“SmartCalc”

A Project Report

Submitted By

CHUDASAMA YASH R. (169700307006)

GAL BHAGIRATH A. (169700307007)

In fulfilment of the award of the degree

Of

DIPLOMA IN ENGINEERING

In

Computer Engineering Department

Radhe Institute of Engineering and Technology, Upleta

Gujarat Technological University, Ahmedabad

Winter 2018

Radhe Institute of Engineering and Technology

Computer Engineering Department

CERTIFICATE

Date:

This is to certify that the project entitled **"SmartCalc"** has been carried out by **MR. CHUDASAMA YASH RAJENDRABHAI**, **MR. GAL BHAGIRATH ARSHIBHAI** under my guidance in fulfilment of the degree of Diploma in Engineering in 5th semester of Gujarat Technological University, Ahmedabad during the academic year 2018-2019.

Guides:

Mr. Anurag Rojiwadiya

Mr. Anurag Rojiwadiya
(H.O.D.)

Mr. R.K. Lamba
(Principal)

Acknowledgement

We students of diploma engineering, Radhe Institute of Engineering and Technology here by express our thanks to our guide **Mr. Anurag Rojiwadiya** for his guidance and constant inspiration with valuable suggestions during our project work for providing us all the necessary information for designing and developing the project.

This project work has been the most exciting part of our learning experience, which would be an asset for our future carrier.

We are also thankful to our staff member of our college, which are teaching or non-teaching in our department, but they give their guidance and fully help in our project work.

Knowledge in itself is a continuous process of getting practical knowledge is important thing, which is not possible without the support, guidance, motivation and inspiration provided by different persons.

Moreover, we would also like to thank our friends and last we are grateful to our parents for their support and unconditional help, which made our project a real success.

Mr. Chudasama Yash R.

Mr. Gal Bhagirath A.

Abstract

"SmartCalc" is an android-based mobile application, which can calculate mathematics problems captured by mobile phone's camera. This application enables a faster calculation by avoiding inputting the data to android device.

As smartphones have become increasingly powerful in recent years, they will come to replace objects we tend to carry around such as pen, paper etc. In short, we will be using them to accomplish our daily tasks.

Our goal is to develop an application that bridges the gap between technology and the traditional pen and paper approach in an intuitive manner. The user can capture a camera image of a mathematical expression and just see the result.

In addition, user can edit expression captured by android device and see the result of that expression. This application can detect a printed formula with the following operators: plus, minus, multiplication, division, power etc. and give the result to user.

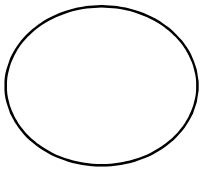
The project is developed in Java programming language by using Android Studio Integrated Development Environment (IDE). We use Android Software Development Kit (SDK), which includes a variety of custom tools that help us in developing mobile application on Android Platform.

Notations

We have used following notation for our project report:

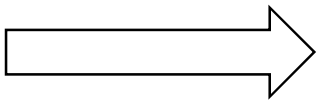
Data Flow Diagram:

External Entity

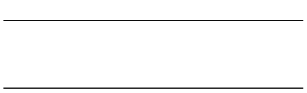


Process

Output



Data Flow



Data Store

Use Case Diagram:

System boundary

Use Case

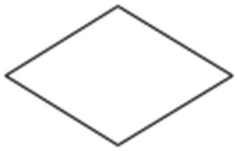
Actor

Uses

Activity Diagram:

Initial Node

Activity

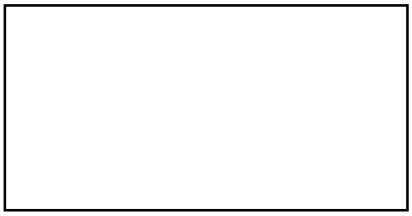


Decision

Join Node

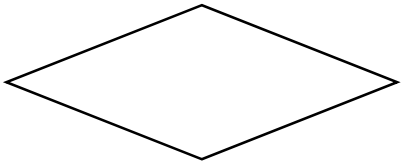
Final Node

Entity Relationship Diagram:



Entity

Attribute



Relationship

Index

List of Figures

List of Tables

CHAPTER – 1
INTRODUCTION

1.1 Project Summery
1.2 Scope
1.3 Purpose
1.4 Technology

1.1 PROJECT SUMMERY

"SmartCalc is an android-based mobile application, which uses OCR technology for calculations. To calculate mathematics problem, you just need to take an image of that written problem and then 'SmartCalc' calculates that problem and shows the result.

This application enables faster calculation by avoiding inputting data to android device. This application detects a printed expression with following operators: plus, minus, multiplication, division, power etc.

As smartphones have become increasingly powerful in recent years, they will come to replace objects we tend to carry around such as pen, paper etc. In short, we will be using them to accomplish our daily tasks.

Our goal is to develop an application that bridges the gap between technology and the traditional pen and paper approach in an intuitive manner. The user can capture a camera image of a mathematical expression and just see the result.

In addition, user can edit expression captured by android device and see the result of that expression. This application also contains SQLite database to store equations and results. User can also use standard calculator to calculate manually entered equation.

1.	**Project Name**	SmartCalc
2.	**Platform**	Android
3.	**Front End**	JAVA
4.	**Back End**	SQLite
5.	**IDE**	Android Studio
6.	**OCR**	Google Vision OCR
7.	**Project Guides**	Anurag Rojiwadiya,
8.	**Team Members**	Chudasama Yash R. Gal Bhagirath A.
9.	**Branch**	Computer Engineering
10.	**College Name**	Radhe Institute of Engineering and Technology
11.	**Term Ending**	Winter 2018
12.	**Submitted To**	Gujarat Technological University

Table 1.1.1 Project Summery

1.2 SCOPE

"SmartCalc" is designed to maximize the ease of use calculator. Specifically this app is designed to avoid inputting data to android device. In addition, this app uses SQLite database to store equations and results. This app also provides the functionality of standard calculator.

1.3 PURPOSE

The Purpose of this application is simply to make our life style easy. Means our cell phone can be used to solve mathematical equations, also can detect equation on paper and solve equation using OCR technology.

1.4 TECHNOLOGY

For any project or software, technologies used to develop are required to be observed carefully. Before adopting any technology, we should review past system or projects. By carrying out those kinds of activities at last, we finalize some technologies, which are the best option for developing this project.

Platform: Android

Android is a mobile operating system developed by Google. It is designed primarily for touch screen mobile devices such as smart phones and tablet computers.

As the project started, there were three mobile operating systems performing noticeably in the market, they were Android, IOS and Microsoft Windows phone OS.

Among them, Android was dominating the market with a share of over 80%. One and a half million Android devices are activated every day in more than 190 countries. Among the three mentioned operating systems above, Android is the only open-source Operating System.

The android development supports with the full java programming language. Android supports large number of applications in smartphones; these applications are more comfortable for user.

Front End: Java

Java is a high-level, object-oriented programming language originally developed by Sun Microsystems and released in 1995. Java runs on a variety of platforms, such as Windows, Mac OS, and Linux etc.

Java provides the features like platform independent, architectural neutral, automatic memory management, networked, distributed, interpreted etc. Java is strong language, java compiler is able to detect errors that are not easy to detect in other programming languages. Java has garbage collector, which automatically manages memory.

Java is used to develop standalone application for desktop, web-application, mobile-phone application, software-tools, scientific-applications etc. Java servlet is used to build dynamic web-application.

Java is official language of Android Development and it is supported by Android Studio. Java code is run by "Virtual Machine", which runs on Android devices and interprets the code.

Back End: SQLite

SQLite is relational database management system. It is self-contained, high reliability, embedded, full featured SQL Database engine. It is free to use. SQLite is not a client-server database engine but it is embedded database engine. The SQLite database file format is cross-platform so that anyone can easily copy a database between 32-bit and 64-bit systems. Due to all these features, it is a popular choice as an Application File Format.

SQLite database transaction follows the ACID properties i.e. Atomicity, Consistency, Isolation, Durability. It implements most of the SQL standard using a dynamic and weakly typed SQL syntax.

SQLite is popular choice as embedded database software for local/client storage in application software. It provides high performance with small size. Almost all OS support SQLite.

Android comes in with built in SQLite database implementation. The package named android.database.sqlite, manages databases. Therefore, it is very easy to use SQLite database in android application.

Advantages of DBMS:

- Redundancy can be avoided.
- Inconsistency can be eliminated.
- Data can be shared.
- Standards can be enforced.
- Integrity can be maintained.
- Data independence can be achieved.

CHAPTER – 2

PROJECT MANAGEMENT

2.1 Project Planning
2.2 Risk Management
2.3 Cost Analysis

2.1 PROJECT PLANNING

Project planning is perhaps one of the most important work in developing any project. Before the project can begin estimate regarding work to be done, what resources will be required and how much time will elapse from start to the finish of a project. Planning helped us to prepare a framework that enables us to make a reasonable estimate of such things.

The purpose of project planning is to ensure that the result is completed on time, within budget and exhibits quality.

2.1.1 Project Development Approach

Our project is developed using specific software development lifecycle. Software development approach is best suited for the project depends on the requirements and other factors.

We have chosen spiral model for our project because it provides rapid development and introduced one new process identifying risk.

2.1.2 Process Model – Spiral Model

This model was proposed by Boehm in 1986. In application development, spiral model uses fourth generation languages and development tools. The diagrammatical representation of this model appears like a spiral with many loops.

Sequentially defining the key artefacts for a project often lowers the possibility of developing system that meets stakeholder "Win Condition". This invariant excludes "hazardous spiral look alike" processes that use a sequence of incremental waterfall passes in settings where the underlying assumptions of the waterfall model do not apply. Boehm lists this assumption as follows:

- The requirements are known in advance of implementation
- The requirements have no unresolved, high-risk implications such as risks due to cost, schedule, performance, safety, security, user interfaces, organizational impacts etc.
- The nature of the requirements will not change very much during development or evolution.
- The requirements are compatible with all the key system stakeholders' expectations, including users, customer, developers, maintainer, and investors.
- The right architecture for implementing the requirements is well understood.
- There is enough calendar time to proceed sequentially.

In situations where these assumptions do apply, it is a project risk not to specify the requirements and proceed sequentially. The waterfall model thus becomes a risk driven special case of the spiral model. This invariant identifies the four basic activities that must occur in each cycle of the spiral model:

- Consider the win conditions of all success critical stakeholders.
- Identify and evaluate alternative approaches for satisfying the win conditions
- Identify ad resolve risks that stem from the selected approach.
- Obtain approval from all success critical stakeholders, plus commitment to pursue the next cycle.

Project cycles that omit or short-change any of these activities risk wasting effort by pursuing options that are unacceptable to key stakeholders, or are too risky.

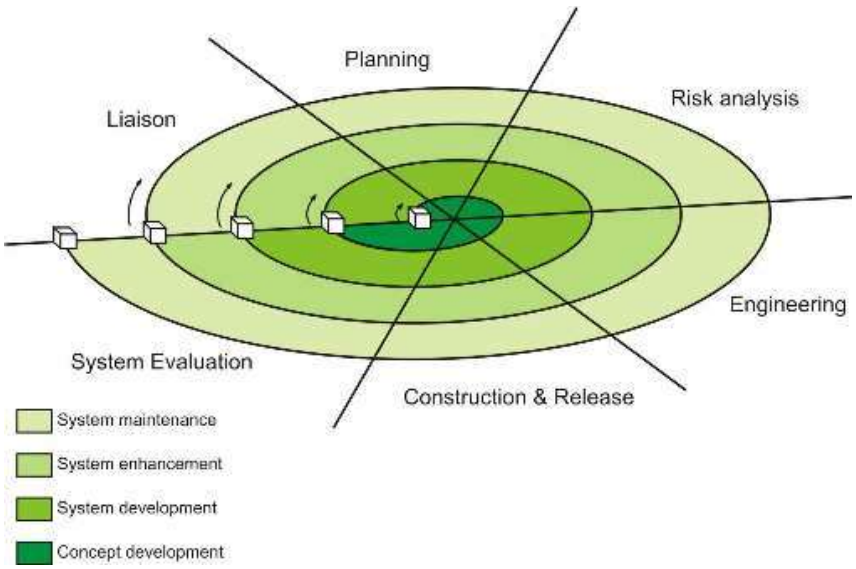


Fig 2.1.2 Spiral Model

Advantages of spiral model:

- It is more flexible, as we can easily deal with changes.
- Due to user involvement, user satisfaction is improved.
- It is good for large and mission-critical projects.
- Additional functionality can be added later.
- Software is produced early in the software life cycle.
- Project estimates in terms of schedule, cost etc. become more and more realistic as the project moves forward and loops in spiral gets completed.

Disadvantages of spiral model:

- It is applicable for large problem only.
- It can be costly model to use.
- Risk analysis requires highly specific expertise.
- It may be hard to define objective, verifiable milestone.
- Spiral may continue indefinitely.

Application of spiral model:

- Used when medium to high risk projects.

2.1.3 Roles & Responsibility

RESPOSIBILITY	ROLES
Analysis	Yash, Bhagirath
Design	Yash, Bhagirath
Coding	Yash
Testing	Yash, Bhagirath
Documentation	Yash

Table 2.1.3 Roles & Responsibility

2.1.4 Schedule Representation

DESCRIPTION	ESTIMATED HOURS	ACTUAL HOURS
System Study	6	5
Requirement Gathering	9	8
Analysis	10	11
System Design	7	6
Coding	10	12
Testing	5	6
Documentation	8	7

Table 2.1.4 Schedule Representation

2.2 RISK MANAGEMENT

Risk analysis and management are a series of steps that help a software team to understand and manage uncertainty. Many problems can plague a software project. A risk is a potential problem – it might happen, it might not. However, regardless of the outcomes, it is really good idea to identify it, assess its probability of occurrence, estimate its impact, and establish a contingency plan should the problem occur.

Software is difficult undertaking. Many things can go wrong, many often do. It is for this reason that being prepared – understanding the risks and talking proactive measures to avoid or manage them – is a key element.

2.2.1 Risk Identification

Risk identification is the first stage of risk management. It is concern with discovering possible risks to the project. In principal, these should not be assessed or prioritized at this stage, although in practice risks with minor consequences or very low probability risks are not usually considered.

2.2.2 General Risks

- **Lack of resources :-**

The resources, which are needed for the development of this project, are not available during project. We need at least one computer per member with all the software-required software installed in order to develop the project as well as for evaluation purpose. If we do not get these resources which can cause the big effect in the form of failure of the project.

- **Time duration :-**

We are developing this software module for real time project so it takes time to implement correctly and completely.

- **Customer requirement :-**

Customer may have such requirement during project development that will cause change of whole design. Therefore, we might not implement the project according to schedule

- **Lack of information :-**

Project manager is planning to integrate some new functionality with new technology. Currently the junior team members are unaware of this technology, which will require some time for team member skill up gradation, which is already in company's planner.

2.3 COST ANALYSIS

The cost spent in the making of the project is categorized into two parts:-

2.3.1 Direct Cost

This is in terms of money. In our project, it is the estimated cost of

- Hardware (Computer)
- Documentation Cost

2.3.2 Indirect Cost

This is in terms of manual work. In our project, it is the estimated in terms of

- The time spent in system analysis and design.
- Managing time for coding.
- Generating Report.
- Referring other sources like the internet.

CHAPTER – 3

SYSTEM REQUIREMENT SPECIFICATIONS (SRS)

3.1 User Characteristics
3.2 Constraints
3.3 Hardware and Software Requirements

3.1 USER CHARACTERISTICS

- **User :**

User is a person, who gives data to "SmartCalc" application in form of image or typing the numbers and retrieves the result of that data by User Interface of this application.

In addition, user can capture an image and then application extracts the data from that image and calculates the result and show the result to user.

3.2 CONSTRAINTS

- ✓ User cannot modify the application.
- ✓ It requires camera enabled Android phone.
- ✓ It requires an Android phone running minimum Android 7.0 (Nougat) OS.
- ✓ Android phone with 1GB RAM.

3.3 HARDWARE AND SOFTWARE REQUIREMENTS

Developer: Hardware and Software Requirements

- **Hardware**
  - Microprocessor: Intel i3 processor (Minimum).
  - RAM: 4GB (Minimum).
  - Smartphone: Android phone.
- **Software**
  - OS: Windows 10.
  - IDE: Android Studio.
  - Android SDK: 28.0 edition SDK.
  - Database: SQLite.
  - Programming Language: JAVA.

Client: Hardware and Software Requirements

- **Hardware**
  - Smartphone: Android phone.
  - RAM: 1GB RAM.
  - Camera Enabled Android Smartphone.
- **Software**
  - OS: Android 7.0 (Nougat OS) (Minimum)
  - App: SmartCalc App

CHAPTER – 4

SYSTEM ANALYSIS

4.1 Study of Current System

The current system provides simple calculator that can be used to calculate simple equation. Some other applications provide scientific calculator to calculate scientific equations.

4.2 Problems and Weaknesses of Current System

Some application does not provide facility to solve equation by using camera. Some application does not provide the facility to store the equations and their results.

4.3 Requirement of New System

"SmartCalc" application provide the facility to solve equation by using camera. It also provide the facility to store the equations and their results.

4.4 Feasibility Study

This important thing is that an approved from the new proposed system is a feasible or not the determination of the system or feasible or proposed system is feasible or not.

The most important outcome of preliminary investigation is that is the system request is feasible. Depend on the preliminary investigation, the investigation need deep, detail feasibility study. Feasibility study is a study of the proposal of the system according to its workability, impact on the organization, ability to meet user needs, and effective user resource. The objective of feasibility study is not to solve the problem but to acquire a sense of its scope. During the study the problem definition is crystalized and aspects of the problem to be include on three system are determine, consequently, cost and benefits are estimated with greater accuracy at this stage.

In a feasibility study, we can learn the three types of feasibility study as below:

1) Technical Feasibility
2) Economical Feasibility
3) Operational Feasibility

1) Technical Feasibility:

It is a measure of the practically of a specific technical solution and the availability of technical reassure and expertise.

There are lots of mobile platform in market such as Android, Windows OS, iOS, BADA, blackberry OS etc. BADA and blackberry OSs became older while windows OS has little market share and iOS requires technically heavy products. Where Android has big market share and requires less resources and provide high quality.

2) Economical Feasibility:

It is a measure of cost effectiveness of a project and solution this is also called cost benefit analysis. This module is called economically feasible since the necessary hardware & software are available in the market & there is need to procedure now. Hardware & Software the initial investment is nothing because we already have domain name and cost of software.

Android is open source OS and SQLite is also open source database, so we do not need to pay to them.

3) Operational Feasibility:

Operational feasibility is the measure of how well a proposed system solves the problems.

4.5 Requirement Validation

- The written equation should be clear.
- The number in equation must be in English.
- The written equation should not contain any invalid character.

4.6 Function of System

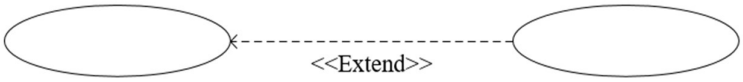
4.6.1. Function of Use Case Diagram :

- Use Case

- Actor

- Association Relationship

- Extend Relationship



- Include Relationship

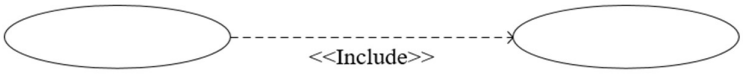


Fig. 4.6.1 Function of Use Case Diagrams

4.6.2. Use Case Diagram:

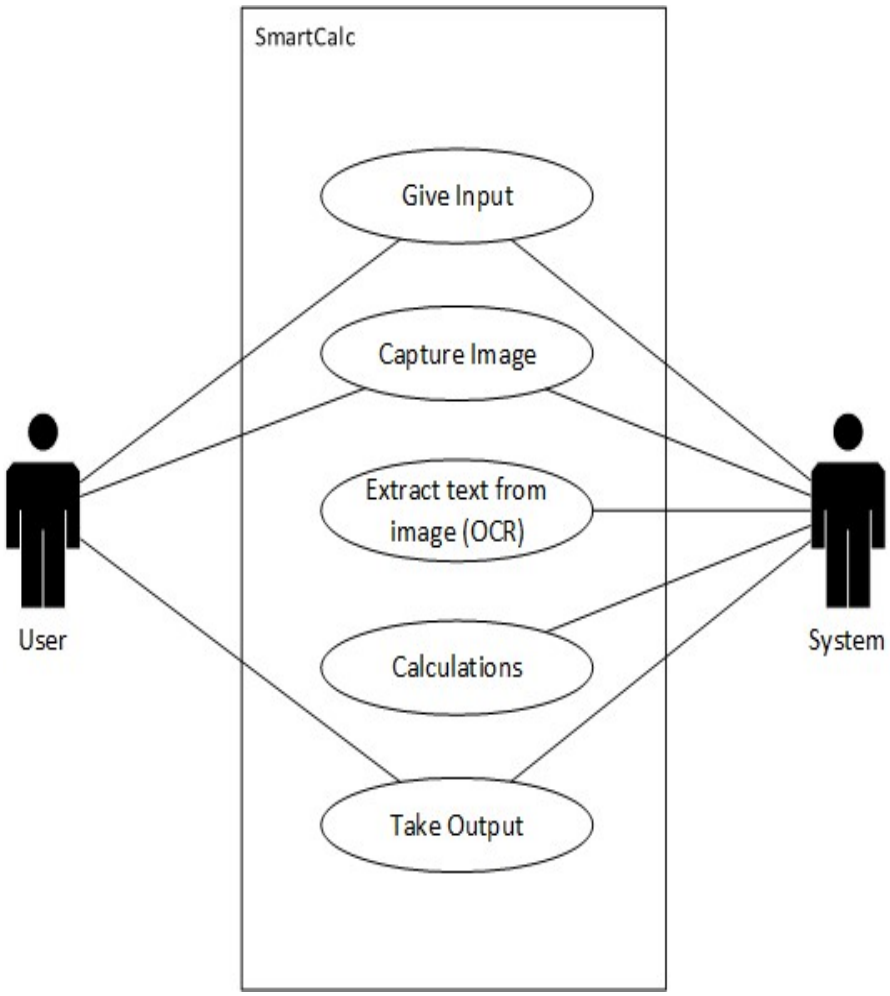


Fig. 4.6.2 Use Case Diagram

4.7 Data Modelling

4.7.1. ER Diagram

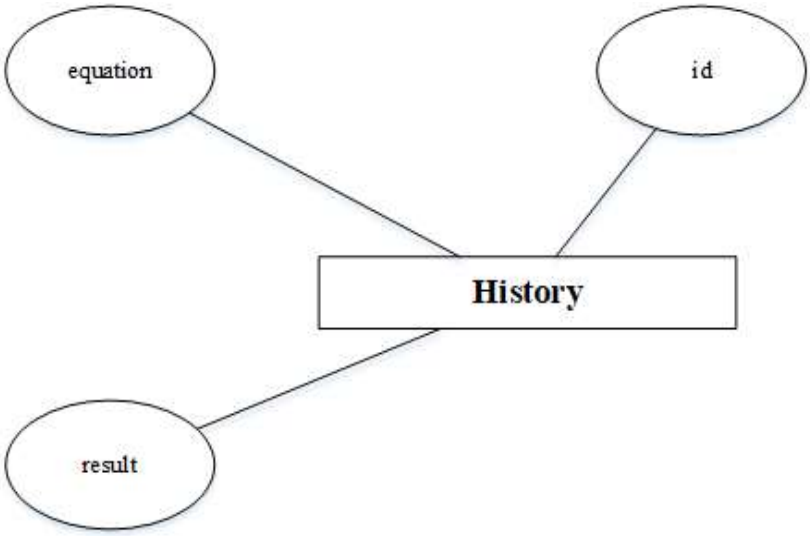


Fig. 4.7.1 ER Diagram

4.7.2. Activity Diagram

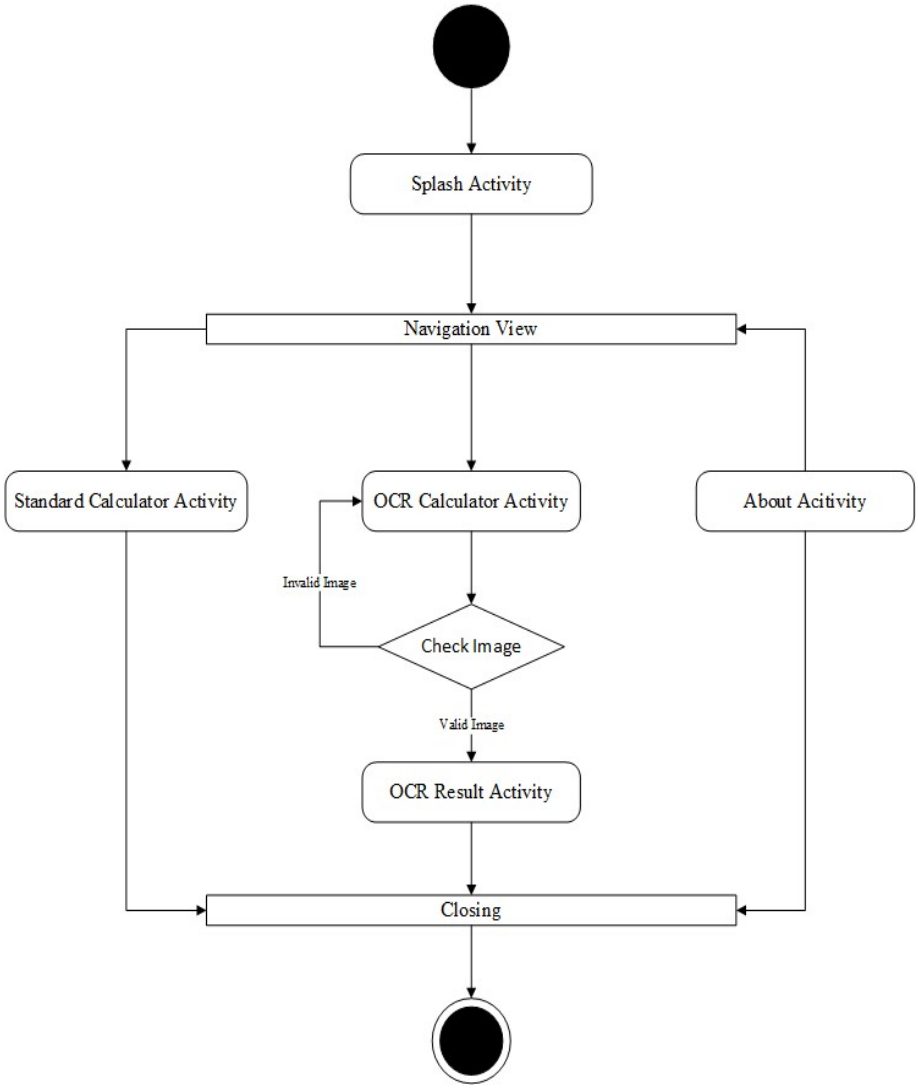


Fig. 4.7.2 Activity Diagram

4.7.3. Data Flow Diagram

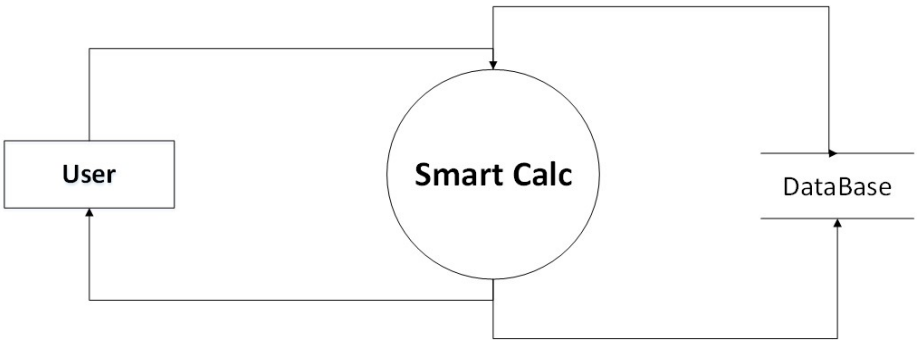


Fig. 4.7.3 Data Flow Diagram

4.8 Main Module of New System

- ✓ Standard Calculator
- ✓ OCR Calculator
- ✓ OCR Calculator Result
- ✓ History
- ✓ About

4.9 Selection of Hardware and Software and Justification

➢ Hardware Requirements

Processor: Intel i3 2.0GHz (Minimum).
Memory: 4GB DDR3 RAM (Minimum).
Other: Keyboard, Mouse, Monitor etc.

➢ Software Requirements

IDE: Android Studio 3.2.0
Backend: SQLite
OS: Windows 10

Chapter – 5

IMPLEMENTATION

5.1 Coding Standards
5.2 Coding Sample
5.3 Screen Shot

5.1 Coding Standards

The coding standard is well-defined and standard style of coding. With the help of the coding standards, any person can go into any code and figure out what is going on and new people can get up to speed quickly. A coding standard ways of doing several things such as the way variables are to be named, the code is to be laid out, the comments are to be described, the work of function are to be carried out.

This section describes the coding standards, which we have used in the program. In the context of coding standards,

- ✓ We have followed the coding standards throughout this application
- ✓ Each table name is given in such a manner that it indicates its use.
- ✓ Keywords are never used as variable name in our project.
- ✓ Each coding is properly documented by comments to clarify its meaning.
- ✓ Variables names are related to the process and the behaviour of the entity.

5.2 Coding Sample

5.2.1. OCRCalcActivity.java

```
package com.smartcalc;

import android.app.Activity;

import android.content.Intent;

import android.database.Cursor;

import android.graphics.Bitmap;

import android.net.Uri;

import android.os.*;

import android.provider.MediaStore;

import android.support.v4.*;

import android.util.*;

import android.view.*;

import android.widget.*;

import android.support.design.widget.NavigationView;

import android.support.v4.widget.DrawerLayout;

import android.support.v7.app.*;

import com.google.android.gms.vision.Frame;

import com.google.android.gms.vision.text.TextBlock;

import com.google.android.gms.vision.text.TextRecognizer;

import java.io.File;

import static android.media.MediaRecorder.VideoSource.CAMERA;


public class OCRCalcActivity extends AppCompatActivity implements
NavigationView.OnNavigationItemSelectedListener

 {

       ImageButton ocr_camera;

       public static final String TAG = ocr.class.getSimpleName();

       Uri outputFileUri;

       public TextRecognizer textRecognizer;

       static final int PHOTO_REQUEST_CODE = 1;

       EditText ocrResultInput;

       String result = "empty";
```

```
    public static String ocrInputString = "";

    public static final String DATA_PATH =
          Environment.getExternalStorageDirectory().toString()+ "/SmartCalc";

    @Override

    protected void onCreate(Bundle savedInstanceState) {

      super.onCreate(savedInstanceState);

      setContentView(R.layout.activity_ocr);

       Toolbar toolbar = (Toolbar) findViewById(R.id.toolbar);

       setSupportActionBar(toolbar);

       ocr_camera = findViewById(R.id.ocr_camera);

       ocrResultInput = (EditText) findViewById(R.id.ocr_input_data);

       ocr_camera.setOnClickListener(new View.OnClickListener() {

              @Override

                public void onClick(View v) {

                    startCameraActivity();

                }

        });

        if (android.os.Build.VERSION.SDK_INT >= Build.VERSION_CODES.M) {

                    requestCameraPermissions();

                }

        DrawerLayout drawer = (DrawerLayout) findViewById(R.id.drawer_layout);

        ActionBarDrawerToggle toggle = new ActionBarDrawerToggle(this, drawer,
                 toolbar, R.string.navigation_drawer_open,
                 R.string.navigation_drawer_close);

        drawer.addDrawerListener(toggle);

        toggle.syncState();

        NavigationView navigationView=(NavigationView)
          findViewById(R.id.nav_view);

        navigationView.setNavigationItemSelectedListener(this);

      }

   @Override

   public void onBackPressed () {

       DrawerLayout drawer = (DrawerLayout) findViewById(R.id.drawer_layout);

       if(drawer.isDrawerOpen(GravityCompat.START)){

           drawer.closeDrawer(GravityCompat.START);

               }
```

```
       else{
            Intent i = new Intent(ocr.this, com.smartcalc.standard.class);
             startActivity(i);
             finish();
         }
    }
    public void startCameraActivity () {
       try {
             File smartCalcDir = new File(DATA_PATH);
             if(!smartCalcDir.exists()){
                 smartCalcDir.mkdir();
             }
             String image_path = DATA_PATH + "/imgs";
             File dir = new File(image_path);
             if(!dir.exists()){
                 dir.mkdir();
             }
             String imageFilePath = image_path + "/ocr.jpg";
             outputFileUri = Uri.fromFile(new File(imageFilePath));
             final Intent takePictureIntent = new
Intent(MediaStore.ACTION_IMAGE_CAPTURE);
             takePictureIntent.putExtra(MediaStore.EXTRA_OUTPUT, outputFileUri);
             if (takePictureIntent.resolveActivity(getPackageManager()) != null) {
                 startActivityForResult(takePictureIntent,PHOTO_REQUEST_CODE);
             }
        } catch (Exception e) {
             Log.e(TAG, e.getMessage());
        } }
       @Override
       public void onActivityResult (int requestCode,int resultCode,Intent data){
         super.onActivityResult(requestCode,resultCode,data);
         if(requestCode==PHOTO_REQUEST_CODE&&resultCode==Activity.RESULT_OK){
                 startOCR(outputFileUri);
           } }
```

```
private void startOCR (Uri imgUri){
  try {
      BitmapFactory.Options options = new BitmapFactory.Options();
      options.inSampleSize = 4;
      Bitmap bitmap = BitmapFactory.decodeFile(imgUri.getPath(), options);
      result = extractText(bitmap);
     Intent i = new Intent(ocr.this,com.smartcalc.ocr_result.class);
      startActivity(i);
      ocrInputString = result;
      finish();
      } catch (Exception e) {
       Log.e(TAG, e.getMessage());
       Toast.makeText(getApplicationContext(),"Error",Toast.LENGTH_SHORT).
                      show();
      }      }
private String extractText (Bitmap bitmap) {
  textRecognizer = new
               TextRecognizer.Builder(getApplicationContext()).build();
  String extractedText = "NULL";
  if(!textRecognizer.isOperational()){
     Toast.makeText(getApplicationContext(),"Could not get
                    text",Toast.LENGTH_SHORT).show();
       }
  else{
      Frame frame = new Frame.Builder().setBitmap(bitmap).build();
      SparseArray<TextBlock> items = textRecognizer.detect(frame);
      StringBuilder sb = new StringBuilder();
      for(int i=0;i<items.size();i++){
           TextBlock myitem = items.valueAt(i);
           sb.append(myitem.getValue());
           sb.append("\n");
         }
     }   return sb.toString();
  }
```

5.2.2. historyActivity.java

```
package com.smartcalc;

import android.content.Intent;

import android.database.Cursor;

import android.os.Bundle;

import android.view.*;

import android.support.design.widget.*;

import android.support.v4.view.GravityCompat;

import android.support.v4.widget.DrawerLayout;

import android.support.v7.app.*;

import android.widget.*;

    public class historyActivity extends AppCompatActivity implements
                 NavigationView.OnNavigationItemSelectedListener {

       DatabaseHelper dbHelper;

       @Override

       protected void onCreate(Bundle savedInstanceState) {

         super.onCreate(savedInstanceState);

         setContentView(R.layout.activity_history);

         Toolbar toolbar = (Toolbar) findViewById(R.id.toolbar);

         setSupportActionBar(toolbar);

         ListView equationListView,resultListView;

         Button clearData = findViewById(R.id.clearDataBtn);

         dbHelper = new DatabaseHelper(this);

         Cursor cursor;

         cursor = dbHelper.getData();

         ArrayList<String> equationList = new ArrayList<String>();

         ArrayList<String> resultList = new ArrayList<String>();

         while(cursor.isAfterLast()==false){
              equationList.add(cursor.getString(cursor.getColumnIndex("equation")
              ));

             resultList.add(cursor.getString(cursor.getColumnIndex("result")));

             cursor.moveToNext();

         }
```

```
ArrayAdapter<String> equationarrayAdapter = new
              ArrayAdapter<String>(this,android.R.layout.simple_list_item_1
              ,equationList);

ArrayAdapter<String> resultarryAdapter = new
              ArrayAdapter<String>(this,android.R.layout.simple_list_item_1
              ,resultList);

equationListView = (ListView) findViewById(R.id.ListView1);

resultListView = (ListView) findViewById(R.id.ListView2);

equationListView.setAdapter(equationarrayAdapter);

resultListView.setAdapter(resultarryAdapter);

clearData.setOnClickListener(new View.OnClickListener() {

       @Override

       public void onClick(View v) {

           dbHelper.clearData();

           finish();

           startActivity(getIntent());

       }

   });

resultListView.setOnScrollChangeListener(new View.OnScrollChangeListener(){

  @Override

  public void onScrollChange(View v,int scrollX,int scrollY, int oldScrollX,
  int oldScrollY) {

           int index = resultListView.getFirstVisiblePosition();

           v = resultListView.getChildAt(0);

           int top = (v==null)?0:v.getTop();

           equationListView.setSelectionFromTop(index,top);

       }

   });

}
```

5.3 Screen Shots

5.3.1. Splash Activity

Fig. 5.3.1 Splash Activity

5.3.2. Navigation View

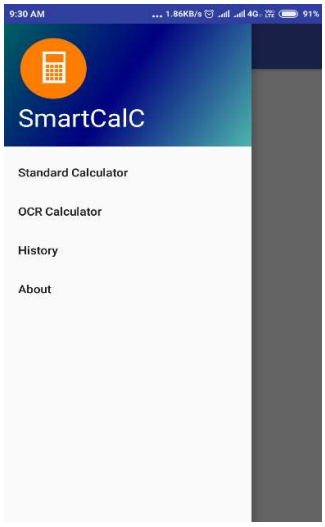


Fig. 5.3.2 Navigation View

5.3.3. Standard Calculator Activity

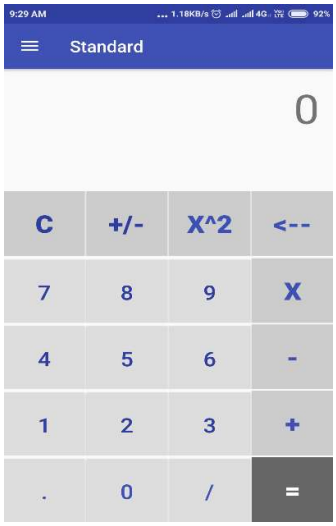


Fig. 5.3.3 Standard Calculator Activity

5.3.4. OCR Calculator Activity

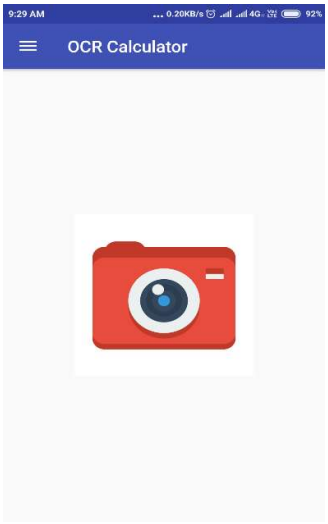


Fig. 5.3.4 OCR Calculator Activity

5.3.5. OCR Result Activity

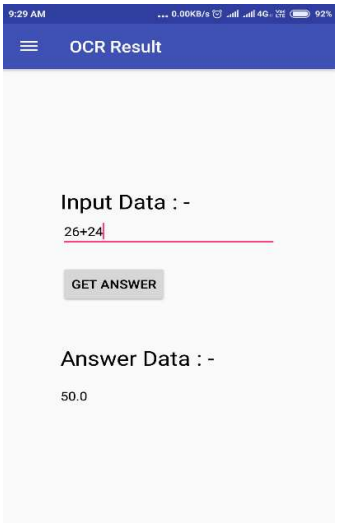


Fig. 5.3.5 OCR Result Activity

5.3.6. History Activity

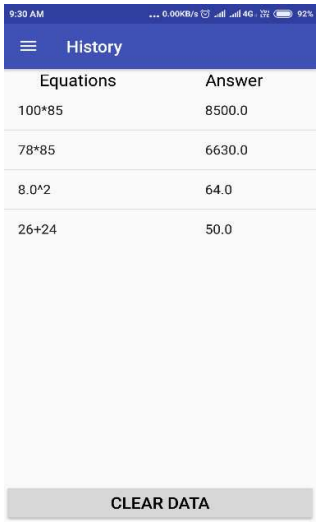


Fig. 5.3.6 History Activity

5.3.7. About Activity

Fig. 5.3.7 About Activity

Chapter – 6

LIMITATIONS

6.1 Limitation

6.2 Conclusion

6.1 Limitation

- OCR is not 100% accurate.
- Only English numbers can be used in equations.
- Sometimes, no numbers are detected.
- Sometimes, operators are not detected.
- User can only calculate simple equations not complex equations

6.2 Conclusion

"SmartCalc" provides the facility to users to calculate the equation without entering data manually. This makes the calculation faster and accurate. This application also provide standard calculator to calculate the equation by entering data manually. It also provides the facility to store the equation and its result. User Interface (UI) of this application is very user friendly and flexible. Anyone can use it without any special knowledge.

REFERENCES

Website:

1. https://en.wikipedia.org/wiki/Android_(operating_system)
2. https://docs.oracle.com/javase/tutorial/
3. https://www.sqlite.org/docs.html
4. https://developers.google.com/vision/android/text-overview