International Journal of Management Science and Information Technology (IJMSIT)
Vol. 3, No. 1, January – June 2023.
E-ISSN: 2774-5694, P-ISSN:2776-7388
DOI: https://doi.org/10.35870/ijmsit.v3i1.923

GARBAGE DISPOSAL INFORMATION SYSTEM USING INTERNET OF THINGS

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Article Info

Article history:

Received January 28, 2023
Revised March 1, 2023
Accepted March 3, 2023

KEYWORDS:

Community
Garbage
Information System
Internet of Things
Perception

ABSTRACT

The waste management carried out by the Puri Panji Kencana Residential and Buana Grand Subang Housing Communities, West Java, is related to the community's perception of waste and the condition of the area where they live. Therefore, this study aims to determine the public's perception of waste, the waste management system, and the public's perception of the effectiveness of waste management in areas with different topography. This study used a survey method with data collection techniques in the form of distributing questionnaires to the respondents. The sampling technique used in this study was quota sampling by selecting 90 respondents in the three research areas. The analysis technique used is the crosstabs and chi square techniques obtained using the SPSS program. The results of this study indicate that people in the three regions with different topography have a positive perception of waste and regard waste as items that can still be recycled. There are differences in waste management in the three research locations, the flatter an area, the better the level of waste management. The effectiveness of waste management according to public perceptions from various aspects is more felt by people in flat and slightly wavy topography.

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1. INTRODUCTION

The background of this research is the accumulation of garbage at three housing points, namely the Housing Complex, namely Perumahan Puri Panji Kencana and Buana Grand Subang, West Java. Disturbing the peace of the local community which can lead to peace in the community.

Garbage is a nest of disease and various kinds of bacteria. Garbage officers who are in charge of cleaning trash cans located at several points are urgently needed, so that there is no buildup in the existing trash cans. However, monitoring of trash cans is still done manually, so garbage officers are required to check trash cans by visiting each trash can at the point where the trash can is located [7]. This is an ineffective method, because it will take longer and reduce worker performance, waste in carrying out their work and cost more [1],[2].

In general, labels on trash cans are also widely ignored by the community to separate organic and inorganic waste. Separation of organic and inorganic waste manually will cause a higher risk of disease [3]. A smart trash can that can sort waste automatically and is connected to the internet by utilizing the Lora network so that it can send real-time garbage load data to the database and the data is converted with an attractive User Interface so you can see the condition of the garbage load. Apart from that, trash can workers will also receive notifications regarding the current status of trash cans so that garbage collection officers can take action quickly and easily [7].

Waste is something that is not used, not used, disliked or something that is thrown away that comes from human activities and does not happen by itself. Based on SK SNI 1990, waste is waste consisting of organic and inorganic materials which are considered useless and must be managed so as not to endanger and protect development infestations [1].

2. RESEARCH METHOD

The author uses several research methods to direct this research (design) so that the research objectives that have been set can be achieved. Several research methods used by the author as follows:

2.1. Data Collection

2.1.1. Interview

Studying and collecting data in the form of community knowledge at the research site Puri Panji Kencana Subang Housing and Buana Grand Subang Housing Society West Java about types of waste, public awareness of disposing of garbage and developing flora networks, this method will be used for the Decision Support System process [10].

2.1.2. Library Studies

To obtain basic knowledge that will be applied in research located at Puri Panjik Kencana Housing Subang and Buana Grand Subang Housing Society, West Java and obtain research information, literature and references from related sources such as printed books, websites, eBook's, journals, articles, and information sources studied. others related to Waste Management Systems at Puri Panjik Kencana Housing Subang and Buana Grand Subang Housing Communities, West Java Based on IOT (Internet Of Thing) Using Lora Network Technology on the Node-Red Platform

2.2. System Development Method

2.2.1. Scope Definition

The thing to do at this stage is to determine the scope of the problem to be examined at the Puri Panjik Kencana Housing Subang and the Buana Grand Subang Housing Society, West Java.

2.2.2. Needs Analysis

The thing to do at this stage is to analyze system requirements by collecting data on the needs of system users which is then modeled in a use case diagram. At this stage, system thinking and design is carried out to solve existing problems using system modeling such as use case diagrams, Program Code Writing. At the writing stage, program code or coding is a translation of the design into a language that is recognized by the computer. The languages to be used by programmers are the Arduino programming language, PHP, and the MySQL database [9].

3. RESULTS AND ANALYSIS

3.1. Results Performance Internet of Things works

The way IoT works is that each object must have an Internet Protocol (IP) address. An Internet Protocol (IP) address is an identity on a network that allows the object to be ordered from another object on the same network. Furthermore, the Internet Protocol (IP) address on the object will be connected to the internet network [11].

Technology There are several supporting technologies for the Internet of Things including [6], Radio Frequency Identification (RFID) Radio Frequency Identification (RFID) is a system that transmits the identity of an object or person wirelessly using radio waves in the form of serial numbers.

The Internet Protocol (IP) is the primary network protocol used on the Internet that was developed in the 1970s. IP is the main communication protocol in the internet protocol suite for relaying datagrams across network boundaries. Electronic Product Code (EPC).

An Electronic Product Code (EPC) is a 64-bit or 98-bit code that is recorded electronically on an RFID tag and is intended to design improvements in the EPC barcoding system. The EPC code can store information about the EPC type, product serial number, specifications, manufacturer information. A barcode is an optical, machine-readable label attached to an item that records information related to that item. Wireless Fidelity (Wi-Fi) is a networking technology that allows computers and other devices to communicate via wireless signals. Vic Hayes has been named the father of Wireless Fidelity. The Wi-Fi precursor was invented in 1991 by the NCR Corporation on Newegg in the Netherlands.

LoRa stands for long range is a communication technology developed and patented by Sentech. The LoRa deployment spectrum uses Chirp Spread Spectrum (CSS) modulation, traditionally CSS is used for military and communications that require security. LoRa has long range, low power consumption, low data rate and secure data transmission. LoRa can be used for public, private, or hybrid networks so that it can achieve a wider range than cellular networks. LoRa technology can be easily integrated with existing networks and can be applied to the low-cost, battery-operated Internet of Things (IoT). LoRa can be applied in various fields, such as: agriculture, smart home, industry, transportation, to the health sector. Semtech develops LoRa hardware in the form of gateways and transceivers. The LoRa Gateway acts as an intermediary between the sensing device and the Cloud application. Meanwhile, LoRa transceivers are long-range wireless devices that provide ultra-long spreading spectrum, are not susceptible to interference, and have low energy consumption. The SX1276/77/78/79 are examples of LoRa transceivers [5].

The features available in LoRa are:

a. Geolocation, this function allows us to detect the location of an object at no cost or free.

b. Low Cost, can reduce costs in 3 ways: reduce infrastructure costs, operational costs and sensors that have their own network.
c. Standardized, built to interact and function with other products or systems, so they can quickly adapt to IoT networks and applications.
d. Low Power, with the required power consumption only ranging from 13Ma to 15Ma. So, the battery can last from 10 to 20 years.
e. Long distance, one LoRa unit can transmit up to 100KM.
f. Embedded secure end-to-end AES128 encryption
g. High Capacity, Support millions of messages per base station, ideal for public network operators serving multiple subscribers.

Figure 1. ESP8266(Modul Wi-Fi)

Residents who are registered with the system can dispose of trash, as well as scan waste to be sorted with sensors to determine the type of organic or inorganic waste, after determining the type of waste then in an empty or filled state the sensor will continue to read objects in the trash. which will send gas, volume and weight parameter data to the gateway, the Lora gateway will send parameter data to the platform which will then be displayed in the form of images to display actual information and officers will monitor [14]

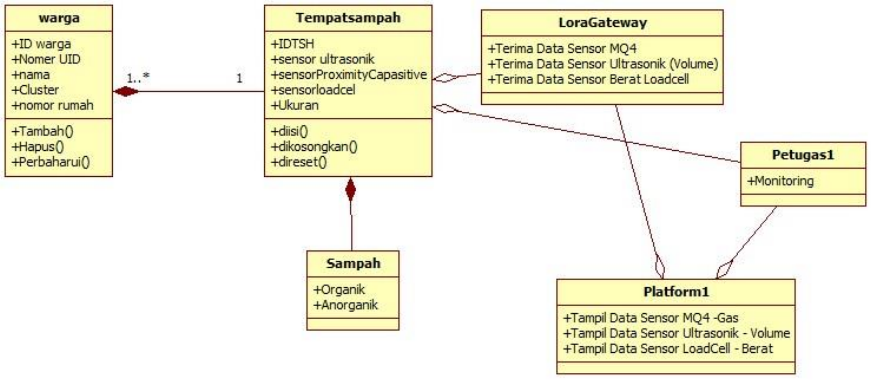

Figure 2. Class Diagram

Residents scan the card then scan the garbage on the sensor on the master microcontroller, after sorting the waste, the sensor in the bin reads the object and sends data through the master and passes it back through the LoRa Node to the LoRa gateway and is displayed through the Node Red platform and the data is displayed in diagrams as information for monitoring officers [9].

3.2. Implementation of Arduino AT Mega 2560 Pro Mini as Master

The design of the control section is composed of a Pro Mini AT Mega 2560 Microcontroller which is embedded in the Arduino minimum system and functions as a data processing center for connected sensor components [11],[13]. The RFID sensor is in charge of identifying the user's card, if the RFID card data matches, it will ring once and send it to the AT mega 2560. The corresponding card data is used by the Atmega2560 to prepare the sensors for operation of the capacitive proximity sensor and infrared proximity sensor in the waste sorting section [15]. After the sensor reads the type of trash can, it will be forwarded to the master by the proximity sensor to open the trash can lid. The Atmega2560 uses a 5-volt voltage source, while the sensor components utilize the voltage from the Vin pin and the 5-volt pin on the Atmega2560. And the master controller will continue to receive data from sensors and forward it to the Lora Gateway.

Figure 3. Arduino Master

3.3. System Interface Implementation

The design of making a web-based monitoring interface with red nodes is to determine flow on red nodes, because the Lora gateway is connected using the MQTT method with the same topic. Then it is made using network nodes, general, parsers, functions, and dashboards by using the MQTT sub node to connect to devices from the LoRa gateway, and using the function to configure from the lora gateway to connect to the red node interface, then using the sub node gauge to display data in the form graph or visualization on node red by going to the dashboard menu and displaying it to the browser. After the data is received, then the data is stored in a database that can be accessed by the server as well as telegram notifications if conditions are met in the form of gas capacity and trash cans.

Designing a Lora Gateway with ESP8266 as a controller and lora as a receiver or transmitter that functions as a receiver of data from various nodes connected to the gateway, then the lora gateway sends data from the Lora node through the same network via the internet and forwarded to the server using the MQTT method [4]. After the data is received by the server, it is then forwarded to the Node-Red platform [8].

The design of the Lora Node uses the Lora component which is connected to the master microcontroller which functions to send data from sensors that have been received by the master microcontroller then sends data to the LoRa gateway with the same frequency

3.4. Server, Tool Specifications Installation and Location

In carrying out this final assignment, the author conducted research with a laptop unit with the following specifications:

a. Processor: Intel Core i7 – 5600U.
b. Processor Speed: 2.60 GHz.
c. Memory: 16GB.
d. HDD: 500GB.
e. Operating System: Windows 10 Pro (64-bit).

XAMPP installation

a. Download the latest version of Xampp software file on the official website.
b. Website: https://www.apachefriends.org/index.html
c. Perform the installation after the download is complete. During the installation process, you may see a message asking if you are sure you want to install it. Please press Yes to continue the installation. Click the Next button.
d. On the next screen, options will appear regarding the XAMPP components you want and do not want to install. Several options like Apache and PHP are essential parts of running a website and will be installed automatically. Please check MySQL and phpMyAdmin, leave it alone for other options.
e. Next, please select the destination folder where you want XAMPP to be installed. For example, in the C:\xampp directory.
f. On the next page there will be an option whether you want to install Bitnami for XAMPP, where later you can use it to install WordPress, Drupal, and Joomla automatically.
g. At this step the XAMPP installation process will begin. Please click the Next button.
h. After successfully installed, a notification will appear to immediately run the control panel. Please click Done.

The design of the Lora Node uses the Lora component which is connected to the master microcontroller which functions to send data from sensors that have been received by the master microcontroller then sends data to the LoRa gateway with the same frequency

Interface implementation is based on a predefined design. In its application, there is an interface page that displays gas sensor data, trash can capacity data and displays data on the weight of waste in filled bins from both organic and inorganic slaves to be displayed providing information on a monitor screen then followed up by a garbage collector.

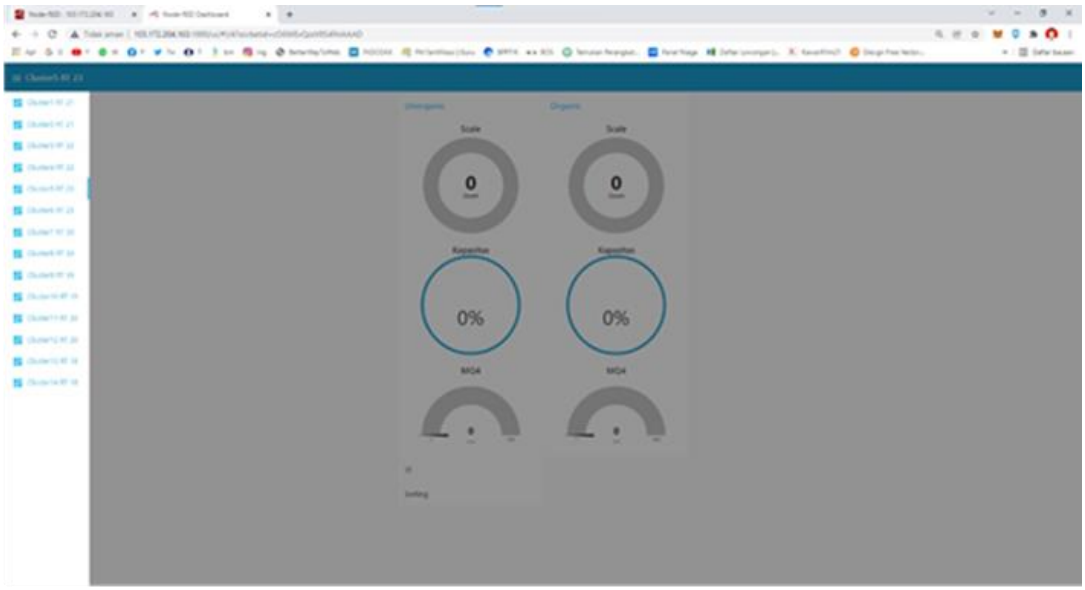

Figure 4. Displayed providing information on a monitor screen

The research location at Puri Panji Kencana Housing Subang and Buana Grand Subang Housing Complex, West Java designed an IOT-based automatic trash bin for 20 households, where most of the community's waste is disposed of or burned. Therefore, the researchers created the concept of an IOT-based automatic garbage system.

Figure 5. Research location map view

The system being researched uses the master controller concept where the master has two parts, namely organic and inorganic with sensor readings in each bin, data transmission architecture via Lora on the Point to Point computer network concept and uses wireless as a tool [6].

The device is turned on, then the device is connected to the network, if the network is not connected (not found), the device will reconnect to the network until it is connected [16]. After the device is connected to the network, the device will be connected to the computer, once connected, the data from the sensor is sent to node-red to be displayed on the node-red dashboard. If the data is sent to the database, then the location id of the research site must be entered, if the location id is not registered in the database, the user must register the location data first, then the data is sent to the database according to the location id input on the Arduino sketch to be stored on the microcontroller.

NO	SEKTOR	RT/RW	NO RUMAH	LATITUDE	LONGITUDE	NAMA	UMUR	PENDIDIKAN	PEKERJAAN	JUMLAH KK	JUMLAH ORANG	KEBIASAAN MENYELANG SAMPAH DALAM SEMINGGU	BOBOT SAMPAH	JARAK KE TEMPAT PENGUMPULAN SAMPAH by UDARA	JARAK KE KEBUN YG BIASA DIGUNAKAN MENYELANG SAMPAH by UDARA	JARAK KE SUNGAI by UDARA	JARAK KE TEMP AT PENGU MPULAN SAMPAH by JALAN	JARAK KE KEBUN YG BIASA DIGUNAKAN MENYELANG SAMPAH by JALAN	JARAK KE SUNGAI by JALAN	JARAK KE PENGUANGAN KEBUN SAMPAH (m)
1	10	19/07	33	5.46036	7.85158	ASEP SUNJAYA	49	SMA	WIRASWASTA	1	3	3	1 KG	165 m	107 m	22.0 m	269.07 m	177.66 m	199.39 m	
2	10	19/07	25	5.45980	7.85273	EEM	49	SMP	IRT	1	3	3	1 KG	142 m	155 m	17.2 m	103.17 m	306.01 m	307.71 m	
3	10	19/07	23	5.46448	7.85471	DODING	42	SMP	BURUH TANI	1	6	7	1 - 2 KG	123 m	141 m	22.0 m	186.19 m	143.09 m	282.95 m	
4	10	19/07	24	5.45997	7.85169	DANI	45	SMA	WIRASWASTA	1	3	3	1 KG	160 m	109 m	21.0 m	227.24 m	134.03 m	259.54 m	
5	10	19/07	24	5.46408	7.85419	SOPIAN	52	SMA	WIRASWASTA	1	4	3	1 - 1.5 KG	127 m	141 m	22.2 m	193.67 m	1.50 m	271.93 m	
6	10	19/07	21	5.46203	7.85267	ATANG	55	SD	PETANI	1	4	3	1 - 1.5 KG	147 m	150 m	19.0 m	225.75 m	191.27 m	293.57 m	
7	10	19/07	29	5.46458	7.85356	UDAY	45	SMP	WIRASWASTA	1	4	3	1 KG	141 m	145 m	19.1 m	223.29 m	179.72 m	287.77 m	
8	10	19/07	26	5.46291	7.85191	KIMING	56	SD	PETANI	1	7	4	1.5 - 2 KG	114 m	169 m	19.7 m	146.24 m	209.39 m	217.6 m	
9	10	19/07	28	5.46490	7.85253	NUNENG	49	SD	IRT	1	4	3	1 KG	116 m	172 m	19.0 m	239.72 m	190.64 m	290.74 m	
10	10	19/07	27	5.46366	7.85349	TARSO	40	SMA	GURU NGAJI	1	6	3	1 - 1.5 KG	200 m	91 m	22.4 m	216.16 m	112.15 m	212.22 m	
11	10	19/07	44	5.46748	7.85402	HJ. AAN	65	SMA	WIRASWASTA	1	7	3	2 KG	99 m	163 m	22.3 m	142.94 m	163.7 m	2 26.4 m	
12	10	19/07	15	5.46321	7.85503	CAU	69	SD	BURUH TANI	1	2	3	1 KG	196 m	108 m	22.4 m	177.76 m	121.33 m	291.66 m	
13	10	19/07	31	5.46350	7.85441	BUDI	42	SMA	BURUH	1	4	3	1-1.5 KG	146 m	139 m	21.4 m	208.54 m	169.93 m	281.91 m	
14	10	19/07	30	5.46357	7.85443	WENI	35	SMA	IRT	1	3	3	1 KG	135 m	140 m	22.2 m	193.67 m	1.50 m	271.93 m	
15	10	19/07	41	5.46394	7.85390	DEDI TARIM	50	SMA	TANI	1	5	4	1-2 KG	122 m	169 m	17.9 m	145.64 m	208.72 m	236.69 m	
16	10	19/07	26	5.46047	7.85310	SUS	46	SMP	IRT	1	4	3	1 KG	191 m	106 m	20.9 m	216.71 m	112.09 m	282.34 m	
17	10	19/07	27	5.46270	7.85616	RETIM	50	SD	PETANI	1	5	3	1 KG	133 m	163 m	17.3 m	215.83 m	105.31 m	212.15 m	
18	10	19/07	40	5.46036	7.85366	AUS	44	SMP	IRT	1	4	3	1 KG	181 m	106 m	21.2 m	255.56 m	101.06 m	312.43 m	
19	10	19/07	39	5.46303	7.85596	UNAH	49	SD	IRT	1	4	4	1 KG	195 m	7 2 m	23.1 m	240. 92 m	69.22 m	353.99 m	
20	10	19/07	39	5.46399	7.85754	MUJIANA	53	SMA	WIRASWASTA	1	4	3	1 KG	204 m	64 m	26.1 m	253.18 m	59.75 m	367.5 m	
21	10	19/07	22	5.46182	7.85175	TASIK	53	SMP	IRT	1	4	3	1 - 1.5 KG	200 m	116 m	20.2 m	220.46 m	126.94 m	321.65 m	

Figure 6. node-red dashboard

the master microcontroller to retrieve id data that has been stored then the garbage sorting sensor reads the type of garbage scanned then the weight, height and gas sensors read the object, the data from the master microcontroller is then forwarded to the LoRa transmitter node to be sent to the LoRa Gateway then sent to the Ubuntu VPS server version 21.04 via a Wi-Fi internet network connected to the same Platform network after that the data is sent to the database and if the methane gas condition is above 250 GWP and the capacity is less than 10% there will be a telegram notification message.

4. CONCLUSION

This system is built using IoT-based microcontroller components using the node-red platform. In this study the authors drew several conclusions, including:

a. After conducting this research, the authors found that with this tool it can slightly reduce the failure rate in detecting the type of waste, reading objects by sensors.
b. The research was conducted using the SAW calculation method, where this method is used to rank so that the results of the most recommended sequence of storage places to be used as IOT-based bins are obtained.

Here are some suggestions from the author for further research to make it even better. Add parameters so that the system becomes better so that it can be implemented in the wider community

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