2022 2nd International Conference on Computing and Information Technology (ICCIT)
Jan. 25 - 27, 2022/ FCIT/UT/KSA

Developing Food Charity Operations Management System

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2022 2nd International Conference on Computing and Information Technology (ICCIT) | 978-1-6654-3605-2/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICCIT52419.2022.9711609

***Abstract*—Food waste is a global concern involving several socio-economic factors that have led to an increased surplus of food quantities in communities. Charitable organizations collect food donations from donors who have excess food quantities and then distribute the food to needy people. Nowadays, technology can contribute to reducing food waste and improves food charity operations management. This paper aims to present a web-based food charity operations management system that automates charity operations, starting from donating food from donors to managing processes within food bank organizations and re-distributing food to the registered needy. The operations management system that has been developed significantly improves the efficiency of overall food charity operations and also overcomes the food access gap between the main entities, including food charity organizations, donors and needy people, ensuring a high level of service quality.**

***Index Terms*—Food charity, Food banks, Operations management, Web-based application.**

I. Introduction

Around one-third of the food produced world-wide is wasted, according to the Food and Agriculture Organization of the United Nations (FAO) [1]. Arabs pay close attention to hospitality, as providing food is considered a welcoming gesture. The Kingdom of Saudi Arabia is among the top 25 countries causing food waste, with 427 kg of food wasted per capita per year. It also has limited arable land and insufficient water supplies to sustain mass agriculture, and depends on food imports from other nations [2]. Waste is mainly caused by a lack of knowledge and poor buying practices, but culture still plays a part. As a result, food management is a critical problem for reducing waste. On the other hand, surplus food demand could increase the global price of food.

Islamic law urges the realization of social solidarity, which is considered it an obligation for every Muslim. Charities play a role in achieving this concept, as they collect surplus food and distribute it to needy people. Many food charities still use paper forms to fill out food data and other documents needed for donating and distributing food. Paper forms have many drawbacks, including problems related to loss, damage, editing, storage space, cost, and difficulty transferring them from one person to another. Charitable societies face challenges in registering beneficiaries of foodstuffs because they must come to the charity to register their personal information and places of residence. It is also difficult for food charities to review requests for food donations, arrange them through paper forms and review prior reservation submissions for donating food from donors via calls.

This paper aims to developed a web-based operations management system. The primary goal of the system for charities is to automate food donations operations management and eliminate the food access gap between food charity organizations, food donors who have surplus food from a social event, and beneficiaries who need food. Going paperless, reducing calls, speeding up operations, and gaining full access to up-to-date data can rapidly enhance operations management for food charity organizations.

II. Related Work

Throughout the last few years, the use of technologies to help with food waste management has expanded. Applications that aid in the management of food waste around the world are reviewed below. Meal Matchup [3]: A research team at the University of Washington created a food waste solution in the form of an open-source website (Meal Matchup), centered on a calendar of receipts, planned deliveries, and activity details. The donation agency, the receipting agency, and the volunteers who transport food from the donating agency to the receipting agency are the three customers. The donating agency provides the food after the receiving agency approves the order. The volunteer collects it and coordinates it. After

both parties have agreed to the request, they are informed that a new donation event has been planned. It appears on their calendar, allowing them access to the contact details of participants.

OLIO [4]: Tessa Clarke and Saasha Celestial-One created the OLIO application. OLIO stands for "a miscellaneous collection of things". It allows neighbors in the United Kingdom to share surplus food by linking them with one another as well as local businesses. Their goal is to avoid food waste by giving food to those in need rather than throwing it away. The donor can add pictures, details, pick-up times, and locations to OLIO, and needy people can search the list of available food, choose what they want, and schedule pick-up through private messaging.

11th Hour [5]: Tan Jun Yuan, a food stall hawker and developer of the 11th Hour application in Singapore, encourages food suppliers to offer last-minute discounts to consumers. Vendors offer at least a 30% discount to get more customers or decrease the quantity of food that goes to waste.

Flashfood [6]: A chef who threw out nearly $4,000 worth of food at an event inspired the Flashfood concept. The application avoids food waste in the United States and Canada in the following two ways: it resells grocery foods at a low price when close to their expiry date, and saves "not good enough" retail products and delivers them to consumers.

Food Cowboy [7]: Food Cowboy has been bridging the connectivity gap that contributes to large-scale food waste in the United States since 2013, by encouraging communication and connecting food companies or anyone who deals with huge quantities of food to the nearest charity that can accommodate their excess or unsaleable wholesome inventory. Food Cowboy also charges a small commission for providing this service.

NoFoodWasted [8]: This application stimulates demand for discounted products close to their expiry date by alerting supermarket shoppers about them. Shoppers can also check these offers online and do not need to go to the supermarket. The No Food Wasted application aims to reduce food waste in the Netherlands by 50% for the coming years.

No Food Waste [9]: It deals with hunger through a sharing economy and helps reduce food waste resulting from weddings or events by delivering it to needy people. Users can locate hunger spots in India through the application, which the team verifies and enters into their database. Users may either donate food or request service from the application, which relies on volunteer drivers to deliver donations.

Winnow [10]: By making the kitchen smarter, Window helps the food service and hospitality sector reduce food waste. With Window Vision, a tool that uses artificial intelligence that enables cooks to track food waste automatically, the system takes pictures of the waste's food. By using the images, the machine trains the types of waste. Winnow Waste Monitor comprises a tablet with a built-in digital scale. Using any box, chefs throw waste food as the usual way, and the tool helps the chefs determine the types and weights of food wasted, then the chefs think of other ways to reduce it. It is a simple and straightforward system, and the application has spread to more than 60 countries in Asia, Europe, and Australia.

Food waste reduction application [11]: This Android mobile application created in the United Arab Emirates offers another way to mitigate food waste. The application helps restaurants donate food by allowing them to upload images of their excess along with a brief overview of the food to be donated. Needy people then choose a meal from a menu, add it to their cart, and finish their order to be picked up later from the restaurant. In Saudi Arabia, there are approximately 40 charitable societies in this field located in various regions of the Kingdom. While they have multiple communication mechanisms, they still lack management systems [12]. Further, most existing charitable societies are suffering from the following shortcomings:

None of these charitable societies has a unified application for all services to donate and distribute food. For example, (charity A) has two applications, one for restaurants and one for beneficiaries. The main goal of these is the distribution of food. However, they do not have services for individuals on their applications. If individuals wish to book a food collection service, they must do so 48 hours in advance of the occasion. Some of the charitable societies have partnerships. For example, (charity B) has a partnership with the (C) application to arrange a social event. After that, (charity B) contacts the users via phone numbers. On the other hand, (D) is one application that does not belong to any charity. In this application, information is presented about charities near the user's location.

III. SYSTEM MODEL

The proposed operations management system aims to develop a unified and automated operations management system for food charities. Further, the aim of the system is to facilitate processes management for the donations and registration of beneficiaries. Another focus is on food collection service through four types of users including donors, beneficiaries, supervisors, and team leaders. Table I clarifies the users and their roles in using the system. Furthermore, Figure 1 demonstrates the interaction between the users and the system in the use case diagram of the proposed system.

TABLE I. FOOD CHARITY MANAGEMENT SYSTEM USERS' ROLES

User	Role
Donor	People who have food surplus and want to donate it.
Beneficiary	Needy people of food who are enrolled in the system to receive it.
Supervisor	The charity organization employee responsible for managing food donations and the enrollment of beneficiaries.
Team leader	The charity organization employee or group of employees responsible for receiving food from donors and distributing it to beneficiaries.

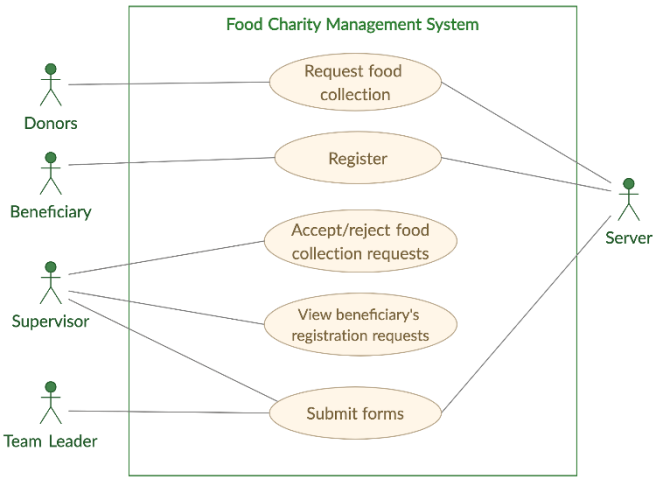

Fig 1. Use cases diagram for food charity management system users, who are the donors, beneficiaries, supervisors, and team leaders, along with their basic functionality and interaction with other users as well as the system.

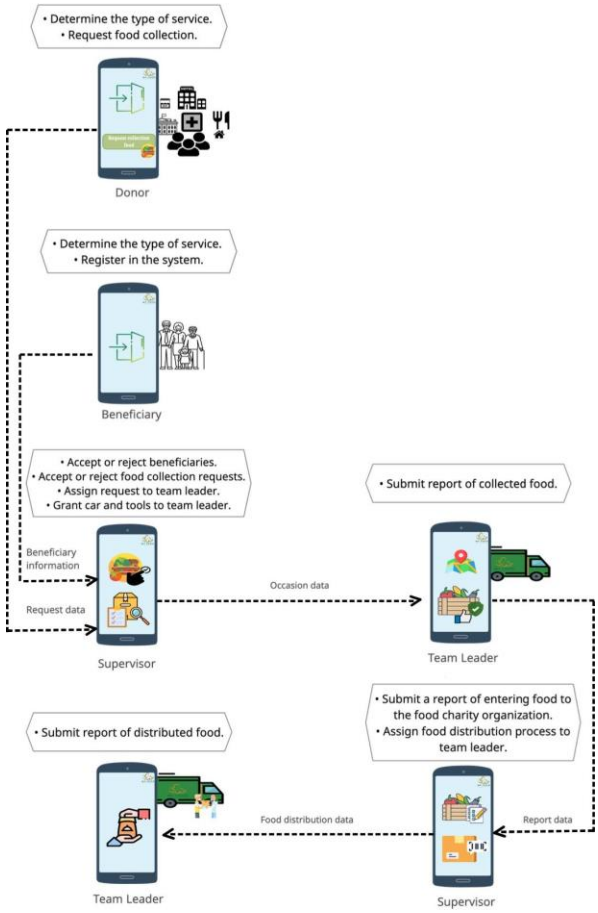

Fig 2. The model for the food charity management system, which shows the flow of data between users from the request for food collection to the delivery of food to the beneficiary.

Figure 2 explains how the proposed system model works. After choosing the donor for food donation service through the system, the system enables donors to fill out the order form and submit it.

Simultaneously, the beneficiary can register their personal information through the system to be viewed by the supervisor. The system allows the supervisor to view and accept the food collection requests as well as the beneficiaries' registration. According to location, assigning the request to the appropriate team leader then completes the vehicle receipt and packaging tools form. The team leader displays the request before going to the location. On arrival at the location, they sort the food and complete the health and safety food receipt form using the system. Upon returning to the food charity organization, the supervisor ensures food entry to the food charity. After all, food delivery by the team leader completes the food distribution form.

IV. Findings and Discussion

This project aims to assist individuals and the world in reducing food waste and raising community awareness about the importance of preservation.

Fig 3. Sample interfaces of the food charity management system, including the home page, donation food form, and beneficiary registration form.

By translating paper forms into online forms, the system helps food charities automate their food donation and distribution processes. The developed system makes it easy for charity workers to connect and collaborate with donor and have easier access to beneficiary information. It facilitates the fast donation of surplus food by donors. Also, beneficiaries would be able to quickly register through charities for food distribution. By designing this web-based application, which

is created in the Arabic language to serve the target community, this paper enhances the technological aspect of food charity management.

Four primary user groups, including donors, beneficiaries, supervisors and team leaders, interact with each other and their individual tasks through the developed system. The donation process begins with a food collection service request from a donor, which the supervisor approves. The process concludes when the team leader delivers the food to beneficiaries. Around Sixteen interfaces were designed to provide the best services to the food charity employees and clients. Through these interfaces, donors can quickly request food collection service. Also, beneficiaries can register their personal information. In addition, employees of food charity organizations can complete their forms.

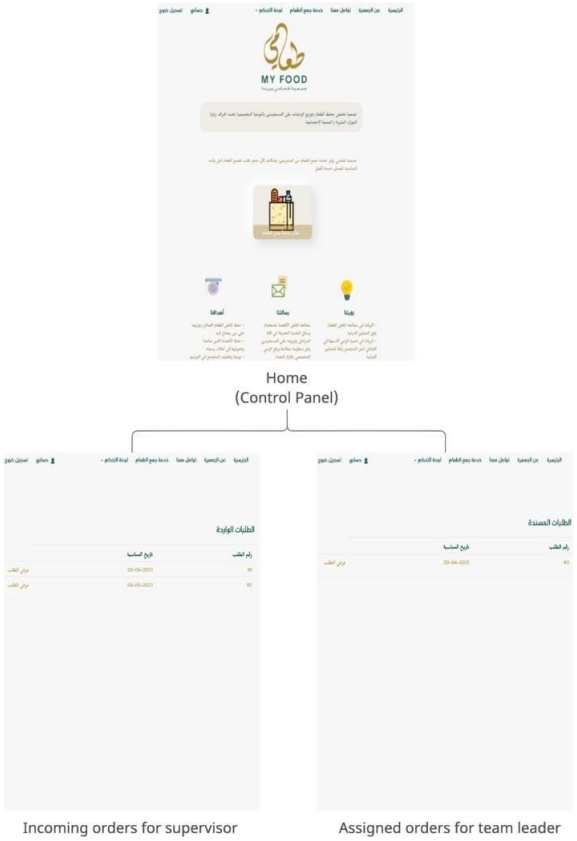

Fig 4. Control panel for the food charity management system, which is available to charity employees only, and shows incoming and assigned orders.

Figure 3 shows a sample of the primary interfaces of the system. The home page contains information about the food charity and system services, food collection service order form for donors, and a sign-up page for beneficiaries. Figure 4 shows the control panel of the system. Incoming orders can only be directed to the supervisor, and assigned orders can only be directed to the selected team leader.

V. Conclusion

The enormous extent of food waste in international food supply chains is gaining interest due to its cultural, social, and economic consequences [13]. Therefore, charities are working to prevent food waste and educate the community to determine appropriate quantities of food. This paper offers a solution to help reduce food waste, which is ultimately beneficial for both the economy and the environment. The solution takes advantage of surplus food by developing a web-based operations management system to ensure the efficiency of food charities, from the food collection process to food distribution. This management system contributes to automating the processes of food charities, which reduces the amount of time and effort required. It also makes it possible to access beneficiaries' information faster and easier. Overall, the system encourages people to donate surplus food because it makes food collection service more accessible through a mobile device.

References

[1] A.Betz, J. Buchli, C. Go¨bel, and C. Mu¨ller, "Food waste in the swiss food service industry–magnitude and potential for reduction," Waste management, vol. 35, pp. 218–226, 2015.

[2] M. B. Baig, K. H. Al-Zahrani, F. Schneider, G. S. Straquadine, and M. Mourad, "Food waste posing a serious threat to sustainability in the kingdom of saudi arabia–a systematic review," Saudi journal of biological sciences, vol. 26, no. 7, pp. 1743–1752, 2019.

[3] I.Spyridakis, M. Holbrook, B. Gruenke, and S. S. Latha, "Smart resource management: Civic engagement and food recovery," in Proc. of IEEE International Smart Cities Conference (ISC2). IEEE, pp. 378–383, 2019.

[4] J. Harvey, A. Smith, J. Goulding, and I. B. Illodo, "Food sharing, redistribution, and waste reduction via mobile applications: A social network analysis," Industrial Marketing Management, vol. 88, pp. 437– 448, 2020.

[5] H. Hajjdiab, A. Anzer, H. A. Tabaza, and W. Ahmed, "A food wastage reduction mobile application," in Proc. of 6th International Conference on Future Internet of Things and Cloud Workshops (FiCloudW). IEEE, pp. 152–157, 2018.

[6] Flashfood. Flashfood app. Accessed: 4.2.2021. [Online]. Available: https://www.flashfood.com

[7] F. Crowboy. apps help in food waste. Accessed: 20.1.2021. [Online]. Available: https://www.foodcowboy.com

[8] NoFoodWasted. Nofoodwasted app. Accessed: 4.2.2021. [Online]. Available: http://www.nofoodwasted.com

[9] N. F. Waste. apps help in food waste. Accessed: 20.1.2021. [Online]. Available: https://nofoodwaste.org

[10] Winnow. Winnow app. Accessed: 4.2.2021. [Online]. Available: https://www.winnowsolutions.com

[11] H. Resource and S. D. Ministry. Charities in the kingdom. Accessed: 2.5.2021. [Online]. Available: https://hrsd.gov.sa/

[12] E. Papargyropoulou, R. Lozano, J. K. Steinberger, N. Wright, and Z. bin Ujang, "The food waste hierarchy as a framework for the management of food surplus and food waste," Journal of cleaner production, vol. 76, pp. 106–115, 2014.