Bilkent University

Department of Computer Engineering

Senior Design Project

Project Specification Report

Pelin Çeliksöz - 21600850

Radman Lotfiazar - 21600450

Asım Güneş Üstünalp - 21602271

Turan Mert Duran - 21601418

Ömer Faruk Kayar - 21602452

Supervisor: İbrahim Körpeoğlu

Innovation Expert: Serkan Köse

Jury Members: Shervin Arashloo, Hamdi Dibeklioğlu

1. Introduction

With the decrease in agricultural production and the increase in industrial production, people started to meet their nutritional needs by consuming more packaged products. Users find it difficult to read because the contents of the products are written very small. In addition, they may not understand because it contains foreign words. Reading the ingredients section can be a waste of time. This difficulty causes users to be hesitant when consuming products. One of the reasons for this is that the allergenic substances in the contents of packaged foods can negatively affect people. The prevalence rates of food allergies with people vary between 6–10.5%, however current data suggest that the prevalence of this rate is increasing worldwide [1]. Considering this condition all over the world, the number of people allergic to certain substances is quite high. People who have adopted vegan and vegetarian lifestyles are also hesitant when purchasing packaged products. In order to understand whether the product complies with that life requirement, it is necessary to examine the ingredients in detail, and at this stage, users have difficulties. In addition, some users do not want to waste time by examining the product and trying to read small texts to learn the calorie of the product, the national stamps, the place of production and the price. In addition to that, the increase in the consumption of packaged products encouraged people to use the market. It is seen that the same product is sold at different prices in different markets [2]. Users have to visit all the markets one by one and keep in mind the prices of the products in order to be able to shop more economically, and this causes both physical and mental fatigue. The GoodBuy application which we will create allows people to protect their health, save time and make shopping more economical.

This report will contain information about GoodBuy, its constraints, professional and ethical issues, functional and nonfunctional requirements.

1.1 Description

GoodBuy is a mobile application. Users who want to buy packaged products take care of their health and save time and money thanks to GoodBuy. A feature of this application is that the application can recognize the packaged products from the camera of the application, thanks to the augmented reality technology. In this way, information about the product can be accessed by the customers in the market, without touching the product, by simply holding

the application camera towards the product. This information is intended to facilitate the life of the user.

Users who are members of the system register the substances that their bodies have allergic reactions to the system. Then, if this allergen is found in the product that the user shows into the system, the system informs the user by giving an alert. In this way, users buy the product after they are sure that the product will not cause an allergic reaction, and the possibility of experiencing product-related health problems is reduced. Users also specify their lifestyles when registering to the system (such as vegan or vegetarian). When the user shows the product in the market to the system, he can easily understand whether the content of the product fits his lifestyle or not. For example, when a user registered to the system as a vegan shows a non-vegan product to the application's camera, the application alerts the user and notifies the user. Thus, users can shop without hesitation, making sure that they buy products suitable for their lifestyle. At the same time, when the user points the camera of this application to a packaged product, he can easily access the calorie, the national stamps, the place of production and the price information about the product. Thus, he does not waste time by taking the product in his hands and examining it.

The same products can be sold at different prices in the markets. GoodBuy also helps users spend less money on their market shopping. This convenience is provided in two ways. First, when the user reads the product to the camera of the application, the system shows the price of that product in other markets to the user, indicating that the user can reach the product at a more affordable price. The second is to create a shopping list before the user goes to the market through the system. The system shows the total price of the products in this shopping list for each market. At the same time, these markets are ranked according to the proximity of the person's location. The person can also access the locations of the markets through the system. In this way, the user decides where to do his shopping in the most economical way and goes to that market.

There will also be an admin website for managing the application. In addition, the GoodBuy application will have a section where users report changing or not found product packaging to the admin.

1.2 Constraints

1.2.1 Implementation Constraints

- Git and Github will be used for version control.

- Unity Game Engine will be used for implementing the project.
- Vuforia AR Engine will be used to add augmented reality functionality to our project. It will also be used for object recognition.
- Vuforia Cloud Recognition Service will be used to create a cloud based solution for image recognition tasks.
- Spring Framework will be used to create an admin webpage for the application. It will be created using Java.
- The admin webpage will be hosted by a AWS(Amazon Web Services) machine.
- User information will be stored on the Google Firebase service.
- As Unity is a cross-platform application development software, our application will run on both Android and IOS.
- Project webpage containing the information of group members etc. will be created by Github Pages and will be hosted by Github.

1.2.2 Economic Constraints

- Vuforia provides 1000 photo recognition and 1000 image uploading to the Cloud server for free however when more photo uploading and recognition is needed we will be change our Vuforia License plan free to Basic+Cloud that is 99$ per month and offers 10.000 recos per month and 100.000 image uploading [3].
- In the future, for unlimited photo recognition and image uploading, we will need to contact Vuforia managers to agree on prices.
- Unity is free.

1.2.3 Sustainability Constraints

- Feedback System will be used to fix bugs that are found by users.
- Feedback System will be used to add new features to the application.
- Users will have the ability to add new products to the system.
- Users will have the ability to add photos of new packaging of the products.
- New updates will be provided periodically for new products and products with changed packages.
- Vuforia Cloud Recognition Service will be used instead of user devices' memories in order to prevent memory shortage problems of the users.

1.2.4 Language Constraints

- Both iOS and Android apps will support Turkish(TR) and English(EN) because the application will only support the products that are generally sold in Turkey and for other users English will be provided.

1.2.5 Ethical Constraints

- Personal information of the users will not be shared with any third party entities.
- The information we collect from the users include medical conditions(allergies, diabetes etc.). Therefore it is highly sensitive. This data will be stored encrypted in a secure database.
- No more personal information than it is required will be collected from the users.

1.3 Professional and Ethical Issues

- The Code of Ethics prepared by National Society of Professional Engineers[4] is considered throughout our designing, implementation and deployment of our project.
- Since the project is using phone cameras for detecting objects, we are asking about permission from users.
- All data including images, videos and users' information, which are stored in the cloud servers. are secured by the company which is providing this service (Vuforia).
- We are not taking advantage of the data stored in the cloud servers by selling them to third parties.
- While the project for finding nearest markets which is compatible with your market list is using your location, that is not stored neither local storage nor cloud servers.
- Since the project has to store some medical information of users which is one of the most important information about them, we are planning to secure this information by a highly secured database or cloud.

2. Requirements

2.1 Functional Requirements

The system should perform following tasks:

1) Displaying the menu

2) Listing user-specialized suggestions if any
3) Listing products to be selected
4) Receiving finalized basket
5) Receiving camera input
6) Communicating with the cloud & receiving related data
7) Informing the user for the best options of markets
8) Redirecting to a map application to show closest market
9) Displaying AR models and outputs on the live camera
10) Showing advertisements

The user can/should perform following tasks:

1) Scanning the product via device camera
2) Choosing the products s/he wants among the product list & adding to the basket
3) Learning the ingredients of the products
4) Entering the ingredients which s/he does not want and s/he allergic to
5) Getting suggestion feedbacks according to her/his past selections
6) Being informed about the best and closest market
7) Observe any advertisements that are showed

2.2 Non-functional Requirements

2.2.1 Scalability

Scalability is an essential component of enterprise software. Prioritizing it from the start leads to lower maintenance costs, better user experience, and higher agility[5]. Since our software is used in markets (somewhere people are in there in their daily life) it is crucial for our project to be scalable as much as possible. In other words, our application has to have the ability to respond to a large number of consumers' requests in the minimum amount of time in order to encourage people to use our app in their daily life. To achieve this, we will be using cloud services that can handle possible large scales of data in the future.

2.2.2 Reliability

Application reliability is the probability of a piece of software operating without failure while in a specified environment over a set duration of time. In a perfect world, a reliable piece of software is completely defect free, does not create downtime, and performs correctly in every scenario[6]. Since our project's goal is to be used in one of the most important

activities in people's daily life, it is urgent for our project that all functionality and features run smoothly and accurately. Unity and cloud servers give us enough opportunities for achieving a high reliability in our project.

2.2.3 Availability

Application availability is a measure used to evaluate whether an application is functioning properly and usable to meet the requirements of an individual or business[7]. We are not designing or developing this project for a company or business. However, Bilkent University is asking about a requirement report in which we should specify all functionalities.. Therefore, we are doing our best to design and develop all functionality with high accuracy and lowest fault.

2.2.4 Maintainability

Understanding software maintainability allows organizations to identify improvement areas as well as determine the value supplied by current applications or during development changes[8]. Since we want to be nominated for at least one of the prizes in the CS Fair, we have to design and implement our project as maintainable as possible. Therefore, high maintainability of the project helps us to make changes and add features easily in order to make our app more and more powerful. We can achieve high maintainability by having a perfect software architecture. Hence, we are planning to have meetings with software architecture experts for deciding our software architecture in different parts of the project.

2.2.5 Security

Since we are storing images, users' information and their medical information, security is one of the most important non-functional requirements for our project. Therefore, we decided to use Firebase which is reliable and highly secure for storing this information. Furthermore, for storing images we are using Vuforia's cloud servers hence, our data will be highly secured there by Vuforia.

2.2.6 Usability

The interface of the application will provide necessary and sufficient features to give the best user-friendly experience to the users. It will consist of accurate images of the products, different language options and simplistic design.

References

1. J. Jiang, C. M. Warren, and R. S. Gupta, “Epidemiology and racial/ethnic differences in food allergy,” *Pediatric Food Allergy*, pp. 3–16, 2020.
2. H. Görg, L. Halpern, and B. Muraközy, “Why do within-firm-product export prices differ across markets? evidence from Hungary,” *The World Economy*, vol. 40, no. 6, pp. 1233–1246, 2016.
3. “VUFORIA engine pricing,” *PTC*, 17-Nov-2020. [Online]. Available: https://www.ptc.com/en/products/vuforia/vuforia-engine/pricing. [Accessed: 09-Oct-2021].
4. “Code of ethics,” *Code of Ethics | National Society of Professional Engineers*. [Online]. Available: https://www.nspe.org/resources/ethics/code-ethics. [Accessed: 10-Oct-2021].
5. “The importance of scalability in software design,” *Orlando Mobile App And Web Development Company*. [Online]. Available: https://www.conceptatech.com/blog/importance-of-scalability-in-software-design. [Accessed: 10-Oct-2021].
6. “Application reliability defined: |free demo: | video explanation,” *Default*. [Online]. Available: https://www.castsoftware.com/glossary/application-reliability. [Accessed: 10-Oct-2021].
7. “What is application availability?: Glossary,” *A10 Networks*, 18-Feb-2021. [Online]. Available: https://www.a10networks.com/glossary/what-is-application-availability/. [Accessed: 10-Oct-2021].
8. “Software maintainability: | free demo: | video explanation,” *Default*. [Online]. Available: https://www.castsoftware.com/glossary/software-maintainability. [Accessed: 10-Oct-2021].