



NIRVIGHNA – A WASTE SEGREGATION AND DISPOSAL APP USING ANDROID

A Mobile-Based Solution for Effective Waste Disposal and Sustainable Practices

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Abstract: NIRVIGHNA is an innovative Android-based application designed to address waste management challenges by offering an intuitive platform for waste segregation and disposal. This project enables users to categorize waste types (e.g., organic, plastic, metal) and guides them to the nearest dumpsite. By integrating real-time user feedback, locality selection, and reward systems for users who weigh and properly dispose of waste, NIRVIGHNA promotes sustainable waste management practices. The app leverages Android Studio for frontend development, MySQL Workbench for backend data storage, and Python Flask for API connectivity, providing a complete system for effective waste disposal. Additionally, the app's user-centric features are designed to encourage consistent participation in eco-friendly waste disposal, potentially reducing the impact of improper waste management on the environment. This paper outlines the application's development process, implementation, and its potential impact on community-driven waste management.

Index Terms – Android, Python Flask, MySQL Workbench, Waste Disposal App, Sustainability.

I. INTRODUCTION

Improper waste disposal is a critical global issue that affects environmental health, urban landscapes, and public safety. With the growth of urbanization and industrialization, the volume of waste produced has significantly increased, demanding more robust and accessible waste management solutions. Current waste disposal methods lack adequate segregation and convenient disposal mechanisms, making it challenging for individuals to actively participate in waste management.

The lack of accessible, user-friendly waste management tools has contributed to rising pollution levels, as waste often accumulates without proper segregation or disposal. Studies show that an effective waste management strategy must incorporate both technological solutions and community engagement to drive sustainable change. By offering a convenient platform that empowers users to participate in responsible waste disposal, our app aligns with global efforts toward environmental sustainability.

NIRVIGHNA application aims to address this gap by introducing a mobile solution that facilitates efficient waste segregation and disposal. The app enables users to easily classify their waste, navigate to nearby dumpsites, and earn rewards, thereby incentivizing sustainable waste management practices. This paper discusses the features, design, and implementation of the app, emphasizing its potential to streamline waste disposal and promote environmental consciousness among urban populations.

II. LITERATURE SURVEY

Improper waste disposal remains a critical challenge globally, especially in urban areas where rapid urbanization and industrialization contribute to significant waste generation. Effective waste management often hinges on proper waste segregation. Singh et al. (2019) emphasize that segregating waste at the source leads to improved recycling rates and reduced landfill waste. However, traditional waste management systems face challenges, such as lack of infrastructure and public engagement, as highlighted by Raza and Ahmed (2020).

Mobile applications have emerged as a promising solution for promoting waste segregation. Apps such as WasteNoTime and Recycle Coach have successfully informed users about waste segregation and nearby recycling centers, relying on user-friendly interfaces and notifications to enhance participation (Kaur et al., 2021) [1]. However, many existing apps focus solely on recycling rather than offering a complete waste management solution, including waste classification and disposal options. Sarkar et al. (2022) argue that a more integrated approach is needed to encourage active participation in all aspects of waste management [2].

Community engagement is critical for the success of waste management systems. Bansal et al. (2020) emphasize the importance of involving local communities to ensure effective waste segregation and disposal. Additionally, Khan et al. (2020) demonstrate that incorporating rewards and gamification into waste disposal practices can incentivize greater participation and reduce improper disposal [3]. NIRVIGHNA builds upon these concepts by rewarding users for correctly disposing of waste, aligning with the literature's call for community-driven solutions.

Technological advancements, such as GPS and real-time data processing, are increasingly being integrated into waste management systems. Verma and Singh (2021) discuss how the incorporation of GPS and APIs helps users locate nearby recycling points and dispose of waste more efficiently. Furthermore, the use of backend systems like MySQL and Flask is crucial for ensuring seamless data management in these applications [4]. NIRVIGHNA leverages these technologies to provide a comprehensive platform for waste management.

Despite the potential of mobile apps in waste management, user retention and location accuracy remain challenges. Jain and Sharma (2020) identify that many users abandon apps after initial use, while Sharma et al. (2021) highlight that inaccuracies in GPS data can hinder the effectiveness of location-based services [5]. NIRVIGHNA addresses these concerns by designing a user-friendly app and improving location accuracy through partnerships with local authorities.

III. EXISTING SYSTEM

Traditional waste disposal methods do not incentivize people to segregate their waste. There are limited efforts to educate or reward users for responsible waste disposal, which results in poor participation. Waste collection systems often fail to provide clear instructions on how to manage different waste types, and there is little to no feedback for users regarding their disposal habits.

Existing waste management systems predominantly rely on traditional methods of waste collection and disposal, which often lack efficiency in waste segregation. Most urban areas still use manual collection and dumping systems that do not facilitate recycling or proper segregation of waste at the source.

- Traditional waste management relies on manual collection and disposal, lacking efficient waste segregation.
- Existing mobile apps (e.g., WasteNoTime, Recycle Coach) primarily guide users to recycling points but don't provide complete waste management solutions.
- Many apps focus only on recycling, neglecting other waste types and proper disposal.
- Lack of integrated solutions and incentive systems reduces user participation.

IV. PROPOSED SYSTEM

NIRVIGHNA, the proposed system, overcomes the deficiency in the existing waste management system because it is an efficient and user-friendly as well as engaging platform for the segregation of waste disposal. This waste disposal app provides the correct guidelines to the user in proper waste segregation and ensures waste is divided into the correct categories: organic, plastic, metal, rags, paper, and Styrofoam packs. It also

uses a reward system to encourage users to properly dispose of waste. Users receive rewards based on the weight of the waste they dispose of properly in the nearest dump site.

A salient characteristic of this app is that it includes location-based services that enable users to locate the nearest authorized dumpsites or recycling centers. This indeed ensures convenience and reduces guesswork about how to find proper disposal points, thereby making users more likely to carry out responsible waste disposal practices. Moreover, the app promotes environmental awareness by offering users sustainable living tips, further reinforcing eco-friendly behavior beyond waste management.

NIRVIGHNA's proposed system will be implemented using modern technologies to provide a smooth, responsive, and interactive experience. The application will be developed in Android Studio with its frontend being built using XML for layout design and Java for backend functionality. It will use MySQL Workbench for user data management and storage, which will include login credentials, waste disposal history, type of waste selected, locality of dumpsite, and user bank details to initiate payment after successful disposal. The application integrates API utilizing Python Flask that connects the app to the backend database for real-time processing and communication.

The above combination of features and technology by this android app encourages active participation in waste segregation streamlines the disposal process, thereby contributing to a cleaner, more sustainable environment through responsible waste management practice penetration.

4.1 How to Create NIRVIGHNA App in Android Studio?

1. Installation: Download and install Android Studio to your system to open a new project for the NIRVIGHNA app.

2. New Project: Open Android Studio and select "New Project" and then an appropriate template, such as Empty Activity.

3. Creating the User Interface: This is achieved by using XML to design the layout of an application, which goes through classes of screens, such as user login, sustainable tips, type of waste, navigation, and user profiles.

- It should include buttons, text fields, or image views for the parts of sections (waste categories, sustainable tips, and rewards).
- Java is the programming language used for the development of login of Android apps.
- In Android Studio, Java interacts with the Android SDK (Software Development Kit), which provides pre-built classes and methods for developing mobile applications.
- Functionality involves responding to button clicks, retrieving data from a database, and managing user sessions.

4. Implement Waste Segregation Functionality: Create logic through buttons or dropdowns to classify different types of waste into, for example, organic, plastic, or metal. Use RecyclerView or GridView to represent the waste categories.

5. Set Up Backend with MySQL: Create a database and required tables for storing user data, types of waste, and their locations in the MySQL Workbench system. Create an application-to-MySQL connection with Volley or Retrofit for network requests.

6. Reward System Development: The system keeps track of the volume of waste disposed of by the users. It employs a points scheme for rewarding the users for proper waste disposal.

7. Connection of Flask API: Flask, a lightweight Python web framework, is used to build RESTful APIs for communication between the Android app and MySQL database.

- Flask acts as the middle layer in processing requests and managing data flow.
- The app sends HTTP requests (e.g., GET, POST) to the Flask API.
- Flask retrieves or updates data in MySQL based on the request.
- The app receives JSON responses with the required information for display or further action.

8. Test and Debug: While running an emulator or actual device, bugs and the app's smooth functioning will be checked.

4.2 Advantage of the Proposed System

- Helps users categorize waste accurately, enhancing organized disposal.
- Guides users to nearby dumpsites, making responsible disposal easy.
- Rewards users for correct disposal, encouraging regular participation.
- Provides eco-friendly tips, promoting sustainable practices among users.
- Boosts public engagement in waste management and environmental responsibility.
- Securely stores and manages user data and waste information with a robust backend.
- User-friendly interface suitable for users of all skill levels to easily explore the app.

V. SYSTEM ARCHITECTURE

- **User Interface Layer:** The app's main screens, where users interact with features like waste categorization, location mapping, sustainable tips, and the reward system.
- **Application Logic Layer:** Handles core functionalities, such as waste segregation logic, rewards calculation, and navigation. It also connects to backend services to retrieve data on disposal sites, update user points, and provide real-time feedback.
- **Data Storage Layer:** Uses MySQL database to securely store user profiles, waste types, reward points, and location data.
- **API Layer:** Python Flask API connects the front end and back end, enabling communication between the app and database.
- Manages data requests, including user login, waste updates, and dumpsite location retrieval.

5.1 Target Audience

- **Individuals in Urban Areas:** Particularly city residents looking for convenient waste disposal solutions.
- **Environmentally Conscious Users:** Users motivated by eco-friendly practices and sustainable living.
- **Local Communities and Municipalities:** Can benefit from organized waste disposal and better waste management practices.

5.2. Alignment with Sustainable Development Goals (SDGs)

- **SDG 11:** Sustainable Cities and Communities - Promotes sustainable waste management to support healthier urban environments.
- **SDG 12:** Responsible Consumption and Production - Encourages responsible disposal practices, reducing waste and promoting recycling.

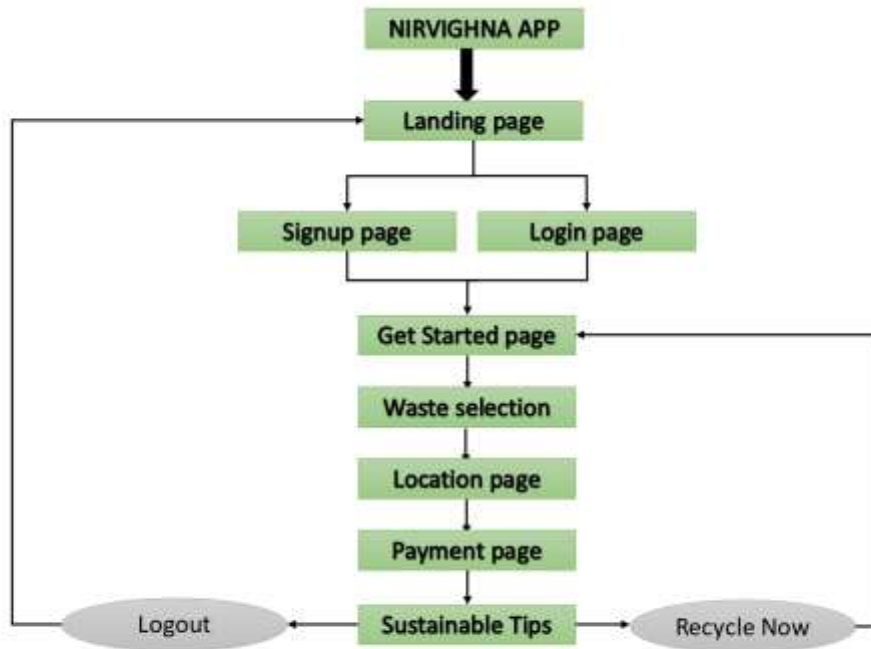


Fig – SYSTEM ARCHITECTURE OF APP

VI. ALGORITHM

The NIRVIGHNA app’s algorithm is designed to facilitate waste segregation, disposal, and user rewards.

6.1. User Registration and Login:

- **Input:** User email, password.
- **Process:** Verify if user exists in the MySQL database.

```

// Using Volley to send login request
StringRequest stringRequest = new StringRequest(Request.Method.POST, LOGIN_URL,
response -> {
    if (response.equals("success")) {
        // Redirect to main page
    } else {
        // Show error
    }
});
  
```

| id | full_name | email | password | created_at |
|----|-----------|--------------------|----------|---------------------|
| 1 | vaishu | vaishu@gmail.com | vaishu | 2024-10-21 11:18:39 |
| 2 | lily | lily@gmail.com | lilylily | 2024-10-21 12:49:21 |
| 3 | vihaan | vihaan@gmail.com | vihaan | 2024-10-21 21:53:49 |
| 4 | rachel | rachel@gmail.com | rachel | 2024-10-21 22:06:56 |
| 5 | vennala | vennala@gmail.com | vennala | 2024-10-23 11:24:59 |
| 6 | chandler | chandler@gmail.com | chandler | 2024-10-23 20:27:57 |
| 7 | manaswi | manaswi@gmail.com | manaswi | 2024-10-23 21:32:43 |
| 8 | madhuri | madhuri@gmail.com | madhuri | 2024-10-23 21:38:40 |

Fig- User Signup Database

| email | password |
|---------------------|-----------|
| chandler@gmail.com | chandler |
| madhuri@gmail.com | madhuri |
| manaswi@gmail.com | manaswi |
| monica@gmail.com | monica |
| neeha@gmail.com | neehaa |
| neeharika@gmail.com | neeharika |
| nivas@gmail.com | nivass |
| phoebe@gmail.com | phoebe |

Fig- Login Database

6.2. Waste Segregation:

- **Input:** Waste type selected by the user.
- **Process:** Store selected waste type in the database via Flask API.

```
@app.route('/store_waste', methods=['POST'])
def store_waste():
    waste_type = request.form['waste_type']
    # Insert into selection table in MySQL
    cursor.execute("INSERT INTO selection (waste_type) VALUES (%s)", (waste_type,))
```



| id | waste_type |
|----|----------------|
| 1 | Metal |
| 2 | Metal |
| 3 | Syro-foam Pads |
| 4 | Metal |
| 5 | Organic Waste |
| 6 | Plastic |
| 7 | Glass |
| 8 | Organic Waste |
| 9 | Glass |

Fig – Waste type Database

6.3 Calculate and Update Rewards:

- **Input:** Waste weight submitted by the user.
- **Process:** Calculate reward points based on weight and add to the user profile.

```
// Example for updating user points
int rewardPoints = calculatePoints(weight);
user.setPoints(user.getPoints() + rewardPoints);
```

6.4. Store Data in MySQL Database:

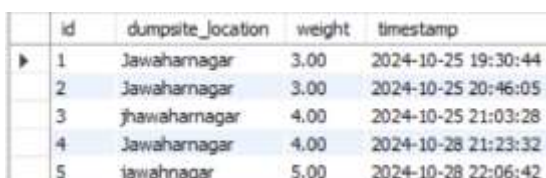
- **Process:** All app data (user profile, waste types, location, and rewards) is securely stored in MySQL.

```
# Store user data
cursor.execute("INSERT INTO users (email, points) VALUES (%s, %s)", (email, points))
db.commit()
```

6.5. Location Selection:

- **Input:** User enters their location and weight of the waste.
- **Process:** Store location and weight data in the database and calculate disposal cost if applicable.
- **Output:** Redirect to the payment page.

```
@app.route('/store_location', methods=['POST'])
def store_location():
    location = request.form['location']
    weight = request.form['weight']
    # Insert location and weight into MySQL database
    cursor.execute("INSERT INTO location (location, weight) VALUES (%s, %s)", (location,
weight))
    db.commit()
    return "location_stored"
```



| id | dumpsite_location | weight | timestamp |
|----|-------------------|--------|---------------------|
| 1 | Jawaharnagar | 3.00 | 2024-10-25 19:30:44 |
| 2 | Jawaharnagar | 3.00 | 2024-10-25 20:46:05 |
| 3 | jhawaharnagar | 4.00 | 2024-10-25 21:03:28 |
| 4 | Jawaharnagar | 4.00 | 2024-10-28 21:23:32 |
| 5 | jawahnagar | 5.00 | 2024-10-28 22:06:42 |

Fig: Location Table

6.6 Payment Processing:

- **Input:** User selects a payment method and submits payment details.
- **Process:** Verify payment details and update user payment status in the database.
- **Output:** Confirm successful payment and completion of disposal transaction.

```
@app.route('/process_payment', methods=['POST'])
def process_payment():
    account_name = request.form['accountName']
    account_number = request.form['accountNumber']
    # Verify and store payment details in MySQL database
    cursor.execute("INSERT INTO payments (account_name, account_number) VALUES (%s, %s)",
(account_name, account_number))
    db.commit()
    return "payment_success"
```

| | id | account_name | account_number | bank_name |
|---|----|---------------|----------------|---------------|
| ▶ | 1 | Phoebe Buffay | 983567320 | National Bank |
| | 2 | Alex Volkov | 8579356220 | national bank |
| | 3 | Neeharika D | 679273801 | Indian Bank |

Fig: Payment Table with sample details

VII. FEASIBILITY STUDY

7.1 Technical Feasibility:

- The app leverages widely used technologies such as Android Studio for the front end, MySQL for data storage, and Python Flask for API connections. These tools are accessible and compatible, making building, deploying, and maintaining the app feasible.
- The app's modular structure allows for easy updates and feature expansion, ensuring that future enhancements, like additional waste categories or new disposal locations, can seamlessly integrate.
- Data transfer between the app and the database is efficient, supported by reliable APIs, ensuring smooth user interactions without significant lag or technical issues.

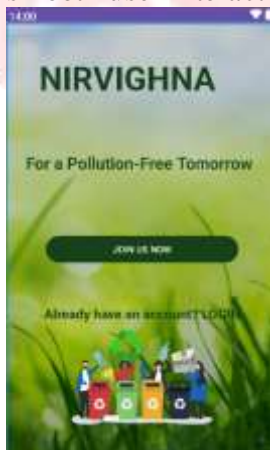


Fig: Landing Page

7.2 Economic Feasibility:

- The app is cost-effective to develop, with minimal expenses for open-source tools and services. Maintenance costs are low, as the technologies used are free or affordable.
- Incentives and rewards encourage user engagement, creating a sustainable model for adoption without heavy financial investment.



Fig: Rewards To Users

7.3 Operational Feasibility:

- The app addresses a pressing issue—improper waste disposal—and is easy to use, even for users with basic technical skills. Clear instructions and an intuitive interface ensure that users can navigate waste disposal and rewards effortlessly.
- By promoting environmental responsibility, the app aligns with sustainable goals, motivating community participation.



Fig: Waste Type Selection

7.4 Legal and Environmental Feasibility:

- The app complies with data protection regulations, as user data is securely managed within the app.
- NIRVIGHNA encourages eco-friendly practices, contributing positively to environmental sustainability, and aligns with SDGs for sustainable cities and responsible consumption.



Fig: Sustainable Tips

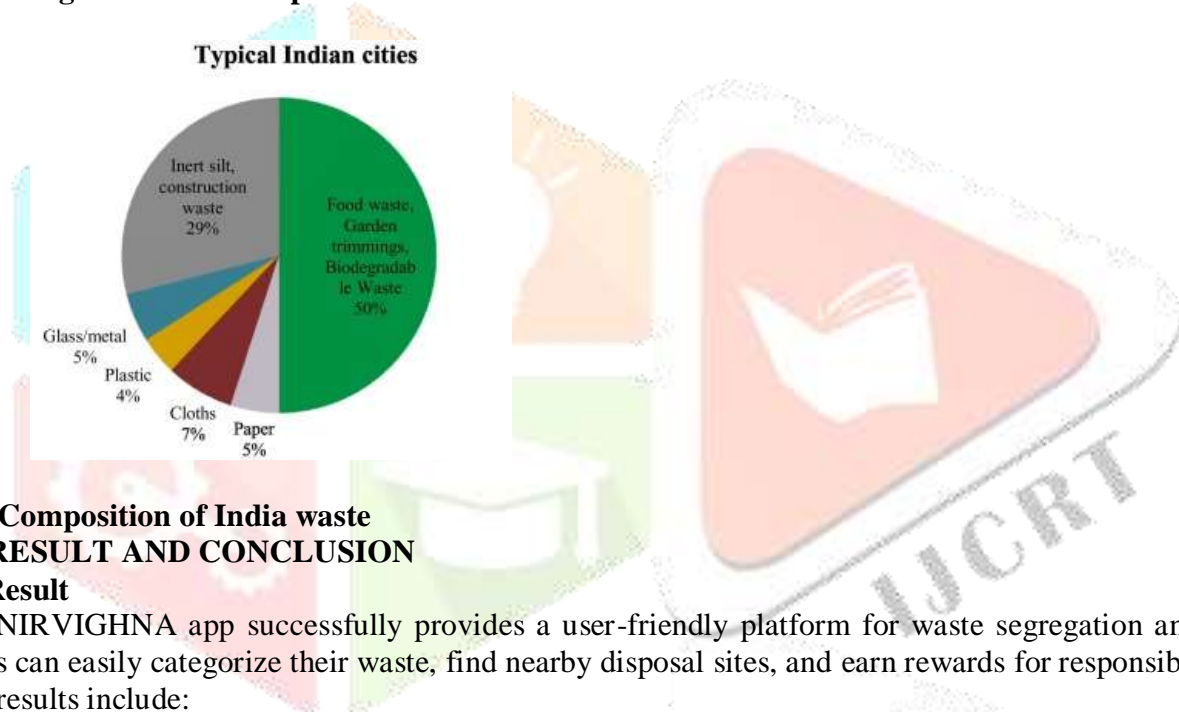


Fig: Composition of India waste

IX. RESULT AND CONCLUSION

9.1 Result

The NIRVIGHNA app successfully provides a user-friendly platform for waste segregation and disposal. Users can easily categorize their waste, find nearby disposal sites, and earn rewards for responsible disposal. Key results include:

- **User Engagement:** The rewards system encourages more users to participate in sustainable waste management.
- **Efficient Waste Tracking:** Data on waste type, weight, and disposal location is securely stored, enabling accurate tracking and management.
- **Increased Awareness:** The app's sustainable tips section educates users on eco-friendly practices, promoting long-term environmental consciousness.

9.2 Conclusion

The NIRVIGHNA app provides a practical solution for waste segregation and disposal, promoting environmentally friendly habits through a user-friendly, reward-based platform. By simplifying waste management and educating users with sustainable tips, the app encourages responsible disposal practices. The project demonstrates how mobile technology can drive positive environmental change and empower communities to contribute to sustainability.

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These references cover the foundational sources that would be helpful for your research paper, covering waste management technologies, mobile apps, and tools used in the development of your project.