

## MANAGING WASTE THROUGH TECHNOLOGY UTILIZATION

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### ABSTRACT

*Well-known as a traveler's choice destination, Bali has recently been highlighted by its waste crisis, specifically, due to massive plastic usage. It is obvious, that the volume of waste is increasingly widespread. Focusing on Information System, this study develops a trash pickup service application, which can be considered as a tool for people's awareness towards waste management response, as well as taking a part in its running process. Taking advantage of Community Service as one of the main pillars in Tridharma Perguruan Tinggi, development process involves a local waste management organization that located in Denpasar City, and academics to experience factual learning, while providing them opportunities for giving back to the community.*

**Keywords:** app development, technology utilization, waste management

### INTRODUCTION

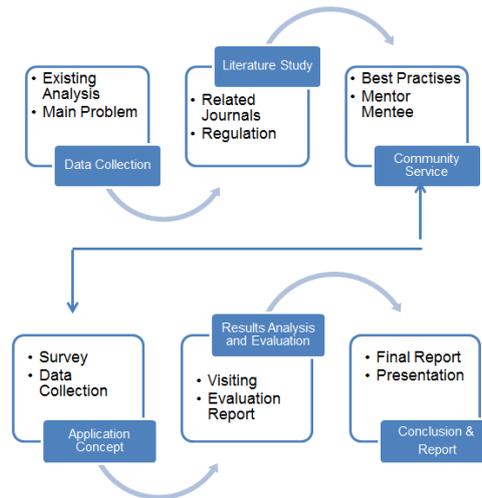
According to *Badan Pusat Statistik* (BPS-Statistics Indonesia) in 2018 Statistical Yearbook of Indonesia, Indonesia's population is estimated to reach nearly 262 million people who are dominated by productive age where around 30% are in Higher Education [3]. Based on data that has been published or released by the Ministry of Research Technology and Higher Education (*Kemendikristek*) on the Higher Education Database (*Forlap Dikti*), the number of Higher Education in Indonesia as of February 25th, 2019 is 4,708, which is an accumulation of 596 Universities, 223 Institutes, 2,553 College, 284 Polytechnics and 1,052 Academic [4]. Considering that, came to a thought how can academics help in waste management response through Community Service as one of the main pillars in *Tridharma Perguruan Tinggi* [5]. Bali took as a case, as one of tourist destinations in Indonesia, which has recently been highlighted through media coverage where the volume of plastic waste invasion is expanding and increasing [6] [7]. Noticeably, very few garbage bins are made available, an unorganized trash drop following with facultative pick-up service, peoples' behaviours inclusive local community, domestic and foreign visitors [1] [2].

This study focused on Information System, in the form of building a Waste Management Information System application, which can be taken as a consideration to assist with the waste management process on a national scale. This study also includes students; enable them to gain practical knowledge. Through Information Systems Concepts and Applications learning and Community Service, the initial concept of AllClean Application was designed.

### METHODS

#### Community Service Based Concept

Taking advantage of this Community Service obligation, development process involves a local waste management organization that located in Denpasar City, and academics to experience factual learning, while providing them opportunities for giving back to the community.



**Figure 1. Community Service Based Concept**

### Research System

The prototype's approach is implemented at the end of the application creation, where the development and testing of a working model (prototype) of the application is developed through a repeated interaction process, and continuous improvement, to suit concepts needed by the user.

Based on a survey done to the community surrounding that was carried out in the beginning of the project, data obtained were formed of community patterns in disposing of garbage, including the amount of waste produced, type of waste, as well as frequency of disposing of their garbage. There was also an input from the community about conventional Waste Management that has been running [9].

The conducted survey also produces data on prices variants among service providers. This makes it easier for students to build partnerships with waste pick-up service providers that have been running. It is also open up opportunities for anyone; age of 16 and above, to join as an AllClean work partner. This will be prioritized for those who do not have a permanent job, but are committed to taking part in protecting the environment. Students are able to release a mobile-based Waste Processing Application, called 'AllClean' as a final result of group assignment on Information System Concept and Application class.

### FINDINGS AND DISCUSSIONS

#### AllClean Application Concept

Initially, an AllClean Application concept that carries 'Better World without Trash' slogan arises because of students' concern for Waste Management on the island of Bali which has recently highlighted worldwide. The idea arose as a subject of group assignment in Information Systems Concept and Application class, mentored by the Author. How 'Service on Demand' option can help Waste Management systems? Students questioned the ability of garbage collectors in the field to deal with conventional waste problematic. In addition, that deserves an attention, is garbage pick-up service that costly, which is suspected to be a trigger for people's habits for littering. Conversely, how can garbage be a source of income for the community?

Given the above challenges, it is essential to discover efficient solutions such as collaborating with some registered tenants as service providers with maintaining quality of service, determining a fixed service fee, recruiting professional manning to handle office and customer service issues, last but not least, to develop an online system called AllClean application. Moving forward, this proposed AllClean application can provide consumers with a convenient service in managing their trash pickup, with no time and place limitation. Furthermore, service flow concepts are as follows:

1. Consumers open AllClean application and click 'Order Service' menu for ordering trash pickup service.
2. The Consumer will then be asked to determine trash bag needed, type of trash (organic/non- organic), as well as trash volume.
3. Next, Consumers determine the pickup point for trashing collection.
4. Upon completing all forms, system will automatically calculate its service fee.
5. If the customer has agreed, they need to confirm the order by clicking on the Order Process button.
6. The system will find a closer tenant.
7. Consumers can then wait for the garbage pick-up to arrive. Alternatively, a schedule can be requested so that consumers who are in a hurry can leave their trash in the appointed place and have it picked up as per schedule.
8. Meanwhile, payment can be made either through a direct payment after the service per order, or by monthly billing that accumulate for monthly orders received by the system. Settlement can be made in cash for a direct payment; while for monthly billing requires consumers to use bank transfer to AllClean account.

In building the application, the Information System cycle was applied by determining database (Originating), where data sources are obtained from community and people involved in local Waste Management. Next steps were to enter the data (Inputting) followed by Processing, where some data will be directly released as Information (Output) needed by users who need it; while some data is stored in Memory to be issued at any time needed by the user. Information and data collection carried out by building direct observations on existing system and procedures in Waste Management [8]. Interviews are also conducted with people involved in local Waste Management, for more information and data, experts and/or those who closely related to Waste Management in the areas that reachable by students.

### Application Features

One of its main features 'On Demand' allows users to order a pick-up service for their garbage at an agreed time. In addition to that highlight, AllClean Application moreover opens opportunities for price or tariff agreements between users and service providers, which adjust to the user's location, type and amount of waste, prior using the AllClean service.

Explicitly, the existence of AllClean services, will provide control into Waste Management on the island of Bali, expected it can be a pilot and developed with a larger scale, so as changing the habits of the community for littering, at the same time helping to maintain public hygiene and health.

As mobile based, AllClean application also expected to be easily and effectively used by user ends, unbounded by time and place.

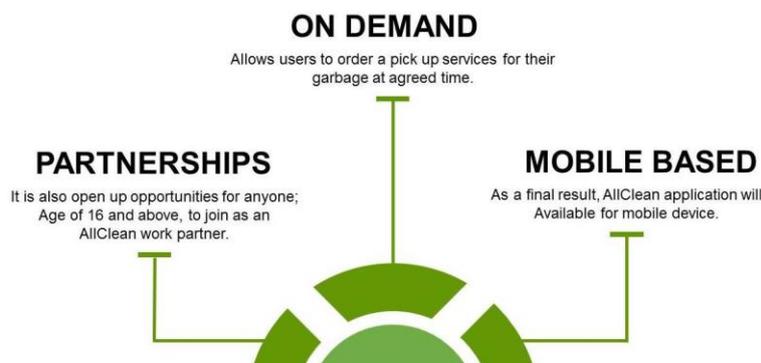
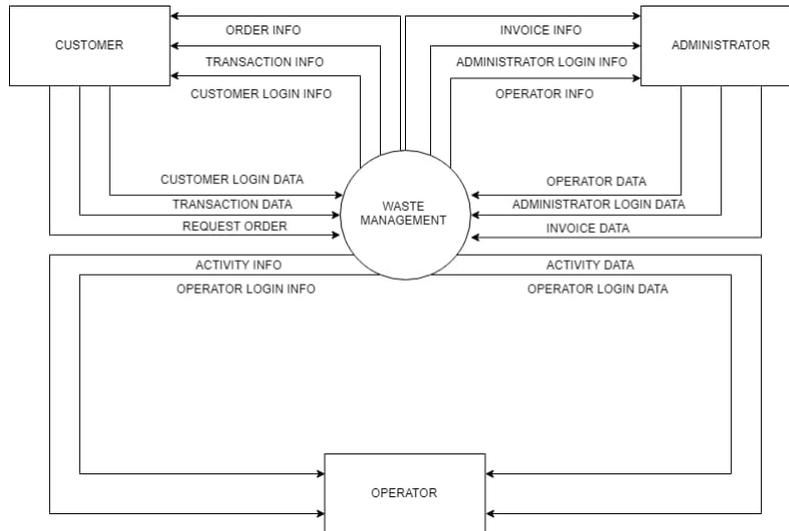


Figure 2. AllClean Application Features

**Data Flow Diagram**

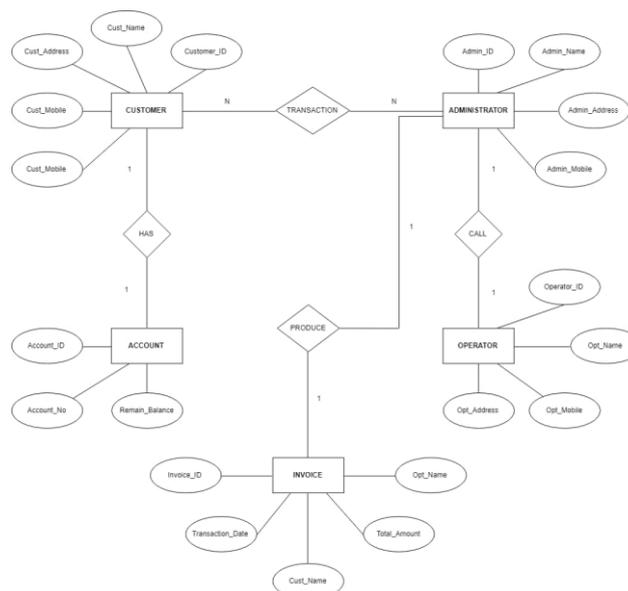
Figure 3 shows Data Flow Diagram (DFD) of AllClean App where there is data entering and data coming out and there are entities and data flow, using Yourdon symbols to describe the AllClean information system. There are 3 entities, namely Customer, Administrator and Operator where the Customer has 6 activities, namely login data, transaction data, order requests, profile info, transaction info and order info. Administrators have 6 activities, namely login data, invoice data, operator data, login info, invoice info and operator info. Meanwhile, the Operator has 4 activities, namely login data, activity data, login info and activity info.



**Figure 3. DFD of AllClean Application**

**Entity Relationship Diagram**

Figure 4 shows the data's relationship on AllClean Application. There are five entities, namely Customer (1), Administrator (2), Operator (3), Account (4) and Invoice (5). Customer related to Account entity as 'Has'; Customer entity is also has relationships with Administrator entity, as 'Transactions'. Administrator entity related to Operator entity, namely 'Get' relation and while Administrator entity has also relationship with an Invoice entity as 'Produce' (Generate).



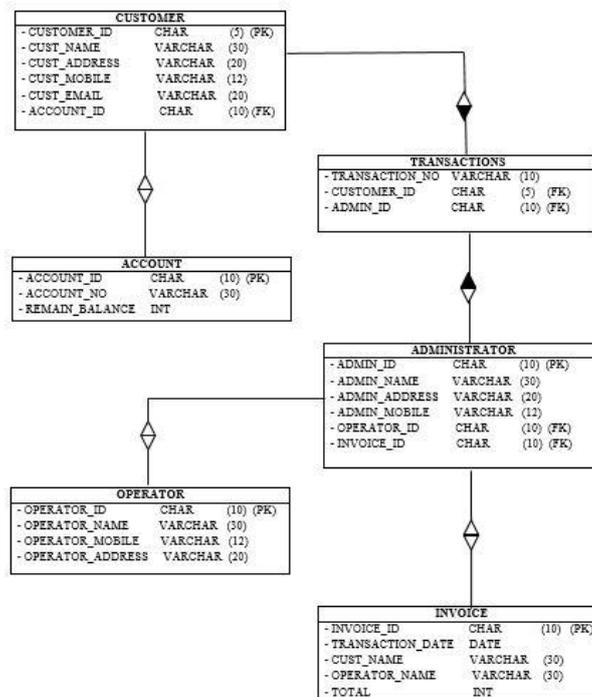
**Figure 4. ERD of AllClean Application**

**Table 1. Entities and Attributes on Allclean Application**

Entities	Attributes	Remarks
Customer	Customer_ID	Customer ID Number
	Cust_Name	Customer's Name
	Cust_Address	Customer Address
	Cust_Mobile	Customer Mobile Phone Number
	Cust_Email	Customer Email Address
	Account_ID	Customer Account ID
Transaction	Transaction_No	Transaction Number
	Customer_ID	Customer ID Number
	Admin_ID	Admin's Name
Administrator	Admin_ID	Admin's Name
	Admin_Name	Admin Address
	Admin_Address	Admin ID Number
	Admin_Mobile	Admin Mobile Phone Number
	Operator_ID	Operator ID Number
	Invoice_ID	Invoice Number
Operator	Operator_ID	Operator ID Number
	Operator_Name	Operator's Name
	Operator_Mobile	Operator Mobile Phone Number
	Operator_Address	Operator Address
Account	Account_ID	Customer Account ID
	Account_No	Bank Account Number
	Remain_Balance	Customer Remaining Balance
Invoice	Invoice_ID	Invoice Number
	Transaction_Date	Transaction Date
	Cust_Name	Customer's Name
	Operator_Name	Operator's Name
	Total	Total Invoice

**Concept and Application Design**

Figure 5 shows the information used to build the AllClean application model.



**Figure 5. AllClean App Conceptual Database**

### User Interface (UI) Design

Next steps were designing the User Interface (UI) that aiming for a simple and efficient application. When the interface is properly designed, it is comprehensible, predictable, and controllable; users feel competent, satisfied, and accountable for their actions. Figure 6 shows the AllClean Admin form. It encloses Admin User name that needs to be inputted, along with its password, enable them to login into the system.

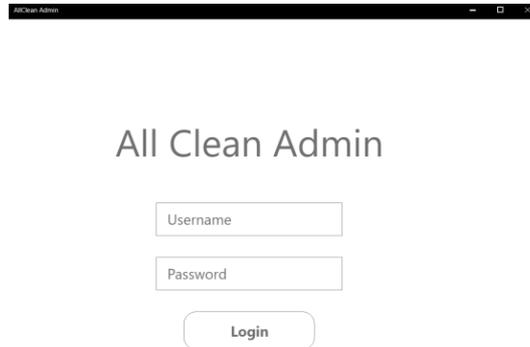


Figure 6. Admin Login Interface

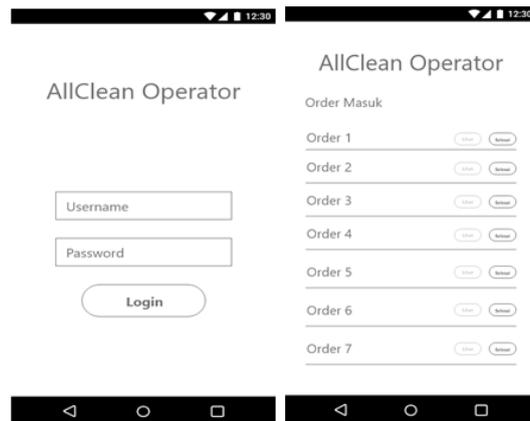


Figure 7. Interface on Android Devices

Meanwhile, the interface on Android devices, will appear as AllClean Operator form that is also requiring User name and password that needs to be inputted, allowing them to login into the system. See Figure 7. Figure 8 to 11 are user interface on Android devices. Users have to register and input their details, and then they can proceed with any service request, including total calculation of payment that needs to be settled for the service.

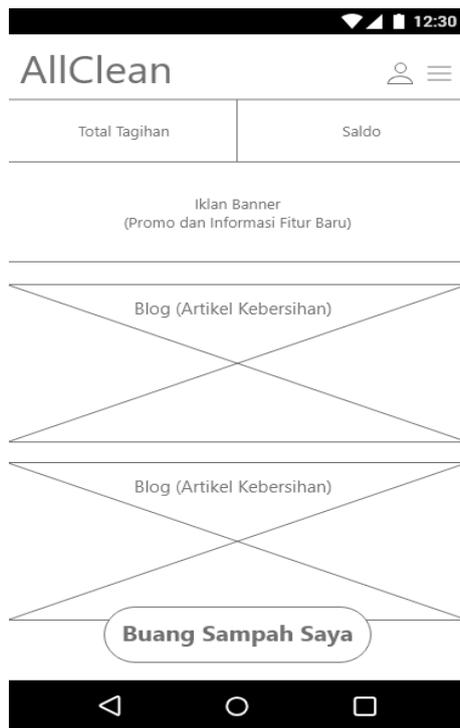


Figure 8. Customer Homepage



Figure 9. Order Form

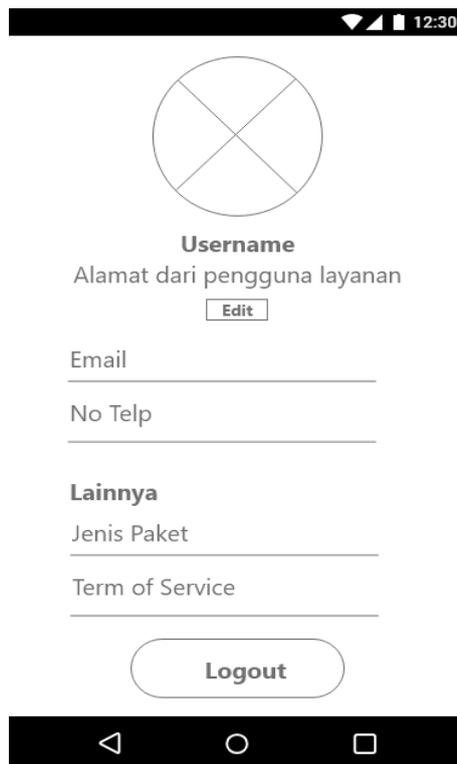


Figure 10. User Profile

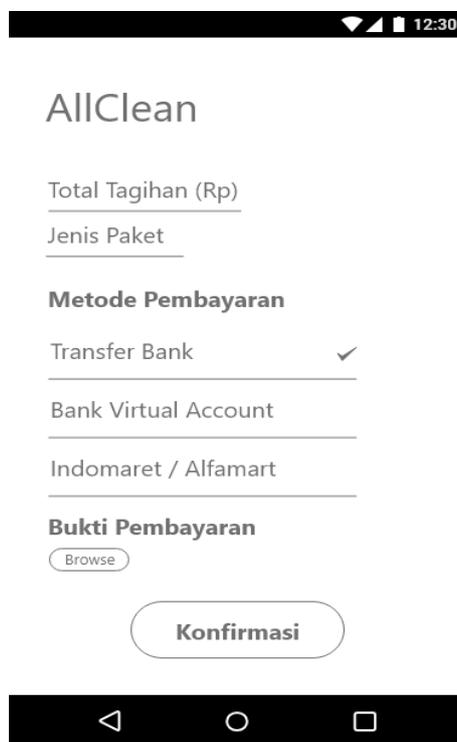


Figure 11. Payment Form

## CONCLUSION

Creating an effective technology, mediated by a prototype approach, in which all process was carried out through repeated interaction and continuous improvement until it complies with the requirements of the user, ensuring its high capability.

AllClean Application aims to help people manage their home/industry waste by managing their own waste pickup service, avoiding waste accumulation. AllClean Application can reach all levels of social order to help everyone creates a clean environment and maintain public health. People can also join and be a partner of. It is indirectly offered job opportunities and help the community.

Academic empowerment can be regarded as the greatest help in waste management, given its expertise and also its responsibility in the community. Further study needed with more data and a wider scope to expand the impact.

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