SMART BIN

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

BY

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(Permanently affiliated to JNTU :: Kakinada, Approved by AICTE)

(An NBA & NAAC A+ accredited and ISO 9001:2015 Certified Institution)
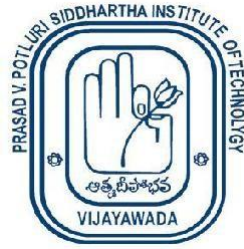
Kanuru, Vijayawada - 520007

2024-25

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<u>CERTIFICATE</u>

This is to certify that the project report titled **"SMART BIN"** is the bonafide work of **T.Ramya (22501A05I0) , S.Muhammad Afzal (22501A05H5) , Shaik Sahira (22501A05G4) ,V.Divya Charitha (22501A05I9)** in partial fulfilment of completing the Academic project in MERN Lab during the academic year 2024-25.

Signature of the Incharge   **Signature of the HOD**

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1. ABSTRACT

Waste management is a critical challenge in urban areas due to increasing population density and environmental concerns. The **Smart Bin** is an **Android-based mobile application** designed to improve waste management practices by **tracking waste collection vehicles in real time, monitoring recycling rates, and identifying high-waste areas (hotspots).**

The application integrates modern technologies such as **GPS tracking, geospatial analysis, and data visualization** to optimize waste collection routes and promote sustainable waste disposal. This system is beneficial for **municipal corporations, waste collection agencies, and residents**, ensuring an efficient and accountable waste management process.

1.1. SDG JUSTIFICATION REPORT

SDG Mapped: SDG 3 – Good Health and Well-being, SDG 6 – Clean Water and Sanitation, SDG 8 – Decent Work and Economic Growth, SDG 11 – Sustainable Cities and Communities, SDG 12 – Responsible Consumption and Production, SDG 13 – Climate Action, SDG 15 – Life on Land

1.1.1 How This Project Supports SDG 3,6,8,11,12,13 &15

The **Smart Waste Management Tracker** aligns with SDG 3 (Good Health and Well-being), SDG 6 (Clean Water and Sanitation), SDG 8 (Decent Work and Economic Growth), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 15 (Life on Land) by leveraging technology to optimize waste collection, improve sanitation, and promote environmental sustainability.

Contribution to SDG 3 (Good Health and Well-being)

- **Reduces health risks:** by preventing the spread of diseases caused by unmanaged waste.

- **Promotes cleaner environments**: by enabling efficient waste collection and disposal.

Contribution to SDG 6 (Clean Water and Sanitation)

- **Prevents water contamination** by monitoring and managing waste disposal near water bodies.

- **Supports sanitation efforts** through optimized waste collection and disposal strategies.

Contribution to SDG 8 (Decent Work and Economic Growth)

- **Creates job opportunities** in waste management, recycling, and sustainability sectors.

- **Encourages circular economy practices** by promoting waste segregation and recycling.

Contribution to SDG 11 (Sustainable Cities and Communities)

- **Enhances waste management systems** through smart tracking and data analytics.

- **Encourages community participation** in maintaining cleaner and more livable cities.

Contribution to SDG 12 (Responsible Consumption and Production)

- **Promotes sustainable waste disposal** by tracking and optimizing recycling efforts.

- **Reduces landfill dependency** by raising awareness about responsible waste management.

Contribution to SDG 13 (Climate Action)

1 **Lowers carbon emissions** by reducing landfill waste and promoting eco-friendly disposal methods.

2 **Encourages sustainable urban planning** through data-driven waste management strategies.

Contribution to SDG 15 (Life on Land)

- **Protects natural habitats** by preventing illegal dumping and land pollution.
- **Encourages eco-friendly waste management practices** to sustain biodiversity and soil health.

2. INTRODUCTION

Background:

Traditional waste collection methods often face inefficiencies such as missed pickups, irregular schedules, and lack of tracking transparency. With rapid urbanization, the volume of waste generated has increased significantly, demanding a smart and automated waste management system.

The Smart Bin project aims to bridge this gap by leveraging technology to digitize the waste collection process, monitor recycling trends, and engage the public in reporting waste issues. This application allows:

- **Citizens** to report waste accumulation in their localities.
- **Municipal authorities** to track collection vehicles and monitor their efficiency.
- **Waste collectors** to receive optimized collection routes.

Problem Statement:

Urban waste collection is often inefficient, leading to overflowing waste bins, environmental pollution, and improper waste disposal. There is a lack of:

- **Real-time tracking** of waste collection vehicles.
- **A digital system** to monitor and analyze waste generation patterns.
- **Public participation** in reporting uncollected waste.

Solution:

The Smart Bin mobile app solves these challenges by offering real-time waste tracking, recycling analytics, and waste hotspot identification. The app creates a data-driven approach to waste management, reducing inefficiencies and ensuring a cleaner environment.

3. OBJECTIVES AND SCOPE OF THE PROJECT

Objectives:

The primary objectives of the Smart Bin project are:

- **Enable real-time tracking** of waste collection vehicles using GPS technology.
- **Provide a reporting mechanism** for residents to report uncollected waste.
- **Monitor recycling progress** through interactive data visualization dashboards.
- **Identify waste hotspots** using geospatial analysis to optimize waste collection efforts.
- **Enhance transparency and accountability** in waste collection and recycling processes.

Scope of the Project:

The Smart Bin system is designed for:

- **Waste Collection Authorities:** To monitor vehicle movements, improve efficiency, and plan optimized routes.

- **Residents:** To report waste issues and receive notifications about collection schedules.

- **Waste Collection Companies:** To analyze recycling data and identify improvement areas.

Future enhancements may include AI-based waste sorting, integration with IoT-enabled smart bins, and blockchain-based waste tracking for enhanced accountability.

4.SOFTWARE USED

Technologies & Tools Used:

Android Studio:

- Android Studio was the primary IDE used for developing and testing the application.
- It offered various tools and emulators that facilitated efficient debugging and optimization of the app's performance.

XML:

- XML was used to design the user interface (UI) for the Android application\
- It defined the layout of various elements such as buttons, text fields, and navigation components, ensuring a clean and intuitive design.

Java:

- Java was used to handle the logic and functionality of the application.
- It ensured smooth integration between UI components and backend services while providing event-driven interaction with the application.

SQLite Database:

- SQLite Database was used as a local database for storing user information, waste reports, and recycling data.
- It provided lightweight and efficient data management within the app, ensuring quick data retrieval and offline functionality.

Google Maps API:

- Google Maps API was integrated for real-time GPS tracking and mapping functionalities.
- It enabled precise location-based services, assisting users with navigation and resource tracking.

This combination of technologies ensures scalability, ease of use, and high efficiency in waste management operations.

5. PROPOSED MODEL

The Smart Bin system consists of three core components:

1. **User Interface (Frontend):** The mobile app allows users, waste collectors, and municipal authorities to interact with the system.
2. **Database (Backend):** Stores user data, waste collection reports, and recycling analytics using SQLite/Firebase.
3. **Geospatial & Data Analytics Module:** Uses heatmaps and graphical reports to identify waste accumulation patterns.

Project Overview:

The Smart Bin is a comprehensive solution that addresses the challenges of waste management by providing real-time tracking of waste collection vehicles, monitoring recycling rates, and identifying areas with high waste generation (hotspots). The app aims to promote sustainable waste management practices and engage the community in environmental conservation efforts.

Key Features:

1. **Waste Collection Tracking:**

   Real-time GPS tracking of waste collection vehicles.

   Notifications for residents about collection schedules and

   delays. Visualization of vehicle routes on a map.

2. **Recycling Rate Monitoring:**

   Data input for recycling volumes and types of materials.

   Visual dashboards to display recycling rates over time.

   Comparative analysis to identify trends and improvements.

3. **Hotspot Identification:**

   Geospatial analysis to identify areas with high waste generation.

   Heatmaps to visualize waste density on the map.

   Alerts for areas that require immediate attention.

UML Diagrams

Use Case Diagram

The Use Case Diagram illustrates the interactions between the system and its actors (users). Here are the primary actors and their use cases:
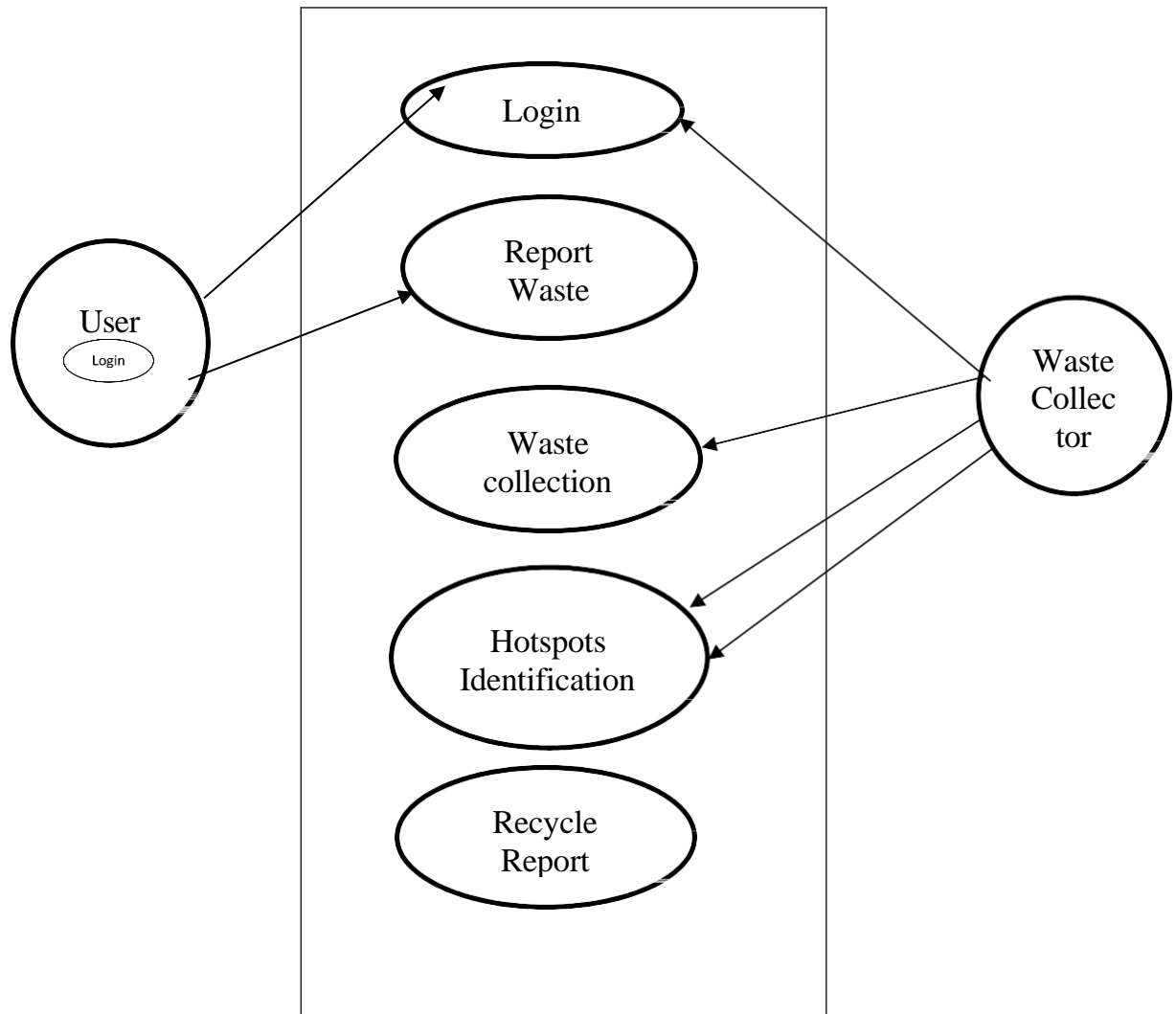
6. SAMPLE CODE

WelcomeActivity.java:

```java
package com.example.smart_waste_management; import
android.content.Intent;
import android.os.Bundle; import
android.view.View; import
android.widget.Button;
import androidx.appcompat.app.AppCompatActivity;
public class WelcomeActivity extends AppCompatActivity { @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_welcome);  Button
        btnLogin = findViewById(R.id.btn_login);
        Button btnRegister = findViewById(R.id.btn_register); btnLogin.setOnClickListener(new
        View.OnClickListener() {
            @Override
            public void onClick(View v) {
                Intent intent = new Intent(WelcomeActivity.this, LoginActivity.class);
                startActivity(intent);
                    }
                });
        btnRegister.setOnClickListener(new View.OnClickListener() { @Override
            public void onClick(View v) {
                Intent intent = new Intent(WelcomeActivity.this, RegisterActivity.class); startActivity(intent);
                    }
                });
    }
}
```

activity_welcome.xml:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="290dp"
    android:layout_height="300dp"
    android:gravity="center" android:orientation="vertical"
    android:background="#E8F5E9"
    android:layout_marginStart="55dp"
    android:layout_marginTop="180dp"
    android:padding="16dp">
    <TextView android:layout_width="166dp"
        android:layout_height="wrap_content"
        android:layout_marginStart="10dp"
        android:layout_marginBottom="32dp"
        android:text="SMART BIN"
        android:textColor="#388E3C"
        android:textSize="28sp"
        android:textStyle="italic" />
    <Button
        android:id="@+id/btn_login"
        android:layout_width="102dp"
        android:layout_height="wrap_content"
        android:layout_marginLeft="20dp"
        android:layout_marginStart="5dp"
        android:backgroundTint="#2E7D32"
        android:text="Login" />
```

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```xml
    <Button
        android:id="@+id/btn_register"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginStart="5dp"
        android:layout_marginLeft="55dp"
        android:layout_marginTop="16dp"
        android:backgroundTint="#2E7D32"
        android:text="Register" />
</LinearLayout>
```

Register Activity.java:

```java
package com.example.smart_waste_management; import
android.content.Intent;
import android.os.Bundle; import
android.view.View; import
android.widget.Button; import
android.widget.EditText;
import androidx.appcompat.app.AppCompatActivity; public class
RegisterActivity extends AppCompatActivity {
    private EditText etUsername, etPassword, etName, etLocation, etRole; private
    Button btnRegister;
    private DBHelper dbHelper;
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_register); etUsername =
        findViewById(R.id.et_username); etPassword =
        findViewById(R.id.et_password); etName =
        findViewById(R.id.et_name);  etLocation =
        findViewById(R.id.et_location); etRole =
        findViewById(R.id.et_role);
        btnRegister = findViewById(R.id.btn_register); dbHelper =
        new DBHelper(this);
        btnRegister.setOnClickListener(new View.OnClickListener() { @Override
            public void onClick(View v) {
                String username = etUsername.getText().toString().trim(); String
                password = etPassword.getText().toString().trim(); String name =
                etName.getText().toString().trim();
                String location = etLocation.getText().toString().trim(); String
                role = etRole.getText().toString().trim();

                if (username.isEmpty() || password.isEmpty() || name.isEmpty() || location.isEmpty() ||
role.isEmpty()) {
                    // Show error message
                    return;
                }
                    dbHelper.addUser(username, password, name, location, role);
                    Intent intent = new Intent(RegisterActivity.this, LoginActivity.class);
                    startActivity(intent);
                }
            });
        }
    }
```

activity_register xml:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="315dp"
    android:layout_height="450dp"
    android:layout_marginStart="50dp"
    android:layout_marginTop="120dp"
    android:background="#E8F5E9"
    android:gravity="center" android:orientation="vertical"
    android:padding="16dp">
    <TextView   android:id="@+id/textView"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginStart="15dp"
        android:layout_marginTop="16dp"
        android:text="REGISTER"
        android:textColor="#388E3C"
        android:textSize="28sp" />
    <EditText android:id="@+id/et_username"
        android:layout_width="262dp"
        android:layout_height="48dp"
        android:layout_marginBottom="16dp"
        android:hint="Username" />
    <EditText android:id="@+id/et_password"
        android:layout_width="263dp"
        android:layout_height="48dp"
        android:layout_marginBottom="16dp"
        android:hint="Password"
        android:inputType="textPassword" />
    <EditText android:id="@+id/et_name"
        android:layout_width="265dp"
        android:layout_height="48dp"
        android:layout_marginBottom="16dp"
        android:hint="Name" />
    <EditText
        android:id="@+id/et_location"
        android:layout_width="263dp"
        android:layout_height="48dp"
        android:layout_marginBottom="16dp"
        android:hint="Location" />
    <EditText android:id="@+id/et_role"
        android:layout_width="263dp"
        android:layout_height="48dp"
        android:layout_marginBottom="16dp"
        android:hint="Role (User/Collector)" />
    <Button
        android:id="@+id/btn_register"
        android:layout_width="118dp"
        android:layout_height="50dp"
        android:backgroundTint="#2E7D32"
        android:text="Register" />
</LinearLayout>
```

Login Activity.java:

```java
package com.example.smart_waste_management; import
android.content.Intent;
import android.os.Bundle; import
android.view.View; import
android.widget.Button; import
android.widget.EditText; import
android.widget.Toast;
import androidx.appcompat.app.AppCompatActivity; public
class LoginActivity extends AppCompatActivity {
    private EditText etUsername, etPassword; private
    Button btnLogin;
    private DBHelper dbHelper;
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_login); etUsername =
        findViewById(R.id.et_username); etPassword =
        findViewById(R.id.et_password); btnLogin =
        findViewById(R.id.btn_login); dbHelper = new
        DBHelper(this);
        btnLogin.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                String username = etUsername.getText().toString().trim(); String
                password    =    etPassword.getText().toString().trim();    if
                (username.isEmpty() || password.isEmpty()) {
                    Toast.makeText(LoginActivity.this,    "Incorrect    username/password",
Toast.LENGTH_LONG).show();
                    return;
                }
                if (dbHelper.authenticateUser(username, password)) { String
                    role = dbHelper.getUserRole(username);
                    Intent intent;
                    if (role.equals("collector")) {
                        intent = new Intent(LoginActivity.this, CollectorMainActivity.class);
                    } else {
                        intent = new Intent(LoginActivity.this, UserMainActivity.class);
                    }
                    intent.putExtra("username",username); startActivity(intent);
                } else {
                    Toast.makeText(LoginActivity.this, " Not Registered",
Toast.LENGTH_SHORT).show();
                    Intent intent=new Intent(LoginActivity.this, RegisterActivity.class);
                    startActivity(intent);
                }
            }
        });
    }
}
```

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activity_login.xml:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent" android:layout_height="match_parent"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    android:orientation="vertical"
    android:gravity="center" android:padding="16dp">
    <LinearLayout android:layout_width="315dp"
        android:layout_height="346dp"
        android:background="#E8F5E9"
        android:orientation="vertical"
        android:padding="16dp">
        <TextView   android:id="@+id/textView"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_marginTop="16dp"
            android:text="LOGIN"
            android:layout_marginStart="75dp"
            android:textColor="#388E3C"
            android:textSize="28sp" />
        <LinearLayout
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:orientation="horizontal"
            android:layout_marginTop="16dp">
            <ImageView
                android:id="@+id/imageView_user"
                android:layout_width="45dp"

                android:layout_height="45dp"
                app:srcCompat="@drawable/usericon"/>
            <EditText android:id="@+id/et_username"
                android:layout_width="0dp"
                android:layout_height="48dp"
                android:hint="Username"
                android:inputType="text"
                android:layout_weight="1" />
        </LinearLayout>
        <LinearLayout
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:orientation="horizontal"
            android:layout_marginTop="16dp">
            <ImageView  android:id="@+id/imageView_lock"
                android:layout_width="45dp"
                android:layout_height="45dp"
                app:srcCompat="@drawable/passwordicon" />
            <EditText android:id="@+id/et_password"
                android:layout_width="0dp"
                android:layout_height="48dp"
                android:hint="Password"
                android:inputType="textPassword"
                android:layout_weight="1" />
        </LinearLayout>
        <Button
            android:id="@+id/btn_login"
```

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```
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_marginTop="16dp"
        android:backgroundTint="#2E7D32"
        android:text="Login"
        android:textColor="#FFFFFF" />
    </LinearLayout>
</LinearLayout>
```

UserMain Activity.java:

```
package com.example.smart_waste_management; import
android.content.Intent;
import android.os.Bundle; import
android.view.View; import
android.widget.Button;
import androidx.appcompat.app.AppCompatActivity;
public class UserMainActivity extends AppCompatActivity { private
    Button btnReportWaste;
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_user_main);

        btnReportWaste = findViewById(R.id.btn_report_waste); btnReportWaste.setOnClickListener(new
        View.OnClickListener() {
            @Override
            public void onClick(View v) {
                Intent intent = new Intent(UserMainActivity.this, ReportWasteActivity.class);
                startActivity(intent);
                    }
                });
    }
}
```

activity_user_main.xml:

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="315dp"
    android:layout_height="346dp"
    android:layout_marginStart="50dp"
    android:layout_marginTop="180dp"
    android:background="#E8F5E9"
    android:gravity="center" android:orientation="vertical"
    android:padding="16dp">
    <TextView android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginBottom="32dp"
        android:text="Activity"
        android:textColor="#388E3C"
        android:textSize="34sp" />
    <Button
        android:id="@+id/btn_report_waste"
        android:layout_width="218dp"
        android:layout_height="wrap_content"
        android:backgroundTint="#2E7D32"
        android:text="Report Waste" />
</LinearLayout>
```

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CollectorMain Activity.java:

```java
package com.example.smart_waste_management; import
android.content.Intent;
import android.os.Bundle; import
android.view.View; import
android.widget.Button;
import androidx.appcompat.app.AppCompatActivity;
public class CollectorMainActivity extends AppCompatActivity { private
    Button btnViewReports;
    private Button btnRecycleReport; private
    Button btnHotspots; @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_collector_main); btnViewReports
        = findViewById(R.id.btn_view_reports);
    btnRecycleReport = findViewById(R.id.btn_recycle_report); btnHotspots =
findViewById(R.id.btn_hotspots);
        btnViewReports.setOnClickListener(new View.OnClickListener() { @Override
            public void onClick(View v) {
                Intent intent = new Intent(CollectorMainActivity.this, ViewReportsActivity.class);
                startActivity(intent);
                    }
                });
        btnRecycleReport.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                Intent intent = new Intent(CollectorMainActivity.this, RecycleReportActivity.class);
                startActivity(intent);
                    }
                });
        btnHotspots.setOnClickListener(new View.OnClickListener() { @Override
            public void onClick(View v) {
                Intent intent = new Intent(CollectorMainActivity.this, HotstopsActivity.class);
                startActivity(intent);
                    }
                });
    }
}
```

activity_collector_main.xml:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="315dp"
    android:layout_height="400dp"
    android:orientation="vertical"
    android:layout_marginStart="55dp"
    android:layout_marginTop="150dp"
    android:gravity="center"
    android:background="#E8F5E9"
    android:padding="16dp">
    <TextView android:layout_width="196dp"
        android:layout_height="wrap_content"
        android:layout_marginBottom="32dp"
        android:text="Activities"
        android:textColor="#388E3C"
```

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```xml
        android:textSize="30sp" />
    <Button
        android:id="@+id/btn_view_reports" android:layout_width="221dp"
        android:layout_height="wrap_content"
        android:layout_marginBottom="16dp"
        android:backgroundTint="#2E7D32"


        android:text="View Reports" />
    <Button
        android:id="@+id/btn_recycle_report"
        android:layout_width="222dp"
        android:layout_height="wrap_content"


        android:layout_marginBottom="16dp"
        android:backgroundTint="#2E7D32"
        android:text="Recycle Report" />
    <Button
        android:id="@+id/btn_hotspots"
        android:layout_width="221dp"
        android:layout_height="wrap_content"
        android:backgroundTint="#2E7D32"
        android:text="Hotspots" />
</LinearLayout>
```

ReportWaste Activity.java:

```java
package com.example.smart_waste_management; import
android.content.Intent;
import android.os.Bundle; import
android.view.View; import
android.widget.Button; import
android.widget.EditText; import
android.widget.Toast;
import androidx.appcompat.app.AppCompatActivity; import
java.text.SimpleDateFormat;
import java.util.Date;
public class ReportWasteActivity extends AppCompatActivity { private
    EditText etWasteType, etWasteLocation;
    private Button btnSubmitReport; private
    DBHelper dbHelper; private String
    username; @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_report_waste); etWasteType =
        findViewById(R.id.et_waste_type); etWasteLocation =
        findViewById(R.id.et_waste_location); btnSubmitReport =
        findViewById(R.id.btn_submit_report); dbHelper = new
        DBHelper(this);
        username = getIntent().getStringExtra("username");
        btnSubmitReport.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                String wasteType = etWasteType.getText().toString().trim();
                String wasteLocation = etWasteLocation.getText().toString().trim(); if
                (wasteType.isEmpty() || wasteLocation.isEmpty() ) {
```
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```java
                Toast.makeText(ReportWasteActivity.this, "Report:Error",
Toast.LENGTH_SHORT).show();
             return;
         }
         String reportDetails = "Type: " + wasteType + "\n" +
             "Location: " + wasteLocation + "\n" ;
         dbHelper.updateCollect(username, reportDetails, 0, 0, new SimpleDateFormat("yyyy- MM-
dd").format(new Date()));
         Toast.makeText(ReportWasteActivity.this, "Report Added successfully",
Toast.LENGTH_SHORT).show();
         Intent intent = new Intent(ReportWasteActivity.this, UserMainActivity.class);
         startActivity(intent);
             }
         });
    }
}
```

activity_report_waste.xml:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
   android:layout_width="315dp"
   android:layout_height="346dp"
   android:layout_marginStart="50dp"
   android:layout_marginTop="120dp"
   android:background="#E8F5E9"
   android:orientation="vertical" android:gravity="center"
   android:padding="16dp">
   <TextView   android:id="@+id/textView"
      android:layout_width="wrap_content"
      android:layout_height="wrap_content"
      android:layout_marginStart="15dp"
      android:layout_marginTop="16dp"
      android:text="Details"
      android:layout_marginBottom="10dp"
      android:textColor="#388E3C"
      android:textSize="28sp" />
   <EditText android:id="@+id/et_waste_type"
      android:layout_width="match_parent"
      android:layout_height="48dp"
      android:hint="Type of Waste"
      android:layout_marginBottom="16dp"/>
   <EditText android:id="@+id/et_waste_location"
      android:layout_width="match_parent"
      android:layout_height="48dp"
      android:hint="Location"
      android:layout_marginBottom="16dp"/>
   <Button
      android:id="@+id/btn_submit_report"
      android:layout_width="185dp"
      android:layout_height="wrap_content"
      android:backgroundTint="#2E7D32"
      android:text="Submit Report" />
</LinearLayout>
```

ViewReports Activity.java:

```java
package com.example.smart_waste_management; import
android.os.Bundle;
import android.view.View; import
android.widget.ListView; import
android.widget.Toast;
import androidx.appcompat.app.AppCompatActivity; import
java.util.List;
public class ViewReportsActivity extends AppCompatActivity { private
   ListView listView;
   private WasteReportAdapter adapter; private
   DBHelper dbHelper;
   private List<WasteReport> wasteReports; @Override
   protected void onCreate(Bundle savedInstanceState) {
      super.onCreate(savedInstanceState);
      setContentView(R.layout.activity_view_reports); listView =
      findViewById(R.id.list_reports); dbHelper = new
      DBHelper(this);
      wasteReports = dbHelper.getUncollectedReports(); if
      (wasteReports.isEmpty()) {
         android.util.Log.d("ViewReportsActivity", "No uncollected reports found.");
         listView.setVisibility(View.GONE);
         Toast.makeText(this, "No list", Toast.LENGTH_SHORT).show(); return;
      }
      adapter = new WasteReportAdapter(this, dbHelper,
R.layout.waste_report_item,wasteReports);
      listView.setAdapter(adapter);
   }
}
```

activity_view_reports.xml:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
   android:layout_width="300dp"
   android:layout_height="600dp" android:layout_marginStart="30dp"
   android:layout_marginTop="120dp"
   android:layout_marginBottom="10dp" android:orientation="vertical">
   <ListView android:id="@+id/list_reports"
      android:layout_marginStart="30dp"
      android:layout_width="match_parent"
      android:background="#E8F5E9"
      android:layout_height="558dp"
      android:layout_weight="1" />
</LinearLayout>
```

RecycleReport Activity.java:

```java
package com.example.smart_waste_management; import
android.os.Bundle;
import android.view.View; import
android.widget.ListView; import
android.widget.Toast;
import androidx.appcompat.app.AppCompatActivity; import
java.util.List;
public class RecycleReportActivity extends AppCompatActivity { private
   ListView listView;
```

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```java
    private RecycledReportAdapter adapter; private
    DBHelper dbHelper;
    private List<WasteReport> wasteReports; @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_recycle_report); listView
        = findViewById(R.id.list_reports); dbHelper = new
        DBHelper(this);
        wasteReports = dbHelper.getUnrecycledReports(); if
        (wasteReports.isEmpty()) {
            android.util.Log.d("RecycledReportActivity", "No unrecycled reports found.");
            listView.setVisibility(View.GONE);
            Toast.makeText(this, "No List", Toast.LENGTH_SHORT).show(); return;
        }
        adapter = new RecycledReportAdapter(this, dbHelper, R.layout.recycle_itemlayout, wasteReports);
        listView.setAdapter(adapter);
    }
}
```

activity_recycle_report.xml:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="300dp"
    android:layout_height="600dp" android:layout_marginStart="30dp"
    android:layout_marginTop="120dp"
    android:layout_marginBottom="10dp" android:orientation="vertical">
    <ListView android:id="@+id/list_reports"
        android:layout_marginStart="30dp"
        android:layout_width="match_parent"
        android:background="#E8F5E9"
        android:layout_height="558dp"
        android:layout_weight="1" />
</LinearLayout>
```

DBHelper.java:

```java
package com.example.smart_waste_management;

import android.annotation.SuppressLint; import
android.content.ContentValues; import
android.content.Context;
import android.database.Cursor;
import android.database.sqlite.SQLiteDatabase; import
android.database.sqlite.SQLiteOpenHelper; import
java.util.ArrayList;
import java.util.List;
public class DBHelper extends SQLiteOpenHelper {
    private static final String DATABASE_NAME = "SmartWasteManagement.db"; private static
    final int DATABASE_VERSION = 1;
    private static final String TABLE_USERS = "users";
    private static final String TABLE_WASTE_REPORTS = "waste_reports"; private
    static final String COLUMN_USER_ID = "user_id";
    private static final String COLUMN_USERNAME = "username"; private
    static final String COLUMN_PASSWORD = "password"; private static
    final String COLUMN_NAME = "name";
    private static final String COLUMN_LOCATION = "location"; private
    static final String COLUMN_ROLE = "role";
```

```java
    private static final String COLUMN_REPORT_ID = "report_id";
    private static final String COLUMN_REPORT_DETAILS = "report_details"; private
    static final String COLUMN_COLLECTED = "collected";
    private static final String COLUMN_RECYCLED = "recycled";
    private static final String COLUMN_COLLECTION_DATE = "collection_date"; public
    DBHelper(Context context) {
        super(context, DATABASE_NAME, null, DATABASE_VERSION);
    }
    @Override
    public void onCreate(SQLiteDatabase db) {
        String CREATE_USERS_TABLE = "CREATE TABLE " + TABLE_USERS + "("
            + COLUMN_USER_ID + " INTEGER PRIMARY KEY AUTOINCREMENT,"
            + COLUMN_USERNAME + " TEXT,"
            + COLUMN_PASSWORD + " TEXT,"
            + COLUMN_NAME + " TEXT,"
            + COLUMN_LOCATION + " TEXT,"
            + COLUMN_ROLE + " TEXT" + ")";
        String CREATE_WASTE_REPORTS_TABLE = "CREATE TABLE " +
TABLE_WASTE_REPORTS + "("
            + COLUMN_REPORT_ID + " INTEGER PRIMARY KEY AUTOINCREMENT,"
            + COLUMN_USERNAME + " TEXT,"
            + COLUMN_REPORT_DETAILS + " TEXT,"
            + COLUMN_COLLECTED + " INTEGER,"
            + COLUMN_RECYCLED + " INTEGER,"
            + COLUMN_COLLECTION_DATE + " TEXT" + ")"; db.execSQL(CREATE_USERS_TABLE);
        db.execSQL(CREATE_WASTE_REPORTS_TABLE);
    }
    @Override
    public void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {
        db.execSQL("DROP TABLE IF EXISTS " + TABLE_USERS); db.execSQL("DROP
        TABLE IF EXISTS " + TABLE_WASTE_REPORTS);
        onCreate(db);
    }
    // Method to add a new user
    public void addUser(String username, String password, String name, String location, String role)
{
        SQLiteDatabase db = this.getWritableDatabase();
        ContentValues values = new ContentValues();
        values.put(COLUMN_USERNAME, username);
        values.put(COLUMN_PASSWORD, password);
        values.put(COLUMN_NAME, name);
        values.put(COLUMN_LOCATION, location);
        values.put(COLUMN_ROLE, role);
        db.insert(TABLE_USERS, null, values); db.close();
    }
    public boolean authenticateUser(String username, String password) {
        SQLiteDatabase db = this.getReadableDatabase();
        String[] columns = {COLUMN_USER_ID};
        String selection = COLUMN_USERNAME + "=?" + " AND " + COLUMN_PASSWORD + "=?";
        String[] selectionArgs = {username, password};
        Cursor cursor = db.query(TABLE_USERS, columns, selection, selectionArgs, null, null, null, null);
        boolean exists = cursor.getCount() > 0;
        cursor.close();
        db.close(); return
        exists;
```

```java
    }
    @SuppressLint("Range")
    public String getUserRole(String username) { SQLiteDatabase
        db = this.getReadableDatabase(); String[] columns =
        {COLUMN_ROLE};
        String selection = COLUMN_USERNAME + "=?"; String[]
        selectionArgs = {username};
        Cursor cursor = db.query(TABLE_USERS, columns, selection, selectionArgs, null, null, null); String
        role = "";
        if (cursor != null && cursor.moveToFirst()) {
            role = cursor.getString(cursor.getColumnIndex(COLUMN_ROLE));
        }
        cursor.close();
        db.close(); return role;
    }
    public void addWasteReport(String username, String reportDetails, int collected, int recycled, String
collectionDate) {
        SQLiteDatabase db = this.getWritableDatabase(); ContentValues
        values = new ContentValues(); values.put(COLUMN_USERNAME,
        username); values.put(COLUMN_REPORT_DETAILS,
        reportDetails); values.put(COLUMN_COLLECTED, collected);
        values.put(COLUMN_RECYCLED, recycled);
        values.put(COLUMN_COLLECTION_DATE, collectionDate);
        db.insert(TABLE_WASTE_REPORTS, null, values);
        db.close();
    }
    public List<String> getAllWasteReports() { List<String>
        wasteReports = new ArrayList<>(); SQLiteDatabase db =
        this.getReadableDatabase();
        Cursor cursor = db.query(TABLE_WASTE_REPORTS, new String[]
{COLUMN_REPORT_DETAILS, COLUMN_COLLECTED, COLUMN_RECYCLED,
COLUMN_COLLECTION_DATE},
            null, null, null, null, null); while
        (cursor.moveToNext()) {
            @SuppressLint("Range") String reportDetails =
cursor.getString(cursor.getColumnIndex(COLUMN_REPORT_DETAILS));
            @SuppressLint("Range") int collected =
cursor.getInt(cursor.getColumnIndex(COLUMN_COLLECTED));
            @SuppressLint("Range") int recycled =
cursor.getInt(cursor.getColumnIndex(COLUMN_RECYCLED));
            @SuppressLint("Range") String collectionDate =
cursor.getString(cursor.getColumnIndex(COLUMN_COLLECTION_DATE)) == null ? "Not collected" :
cursor.getString(cursor.getColumnIndex(COLUMN_COLLECTION_DATE));
            String report = "Report Details: " + reportDetails +
                ", Collected: " + (collected == 1 ? "Yes" : "No") + ",
                Recycled: " + (recycled == 1 ? "Yes" : "No") +
                ", Date: " + (collectionDate.equals("Not collected") ? "" : collectionDate);
            wasteReports.add(report);
        }
        cursor.close();
        db.close();
        return wasteReports;
    }
    public List<String> getAllRecycleReports() { List<String>
        recycleReports = new ArrayList<>(); SQLiteDatabase db =
```

```java
        this.getReadableDatabase();
        Cursor cursor = db.query(TABLE_WASTE_REPORTS, new String[]
{COLUMN_REPORT_DETAILS, COLUMN_COLLECTED, COLUMN_RECYCLED,
COLUMN_COLLECTION_DATE},
            COLUMN_COLLECTED + "=?" + " AND " + COLUMN_RECYCLED + "=?", null, null,
null, null);
        while (cursor.moveToNext()) { @SuppressLint("Range")
            String reportDetails =
cursor.getString(cursor.getColumnIndex(COLUMN_REPORT_DETAILS));
            @SuppressLint("Range") int collected =
cursor.getInt(cursor.getColumnIndex(COLUMN_COLLECTED)); @SuppressLint("Range") int
            recycled =
cursor.getInt(cursor.getColumnIndex(COLUMN_RECYCLED));
            @SuppressLint("Range") String collectionDate =
cursor.getString(cursor.getColumnIndex(COLUMN_COLLECTION_DATE)) == null ? "Not collected" :
cursor.getString(cursor.getColumnIndex(COLUMN_COLLECTION_DATE));
            String report = "Report Details: " + reportDetails +
                ", Collected: " + (collected == 1 ? "Yes" : "No") + ",
                Recycled: " + (recycled == 1 ? "Yes" : "No") +
                ", Date: " + (collectionDate.equals("Not collected") ? "" : collectionDate);
            recycleReports.add(report);
        }
        cursor.close();
        db.close();
        return recycleReports;
    }
    public List<WasteReport> getUncollectedReports() { List<WasteReport>
        uncollectedReports = new ArrayList<>(); SQLiteDatabase db =
        this.getReadableDatabase();
        Cursor cursor = db.query(TABLE_WASTE_REPORTS, new String[]
{COLUMN_REPORT_ID, COLUMN_REPORT_DETAILS, COLUMN_COLLECTED,
COLUMN_RECYCLED, COLUMN_COLLECTION_DATE},
            COLUMN_COLLECTED + "=0" , null, null, null, null); while
        (cursor.moveToNext()) {
            @SuppressLint("Range") String reportId =
cursor.getString(cursor.getColumnIndex(COLUMN_REPORT_ID));
            @SuppressLint("Range") String reportDetails =
cursor.getString(cursor.getColumnIndex(COLUMN_REPORT_DETAILS));
            @SuppressLint("Range") int collected =
cursor.getInt(cursor.getColumnIndex(COLUMN_COLLECTED));
            @SuppressLint("Range") int recycled =
cursor.getInt(cursor.getColumnIndex(COLUMN_RECYCLED));
            @SuppressLint("Range") String collectionDate =
cursor.getString(cursor.getColumnIndex(COLUMN_COLLECTION_DATE)) == null ? "Not collected" :
cursor.getString(cursor.getColumnIndex(COLUMN_COLLECTION_DATE));
            WasteReport report = new WasteReport(reportId, reportDetails, collected, recycled, collectionDate);
            uncollectedReports.add(report);
        }
        cursor.close();
        db.close();
        return uncollectedReports;
    }
    public List<WasteReport> getUnrecycledReports() {
        List<WasteReport> unrecycledReports = new ArrayList<>();
        SQLiteDatabase db = this.getReadableDatabase();
```

```java
        Cursor cursor = db.query(TABLE_WASTE_REPORTS, new String[]
{COLUMN_REPORT_ID, COLUMN_REPORT_DETAILS, COLUMN_COLLECTED,
COLUMN_RECYCLED, COLUMN_COLLECTION_DATE},
            COLUMN_COLLECTED + "=1" + " AND " + COLUMN_RECYCLED + "=0" , null,
null, null, null);
        while (cursor.moveToNext()) { @SuppressLint("Range")
            String reportId =
cursor.getString(cursor.getColumnIndex(COLUMN_REPORT_ID)); @SuppressLint("Range")
            String reportDetails =
cursor.getString(cursor.getColumnIndex(COLUMN_REPORT_DETAILS));
            @SuppressLint("Range") int collected =
cursor.getInt(cursor.getColumnIndex(COLUMN_COLLECTED)); @SuppressLint("Range") int
            recycled =
cursor.getInt(cursor.getColumnIndex(COLUMN_RECYCLED));
            @SuppressLint("Range") String collectionDate =
cursor.getString(cursor.getColumnIndex(COLUMN_COLLECTION_DATE)) == null ? "Not collected" :
cursor.getString(cursor.getColumnIndex(COLUMN_COLLECTION_DATE));

            WasteReport report = new WasteReport(reportId, reportDetails, collected, recycled, collectionDate);
            unrecycledReports.add(report);
        }
        cursor.close();
        db.close();
        return unrecycledReports;
    }
    public void updateCollect(String username, String reportDetails, int collected, int recycled, String
collectionDate) {
        SQLiteDatabase db = this.getWritableDatabase(); ContentValues
        values = new ContentValues(); values.put(COLUMN_COLLECTED,
        collected); values.put(COLUMN_RECYCLED, recycled);
        values.put(COLUMN_COLLECTION_DATE, collectionDate); String
        whereClause = COLUMN_USERNAME + "=? AND " +
COLUMN_REPORT_DETAILS + "=?";
        String[] whereArgs = new String[]{username, reportDetails};
        db.update(TABLE_WASTE_REPORTS, values, whereClause, whereArgs); db.close();
    }
    public List<String> getHotspots() { List<String>
        hotspots = new ArrayList<>();
        SQLiteDatabase db = this.getReadableDatabase();
        String query = "SELECT location, COUNT(location) AS count FROM " +
TABLE_WASTE_REPORTS +
            " GROUP BY location HAVING count > 3"; Cursor
        cursor = db.rawQuery(query, null);
        while (cursor.moveToNext()) { @SuppressLint("Range")
            String location =
cursor.getString(cursor.getColumnIndex("location"));
            hotspots.add(location);
        }
        cursor.close();
        db.close(); return
        hotspots;
    }
}
```

WasteReportAdapter.java:

```java
package com.example.smart_waste_management; import
android.content.Context;
import android.view.LayoutInflater; import
android.view.View;
import android.view.ViewGroup; import
android.widget.ArrayAdapter; import
android.widget.Button; import
android.widget.TextView; import
java.util.List;
public class WasteReportAdapter extends ArrayAdapter<WasteReport> { private
    Context context;
    private DBHelper dbHelper;

    private List<WasteReport> wasteReports; private int
    layoutResourceId;
    public WasteReportAdapter(Context context, DBHelper dbHelper, int resource, List<WasteReport>
wasteReports) {
        super(context, resource, wasteReports); this.context
        = context;
        this.dbHelper = dbHelper; this.layoutResourceId =
        resource; this.wasteReports = wasteReports;
    }
    @Override
    public View getView(int position, View convertView, ViewGroup parent) { View
        view = convertView;
        if (view == null) {
            view = LayoutInflater.*from*(context).inflate(layoutResourceId, parent, false);
        }
        WasteReport report = getItem(position);
        TextView textViewDetails = view.findViewById(R.id.*text_view_details*); Button
        btnCollect = view.findViewById(R.id.*btn_collect*);
        textViewDetails.setText(report.getReportDetails());
        btnCollect.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                dbHelper.addWasteReport(report.getReportId(), report.getReportDetails(), 1, 0, null);
                wasteReports.remove(report);
                notifyDataSetChanged();
                    }
                });
        return view;}
}
```

WasteReport.java:

```java
package com.example.smart_waste_management; public
class WasteReport {
    private String reportId; private
    String reportDetails; private int
    collected; private int recycled;
    private String collectionDate;
    public WasteReport(String reportId, String reportDetails, int collected, int recycled, String
collectionDate) {
        this.reportId = reportId; this.reportDetails =
        reportDetails; this.collected = collected;
        this.recycled = recycled; this.collectionDate
```

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```
        = collectionDate;}
    public String getReportId() { return
        reportId;}
    public String getReportDetails() {

        return reportDetails;}
    public int getCollected() { return
        collected;}
    public int getRecycled() { return
        recycled;}
    public String getCollectionDate() { return
        collectionDate;}
}
```

RecycledReportAdapter.java:

```java
package com.example.smart_waste_management; import
android.content.Context;
import android.os.Bundle;
import android.view.LayoutInflater; import
android.view.View;
import android.view.ViewGroup; import
android.widget.ArrayAdapter; import
android.widget.Button; import
android.widget.TextView; import
java.util.List;
public class RecycledReportAdapter extends ArrayAdapter<WasteReport> { private
    Context context;
    private DBHelper dbHelper;
    private List<WasteReport> recycledReports; private
    int layoutResourceId;
    public RecycledReportAdapter(Context context, DBHelper dbHelper, int resource,List<WasteReport>
recycledReports) {
        super(context, resource,recycledReports);
        this.context = context;
        this.dbHelper = dbHelper; this.layoutResourceId =
        resource; this.recycledReports = recycledReports;
    }
    @Override
    public View getView(int position, View convertView, ViewGroup parent) { View
        view = convertView;
        if (view == null) {
            view = LayoutInflater.from(context).inflate(layoutResourceId, parent, false);
        }
        WasteReport report = getItem(position);
        TextView textViewDetails = view.findViewById(R.id.text_view_details); Button
        btnRecycle = view.findViewById(R.id.btn_recycle);
        textViewDetails.setText(report.getReportDetails());
        btnRecycle.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                dbHelper.addWasteReport(report.getReportId(), report.getReportDetails(), 1, 1, null);
                recycledReports.remove(report);
                notifyDataSetChanged();
                    }        });
                return view;
    }}
```
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waste_report_item.xml:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  xmlns:tools="http://schemas.android.com/tools"
  android:layout_width="match_parent" android:layout_height="wrap_content"
  android:orientation="vertical" android:padding="8dp">
  <TextView android:id="@+id/text_view_details"
    android:layout_width="212dp"
    android:layout_height="50dp"
    android:layout_weight="1" android:textSize="16sp"
    tools:ignore="Suspicious0dp" tools:text="item" />
  <Button
    android:id="@+id/btn_recycle"
    android:layout_width="141dp"
    android:layout_height="48dp"
    android:backgroundTint="#2E7D32"
    android:text="Recycle" />
</LinearLayout>
```

recycle_itemlayout.xml:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  xmlns:tools="http://schemas.android.com/tools"
  android:layout_width="match_parent" android:layout_height="wrap_content"
  android:orientation="vertical" android:padding="8dp">
  <TextView android:id="@+id/text_view_details"
    android:layout_width="212dp"
    android:layout_height="50dp"
    android:layout_weight="1" android:textSize="16sp"
    tools:ignore="Suspicious0dp" tools:text="item" />
  <Button
    android:id="@+id/btn_collect"
    android:layout_width="141dp"
    android:layout_height="48dp"
    android:backgroundTint="#2E7D32"
    android:text="Collect" />
</LinearLayout>
```
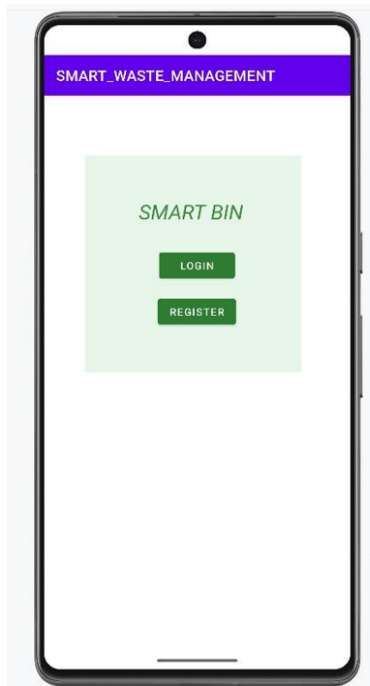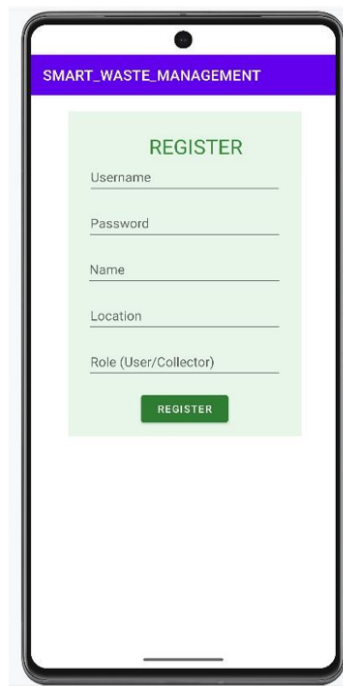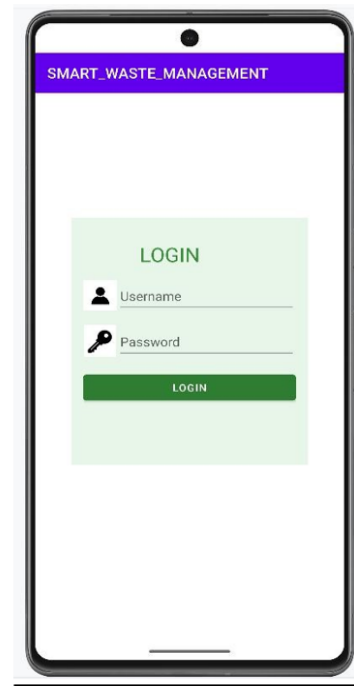
7.OUTPUT
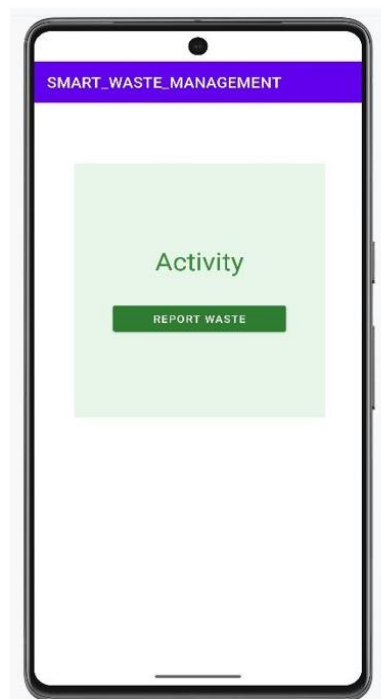

Fig.1 Home Page

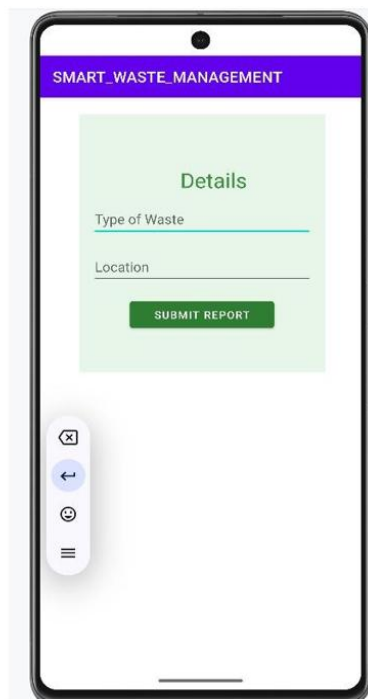Fig.2 Register Page

Fig.3 Login Page
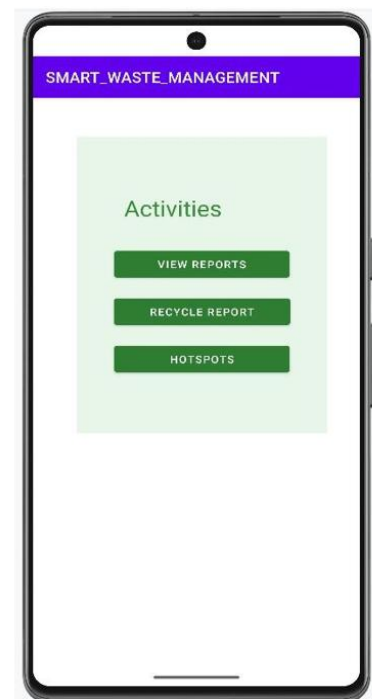

Fig.4 User Acitivty Page

Fig .5 Report waste Page

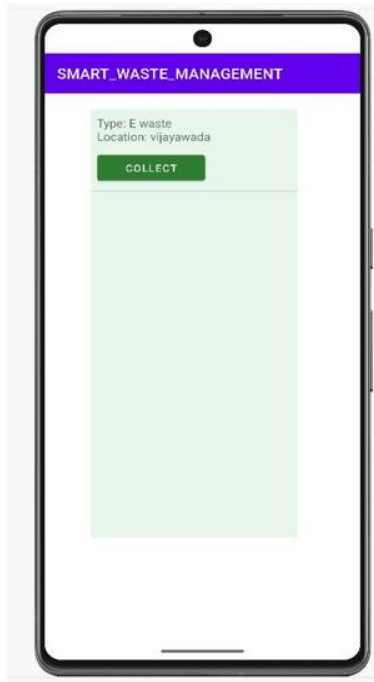Fig .6 Collector Activity Page

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Fig .7 Collect Page   Fig .8 Recycle Page

8.CONCLUSION

The Smart Bin project is a game-changer in waste management by integrating technology, real- time tracking, and data analytics to optimize waste collection and recycling.

Key Benefits:

1. Improved efficiency in waste collection through optimized routes.

2. Better accountability through real-time tracking of collection vehicles.

3. Public engagement via waste reporting features.

4. Data-driven decision-making using geospatial analysis and recycling rate monitoring.

Future Enhancements:

- AI-based smart sorting for automatic waste segregation.

- IoT-enabled smart bins that notify authorities when full.

- Blockchain-based waste tracking for transparency in recycling.

The Smart Bin application contributes to a sustainable and cleaner environment, making waste management smarter and more effective.

9.REFERENCES

1. **Android Development Guide :** https://developer.android.com/
Provides official documentation for developing Android applications, including **UI design, APIs, and best practices** for efficient mobile development.

2. **Google Maps API :** https://developers.google.com/maps
Used to integrate **real-time GPS tracking and mapping** capabilities into applications, essential for tracking waste collection vehicles in the Smart Bin app.

3. **SQLite Database :** https://www.sqlite.org/
A lightweight, embedded database that allows **local data storage and retrieval**, used in the Smart Bin app for storing user reports, waste data, and collection records.