FoodX, a System to Reduce Food Waste

Shinta Oktaviana R, Diana Ambarwati Febriani, Intan Yoshana
Dept. Computer and Informatics Engineering
Politeknik Negeri Jakarta
Indonesia
shinta.oktaviana@tik.pnj.ac.id

LR. Payanta
Dept. Technology and Management
Instituto Politecnico de Braganca
Portugal
m303544@alunos.ipb.pt

Abstract—**Food waste is a serious problem that occurs in various countries. Indonesia is a country that produces food waste, the second largest after Saudi Arabia. Currently, there are several communities who care about the issue of food waste and hunger in Indonesia. The Community collects excess food from eligible donor consumption to be distributed to people in need. They have the aim to reduce the problem of food waste and numbers starving in Indonesia. However, the process of channeling food to donors and the community is still practically a manual where the community contacts the donors one by one, so it is considered less effective. This research aims to create a system to connect the community with individuals or organizations that want to donate excess food. In order for users to give faster feedback, this system was made using the prototype methodology. At the final stage of the development, testing was carried out by involving several volunteers and 3 communities to see the completeness of the features system. FoodX system made already accommodate the needs of 2 types of food communities (with and without volunteer).**

Keywords— food waste, hunger rate, sustainable development goals, social entrepreneurship.

I. INTRODUCTION

The Economist Intelligence Unit mentions that Indonesia is a country with the second largest producer of food waste after Saudi Arabia, one person Indonesia annually produces 300 kg of food waste. While in Saudi Arabia, one man produces 427kg. Even though Famine numbers in Indonesia are high, according to the Global Hunger Index, Indonesia is in the serious category with a score of 20.1 and ranks 70th from 117 countries [1]. While the United Nations (UN) data shows that 1.3 billion tons of food in the world is wasted every year, while almost 2 billion people in the world are hungry or malnourished. In 2011, the FAO started the "SAVE FOOD: Global Initiative on Food Loss and Waste Reduction" program. this program encouraging dialog between industry, research, politics, and civil society on food losses working together to raise public awareness the effect of food waste [2] [3]. Food waste define as any raw or cooked quality food along the value chain which is suitable for human consumption but ultimately ends up un-consumed or discarded, usually at the retail or consumer end of the chain, or process [4]. There are several factors that cause food waste, such as household income and demographics, culture, individual attitude, and cooking process/method [5].

Between 2000 and 2019, Indonesia's hunger rate in the Global Hunger Index (GHI) score decreases from the number 25.8 to 20.1. Despite the decline, the score is still included into the serious category [6]. According to the Food and Agriculture Organization, 30 percent is food wasted throughout the supply chain, contributing 8 percent of total gas emissions global greenhouse. So that in 2015, all members of the United Nations set a global goal to ensure that everyone can enjoy peace and prosperity in 2030 called Sustainable Development Goals (SDG). SDG has seventeen mutually objective objectives integrated, where actions in one area will affect results in other fields [6].

Nowadays in Jakarta, there are several communities that care about the issue of food waste and hunger in Indonesia. The community collects leftovers that are still suitable for consumption to be distributed to people in need. They have a goal to reduce the problem of food waste and hunger in Indonesia. On the other hand, many individuals or organizations that still have leftovers worthy of consumption for distribution to those in need, but do not know who to distribute to if enough food is to be donated. Based on the results of the questionnaire that was conducted, 65.2% of respondents did not know that they could donate excess food to a community. Even 63.4% of respondents did not know of the existence of the social community. The food donation business process that is happening at this time is still ineffective because from donation requests by donors to reporting recipients in the form of photos and descriptions from the community, they still use communication platforms such as WhatsApp or telephone.

This research aims to create an application model that can connect food donors, humanitarian communities, and people who are starving in Jakarta. In this paper we will discuss some of the business process in existing social community, the design of the application, the application, and some further research recommendation.

II. BACKGROUND LITERATURE

A. Social Entrepreneurship

Social entrepreneurs are people who have the ability to solve community problems by implementing innovative ideas. The main objective of social entrepreneurs is not to get profit but to implement an increase in the welfare of society at large, the financial benefits obtained are considered as a means or tool to complete social missions [7] [8].

Social entrepreneurship is divided into two different categories; non-profit organizations (nonprofit organizations) and organizations with financial and social goals (hybrid). Non-governmental organizations (NGOs), as non-governmental organizations categorized into a non-profit organization. This organization is usually formed by an ordinary citizen and can be funded by the government, foundation, business, or individual. Some were founded by not having funds at all and operated by volunteers. The second category is further divided into social hybrids and economic hybrid. Both are organizations with a purpose, financial and social. What distinguishes the two is the main goal, both of which more social or economic leaning. For social hybrid organizations, it is more focus on the social mission, while

generating income is the goal secondary. Usually financial benefits are used for sustainability organization. On the other hand, the main objective of a hybrid economic organization is profit. However, actively involved in social activities. In other words, organization social responsible businesses are classified in this category [9] [10].

In Indonesia, an example of social entrepreneurship is the Kitabisa.com application. Kitabisa.com is a platform to raise funds and donate online. Kitabisa is a good linking site that brings together social activity actors with a group of donors. Since it was founded in September 2014, the Kitabisa.com crowdfunding application has successfully carried out social entrepreneurship by promoting the principle of openness and has succeeded in collecting and distributing funds of 500 billion rupiahs [11].

Another social entrepreneurship application that contribute to prevention of food waste is Olio. Olio is a platform for sharing food that connects individuals with neighbors and local shops around the world. Olio users can donate fresh vegetables, bread from bakeries and excess household food. To register food, users only need to add food photos, descriptions, and when and on which food is available to take. Meanwhile, to see food available simply by browsing the main page that contains a list of foods in the surrounding area. Olio was first released in early 2015 by Tessa Clarke and Saasha Celestial One. In October 2017, Olio successfully collected funds of $2.2 million. Olio also has around 1.2 million users on throughout the world in July 2019 [12].

B. Sustainable Development Goals

Sustainable Development Goals (SDG) is a global goal approved by UN members as a universal call to end poverty, fighting hunger, protecting the planet (world), and ensuring that everyone can enjoy peace and prosperity in the year 2030 which is called the Sustainable Development Goals (SDG). SDG has seventeen integrated objectives, where actions in one field will be influencing results in other fields. The objectives are No Poverty, Zero Hunger, Good Health and Well-being, Quality Education, Gender Equality, Clean Water and Sanitation, Affordable and Clean Energy, Decent Work and Economic Growth, Industry, Innovation, and Infrastructure Reduce Inequalities, Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action, Life below Water, Life on Land, Peace, Justice, and Strong Institutions, Partnerships for the Goals [13]. This research is a focus on making the application how to achieve the goal in Zero Hunger and Responsible Consumption and Production of SGD.

The second SDG states that by 2030 it must end hunger and all forms of malnutrition. This is achieved by doubling agricultural productivity and income of small-scale food producers, with ensuring a sustainable food production system and progressively improve soil quality. Agriculture is the only largest company in the world, which provides livelihoods for 40% of the global population, where is the largest source of income for poor rural households. Women make up about 43% of the agricultural workforce in these countries growing, and more than 50% in parts of Asia and Africa. However, women only have 20% of the land [13].

The food industry accounts for around 30% of total energy consumption in the world also contributes 22% to greenhouse gas emissions. Therefore, the 12th SDG can only be achieved when each country ensures that production patterns and their consumption do not damage the environmental boundaries of the planet, and also the conditions economically and socially in other countries. The main planning in this SDG is to reduce inequality in the use of natural resources. Developed countries are asked to take the lead in adopting consumption practices and sustainable production, to improve livelihoods underdeveloped countries. For example, reducing food waste can have an impact on reducing food prices worldwide so that it is beneficial for the poor. In addition, increasing the purchasing power of the poor is ideal must be harmonized with increasing awareness of sustainable consumption [13].

III. METHOD

The work implemented the Prototyping model in the effort of design and development of FoodX application, due to its ability to reduce development time, and several iteration with the user makes this method easier to actively involve the user in system development. The process development of prototyping shows in Fig. 1[14].
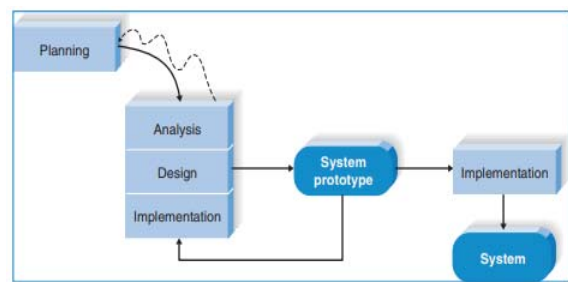

Fig. 1. Prototyping Phase [15]

A. Analysis Phase

In developing this system, the analysis was carried out in 2 ways such as direct observation and literature study. Direct observation was carried out by involving 3 food distribution communities. They are Food Cycle and Foodbank of Indonesia in Jakarta, and Garda Pangan in Surabaya. Those social community has been working to distribute processed food and processed packaged food to people who are vulnerable to hunger around the city area for several years. Each community has a different way of working despite having the same goal. The analysis process is carried out to find a model to build the system that can be used by all of these social communities.

The literature study was conducted by studying several forms of similar application that already exist in Indonesia. One application we studied was gifood.id. that work in Yogyakarta area. This application has the same mission as the application being developed, there are only different concepts in terms of business process frameworks.

From the results of the analysis the business process model is designed from the application developed as shown on Fig. 2. There are 4 types of users of this system, application managers, community managers, donors, and volunteers. The application manager has a role to oversee and manage all transactions from each community, donors, and volunteers. Community managers function to regulate the distribution of food from donors and report the results of distribution to donors. Donors need an application to distribute food. Because not all communities have volunteers, the application for volunteers only serves to help in the process of picking up and distributing food.

362

B. Design

At this phase, an interface design for features that have been determined in the previous phase is carried out. The results of this design will be used to develop prototype applications at the next phase. Whimsical tools are used to design the user interface of the application. Indonesia language is used as user interface instruction to make it easier to use in local communities Fig. 3 and Fig. 4 are some example we created for UI design.
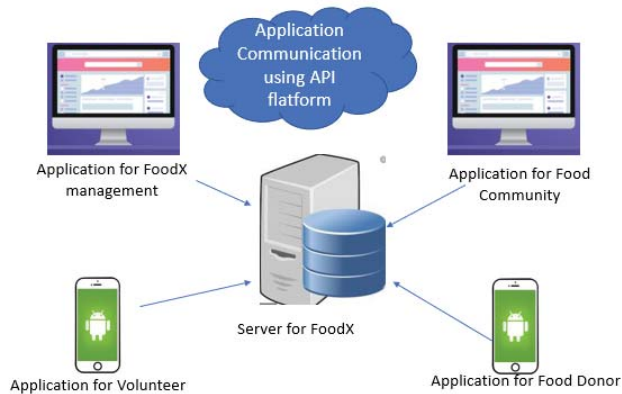

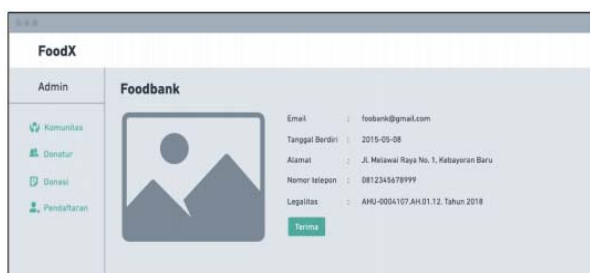Fig. 2. The FoodX System

Fig. 3. UI Design for Mobile Application

Fig. 4. UI Design for Web Application

C. Develop Prototyping

The prototype of the application was developed based on the results of the design stage. Applications are made using the PHP programming language with Laravel framework for web-based applications, and Kotlin for android-based applications. While the DBMS used its PostgreSQL.

D. User Evaluation

User evaluation is part of testing in prototyping method. the users give the feedback from the prototyping product. It is very important because it helps ensure that the system does not meet usability issues. The Food Cycle and Foodbank of Indonesia as a food community, and the volunteers are included in this process. The phase did in 3 cycles, the result are the improvements features in application for donors, volunteers, and the food communities. Table I shows the incremental process in the developing application.

In this phase, the process testing of the system using user acceptance test template. We included 3 community managers, 4 volunteers, and 3 donors. Some iterations are done until all the errors resolve successfully and all the requirements fulfill.

TABLE I.   TABLE OF APPLICATION FUNGTIONALITY

Phases	Type of User		
	Community Managers	Donors	Volunteers
Phase 1	• Registration form • Login form • List of Food Distribution • List of Donors • List of Volunteers	• Registration form • Login form • Donation form	• Registration form • Login form • Automatically receive task
Phase 2	• Find the closed volunteers • Reporting process	• Find the closed communities • Food picture and food description	• Reporting task form • Donation picture and description
Phase 3	• Notification for every request • Approval for the donation • Tracking donation	• Notification • Tracking donation	• Connecting to google map

E. Implementation

This is the last phase where the system was developed. The work uses the Geotag to integrate GPS and GIS. It also incorporates hotspots pinpoint using the Geotag location, Google Maps Engine API, Google Maps Direction API, and Apple Maps. Unit testing, Integration testing, and Systems testing were performed to test the system.

Fig. 5 is an example user interface mobile application for donors. The features of this application are donors explaining the amount, type, condition of food, and food expiration date. And then they chose the existing food community. The system provides information on several parties who have received food donations so far in terms of the closed location to donors. After receiving confirmation from the selected community, donors will receive further information on the process. Another additional feature is a summary of the history of donations that have been made so far.

Fig. 6 shows some implementation application for food community. The system has features like maintain beneficiary data and volunteer data, finding the closer volunteer with the donor location, and updating process food distribution. Because not all community has a volunteer community could arrange the process food distribution using other party.
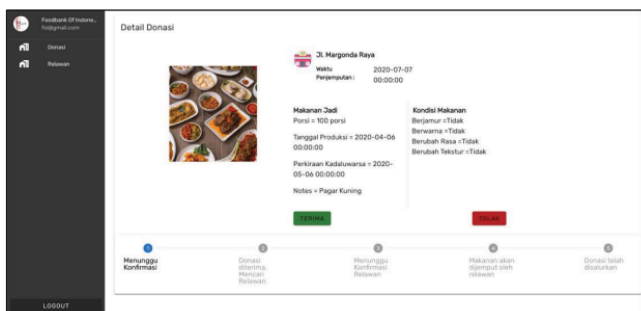
363

Fig. 5. UI Design for Web Application

Fig. 6. FoodX Web Application for Community

The mobile application for volunteer is show in Fig. 7. it has features such as accepting and declining to pick up donations, and making report to community about the quality of donation, and giving a picture of distribution process in location.

IV. RESULT AND DISCUSSION

In order to obtain responses from the users with regards to the functionality of the FoodX system, 25 volunteers and 3 communities were asked to test 23 features of the system, and all the features running well. They also give very good feedback, because the FoodX system made already accommodate the needs of 2 types of food communities (with and without volunteer), and provide convenience to the citizen in donating food.

V. CONCLUSION

Even though all the requirements have been met, and people who had extra food, humanitarian communities, and people who are starving are connected with the application, but some improvements are still needed. We need to work with people who understand food safety, so we can guarantee that all food from donors is safe. We also need to work with

other NGOs working on humanitarian issues, and with local governments. For the system, we can add a gamification method to encourage volunteers and citizens for more donations.

Fig. 7. FoodX Mobile Application for Volunteer

REFERENCES

[1] H. Gusman, "tirto.id," 3 July 2018. [Online]. Available: https://tirto.id/makanan-di-indonesia-banyak-yang-membutuhkan-banyak-yang-membuang-cNob.

[2] "Food and Agriculture Organization of the united Nation," [Online]. Available: http://www.fao.org/save-food/background/en/. [Accessed january 2020].

[3] J. Gustavsson, C. Cederberg, U. Sonesson, R. van Otterdijk and A. Meybeck, "Global Food Losses and Food Waste," FAO, 2011.

[4] M. G. Abiad and L. I. Meho, "Food loss and food waste research in the Arab world:a systematic review," *Food Security,* 2018.

[5] S. K. S. H. L. Rovshen Ishangulyyev, "Understanding Food Loss and Waste—Why Are We," *Food,* 2019.

[6] A. Pakpahan, " Shift in Global Hunger Index 2000-2017: Implications to Agricultural Policy, Food and Quality of Indonesian Human Resources.," *Forum Penelitian Argo Ekonomi,* pp. 75-90, 2017.

[7] S. &. S. V. Shukla, "Social Entrpreneurship: A Concept Towards Societal," *Journal of The Institute of Professional Excellence &,* p. 38, 2016.

[8] M. Ć. P. M. B. P. Rossella Canestrino, "Understanding social entrepreneurship: A cultural perspective in business," *Journal of business Research ,* vol. 110, pp. 132-143, 2020.

[9] H. L. &. M. S. Rahim, " Social Entrepreneurship: A Different Perspective.," *IOSR Journal of Computer Engineering (IOSR-JCE),* pp. 1-8, 2015.

[10] D. C.Chou, "Applying design thinking method to social entrepreneurship project," *Computer Standards & Interfaces,* vol. 55, pp. 73-79, 2018.

[11] kitabisa.com, "https://kitabisa.com/," kitabisa.com, 2020. [Online]. Available: https://kitabisa.com/about-us. [Accessed 2020].

[12] "https://olioex.com/," OLIO, 2020. [Online]. Available: https://olioex.com/. [Accessed 2020].

[13] "United Nation Departement of Economic and Social Affairs," [Online]. Available: https://sdgs.un.org/goals. [Accessed 2020].

[14] K. A. O. &. O. A. H. Al-Husseini, "Usage of Prototyping in Software Testing," *Multi-Knowledge Electronic Comprehensive Journal for,* 2018.

[15] W. R. Dennis, System Analysis & Design, Wiley, 2011.

365