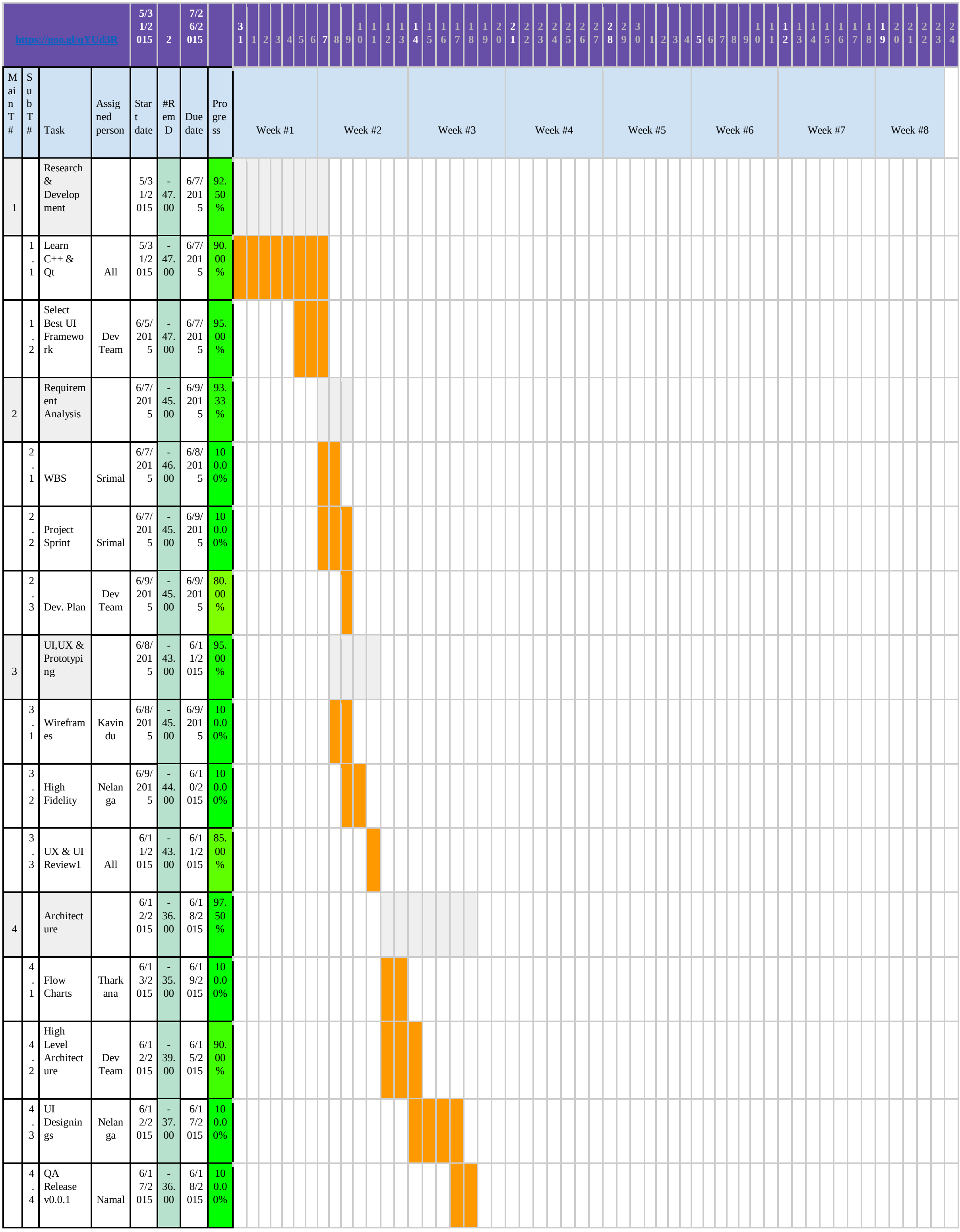
	Tharkana (T)						Nelanga (Ne)						Poorni (Po)						Kavindu (K)						Namal (Na)						Priyanga (Pr)					
	T	Ne	Po	K	Na	Pr	T	Ne	Po	K	Na	Pr	T	Ne	Po	K	Na	Pr	T	Ne	Po	K	Na	Pr	T	Ne	Po	K	Na	Pr	T	Ne	Po	K	Na	Pr
Team Leader	🟥	🟩	🟩		🟩																			🟩												
Report Writers							🟩	🟥				🟩	🟩	🟩	🟥	🟩	🟩	🟩		🟩	🟩	🟥				🟩		🟩	🟥							
UI Designers	🟥						🟩	🟥	🟩	🟩	🟩	🟩		🟩					🟩	🟩	🟩	🟥	🟩									🟩	🟩	🟩	🟩	🟥
Developers	🟥	🟩	🟩	🟩	🟩	🟩	🟩	🟥	🟩	🟩	🟩				🟥		🟩			🟩	🟩	🟥	🟩	🟩		🟩	🟩		🟥	🟩	🟩	🟩	🟩	🟩	🟩	🟥
QA	🟥	🟩	🟩				🟩	🟥					🟩	🟩	🟥	🟩		🟩		🟩					🟩	🟩	🟩	🟩	🟥	🟩		🟩			🟩	

Task	**Assigned Persons**	**Follow up**
Team Leader	Tharkana	
Report Writers	Poorni / Namal	Kavindu
UI Designers	Nelanga / Kavindu	Team
Developers	Tharkana / Priyanga / Kavindu / Nelanga	
QA	Poorni / Namal	Team

Dev Team	Tharkana, Priyanga, Kavindu, Nelanga
Designing Team	Nelanga, Kavindu
Documentation Team (Reporting, QA)	Poorni, Namal

5.2 Project Sprint

This is the Project Sprint we are following at the moment to keep track of the project.

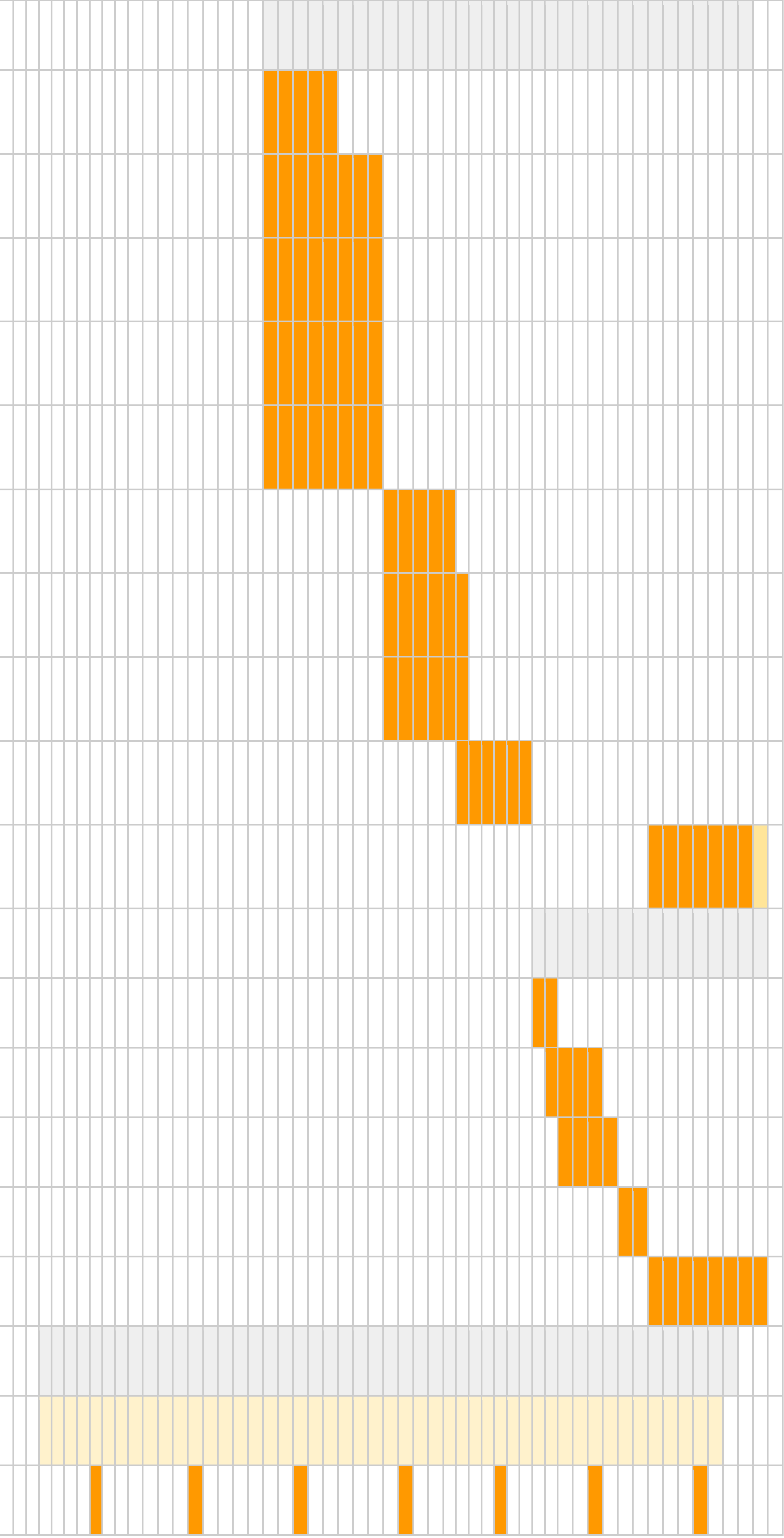


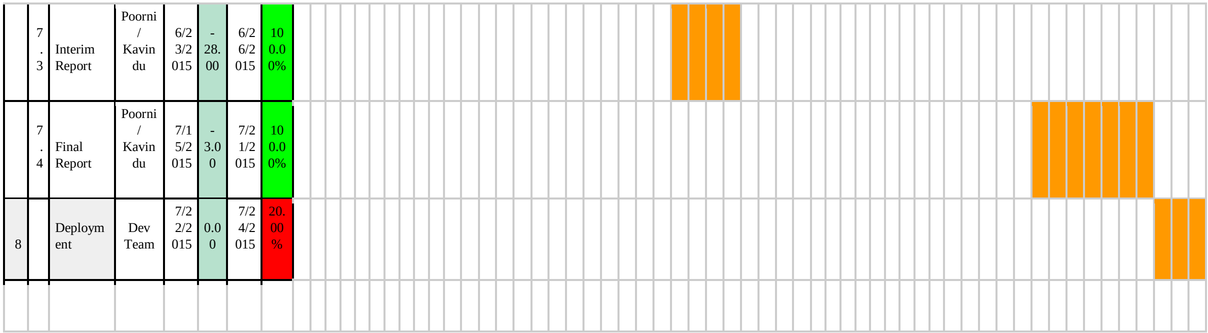
https://goo.gl/qYUd3R				5/31/2015	2	7/26/2015	
Main T #	Sub T #	Task	Assigned person	Start date	#Rem D	Due date	Progress
1		Research & Development		5/31/2015	-47.00	6/7/2015	92.50%
	1.1	Learn C++ & Qt	All	5/31/2015	-47.00	6/7/2015	90.00%
	1.2	Select Best UI Framework	Dev Team	6/5/2015	-47.00	6/7/2015	95.00%
2		Requirement Analysis		6/7/2015	-45.00	6/9/2015	93.33%
	2.1	WBS	Srimal	6/7/2015	-46.00	6/8/2015	100.00%
	2.2	Project Sprint	Srimal	6/7/2015	-45.00	6/9/2015	100.00%
	2.3	Dev. Plan	Dev Team	6/9/2015	-45.00	6/9/2015	80.00%
3		UI,UX & Prototyping		6/8/2015	-43.00	6/11/2015	95.00%
	3.1	Wireframes	Kavindu	6/8/2015	-45.00	6/9/2015	100.00%
	3.2	High Fidelity	Nelanga	6/9/2015	-44.00	6/10/2015	100.00%
	3.3	UX & UI Review1	All	6/11/2015	-43.00	6/11/2015	85.00%
4		Architecture		6/12/2015	-36.00	6/18/2015	97.50%
	4.1	Flow Charts	Tharkana	6/13/2015	-35.00	6/19/2015	100.00%
	4.2	High Level Architecture	Dev Team	6/12/2015	-39.00	6/15/2015	90.00%
	4.3	UI Designings	Nelanga	6/12/2015	-37.00	6/17/2015	100.00%
	4.4	QA Release v0.0.1	Namal	6/17/2015	-36.00	6/18/2015	100.00%

31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Week #1 Week #2 Week #3 Week #4 Week #5 Week #6 Week #7 Week #8

5		Development		6/19/2015	-2.00	7/22/2015	61.67%
	5.01	Basic Math Functions	Nelanga	6/19/2015	-31.00	6/23/2015	80.00%
	5.02	Scientific Math Functions	Tharkana	6/19/2015	-31.00	6/23/2015	75.00%
	5.03	History Implementation	Tharkana	6/19/2015	-28.00	6/26/2015	70.00%
	5.04	Formula Storage	Tharkana/Namal	6/19/2015	-28.00	6/26/2015	60.00%
	5.05	Formula Evaluation	Tharkana	6/19/2015	-28.00	6/26/2015	80.00%
	5.06	Formula Integration	Kavindu	6/27/2015	-23.00	7/1/2015	50.00%
	5.07	Formula Graphing	Srimal	6/27/2015	-22.00	7/2/2015	40.00%
	5.08	Multiple Formula Graphing	Srimal	6/27/2015	-22.00	7/2/2015	20.00%
	5.09	File Handling	Tharkana	7/2/2015	-17.00	7/7/2015	50.00%
	5.10	Bug Resolving	Dev Team	7/16/2015	-1.00	7/23/2015	30.00%
6		QA		7/8/2015	-1.00	7/23/2015	54.00%
	6.1	Create Test Scenario	Namal	7/8/2015	-15.00	7/9/2015	80.00%
	6.2	Unit Testing	Namal	7/9/2015	-12.00	7/12/2015	50.00%
	6.3	Component Testing	Namal	7/10/2015	-11.00	7/13/2015	80.00%
	6.4	Integration Testing	Namal	7/14/2015	-9.00	7/15/2015	30.00%
	6.5	User Testing	All	7/16/2015	-1.00	7/23/2015	30.00%
7		Documentation		6/20/2015	-28.00	6/26/2015	73.48%
	7.1	Daily Scrum Notes	Poorni	6/3/2015	-4.00	7/20/2015	51.06%
	7.2	Weekly Report	Kavindu	6/7/2015	-5.00	7/19/2015	42.86%





	7.3	Interim Report	Poorni / Kavindu	6/23/2015	-28.00	6/26/2015	100.00%
	7.4	Final Report	Poorni / Kavindu	7/15/2015	-3.00	7/21/2015	100.00%
8		Deployment	Dev Team	7/22/2015	0.00	7/24/2015	20.00%

Read more - https://goo.gl/F6CpBk

6.0 Conclusion

Past few couple of weeks had been a very busy period for us. From the day one we started the project it became harder by day. With some of our team members work schedules we had a tough time for the project.

We've been a great team till this moment we present our project. That's why we could make it a success even though we had some few barriers and short comings.
We had to learn so many new things when we were doing the project.

With all the lessons learnt through mistakes, challenges and specially with a great team spirit finally we made it a success.