RESEARCH ARTICLE OPEN ACCESS

Developing BuJel Application Using Extreme Programming (XP)Methodology

Dwi Wulandari Sari*, Kurnia Gusti Ayu**
*(Faculty of Computer Science, Universitas Mercu Buana, Jakarta
Email: dwi.wulandari@mercubuana.ac.id)
** (Faculty of Computer Science, Universitas Mercu Buana, Jakarta
Email: kurnia.gusti@mercubuana.ac.id)

----------**********----------

Abstract:

Waste Cooking Oil (WCO) is one kind of household waste that damages and pollutes the cleanliness of water. It is better to process WCO(*Jelantah* ~Ind.) into biodiesel, which is currently being promoted, and one of which is in PancoranSub-district, South Jakarta. However, the officials at Pancoran Sub-district office are constrained in regulating the time for collecting WCO due to limited officials. In general, this research aimed to reduce WCO in the environment, and the specific goal was to make it easier for the Pancoran Sub-district office to collect WCO effectively and efficiently. Regarding the existing problems, the researchers have provided a solution through this research, which was called the BuJel (stands for – *Buang Jelantah* in Indonesian, meaning 'Throw WCO Away') Application using the Android-based Extreme Programming methodology by adding Google Maps API feature to determine the locations where the WCO were collected, thus it can save time. This research has also given new experiences for researchers in helping people by relying on science and knowledge based on information and technology.

Keywords —***extreme programming, Waste Cooking Oil (WCO), android, Google Maps API.***

----------**********----------

I. INTRODUCTION

Waste cooking oil (WCO) is obtained from the residue of the frying process. According to the data from Statistics Indonesia (BPS), the amount of cooking oil consumption keeps increasing every year. As a result, the increasing amount of cooking oil consumption will cause the increasing amount of WCO. Another big problem occurs whenWCO is disposed carelessly into the environment, which leads to environmental pollution. Based on field observations, almost all WCO is from household activities that are disposed directly into environmental media. Therefore, people awareness, especially the people of Jakarta, is necessity [1].

Based on the Regulation of the Governor of DKI Jakarta (PERGUB DKI), all WCO producers or businesses are obliged to process their WCO in a betterway so as not to pollute the environment. This regulation encourages the Pancoran Sub-district officials initiatively collects WCO produced by household activities from each of the residents' houses, which will later be distributed to the waste processing officials to be processed into biodiesel.

However, based on the implementation on the field, Pancoran Sub-district officialsfaces obstacles, such as limited number of people who are assigned for collecting WCOall over Pancoran; in one neighborhood association (RT), there is only one person assigned, and this person is a housewife who actively participates in Family Welfare Movement (PKK) activities in Pancoran Sub-district. Thus,it takes a longer time for the officials in collecting WCO.

By looking at the problem of time management and the lack of sub-district officials, it is shown that the application is extremely needed. Therefore, the researchers conducted a research adapted to field condition by creating an Android-based application using the Extreme Programming methodology. Later on, Pancoran Sub-district office can easily collect WCO.

There are several researches about the Extreme Programming applications, and one research conducted by Azdy *et al*. resulted in making a customer service application at college; a research conducted by Mesri Silalahi resulted in the form of a web-based inventory system design for CV Profestama Kurnia Nisa using Extreme Programming; another research conducted by Shofwatul presented online information on the river quality status, as well asup-to-date relationships that can be accessed online, all were built using the Extreme Programming method.

This research aimed to create an application called BUJEL to ease the Pancoran Sub-district officials to collect WCO efficiently and effectively, to provide information to the public about the benefits of collecting WCO as well as the dangers and future impacts, so that the biodiesel production can run smoothly.

II. LITERATUR REVIEW

A. Waste Cooking Oil (WCO)

Cooking oil is one kind of oil (liquidv) derived and purified from plant or animal fat, which is at room temperature and usually used for frying food. In Indonesia, cooking oil is produced from palm oil on a large scale. The process of filtering palm oil is usually done 2 times (removing the unsaturated layer), and this causes the content of unsaturated fatty acids to be higher. The high unsaturated fatty acids in cooking oil causes cooking oil to be easily damaged in the deep-frying process since the oil will be heated continuously at high temperatures in the frying process. During the frying process, the oil will immediately mix with the air as well, causing an oxidation reaction. This is known as the waste cooking oil, which is the cooking oil that has been used many times for frying. Repeated use of cooking oil is usually caused by reasons of savings, and in the other side, it will reduce the quality of the cooking oil, which is also affects the quality of the fried food[4].

Biodiesel is known as an environmentally friendly and renewable fuel. Biodiesel is made from transesterification of plant oil or animal fat, with either methanol or ethanol. Biodiesel produced from plant oil or animal fat is generally more expensive than the conventional diesel fuel. Therefore, biodiesel can be made from vegetable oil that does not have to be new or fresh oil, such as WCO (waste cooking oil)[5]

B. Extreme Programming (XP) Method

A structured, object-oriented, systematic development method is used in the development process to produce an information system as needed [6]. Extreme Programming is a software development technique that is quite simple, has communication, and has a good feedback. Extreme Programming is designed for small teams who would like to develop software quicker and in a fast-changing environment as well [7]. The XP method is a lightweight software development technique and one of the agile methods pioneered by Kent Beck, Ron Jeffries, and Ward Cunningham. XP is one of the most widely used agile methods and a very popular approach. XP only targets small to medium teams, and does not need large teams. This is intended to deal with unnecessary requirements or rapid changes in requirements. Compared to other agile methods, XP has advantages, such as it is a suitable technique for projects that require rapid changes, projects with high risks, and projects with new challenges. The programmer team consists of at least 2 to 10 people, and they should be capable of automating testing, as well as the role of direct customers[3]. The stages carried out are Planning, Design, Coding, and Testing.

According to Wongso (2020), this XP methodology consists of 4 core values as follows:

1. Communication

Communication is especially important in software development. Therefore, XP focuses on good communication between consumers, team members, and project managers. XP usually builds pair programming where consumers should be directly involved in the software development process in order to get the desired development perspective, and to adjust it to the system being built.

2. Simplicity

XP runs all systems with practical simplicity without losing the main function of the system. A short and simple method is used for the design. Therefore, XP usually makes a simple design, which eliminates or remove sun used features.

3. Feedback

Feedback is necessary for a system to work optimally. Therefore, any information should be collected at each interval and consistent time, and any problems that arise during the development process should be discussed and solved. This feedback is used as an indicator for processing the project and informs the project manager if changes need to be made.

4. Courage

XP programmers are expected to be courageous to experiment in rewriting codes if they think there are lacks with the existing codes or designs. This can help improve the morale and integrity of the project developer and support further communication with other project developers.

C. *Android*

Android is an operating system developed for Linux-based mobile devices. This operating system was initially developed by Android Inc. which was later purchased by Google in 2005 [4]. Firebase is a backend service currently owned by Google. Firebase becomes one of the solutions offered by Google to facilitate mobile application developers. Firebase offers many features that allow application developers to develop applications easily [11].

D. *Google Maps API*

Google Maps is a free service provided by Google and is very popularly used to show location points using maps. Google Maps is a world map that can be used to view an area. In other words, Google Maps is a map that can be seen using a browser [8]. However, with today's sophistication of technology, the Google Maps feature can be added to a mobile device by utilizing a Java Script library.

III. RESEARCH METHOD

The design model used in this research was the Extreme Programming (XP). The figure below describes the stages of the Extreme Programming methodology:

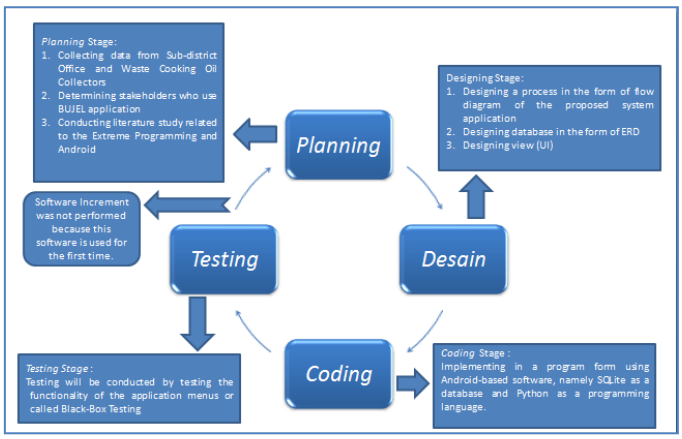

Figure 1.Stages of the Extreme Programming Methodology[9]

A. *Data Searching Method*

Field Study

a. Observation

Observation is a method of collecting data by conducting a direct observation and being involved as waste collection and Pancoran Residents

b. Interview

Interview is an activity containing questions and answers session between two parties: the questioner and the answerer, to ask for information

or opinions on a matter. In this interview stage, the researchers were going to interview user.

c. Literature Study

This is done by concluding data from the reference books concerning Extreme Programming which was applied in built application.

IV. RESULTS AND DISCUSSION

The stages in designing the BuJel Application using the Extreme Programming methodology will be explained as follows:

A. *Planning*

The planning was started by gathering the requirements that allowed the members of XP team to understand the business context of the software to be created and obtained broad insights as to what outputs were required and the main features of the software. This stage would direct to the making of "stories" that described the required output, features, and functions of the software to be created [10]. At this stage, the first things to do were observing and interviewing the Pancoran Sub-district officials and WCO collectors to find out the problems related to the WCO collection program. The problems faced were ineffectiveness and inefficiency in collecting WCO due to the small number of officials appointed by the Sub-district Office, which results in a waste of time. The next step was running the system analysis such as determining the stakeholders who would use the application. The final stage was conducting a literature study on the use of the Extreme Programming methodology in building an Android-based application. The stakeholders who would use the BUJEL Application are as follows:

TABLE 1.
LIST OF STAKEHOLDERS: BUJEL APPLICATION USERS

No.	*Stakeholder*	Status
1.	Pancoran Residents	User
2.	Sub-district Officials	User
3.	Application Admin	Admin
4.	Waste Collector	User

B. *Design*

The next stage was making design,in which the modeling activities were conducted, starting from system modeling, architectural modeling, and database modeling. The system and architecture modeling used the Unified Modeling Language (UML) diagram, while the database modeling used the Entity Relationship Diagrams (ERD) [12]. Below is an overview of the proposed system in the form of a proposed system flow chart for the BuJel Application:

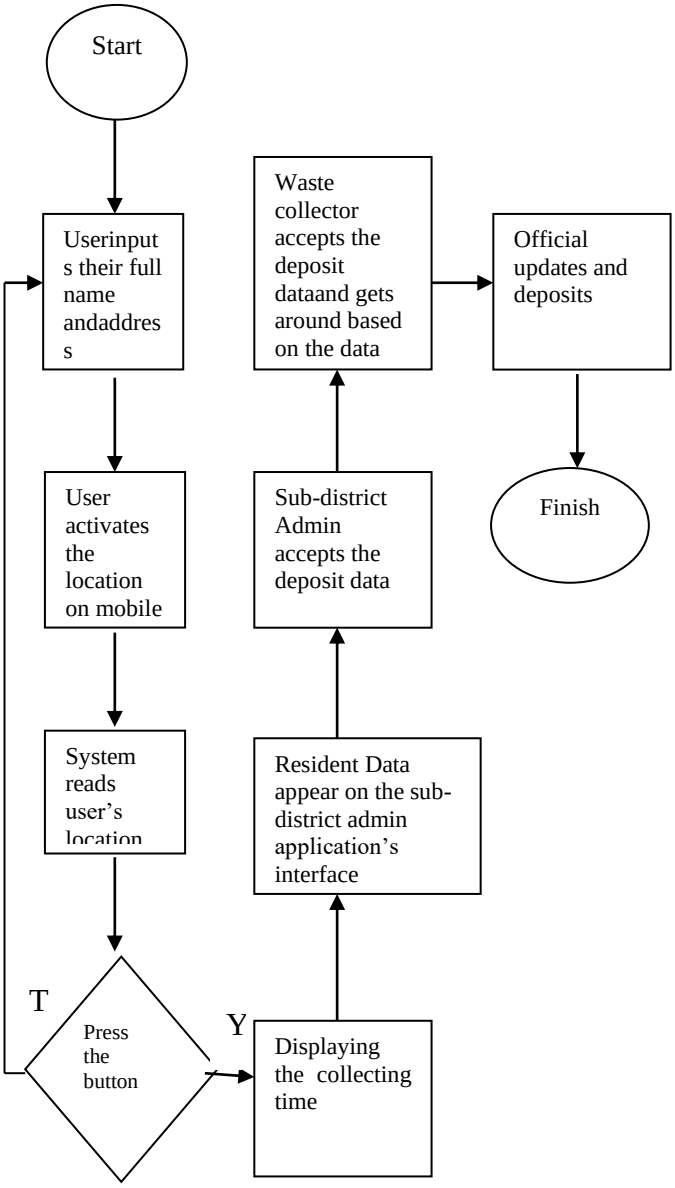

Figure2.Proposed system flow chart for the BUJEL Application

The figure below shows the diagram used for describing the business process:

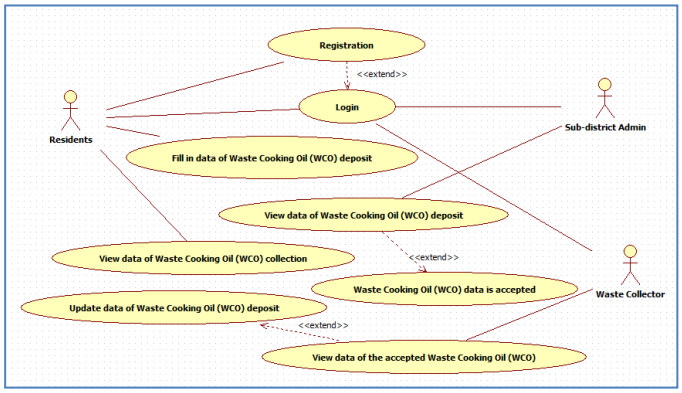

Figure3.Use Case Diagram of BUJEL Application

Database relations used are described by the Logical Database Design as follows:

Figure3.Logical Database of BUJEL Application Design

C. ***Coding***

After passing the two stages above, the next stage was the implementation into the program code which would produce the BuJel Application. SQLite was used for the database implementation since this is an Android-based application; mean while, Pyton was used for the programming language. The use of the Google Maps API in Android was to determine the location of residents who needed to collect WCO.

Figure4. Login screen

Figure5. Account registration screen

Figure 4 shows the initial appearance of the application when it is run on an Android phone. A menu for logging in is displayed for users who have registered themselves to the application. If you are not registered yet, just proceed to the registration menu.

Figure 5 shows the application user account registration form which required uploading Identity Card (KTP) to find out where the residents live.

Figure6.Information After logging in

Figure7. User account after registration

Figure 6 shows the information display after registration, where the user data will be validated by the Sub-district Office, and infromation whether the user data are accepted will be informed via WhatsApp later.

Figure7shows the user screen display after successfully logging in to their accounts. This is where the user wants to deposit WCO. Entering the

current date will also be recorded in the database as the time of deposit. Address synchronization will be processed before the data are sent.

Figure8. Information if the Location matches

Figure9. Information if the location does not match

Figure 8 shows the information display; if the sync button is clicked, then it matches the address listed in the database.

Figure 9 shows the information display; if the synchronization button is clicked, and it does not match the address listed in the database, then you must enter a new address for WCO collection.

Figure10. Information for user

Figure 11. Menu for waste collector

Figure 10 shows information for user after the deposit form has been filled in correctly and the *send data* button is clicked. It informs that WCO will be taken within 7-14 working days after the deposit time.

Figure 11shows the waste collector menu after logging into the application. You can clearly see the list of the residents' names along with the exact location and address and the date of deposit.Data on the waste collector menu contains data of the residents whose deposit has been approved by the Sub-districtAdmin to be collected.

Figure 12. Menu for Sub-district Admin

Figure 13. Menu for waste collecting

Figure 12 shows the Sub-district Admin menu after entering the application. The list of residents' names, whose deposit data will be accepted, is clearly visible. After all data are accepted, it will be updated automatically on the waste collector menu display so that it can be followed up.

Figure 13 shows the update menu on the waste collector display. After the waste collector takes the waste cooking oil from each resident, the waste collector will enter the current date and it will be automatically saved when the save button is clicked.

D. ***Testing***

The process conducted at this stage was to test the application being made. One of the things tested was the overall functionality of the BUJEL Application.The method used to test the BUJEL Application was the Black-Box Testing, namely by testing the input and output of the BUJEL Application. This test wasperformed using the Blackbox method. The Blackbox testing only focuses on the functional requirements of the software to see whether the application program produces the desired output and is in accordance with the function of the program.

TABLE 2.
THE RESULTS OF BLACKBOX TESTING

Input	Expected Results	Output Test	Test Results
Submit Button– Login Menu for residents	Display the Waste Deposit Form menu	The waste deposit form based on the user account is displayed	Ok
Registration Link	Display the registration form of plication user account	The registration formis displayed	Ok
Send data button	Display the information that the data has been sent	The information that the data has been sent is displayed	Ok
Accepted button	Display the approved depositor data	The approved depositor data are displayed	Ok
Update Link	Display the updated information of depositor data	The updated information of depositor data are displayed	Ok
Address Synchronization Button	Display the information of synchronized data	The information of synchronized address data is displayed	Ok
Submit Button – Menu Login for Sub-district Admin	Display the data of depositors who will be accepted	The list of depositors who will be accepted is displayed	Ok
Submit Button – Login Menu for Waste Collector	Display the data of depositor whose waste will be collected	The data of depositor whose waste will be collected is displayed	Ok

E. ***Software Increment***

This stage was the stage of developing a system that had been made gradually, which aimed to increase the functionality of the system. In this research, the Software Increment stage was not carried out because the software being built was still the first time to be applied.

V. CONCLUSIONS

Based on the results of this research, it can be concluded that:

1. The involvement of stakeholders who are directly involved in collecting WCO shows that this application has really been adjusted to their needs.
2. Residential addresses are synchronized because many of the addresses are different from the address on their Identity Card (KTP).
3. By using Google Maps API technology, residents can obtain the latest location, making it easier for waste officers to collect WCO.
4. The BUJEL Application is developed using an Android-based application, which consists of a login menu, account registration for application users, waste oil deposits, validation of citizen deposit data, updated deposit data and information provided to residents regarding synchronization of addresses and collection times of WCO.

ACKNOWLEDGMENT

Our praise and gratitude go to the Lord for all His grace and gifts so that this internal research can be successfully completed. We would also like to thank our family *Faculty of Computer Science, UniversitasMercuBuana*, and especially *PUSLIT UniversitasMercuBuana* for funding this research. The theme chosen in this internal research activity is *"**Developing BuJel Application Using Extreme Programming (XP)Methodology**"*. The authors

realize that this report is far from perfection, and therefore constructive criticism and suggestions are welcomed to make this research better.

REFERENCES

[1] DLH, Dampak Negatif Minyak Jelantah Bagi Lingkungan dan Kesehatan, https://lingkunganhidup.jakarta.go.id/dampak-negatif-minyak-jelantah-bagi-lingkungan-dan-kesehatan/#:~:text=Limbah%20minyak%20goreng%2Fjelantah%20yg,dapat%20masuk%20ke%20perairan%2C%20akibatnya, 2019.

[2] Azdy, R. A., Penerapan Extreme Programming Dalam Membangun Aplikasi Pengaduan Layanan Pelanggan (PaLaPa) Pada Perguruan Tinggi, *Jurnal Teknologi Informasi dan Ilmu Komputer (JTIK)* , 197-206, 2018.

[3] Mesri Silalahi, Y, Implementasi Extreme Programming Pada Sistem Inventory Mebel Pada CV Profestama Kurnia Nisa, *Kumpulan Jurnal Ilmu Komputer (KLIK)* , 2019.

[4] Malyana, E., Pemanfaat Android Dalam Perancangan Aplikasi Kumpulan Doa, *Jurnal Sains Dan Informatika*, 2018.

[5] Syam, M. E, P. A., Amaliyah, N., and Hayat, A., Peluang Pemanfaatan Limbah Minyak Goreng Sebagai Bahan Baku Biodiesel di Makasar, *TEPAT*, 2018.

[6] Fatoni and Irawan, D., Implementasi Metode Extreme Programming dalam Pengembangan Sistem Informasi Izin Produk Makanan, *Jurnal SISFOKOM*, 2019.

[7] Chandra.B.A, Muludi. K., and Irawati, A.R., Rancang Bangun Sistem Informasi Manajemen Terpadu (SIMANTEP) Online PT. PLN (Persero) Sektor Pembangkitan Tarahan Lampung Dengan Metode Extreme Programming, *JKomputasi* , 31-42, 2012.

[8] Ariyanti, R. K., Pemanfaatan Google Maps API Pada Sistem Informasi Geografis Direktori Perguruan Tinggi Di Kota Bengkulu, *Jurnal Media Infotam*a 2015.

[9] Supriyatna, A, Metode Extreme Programming Pada Pembangunan Web Aplikasi Seleksi Peserta Pelatihan Kerja, *Journal Tek. Inform* , 1-18, 2018.

[10] Dwi R.A, Imamah, F., Andre Y.M., and Ardiansyah. Aplikasi ChatBot(Milki Bot) yang terintegrasi dengan Web CMS untuk Customer Service pada UKM Minsu, *Jurnal Cendikia, 2018.*

[11] Anisah , N., Ecintia, D., Lukman , A., & Devianto, Y, Android-Based Boarding House Management Information System,*International Journal of Computer Techniques-Volume 5 Issue 6, Nov-Dec 2018.*

[12] Carolina, I. and Supriyatna, A., Penerapan Metode Extreme Programming Dalam Perancangan Aplikasi Perhitungan Kuota SKS Mengajar Dosen., *Jurnal IKRA-ITH Informatika*, 2019.