Vivekanand Education Society's Institute of Technology

An Autonomous Institute Affiliated to University of Mumbai
Hashu Advani Memorial Complex, Collector Colony, Chembur East, Mumbai - 400074.

Department of Information Technology

CERTIFICATE

This is to certify that **Jeetu Mamtora** of **D15B** semester **VI,** have successfully completed necessary experiments in the **MAD & PWA Lab** under my supervision in **VES Institute of Technology** during the academic year **2024-2025.**

Lab Teacher
Dr. Ravita Mishra
Signature:

Head of Department
Dr. Mrs. Shalu Chopra
Signature:

Principal

Name of the Course : MAD & PWA Lab **Course Code :** ITL604

Year/Sem/Class : D15A/D15B **A.Y.:** 24-25

Faculty Incharge : Dr. Ravita Mishra

Lab Teachers : Dr. Ravita Mishra.

Email : ravita.mishra@ves.ac.in

Programme Outcomes: The graduate will be able to:

PO1) Basic Engineering knowledge: An ability to apply the fundamental knowledge in mathematics, science and engineering to solve problems in Computer engineering.

PO2) Problem Analysis: Identify, formulate, research literature and analyze computer engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and computer engineering and sciences.

PO3) Design/ Development of Solutions: Design solutions for complex computer engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

PO4) Conduct investigations of complex engineering problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.

PO5) Modern Tool Usage: Create, select and apply appropriate techniques, resources and modern computer engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6) The Engineer and Society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to computer engineering practice.

PO7) Environment and Sustainability: Understand the impact of professional computer engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

PO8) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of computer engineering practice.

PO9) Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.

PO10) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and

write effective reports and design documentation, make effective presentations and give and receive clear instructions.

PO11) Project Management and Finance: Demonstrate knowledge and understanding of computer engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12) Life-long Learning: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program specific Outcomes

PSO1) An ability to manage and analyze data / information effectively for making better decisions.

PSO2) Demonstrate the ability to use state of the art technologies and tools including Free and Open Source Software (FOSS) tools in developing software.

Lab Objectives:

Sr. No.	**Lab Objectives**
The Lab experiments aims:	
1	Learn the basics of the Flutter framework.
2	Develop the App UI by incorporating widgets, layouts, gestures and animation
3	Create a production ready Flutter App by including files and firebase backend service
4	Learn the Essential technologies, and Concepts of PWAs to get started as quickly and efficiently as possible
5	Develop responsive web applications by combining AJAX development techniques w the jQuery JavaScript library.
6	Understand how service workers operate and also learn to Test and Deploy PWA.

Lab Outcomes:

Sr. No.	Lab Outcomes	Cognitive levels attainment as Bloom's Taxono
On Completion of the course the learner/student should be able to:		
1	Understand cross platform mobile application development using Flutter framework	L1, L2
2	Design and Develop interactive Flutter App by using widgets, layouts, gestures and animation	L3
3	Analyze and Build production ready Flutter App by incorporating backend services and deploying on Android / iOS	L3, L4
4	Understand various PWA frameworks and their requirements	L1, L2
5	Design and Develop a responsive User Interface by applying PWA Design techniques	L3
6	Develop and Analyse PWA Features and deploy it over app hosting solutions	L3, L4

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Sr. No	Experiment Title	LO	DOP	DOS	Grade
1.	To install and configure the Flutter Environment	LO1			
2.	To design Flutter UI by including common widgets.	LO2			
3.	To include icons, images, fonts in Flutter app	LO2			
4.	To create an interactive Form using form widget	LO2			
5.	To apply navigation, routing and gestures in Flutter App	LO2			
6.	To Connect Flutter UI with fireBase database	LO3			
7.	To write meta data of your Ecommerce PWA in a Web app manifest file to enable “add to homescreen feature”.	LO4			
8.	To code and register a service worker, and complete the install and activation process for a new service worker for the E-commerce PWA	LO5			
9.	To implement Service worker events like fetch, sync and push for E-commerce PWA	LO5			
10.	To study and implement deployment of Ecommerce PWA to GitHub Pages.	LO5			
11.	To use google Lighthouse PWA Analysis Tool to test the PWA functioning.	LO6			
12.	Assignment-1	LO1,LO2 ,LO3			
13.	Assignment-2	LO4,LO5 ,LO6			

MAD & PWA Lab
Journal

Experiment No.	01
Experiment Title.	To install and configure the Flutter Environment
Roll No.	30
Name	Jeetu Mamtora
Class	D15B
Subject	MAD & PWA Lab
Lab Outcome	LO1: Understand cross platform mobile application development using Flutter framework
Grade:	

Aim:

To install and configure the Flutter development environment on your system to start building applications with Flutter.

Theory:

Flutter is an open-source framework developed by Google to create cross-platform applications from a single codebase. It enables the development of high-performance apps for Android, iOS, Web, and Desktop. Flutter uses Dart, a programming language developed by Google, which offers fast compilation and powerful async features.

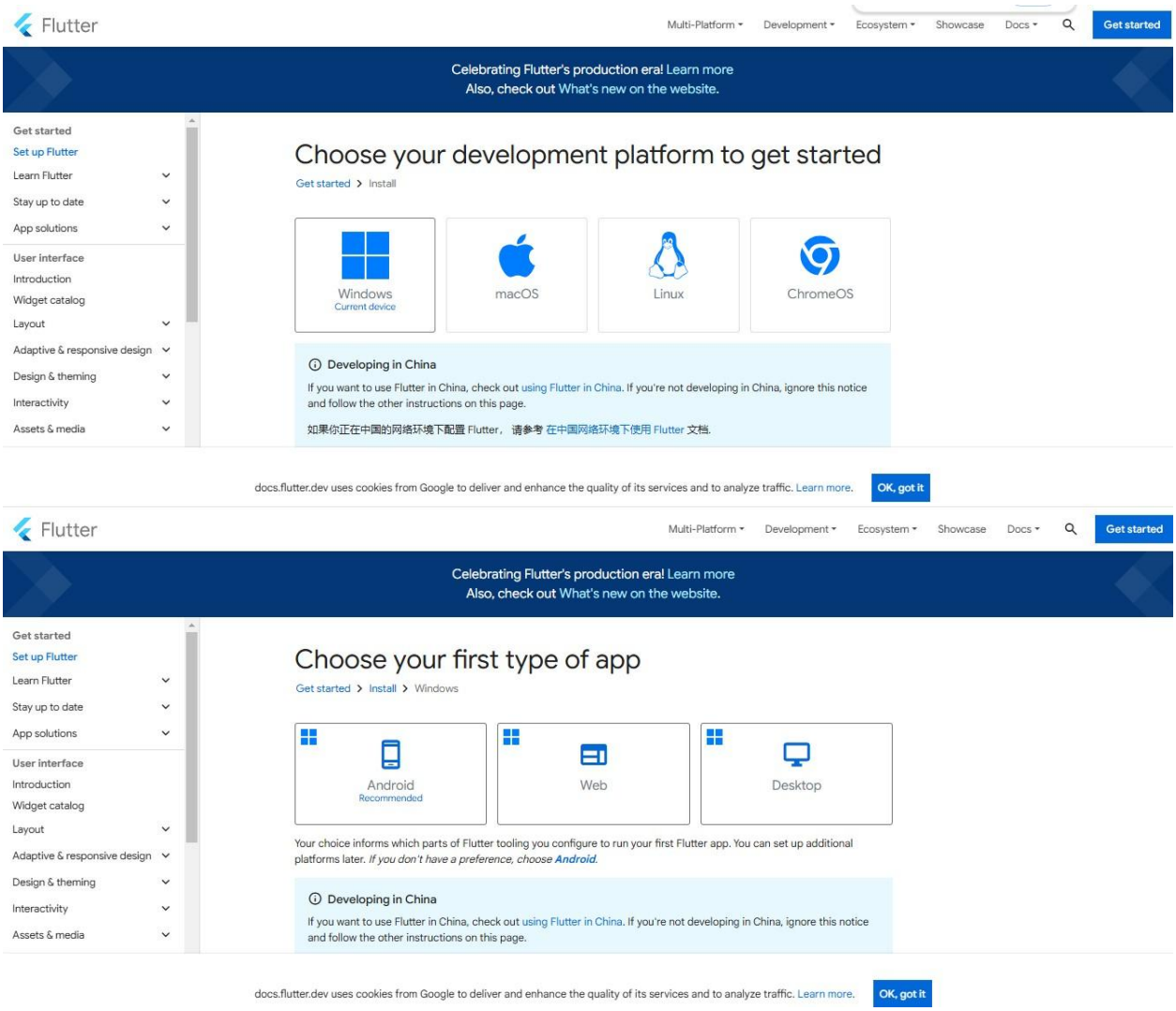
Key Components for Setting Up the Flutter Environment:

1. Flutter SDK:
    - The core development kit for building Flutter applications. It includes the Flutter framework, which provides widgets and tools for creating UIs, and the engine, which handles rendering using the Skia graphics library.
    - It also includes Flutter CLI tools like flutter doctor, flutter run, and flutter build for managing projects and debugging.
2. Dart SDK:
    - Dart is the programming language used by Flutter. It is object-oriented and supports asynchronous programming.
    - Dart uses Just-In-Time (JIT) compilation during development for fast build times and Hot Reload, and Ahead-Of-Time (AOT) compilation for production builds for better performance.
3. IDE (Integrated Development Environment):
    - Android Studio: A full-featured IDE that includes Flutter and Dart plugins, device emulators, and tools for debugging and profiling.
    - Visual Studio Code (VS Code): A lightweight editor with excellent Flutter and Dart plugin support for development and debugging.
4. Platform-Specific Tools:

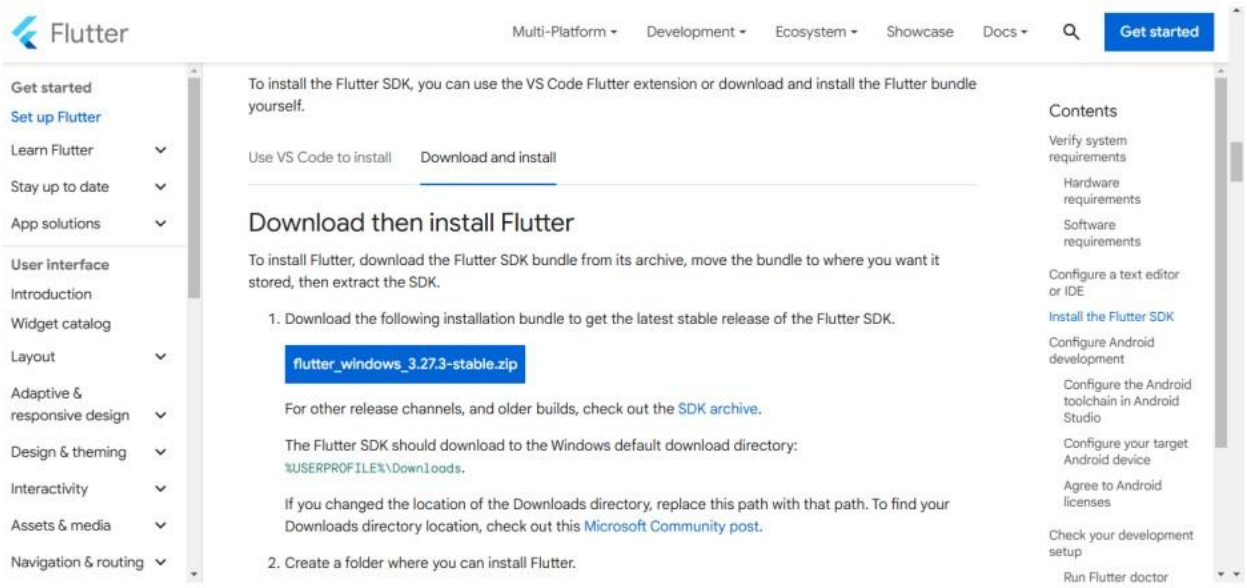
- Android Studio: Required for Android development with Flutter, including the Android SDK and emulator.
- Xcode: Needed for iOS development on macOS, with tools like the iOS Simulator

Steps To Install Flutter:

Step 1:
Download the installation bundle of the Flutter Software Development Kit for windows.
To download Flutter SDK, Go to its official website https://docs.flutter.dev/get-started/install , you will get the following screen.



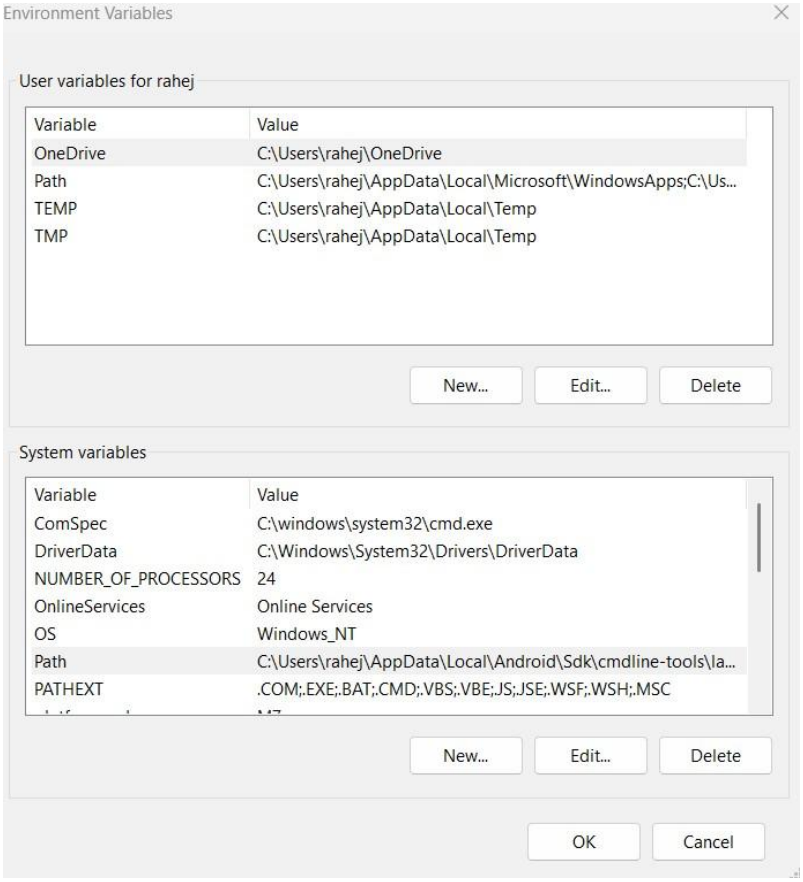
Step 2:
Next, to download the latest Flutter SDK, click on the Windows icon. Here, you will find the download link for SDK.



Step 3:
When your download is complete, extract the zip file and place it in the desired installation folder or location, for example, C: /Flutter.

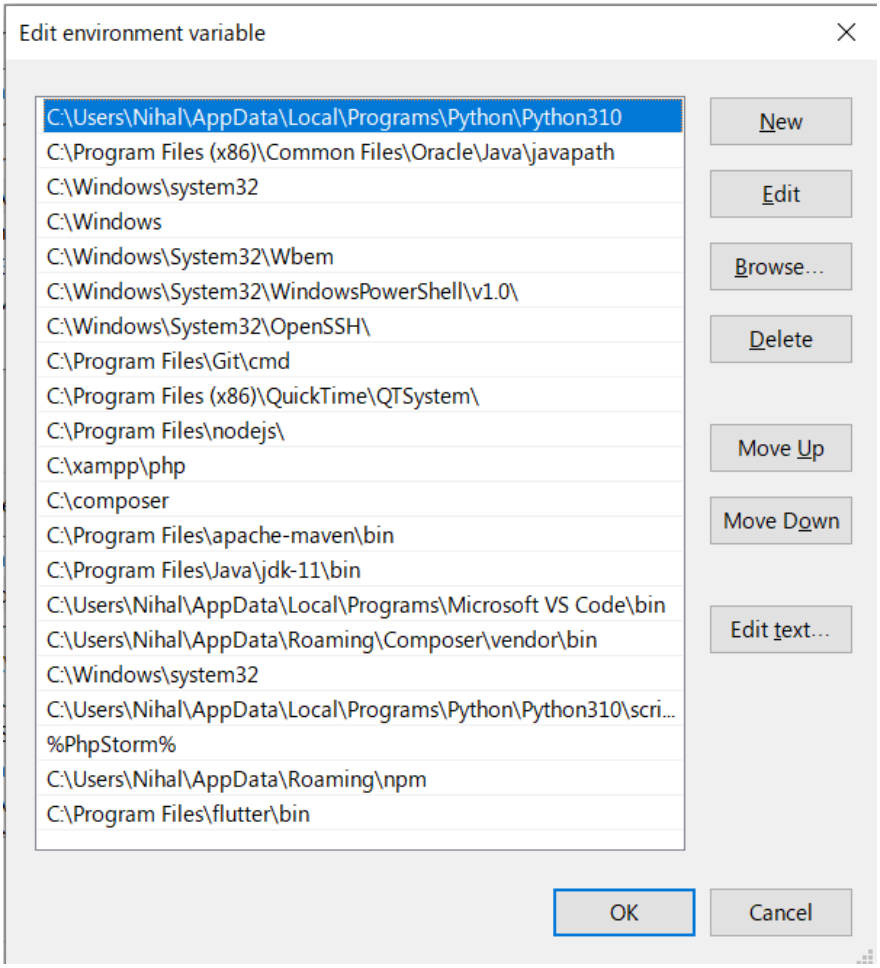
Step 4:
To run the Flutter command in regular windows console, you need to update the system path to include the flutter bin directory. The following steps are required to do this:

Step 4.1:
Go to MyComputer properties -> advanced tab -> environment variables. You will get the following screen.



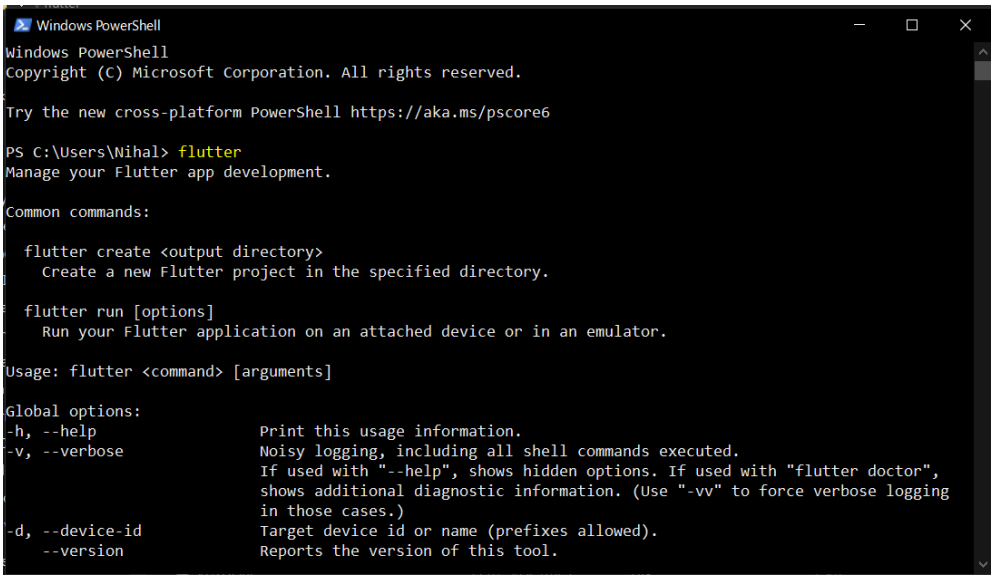
Step 4.2:
Now, select path -> click on edit. The following screen appears

Step 4.3:
In the above window, click on New->write path of Flutter bin folder in variable value - > ok -> ok -> ok.



Step 5:

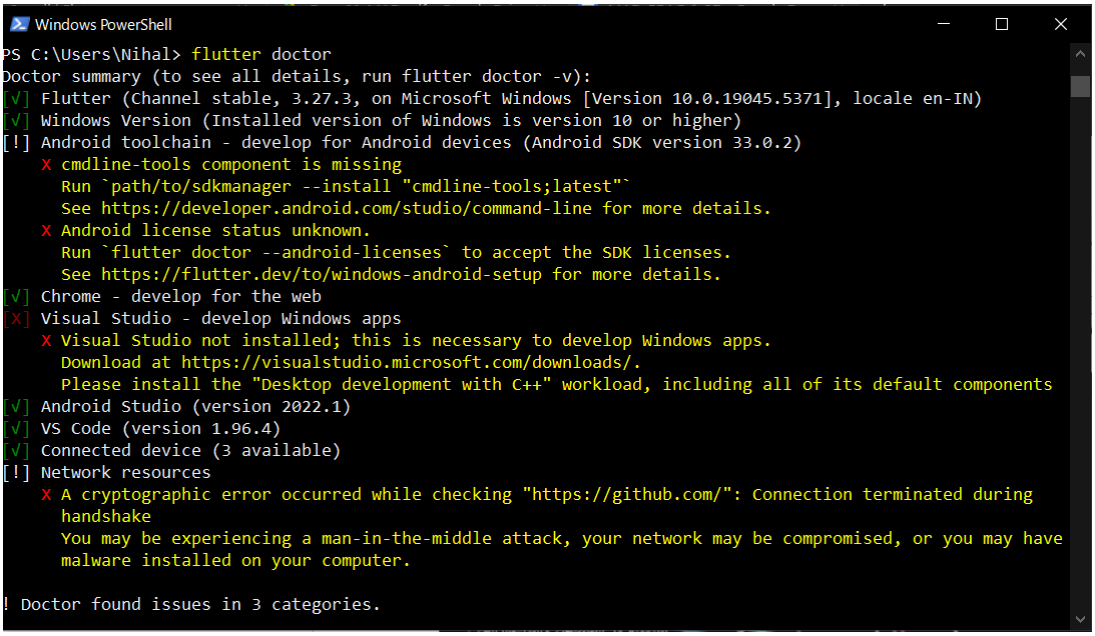
Now, run the $ flutter command in command prompt.



Now, run the $ flutter doctor command. This command checks for all the requirements of Flutter app development and displays a report of the status of your Flutter installation.

Step 6:

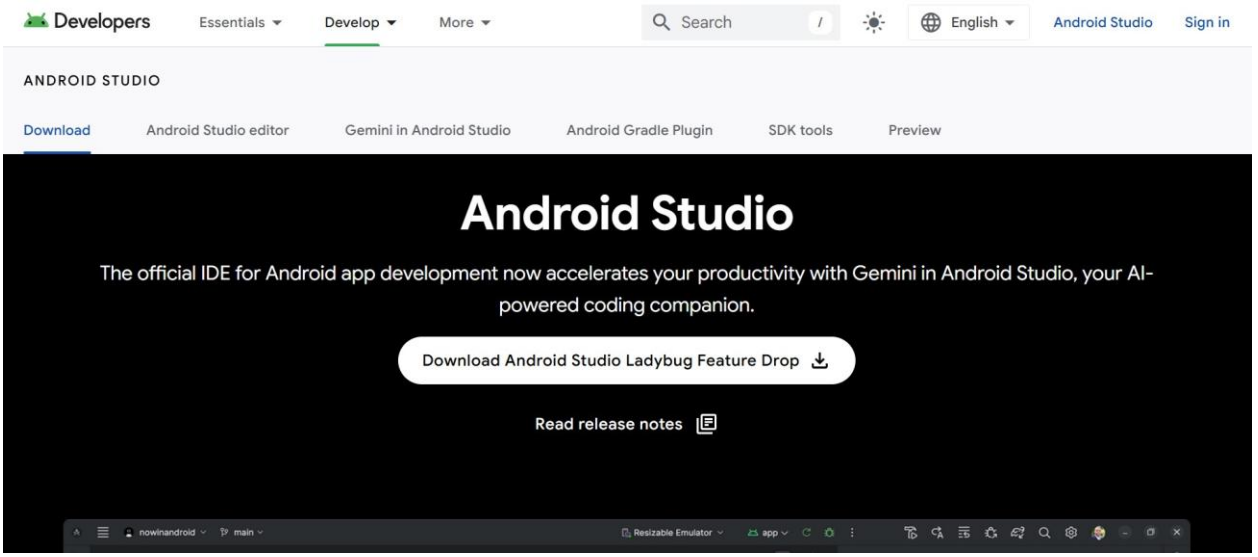
When you run the above command, it will analyze the system and show its report, as shown in the below image. Here, you will find the details



of all missing tools, which required to run Flutter as well as the development tools that are available but not connected with the device.

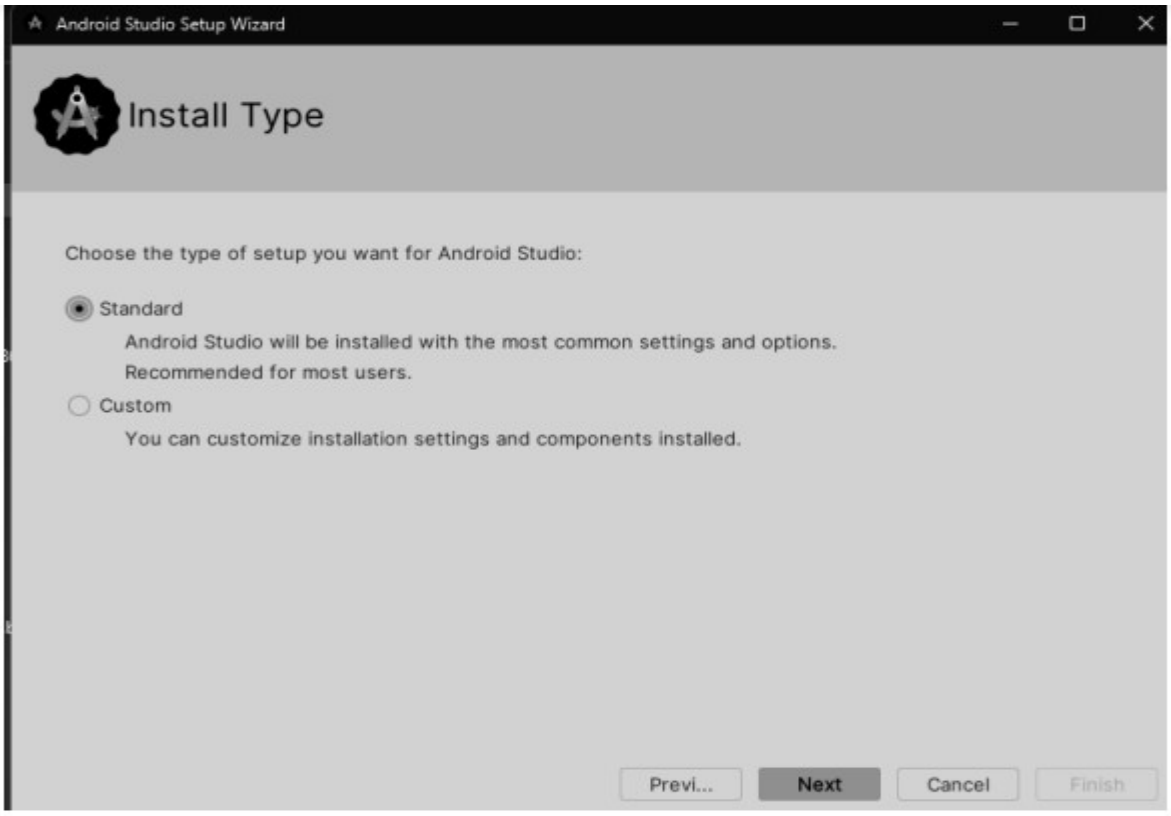
Step 7:

Install the Android SDK. If the flutter doctor command does not find the Android SDK tool in your system, then you need first to install the Android Studio IDE. To install Android Studio IDE, do the following steps.



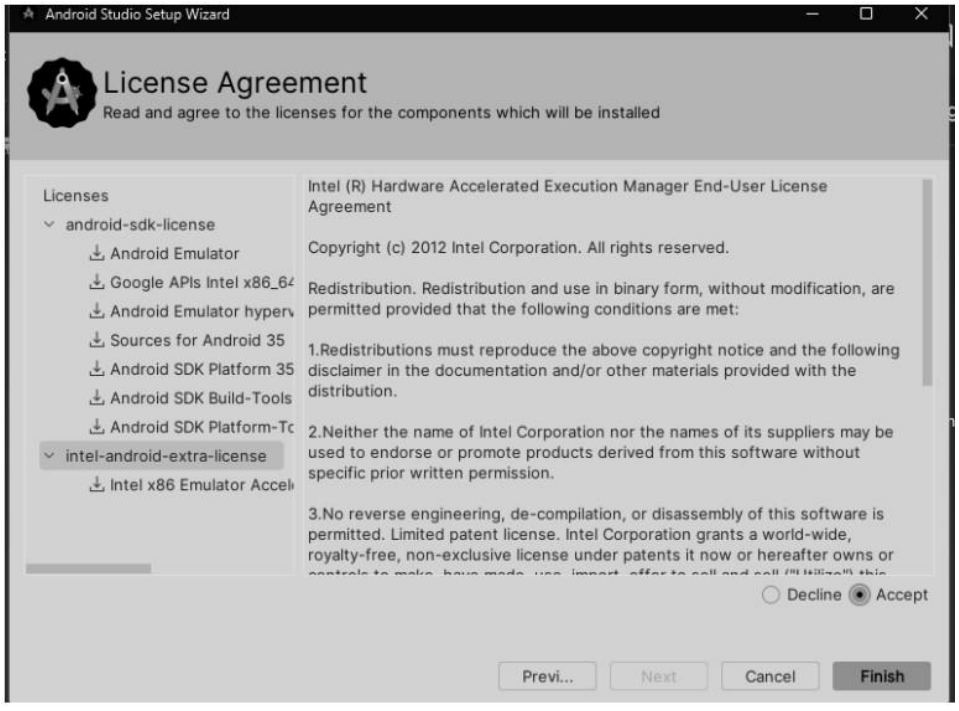
Step 8:

After opening the installer you will see the following. Select standard and click next.



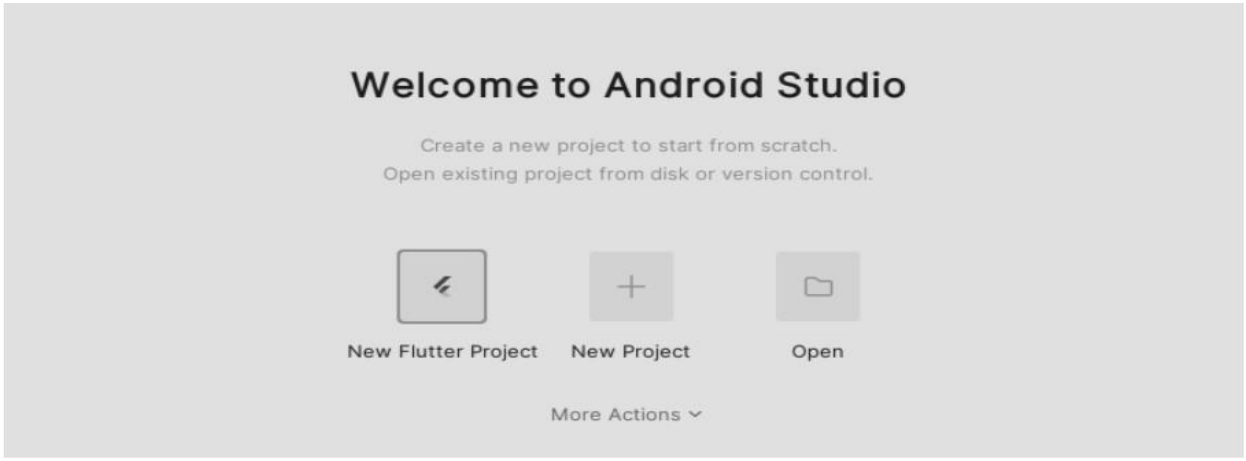
Step 9:

Accept all and finish the installation.



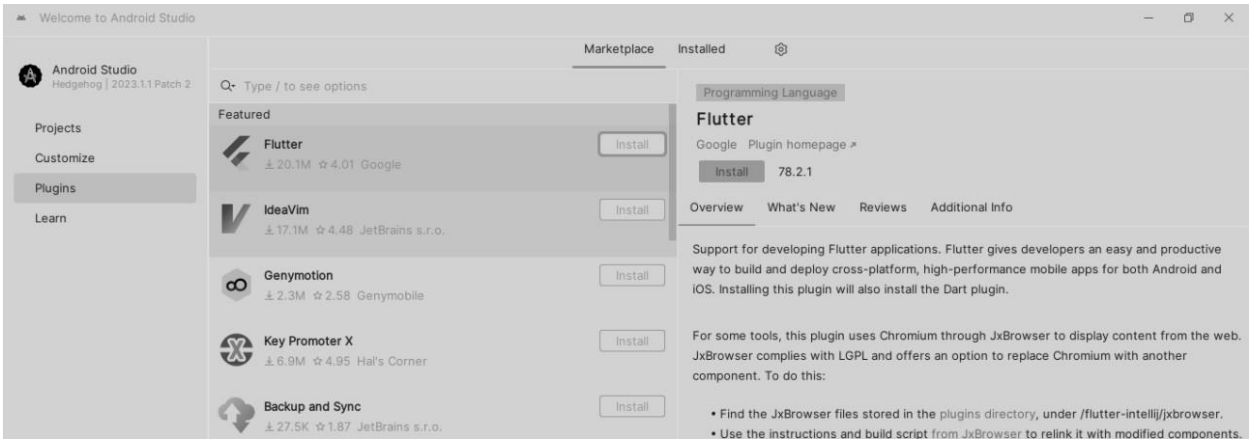
Step 10:
Install Flutter and Dart plugins from Marketplace.

Step 11:
Click on New Flutter Project.



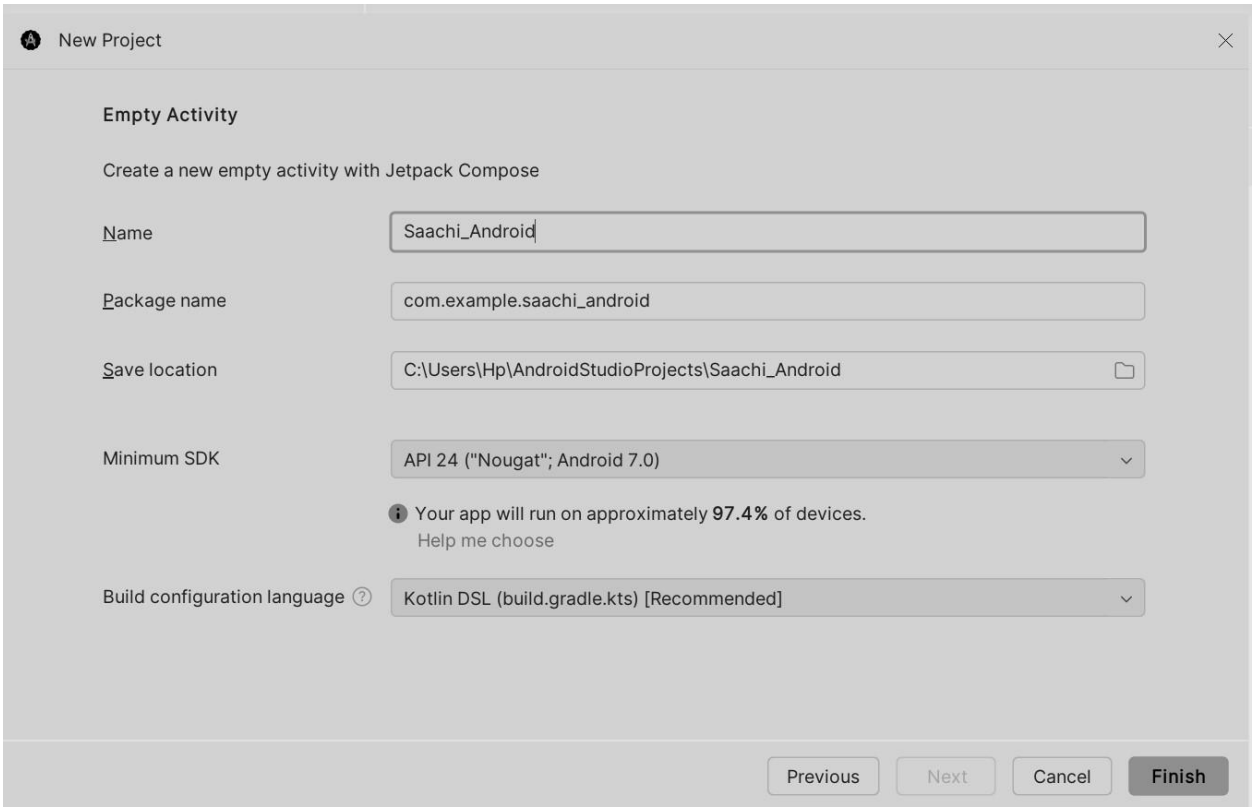
Step 12:
Set path C:\flutter\flutter

Step 13:
Enter a name for project and click on create.



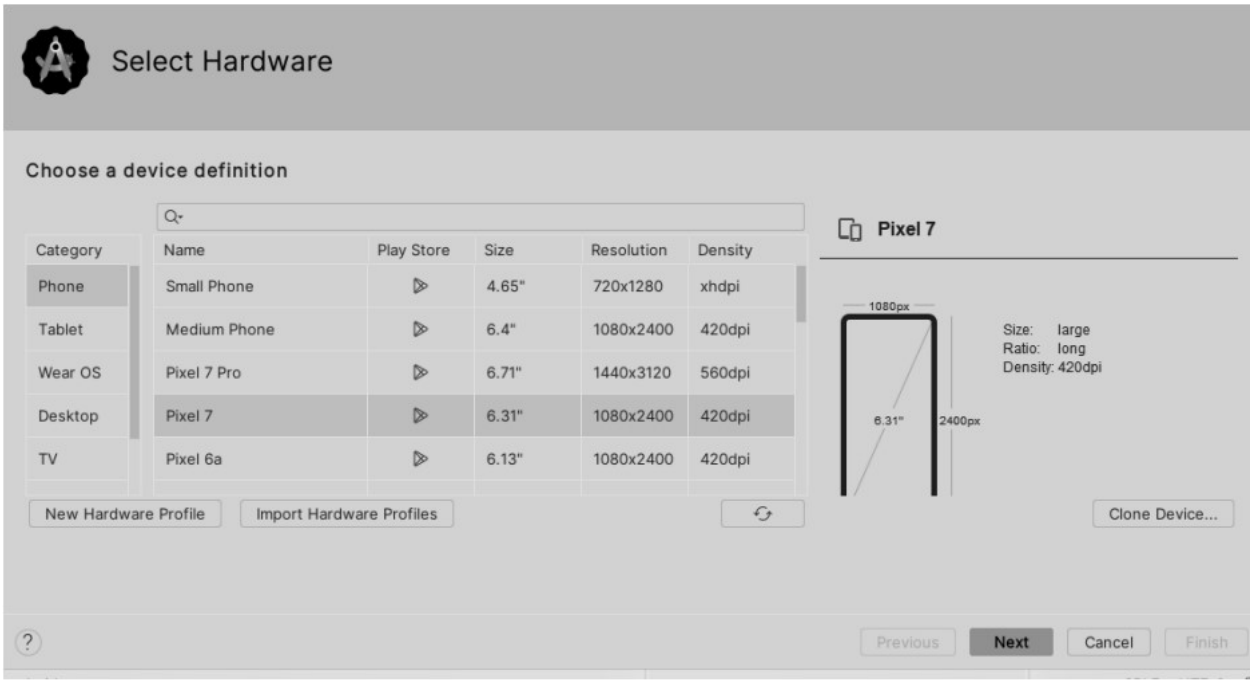
Step 14:

Go to Menu > Tools > Device Manager



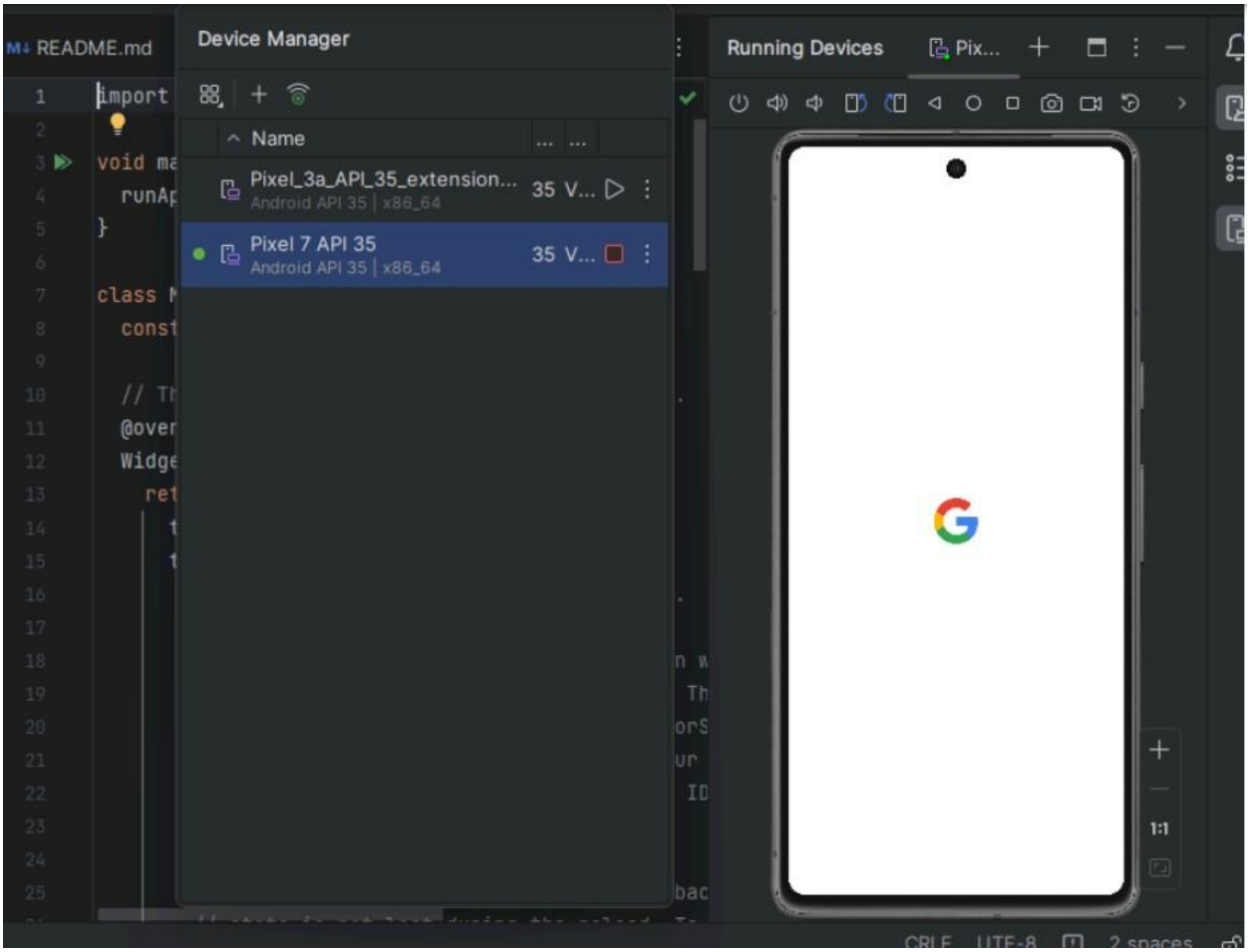
Step 15:

Choose your device on which you want to run your project and click Next.



Step 16 :

Click on play button in the toolbar above and you will see the emulator starting. It will take time to load for the first time.



Conclusion:

Flutter allows developers to build cross-platform applications with a single codebase. The Flutter SDK, Dart programming language, and the right IDE (Android Studio or Visual Studio Code) are essential for setting up the development environment. With tools for fast compilation, real-time changes (Hot Reload), and native-like performance, Flutter makes it easy to create powerful, multi-platform apps.

MAD & PWA Lab
Journal

Experiment No.	02
Experiment Title.	To design Flutter UI by including common widgets.
Roll No.	30
Name	Jeetu Mamtora
Class	D15B
Subject	MAD & PWA Lab
Lab Outcome	LO2: Design and Develop interactive Flutter App by using widgets, layouts, gestures and animation
Grade:	

Aim:
To design Flutter UI by including common widgets.

Theory:

Widgets are the building blocks of a Flutter application. In Flutter, everything is a widget, from simple elements like text and images to complex structures like entire layouts and navigations. Flutter provides a rich set of predefined widgets to create various UI components, which can be combined to build a complex UI.

Common Flutter Widgets:

1. Text Widget:
    - Used to display text on the screen. You can customize its style, size, color, and alignment.
2. Container Widget:
    - A box that can contain other widgets. It is used for styling, adding padding, margin, alignment, and background color to widgets.
3. Row and Column Widgets:
    - Row: Arranges widgets horizontally.
    - Column: Arranges widgets vertically.
    - These widgets are fundamental for creating flexible layouts and positioning UI elements.
4. Image Widget:
    - Used to display images in the app, either from assets, network, or file system.
5. Button Widgets:
    - Flutter offers several button widgets like RaisedButton, FlatButton, ElevatedButton, and IconButton that are used for interaction. These buttons are essential for handling user input and triggering actions.
6. TextField Widget:
    - Used for user input. It provides an editable field where the user can type text.
7. Scaffold Widget:

    - This is a top-level container that holds the structure of the UI. It includes the app bar, body, drawer, and bottom navigation bar. It provides a standard layout for the app.
8. ListView Widget:
    - A scrolling widget that allows the display of a long list of items. It is used for displaying dynamic content efficiently.

Layouts in Flutter:

- Padding: Adds space around a widget.
- Align: Aligns a widget within its parent.
- Expanded: Makes a widget expand to fill available space in a Row, Column, or Flex.
- Stack: Used for placing widgets on top of one another.

Conclusion:

We learned how to design a basic Flutter UI by utilizing common widgets such as Text, Container, Row, Column, Image, Button, TextField, ListView, and Scaffold. These widgets provide a flexible and powerful way to create UIs that are visually appealing and functional. By combining these widgets, you can build complex layouts that cater to your app's design needs.

- Text and Container are fundamental for displaying text and styling.
- Row and Column are essential for structuring layouts, either horizontally or vertically.
- Buttons allow users to interact with the app.
- Scaffold provides a basic structure for the app, including app bars, bodies, and drawers.
- ListView is ideal for displaying lists of items, especially when the content is dynamic or long.

Mastering these common widgets enables developers to design clean and efficient UIs that cater to the needs of modern mobile applications.

Code:

```
import 'package:crimetrack/validation/validator.dart'; import
'package:flutter/material.dart'; import
'package:firebase_auth/firebase_auth.dart'; import
'package:fluttertoast/fluttertoast.dart'; // Import FlutterToast
import 'verify_page.dart'; // Import VerifyEmailScreen import
'../app_colors.dart'; // Import AppColors

class RegScreen extends StatefulWidget {   const
RegScreen({Key? key}) : super(key: key);

  @override
  _RegScreenState createState() => _RegScreenState();
}

class _RegScreenState extends State<RegScreen> {
final _formKey = GlobalKey<FormState>();   final
TextEditingController _nameController =
TextEditingController();
  final TextEditingController _emailController =
TextEditingController();
  final TextEditingController _passwordController =
TextEditingController();
  final TextEditingController _confirmPasswordController =
TextEditingController();

  bool _isPasswordVisible = false;   bool
_isConfirmPasswordVisible = false;
bool _isLoading = false;

  FocusNode _nameFocusNode = FocusNode();
  FocusNode _emailFocusNode = FocusNode();
  FocusNode _passwordFocusNode = FocusNode();
  FocusNode _confirmPasswordFocusNode = FocusNode();

  @override
void dispose() {
    _nameController.dispose();
    _emailController.dispose();
    _passwordController.dispose();
```

```
    _confirmPasswordController.dispose();
    _nameFocusNode.dispose();
    _emailFocusNode.dispose();
    _passwordFocusNode.dispose();
_confirmPasswordFocusNode.dispose();
super.dispose();
  }

  Future<void> _registerUser() async {     if
(_formKey.currentState?.validate() ?? false) {
setState(() => _isLoading = true);       try {
       UserCredential userCredential = await FirebaseAuth.instance
           .createUserWithEmailAndPassword(
email: _emailController.text, password:
_passwordController.text);

       // Set display name after user is created
await
userCredential.user?.updateDisplayName(_nameController.text);

       // Send email verification         await
userCredential.user?.sendEmailVerification();

       // Show success toast
       Fluttertoast.showToast(           msg: "Registration
Successful! Please verify your email.",           toastLength:
Toast.LENGTH_SHORT,           gravity:
ToastGravity.BOTTOM,           timeInSecForIosWeb: 1,
backgroundColor: AppColors.successColor,           textColor:
AppColors.textColor,           fontSize: 16.0,
       );

       // Navigate to VerifyEmailScreen
Navigator.pushReplacement(
         context,
         MaterialPageRoute(builder: (context) => VerifyEmailScreen()),
       );
     } catch (e) {
```

```
        // Show error toast
Fluttertoast.showToast(          msg: "Error:
${e.toString()}",          toastLength:
Toast.LENGTH_SHORT,          gravity:
ToastGravity.BOTTOM,
timeInSecForIosWeb: 1,
backgroundColor: AppColors.errorColor,
textColor: AppColors.textColor,
fontSize: 16.0,
        );
      } finally {        setState(() =>
_isLoading = false);
      }
    }
  }

  @override
  Widget build(BuildContext context) {
return Scaffold(
      body: Stack(
children: [
         // Background Gradient
Container(            height: double.infinity,
width: double.infinity,            decoration:
const BoxDecoration(              gradient:
LinearGradient(                colors:
[AppColors.primaryColor,
AppColors.secondaryColor],
            ),
          ),
          child: const Padding(              padding:
EdgeInsets.only(top: 60.0, left: 22),              child:
Text(
              'Create Your\nAccount',              style: TextStyle(fontSize:
30, color: Colors.white, fontWeight:
FontWeight.bold),
            ),
          ),
        ),
```

```
Padding( padding: const
EdgeInsets.only(top: 200.0), child:
Container( decoration: const
BoxDecoration( borderRadius:
BorderRadius.only(topLeft: Radius.circular(40),
topRight: Radius.circular(40)), color:
AppColors.backgroundColor,
),
height: double.infinity, width: double.infinity,
child: SingleChildScrollView( padding: const
EdgeInsets.symmetric(horizontal: 18.0, vertical: 30),
child: Form(
key: _formKey,
child: Column(
children: [
_buildTextField('Full Name', _nameController, false,
Validator.validateName, _nameFocusNode),
const SizedBox(height: 10),
_buildTextField('Email', _emailController,
false, Validator.validateEmail, _emailFocusNode),
const SizedBox(height: 10),
_buildTextField('Password', _passwordController, true,
Validator.validatePassword, _passwordFocusNode),
const SizedBox(height: 10),
_buildTextField('Confirm Password',
_confirmPasswordController, true, (value) { return
Validator.validateConfirmPassword(value ?? '',
_passwordController.text);
}, _confirmPasswordFocusNode),
const SizedBox(height: 50),
GestureDetector( onTap: _isLoading ? null
: _registerUser, child: Container(
height: 55, width: 300,
decoration: BoxDecoration(
borderRadius: BorderRadius.circular(30),
gradient: const LinearGradient( colors:
[AppColors.primaryColor,
AppColors.secondaryColor],
```

```
                    ),
),                   child: Center(
child: _isLoading
                      ? const CircularProgressIndicator(color:
Colors.white)
                      : const Text(
                     'SIGN UP',                    style:
TextStyle(fontWeight: FontWeight.bold, fontSize: 20, color:
AppColors.buttonTextColor),
                    ),
                  ),
                ),
                const SizedBox(height: 50),
              ],
            ),
          ),
        ),
      ),
    ],
  ),
 );
}

 // Updated text field method
 Widget _buildTextField(String label, TextEditingController
controller, bool isPassword, String? Function(String?) validator,
FocusNode focusNode) {   return TextFormField(   controller:
controller,   focusNode: focusNode, // Assign focus node
obscureText: isPassword ? (!_isPasswordVisible &&
!_isConfirmPasswordVisible) : false,   cursorColor:
AppColors.primaryColor, // Set cursor color to primary
   // Set selection color to primary
decoration: InputDecoration(
labelText: label,   labelStyle:
TextStyle(   fontWeight:
FontWeight.bold,   color:
```

```
focusNode.hasFocus ?
AppColors.primaryColor :
AppColors.secondaryColor, // Change label color on focus
      ),
      suffixIcon: isPassword            ? IconButton(          icon: Icon(
label == 'Password' ? (_isPasswordVisible ? Icons.visibility :
Icons.visibility_off)
             : (_isConfirmPasswordVisible ? Icons.visibility
: Icons.visibility_off),           color: Colors.grey,
        ),
        onPressed: () {
setState(() {             if (label ==
'Password') {
              _isPasswordVisible = !_isPasswordVisible;
            } else {
              _isConfirmPasswordVisible = !_isConfirmPasswordVisible;
            }
          });
        },
      )
          : null,
    ),
    validator: validator,       style:
TextStyle(color: focusNode.hasFocus ?
AppColors.primaryColor : AppColors.textColor), // Text color on focus
   );
 }
}
```

Login Screen:

```
import 'package:flutter/material.dart';
import 'package:firebase_auth/firebase_auth.dart'; // Import
FirebaseAuth package
import 'package:crimetrack/screens/forgot_password.dart'; // Import
ForgotPasswordScreen
import 'package:crimetrack/screens/home_screen.dart'; // Import
HomeScreen
```

```
import 'package:crimetrack/screens/register_screen.dart'; // Import RegisterScreen import 'package:crimetrack/validation/validator.dart'; // Import Validator class import '../app_colors.dart'; // Import AppColors class import 'package:fluttertoast/fluttertoast.dart'; // Import fluttertoast

class LoginScreen extends StatefulWidget {   const LoginScreen({Key? key}) : super(key: key);

  @override
  _LoginScreenState createState() => _LoginScreenState();
}

class _LoginScreenState extends State<LoginScreen> {   final _formKey = GlobalKey<FormState>(); // Key to identify the form
  final TextEditingController _emailController = TextEditingController();
  final TextEditingController _passwordController = TextEditingController();

  bool _isPasswordVisible = false; // Boolean variable to track password visibility   bool _isLoading = false; // Boolean to track loading state

  @override
  Widget build(BuildContext context) {
return Scaffold(       appBar: AppBar(
leading: IconButton(
         icon: const Icon(Icons.arrow_back),
onPressed: () {
           Navigator.pop(context);
         },
         color: AppColors.backgroundColor, // Set the back button color to white
       ),
       backgroundColor: AppColors.primaryColor, // Use primaryColor from AppColors
       elevation: 0,
     ),
```

```
    body: Stack(
children: [
        // Background gradient
Container(          height:
double.infinity,          width:
double.infinity,          decoration:
BoxDecoration(            gradient:
LinearGradient(              colors: [
                AppColors.primaryColor, // Dark Blue from AppColors
                AppColors.secondaryColor, // Light Blue from AppColors
              ],
            ),
          ),
          child: const Padding(            padding:
EdgeInsets.only(top: 60.0, left: 22),            child:
Text(              'Hello\nSign in!',              style:
TextStyle(                fontSize: 30,
                color: AppColors.backgroundColor, // White color from
AppColors
                fontWeight: FontWeight.bold,
              ),
            ),
          ),
        ),
        // Login form container          Padding(
padding: const EdgeInsets.only(top: 200.0),
child: Container(            decoration:
BoxDecoration(              borderRadius: const
BorderRadius.only(                topLeft:
Radius.circular(40),                topRight:
Radius.circular(40),
              ),
              color: AppColors.backgroundColor, // White background for
the login form
            ),
            height: double.infinity,            width:
double.infinity,            child: Padding(              padding:
const EdgeInsets.only(left: 18.0, right: 18),              child:
Form(                key: _formKey, // Attach the form key
```

```
child: Column( mainAxisAlignment:
MainAxisAlignment.center, children: [
// Email input field with validation
TextFormField( controller:
_emailController, decoration:
InputDecoration( suffixIcon:
const Icon( Icons.check,
color: Colors.grey,
),
label: Text(
'Gmail', style:
TextStyle(
fontWeight: FontWeight.bold,
color:
AppColors.secondaryColor, // Set
the label color to secondary color
),
),
enabledBorder: UnderlineInputBorder(
borderSide: BorderSide(color:
AppColors.primaryColor), // Set the border color to primary color
),
focusedBorder: UnderlineInputBorder(
borderSide: BorderSide(color:
AppColors.primaryColor), // Set the border color to primary color when
focused
), hintStyle: TextStyle(
color: AppColors.primaryColor, // Set the hint text color to primary
color
), ), style: TextStyle(
color: AppColors.primaryColor, // Set the input text color to
primary color
),
validator: (value) {
return Validator.validateEmail(value); // Using
Validator class to validate email
},
),
const SizedBox(height: 20),
```

```
// Password input field with validation and visibility toggle
TextFormField( controller: _passwordController, obscureText: !_isPasswordVisible, // Toggle the visibility based on the boolean value
decoration: InputDecoration(
suffixIcon: IconButton(
icon: Icon(
_isPasswordVisible
? Icons.visibility
: Icons.visibility_off,
color: AppColors.primaryColor,
),
onPressed: () {
setState(() {
_isPasswordVisible = !_isPasswordVisible; // Toggle password visibility
});
}, ), label: Text( 'Password', style: TextStyle(
fontWeight: FontWeight.bold, color: AppColors.secondaryColor, // Set the label color to secondary color
),
),
enabledBorder: UnderlineInputBorder(
borderSide: BorderSide(color: AppColors.primaryColor), // Set the border color to primary color
),
focusedBorder: UnderlineInputBorder(
borderSide: BorderSide(color: AppColors.primaryColor), // Set the border color to primary color when focused
), hintStyle: TextStyle(
color: AppColors.primaryColor, // Set the hint text color to primary color
), ), style: TextStyle(
color: AppColors.primaryColor, // Set the input text color to primary color
```

```
                    ),
validator: (value) {
                      return Validator.validatePassword(value); // Using
Validator class to validate password
                    },
                  ),
                  const SizedBox(height: 20),
                  // Forgot password text
Align(                    alignment:
Alignment.centerRight,                    child:
GestureDetector(                    onTap: () {
                      // Navigate to ForgotPasswordScreen when tapped
Navigator.push(                      context,
                        MaterialPageRoute(
builder: (context) => const
ForgotPasswordScreen(),
                        ),
                      );                    },                    child: const Text(
'Forgot Password?',                      style: TextStyle(
fontWeight: FontWeight.bold,                      fontSize: 17,
color: AppColors.secondaryColor, // Darker color for the text
                        ),
                      ),
                    ),
                  ),
                  const SizedBox(height: 70),
                  // Sign In button with loading indicator
GestureDetector(                    onTap: () async {
if (_formKey.currentState!.validate()) {
setState(() {
                        _isLoading = true; // Set loading state to true
                      });

                      // Attempt login using Firebase Authentication
try {
                        UserCredential userCredential = await
FirebaseAuth.instance
```

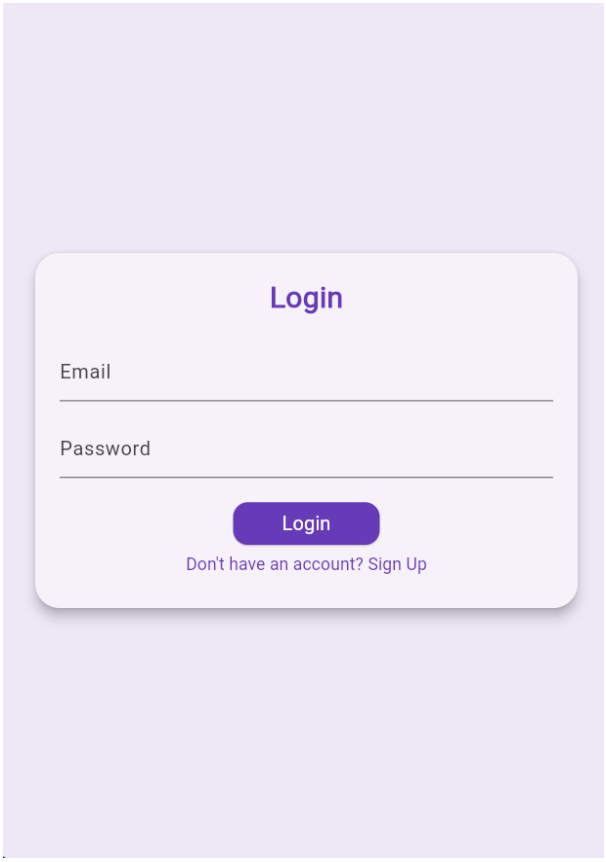
```
                        .signInWithEmailAndPassword(
email: _emailController.text,
password: _passwordController.text,
                    );

                    // Check if the email is verified
if (userCredential.user != null &&
userCredential.user!.emailVerified) {
                      // Show success toast
Fluttertoast.showToast(                    msg: "Login
Successful",  // Toast message
toastLength: Toast.LENGTH_SHORT,
gravity: ToastGravity.BOTTOM,
timeInSecForIosWeb: 1,
backgroundColor: Colors.green,                    textColor:
Colors.white,                    fontSize: 16.0,
                      );

                      Navigator.push(
                        context,
                        MaterialPageRoute(
builder: (context) => const HomeScreen(),
                        ),
                      );
                    } else {
                      // Show email verification message as toast
Fluttertoast.showToast(                    msg: "Please verify your
email before logging in.",                    toastLength:
Toast.LENGTH_SHORT,                    gravity:
ToastGravity.BOTTOM,                    timeInSecForIosWeb: 1,
backgroundColor: Colors.orange,                    textColor:
Colors.white,                    fontSize: 16.0,
                      );
                    }
                  } catch (e) {
                    String errorMessage = 'Error: Invalid Credentials';

                    // Handle specific Firebase errors
if (e is FirebaseAuthException) {                    if (e.code ==
```

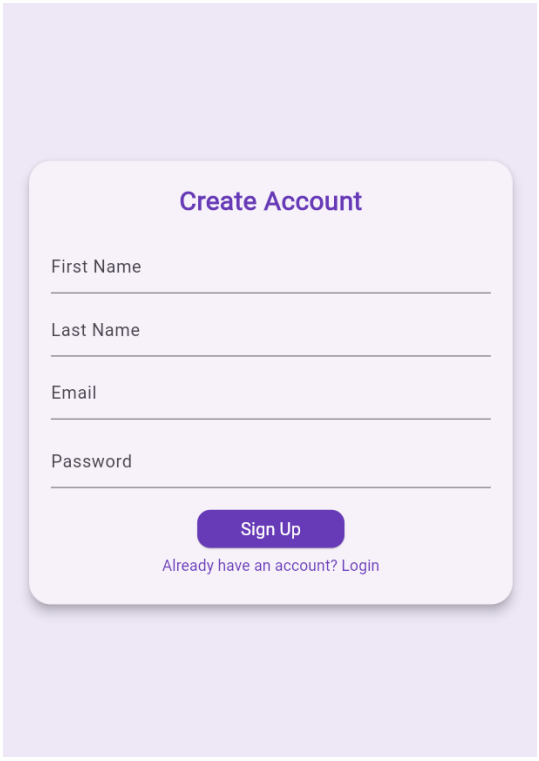
```
'user-not-found') {                    errorMessage = 'No user
found for that email.';                } else if (e.code ==
'wrong-password') {                    errorMessage = 'Incorrect
password.';                } else if (e.code == 'invalid-email')
{                    errorMessage = 'Invalid email address.';
                  }
                 }

                 // Show error toast
Fluttertoast.showToast(                msg: errorMessage,  //
Display the error message in toast
                   toastLength:
Toast.LENGTH_SHORT,                    gravity:
ToastGravity.BOTTOM,
timeInSecForIosWeb: 1,
backgroundColor: Colors.red,
textColor: Colors.white,               fontSize:
16.0,
                 );
} finally {
setState(() {
                   _isLoading = false; // Set loading state to false
                 });
                }
               }
              },
child: _isLoading
                ? const CircularProgressIndicator() // Show loading
indicator while processing
                : Container(                height: 55,
width: 300,                decoration: BoxDecoration(
borderRadius: BorderRadius.circular(30),
gradient: LinearGradient(                colors: [
                     AppColors.primaryColor,
                     AppColors.secondaryColor,
                   ],
                 ),                ),
child: const Center(                child: Text(
'SIGN IN',                style: TextStyle(
```

```
fontWeight: FontWeight.bold,
fontSize: 20,
                            color: AppColors.backgroundColor,
                          ),
                        ),
                      ),
                    ),
                  ),
                  const SizedBox(height: 150),
                  // Sign up link                  Align(
alignment: Alignment.bottomRight,                  child:
Column(                  crossAxisAlignment:
CrossAxisAlignment.end,                  children: [
const Text(
                    "Don't have an account?",
style: TextStyle(                  fontWeight:
FontWeight.bold,                  color:
Colors.grey,
                  ),
                ),
                GestureDetector(
onTap: () {
                    // Navigate to the Register screen
Navigator.push(                  context,
                    MaterialPageRoute(
                      builder: (context) => const RegScreen(), //
Navigate to RegisterScreen
                    ),
                  );                  },
child: const Text(                  "Sign up",
style: TextStyle(                  fontWeight:
FontWeight.bold,                  fontSize:
17,                  color:
AppColors.primaryColor, // Black color for
"Sign up"
                  ),
                ),
              ),
```

```
                    ],
                  ),
                ),
              ],
            ),
          ),
        ),
      ),
    ),
  ),
 );
 }
}
```

Output:




Create Account
First Name
Last Name
Email
Password
Sign Up
Already have an account? Login

MAD & PWA Lab
Journal

Experiment No.	03
Experiment Title.	To include icons, images, fonts in Flutter app
Roll No.	30
Name	Jeetu Mamtora
Class	D15B
Subject	MAD & PWA Lab
Lab Outcome	LO2: Design and Develop interactive Flutter App by using widgets, layouts, gestures and animation
Grade:	

Aim:

To include icons, images, and fonts in a Flutter app.

Theory

1. Icons in Flutter

Icons are essential elements in modern mobile apps, visually representing actions, features, or categories. In Flutter, they enhance the UI's clarity and intuitiveness.

Types of Icons:

- Material Icons:
  - Built-in set of icons following Material Design guidelines.
  - Scalable and optimized for various devices and screen sizes.
- Custom Icons:
  - You can add and use your own icons as image assets. ○ Useful for branding and specific UI needs.

Benefits of Using Icons:

- Provide visual cues for actions.
- Improve app aesthetics.
- Offer consistent and recognizable symbols (e.g., home, settings).

2. Images in Flutter

Images enhance UI by making it more engaging and visually descriptive. Flutter supports multiple image sources.

Types of Images:

- Asset Images:
  - Stored locally in the app’s directory.
  - Bundled during the build process.
- Network Images:

    - Fetched from the internet (e.g., URLs, cloud-hosted content).
    - Great for displaying dynamic and real-time data.
- File Images:
    - Reside on the device’s storage.
    - Often used for user-uploaded content.

Benefits of Using Images:

- Add visual context and appeal.
- Communicate ideas and features effectively. ● Support branding (e.g., logos, banners).

3. Fonts in Flutter

Fonts define the typographic style and play a vital role in an app's branding and readability.

Types of Fonts:

- Custom Fonts:
    - Support .ttf and .otf formats.
    - Defined in pubspec.yaml for app-wide use.
- Default Fonts:
    - Flutter provides system default fonts.

Benefits of Using Custom Fonts:

- Enhance aesthetic appeal.
- Ensure brand consistency.
- Enable flexible text styling for different elements (headings, paragraphs, etc.).

Code Implementation :

```
import
'package:crimetrack/validation/validator.dart';
import 'package:flutter/material.dart'; import
'package:firebase_auth/firebase_auth.dart'; import
'package:fluttertoast/fluttertoast.dart'; import
'verify_page.dart';
import '../app_colors.dart';
```

```
class RegScreen extends StatefulWidget {   const
RegScreen({Key? key}) : super(key: key);

  @override
  _RegScreenState createState() => _RegScreenState();
}

class _RegScreenState extends State<RegScreen> {
final _formKey = GlobalKey<FormState>();   final
TextEditingController _nameController =
TextEditingController();
  final TextEditingController _emailController =
TextEditingController();
  final TextEditingController _passwordController =
TextEditingController();
  final TextEditingController _confirmPasswordController =
TextEditingController();

  bool _isPasswordVisible = false;   bool
_isConfirmPasswordVisible = false;
bool _isLoading = false;

  FocusNode _nameFocusNode = FocusNode();
  FocusNode _emailFocusNode = FocusNode();
  FocusNode _passwordFocusNode = FocusNode();
  FocusNode _confirmPasswordFocusNode = FocusNode();

  @override   void dispose() {
_nameController.dispose();
    _emailController.dispose();
    _passwordController.dispose();
    _confirmPasswordController.dispose();
_nameFocusNode.dispose();
    _emailFocusNode.dispose();
    _passwordFocusNode.dispose();
_confirmPasswordFocusNode.dispose();
super.dispose();
  }
```

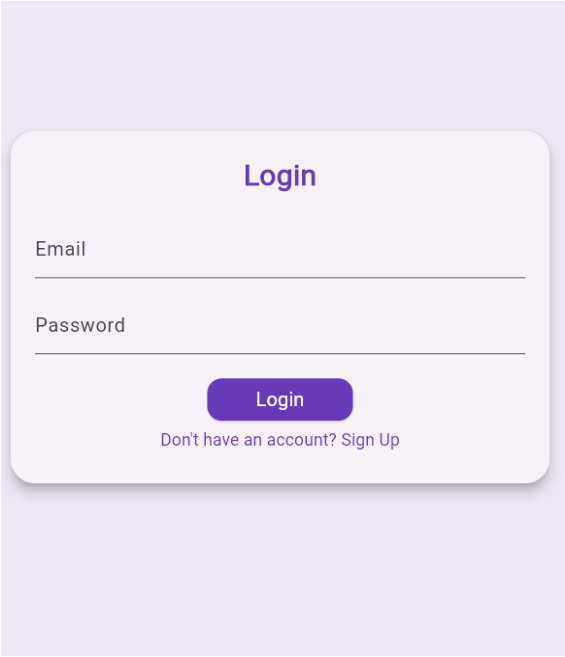
```
  Future<void> _registerUser() async {     if
(_formKey.currentState?.validate() ?? false) {
setState(() => _isLoading = true);       try {
       UserCredential userCredential = await FirebaseAuth.instance
          .createUserWithEmailAndPassword(
email: _emailController.text, password:
_passwordController.text);

await
userCredential.user?.updateDisplayName(_nameController.text);
await userCredential.user?.sendEmailVerification();

       Fluttertoast.showToast(          msg: "Registration
Successful! Please verify your email.",          toastLength:
Toast.LENGTH_SHORT,          gravity:
ToastGravity.BOTTOM,          timeInSecForIosWeb: 1,
backgroundColor: AppColors.successColor,          textColor:
AppColors.textColor,          fontSize: 16.0,
       );

       Navigator.pushReplacement(
         context,
         MaterialPageRoute(builder: (context) => VerifyEmailScreen()),
       );
     } catch (e) {
       Fluttertoast.showToast(          msg:
"Error: ${e.toString()}",          toastLength:
Toast.LENGTH_SHORT,          gravity:
ToastGravity.BOTTOM,
timeInSecForIosWeb: 1,
backgroundColor: AppColors.errorColor,
textColor: AppColors.textColor,
fontSize: 16.0,
       );
     } finally {        setState(() =>
_isLoading = false);
     }
   }
```

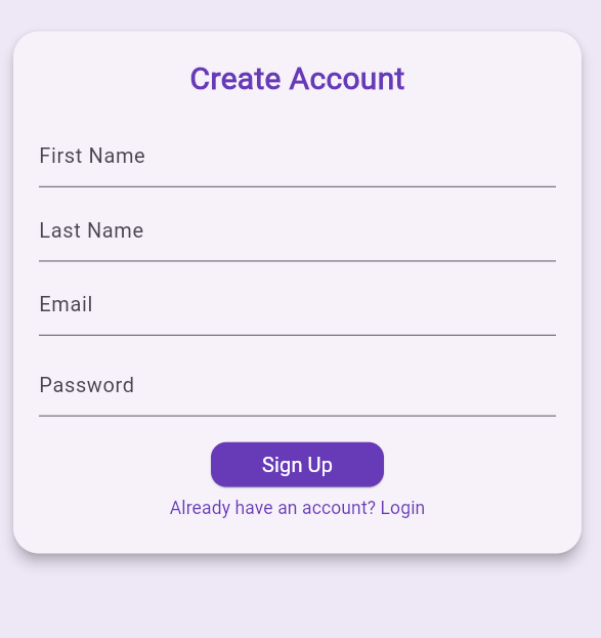
```
  }

  @override
  Widget build(BuildContext context) {
return Scaffold(       body: Stack(
children: [
         // Background Gradient
Container(            height: double.infinity,
width: double.infinity,            decoration:
const BoxDecoration(              gradient:
LinearGradient(                colors:
[AppColors.primaryColor,
AppColors.secondaryColor],
            ),
          ),
          child: const Padding(              padding:
EdgeInsets.only(top: 60.0, left: 22),              child:
Text(
              'Create Your\nAccount',
style: TextStyle(                  fontSize:
30,                  color: Colors.white,
fontWeight: FontWeight.bold),
            ),
          ),
        ),
        Padding(            padding: const
EdgeInsets.only(top: 200.0),            child:
Container(              decoration: const
BoxDecoration(                borderRadius:
BorderRadius.only(                  topLeft:
Radius.circular(40), topRight:
Radius.circular(40)),              color:
AppColors.backgroundColor,
            ),
            height: double.infinity,              width: double.infinity,
child: SingleChildScrollView(              padding: const
EdgeInsets.symmetric(horizontal: 18.0, vertical: 30),
child: Form(                key: _formKey,              child:
Column(                children: [
```

```
                _buildTextField('Full Name', _nameController, false,
Validator.validateName, _nameFocusNode),
                const SizedBox(height: 10),
                _buildTextField('Email', _emailController,
false, Validator.validateEmail, _emailFocusNode),
const SizedBox(height: 10),
                _buildTextField('Password', _passwordController, true,
Validator.validatePassword, _passwordFocusNode),
                const SizedBox(height: 10),
                _buildTextField('Confirm Password',
_confirmPasswordController, true, (value) {
                  return Validator.validateConfirmPassword(value ?? '',
_passwordController.text);
                }, _confirmPasswordFocusNode),
const SizedBox(height: 50),
GestureDetector(                    onTap: _isLoading ? null
: _registerUser,                    child: Container(
height: 55,                    width: 300,
decoration: BoxDecoration(
borderRadius: BorderRadius.circular(30),
gradient: const LinearGradient(                    colors:
[AppColors.primaryColor,
AppColors.secondaryColor],
                    ),
),                    child: Center(
child: _isLoading
                    ? const CircularProgressIndicator(color:
Colors.white)
                    : const Text(
'SIGN UP',                    style: TextStyle(
fontWeight: FontWeight.bold,
fontSize: 20,                    color:
AppColors.buttonTextColor),
                    ),
                  ),
                ),
              ),
              const SizedBox(height: 50),
```

```
                ],
              ),
            ),
          ),
        ),
      ),
    ],
  ),
 );
 }
}
```

Output:





Conclusion:

We learned how to include icons, images, and custom fonts in a Flutter app to elevate the visual appeal and user experience.

Key Takeaways:

- Icons provide intuitive navigation and reinforce meaning.
- Images enhance design and communicate content visually.
- Custom Fonts support brand identity and text styling flexibility.

Mastering these assets is crucial for creating visually polished and user-friendly Flutter apps.

MAD & PWA Lab
Journal

Experiment No.	04
Experiment Title.	To create an interactive Form using form widget
Roll No.	30
Name	Jeetu Mamtora
Class	D15B
Subject	MAD & PWA Lab
Lab Outcome	LO2: Design and Develop interactive Flutter App by using widgets, layouts, gestures and animation
Grade:	

Aim:
To create an interactive Form using form widget

Theory:
In Flutter, forms are created using the Form widget, which serves as a container for input fields (like TextFormField) and allows you to handle the validation and submission of data.
Key Components:
1. Form Widget:
○ The Form widget is used to group multiple input fields. It provides the ability to manage and validate the form data. ○ A GlobalKey<FormState> is required to track the form's state for validation and saving the data.
2. TextFormField:
○ TextFormField is the primary widget for collecting text input in Flutter forms.
○ It comes with built-in support for validation and user input handling.
3. Validation:
○ The validator property of the TextFormField allows you to define rules that ensure user inputs are valid (e.g., email format, required fields).
○ Flutter will automatically show error messages when the validation fails.
4. FormState:
○ To manage the state of the form, you use FormState which allows you to validate, save, and reset the form. ○ You can trigger validation by calling formKey.currentState?.validate().
5. Saving Data:
○ Once the form is valid, you can save the data using the onSaved property of the TextFormField.
Steps to Create an Interactive Form:
1. Create a Form Widget:
○ You use the Form widget to wrap the form fields and manage validation. ○ A GlobalKey<FormState> is used to access the form's state. 2. Add Form Fields (TextFormField):
○ For each input field, you use the TextFormField widget. ○ Each TextFormField can have a validator to ensure the input is valid (e.g., ensuring that the user provides a valid email, password, etc.).
○ Use onSaved to store the user input when the form is submitted.

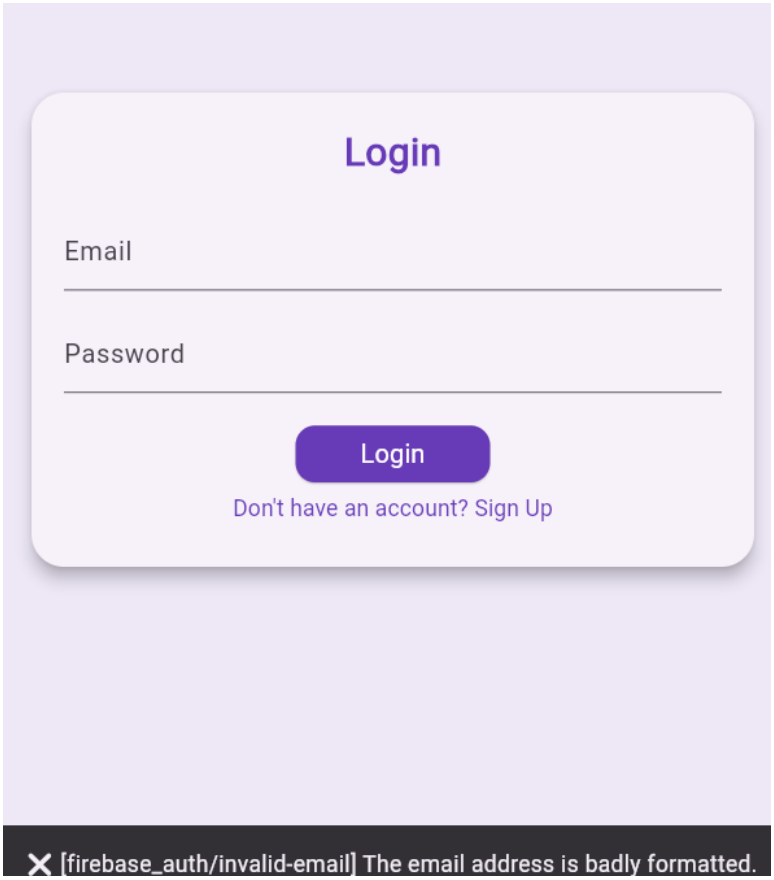
3. Validate the Form:
○ You can validate the form using the formKey.currentState?.validate() method, which triggers the validator for each field. If any field is invalid, it prevents form submission.
4. Handle Form Submission:
○ Once the form is validated, the form data is saved by calling formKey.currentState?.save().
○ The form can then be processed (e.g., sending data to a server, storing locally).

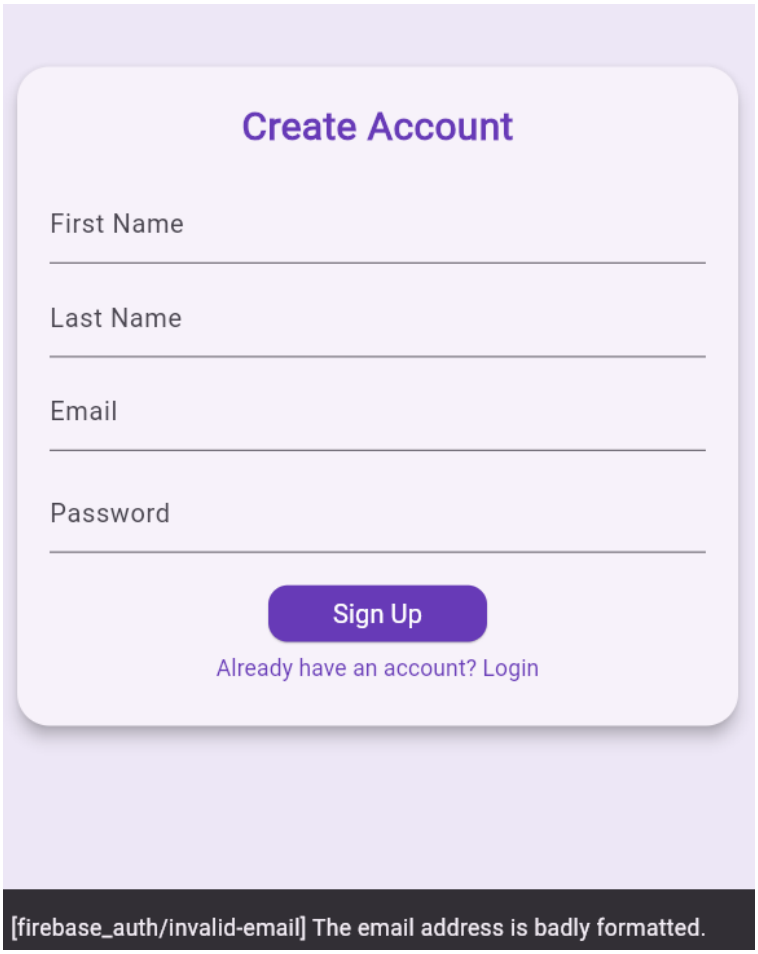
Code:

```
class Validator {   static String?
validateEmail(String? value) {     if (value ==
null || value.isEmpty) {       return 'Please
enter your email';
   }
   // Regex for validating email format
final emailRegex =
RegExp(r"^[a-zA-Z0-9._%+-]+@[a-zA-Z0-9.-]+\.[a-zA-Z]{2,}$");
if (!emailRegex.hasMatch(value)) {       return 'Please enter a valid
email address';
   }     return
null;
 }

 static String? validatePassword(String? value) {
   if (value == null || value.isEmpty) {
return 'Please enter your password';
   }

   if (value.length < 6) {       return 'Password must be
at least 6 characters long';
   }

   final regex = RegExp(r'^(?=.*[A-Z])(?=.*[a-z])(?=.*\d).{6,}$');
if (!regex.hasMatch(value)) {       return 'Password must contain at
least one uppercase letter, one lowercase letter, and one number';
```

```
    }

    return null;
  }


  static String? validateName(String? value) {
if(value == null || value.isEmpty) {       return
'Please enter a valid name';
    }
    if(value.length < 2){       return 'Name must be at
least 2 characters long';
    }     return
null;
  }

  static String? validateConfirmPassword(String value, String password) {
if (value.isEmpty) {       return 'Confirm password cannot be empty';
    }
    if (value != password) {
return 'Passwords do not match';
    }     return
null;
  }
}
```

Output:


Login
Email
Password
Login
Don't have an account? Sign Up
[firebase_auth/invalid-email] The email address is badly formatted.


Create Account
First Name
Last Name
Email
Password
Sign Up
Already have an account? Login
[firebase_auth/invalid-email] The email address is badly formatted.

Conclusion

In this experiment, you learned how to create an interactive form in Flutter using the Form widget. The Form widget allows for easy management of form fields, validation, and submission, while TextFormField provides the necessary functionality for input fields. By using validation and form state management, you can ensure that data entered by the user is valid before proceeding with any further operations, such as sending the data to a backend or storing it locally. This is a fundamental concept in Flutter for collecting and processing user input effectively.

MAD & PWA Lab
Journal

Experiment No.	05
Experiment Title.	To apply navigation, routing and gestures in Flutter App
Roll No.	30
Name	Jeetu Mamtora
Class	D15B
Subject	MAD & PWA Lab
Lab Outcome	LO2: Design and Develop interactive Flutter App by using widgets, layouts, gestures and animation
Grade:	

Aim:

To apply navigation, routing and gestures in Flutter App

Theory :

1. Navigation in Flutter

Navigation refers to the mechanism that allows users to move between different screens or pages within a Flutter app. Flutter uses the Navigator widget to manage a stack of screens, providing a way to push and pop screens.

Key Concepts:

- Navigator: The core widget for managing a stack of routes.
- Routes: Represent different screens in an app.

Push and Pop Navigation:

Push: Navigates to a new screen.

```
Navigator.push(  context,
MaterialPageRoute(builder: (context) => SecondScreen()),
);
```

Pop: Returns to the previous screen.

```
Navigator.pop(context);
```

Named Routes:

Using named routes improves code readability:

```
Navigator.pushNamed(context, '/second');
```

2. Routing in Flutter

Routing refers to how screens or pages are mapped and displayed in an app. In Flutter, routing is managed by the MaterialApp or CupertinoApp widget, which uses routes to determine which screen to show.

Types of Routes:

Static Routes: Defined at app launch.

```
MaterialApp(  routes: {
'/': (context) => HomeScreen(),
'/second': (context) => SecondScreen(),
},
);
```

Dynamic Routes: Allow passing parameters when navigating

```
Navigator.push(  context,
    MaterialPageRoute(builder: (context) => DetailScreen(itemId:
        42)),
```

);

3. Gestures in Flutter

Gestures are actions performed by the user on the screen, like tapping, swiping, or pinching. Flutter provides the GestureDetector widget to detect these actions.

Common Gestures:

Tap Gesture: Detects taps.

GestureDetector(onTap: () => print("Tapped"), child: Container());

Long Press Gesture: Detects long presses.

GestureDetector(onLongPress: () => print("Long Pressed"), child: Container());

Swipe Gesture: Detects swipes (horizontal or vertical). GestureDetector(onHorizontalDragEnd: (details) => print("Swiped"), child: Container(),
);

Combining Navigation and Gestures:

Gestures can also trigger navigation between screens. GestureDetector(onHorizontalDragEnd: (details) => Navigator.pushNamed(context, '/nextScreen'), child: Container(),
);

Code:

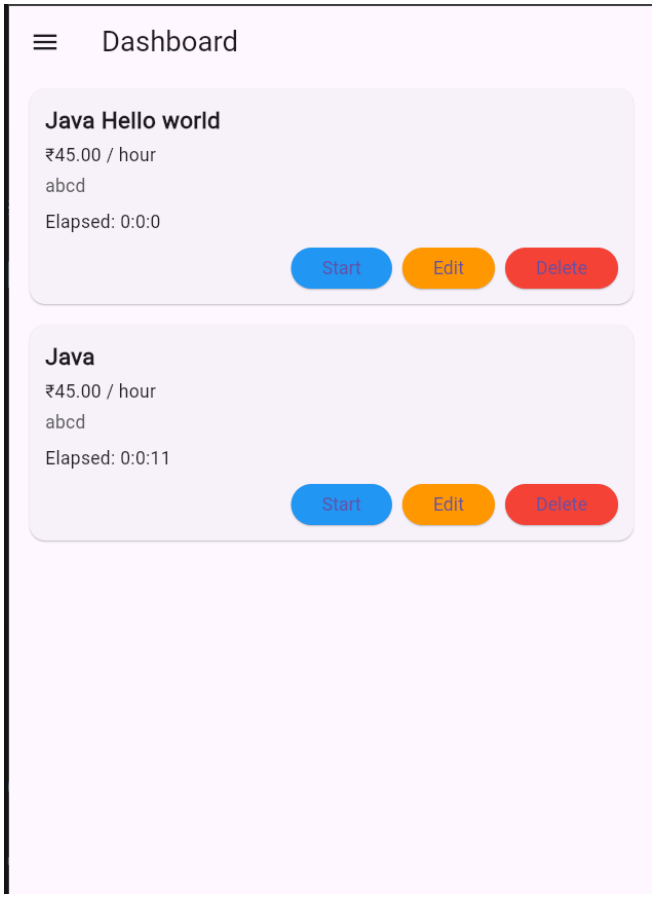
```
import 'package:flutter/material.dart'; import
'package:firebase_auth/firebase_auth.dart'; import
'package:fluttertoast/fluttertoast.dart'; // Import FlutterToast
import 'login_screen.dart'; // Import Login screen import
'../app_colors.dart'; // Import AppColors

class VerifyEmailScreen extends StatelessWidget {
  VerifyEmailScreen({Key? key}) : super(key: key);

  Future<void> _verifyEmail(BuildContext context) async {
try {
    User? user = FirebaseAuth.instance.currentUser;

    if (user != null) {
```

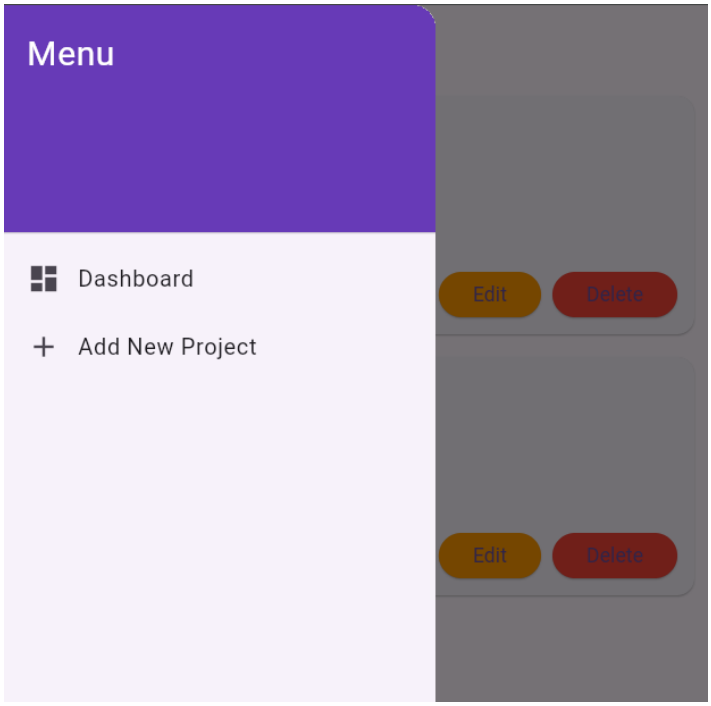
```
      // Check if the email is verified        await
user.reload();        user =
FirebaseAuth.instance.currentUser;

      if (user?.emailVerified == true) {
        // Show success toast message for email
verification          Fluttertoast.showToast(          msg:
"Email Verified Successfully!",          toastLength:
Toast.LENGTH_SHORT,          gravity:
ToastGravity.BOTTOM,          timeInSecForIosWeb: 1,
backgroundColor: Colors.green,          textColor:
Colors.white,          fontSize: 16.0,
        );

        // Navigate to the login screen
Navigator.pushReplacement(
          context,
          MaterialPageRoute(          builder:
(context) => const LoginScreen(),
          ),
        );
      } else {
        // Show a toast if email is not verified
Fluttertoast.showToast(          msg: "Email is not verified.
Please check your inbox.",          toastLength:
Toast.LENGTH_SHORT,          gravity:
ToastGravity.BOTTOM,          timeInSecForIosWeb: 1,
backgroundColor: Colors.orange,          textColor:
Colors.white,          fontSize: 16.0,
        );
      }
    } else {
      // Show toast if no user found
Fluttertoast.showToast(          msg: "No user found or
email already verified!",          toastLength:
Toast.LENGTH_SHORT,          gravity:
ToastGravity.BOTTOM,          timeInSecForIosWeb:
1,          backgroundColor: Colors.red,
textColor: Colors.white,          fontSize: 16.0,
```

```
        );
      }
    } catch (e) {
      // Show error toast in case of exception
Fluttertoast.showToast(         msg: "Error:
${e.toString()}",         toastLength:
Toast.LENGTH_SHORT,         gravity:
ToastGravity.BOTTOM,
timeInSecForIosWeb: 1,
backgroundColor: Colors.red,
textColor: Colors.white,         fontSize:
16.0,
      );
    }
  }

  @override
  Widget build(BuildContext context) {
return Scaffold(       appBar: AppBar(
leading: IconButton(           icon: const
Icon(Icons.arrow_back),
onPressed: () {
            Navigator.pop(context);
          },
          color: AppColors.backgroundColor,
        ),
        backgroundColor: AppColors.primaryColor,
elevation: 0,
      ),
      body: Padding(         padding: const
EdgeInsets.all(20.0),         child: Column(
mainAxisAlignment: MainAxisAlignment.center,
children: [             const Text(
              'Verify Your Email',
style: TextStyle(                 fontSize: 24,
fontWeight: FontWeight.bold,
color: AppColors.primaryColor,
              ),
            ),
```

```
          const SizedBox(height: 20),
const Text(
            'We have sent a verification email to your provided address. Please
          check your inbox and verify your email.',
            textAlign:
TextAlign.center,              style:
TextStyle(              fontSize: 16,
color: Colors.grey,
            ),
          ),
          const SizedBox(height:
20),            GestureDetector(
onTap: () {
              _verifyEmail(context);
            },              child: Container(              height: 55,              width:
300,              decoration: BoxDecoration(              borderRadius:
BorderRadius.circular(30),              gradient: const LinearGradient(
colors: [AppColors.primaryColor, AppColors.secondaryColor],
                ),
              ),
              child: const Center(
child: Text(
                  'CHECK EMAIL VERIFICATION',
                  style: TextStyle(
fontWeight: FontWeight.bold,
fontSize: 20,                    color:
AppColors.backgroundColor,
                  ),
                ),
              ),
            ),
          ),
        ],
      ),
    ),
  );
 }
}
```

Output:


Dashboard
Java Hello world
₹45.00 / hour
abcd
Elapsed: 0:0:0
Start
Edit
Delete
Java
₹45.00 / hour
abcd
Elapsed: 0:0:11
Start
Edit
Delete


Menu
Dashboard
Add New Project
Edit
Delete
Edit
Delete

Conclusion

In Flutter, navigation, routing, and gestures are integral for creating interactive and user-friendly applications.

- Navigation enables seamless transitions between screens, using methods like push and pop.
- Routing allows for both static and dynamic screen management, enhancing flexibility and modularity in app design.
- Gestures offer a way for users to interact with the app, making the experience more engaging.

By mastering these concepts, developers can build well-structured, responsive, and intuitive applications in Flutter. These techniques are essential for handling user interactions, creating dynamic navigation flows, and optimizing the overall user experience in any mobile app.

MAD & PWA Lab
Journal

Experiment No.	06
Experiment Title.	To Connect Flutter UI with fireBase database
Roll No.	30
Name	Jeetu Mamtora
Class	D15B
Subject	MAD & PWA Lab
Lab Outcome	LO3: Analyze and Build production ready Flutter App by incorporating backend services and deploying on Android / iOS
Grade:	

Aim:

To connect a Flutter application to Firebase by integrating Firebase Core and initializing Firebase services in a Flutter project.

Theory:

Firebase offers a suite of backend services such as Authentication, Firestore, Realtime Database, Storage, and more to aid in mobile and web app development. To use these services in Flutter, the firebase_core package is essential. It acts as a bridge between your Flutter app and Firebase.
This experiment focuses on:

1. Setting up Firebase for your Flutter project.
2. Integrating firebase_core into a Flutter application.
3. Configuring platform-specific settings for Android and iOS.
4. Initializing Firebase to enable other services.

Steps to Connect Firebase with Flutter:

1. Firebase Console Setup:

- Go to Firebase Console.
- Click "Create a Project" and follow the setup instructions.
- Enable required Firebase services (e.g., Firestore, Authentication, Storage).

2. Add Your Flutter App to Firebase:

For Android:

1. In Firebase Console → Click Add App → Choose Android.
2. Enter your app's Android package name (check android/app/src/main/AndroidManifest.xml).
3. Download google-services.json.
4. Place the file inside android/app/.
5. Modify Android build files:

In android/build.gradle:

```
dependencies {
classpath 'com.google.gms:google-services:4.3.3' // Add this
}
```

In android/app/build.gradle (bottom of file):

apply plugin: 'com.google.gms.google-services' // Add this

For iOS:

1. In Firebase Console → Add App → Choose iOS.
2. Enter your iOS Bundle ID.
3. Download GoogleService-Info.plist.
4. Open the project in Xcode and drag the .plist file into the Runner project. Check "Copy items if needed".

In ios/Podfile, ensure:

platform :ios, '10.0'

3. Add Firebase Dependencies in Flutter:

In pubspec.yaml:
dependencies:
flutter:
sdk: flutter
firebase_core: ^1.10.0 Run:
flutter pub get

4. Initialize Firebase in Flutter:

In main.dart: import
'package:flutter/material.dart'; import
'package:firebase_core/firebase_core.dart';

```
void main() async {
  WidgetsFlutterBinding.ensureInitialized();
await Firebase.initializeApp();
runApp(MyApp());
}

class MyApp extends StatelessWidget {
  @override
  Widget build(BuildContext context) {     return MaterialApp(
title: 'Flutter Firebase Connection',       theme:
ThemeData(primarySwatch: Colors.blue),       home: Scaffold(
appBar: AppBar(title: Text('Firebase Initialized')),         body:
Center(child: Text('Firebase Connected Successfully!')),
      ),
```

```
    );
  } }
```

5. Platform-Specific Configuration:

Android:

In AndroidManifest.xml, add inside <application>:

```
<meta-data
android:name="com.google.firebase.messaging.default_notification_icon"
android:resource="@drawable/ic_notification" />
```

iOS:

In Info.plist, add:

```
<key>UIBackgroundModes</key>
<array>
  <string>fetch</string>
  <string>remote-notification</string>
</array>
<key>NSLocationWhenInUseUsageDescription</key>
<string>Your app requires access to location</string>
```

6. Test Firebase Connection:

- Run your app on a physical device or emulator.

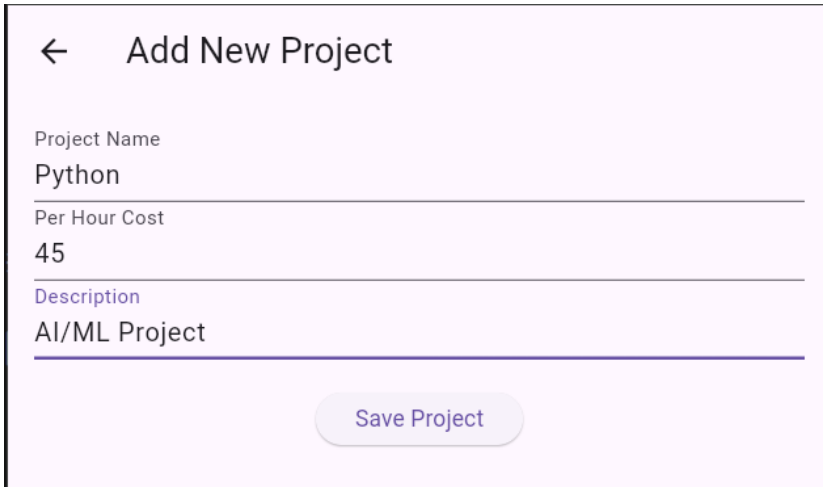
- If everything is configured correctly, the app should display:

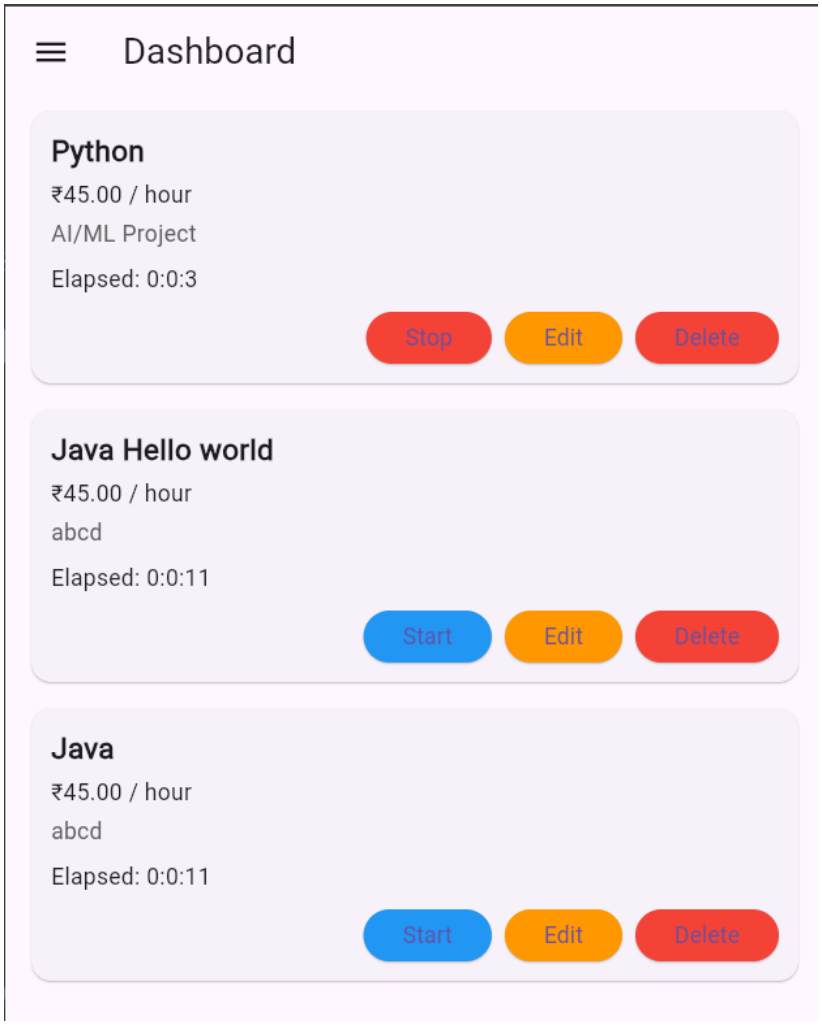
"Firebase Connected Successfully!"

7. Optional: Add Other Firebase Services

- Firestore:
  Add cloud_firestore package for database operations.
- Authentication:
  Use firebase_auth for email/password or social sign-ins.
- Storage:
  Add firebase_storage to handle file uploads and downloads.

Output:


Add New Project
Project Name
Python
Per Hour Cost
45
Description
AI/ML Project
Save Project


Dashboard
Python
₹45.00 / hour
AI/ML Project
Elapsed: 0:0:3
Stop
Edit
Delete
Java Hello world
₹45.00 / hour
abcd
Elapsed: 0:0:11
Start
Edit
Delete
Java
₹45.00 / hour
abcd
Elapsed: 0:0:11
Start
Edit
Delete

Conclusion:

After following the above steps, your Flutter application is successfully connected to Firebase. The Firebase Core integration is the foundation that allows you to utilize Firebase services such as Firestore, Authentication, Cloud Storage, etc., to enhance your app functionality.

MAD & PWA Lab
Journal

Experiment No.	07
Experiment Title.	To write meta data of your Ecommerce PWA in a Web app manifest file to enable “add to homescreen feature”.
Roll No.	30
Name	Jeetu Mamtora
Class	D15B
Subject	MAD & PWA Lab
Lab Outcome	LO4: Understand various PWA frameworks and their requirements
Grade:	

Aim :

To write metadata for an eCommerce Progressive Web App (PWA) in a web app manifest file to enable the “Add to Home Screen” feature.

Theory:

A Web App Manifest is a JSON file that contains essential metadata about a Progressive Web App (PWA). This metadata allows browsers to recognize and display the web app appropriately when a user chooses to install it. For the "Add to Home Screen" feature to function, the manifest file must define key details, such as the app name, icons, and display preferences.

Key Components of a Web App Manifest:

1. name: The full name of the app, displayed when users add the app to their home screen. It should be clear, descriptive, and concise.
2. short_name: A shorter version of the app’s name, used when there isn't enough space (e.g., on the home screen or app launcher).
3. description: A brief explanation of the app's purpose. It gives users an idea of what to expect when they add the app to their home screen.
4. start_url: Defines the entry point for the app. When the app is launched from the home screen, this URL is opened first.
5. display: Specifies how the app should appear when launched. Options include:
    - ○ standalone: App behaves like a native app with no browser chrome.
    - ○ fullscreen: App runs in full-screen mode.
    - ○ minimal-ui: App provides a minimal UI with navigation controls. ○ browser: App behaves like a regular web page in a browser.
6. background_color: The background color that appears during the app's splash screen as it loads.
7. theme_color: Sets the color of the browser's UI elements, such as the address bar, to match the app's branding.
8. orientation: Specifies whether the app should open in portrait or landscape mode, improving the experience on mobile devices.
9. scope: Defines the navigation scope for the PWA. It limits the URLs that are considered within the app's domain.

10. icons: Specifies the various icon images used for the app on the home screen, app launcher, or other areas. Icons should be provided in multiple sizes for different devices and resolutions.

Importance for PWAs:

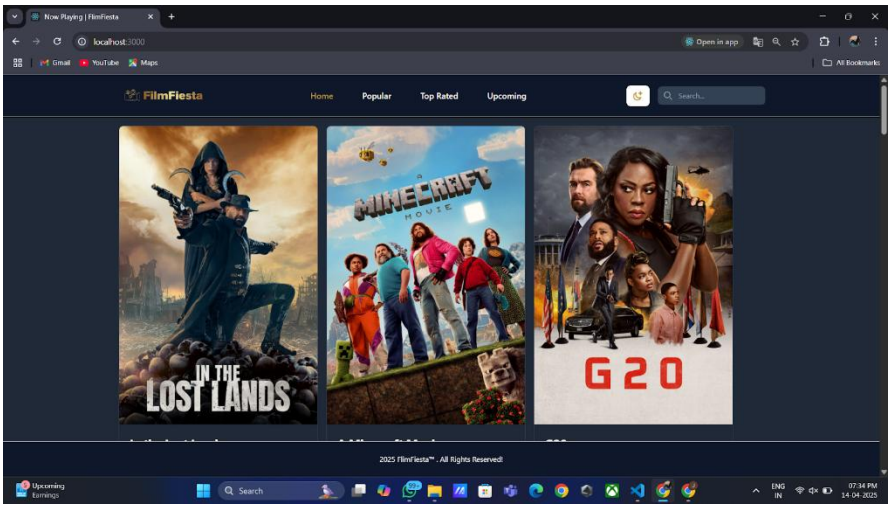
The web app manifest is fundamental for delivering a native-like experience on mobile and desktop devices. It gives users a smooth, app-like feel while ensuring that the app is visually consistent across different platforms. For eCommerce PWAs, this is crucial to enhance user experience, especially in terms of engagement and accessibility.

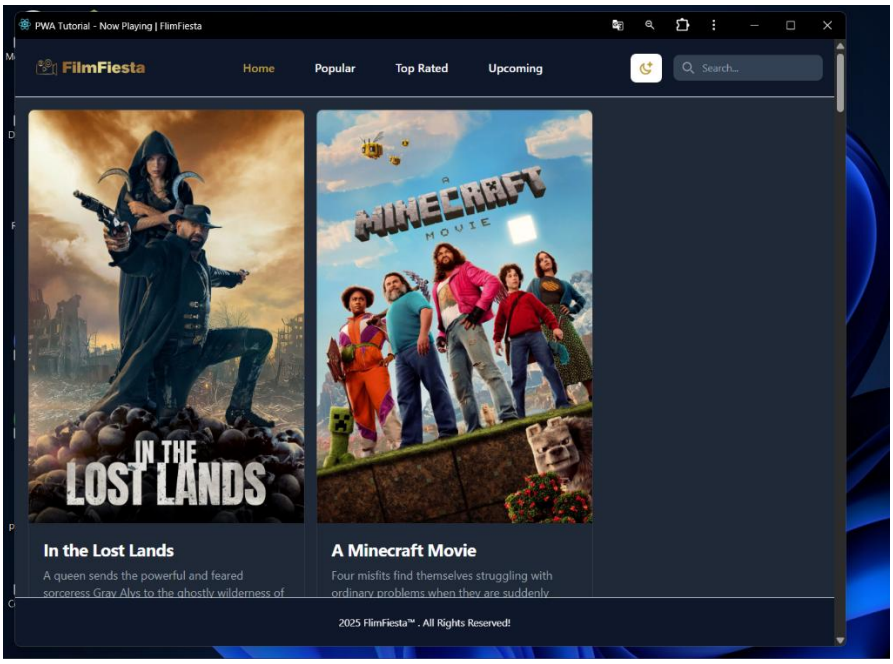
Codes:

Manifest.json

```
{
   "name": "Flashcard Learning App",
   "short_name": "Flashcards",
   "description": "An app for learning through flashcards with Quiz and Study modes",
   "start_url": "/",
   "display": "standalone",
   "background_color": "#ffffff",
   "theme_color": "#000000",
   "icons": [
     {
       "src": "/static/images/icon-128x128.png",
       "sizes": "128x128",
       "type": "image/png"
     },
     {
       "src": "/static/images/icon-512x512.png",
       "sizes": "512x512",
       "type": "image/png"
     }
   ]
 }
```

Screenshots:





Conclusion:

Writing the metadata in the Web App Manifest file is vital for enabling the “Add to Home Screen” feature in an eCommerce PWA. By ensuring that essential details like the app's name, icons, start URL, and display settings are correctly defined, users can enjoy a seamless experience when adding the app to their home screen.

MAD & PWA Lab
Journal

Experiment No.	08
Experiment Title.	To code and register a service worker, and complete the install and activation process for a new service worker for the E-commerce PWA
Roll No.	30
Name	Jeetu Mamtora
Class	D15B
Subject	MAD & PWA Lab
Lab Outcome	LO5: Design and Develop a responsive User Interface by applying PWA Design techniques
Grade:	

Aim:

To code and register a service worker, and complete the install and activation process for a new service worker for the E-commerce PWA.

Theory:

A service worker is a script that runs in the background of the web browser, independent of the web page. It acts as a network proxy, allowing the app to manage caching, intercept network requests, and enable offline functionality. Service workers are essential for PWAs to function offline and to provide fast loading times.

The process of implementing a service worker for an E-commerce PWA includes:

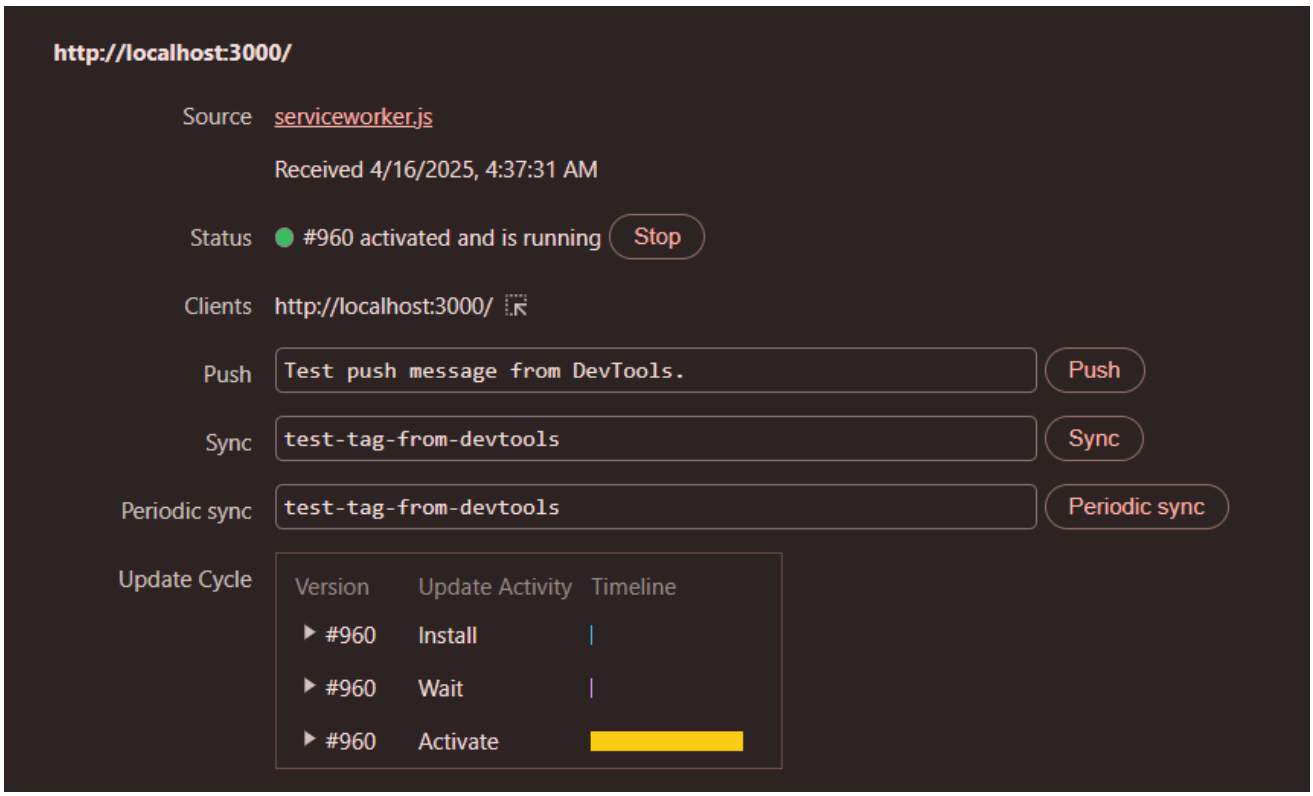
1. Coding the Service Worker: The service worker script typically handles tasks like caching static assets, intercepting network requests, and managing updates.
2. Registering the Service Worker: To enable the service worker, it must be registered in the main JavaScript file of the application.
3. Install Event: The install event occurs when the service worker is first installed. During this event, caching of essential assets like HTML, CSS, JS, and images happens.
4. Activate Event: After installation, the service worker goes through the activation phase. During activation, the previous service workers (if any) are deleted, and the new worker becomes active.
5. Update Process: The service worker can be updated if the script changes. When an update is available, the old service worker is terminated, and the new one is activated.

Code:

```
self.addEventListener('install', function(event) {
event.waitUntil(
caches.open('v1').then(function(cache) {
return cache.addAll([
      '/',
      '/static/manifest.json',
      '/static/js/script.js',
       '/static/images/icon-128x128.png',
       '/static/images/icon-512x512.png',
```

```
      ]);
    })
  );
});

self.addEventListener('fetch', function(event) {
event.respondWith(
caches.match(event.request).then(function(response) {
return response || fetch(event.request);
    })
  );
});
```

Screenshots:



Conclusion:

Implementing and registering a service worker for the E-commerce PWA is crucial for enabling offline capabilities, improving performance, and managing caching. Through the install and activation process, the PWA can provide a seamless experience for users even without a network connection.

MAD & PWA Lab

Journal

Experiment No.	09
Experiment Title.	To implement Service worker events like fetch, sync and push for E-commerce PWA
Roll No.	30
Name	Jeetu Mamtora
Class	D15B
Subject	MAD & PWA Lab
Lab Outcome	LO5: Design and Develop a responsive User Interface by applying PWA Design techniques
Grade:	

Aim :

To implement Service Worker events like fetch, sync, and push for the E-commerce PWA.

Theory:

Service workers provide powerful features that allow web applications to operate reliably, even under unreliable network conditions. Key events such as fetch, sync, and push enhance the performance, offline capability, and user engagement of a Progressive Web App (PWA).

1. Fetch Event

The fetch event allows the service worker to intercept network requests made by the PWA. This is commonly used for caching strategies, such as:

- Cache-first: Serve content from cache, then update in the background.
- Network-first: Try to fetch from the network, fall back to cache if offline.

This is useful for delivering product pages, images, or static assets quickly and reliably.

2. Sync Event

The sync event, especially background sync, helps the app manage tasks when connectivity is restored. For instance, if a user submits an order or review while offline, the service worker can save it locally and send it once the connection is re-established.

- Requires registering a sync task using registration.sync.register('tag-name').

3. Push Event

The push event enables the PWA to receive push notifications from a server, even when the app is not open. This is ideal for eCommerce apps to send:

- Order updates
- Promotional offers ● Cart reminders

It requires integration with a push service and permission from the user.

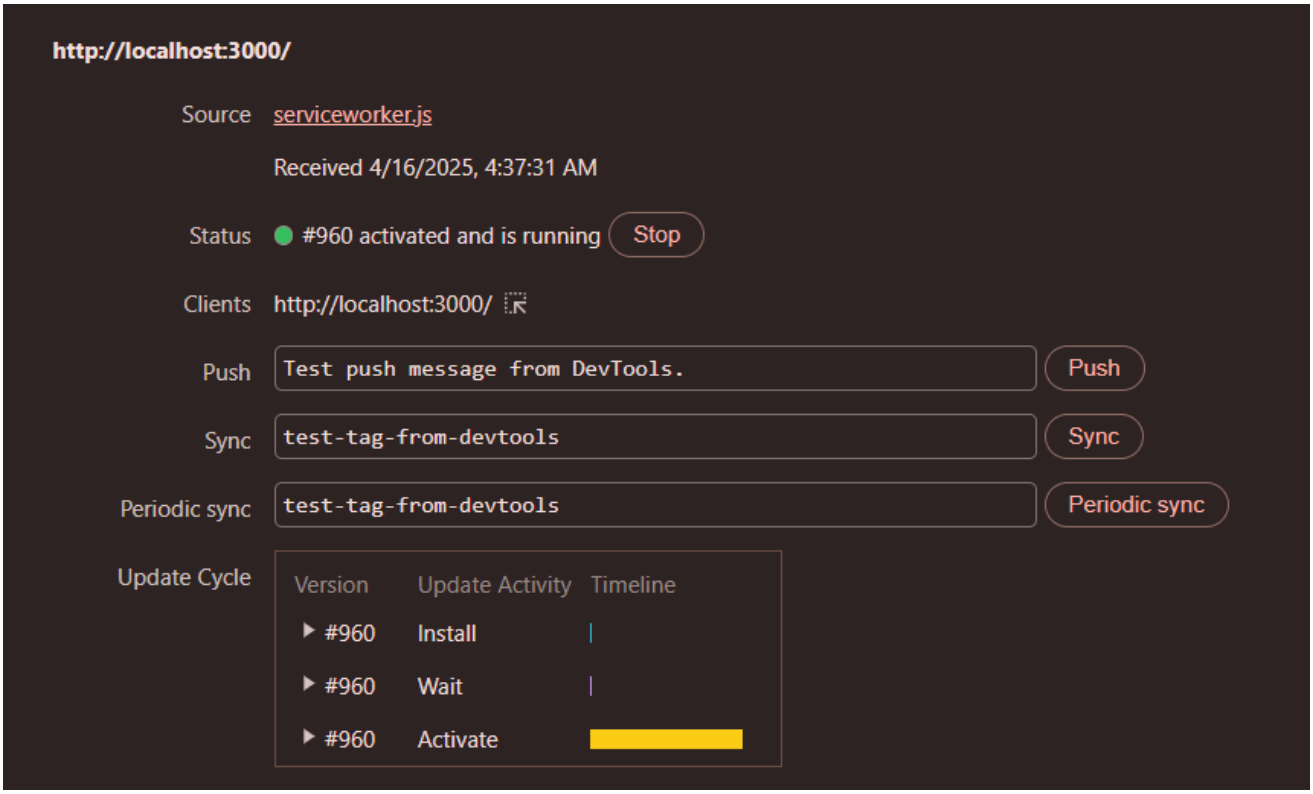
Code:

```
self.addEventListener('install', function(event) {
event.waitUntil(     caches.open('flashcard-cache-
v1').then(function(cache) {       return cache.addAll([
        '/',
        '/static/manifest.json',
        '/static/js/script.js',
        '/static/images/icon-128x128.png',
        '/static/images/icon-512x512.png'
      ]);
    })
  );
});

self.addEventListener('fetch', function(event) {
event.respondWith(
caches.match(event.request).then(function(response) {
return response || fetch(event.request);
    })
  );
});

self.addEventListener('activate', function(event)
{   const cacheWhitelist = ['flashcard-cache-v1'];
event.waitUntil(
caches.keys().then(function(cacheNames) {
return Promise.all(
cacheNames.map(function(cacheName) {
if (!cacheWhitelist.includes(cacheName)) {
return caches.delete(cacheName);
          }
        })
      );
    })
  );
});

// Background Sync - For syncing offline-created flashcards or
decks self.addEventListener('sync', function(event) {   if (event.tag
```

```
=== 'sync-flashcards') {
event.waitUntil(syncFlashcardsToServer());
  }
});

async function syncFlashcardsToServer() {   const cards = await
getUnsyncedFlashcards(); // Replace with IndexedDB logic   for (const card of
cards) {     try {       const res = await fetch('/api/cards', {         method: 'POST',
body: JSON.stringify(card),         headers: {
          'Content-Type': 'application/json'
        }       });       if (res.ok) {
await markCardAsSynced(card.id);
      }
    } catch (err) {       console.error('Sync failed for
card', card.id, err);
    }
  }
}

// Push Notifications - For reminders or study tips
self.addEventListener('push', function(event) {
const data = event.data ? event.data.json() : {};
const options = {
   body: data.body || 'Time to study your
flashcards!',     icon: '/static/images/icon-
128x128.png',     badge: '/static/images/icon-
128x128.png',     data: {       url: data.url || '/'
    }
  };

  event.waitUntil(     self.registration.showNotification(data.title || 'Flashcard
Reminder', options)
  );
});

self.addEventListener('notificationclick', function(event)
{   event.notification.close();   event.waitUntil(
clients.openWindow(event.notification.data.url)
```

```
  );
});

// Demo IndexedDB stubs — replace with real logic async function
getUnsyncedFlashcards() {   return [{ id: 1, question: 'What is PWA?',
answer: 'Progressive Web App' }]; }

async function markCardAsSynced(id) {
console.log(`☑ Flashcard ${id} marked as synced.`);
}
```

Screenshots:



Conclusion

Implementing fetch, sync, and push events in the service worker of an E-commerce PWA significantly enhances the app's usability, resilience, and user engagement. These features enable the PWA to function offline, perform background tasks, and communicate with users proactively, providing a seamless and efficient shopping experience.

MAD & PWA Lab
Journal

Experiment No.	10
Experiment Title.	To study and implement deployment of Ecommerce PWA to GitHub Pages.
Roll No.	30
Name	Jeetu Mamtora
Class	D15B
Subject	MAD & PWA Lab
Lab Outcome	LO5: Design and Develop a responsive User Interface by applying PWA Design techniques
Grade:	

Aim:

To study and implement deployment of E-commerce PWA to GitHub Pages.

Theory:

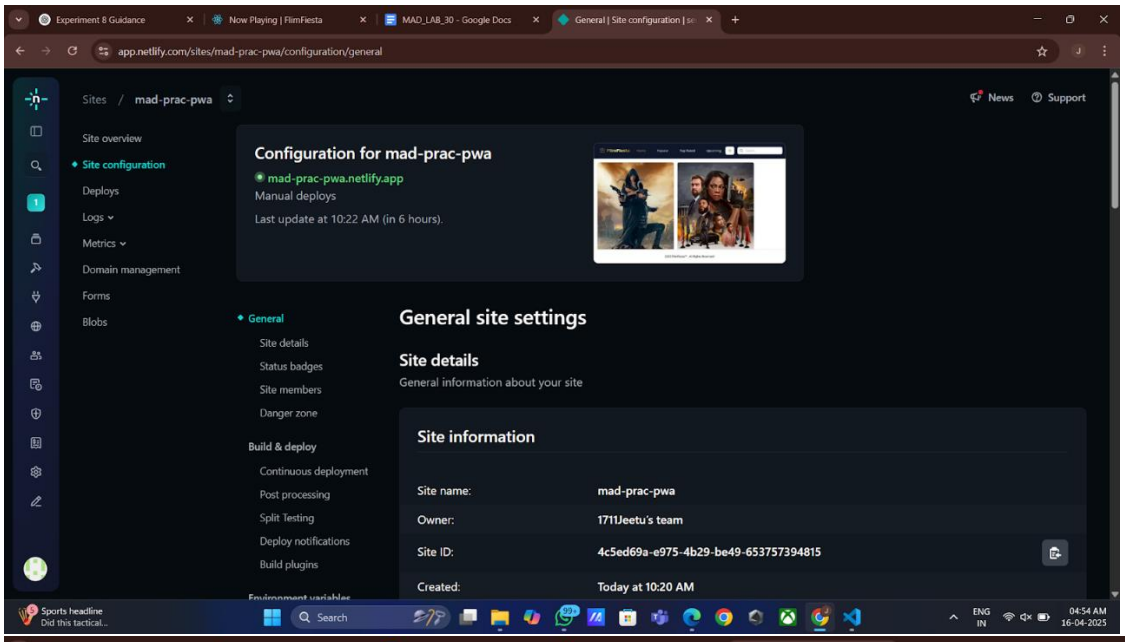
GitHub Pages is a free hosting service provided by GitHub that allows you to deploy static websites directly from a GitHub repository. Progressive Web Apps (PWAs), being primarily composed of HTML, CSS, and JavaScript, are well-suited for deployment on GitHub Pages.

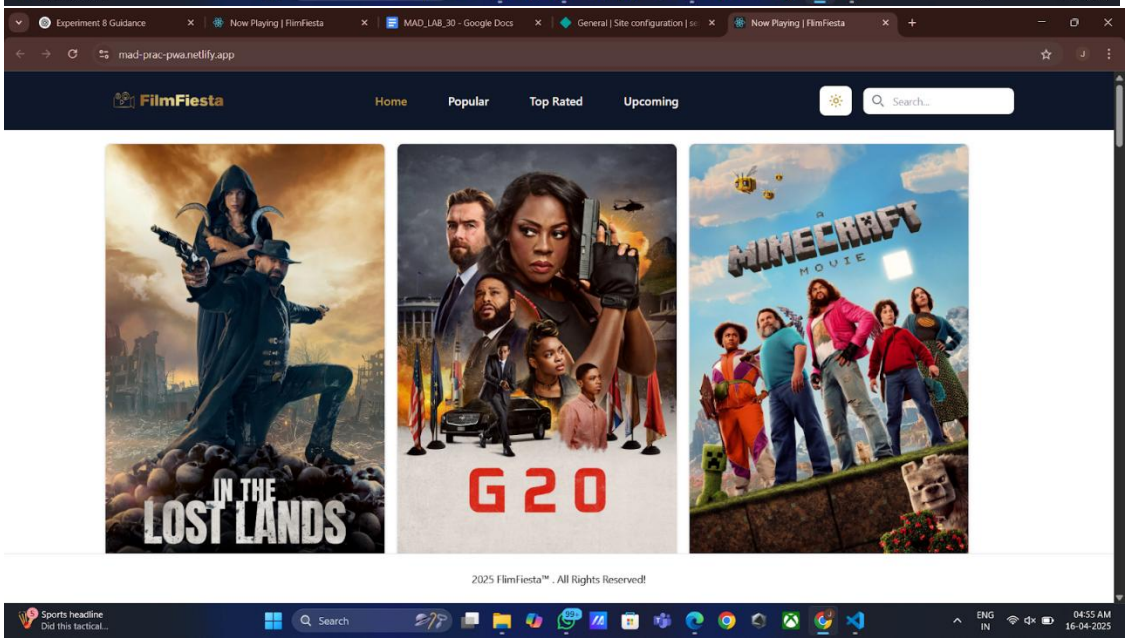
Steps for Deployment:

1. Prepare the PWA:
   Ensure your PWA is complete with the required files:
   - index.html
   - manifest.json
   - service-worker.js
   - Assets (CSS, JS, icons, etc.)
2. Push Code to GitHub Repository:
   Create a repository on GitHub and push all your PWA files to it.
3. Configure the Repository:
   - Go to the repository settings.
   - Scroll down to the GitHub Pages section.
   - Under Source, select the branch (main or master) and root or /docs folder.
4. Update Service Worker Scope (if needed):
   Since GitHub Pages serves the app from a subpath like https://username.github.io/repo-name/, you may need to:
   - Set start_url in manifest.json accordingly. ○ Update the service worker's scope.
5. Build (if using a bundler like Webpack or Vite):
   Run the build command to generate production files, and deploy the output folder (commonly dist/ or build/).

6. Access the App:
   Your PWA will be available at:
   https://<your-username>.github.io/<repo-name>/

Screenshots:





Conclusion:

Deploying an E-commerce PWA to GitHub Pages is a practical and cost-effective solution for showcasing and testing your app online. It allows developers to host their PWA using a simple, version-controlled workflow, ensuring easy updates and accessibility. Proper configuration of paths and service worker settings ensures that the app functions smoothly, including offline capabilities and the "Add to Home Screen" feature.

MAD & PWA Lab
Journal

Experiment No.	11
Experiment Title.	To use google Lighthouse PWA Analysis Tool to test the PWA functioning.
Roll No.	30
Name	Jeetu Mamtora
Class	D15B
Subject	MAD & PWA Lab
Lab Outcome	LO6: Develop and Analyze PWA Features and deploy it over app hosting solution
Grade:	

Aim:

To use the Google Lighthouse PWA Analysis Tool to test the Progressive Web App (PWA) functionality.

Theory:

Progressive Web Apps (PWAs) are web applications designed to provide a seamless, app-like experience on the web. Key characteristics of PWAs include:

1. Responsive Design: PWAs automatically adjust to different screen sizes and devices, providing a consistent user experience across mobile, tablet, and desktop.
2. Offline Capabilities: PWAs can function without an internet connection, thanks to service workers that cache assets and enable offline functionality.
3. App-like Experience: PWAs provide an app-like feel, including features such as home screen installation, push notifications, and improved loading performance.
4. Web App Manifest: A PWA includes a manifest file that defines how the app should appear when installed on the device, such as app name, icons, and theme color.

Google Lighthouse is an automated tool by Google that audits web pages for performance, accessibility, SEO, and best practices. Specifically, for PWAs, Lighthouse checks:

- Service Worker: Ensures that your app has a properly configured service worker for offline functionality.
- Web App Manifest: Validates that your app includes a manifest file with the necessary metadata for installation.
- Offline Functionality: Verifies that the app works offline by caching assets and supporting service worker operations.
- Performance Metrics: Assesses loading time, interactivity, and other critical aspects for a smooth user experience.

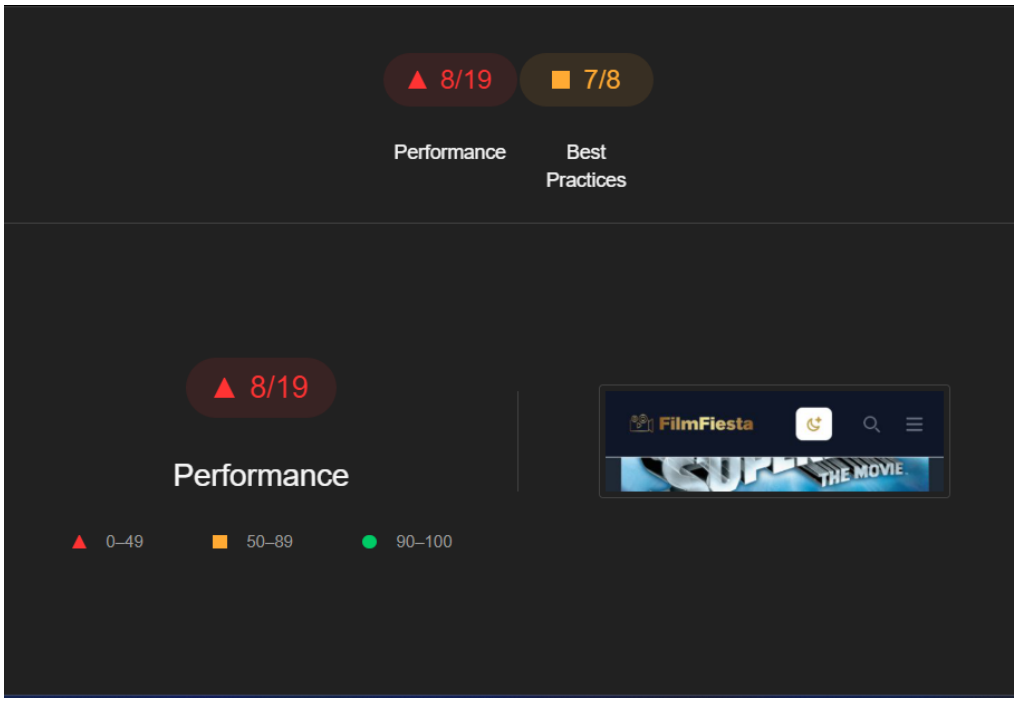
Objective:

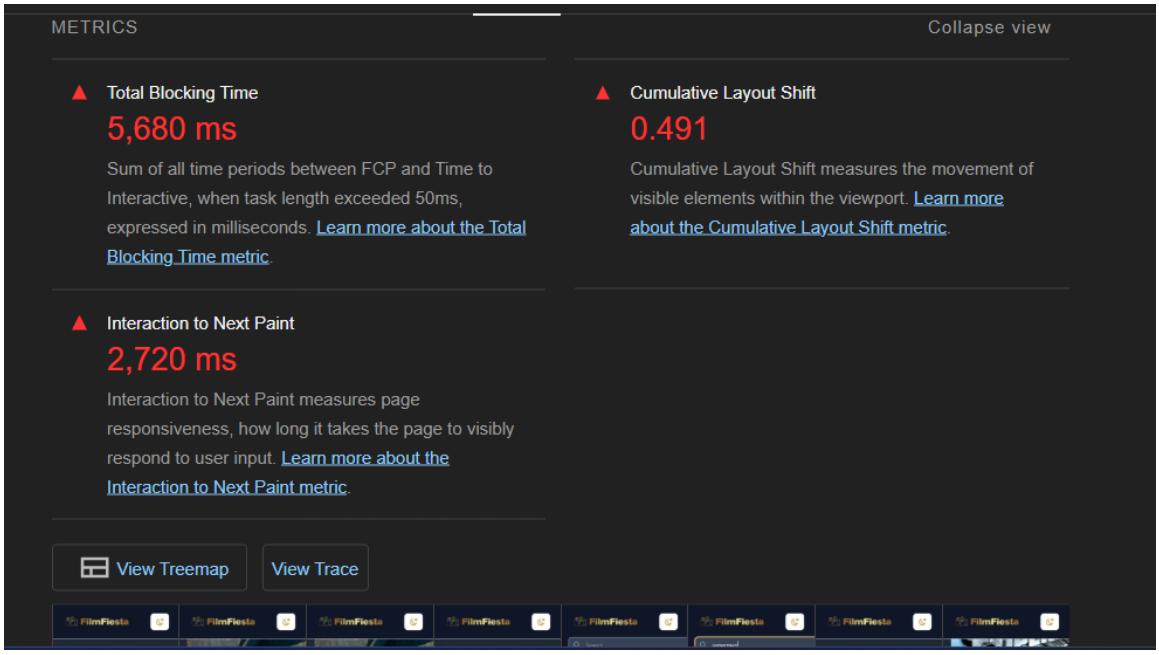
- To evaluate the performance, PWA compliance, and best practices of the web app.
- To identify areas for improvement in the offline functionality, manifest file configuration, and service worker setup.

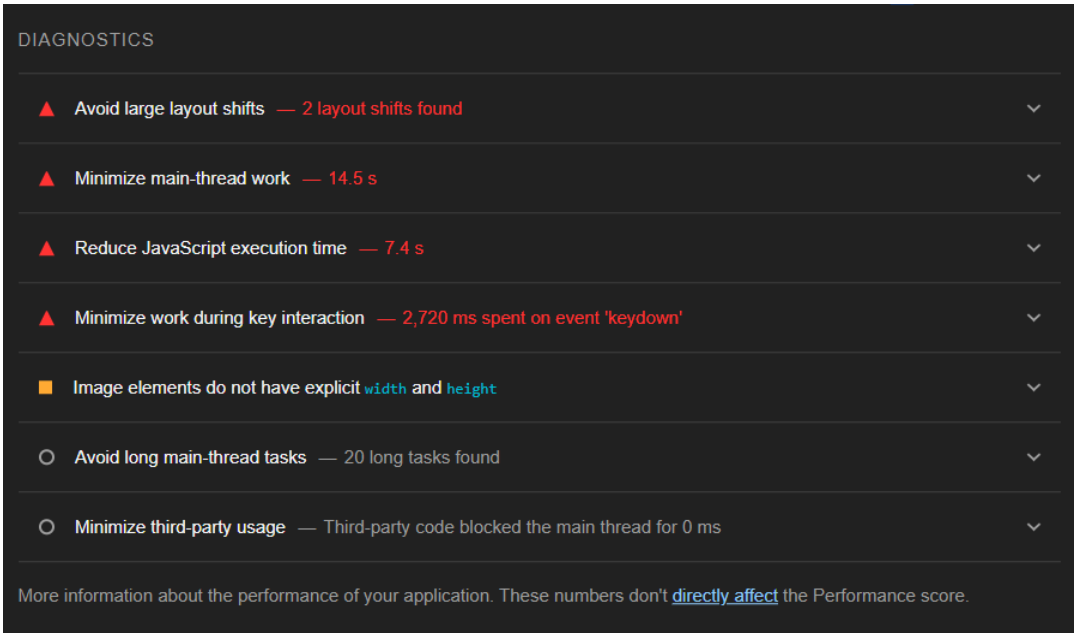
Steps to Use Google Lighthouse for PWA Analysis:

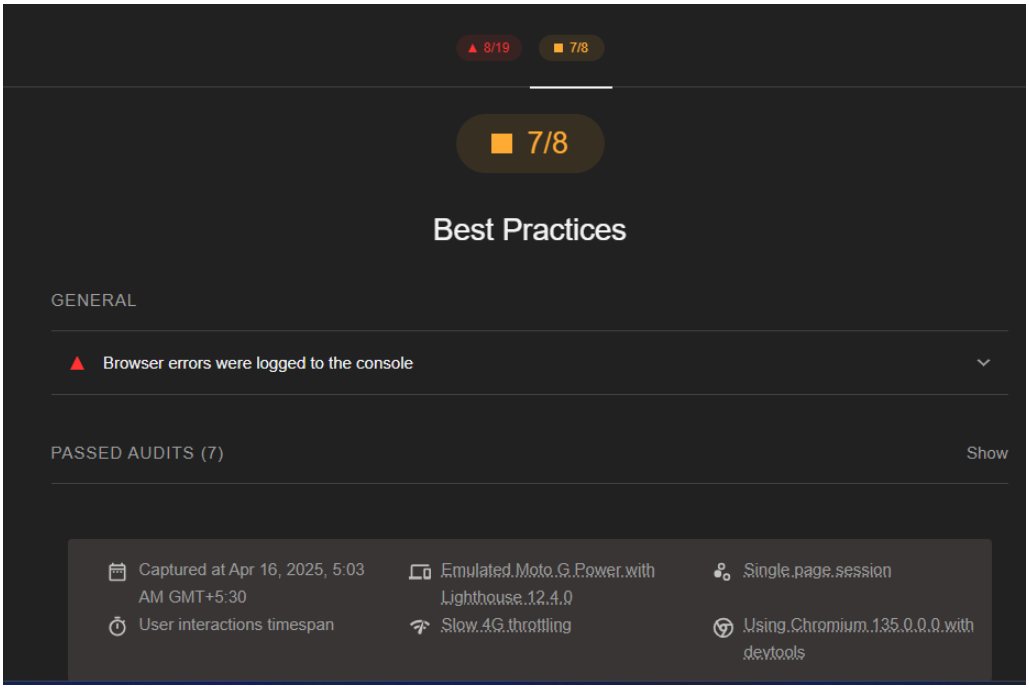
1. Open Google Chrome:
    - Make sure you're using Google Chrome, as Lighthouse is integrated into Chrome's DevTools.
2. Open Your PWA in Google Chrome:
    - Navigate to your PWA URL in Google Chrome.
3. Open Chrome DevTools:
    - Right-click anywhere on the page and select Inspect (or use the shortcut Ctrl+Shift+I on Windows/Linux or Cmd+Opt+I on macOS).
    - Click on the Lighthouse tab in the DevTools panel. If it’s not visible, click the » icon to find it.
4. Configure Lighthouse Settings:
    - Categories: Choose the categories you want to audit, including Performance, PWA, Accessibility, Best Practices, and SEO.
    - Device Mode: Select between Mobile or Desktop to simulate the audit on different devices.
    - Make sure to select the PWA category for a specific audit on Progressive Web App functionality.
5. Run the Lighthouse Audit:
    - Click the "Generate report" button to begin the audit. Lighthouse will analyze your PWA and generate a report.
6. Review the Results:
    - Once the audit is completed, you’ll see a detailed report with scores in different categories. In the PWA section, Lighthouse will evaluate:
        - Service Worker: Checks if a service worker is installed and functioning correctly.
        - Web App Manifest: Verifies the presence and correctness of your manifest file.
        - Offline Capability: Assesses if your PWA can function offline.
        - App Installability: Tests whether the app can be installed on the home screen.
7. Analyze Issues and Recommendations:
    - Review the findings and follow Lighthouse’s suggestions to improve areas such as offline support, manifest configuration, and service worker implementation.
8. Re-test After Fixes:
    - After applying fixes to the identified issues, re-run the Lighthouse audit to ensure the PWA now meets the required standards.

Screenshots:









Conclusion:

Using the Google Lighthouse PWA Analysis Tool is a crucial step in ensuring that your Progressive Web App meets key functionality standards. By following the steps above, you can identify and resolve any issues related to service workers, manifest files, and offline capabilities. This process helps optimize performance, enhances the user experience, and ensures compliance with PWA best practices.

MAD & PWA Lab

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Experiment No.	Assignment-1
Assignment 1 Questions	1. a) Explain the key features and advantages of using Flutter for mobile app development. b)Discuss how the Flutter framework differs from traditional approaches and why it has gained popularity in the developer community. 2. a)Describe the concept of the widget tree in Flutter. Explain how widget composition is used to build complex user interfaces. b) Provide examples of commonly used widgets and their roles in creating a widget tree. 3. a) Discuss the importance of state management in Flutter applications. b) Compare and contrast the different state management approaches available in Flutter, such as setState, Provider, and Riverpod. Provide scenarios where each approach is suitable. 4.a) Firebase Integration in Flutter: Explain the process of integrating Firebase with a Flutter application. b)Discuss the benefits of using Firebase as a backend solution. Highlight the Firebase services commonly used in Flutter development and provide a brief overview of how data synchronization is achieved.
Roll No.	37
Name	Nihal Nagdev
Class	D15B
Subject	MAD & PWA Lab
Lab Outcome	LO1: Understand cross platform mobile application development using Flutter framework LO2: Design and Develop interactive Flutter App by using widgets, layouts, gestures and animation LO3: Analyze and Build production ready Flutter App by incorporating backend services and deploying on Android / iOS
Grade:	

Jeetu Mamtora
Div-D15B Rollno-30.

Assignment-01.

(04) & (A)

Q1) Explain the key features and advantages of using flutter for mobile app development.

→ Flutter is a popular open-source UI toolkit developed by Google for building natively compiled applications for mobile (ios & Android) web & desktop from a single codebase.

Key features of flutter-

1) Single Codebase- write once, run on multiple platform (ios, Android, web, desktop).

2) Dart Programming- Uses Dart, which is optimised for & fast performance. and ahead-of-time (AOT) compilation

3) Hot Reload- Instantly reflects changes in the app without it restarting, making development faster.

4) Rich widget Library- Provides a vast collection of customization widgets that supports Material design & cupertino styles for a native look & feel.

Advantages of using flutter-

1) Faster Development Time- Hot reload & a single code-base reduce development effort & time.

2) cost Effective- Since developers write once codebase for multiple platforms, it reduces costs associated with maintaining separate teams for ios & android.

3) Consistent ui- flutter- renders everything using its own engine

1)b) Discuss how the flutter framework differs from traditional approaches? and why it has gained popularity in the developer community?

→ Flutter uses a single codebase for multiple platforms, unlike traditional native development that requires seperate code for IOS (Swift) & Android (Kotlin). It does not rely on platform-specific UI components but instead render everything using its own Skia graphic engine, ensuring consistency. Unlike React Native, which uses a Javascript bridge, Flutter compiles directly to native ARM code, offering better performance. Its hot reload feature allows developer to see changes instantly, making development faster & more efficient.

Flutter has gained popularity due to its faster development cost efficient & cross platform support Business prefer it as it reduces development time & cross while delivering high performance apps. Its customizable widget system ensures a smooth. native like experience.

2)a) Describe the concept of the widget tree in Flutter. Explain the widget composition is used to build complex UI.

→ In Flutter, everything is a widget (button, text, layouts, etc). These widgets are arranged in a hierarchial structure known as the widget tree. The widget tree determines the UI. widget composition to build complex UI-

Flutter encourages a composition-based approach rather than inheritance.

Instead of creating large, monolithic widget, developer build small, reusable widget that are combined to form complex UIs. or A column widget can hold multiple Text & Button widget, creating a structured ~~inf~~ layout.

2)b) Provide ex of commonly used widgets & their roles in creating a widget tree.

→ 1) Structural widget.
- Scaffold - Provide basic structure of a screen.
- container - used for layout styling.
- Column & Row - used for vertical & Horizontal layout.

2) Interactive widget.
- Text field - for user input.
- Elevated Button - clickable buttons.

3) Styling widget.
- Padding - Adds spacing around widget.
- Align, centre - Adjust alignment.

4) List & Scrollable widget.
- ListView - Scrollable widget.
- Gridview - provide/Display items in Grid.

Ex Simple widget Tree -

```
Scaffold (
appBar: AppBar (title: Text ("Flutter APP")),
body: column
  children: [
     Text ("welcome to flutter!"),
     ElevatedButton(onPressed: ( ) { }, child: Text ("Click me")
  ];
);
);
```

Q3)a) Discuss the importance of State management in Flutter application.

→ Importance of State Management in Flutter Application State Management refers to ~~having~~ handling dynamic data that changes overtime. In Flutter, the UI rebuilds when the state changes, ensuring the app remains interactive & responsive proper State management helps in performance optimization, code ~~mai~~ maintainability & better UI behaviour.

Q3)b) Compare & contrast the different State Management in Flutter approaches available in Flutter, such as SetState, provider & Riverpod provide scenarios where each approach is suitable.

→ Comparision of State Management Approaches in Flutter Approach Description Suitable Scenarios SetState Basic State Management by calling SetState() to update UI Small apps, Simple UI updates (eg toggling a switch) Provider Uses inherited widget to efficiently manage state across the widget tree. Medium Sized Apps needing global state sharing (eg - User authentication) Riverpod More scalable than provider with improved dependency injection & state handling. Large, complex apps requiring modular & scalable state management (eg - e-commerce apps).

4)a) Explain the process of integrating Firebase with a Flutter application.
Discuss the benefits of using Firebase as a backend Soln.
Integrating Firebase with Flutter & its benefits.

→ Integration Process:
Setup Firebase Console:

Create a firebase project
Register the App for Android & ios.
Download & add google-services.json (Android) or Google Service-info.plist (ios)
install firebase Dependencies.

yaml

```
dependencies -
  firebase_core : latest_version
  firebase_auth : latest_version
  cloud_firestore : latest_version
```

initialize firebase in flutter.

dart

```
void main() async {
  widgetsFlutterBinding.ensureInitialized();
  await firebase.initializeApp();
  runApp(MyApp());
}
```

Benefits -
No need to manage servers (Backend-as-a-Service) Provide authentication, database & cloud function, scalable & cost effective.

4)b) Highlight the firebase services commonly used in Flutter development & provide brief overview of how data synchronization is achieved.

→ commonly used Firebase services in Flutter & Data Synchronization service functionality.

Firebase Authentication user-sign-in (Email, Google, Facebook)
Cloud FireStore NoSQL database for real time data syncing
Firebase Storage upload & manage files (images, videos)
Cloud messaging push notifications, firebase Analytics App usage analytics.

Data Synchronization in FireStore -
FireStore allows realtime data syncing using snapshot listener.

Ex-of realtime listener in FireStore.
dart:

```
Firebase firestore.instance.collection('message').snapshots().
listen((snapshot){
    for(doc in snapshot.docs){
      Print(doc.dart());
    }
});
```

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Experiment No.	Assignment-2
Assignment 2 Questions	1. Define Progressive Web App (PWA) and explain its significance in modern web development.Discuss the key characteristics that differentiate PWAs from traditional mobile apps 2. Define responsive web design and explain its importance in the context of Progressive Web Apps.Compare and contrast responsive, fluid, and adaptive web design approaches. 3. Describe the lifecycle of Service Workers, including registration, installation, and activation phases. 4. Explain the use of IndexedDB in the Service Worker for data storage.
Roll No.	37
Name	Nihal Nagdev
Class	D15B
Subject	MAD & PWA Lab
Lab Outcome	LO4:Understand various PWA frameworks and their requirements LO5: Design and Develop a responsive User Interface by applying PWA Design techniques LO6:Develop and Analyze PWA Features and deploy it over app hosting solutions
Grade:	

Name - Jeetu Mamtora
Div - D15B - 30
Sub - MPL.

MPL Assignment - 2

Q1) Define Progressive web app (PWA) & explain its Significance in Modern web development. Discuss the key characteristics that differentiate PWAs from traditional Mobile apps.

→ A Progressive web APP (PWA) is a type of web Application that work, like a Mobile App but runs in a browser. It can be installed on a device, work offline & provide a fast and smooth user experience.

Significance of PWA in Modern web development:
1] cross platform Compatiblity - works on both Mobile & desktop with a single codebase.
2] Offline Support - can support without the internet using cached data.
3] Fast Performance - loads quickly, even on slow networks
4] No app stored required - User can installed it directly from the browser.
5] lower development cost - One pwa, can replace Separate android and ios apps

Key difference between PWA and Traditional Mobile APP-

Features	PWA	Traditio
Installation	Direct from brown	Download from App Store
Internet Required	work offline with caching	usually required Internet.

Performance	Fast with Service workers	Fasters but need Installation
Updates	Automatic, no App Store Approval	Manual updates needed.
Development cost	lower (one codebase for all)	Higher (Seperate app for each platform)

PWA's combine the best of web & MobileApp, Making them efficency & user friendly.

Q2) Define responsive web design, and ~~web~~ Explain its importance in the context of progressive web Apps. Compare and contrast, responsive fluid and adaptive web design approaches.

→ Responsive web design its a technique that makes web pages adjust automatically to different screen size and devices. It ensures a goal user experience on Mobile tablet and desktops without needs Separate version of a website.

Importance of responsive Design in PWA's
1] Better user Experience - PWA's work Smoothly on any device
2) Task load time - Optimized design improves Speed.
3) SEO Benefits - google ranks responsive sites higher.
4] cost efficient - No need to build Multiple version for different screens.

•) Comparision of web design Approaches-

Approach	How it works	Pros	Cons
Responsive	use flexible grids & CSS Media queries to adjust layout	works on all devices improves SEO	can be complex to design.
Fluid	uses percent-based widths instead of fixed pixels, so elements resizes smoothly	works wells on different Screen sizes easy to implement	less control over layout on large screens
Adaptive	uses fixed layouts that changes at specific breakpts	optimized for known Screen sizes	More efficient to design for each Screen size.

Q3) Describe the lifecycle of Screen workers, including registration installation & activation for phases.

→ lifecycle of Service workes-
A Service workers is a Script that runs in the backgrounds & helps a web App work offline, load faster & Send push notification. Its lifecycle has there Main phases

1] Registration phase-
The register the Service workers using Javascript

Code Example-

```
if ('service worker' is navigator) {
    navigation.serverWorker.register('/sw.js
then(() => console.log('Services worker Registe
catch(errors => console.log('Registration failed
    Error));
}
```

2] Installation Phase-
The serve worker downloads necessary files (HTML CSS, JS) & stores them in caches.

if successful, it moves to the Activation phase.

Code Example-

```
Self.addEventListener('install', event => {
  event.waitUnit(
    caches.open('app-cache) then (cache => {
    return cache.addAll(['/', "/index.html', '/sty
      css']);
  })
  );
});
```

3) Activation phase -
The old service workers with the new one.
unused cache file from the previous version are detected.

Code Example -

```
self.addEventListener('activate', event => {
    event.waitUntil(
        caches.keys().then(keys => {
        return Promise.all(keys.map(key => {
            if(key !== 'app-cache') {
                return cache.delete(key);
            }
        }));
    })
);
});
```

4) Final step: fetch & Sync

Once activated, the ~~Servic~~ service worker intercepts network requests serves cached files & syncs data when the internet is available This lifecycle makes PWA's faster, More reliable & capable for working for Offline.

Q4) Explain the use of indexed DB in the Service worker for data storage.

→ Indexed DB is a browser database that stores large amount of structured data like JSON Objects. It helps PWAs work Offline by saving & retreving data efficiency

Why use IndexedDB in Services Workers?

1) Offline Support - Stores data when ~~the~~ offline & Syncs it later -

2) efficient storage - Saves structured data like user settings, cast items or form inputs
3) Faster Access - Retrieves data quickly without needed a network request.
4) Persistent Data - Data remains saved even often the browser is closed

Opening the database -

```
let db;
let request = indexedDB('My Database', 1);
request.onSuccess = function (event) {
    db = event.target.result;
};
```

creating a store & adding Data -

```
request.onUpgradeNeeded = function (event) {
let db = event.target.result;
let store = db.createObjectStore('users', {keyPath: 'id'})
Store.add({id: 1, name: 'John Doe', age: 25 });
};
```

fetching data in service worker.

```
let transaction = db.transaction('users', 'readonly');
let store = transaction.objectStores('users');
let getUser = store.get(1);
get user.onSuccess = function() {
    console.log(get user result);
};
```