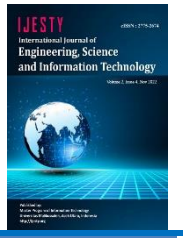
International Journal of Engineering, Science & InformationTechnology (IJESTY)
Volume 2, No. 4 (2022) pp. 61-69
ISSN 2775-2674 (online)
Website: http://ijesty.org/index.php/ijesty
DOI: https://doi.org/10.52088/ijesty.v1i4.327
Research Paper, Short Communication, Review, Technical Paper



"WASTEAPP" Application Based on Android for Household Waste Self-Tracking

Zara Yunizar[1], Nanda Savira Ersa[2], Zalfie Ardian[3], Rusnani[1], Fathan Maulana Helmi[2]

[1]Department of Informatics, Universitas Malikussaleh, Aceh, Indonesia
[2]Department of Civil Engineering, Universitas Malikussaleh, Aceh, Indonesia
[3]Department of Information System, Universitas Malikussaleh, Aceh, Indonesia
**Corresponding author E-mail: nanda.savira@unimal.ac.id*

Manuscript received 19 July 2022; revised 1 Sept 2022; accepted 15 Sept 2022. Date of publication 4 Nov 2022

Abstract

Rapid population growth has both a positive and a negative impact, such as an increase in household waste generation. This also becomes a new chain of problems in other aspects, such as health, flood, air pollution, and environmental pollution. To overcome this problem, an integrated waste management system is needed. Household waste, especially inorganic waste, was valuable. The application was developed to promote a new paradigm; waste is a new source of money. As well as help run a circular economy in the waste recycling industry. The application to be built is "WasteApp", an independent household waste management application that can track and help manage it. This application is built using the Android operating system to make it a user-friendly tool. An application trial was conducted in Geulanggang Baro village, Bireuen district involving the operator, local government, and community. This location was chosen because they already have informal waste management, and it is easier to maximize by information technology intervention. The final result of this research is the "WasteApp" application based on android to manage household waste independently. The community, operator, and local government can work waste independently and systematically through this system. This application contains several menus, including the Home menu, login, register, and the main menu, namely the waste sell history and selling waste, as well as educational articles that contain how to manage waste, from sorting waste to the recycling process. Community participation was needed to increase to full implementation of good waste management.

***Keywords**: Android, Application, Household Waste, WasteApp.*

1. Introduction

A rapid increase in several populations of the earth has led to a new problem, i.e., an increase in a waste generation [1] [2], specifically household waste in a developing country [3]. Moreover, it is intensified by the lack of community awareness and understanding of the household waste sector [4]. The community still does not understand how to manage household waste properly. In addition, they care less about the impact of mismanaged household waste and the economic value of household waste.

Household waste comes from daily activities consisting of organic waste (kitchen, yard waste, etc.) and inorganic (paper, cans, etc.). In general, Indonesian people's waste management is still based on the collection, transport, and disposal without waste segregation. Consequently, the government bears higher waste management costs to increase waste management operational costs. In Indonesia, people are not used to reducing the consumption of products (minimization) or reusing their waste. However, recycling behavior for waste such as plastic bottles, paper, and so on has often been carried out, especially involving the informal sector. Therefore, the right waste management system for Indonesian people starts with recycling [5].

Indonesia, especially the province of Aceh, is now facing the complicated problem of household waste. Some of the problems faced by the government include the landfill being too far from the city center, the impact on higher operational costs, the landfill has exceeded its capacity, and so on. Furthermore, the government's lack of waste transportation services has resulted in the accumulation of waste around Bireuen city. It has caused other impacts, such as odor pollution, flooding, and other health problems. Good Environmental Governance could be achieved through good waste management, i.e. preventive and repressive [6].

Community and government is play the main role of development in developing country [7], including waste problem. The waste crisis problem could be accelerated by involving community actively [8]. A new paradigm is currently being promoted by the government, n: waste an economic value resource. Through this program, people are expected to manage their own waste. Finally, in the future, it will led to an environmental new paradigm where it focused on the quality and utilization of recovered materials and energy [9].

In this research, a waste management program was developed to support the government he t problem. This application help the people to find out the daily generation of household waste produced and how it is managed, so thatpeople can find out the economic value of waste.

In addition, this application also helps the government to obtain data on the waste generation and composition in their area by an integrated system.
Several studies related to waste management based on information technology have been carried out before; to check the poisonous gas from waste[10]; IoT to monitor the volume of garbage bins [11][12]. In this study, the applications not only to created can be used by the community independently and by waste operators and local government. Besides, public awareness in managing household waste could be increased, thus able to be new income for people

2. Literature Review

2.1. Waste Management

Based on Law of Indonesia No. 18 Year 2008 about Waste Management, waste is the daily residue of human activities or natural processes in solid or semi-solid form in the form of organic or inorganic substances that are biodegradable or non-degradable which are considered useless and disposed of into the environment. Household waste is waste generated from everyday household life.
Household waste and household-like waste management consists of (1) Waste reduction, including activities to limit waste generation, waste recycling, and/or waste reuse. (2) Waste handling, including; waste segregation and classification according to the type, quantity, and/or nature of the waste; collection and transfer of waste from waste sources to temporary storage sites or integrated waste processing sites; transportation of pick up waste from the source and/or from the temporary waste collection site or from the integrated waste processing site to the final processing site; processing of changing the characteristics, composition, and quantity of waste; waste final processing of safely returning waste and/or residue from previous processing to environmental media.
In Indonesia, the classification of waste that is often used is as follows a) organic waste, or wet waste, which consists of leaves, wood, paper, cardboard, bones, leftover animal feed, vegetables, fruit, etc; b) inorganic waste, or dry waste consisting of cans, plastic, iron and other metals, glass and mica. Quantifying of waste generation is needed to design the equipment used for waste transportation, material recovery facilities and Final Processing Sites (landfill). Waste generation is usually expressed in terms of volume and weight. Waste generation can be expressed in [13]; Units of weight: kilograms per person per day (kg/org/d) or kilograms per square meter of building per day (kg/m2/h) or kilograms per bed per day (kg/tt/d) and so on; Volume units: liters/person/day (l/o/h) or liters per square meter of building per day (l/m2/h).

2.2. System

Information systems are widely used to improve the performance of an organization to be more effective and integrated, so that it has consistent data and can be utilized more optimally. One form of the current informat ion system is in the form of an application that can be used by anyone who has access to use the application by installing the application, the installed application will present the information the user wants and can be used more efficiently and effectively because the system is more efficient and flexible.

2.3. Android

Android is a collection of software in mobile devices that includes an operating system, middleware, and main mobile applications. Android is a Linux-based operating system, currently, Android is turning into a platform that innovates quickly thanks to its main developer, namely Google, which acquired Android Pafda in 2009. Until now, Android has always released its latest version of the operating system, starting from Android version 1.1 which was released in March 2009, to Android 12 (Snow Cone) which was launched in October 2021.
Android version 12 was first released on October 4, 2021, this version has a major update to Material Design which is then referred to as “Material You.” Some of the advantages of this version are that the operating system can automatically generate color themes for system menus and supported applications using the user's wallpaper color, is equipped with a feature to take screenshots of the full or scrolling web view, and can prevent applications from using applications and the microphone via quick settings.

3. Methods

The integrated waste management system that will be built through an application based on Android called "WasteApp". WasteApp was developed to manage household waste independently, which can track and help manage it. This application was built using the Android operating system.
The implementation stage in this research begins with a literature study, such as by reading books and journals related to this research, then analyzing the software requirements that will be used for installing this application. Then, the system design was built. The system used in this application is based on android. The last step is, implementing and testing the system tries to ensure the WasteApp application is running well. The local government conducted this trial as application managers in Geulanggang Baro village, Bireuen regency.

4. Results and Discussion

4.1. Application Design

The system can be defined as a group of elements, a set of constituents, and functional components that interact to achieve the expected goals [14]. This application design system is carried out using Figma software. The main menu in this application consists of:
a. Home

The home menu is the initial page of the WasteApp. In this menu, the user will be asked to log in before using the application; users who have not registered yet will be asked to write first using their email and password. Figure 1 shows the display of the Home menu.

Fig 1. WasteApp Landing Page

b. Household Waste Sales History

In this menu, the user's household waste sales history for several periods and its status will be displayed. Besides, a menu option will also be communicated to view collectors around you as well as educational articles. Figure 2 shows the appearance of the WasteApp home page. In this application, people can sell waste through the Sell Garbage menu. The waste sales page can be seen in Figure 3. In this menu, people can choose the type and input quantity of inorganic waste sold. It will help provide information for waste operators about waste generation and its characteristics.

Fig 2. WasteApp Home (Household Waste Sales History)

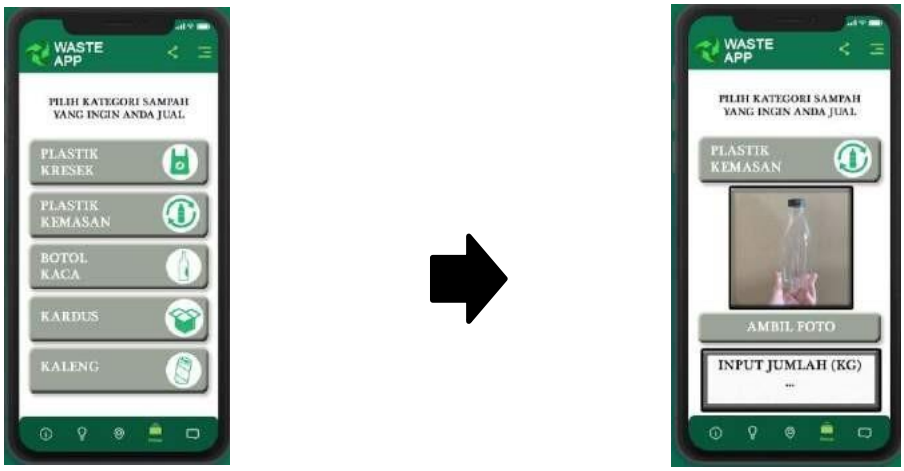


Fig 3. Waste Sales Page

c. Tracking Menu

This menu will display the address collection on the map (Figure 4). Users can use this tracking feature to find out the location of waste collection operators to predict when they will arrive [15].

Fig 4. Waste collection address

4.2. Application Design

The Wasteapp application was designed using Android Studio and Flutter using the Dart language. Figure 5 , 6, 7 show the coding of the program in the WasteApp application.

```
package com.example.sairamkrishna.myapplication;

import android.content.Intent; import
android.database.Cursor;

import android.support.v7.app.AlertDialog; import
android.support.v7.app.AppCompatActivity; import android.os.Bundle;

import android.view.View; import
android.widget.Button; import
android.widget.Toast;

public class MainUserOutput extends AppCompatActivity { DatabaseHelper
    databaseHelper;
    String area_id;
    @Override
```

```
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main_user_output); Intent intent = getIntent();

    area_id = intent.getStringExtra("AREA_ID"); databaseHelper =
    new DatabaseHelper(this);

    Button b1 = (Button)findViewById(R.id.button3); Button b2 =
    (Button)findViewById(R.id.button4); Button b3 =
    (Button)findViewById(R.id.button5); Button b4 =
    (Button)findViewById(R.id.button6); Button b5 =
    (Button)findViewById(R.id.button7); Button b6 =
    (Button)findViewById(R.id.button8); Button b7 =
    (Button)findViewById(R.id.button9);

    b1.setOnClickListener(new View.OnClickListener() { @Override }
public void showMessage(String title, String message){
```

```
        AlertDialog.Builder builder = new AlertDia-
log.Builder(this);
        builder.setCancelable(true);      //Used to cancel after
showing the message
        builder.setTitle(title);    //Set the title of the message
        builder.setMessage(message);    //Set the message
        builder.show(); // to display the message
    }
}
```

Fig 5. Main User Output

d. Activity Main

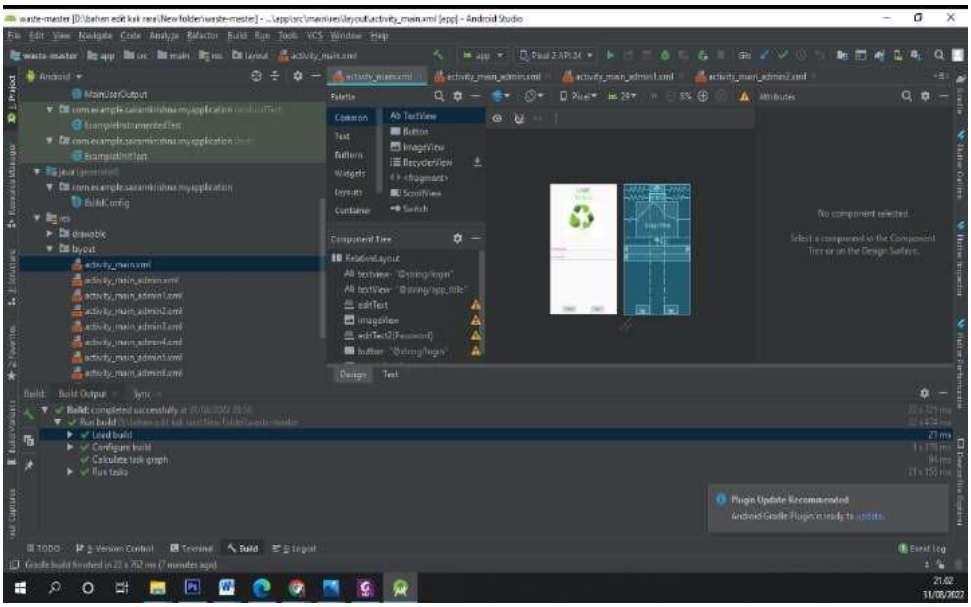


Fig 6. Activity Main

e. Databasehelper Menu

```
package com.example.sairamkrishna.myapplication;

import     android.content.ContentValues;
import   android.content.Context;   import
android.database.Cursor;

import android.database.sqlite.SQLiteDatabase; import
android.database.sqlite.SQLiteOpenHelper;

public  class  DatabaseHelper  extends  SQLiteOpenHelper  {  public
    static final String databaseName = "student.db"; public static
    final String area = "area";

    public static final String town = "town"; public
    static  final  String  taluk  =  "taluk";  public
    static final String waste = "waste";

    public static final String suggestion = "suggestion"; public
    static final String user = "user";

    public static final String grievance = "grievance"; public
    static final String area_id = "AREA_ID"; public static final
    String  taluk_id  =  "TALUK_ID";  public  static  final  String
    taluk_name  =  "TALUK_NAME";  public  static  final  String
    area_name = "AREA_NAME"; public static final String town_id
    =  "TOWN_ID";  public  static  final  String  town_name  =
    "TOWN_NAME";  public  static  final  String  waste_id  =
    "WASTE_ID";  public  static  final  String  waste_type  =
    "WASTE_TYPE"; public static final String level = "LEVEL";

    public  static  final  String  method  =  "METHOD";  public
    static final String solution = "SOLUTION";


    public static final String id = "ID";

    public static final String password = "PASSWORD"; public
    static  final  String  reason  =  "REASON";  public  static
    final String name = "NAME";
    public static final String phone_number = "PHONENUMBER"; pub-
    lic static final String email_id = "EMAIL_ID";

    public static final String user_type = "USER_TYPE"; public
    static final String col_1 = "LEVEL";

    public  static  final  String  col_2  =  "LEVEL";
    public  static  final  String  col_3  =  "LEVEL";
    public DatabaseHelper(Context context) {
        super(context, databaseName, null, 1);}
```

```
    @Override

    public    void    onCreate(SQLiteDatabase    sqLiteDatabase)    {
        sqLiteDatabase.execSQL("create table "+town+" (TOWN_ID in-
teger,      TOWN_NAME      text,primary      key(TOWN_ID))");
        sqLiteDatabase.execSQL("create table "+taluk+" ( (


        return res;
    }

    public Cursor checkAreaData(String areaID){
        SQLiteDatabase sqLiteDatabase = this.getWritableDatabase();

        Cursor res = sqLiteDatabase.rawQuery("select * from
"+area+" where area_id = "+areaID,null);

        return res;

    }


}
```

Fig 7. Database helper

4.3. Testing Using Black Box

Functional testing using the black box method that has been carried out by the application development team shows that all functions and features in the application, from the time it is first run to completion, can run well and according to what has been planned (Table 1).

Table 1. Functionality Testing Results

No	Fit	Expected Function	Status
1	Login	Login with the correct username and password according to their roles (community, officers)	Success
2	Account Registration	User account registration with entering *username* and *password*	Success
3	Waste classification menu	Displays the name and picture of each category	Success
4	Waste list menu	Displays waste data: names and pictures based on waste classification	Success
5	Add waste by people (user)	Adds waste data to the queue before it's sent to the admin	Success
6	Remove trash by peo-	Waste data selected from the queue is deleted	Success
7	Select pick-up location	Input of people (user) location data. Can choose the current location or home address.	Success
8	Submit a pick-up request	A notification appears that the waste pickup request has been sent	Success
9	Transaction menu	Displays all requests for waste pick-up	Success
10	Transaction detail	Displays detailed waste pickup information	Success
11	Successful transaction menu	Displays waste pickup transactions list that have been successfully carried out by operator	Success
12	Tips menu	Displays a list of articles related to waste management	Success
13	Profil menu	Displays user information; name, telephone number and address	Success
14	Change Profil	Name, address and password data changes with the new name, address and password.	Success

No	Fit	Expected Function	Status
15	Manage waste data by admin	Adding, modifying and deleting waste quantitiy and classification	Success
16	Manage operator data by admin	Add, change and delete data operators	Success
17	Waste pickup request menu	Displays all waste pickup requests from users	Success
18	Waste pickup request details	Displays detailed waste pickup information; address, location distance, estimated pick-up time, and user information.	Success
19	Change waste pickup request status	The pickup status changes according to the input by admin	Success
20	Waste menu successfully picked up	Displays all successful lists of waste pickup requests by users	Success
21	Rejected wWaste pickup request menu	Displays all lists of rejected user waste pick-up requests	Success
22	Operator main page menu	Displays all lists of waste pickup requests that have been processed by admin	Success
23	Route view menu	Displays a map and the route to waste pick up point location	Success
24	Public telephone by operator	Make phone calls through the app to users	Success
25	Navigation menu	Displays navigation between operator location and waste pick-up point	Success

4.4. WasteApp Application Trial

The trial was carried out by local government in Geulanggang Baro Village, Bireuen District. This location was chosen because it has carried out waste management independently, so that it can be optimized using an application to facilitate the operator performance in managing waste. Figure 8 shows the context diagram of the research re- sults.

The village facing some problems including the lack of operational costs for waste management. Cost problems are common in Indonesia [4], [16], [17]. In the case of this area, apart from the lack of support from the government, there were also many people who had not participated in waste management. One of a method to increase community participation is through reward and punishment laws [2]. To strengthen the institutional collaboration need to develop a non-hierarchical forum which is concerned in solving problem [18].

This application provides a waste-selling menu that residents can use to sell their inorganic waste. A waste sale notification will appear and the operator can pick it up at the destination house. This will make it easier for operators to sell segregated waste. It is expected that the sales results can help operational costs and economic value can also be perceived by the community. Furthermore, segregated waste will reduce the health risk to the waste operator [19].

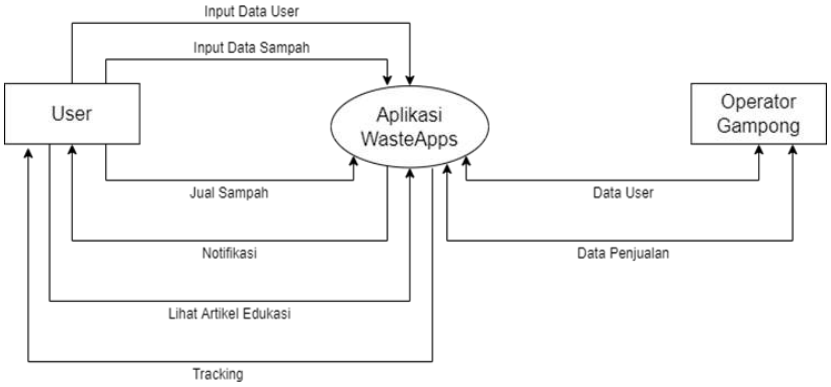


Fig 8. Context diagram of the research results

Community participation is directly proportional to the knowledge gained by the community regarding envi- ronmental management. The local government is expected to be able to provide sufficient campaigns or information,

so that it can inspire the community to manage their waste independently [20]. However, community participation in Indonesia is still lacking, one of which is due to the lack of support from the government for various community- based programs. Therefore, the important role of household waste management is mainly at the scale of the family, community and surrounding environment to convey information [1].

5. Conclusion

From the research that has been done, it can be concluded that; the WasteApp has been successfully tested with the local government of Geulanggang Baro village, Bireuen district. The features in this application was user-friendly and help users in managing household waste. Moreover, through the notification feature, users can find out the retribution schedule, so ease the collection of operational cost.

Acknowledgment

This research was funded by Universitas Malikussaleh PNBP funds year 2022 with contract number 11/PPK- 2/SPK-JL/2022.

References

[1] L. Salsabila, E. P. Purnomo, and H. D. Jovita, "The Importance of Public Participation in Sustainable Solid Waste Management," *Journal of Governance and Public Policy*, vol. 8, no. 2, pp. 106–123, Jun. 2021, doi: 10.18196/jgpp.v8i2.11519.

[2] M. Luo, X. Song, S. Hu, and D. Chen, "Towards the sustainable development of waste household appliance recovery systems in China: an agent-based modeling approach," *J Clean Prod*, vol. 220, pp. 431–444, May 2019, doi: 10.1016/j.jclepro.2019.02.128.

[3] T. C. Ogwueleka, "Survey of household waste composition and quantities in Abuja, Nigeria," *Resour Conserv Recycl*, vol. 77, pp. 52–60, Aug. 2013, doi: 10.1016/j.resconrec.2013.05.011.

[4] Z. Zainal, R. R. Rambey, and K. Rahman, "Governance of Household Waste Management in Pekanbaru City," *MIMBAR : Jurnal Sosial dan Pembangunan*, vol. 37, no. 2, Dec. 2021, doi: 10.29313/mimbar.v37i2.7947.

[5] R. N. Yusfi and T. P. Damanhuri, "STUDI KARAKTERISTIK DAN POTENSI DAUR ULANG SAMPAH DI BANTARAN SUNGAI CIKAPUNDUNG," *Jurnal Tehnik Lingkungan*, vol. 18, no. 2, pp. 155–166, Oct. 2014, doi: 10.5614/jtl.2012.8.2.6.

[6] N. Asiyah, "KEBIJAKAN PEMERINTAH KOTA LANGSA TERHADAP PENGELOLAAN SAMPAH DALAM MEMENUHI PRINSIP GOOD ENVIRONMENTAL GOVERNANCE," *Jurnal Hukum Samudra Keadilan*, vol. 14, no. 2, pp. 316–327, Dec. 2019, doi: 10.33059/jhsk.v14i2.1920.

[7] D. Fardiah, F. Darmawan, and R. Rinawati, "Government and Society Synergy For Community-Based Internet Development," *MIMBAR : Jurnal Sosial dan Pembangunan*, vol. 35, no. 2, pp. 265–276, Dec. 2019, doi: 10.29313/mimbar.v35i2.4404.

[8] D. Knickmeyer, "Social factors influencing household waste separation: A literature review on good practices to improve the recycling performance of urban areas," *J Clean Prod*, vol. 245, p. 118605, Feb. 2020, doi: 10.1016/j.jclepro.2019.118605.

[9] S. Andreasi Bassi, T. H. Christensen, and A. Damgaard, "Environmental performance of household waste management in Europe - An example of 7 countries," *Waste Management*, vol. 69, pp. 545–557, Nov. 2017, doi: 10.1016/j.wasman.2017.07.042.

[10] S. Dubey, P. Singh, P. Yadav, and K. K. Singh, "Household Waste Management System Using IoT and Machine Learning," *Procedia Comput Sci*, vol. 167, pp. 1950–1959, 2020, doi: 10.1016/j.procs.2020.03.222.

[11] Prof. Dr. S. M. Chaware, S. Dighe, A. Joshi, N. Bajare, and R. Korke, "Smart Garbage Monitoring System using Internet of Things (IOT)," *IJIREEICE*, vol. 5, no. 1, pp. 74–77, Jan. 2017, doi: 10.17148/IJIREEICE.2017.5115.

[12] A. Anitha, "Garbage monitoring system using IoT," *IOP Conf Ser Mater Sci Eng*, vol. 263, p. 042027, Nov. 2017, doi: 10.1088/1757-899X/263/4/042027.

[13] Enri Damanhuri and Tri Padmi, *Pengelolaan Sampah Terpadu*. Bandung: ITB Press, 2016.

[14] Fathansyah, *Basis Data*, 2nd ed. Bandung: Informatika Bandung, 2015.

[15] N. Nurfadillah and N. R. Kurnianda, "Analisa dan Perancangan Aplikasi Pengolahan Sampah Rumah Tangga Berbasis Android," *Jurnal Ilmiah FIFO*, vol. 11, no. 1, p. 41, Jun. 2019, doi: 10.22441/fifo.2019.v10i1.005.

[16] A. R. Mulyawan, R. P. Mahyudin, B. Badaruddin, and A. Ahmadi, "Evaluating Problems of Waste Management in Tarakan City, North Kalimantan," *International Journal of Environment, Agriculture and Biotechnology*, vol. 4, no. 3, pp. 713–719, 2019, doi: 10.22161/ijeab/4.3.18.

[17] H. Wibisono, F. Firdausi, and M. E. Kusuma, "Municipal solid waste management in small and metropolitan cities in Indonesia: A review of Surabaya and Mojokerto," *IOP Conf Ser Earth Environ Sci*, vol. 447, no. 1, p. 012050, Feb. 2020, doi: 10.1088/1755-1315/447/1/012050.

[18] L. P. Sayrani and L. M. Tamunu, "Kewargaan dan Kolaborasi Pemecahan Masalah Publik : Studi Isu Sampah di Kota Kupang," *Timorese Journal of Public Health*, vol. 2, no. 1, pp. 1–13, Sep. 2020, doi: 10.35508/tjph.v2i1.2191.

[19] J. Gutberlet and S. M. N. Uddin, "Household waste and health risks affecting waste pickers and the environment in low- and middle-income countries," *Int J Occup Environ Health*, vol. 23, no. 4, pp. 299–310, Oct. 2017, doi: 10.1080/10773525.2018.1484996.

[20] E. S. Pandebesie, I. Indrihastuti, S. A. Wilujeng, and I. Warmadewanthi, "Factors influencing community participation in the management of household electronic waste in West Surabaya, Indonesia," *Environmental Science and Pollution Research*, vol. 26, no. 27, pp. 27930–27939, Sep. 2019, doi: 10.1007/s11356-019-05812-9.