Design of Recyclable Waste Mapping Information System for Waste Pickers

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Abstract. To support the activities of Waste Pickers in collecting valuable waste, massive information is needed through the availability of valuable trash information obtained from the public, government, and industry (Information Providers). The provision of information socially supports the activities of Waste Pickers in order to obtain sufficient income. For this reason, the use of information systems has become one of the media for Waste Pickers to obtain actual information. The involvement of the government becomes support in the delivery of information both online and offline. The information system that is designed will map where the available valuable used items come from the Information Provider. Design of information systems through needs analysis that was submitted in the initial research, to further carry out the design and construction of the whole system. The design of the view of all elements of the information system through a prototype model, namely procedures, data, brainware, software, hardware, and network. The purpose of the design of the information system is to obtain a media that can fully distribute information to Waste Pickers to help increase their income.

1. Introduction

Waste Pickers are part of informal work that is not legally recognized by the state in the formal sector. Scavenging activities require high mobility by tracing the area where waste is located by utilizing a geographical information system. The activity is carried out on foot so it takes time in searching for rubbish with a duration of 9-13 hours a day. Obviously, their daily income ranges from 5,000-100,000 rupiah. This has an impact on their daily income level and influences their continued economy to other impacts especially in developing countries (for example food and clothing, health, education, law, etc.) [1-11]. Based on the findings of the author, the social spirit of each Society they sometimes get through the act of giving money or giving garbage that has value by the Society to them. They can at least meet the needs of their lives at that time through these things apart from the search for rubbish that they do themselves. For this reason, the author design a recyclable waste mapping information system for Waste Pickers. Where information system aims to distribute information about waste to Waste Pickers from the public or the government to assist them in increasing the quantity of valuable waste that affects many lines.

According to Laudon and Sawyer, the presence of information technology, including information systems, has an important role in improving and even changing procedures to obtain organizational effectiveness and efficiency [12,13]. This is supported based on various previous studies in each organization, where information systems assist stakeholders in carrying out each of their activities in carrying out organizational procedures. Given the role of information systems that have a significant
impact, the author wants to accommodate the needs of waste collectors in finding valuable waste through information conveyed by the public and the government. The information system used can map waste areas and involve Waste Pickers in activities that indirectly produce waste (for example: seminars, weddings, training, demonstrations, etc.). The purpose of this information system is to encourage an increase in the quantity of valuable waste collection to waste pickers so that it can have an impact on improving their economy, which indirectly affects many lines in the lives of Waste Pickers. Previously the author has done an analysis of basic needs before designing the system through previous research [14]. In the current research, it discusses the design which is a standard in the development of information systems for Waste Pickers.

This research purpose is to capture the design of information systems in all elements of the information system, namely: (1) data and procedures, (2) brainware, (3) software, (4) hardware, and (5) network. All of these elements are modeled into a complete design to support the implementation of information system development for Waste Pickers.

2. Method

The phase of research refers to Figure 1. The research phase that the author does is mapping the needs of designing computer components in the system, namely hardware, software, brainware, and network. The design that the authors build is modeled with the Unified Modeling Language tool by translating the entire procedure into a use case. The user interfaces layout built with the appearance of a mobile application that generally expresses the operational use of the system. Whereas brainware is translated into access that can be done by each stakeholder. The network is designed by simulating using a computer network simulation tool to get the network design scheme that is connected to the system.

Figure 1. Research Method

3. Results and Discussion

3.1. Data dan Procedure Design

When data collection was carried out, based on the primary data collection method that the author found, it was found that: (1) Waste Pickers conduct their activities for 4-12 hours/day, (2) Waste Pickers income ranges from 25,000-125,000 rupiah, (3) Waste Pickers Economy makes them located on the poverty line, (4) Waste Pickers education levels range from elementary to high school, (4) Society Stigma that looks down on Waste Pickers, and (5) There is no recognition of formal employment sectors that have an impact on services such as BPJS and the like. The data is used as a qualitative reference in the design of procedures for mapping the system of waste circulation for waste collectors. There are five procedures designed, namely:

1. Registration Procedure

There are three actors involved in the system, namely the Government, Society, and Waste Pickers. The registration is only done by the Society and Government. This is done because the internal management is carried out by the Government. Or in other words, the Government's role in the system is as an Administrator. There are differences in Society and Waste Pickers registration. The difference lies in the Society as the giver of information and the Waste Pickers as the recipient of information. Society account registration through the provision of data in the form of; KTP ID number (scan), full name, address of residence, occupation, telephone number (including WhatsApp), email and social media accounts (Facebook, Instagram, and Twitter). Whereas Waste Pickers provide data; KTP ID number (scan), full name, residential address, telephone number, email, and social media accounts (Facebook, Instagram, and Twitter). When the Society and Waste Pickers register themselves in the system, the Government will validate and verify whether the data submitted is correct and appropriate or not. This takes time because the Government will look at the population data bank in accordance with the Population Registration Number in accordance
with the KTP. Then the Government is also possible to check the reality of the situation in the real environment through a survey conducted, whether appropriate or not. Based on the verification results, the Government has the right to accept or reject potential members involved in the system. If accepted, the Society or Waste Pickers can directly access the system, whereas if rejected, the Government will provide confirmation and reasons for rejection.

2. Information Dissemination Procedure
Verified citizens and Waste Pickers are entitled to become system users. For the Society, they will provide information about the waste they own or know. The Society may have valuable rubbish that will be given to Waste Pickers through the system or the Society may know the route or area that has potential for valuable rubbish. This is conveyed into the system through accurate information. The information must have the attributes of the address, the name of the area, the type of waste, a photo of the trash and the area around it, including a photo of the person in charge. This is done in order to obtain correct, detailed and accountable information. Furthermore, the information provided by the public will be temporarily accommodated for further verification by the Government. The government checks all information provided by the Society. If possible, the Government will personally contact the giver of information or even see clearly the information. When verified, then the verified information becomes active and disseminated to the Waste Pickers in the nearest area. The nearest Waste Pickers will receive a notification regarding the information and choose to retrieve it. If not, then other waste collectors can collect it. Every information is addressed to one Waste Pickers, this is done in order to get equalization of garbage collection for each Waste Pickers in one area (specifically the sub-district area). On one hand, it can suppress chaos among Waste Pickers because of fighting over information on waste collection. After a Waste Pickers conducts validation, he will take the garbage, the information in the system will turn into information notification that there has been a follow up from the Waste Pickers with his identity and the information will become inactive.

3. Event Management Procedure
Society when carrying out activities or events (for example; weddings, circumcision, births, etc.) will certainly produce valuable waste (for example, plastic bottles, plastic cups, paper, etc.). In the Activity Management section, the Society can create an activity in the system by inviting and involving Waste Pickers as a cleaning team for the activity. Starting from the Society to make an activity on the system, convey the name of the activity, schedule, time, person in charge, telephone number, the number of team needs, facilities and costs of the cleaning team, and an image file or a scanned image of the activity. Furthermore, the Government will verify by checking whether the activity is correct or not. The government can contact personally or even check the reality of the situation in a real environment through a survey he conducted. After that, the Government can decide whether this is appropriate or not. If it is not suitable, the Government will provide notification of the reasons why it was rejected, whereas if it is suitable, the information is valid and disseminated to all Waste Pickers who have accounts. The information is active and will provide a slot on how much the informer (Society) determines the amount of team needs. The active information will be inactive if the number of team needs has been met. For example, if the Society organizing activities establish 5 Waste Pickers as a cleaning team, then after being verified by the Government, the Waste Pickers can enter as one of the cleaning teams. If there are already 5 Waste Pickers who register themselves as a cleaning team, then the activity cannot be accessed by other Waste Pickers. There are conditions that limit Waste Pickers in their participation as a cleaning team in an activity. Within 1 week, Waste Pickers are limited to only one activity. When that situation This situation is done to provide access to activities for other Waste Pickers who have not participated in the activities where they are a cleaning team.

4. Membership Management Procedure
Communities and Waste Pickers are Members of the system. For the Society, the Government manages the accounts of each Society by looking at the extent of the Society's role in informing the
existence of waste. If assessed by the Government "Very Good" then the Society will be recognized and marked in the system as one of the Communities that has a large contribution to the Waste Pickers (it is possible there will be a reward for the Society). The benchmarks are based on the attributes of how much information is given (verification or rejection by the Government), how many activities (acceptance or rejection of verification by the Government), and the extent of reports from the public and other waste collectors (whether the report is positive or negative). Likewise with the waste pickers, if the government is considered "Very Good" then the waste pickers will be recognized and marked in the system as one of the active and hardworking waste collectors (there will be a reward for the waste pickers). The benchmarks based on the attribute of how much information is taken about the existence of waste from which information is provided by the Society, how much is involved in activities to become a cleaning team, and extent of reports from Society and other waste collectors (whether the report is positive or negative). For rewards given to the public and the "Best" Waste Pickers, it is done once every semester.

5. Report Procedures
Reporting Procedures emphasize various forms of complaints directed at the Government, the Society, and Waste Pickers. This report can be done by the Society or waste pickers who feel disadvantaged or find findings that are not appropriate. Henceforth, the reporting will be followed up starting from system improvement, a reprimand to certain actors, account termination, and others. The reporting is through a verification process, with a view to establishing the truth of each Report given by the Society or Waste Pickers. If it is appropriate or not appropriate there will be a follow-up from the Government.

3.2. Brainware Design
Figure 2 is a use case in the Waste Mapping Information System for Waste Pickers. In the use case, there were five cases which were procedures in the system and three actors involved, namely the Government, Society, and Actors. Actors who are brainware in the system are active users who later have accounts with different roles. The government acts as the party that manages and verifies each account, information, and procurement activities. and reporting from the Society or Waste Pickers. For the Society, it acts as a party providing information on the circulation of waste and activities providers that need a cleaning team. As for Waste Pickers, it acts as the party who receives information about the circulation of waste and follows the activities as a cleaning team.
3.3. Software Design

Software designed to suit the needs of system users. In software design, it is determined that the platforms used are website and android. The reason for using the platform is because of the 141 Society and 5 Waste Pickers we surveyed found that they use computers or laptops with Windows operating systems of various versions and mobile devices with the Android platform with various versions as well. That usage becomes the author's reference in designing software requirements. Software built for the Government uses a website platform, while for the Society and Waste Pickers uses the Android platform. Software built with a Government account has five menus, namely; User Management, Waste Circulation Information Management, Activity Management, Reporting Management, and Reporting. For the Society account, there are three menus, namely: Provision of Waste Circulation Information, Provision of Cleaning Team Activities, and Reporting. Whereas for Waste Pickers accounts, there are three menus, namely; Receiving Information, Receiving Cleaning Team Activities, and Reporting. Figures 3, 4 and 5 respectively represent drawings that refer to the design of the homepage display on Government accounts, Provision of Information on Waste Circulation on Society accounts, and Acceptance of Cleaning Team Activities on Waste Pickers Accounts.

![Figure 2. Use Case Waste Information Mapping System for Waste Pickers](image)

![Figure 3. Design of Homepage on Government Accounts.](image)
3.4. Hardware Design

Hardware design is supported by brainware and software design. Hardware that is designed must meet the data requirements as appropriate. The hardware design includes use for the Government, Society and Waste Pickers. Table 1 shows that each system user has different hardware requirements but still has the same function in distributing data and information so that there are 3 types of hardware based on the client-server. The government uses server hardware, while the public and Waste Pickers use client hardware.

Table 1. Hardware Client Server Information System for Waste Collection Mapping for Waste Pickers

| Account  | Category | Minimum Requirement |
|----------|----------|---------------------|
| Government | Server  | Desktop: Platform: Dual CPU Rack Server, O/S Provided: Optional, PSU: 550 W, Optical Drive: Optional, 1st Processor Onboard: Intel® Xeon® Processor Silver 4114 (10 Cores, 2.20 GHz, 13.75M Cache), 2nd Processor Onboard: Optional, Input |
| Account | Category | Minimum Requirement |
|---------|----------|---------------------|
| Society | Device Type: Optional, Dimension (W x H x D): 59 x 21 x 100 Cm, Standard Bays: 8 x 2.5” SAS/SATA HDD, Slot Provided: 6 Gbps SATA, Onboard SATA AHCI (non-RAID), 12 Gbps SAS/6 Gbps SATA, RAID 0/1/10/5/50 with RAID 530-8i, RAID 730-8i 1 GB Cache atau RAID 930-8i 2GB Flash, Chipset: Intel C622, Networking: 2 x 1 GbE Network, Video Type: Integrated Matrox G200, Chasis Form Factor: 1U Rackmount Chassis, Monitor: Optional, Standard Memory: 1 x 8GB RDIMM, Processor Type: Intel Xeon Processor, Weight: 20 Kg, 1st Hard Drive: Optional, Keyboard Type: Optional, Max. Memory: Up to 12 DIMM sockets. 
Mobile: Processor: Intel Core 2 Duo 2.0 GHz, Mainboard: Amptron G41, HDD: 80 Gb, RAM: DDR3 2 GB, VGA Card: GT 210 1 GB, DDR3, DVD RW: LG, Cassing: Castello Moluca, Power Supply: 450 Watt, Keyboard: Optional, Mouse: Optional, Monitor: Optional. |
| Client | Processor: Qualcomm® Snapdragon™ 430 with 64bit Quadcore, Screen: 5.45” 18:9 Ultrawide display in 5’ compact size, Camera: 5 MP + 13 MP, Jaringan: 2G/3G/4G, RAM: 2 GB, Memory: 16 GB. |
| Waste Pickers | |

3.5. Network Design

Computer networks are designed using internet networks that aim to reach every user with a star topology design. Star topology focuses the server as a center in the distribution and management of information. The network used is public with a class C IP address, where the required range is 192.1.0.0 - 192.255.255.255. Figure 6 shows the design of a computer network system through network simulation.

![Figure 6. Computer Network Simulation of Waste Circulation Mapping Information System for Waste Pickers](image)

4. Conclusion

The design of the Information System for Mapping Waste Recycling for Waste Pickers looks at every element of the information system, namely: Data and Procedure Design, Brainware Design, Software Design, Hardware Design, and Computer Network Design. The design was put forward as a standard in the development of the Information System for Waste Distribution for Waste Waste Pickers later.

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