MICRO-PROJECT

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Mobile Application Development (MAD)

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➢ Introduction

Mobile application development has gained immense popularity, and Java remains one of the primary programming languages used for Android app development. This report focuses on creating a simple calculator application using Java, exploring its features, architecture, and development process.

➢ Overview of Java in Mobile Development

Platform: Java is the official language for Android development, supported by Android Studio.

Advantages:

- Object-oriented programming
- Robust libraries and frameworks
- Strong community support

➢ Project Scope:_

The calculator application will perform basic arithmetic operations:

- Addition
- Subtraction
- Multiplication
- Division

➢ Architecture

The architecture of the calculator app follows the Model-View-Controller (MVC) pattern:

- **Model**: Represents the data and business logic (e.g., calculations).
- **View**: User interface components (buttons, display).
- **Controller**: Handles user interactions and updates the model and view accordingly.

➢ Development Process

1. Setting Up the Environment

- **Tools**: Android Studio, Java Development Kit (JDK)
- **SDK**: Ensure the Android SDK is installed and configured.

2. Creating a New Project

- Open Android Studio and create a new project.
- Choose an "Empty Activity" template.

➢ Designing the User Interface

activity_main.xml :_

```
<?xml version="1.0" encoding="utf-8"?>
<layout
   xmlns:android="http://schemas.android.com/apk/res/android"
   xmlns:app="http://schemas.android.com/apk/res-auto"
   xmlns:tools="http://schemas.android.com/tools">

   <androidx.constraintlayout.widget.ConstraintLayout
      android:layout_width="match_parent"
      android:layout_height="match_parent"
      android:background="#8BC34A"
      android:backgroundTint="@android:color/darker_gray"
      tools:context=".MainActivity">

      <!-- Text View to display our basic heading of "calculator"-->
      <TextView
         android:layout_width="194dp"
         android:layout_height="43dp"
         android:layout_marginStart="114dp"
```

```
   android:layout_marginLeft="114dp"
   android:layout_marginTop="58dp"
   android:layout_marginEnd="103dp"
   android:layout_marginRight="103dp"
   android:layout_marginBottom="502dp"
   android:scrollbarSize="30dp"
   android:text=" Calculator"
   android:textAppearance="@style/TextAppearance.AppCompat.Body1"
   android:textSize="30dp"
   app:layout_constraintBottom_toBottomOf="parent"
   app:layout_constraintEnd_toEndOf="parent"
   app:layout_constraintStart_toStartOf="parent"
   app:layout_constraintTop_toTopOf="parent" />

<!-- Edit Text View to input the values -->
<EditText
   android:id="@+id/num1"
   android:layout_width="364dp"
   android:layout_height="28dp"
   android:layout_marginStart="72dp"
   android:layout_marginTop="70dp"
   android:layout_marginEnd="71dp"
   android:layout_marginBottom="416dp"
   android:background="@android:color/white"
   android:ems="10"
   android:onClick="clearTextNum1"
   android:inputType="number"
   app:layout_constraintBottom_toBottomOf="parent"
   app:layout_constraintEnd_toEndOf="parent"
   app:layout_constraintStart_toStartOf="parent"
   app:layout_constraintTop_toTopOf="parent" />

<!-- Edit Text View to input 2nd value-->
<EditText
   android:id="@+id/num2"
   android:layout_width="363dp"
   android:layout_height="30dp"
   android:layout_marginStart="72dp"
   android:layout_marginTop="112dp"
   android:layout_marginEnd="71dp"
   android:layout_marginBottom="374dp"
   android:background="@android:color/white"
   android:ems="10"
   android:onClick="clearTextNum2"
   android:inputType="number"
   app:layout_constraintBottom_toBottomOf="parent"
   app:layout_constraintEnd_toEndOf="parent"
   app:layout_constraintStart_toStartOf="parent"
   app:layout_constraintTop_toTopOf="parent" />

<!-- Text View to display result -->
```

```
<TextView
   android:id="@+id/result"
   android:layout_width="356dp"
   android:layout_height="71dp"
   android:layout_marginStart="41dp"
   android:layout_marginTop="151dp"
   android:layout_marginEnd="48dp"
   android:layout_marginBottom="287dp"
   android:background="@android:color/white"
   android:text="result"
   android:textColorLink="#673AB7"
   android:textSize="25sp"
   app:layout_constraintBottom_toBottomOf="parent"
   app:layout_constraintEnd_toEndOf="parent"
   app:layout_constraintStart_toStartOf="parent"
   app:layout_constraintTop_toTopOf="parent" />

<!-- A button to perform 'sum' operation -->
<Button
   android:id="@+id/sum"
   android:layout_width="wrap_content"
   android:layout_height="wrap_content"
   android:layout_marginStart="16dp"
   android:layout_marginTop="292dp"
   android:layout_marginEnd="307dp"
   android:layout_marginBottom="263dp"
   android:backgroundTint="@android:color/holo_red_light"
   android:onClick="doSum"
   android:text="+"
   app:layout_constraintBottom_toBottomOf="parent"
   app:layout_constraintEnd_toEndOf="parent"
   app:layout_constraintStart_toStartOf="parent"
   app:layout_constraintTop_toTopOf="parent" />

<!-- A button to perform subtraction operation. -->

<!-- A button to perform division. -->

<Button
   android:id="@+id/sub"
   android:layout_width="wrap_content"
   android:layout_height="wrap_content"
   android:layout_marginStart="210dp"
   android:layout_marginTop="292dp"
   android:layout_marginEnd="113dp"
   android:layout_marginBottom="263dp"
   android:backgroundTint="@android:color/holo_red_light"
   android:onClick="doSub"
   android:text="-"
   app:layout_constraintBottom_toBottomOf="parent"
   app:layout_constraintEnd_toEndOf="parent"
```

```
    app:layout_constraintHorizontal_bias="1.0"
    app:layout_constraintStart_toStartOf="parent"
    app:layout_constraintTop_toTopOf="parent"
    app:layout_constraintVertical_bias="0.507" />

  <Button
    android:id="@+id/div"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_marginStart="307dp"
    android:layout_marginTop="292dp"
    android:layout_marginEnd="16dp"
    android:layout_marginBottom="263dp"
    android:backgroundTint="@android:color/holo_red_light"
    android:onClick="doDiv"
    android:text="/"
    app:layout_constraintBottom_toBottomOf="parent"
    app:layout_constraintEnd_toEndOf="parent"
    app:layout_constraintHorizontal_bias="0.0"
    app:layout_constraintStart_toStartOf="parent"
    app:layout_constraintTop_toTopOf="parent" />

  <!-- A button to perform multiplication. -->
  <Button
    android:id="@+id/mul"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_marginStart="16dp"
    android:layout_marginTop="356dp"
    android:layout_marginEnd="307dp"
    android:layout_marginBottom="199dp"
    android:backgroundTint="@android:color/holo_red_light"
    android:onClick="doMul"
    android:text="x"
    app:layout_constraintBottom_toBottomOf="parent"
    app:layout_constraintEnd_toEndOf="parent"
    app:layout_constraintStart_toStartOf="parent"
    app:layout_constraintTop_toTopOf="parent" />

  <!-- A button to perform a modulus function. -->

  <!-- A button to perform a power function. -->

  <Button
    android:id="@+id/button"
    android:layout_width="103dp"
    android:layout_height="46dp"
    android:layout_marginStart="113dp"
    android:layout_marginTop="356dp"
    android:layout_marginEnd="206dp"
    android:layout_marginBottom="199dp"
```

```
        android:backgroundTint="@android:color/holo_red_light"
        android:onClick="doMod"
        android:text="%(mod)"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent"
        app:layout_constraintVertical_bias="0.515" />

    <Button
        android:id="@+id/pow"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginStart="113dp"
        android:layout_marginTop="292dp"
        android:layout_marginEnd="210dp"
        android:layout_marginBottom="263dp"
        android:backgroundTint="@android:color/holo_red_light"
        android:onClick="doPow"
        android:text="n1^n2"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.0"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent"
        app:layout_constraintVertical_bias="0.507" />

  </androidx.constraintlayout.widget.ConstraintLayout>

</layout>
```

activity_main.java:_

```
package com.example.myapplication;

import android.os.Bundle;
import androidx.appcompat.app.AppCompatActivity;
import android.view.View;
import androidx.navigation.ui.AppBarConfiguration;

import android.widget.EditText;
import android.widget.TextView;

class MainActivity extends AppCompatActivity {
  private AppBarConfiguration appBarConfiguration;
  private ActivityMainBinding binding;
  public EditText e1, e2;
  TextView t1;
  int num1, num2;
```

```
public boolean getNumbers() {

   //checkAndClear();
   // defining the edit text 1 to e1
   e1=(EditText)findViewById(R.id.num1);

   // defining the edit text 2 to e2
   e2 = (EditText) findViewById(R.id.num2);

   // defining the text view to t1
   t1 = (TextView) findViewById(R.id.result);

   // taking input from text box 1
   String s1 = e1.getText().toString();

   // taking input from text box 2
   String s2 = e2.getText().toString();



   if(s1.equals("Please enter value 1") && s2.equals(null))
   {
      String result = "Please enter value 2";
      e2.setText(result);
      return false;
   }
   if(s1.equals(null) && s2.equals("Please enter value 2"))
   {
      String result = "Please enter value 1";
      e1.setText(result);
      return false;
   }
   if(s1.equals("Please enter value 1") || s2.equals("Please enter value 2"))
   {
      return false;
   }

   if((!s1.equals(null) && s2.equals(null))|| (!s1.equals("") && s2.equals("")) ){

      String result = "Please enter value 2";

      e2.setText(result);
      return false;
   }
   if((s1.equals(null) && !s2.equals(null))|| (s1.equals("") && !s2.equals("")) ){
      //checkAndClear();
      String result = "Please enter value 1";
      e1.setText(result);
      return false;
   }
   if((s1.equals(null) && s2.equals(null))|| (s1.equals("") && s2.equals("")) ){
```

```
        //checkAndClear();
        String result1 = "Please enter value 1";
        e1.setText(result1);
        String result2 = "Please enter value 2";
        e2.setText(result2);
        return false;
    }

    else {
        // converting string to int.
        num1 = Integer.parseInt(s1);

        // converting string to int.
        num2 = Integer.parseInt(s2);


    }

    return true;
public void doSum(View v) {

    // get the input numbers
    if (getNumbers()) {
        int sum = num1 + num2;
        t1.setText(Integer.toString(sum));
    }
    else
    {
        t1.setText("Error Please enter Required Values");
    }

}
public void clearTextNum1(View v) {

    // get the input numbers
    e1.getText().clear();
}
public void clearTextNum2(View v) {

    // get the input numbers
    e2.getText().clear();
}
public void doPow(View v) {

    //checkAndClear();
    // get the input numbers
    if (getNumbers()) {
        double sum = Math.pow(num1, num2);
        t1.setText(Double.toString(sum));
    }
    else
```

```
    {
        t1.setText("Error Please enter Required Values");
    }
}

// a public method to perform subtraction
public void doSub(View v) {
    //checkAndClear();
    // get the input numbers
    if (getNumbers()) {
        int sum = num1 - num2;
        t1.setText(Integer.toString(sum));
    }
    else
    {
        t1.setText("Error Please enter Required Values");
    }
}

// a public method to perform multiplication
public void doMul(View v) {
    //checkAndClear();
    // get the input numbers
    if (getNumbers()) {
        int sum = num1 * num2;
        t1.setText(Integer.toString(sum));
    }
    else
    {
        t1.setText("Error Please enter Required Values");
    }
}

// a public method to perform Division
public void doDiv(View v) {
    //checkAndClear();
    // get the input numbers
    if (getNumbers()) {

        // displaying the text in text view assigned as t1
        double sum = num1 / (num2 * 1.0);
        t1.setText(Double.toString(sum));
    }
    else
    {
        t1.setText("Error Please enter Required Values");
    }
}

// a public method to perform modulus function
public void doMod(View v) {
```

```
        //checkAndClear();
        // get the input numbers
        if (getNumbers()) {
            double sum = num1 % num2;
            t1.setText(Double.toString(sum));
        }
        else
        {
            t1.setText("Error Please enter Required Values");
        }
    }


    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
        e1 = (EditText) findViewById(R.id.num1);
        // defining the edit text 2 to e2
        e2 = (EditText) findViewById(R.id.num2);
    }
}
```

build.gradle :_

```
plugins {
    alias(libs.plugins.android.application)
}

android {
    namespace 'com.example.myapplication'
    compileSdk 34

    defaultConfig {
        applicationId "com.example.myapplication"
        minSdk 24
        targetSdk 34
        versionCode 1
        versionName "1.0"

        testInstrumentationRunner "androidx.test.runner.AndroidJUnitRunner"
    }

    buildTypes {
        release {
            minifyEnabled false
            proguardFiles        getDefaultProguardFile('proguard-android-optimize.txt'),
'proguard-rules.pro'
        }
    }
```

```
    compileOptions {
        sourceCompatibility JavaVersion.VERSION_1_8
        targetCompatibility JavaVersion.VERSION_1_8
    }
    buildFeatures{
        dataBinding = true
    }
}

dependencies {

    implementation libs.appcompat
    implementation libs.material
    implementation libs.navigation.ui
    testImplementation libs.junit
    androidTestImplementation libs.ext.junit
    androidTestImplementation libs.espresso.core
}
```

➢ Testing the Application:_

- Test the application on an Android emulator or physical device.
- Ensure all operations work correctly and handle edge cases (e.g., division by zero)

➢ Conclusion

Developing a calculator application in Java is a straightforward project that helps reinforce fundamental programming concepts and mobile development practices. By following the MVC architecture and leveraging Java's capabilities, developers can create a functional and user-friendly application.