Bilkent University Department of Computer Engineering

Senior Design Project

Project short-name: Yicem (Group T2302)

Project Specification Report

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1. Introduction

1.1. Description

Food waste caused by leftover foods that go unsold in bakeries and cafes is a pressing issue in our modern society. According to the Food and Agriculture Organization of the United Nations (FAO), approximately 13.8% of the food produced is wasted across various stages [1]. Retail stands out as one of these stages, including establishments that directly sell food to end customers, such as cafes and restaurants. According to the FAO, inadequate sales of products nearing the 'best before' date and insufficient stock management are among the reasons for food waste at the retail level [1]. Each day, countless delectable pastries, sandwiches, and other culinary creations remain unsold and eventually end up discarded, contributing to a significant environmental and ethical problem. This wastage squanders valuable resources and money, exacerbates food insecurity, and puts additional strain on our planet's resources.

Yicem aims to solve this issue. Yicem is a mobile application that allows businesses such as cafes, bakeries, restaurants etc. to sell daily fresh and perishable items like cakes, pastries, and baked goods that need to be sold on the same day at a discounted price when they remain unsold at the end of the day.

This mobile application will be designed for cafes, bakeries, restaurants, and similar establishments to offer daily fresh and perishable items like cakes, pastries, and baked goods that need to be sold on the same day at a discounted price when they remain unsold at the end of the day. With this application, our aim is to increase the profitability of businesses, reduce food waste, and provide people with the opportunity to purchase items at a reduced price.

This application will have two different types of users: first, businesses like cafes and restaurants that will list their unsold daily items at a discounted price at a specific time, and second, individual users who will purchase these discounted items. Businesses will offer their unsold items at a discounted rate in a concept known as the 'mystery box'. The mystery box concept is designed to help businesses sell surplus items in bulk and to

prevent misuse of the application. For instance, instead of selling individual items separately, a business may put items like donuts and cakes into a 'mystery box' named 'dessert box' and sell it as a whole.

With this system, we aim to encourage individual users to purchase the items they want during regular sales hours and avoid waiting for the discounted time since they won't know the exact contents of the mystery box. Individual users can purchase items from these mystery boxes through the application and then collect them from the respective business during the designated pickup times. Additionally, the application will offer features for individual users such as personalized meal recommendations, detailed filtering, and displaying businesses on a map based on their offerings."

1.2. Constraints

1.2.1. Implementation Constraints

We must integrate the Yicem application into the daily operations of cafes, patisseries, and restaurants while maintaining their existing processes. The implementation process should be user-friendly and efficient, ensuring businesses can adopt Yicem without disruptions. Compatibility with various point-of-sale systems and hardware configurations needs to be considered to facilitate widespread adoption across different types of organizations.

In the project, version control systems Git and Github will be used to establish consistency of implementation and to provide organized version control. For managing the implementation of the project, Jira will be used to provide agile project management.

1.2.2. Economic Constraints

We need to structure commission rates charged on transactions made through Yicem in a way that businesses perceive a tangible economic benefit to encourage businesses to participate in reducing food waste. The pricing model should be compatible with the budget constraints of small and medium-sized businesses, ensuring that the adoption of Yicem remains financially viable for a wide range of food businesses.

1.2.3. Health Constraints

Yicem must comply with health and safety regulations governing the sale and distribution of perishable food items. The application must provide mechanisms to ensure that food sold through the platform is safe for consumption, considering expiration dates, storage conditions, and processing practices. Compliance with local health codes and standards is crucial to protecting consumer welfare.

1.2.4. Environmental Constraints

The Yicem platform aims to contribute to reducing food waste in line with environmental sustainability goals. Businesses using the application should be encouraged to adopt environmentally friendly packaging practices, and we should prioritize environmentally friendly methods in delivery logistics. Yicem's environmental impact, including carbon footprint considerations, should be carefully assessed and reduced.

1.2.5. Ethical Constraints

Our fundamental principle is to ensure the ethical treatment of users and businesses. Our project must prioritize transparency in its operations and ensure fair treatment of consumers and businesses. We must have a robust data protection system to protect user privacy. Furthermore, we have to consider ethical concerns arising from using the app, such as the possible use of discounts.

1.3. Professional and Ethical Issues

Because Yicem involves processing sensitive information, including user data and business transactions, it must adhere to the highest data protection and security standards. The application should implement encryption protocols to protect user data, and we should take measures to prevent unauthorized access. Additionally, Yicem's user interface design should keep accessibility in mind to ensure that users with different backgrounds and technological skills can easily navigate and use the

application. Transparent communication and education on ethical issues such as responsible consumption and waste reduction should be integrated into the user experience to promote a shared responsibility among all stakeholders.

2. Design Requirements

2.1. Functional Requirements

- There should be 2 different applications, one specifically catered for the buyers, and one for the business owners/sellers.
- The business owners must be verified by the admins before they can start to use the application at its full capacity.
- The buyer users will be verified via email authentication.
- The buyer user will be able to see all the businesses that have products to sell.
- The buyer user will see the active discounted offers on the home page.
- The buyer user will be able to see the registered businesses on a map.
- Upon selecting a seller, or via selecting a discounted offer, the buyer user will be able to see all the offers of the selected seller and make reservations for the product they wish to buy.
- On a specific seller's page, the buyer user will be able to see the opening and closing times of the business.
- On a specific seller's page, the buyer user will be able to see the user reviews left for the seller.
- The buyer user will be able to see their past purchases and leave reviews for these purchases.
- The buyer user will see the general food types that are being sold by a specific seller. Some examples for the food types are desserts with milk, desserts with sherbet, donuts, biscuits, cookies, etc.
- The buyer users and the seller users will be able to change their account passwords.
- The buyer users will be notified of new offers from the businesses in their proximity.

- The buyer users will be able to favorite a business. The buyer users will be notified of their favorite business' offers regardless of their proximity.
- The buyer users will be able to unlock achievements with different milestones they hit (x amount of purchases made), which will be displayed in their profiles.
- The seller users will be able to put their products up for sale at a desired price.
- The seller users' sale activity will be logged. The logged statistics will be accessible by the seller user to adjust sale prices or times.
- The seller users will be given suggestions by examining their sales statistics.
- The seller users will be able to approve a transaction as complete after a product has been sold to the buyer that had reserved it.

2.2. Non-Functional Requirements

2.2.1. Scalability

The initial platform of the application is planned to be the campus of Bilkent university. But the plan is to grow the platform over time and open it up to other campuses in Ankara, and eventually other cities too. Considering this, it is essential to design the system to handle an increasing number of users and businesses.

- Initially, the application should support up to around 12.000 users (number of students in Bilkent). That is, the database of the application should be expected to have large enough space for storing this many users.
  - Space cost of business and admin accounts is negligible compared to customers.
- As an estimation, the application should be able to accommodate around %20 monthly increase in scale (number of active users and businesses) without a decrease in performance.
- The system should be designed to allow horizontal scaling in elements such as server and database. For example, if the

need arises, the system should be able to allow the addition of more servers without disrupting the existing server.

2.2.2. Performance

As it is the case with mobile apps, providing a seamless user experience should be a key requirement. Having slow response times and frequent crashes could deter potential users away from the application. To address these issues, there will be certain constraints:

- Upon opening, the application should ideally load within 3-5 seconds. Intermediate loading times shouldn't exceed 3 seconds either.
- During peak hours (around the general closing hours of restaurants/cafes in this case, which is roughly 17.30 in Bilkent for example) the application should be expected to support at least 500 users simultaneously. This number can be larger as the platform grows (see scalability).

2.2.3. Reliability

- In the case of a server failure or a shutdown, the system should recover without loss of data.
- In-app payments should be made in an atomic way; that is, outer factors should not result in the loss of a value. In the case of a system failure or shutdown in the middle of a transaction, the system should abort the process and not do any transaction. It is not acceptable to have a scenario where the user loses money because of a system failure.

2.2.4. Security

- Authentication and authorization methods should comply with the industry standards. Only the most up-to-date and verified A&A technologies are accepted to be used.
- Sensitive data should be encrypted and payment info should be invisible to all parties, including the user themselves (for example, the user should only be able to see the last 4 digits of

their credit card after they have entered it). This ensures that payment info is secure even if a malicious source enters the user's account.

- ○ Secure third-party payment frameworks (such as iyzico) can be used to handle transactions.

2.2.5. Usability

A clean and intuitive UI design is crucial for a mobile application. The application will follow certain constraints for this purpose:

- The most common functionalities should be available right away in the homepage (such as the list of currently open businesses).
- Navigation should not be convoluted. Each core functionality should be reachable from the main page within 3-4 touches.
- The labels and icons for functionalities should be intuitive. For example, the label/icon to indicate a functionality should be selected from the most commonly used options to indicate a similar functionality in other popular applications.
- The application should support Turkish and English at the very least. As the platform grows, different languages should be able to be added easily.

3. Feasibility Discussions

3.1. Market & Competitive Analysis

3.1.1. Market Analysis

The intersection of information technology and the food industry has birthed the Online Food Market. Fueled by advancements in informatics technologies, this market has soared to a remarkable valuation of 210.3 Billion US dollars globally as of 2023, with forecasts of reaching half a trillion US dollars by 2030 [2]. The high rate of growth and the economic volume in the sector illuminate the Online Food Market as an indispensable player in global economics. Yicem

project positions itself in this market, which has a predicted annual growth rate of %17 in Turkey as of 2023 [3]. As a new and rapidly developing sector, we concluded that the sector is a viable option for enterprises.

3.1.2. Competitive Analysis

While established companies like Getir and Yemeksepeti engage in clearly defined competition within the sector, the Yicem project sets itself apart by specializing in the sale of unsold food items, aiming to efficiently reduce surplus inventory.

Other competitors that focus on the same goal as the Yicem project are also emerging in Europe. There is also a company named Fazla who are trying to accomplish similar goals to ours. However, their operations are solely active in İstanbul and no such competitor product is in service in Ankara. This can position us uniquely in the Ankara market without competition and may facilitate the smooth expansion of our project in Ankara.

4. References

[1] FAO, "Turkey's National Strategy Document On Prevention, Reduction And Monitoring Of Food Loss And Waste And Its Action Plan." *Food And Agriculture Organization of the United Nations*, pages 9, 12, 2020.

[2] "Online Food Delivery Market." *Precedence Research*, www.precedenceresearch.com/online-food-delivery-market. Accessed 17 Nov. 2023.

[3] "Online Food Delivery - Turkey: Statista Market Forecast." *Statista*, www.statista.com/outlook/dmo/online-food-delivery/turkey. Accessed 17 Nov. 2023.