

What's In My Pouch?

Final Report

Human-Computer Interaction (12607)

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0. Abstract

People get skin troubles when they use cosmetic products that include some particular ingredient, so they want to buy the cosmetic product that fits their skin. There are also people that feel inconvenient when using recommendation apps with complex UI. By apprehending these needs, we designed an app with a simple UI that finds the cosmetic ingredient that doesn't fit people's skin and recommends cosmetic products that fits with people's skin characteristics. To find the ingredient that doesn't fit people's skin, we used OCR technology to extract text from the cosmetic product ingredient indication image. We crawled OliveYoung data to list the cosmetic products and recommended users the product that matches with their age, skin type, and skin concern. This project holds significance in creating an app based on people's needs identified verified by pre-survey, with the aim of enhancing user convenience. Through post-survey, we could see that people positively evaluated the app. This project was meaningful as it provided opportunities to think about various aspects of Human Computer Interaction.

1. Introduction

1.1. Project Background and Motivation

There are many customers who feel that some cosmetic products don't fit well to their skin, but they don't know the reason. High likelihood is that there is a common ingredient in the cosmetic products that doesn't fit well or cause allergies to their skin. Also Yeeun has experience of working in Olive Young, and there are some customers who avoid some ingredient when buying a cosmetic product because they know that the ingredient is harmful to their skin, or they are allergic to it. So we propose an application to help users find the ingredients that don't fit well to their skin, check if some ingredient is in the cosmetic product, and recommend users products that will fit well to their skin based on skin type, age, and ingredients.

Also, when using 'Olive Young' app or '화해', we had experience of having difficulties choosing cosmetic product because of complex UI. There were various options and features available, but not all the users required complex features. We felt the need for an app with a simple UI, allowing users to easily receive cosmetic recommendations.

Based on these motivations, we decided to design an app with a simple UI that finds the ingredient that does not fit well with the user and recommends cosmetic products based on people's skin characteristics.

1.2. Pre-survey

We conducted a preliminary survey before designing the app to verify whether the needs or discomfort we speculated about people were indeed valid. Based on our assumption that the group most likely to use our application is 20s female, we recruited total 23 participants as below graphs and table. There were 14 females and 9 males. Age 13-17 was 3 people, age 18-37 was 17 people and age over 38 was 3 people.

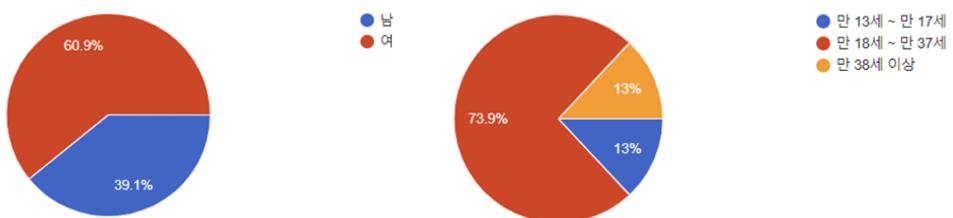


Figure1. Gender and age groups of participants in the survey

In the pre-survey, we asked questions related to considerations when purchasing cosmetics, experiences with skin issues, experiences with recommendations for cosmetics online or offline, and any complaints about the user interface of product recommendation apps.

(1) Considerations when purchasing cosmetics

When we asked about considerations when purchasing cosmetics, 15 people answered that they consider skin type when buying cosmetic products. 13 people answered that they consider skin concern when buying cosmetic products.

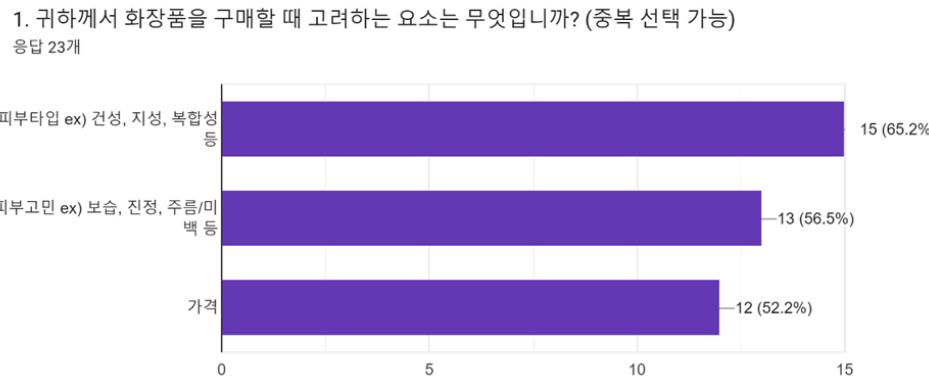


Figure2. Considerations when purchasing cosmetics

(2) Experiences with skin issues

In question2, when asked if people had experiences of skin troubles, 14 answered yes and 9 answered no. In question 2-1, for 14 people who had experience of skin troubles, 13 people answered they know the ingredients of cosmetic products that induce skin troubles. In question 2-2, we asked if knowing the specific cosmetic ingredient that does not fit their skin would be helpful in selecting cosmetic products. All 14 people answered yes. By these questions, we were able to see that people want to know the ingredients of cosmetics that cause skin problems. Also, helping them find the cosmetic ingredient that does not fit to their skin would help them select cosmetic products.



Figure3. Experiences with skin troubles

(3) experiences with recommendations for cosmetics online or offline

In question 3, we asked if people had experience of using an application or chatbot that recommends cosmetic products. 20 people answered no and 3 people answered yes. We could see that people have little experience of using cosmetic recommendations online.

3. 개인 맞춤형 화장품을 추천해 주는 '어플리케이션' 혹은 '챗봇'을 사용해 보신 경험이 있습니까?
응답 23개

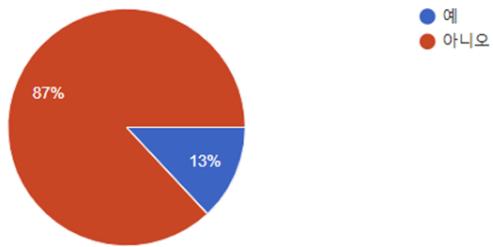


Figure4. Experiences using online recommendations

Also in question 4, we asked people if they had experience of buying cosmetic products by youtube, blog, or recommendation by store employees. 19 people answered yes and 4 people answered no.

4. 유튜브, 블로그, 혹은 매장 직원의 추천에 따라 화장품을 구매하신 경험이 있습니까? 복사
응답 23개

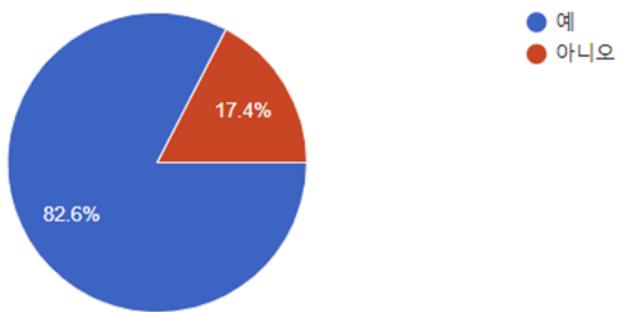


Figure5. Experiences using recommendations (youtube, blog, store employee)

We asked them to share any experiences of dissatisfaction if they had purchased in such a way. There were responses such as 'There was a time when I was recommended skincare products not suitable for my age, and after using them, I experienced skin troubles.', 'Lower satisfaction due to the products not being compatible with my skin'. By these answers, we could see that people have needs for recommendations of cosmetic products that are compatible with their age and skin characteristics.

(4) complaints about the user interface of product recommendation apps

We asked people if they had an inconvenient experience of using product recommendation apps. Over half (12 people) answered that the UI of the product recommendation apps are inconvenient to use. When we asked reasons, there were responses such as 'There were too many lengthy explanations, deviating from the key focus of the app service', 'Would like the text on the screen to be reduced', 'It would be great if it recommends only the interests suitable for my age group and organizes the rest in a sidebar at the top', and 'Simplifying the overly detailed product categories would be beneficial.' We could see that people feel the need for a recommendation application with a simple UI.

5. 상품 추천 서비스(화해, 무신사, 카카오 선물하기 등)를 사용하였을 때, 자신에게 불필요한 버튼이 많거나 화면 구성이 복잡하여 서비스를 사용하기 불편했던 경험이 있습니까?

응답 23개

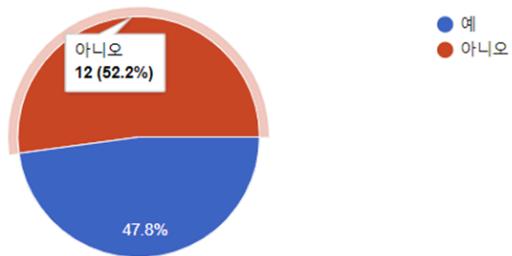


Figure 6. Inconvenient experience of using recommendations apps

By doing the pre-survey we could see that people's needs and discomfort were in line with what we had anticipated.

1.3. Specific goals

After thinking about people's discomfort in choosing cosmetic products and using recommendation applications, and verifying people's needs and discomforts through an actual preliminary survey, we established the following specific goals for designing the app.

- Help users find cosmetic ingredients that don't fit people's skin. We will ask users to input the cosmetic products that do not fit to people's skin, analyze the ingredients in those cosmetic products, and find out which ingredients induce skin troubles.
- Recommend users cosmetic products that match with individual age, skin type, skin concern.
- Make an app with a simple UI that includes only key necessary functions.
- We provide labels on cosmetics containing ingredients that users need to be cautious about, enabling users to be mindful when making purchases.

1.4. The scope of the project

We designed a cosmetic product recommendation app. Although not making a perfectly-functioning app, we designed an app and demonstrated it to future users by showing the UI by Figma and showing how the app works by python code. We actually collected cosmetic product data for app development from Olive Young website. We involved acquaintances in pre and post surveys to reference in the app development process.

1.5. Significance in the HCI field

After considering the current discomforts of individuals, and conducting a preliminary survey to verify needs and discomforts that we have anticipated, this project has significance in developing an app to address these concerns and provide convenience to users. This application holds particular importance for those who have struggled to find cosmetic product ingredients that are incompatible with their skin. Additionally, individuals who found inconvenience in complex app features will now experience faster and more convenient cosmetic recommendations through an app with simple UI.

Although users might not use this app everyday, they will use this app whenever they have to buy a new cosmetic product or when some product causes problems to their skin.

2. Methodology

2.1. user research methods

We can get data about the users through surveys and interviews. As we learned in HCI class, when we make the survey questionnaires, we try to use simple words, be specific, avoid bias and avoid hypothetical questions. Also, when we interview the users, we tried to have the same extent of subjectivity because a number of researchers interviewed the users. In addition, we recruited 23 people to do the preliminary survey, and 15 people among them experienced our application and did the post-survey. Then, we selected half (seven) of the people who took the user test and conducted the interview.

2.1.1. Quantitative analysis methods

a. Preliminary survey

We used some question types - closed-ended, responses over a continuum, branching. When questioning users' experiences or not, we ask them to answer yes or no. When questioning their satisfaction, we used responses over a continuum type with five options. If users select dissatisfaction about some questions, next questions are open-ended questions about unsatisfactory experiences. In order to analyze survey results, we used descriptive statistics. We gathered the percentage of answers for each item to identify the needs of users.

b. Post survey

We used similar question types to the preliminary survey. However, in order to prove the effect our application, we ask the users to use both '화해' application and our application. Then, we questioned the comparison of two applications in two aspects of GUI and cosmetic ingredient analysis in the post survey. After comparing them, we ask them to select the easy to use, and check dissatisfaction about the other application. To analyze the results, we used descriptive statistics as the same as pre-survey.

2.1.2. Qualitative analysis method

a. Survey

In order to get more specific thoughts or experiences of users, we asked them open-ended questions. We analyzed the answers by visualizing through the word cloud method. Through this, we can figure out words that users mentioned many times and their needs and unsatisfactory factors of existing applications or their experiences.

b. Interview

After conducting user tests, we conducted interviews to inquire about users' specific opinions and experiences that were not covered in the survey. Through these interviews, we were able to hear stories about the interviewees' specific skin concerns and the efforts they have made to address these concerns. By listening to their narratives, we confirmed whether our application aligns with the purpose for which it was implemented, thus solidifying our motivation. Moreover, by extracting concrete experiences, we gained insights into the direction in which we should improve our implemented application. The interview responses were converted into text and, similar to the survey, the results were aggregated using the word cloud method.

2.2. Design thinking processes (Appendices E)

2.2.1. Affinity Diagram

We created an affinity diagram through brainstorming to reflect the user needs as much as possible and to establish the specific operational mechanisms and flow of the application to implementation. We proceeded with a bottom-up approach, considering why such features and designs are necessary. We broadly categorized components into UI design for user convenience and technical aspects, and established specific plans for the implementation of the application.

2.2.2. Claim Analysis

We conducted a claim analysis to objectively assess our application and examine potential issues. We identified strengths and weaknesses in five aspects, including the method of recommending cosmetics including unsuitable ingredient information, data crawling from the Olive Young website, only presenting a personalized UI, determining the criteria for recommending cosmetics by category, and analysis method of cosmetic ingredients through OCR. Each aspect was analyzed with two points of consideration.

2.2.3. Persona & Scenario

Our team anticipated the most frequent users of our application to be three groups: a teenage adolescent girl, a man with a lover in his 20s, and a woman in their 50s going through menopause. We expected these groups to have a keen interest in their skin conditions. To enhance our understanding of potential users, we created personas by establishing virtual characters for each group. Additionally, we developed more detailed user scenarios based on these personas. We made efforts to create specific use cases by defining the needs of these virtual characters regarding their skin, the goals they aimed to achieve through this app, their daily behavior patterns, and their reactions after using the application.

2.3. Prototyping techniques (Appendices F)

To create a low-fidelity prototype, we initially opted for the paper prototype method. Each team member sketched a simple prototype on each tablet, including features they found useful. Through collaborative meetings, unnecessary functions were excluded, and the essential prototype form was determined. Based on this, a more refined low-fidelity prototype was completed. Subsequently, to visualize the overall design elements such as typography and color, we used PowerPoint to formalize the paper prototype.

Following this, we utilized the Figma website to implement a medium-fidelity prototype to articulate the functioning and flow of our application on a mobile device. The mid-fi prototype was designed to simulate actual functionality when executed on a real phone with the Figma app installed. We leveraged this for user testing purposes.

3. System Design

3.1. User Interface

We tried to design the simple and user-friendly UI, based on the preliminary survey. We designed the medium fidelity prototype on Figma and all pages are sized to iphone. We will explain the interface design and interaction flows together with Figma captures.

3.1.1. Login & Sign up

The figure displays four sequential sign-up pages for a cosmetic recommendation service:

- Step 1: Personal Information**
 - Age: 20-30 (Male)
 - Sex: Male
 - Skin Type: Combination
 - Agree to terms: Yes
- Step 2: Skincare**
 - Facial wash: 35,000원 (Arboreum Brightening Cream)
 - Toner: 26,000원 (Toladerm Day Cream)
 - Essence: 19,000원 (Estee Lauder Advanced Night Repair Serum)
 - Moisturizer: 25,000원 (Laneige Water Bank Water Cream)
- Step 3: Cleansing**
 - Foaming cleanser: 39,000원 (L'Oréal Paris Skin Purifying Foaming Gel)
 - Facial wash: 37,500원 (Bayer Beauty Sensi-Bio H2O)
 - Toner: 12,000원 (Marie Claire Pore & Deep Toner)
 - Moisturizer: 30,000원 (Chosunmiree Brightening Cream Set)
- Step 4: Makeup**
 - Foundation: 38,000원 (Ettusais BB Cream)
 - Concealer: 24,000원 (Ruerne Blending Concealer)
 - BB cream: 29,000원 (Banila Co. All-in-one BB Cream)

Figure 7. Login & Sign up pages

These pages are login and sign up pages. If you enter your ID and password and click the login button, the page passes to customized recommendation pages directly. However, if you click the sign up button, you should enter your personal information. Your sex, age, skin type and skin consideration are needed for cosmetic recommendation. After entering all information, if you click the next button, you should agree to collecting personal information for your privacy protection. In addition, we separated male and female sections, so if you select 'Male', you can only get the male cosmetic recommendations. On the other hand, if you select 'Female', you can get the female cosmetic recommendations that are divided into four categories, skincare, cleansing, suncare and makeup.

3.1.2. Recommendations

The figure displays four recommendation pages for different cosmetic categories:

- Skincare**
 - 1st place: Arbutin Brightening Cream (35,000원)
 - 2nd place: Bayaderm Day Cream (26,000원)
 - 3rd place: Estee Lauder Advanced Night Repair Serum (19,000원)
- Cleansing**
 - 1st place: L'Oréal Paris Skin Purifying Foaming Gel (39,000원)
 - 2nd place: Bayer Beauty Sensi-Bio H2O (37,500원)
 - 3rd place: Marie Claire Pore & Deep Toner (12,000원)
- Makeup**
 - 1st place: Chosunmiree Brightening Cream Set (30,000원)
 - 2nd place: Etude House Super Director's Water Base Foundation (25,000원)
 - 3rd place: Banila Co. All-in-one BB Cream (29,000원)
- Haircare**
 - 1st place: Clary Kilkiberry Honey Glucose Cream (26,000원)
 - 2nd place: Dejizk Seido 20 colors (34,000원)
 - 3rd place: Dejizk Zumi Dwi Tint 19 (29,000원)

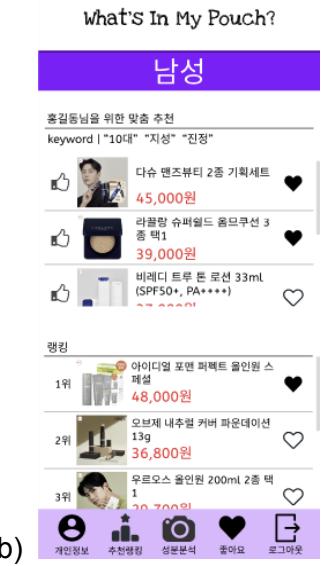


Figure 8. Recommendation pages for female (a) and for males (b)

The recommendation pages are separated into two parts. The upper part shows the customized recommendations according to age, skin type and skin considerations. The lower part shows the ranking of products regardless of your information. Because we provide only customized recommendations to simplify the UI, you cannot see the recommendations for other skin types or skin considerations. So, if you want to get other recommendations, you can change the personal information by clicking the ‘개인 정보’ button at the bottom of the pages. Then, the pages will move to the same as sign up pages.

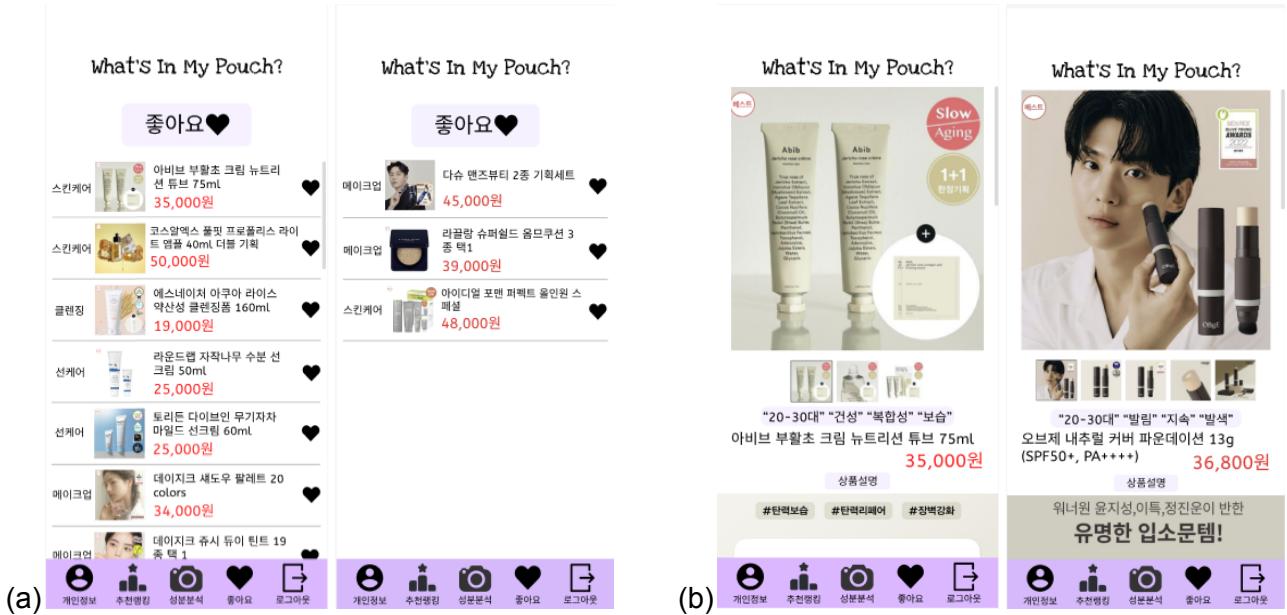


Figure 9. Like pages and details of products pages

If you click the heart buttons of which you like a product and you click the heart button at the bottom of the page, you can see those products on one page as follows(a). In addition, if you click the product , you can see the more detailed information of that product as follows(b).

3.1.3. Ingredient analysis

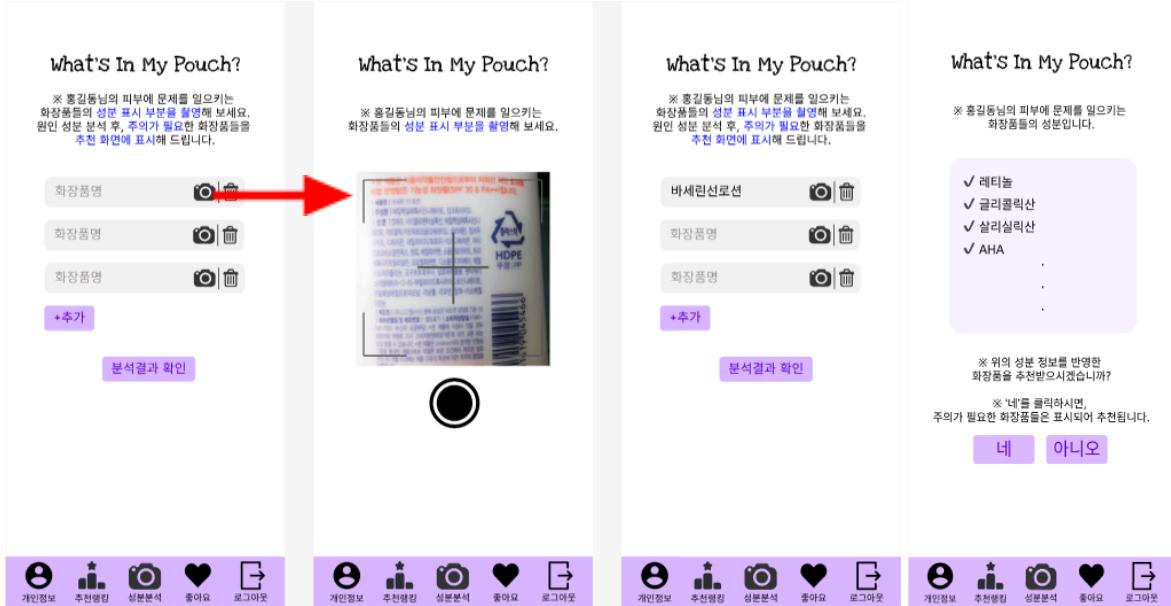


Figure 10. Cosmetic ingredients analysis pages

These pages are core pages of our application. When clicking the camera button at the bottom of pages, you can get ingredient analysis. First, you can take pictures of cosmetic ingredient labels which cause skin problems to you. Then, our application will read and analyze the ingredients. If you click ‘분석결과 확인’ button, you can see the ingredients which you should beware. And if you click the ‘Yes’ button, you can get recommendations again including warning signs to products which have those ingredients as follows. However, if you click the ‘No’ button, the page is back to original recommendation pages.

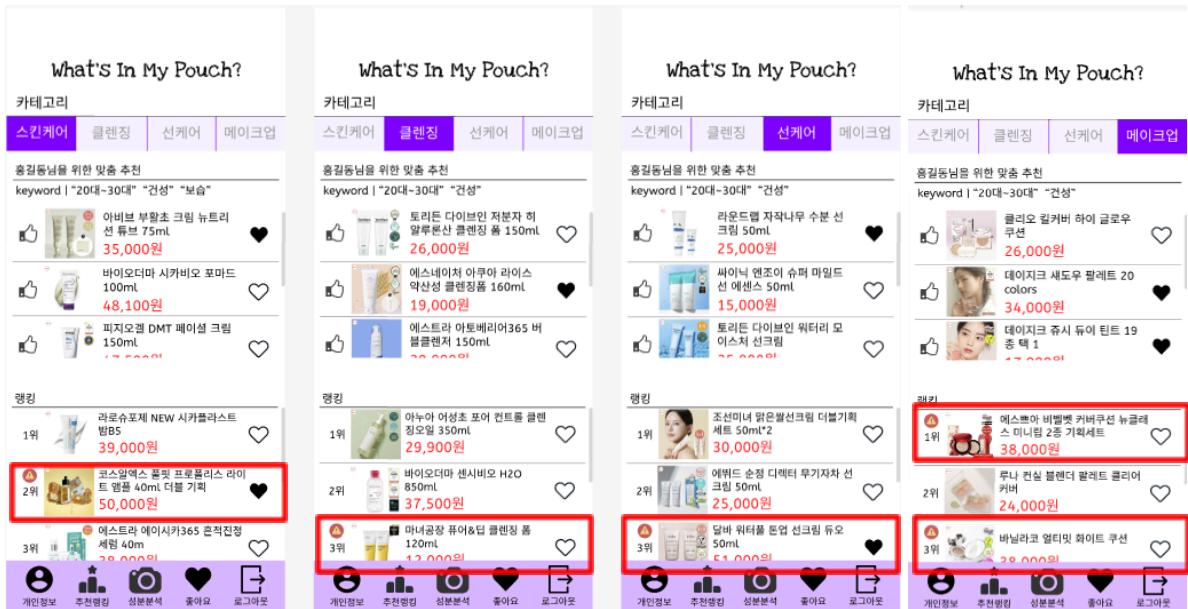


Figure 11. Recommendation pages with warning signs

3.2. Technical Architecture

3.2.1. Ingredient analysis

1) Finding the best OCR model for our project

To find the ingredient that does not fit people's skin, we had to know the ingredient of the cosmetic product that the user uses. We thought it would be a tedious task for the user to type in the ingredients individually, so we made the user take a picture of the cosmetic product. After the user takes the picture of the cosmetic product ingredient indication, we extract text from the image by using OCR. OCR is the abbreviation for optical character recognition.

We tried to find the best OCR model for our project. At first, we tried OCR by using the Tesseract library. The recognition result of English was good, but it had poor results in recognizing Korean. However, most of the cosmetic product ingredient indications are written in Korean, so we tried to look for another model that recognizes Korean also well.

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정제수, 부틸렌글라이콜, 글리세린, 트루로즈오브예리코주출물
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스테아 립말레이트, 코코넛아자오일, 시어버터, 세테아릴알코올,
다이글리세린, 펜틸렌글라이콜, 1,2-헥산다이올, 비스-다이글리세
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키딜알코올, 호호바에스터, 카나우비왁스, 락토바실러스발효물,
자가버섯주출물, 블루아가베잎주출물, 판테놀, 합성비즈왁스, 비
널다이메티콘

In [56]: text = pytesseract.image_to_string(im, lang = 'kor+eng', config=config)
print(text)

초초모
정제수, 부틸렌글라이콜, 글리세린, 트루로즈오브예리코
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스테아 립말레이트, BAAS, 시어버터, 세테아릴알코올,
다이글리세린, 펜틸렌글라이콜, 1,2-AMCPoIs, 비스-다이글리세
릴폴리아실아디페이트-2, 카프릴릭/카프릭/미리스틱/스테아릭트
라이글리세라이드, 아이소트라이데실아이소노나노에이트, 아라
키딜알코올, 호호바에스터, 카나우비왁스, 락토바실러스발효물,
AI
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Figure 12. Result of OCR by Tesseract library

So we tried to do OCR by using EasyOCR, based on the information that it has better Korean text recognition than OCR. However the performance still fell short of expectations.

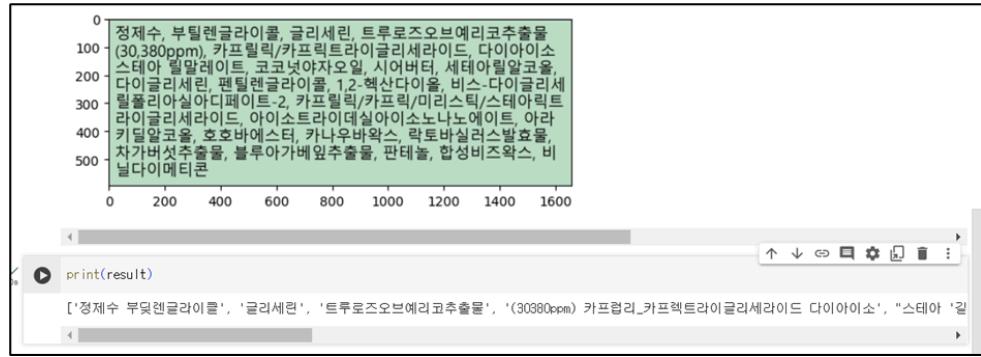


Figure 13. Result of OCR by EasyOCR

Then we decided to try Pororo for the OCR task. Pororo is an abbreviation for Platform Of neuRal mOdels for natuRal language prOcessing, and it is an integrated form of natural language framework developed by KakaoBrain for various Korean natural language processing tasks. While there were some errors in the results, we decided to use Pororo for our project because it still yields high accuracy.

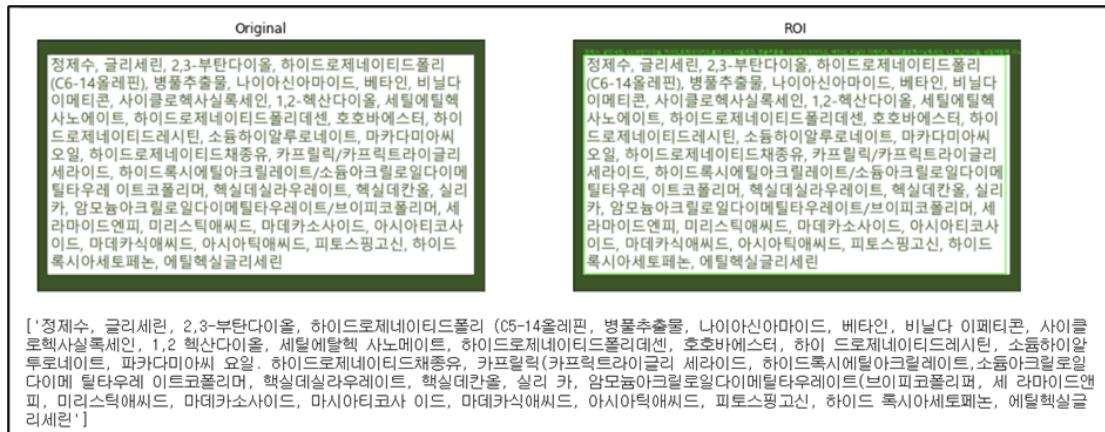


Figure 14. Result of OCR by Pororo

2) Finding the ingredient that does not fit to people's skin

For example, let's say that the user(woman) had 2 cosmetic products that did not fit her skin. We input 2 images of cosmetic product ingredient indication images and get the OCR result. We also have the lists of (1) dangerous components for different skin types, (2) allergen-triggering elements, and (3) 20 cosmetic ingredients of caution. If the ingredient of the cosmetic product is included in one of the lists, we classify it as the ingredient that the user has to be cautious of.

First of all, we get the user information. We can see that the user has '복합성' skin type.

User information

```
# get user's skin type from user_info.txt
with open("../Ranking/user_info.txt") as f:
    user_info=f.readlines()
    name = user_info[0]
    name=name.strip()
    skinType = user_info[2]
    skinType=skinType.strip()
print(str(name)+"님의 피부 타입은 "+str(skinType)+"입니다.")
print(str(name)+"님께서 조심해야 하는 화장품 주의성분을 알려드릴께요!")
```

최윤선님의 피부 타입은 복합성입니다.
최윤선님께서 조심해야 하는 화장품 주의성분을 알려드릴께요!

Figure 15. User Information

(1) Dangerous components for different skin types

1) 피부타입 위험성분

지성, 건성, 복합성 등 각 피부타입 별로 조심해야 할 위험성분을 보여줍니다

```
#find the dangerous ingredients for each skin type
if skinType=='지성':
    dangerous_ingredients=['미리스틱애씨드', '미리스틴산', '벤조페논-3', '옥시벤존', '시어버터', '쉐어버터', '코코넛야자오일', '코코넛오일', '트라우마']
elif skinType=='건성':
    dangerous_ingredients=['레이디스맨틀잎추출물', '성모초잎추출물', '멘톨', '변성알코올39-C', '변성알코올40', '부티톨락톤', '비스-부틸옥시아도']
elif skinType=='복합성':
    dangerous_ingredients=['스테아릭애씨드', '스테아르산염', '미리스틱애씨드', '미리스틴산', '벤조페논-3', '옥시벤존', '시어버터', '쉐어버터', '코코넛야자오일', '코코넛오일', '트라우마']
else:
    print("skinType Error")

skinType_danger=[]
count=0
for i in range (len(dangerous_ingredients)):
    if (dangerous_ingredients[i] in cos):
        count+=1
        skinType_danger.append(dangerous_ingredients[i])
if count!=0:
    print("피부타입 위험성분:",skinType_danger)
elif count==0:
    print("분석 결과, 사용하시는 화장품 내에 피부타입 위험성분은 없습니다.")
```

피부타입 위험성분: ['미리스틱애씨드', '알코올']

Figure 16. Dangerous components for different skin types

We have a list of the dangerous ingredients for each skin type. Since the user has '복합성' skin, we have to see if user's cosmetic product includes any of the ingredients in the '복합성' dangerous ingredient list. In the result, we can see that the user's cosmetic product includes '미리스틱 애씨드' and '알코올'.

(2) allergen-triggering elements

2) 알레르기 유발 주의 성분

알레르기 유발 주의 성분은 식약처가 고시한 '화장품 알러지 성분'을 기준으로 하였습니다. 해당 성분들은 착향제 구성성분 중 알레르기 유발 가능성이 있어, 식약처가 기재 및 표시를 권장한 성분입니다. 해당 성분 목록은 다음과 같습니다.

```
allergy=['d-리모넨', '리모넨', '나무이끼추출물', '리날룰', '메틸2-옥티노에이트', '메칠2-옥티노에이트', '벤질벤조에이트', '벤질살리실레이트', '벤',
allergy_danger=[]
count=0
for i in range (len(allergy)):
    if (allergy[i] in cos):
        count+=1
        allergy_danger.append(allergy[i])
if count!=0:
    print("알레르기 유발 주의 성분:",allergy_danger)
elif count==0:
    print("분석 결과, 사용하시는 화장품 내에 알레르기 유발 주의성분은 없습니다.")
```

분석 결과, 사용하시는 화장품 내에 알레르기 유발 주의성분은 없습니다.

Figure 17. Allergen-triggering elements

We also have a list of allergen-triggering elements. The list of allergen-causing ingredients is based on the "Cosmetic Allergen Ingredients" specified by the Korea Food and Drug Administration. These ingredients are part of the fragrance composition and have the potential to cause allergies, so the administration recommends their disclosure and labeling. In the result, we can see that the user's cosmetic products do not include allergen-triggering elements.

(3) 20 cosmetic ingredients of caution

```
3) 20가지 주의성분
20가지 주의성분은 화장품 계열 베스트셀러 도서인 '대한민국 화장품의 비밀'에 수록되어 있는 '가장 피해야 할 20가지 성분'의 목록입니다.

features=['o-사이멘-5-올','아이소프로필크레솔','녹색3호','동색205호','디아졸리디닐우레아','디엠디엠하이단토인','미네랄오일','벤조페논-3',
features_danger=[]
count=0
for i in range (len(features)):
    if (features[i] in cos):
        count+=1
        features_danger.append(features[ i])
if count!=0:
    print("20가지 주의 성분:",features_danger)
elif count==0:
    print("분석 결과, 사용하시는 화장품 내에 20가지 주의성분은 없습니다.")
분석 결과, 사용하시는 화장품 내에 20가지 주의성분은 없습니다.
```

Figure 18. 20 cosmetic ingredients of caution

Finally, we have a list of 20 cosmetic ingredients of caution. The list of 20 cautionary ingredients is from the book "The Secret of Korean Cosmetics," which is a best-selling book in the cosmetics category. In the result, we can see that the user's cosmetic products do not include any of the 20 cosmetic ingredients of caution. Aggregating the results, the user has to be cautious of '미리스틱애씨드' and '알코올'.

3.2.2. Ranking recommendation

For each category (Skincare, Suncare, Cleansing, Makeup, Men), we wanted to do a recommendation by showing the ranking of the cosmetic products that fit with the user's age, skin type, and skin concern. For women users, we show the result of 4 categories (Skincare, Suncare, Cleansing, Makeup). For men users, we show the result of one category 'Men'. We have the same ranking recommendation algorithm for each category, and as an example, we will show the process of doing ranking recommendations by skin care data.

First of all, we get the user information. We can see that the user's age is '30대', skin type is '복합성', and skin concern is '진정'.

User Information

```
In [5]: file = open('~/user_info.txt')
user_info=file.readlines()

name=user_info[0]
name=name.strip()
print("----"+str(name)+"님의 정보 ----")

age=user_info[1]
age = age.strip()
print(' age: ',age)

skinType=user_info[2]
skinType=skinType.strip()
print(' skinType: ',skinType)

skinConcern=user_info[3]
print(' skinConcern: ',skinConcern)

---- 최윤선님의 정보 ---
age: 30대
skinType: 복합성
skinConcern: 진정
```

Figure 19. User Information

In the ‘Recommendation Ranking’ part, we show all the cosmetic products that perfectly match the user’s age, skin type, and skin concern. The ranking is based on the sales volume data in OliveYoung.

Recommendation Ranking

나이대, 피부타입, 피부고민에 의해 선정된 랭킹 (만약 데이터가 적다면 오직 피부타입으로만 결정됨)

	상품명	가격	성분	나이	피부타입	피부고민
1	[대용량] 파티온 노스카나인 트러블 세럼 단독 기획 (50ml+15ml)	38000	숙일추출물, 정제수, 글리세린, 다이프로필렌글라이콜, 판테놀, 1,2-헥산다이올, ...	30대	복합성	진정
2	[파부걸] 네버즈인 3번 보습보습 결 세럼 50ml 기획 (+15ml 증정)	30000	비피다발효용해물(42%), 갈락토미세스발효여과물(21%), 부틸렌글라이콜, 메릴글루...	30대	건성, 복합성 보습, 진정	
3	에스트라 에이시카365 혼적진정세럼 40ml 기획 (+크림 10ml+토너25ml 증정...)	38000	정제수, 글리세린, 부틸렌글라이콜, 다이프로필렌글라이콜, 베타인, 나이아신아마이드,...	30대	복합성	진정
4	[리필기획] 아누아 어성조 77 수딩 토너 350ml 리필 기획세트 (350ml+35...)	49000	악모밀추출물(77%), 정제수, 1,2-헥산다이올, 글리세린, 베타인, 병풀추출물,...	30대	복합성	진정
5	라로슈포제 시카플라스트 멀티 리페어 크림 100ml+15ml 증정 기획	46000	정제수, 다이카프릴릴에터 판테놀, 글리세린, 웬틸렌글라이콜, 폴리글리세릴-6다이스테아레이트...	30대	건성, 복합성 보습, 진정	
6	VT 리듬샷 300 애센스 50ml	43000	정제수, 다이프로필렌글라이콜, 글리세린, 나이아신아마이드, 부틸렌글라이콜, 미카다미...	20대, 30대	복합성	진정, 주름/미백
7	우르으스 스킨로션 200ml	29700	■ 정제수, 에탄올, 웬틸렌글라이콜, 글리세린, 베타인, 피이지-6, 피이지-32,...	30대	복합성	보습, 진정

Figure 20. Recommendation Ranking

There might be special cases where there is no result when showing the ranking based on all considerations(age, skin type, skin concern). In that case, we only consider skin concern and show the ranking of the result. Also for each category (skin care, sun care, makeup, men, cleansing), the considerations(age, skin type, skin concern) are different due to data difference, so refer to the specific details in the code.

We thought that the result of recommendation ranking might not be enough for some particular users. Because there were some cases where there were only few results for recommendation ranking for users that have particular skin characteristics. So, we also decided to additionally show the cosmetics products that are in the dataset, but are not included in recommendation ranking. The ranking is based on the sales volume data in OliveYoung.

Others Ranking

Recommendation Ranking에 제시된 화장품을 제외한 랭킹

others

	상품명	가격	성분	나이	피부타입	피부고민
1	[심플 PICK15ml 추가증정]바이오더마 시카비오 포마드 100ml 더블기획	48100	정제수, 글리세린, 미네랄오일, 카프릴릭/카프릭트라이글리세라이드, 프룩토올리고사카라...	30대	건성, 복합성	보습
2	[리뷰이벤트모공교정앰플] 디마르3 시그니처 에스투드 프로텍터 대용량 앰플 170ml	59900	병풀추출물, 글리세린, 메틸프로판다이올, 글리세레스-26, 정제수, 1,2-헥산다이...	30대	복합성	보습
3	VT 리들샷 100 에센스 50ml	32000	정제수, 다이프로필렌글라이콜, 글리세린, 나이아신아마이드, 부틸렌글라이콜, 마카다이...	20대	복합성	진성, 주름/미백
4	에스트라 아토베리어365 크림 80ml 기획 (+하이드로에센스 25ml+무기자차선크...	31000	정제수, 부틸렌글라이콜, 글리세린, 부틸렌글라이콜다이카프릴레이트/다이카프레이트, 펜...	30대	건성, 복합성	보습

Figure 21. Others Ranking

The user might want to check which cosmetic products contain the ingredients they need to be cautious about. So, we retrieve the lists of cosmetic ingredients that are not suitable for the user. (Result from ingredient analysis)

OCR

```
ocr_result=[]

with open("./ocr.txt", "r") as ocr_file:
    for line in ocr_file:
        line=line.strip()
        ocr_result.append(line)

print("OCR Result: ", ocr_result)
OCR Result: ['미리스틱애씨드', '알코올']
```

Figure 22. Result of ingredient analysis

Based on the result from ingredient analysis, cosmetic products containing ingredients that require caution are labeled with a "caution" indication. We do it for 'Recommendation Ranking' and 'Others Ranking' and show the result to the user.

	상품명	주의성분 유무	가격	성분	나이	피부타입	피부고민
1	[대용량] 파티온 노스카나인 트러블 세럼 단독 기획 (50ml+15ml)	X	38000	쑥잎추출물, 정제수, 글리세린, 다이프로필렌글라이콜, 판테놀, 1,2-헥산다이...	30대	복합성	진정
2	[피부결] 넘버즈인 3번 보습보습 결 세럼 50ml 기획 (+15ml 증정)	X	30000	비피다발호응해물(42%), 갈락토미세스발호여과물(21%), 부틸렌글라이콜, 메릴글루...	30대	건성, 복합성	보습, 진정
3	에스트라 에이시카365 혼적진정세럼 40ml 기획 (+크림 10ml+토너25ml 증정...)	주의	38000	정제수, 글리세린, 부틸렌글라이콜, 다이프로필렌글라이콜, 베타인, 나이아신아마이드,...	30대	복합성	진정

Figure 23. "Caution" indication

For other categories(sun care, make up, cleansing, men), they follow a similar process.

4. User Study (Post-experience/survey methodology procedure)

4.1. Participant Demographics

4.1.1. User Test & Post-survey

Total Participants : 15

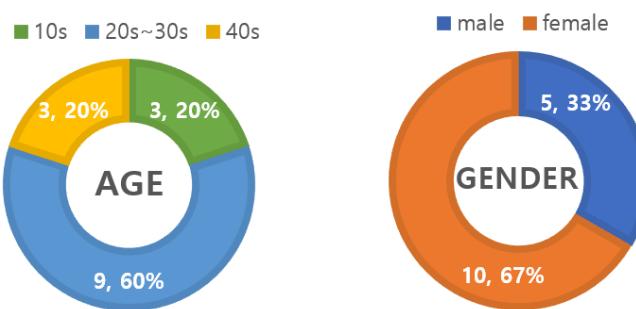
age group : 10s, 20s~30s, over 40s

gender : male (5), female (10)

[in detail]

- male : 10s (1), 20s (3), over 40s (1)
- female : 10s (2), 20s (6), over 40s (2)

[Details of data in below graphs : (count, %)]



4.1.2. Interview

Total Participants : 7 selected from Users who tested our application

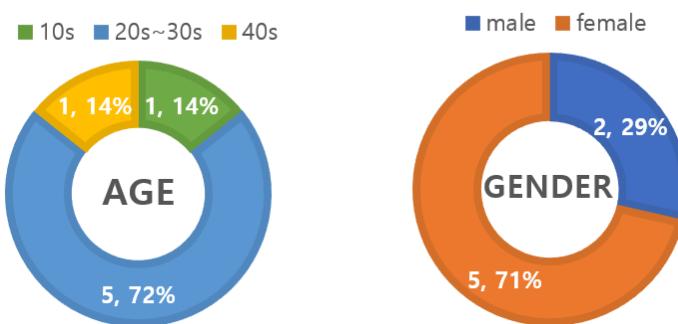
age group : 10s, 20s~30s, over 40s

gender : male (2), female (5)

[in detail]

- male : 20s (2)
- female : 10s (1), 20s (3), over 40s (1)

[Details of data in below graphs : (count, %)]



4.2. Procedures (Appendices D)

< User Test Protocol >

Time required : 20 minutes per participant

4.2.1. Test the functionality of our Application

1. Enter user information in the 'User Input' code file : ./Ranking/User_input.ipynb
2. After asking the user which cosmetics they had used that caused skin problems,
 - 1) If they had such cosmetics, searched the Internet, copied and pasted the ingredient list, and transferred it to ppt (for accuracy of results)
→ Save the png file as its simple cosmetic name to 'Images' folder
.Pororo/korean_ocr_using_pororo/assets/images
 - 2) If they had no such cosmetics, show an example of OCR results (ingre_test1/2/3/4)

4.2.2. Recommend before reflecting the ingredient analysis results

3. The process is different for each gender
 - 1) (female) Select one of cleansing, skin care, sun care, and makeup categories to show the user the recommended ranking and sales ranking according to user information and to have them check them.
 - 2) (male) Show the user the recommended ranking and sales ranking based on user information at ./Ranking/Men.ipynb and have them check them.

4.2.3. Recommend after reflecting the ingredient analysis results

4. After changing the 'img_path' address in ./Proro/korean_ocr_using_proro/HCI_OCR.ipynb, run the code and show the analysis results of ingredients that do not suit the user & ingredients that cause allergies.
5. Go back to ./Ranking's recommended ipynb file, show the user the recommended list with ocr applied and have them check them.

4.2.4. Test the UI structure of our Application

6. Comparison of UI of two applications 'Our Application' and '화해'. Proceed with both.
 - 1) 화해's Ingredient Search recommendation experience → Let the users know that the Hwahae app also has an ingredient search recommendation function and let them experience the UI.
 - 2) Our application's Figma experience → Let them know that it is a model, and that there are no other functions other than button operation and page movement, and then proceed with the experience.
7. Conduct post-surveys for all users (15) and conduct interviews for some users (7)
(+ create ocr & ranking result storage file)

4.3. Tools used for Data Collection

4.3.1. User Data Collection

1. OCR result

Personalized recommendation results for application functionality.

We could obtain user input information and information on ingredient results that do not suit the user generated as a result of user testing.

2. Google Form Survey (pre-survey & post-survey)

1) Pre-Survey

Through this survey conducted before determining the overall function and structure of the app, we explored people's cosmetics purchasing methods, perceptions of recommended apps, and needs for the app.

2) Post-Survey

Through this survey conducted after user testing, we collected data on users' satisfaction and improvements in terms of the application's functions and UI, and could additionally collect results compared to Hwahae in terms of the application's UI.

3. Interview

It was conducted after user testing and post-survey. By conducting a deeper exploration of users' personal characteristics, we could hear specific impressions about what aspects of the cosmetics recommendation application were helpful for these personal characteristics and explore ways to improve the application.

4.4. Ethical Considerations

When conducting a survey, we must be careful to collect personal information that identifies specific individuals, such as the participants' names and phone numbers. We specified in advance that the experiment participants' information will not be used for purposes other than project work, and we followed this rule. After the project is completed, we will delete the participants' personal information data.

Also, although this is a less important consideration than privacy issues, psychological pressure should not be placed on experimental participants to elicit the intended answer. It is important to create an environment so that experiment participants can participate in the experiment with a comfortable mindset.

5. Results

5.1. User Test one representative result

for one 40s female user's result

Make File of User

```
file = open("user_info.txt", "w")
```

User Input

나이: 20대 | 30대 | 40대 이상
피부타입: 건성 | 복합성 | 지성
피부고민: 보습 | 진정 | 주름/미백

이름: [REDACTED]

나이: 40대 이상

피부타입: 복합성

피부고민: 주름/미백

[REDACTED] 님의 회원가입을 환영합니다!

A user test was conducted with a total of 15 participants to experience the application's functions and UI design. Among them, we have attached the test results of one female user whose age is '40대 이상'. The user's skin type is '복합성', the skin concern is '주름/미백', and the picture on the right shows the user's information about it.

This user conducted an ingredient analysis using the OCR model (Pororo) for three cosmetics that did not suit her. After searching for each cosmetic ingredient and adjusting the image of the ingredient's text information so that the text appears clearer, the task was executed.

The three images below show the cosmetic ingredient text generation results of the OCR model (Pororo).

Cosmetic 1

인센서 스킨 컨디셔닝 젤

```
img_path = 'assets/images/test1.png'
ocr.run_ocr(img_path, debug=True)
```

Original

정제수, 알로에베라잎즙, 부틸렌글라이콜, 폴리솔베이트20, 글리세린, 카보마, 아미노메틸프로판올, 카프릴릴글라이콜, 비사보롤, 알란토인, 판테놀, 인도멀구슬나무잎주출물, 소듐피씨에이, 다이소듐이디티에이, 블래디액추출물, 소듐하이알루로네이트, 페녹시에탄올, 클로페네신, 향료, 리모넨

[정제수, 알로에베라잎즙, 부틸렌글라이콜, 폴리솔베이트20, 글리세린, 카보마, 아미노메틸프로판올, 카프릴릴글라이콜, 비사보롤, 알란토인, 판테놀, 인도멀구슬나무잎주출물, 소듐피씨에이, 다이소듐이디티에이, 블래디액추출물, 소듐하이알루로네이트, 페녹시에탄올, 클로페네신, 향료, 리모넨]

ROI

정제수, 알로에베라잎즙, 부틸렌글라이콜, 폴리솔베이트20, 글리세린, 카보마, 아미노메틸프로판올, 카프릴릴글라이콜, 비사보롤, 알란토인, 판테놀, 인도멀구슬나무잎주출물, 소듐피씨에이, 다이소듐이디티에이, 블래디액추출물, 소듐하이알루로네이트, 페녹시에탄올, 클로페네신, 향료, 리모넨

Cosmetic 2

모이스처라이저 크림

```
img_path = 'assets/images/test2.png'
ocr.run_ocr(img_path, debug=True)
```

Original

정제수, 세틸리시놀레이트, 카프릴릭/카프릭/석시닉트라이글리세라이드, 세테아릴알코올, 폴리글리세릴-6-스테아레이트, 글리세린, 사이클로펜타실록세인, 카프릴릭/카프릭/마리스/스테아릭트라이글리세라이드, 다이에티콘, 암모늄아크릴오일다이메틸타우레이트브이파드, 티타늄디ок사이드, 디아이소듐이디티에이, 세틸세아릭레이트, 아이드로로시아세트페논, 클로페네신, 옥타데케인, 글리세릴스테아레이트, 향료, 전단검, 다이에티콘/비닐다이에티콘크로스폴리머, 트리아이소듐에틸다이아이민디아이소네이트, 에보디아염매주출물, 시트릭애씨드, 바위돌꽃주출물, 차가버섯주출물, 로즈오브에리코주출물, 벤질살리실레이트, 리날룰, 헥실신남알, 리모넨, 시트로넬올

[정제수, 세틸리시놀레이트, 카프릴릭/카프릭/석시닉트라이글리세라이드, 세테아릴알코올, 폴리글리세릴-6-스테아레이트, 글리세린, 사이클로펜타실록세인, 카프릴릭/카프릭/마리스/스테아릭트라이글리세라이드, 다이에티콘, 암모늄아크릴오일다이메틸타우레이트브이파드, 티타늄디ок사이드, 디아이소듐이디티에이, 세틸세아릭레이트, 아이드로로시아세트페논, 클로페네신, 옥타데케인, 글리세릴스테아레이트, 향료, 전단검, 다이에티콘/비닐다이에티콘크로스폴리머, 트리아이소듐에틸다이아이민디아이소네이트, 에보디아염매주출물, 시트릭애씨드, 바위돌꽃주출물, 차가버섯주출물, 로즈오브에리코주출물, 벤질살리실레이트, 리날룰, 헥실신남알, 리모넨, 시트로넬올]

ROI

정제수, 세틸리시놀레이트, 카프릴릭/카프릭/석시닉트라이글리세라이드, 세테아릴알코올, 폴리글리세릴-6-스테아레이트, 글리세린, 사이클로펜타실록세인, 카프릴릭/카프릭/마리스/스테아릭트라이글리세라이드, 다이에티콘, 암모늄아크릴오일다이메틸타우레이트브이파드, 티타늄디ок사이드, 디아이소듐이디티에이, 세틸세아릭레이트, 향료, 전단검, 다이에티콘/비닐다이에티콘크로스폴리머, 트리아이소듐에틸다이아이민디아이소네이트, 에보디아염매주출물, 시트릭애씨드, 바위돌꽃주출물, 차가버섯주출물, 로즈오브에리코주출물, 벤질살리실레이트, 리날룰, 헥실신남알, 리모넨, 시트로넬올

Cosmetic 3

트루 페이스 프라이밍 솔루션

```
img_path = 'assets/images/test3.png'
ocr.run_ocr(img_path, debug=True)
```

Original

정제수, 베지니아풍년화수, 펜틸렌글라이콜, 다이메틸엠이에이, 부틸렌글라이콜, 에톡시시다이글리아이콜, 시트릭애씨드, 글리세린, 피이지-40하이드로제네이티드캐스터오일, 폴리솔베이트20, 클로페네신, 소듐피씨에이-스odium-hexameteate, 향료, 알제닌, 아스파틱애씨드, 피씨에이, 유신, 라이신에이치씨랄, 글리신, 알라닌, 세린, 발린, 트레오닌, 프롤린, 아이소류신, 테트라하이드로피페린, 히스티딘, 페닐알라닌, 녹차주출물, 알파-아이소메틸아이오논, 시트로넬올, 리날룰

[정제수, 베지니아풍년화수, 펜틸렌글라이콜, 다이메틸엠이에이, 부틸렌글라이콜, 에톡시시다이글리아이콜, 시트릭애씨드, 글리세린, 피이지-40하이드로제네이티드캐스터오일, 폴리솔베이트20, 클로페네신, 소듐피씨에이-스odium-hexameteate, 향료, 알제닌, 아스파틱애씨드, 피씨에이, 유신, 라이신에이치씨랄, 글리신, 알라닌, 세린, 발린, 트레오닌, 프롤린, 아이소류신, 테트라하이드로피페린, 히스티딘, 페닐알라닌, 녹차주출물, 알파-아이소메틸아이오논, 시트로넬올, 리날룰]

ROI

정제수, 베지니아풍년화수, 펜틸렌글라이콜, 다이메틸엠이에이, 부틸렌글라이콜, 에톡시시다이글리아이콜, 시트릭애씨드, 글리세린, 피이지-40하이드로제네이티드캐스터오일, 폴리솔베이트20, 클로페네신, 소듐피씨에이-스odium-hexameteate, 향료, 알제닌, 아스파틱애씨드, 피씨에이, 유신, 라이신에이치씨랄, 글리신, 알라닌, 세린, 발린, 트레오닌, 프롤린, 아이소류신, 테트라하이드로피페린, 히스티딘, 페닐알라닌, 녹차주출물, 알파-아이소메틸아이오논, 시트로넬올, 리날룰

The text results for the ingredients of each cosmetic were combined into one to create a list of ingredients to be used for analysis, and the ingredients were identified through three steps to identify cosmetic ingredients that were not suitable for the user. First, '알코올', and '에탄올' were identified as dangerous ingredients to watch out for depending on skin type. Second, '리모넨', '리날룰', '벤질살리실레이트', and '시트로넬올' were identified as cautionary ingredients that may cause allergies. Lastly, among the 20 cautionary ingredients, '페녹시에탄올' and '향료' were identified.

피부타입 위험성분: ['알코올', '에탄올']

알레르기 유발 주의 성분: ['리모넨', '리날룰', '벤질살리실레이트', '시트로넬올']

20가지 주의 성분: ['페녹시에탄올', '향료']

Therefore, the ingredients that do not match the user are displayed as follows by combining the three results above.

```
dangerous_for_user = skinType_danger+allergy_danger+features_danger
print(str(name)+"님께서 주의하셔야 하는 성분은 "+str(dangerous_for_user)+" 입니다.")
```

[] 님께서 주의하셔야 하는 성분은 ['알코올', '에탄올', '리모넨', '리날룰', '벤질살리실레이트', '시트로넬올', '페녹시에탄올', '향료'] 입니다.

Below are the results in the ‘Suncare’ ranking categories. The ‘Recommendation Ranking’ is a user-customized ranking shown to users before ingredient analysis, and is the result of selection based on age ‘40대 이상’, ‘복합성’ skin type, and ‘주름/미백’ skin concerns. The user can see that 4 out of 100 suncare cosmetics products have been filtered.

Recommendation Ranking			
나이대, 피부타입, 피부고민에 의해 선정된 랭킹 (만약 데이터가 적다면 오직 피부타입)			
Ranked			
상품명 가격			
1 메이크프럼 유브이 디펜스 미 카밍톤업선크림 40ml 1+1 기획		28000	정제수, 징크옥
2 피지오겔 레드수딩 AI 센서티브 UVbens스크린 40ml		30000	정제수
3 로레알파리 UV 디펜더 선크림 50ml 4종 (데일리톤업오일프리아쿠아)		26000	정제수, 에칠판디올
4 블랙몬스터 별련싱 알로에 선크림 50ml		14000	알로에베라
Others Ranking			
Recommendation Ranking에 제시된 화장품을 제외한 랭킹			
others			
상품명 가격			
1 [1+1율영1위] 달바 워터풀 톤업 선크림 듀오 기획(50ml+50ml)		51000	
2 차엔박(CNP) 툰업프로텍션션SPF42 50ml 1+1 단독기획		28000	
3 [유리아PICK] 조선미녀 맑은 البشر선크림 더블기획세트 50ml2		30000	
4 라운드랩 자작나무 수분 선크림 50ml 기획(클렌저 20ml 증정)		25000	
5 [1+1기획] 구달 맑은 어성초 진정 수분 선크림 50ml 1+1 기획 SPF50+...		18000	

The following also shows results in the same ‘Suncare’ ranking category. The difference from the above results is that they are displayed to the user after the ingredient analysis has been reflected. In the results selected based on age ‘40대 이상’, ‘복합성’ skin type, and ‘주름/미백’ skin concerns, caution signs are reflected for ingredients that do not match the user, and the number of products to be cautious of is indicated. The user can confirm that an ingredient to be aware of was found in 2 of the 4 cosmetics recommended by the user-customized ranking, and an ingredient to be aware of was found in 27 of the remaining 96 cosmetics recommended by the sales volume ranking.

Recommendation Ranking after OCR			
OCR_Ranked = Ranked OCR_Ranked['주의성분유무'] = 'X' for i in range (len(ocr_result)): OCR_Ranked._index=OCR_Ranked[('성분')].str.contains(ocr_result[i])==True OCR_Ranked._index=OCR_Ranked._index.reset_index(drop=False)			
indexes=OCR_Ranked._index[['index']] index_list=indexes.values			
for i in range (len(index_list)): OCR_Ranked.loc[index_list[i], '주의성분유무'] = '주의' OCR_Ranked.reset_index(inplace=True) OCR_Ranked.index=OCR_Ranked.index + 1 print("주의상품개수:", len(OCR_Ranked_index))			
주의상품개수: 2			
OCR_Ranked = OCR_Ranked.drop(['index'], axis=1) OCR_Ranked = OCR_Ranked[['상품명', '주의성분유무', '가격', '성분', '나이', '피부타입']] OCR_Ranked			
상품명 주의성분유무 가격			
1 메이크프럼 유브이 디펜스 미 카밍톤업선크림 40ml 1+1 기획		X 28000	정제수
2 피지오겔 레드수딩 AI 센서티브 UVbens스크린 40ml		X 30000	
3 로레알파리 UV 디펜더 선크림 50ml 4종 (데일리톤업오일프리아쿠아)		주의 26000	정제수, 에칠판디올
4 블랙몬스터 별련싱 알로에 선크림 50ml		주의 14000	

Others Ranking after OCR			
OCR_others = others OCR_others['주의성분유무'] = 'X' for i in range (len(ocr_result)): OCR_others._index=OCR_others[('성분')].str.contains(ocr_result[i])==True OCR_others._index=OCR_others._index.reset_index(drop=False)			
indexes=OCR_others._index[['index']] index_list=indexes.values			
for i in range (len(index_list)): OCR_others.loc[index_list[i], '주의성분유무'] = '주의' OCR_others.reset_index(inplace=True) OCR_others._index=OCR_others._index + 1 print("주의상품개수:", len(OCR_others_index))			
주의상품개수: 27			
OCR_others = OCR_others.drop(['index'], axis=1) OCR_others = OCR_others[['상품명', '주의성분유무', '가격', '성분', '나이', '피부타입']] OCR_others			
상품명 주의성분유무 가격			
1 [1+1율영1위] 달바 워터풀 톤업 선크림 듀오 기획(50ml+50ml)		X 51000	
2 차엔박(CNP) 툰업프로텍션션SPF42 50ml 1+1 단독기획		X 28000	
3 [유리아PICK] 조선미녀 맑은 البشر선크림 더블기획세트 50ml2		X 30000	
4 라운드랩 자작나무 수분 선크림 50ml 기획(클렌저 20ml 증정)		X 25000	
5 [1+1기획] 구달 맑은 어성초 진정 수분 선크림 50ml 1+1 기획 SPF50+...		X 18000	

5.2. Post-Survey result - Quantitative Analysis

We conducted a post survey on the user test with a total of 15 people who participated in the previous user test. This survey provides insight into the satisfaction and performance of the functional elements of our

application, and compares the UI structure of the '화해' application, showing significant differences with the existing cosmetics recommendation application UI and satisfaction with the UI of our application.

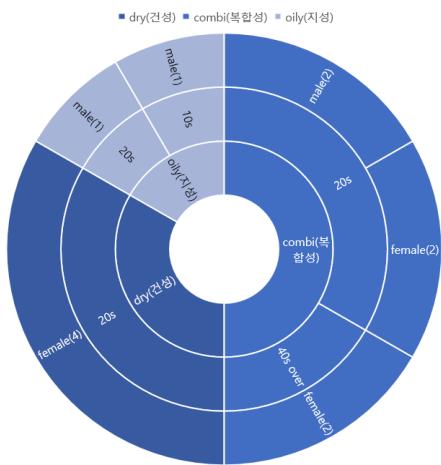


5.2.1. Function

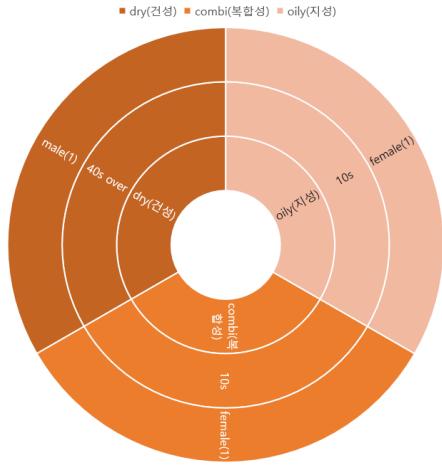
First, here are the results of this survey on functional factors. As a result of the user test, 12 out of 15 people were able to identify the ingredients of cosmetics that did not suit them through our app's cautionary ingredient analysis filter. Through these statistical results, we can see that the caution ingredient analysis filter worked properly for 80% of the users, and we can see that most of the users who participated in the experiment had experience using cosmetics that did not suit them.

In order to find out if there was any difference between the group that could confirm the ingredient analysis results and the group that did not, user information was displayed by skin type, age group, and gender. As a result, in the red sunburst graph, you can see that only 2 people in '10대' and 1 person in '40대 이상' were unable to confirm the ingredients. This suggests that there are no cosmetics that do not suit them, or that the ingredient filter does not work properly. The exact cause of these results can be found in the 5.3.Interview section with users whose age is '10대' and '40대 이상'.

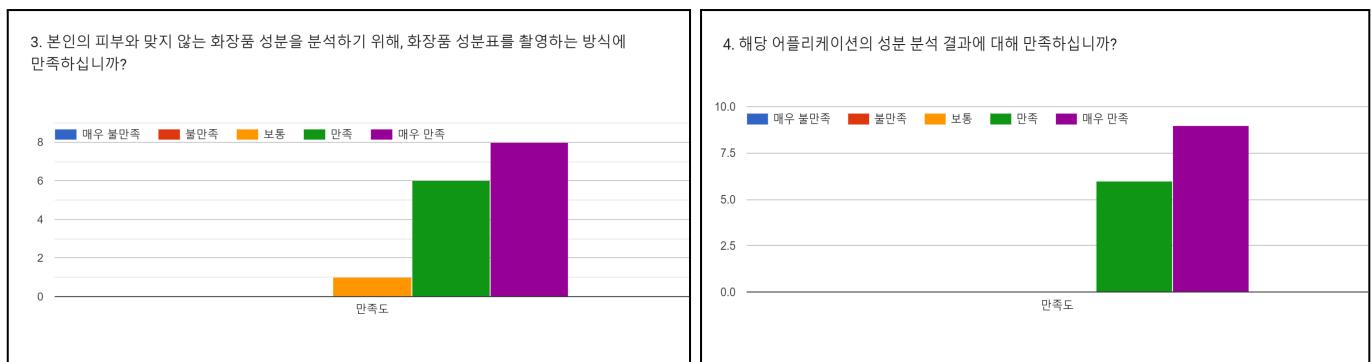
Users who could check which ingredients did not suit them.



Users who couldn't check which ingredients did not suit them.



In the bar graph below, you can see that most users are satisfied with our application's method of photographing ingredient lists and ingredient analysis results. Regarding the method of photographing the ingredient list, 8 people were 'very satisfied', 6 people were 'satisfied', and 1 person was 'average'. Regarding the ingredient analysis results, 9 people were 'very satisfied' and 6 people were 'satisfied'.

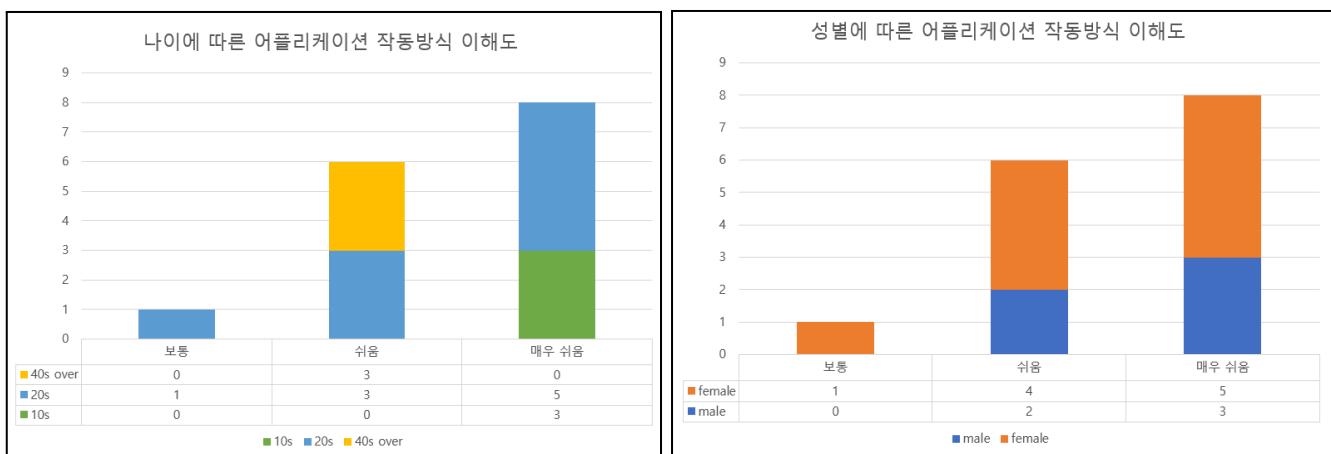


5.2.2. UI structure and design



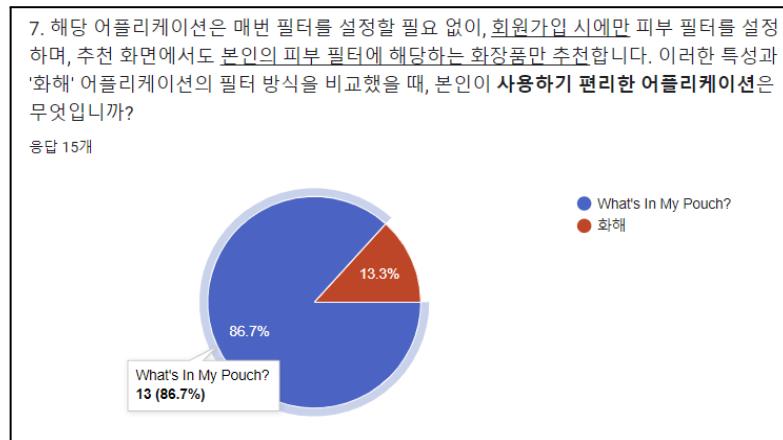
The second is the survey results about the application's UI structure and design. The UI of our application pursues '**simplicity**' to make it easy for users to use. To determine whether these elements were well reflected, we evaluated users' ability to understand how to operate the application on their own. As a result, 8 users found it 'very easy', 6 users found it 'easy', and 1 user found it 'average'. Approximately 93% of users were able to understand the structure of the application without any explanation of how it works from the developer.

In order to understand the level of understanding of how to use the application by user characteristics, we graphed the ratios of each age group and gender. All teenagers who were good at using smartphones had a higher level of understanding than those in '20대', and '40대 이상'. We expected that users in '40대 이상' would have a lower level of understanding than those in '10대' or '20대', but contrary to our worries, users in '40대 이상' also showed a high understanding of how to use the application. However, there is little difference in understanding of how to use it depending on gender.



Therefore, the results of our application UI itself show satisfactory achievement in terms of understanding for people in '10대', '20대', and '40대 이상'.

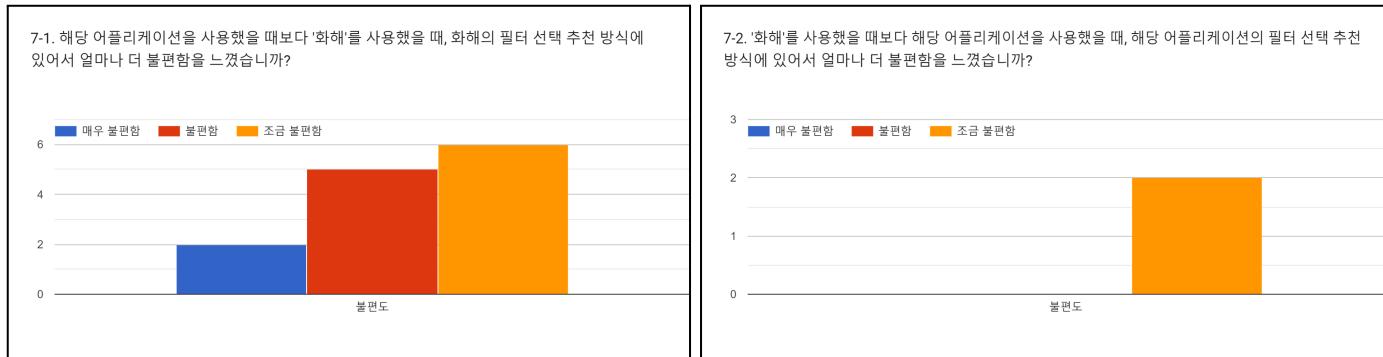
5.2.3. Comparison with other similar application ‘화해’



Next, to compare the UI of our app with existing cosmetics recommendation application, 15 users tried cosmetics recommendations through ingredient analysis in both our application and ‘화해’ and compared the convenience. As a result, you can see that 86.3% of users felt that our application was easier to use.

Of the 13 people who chose our application, 2 chose ‘very difficult’, 5 chose ‘difficult’, and 6 chose ‘somewhat inconvenient’ regarding the recommended method of ‘화해’. Conversely, the

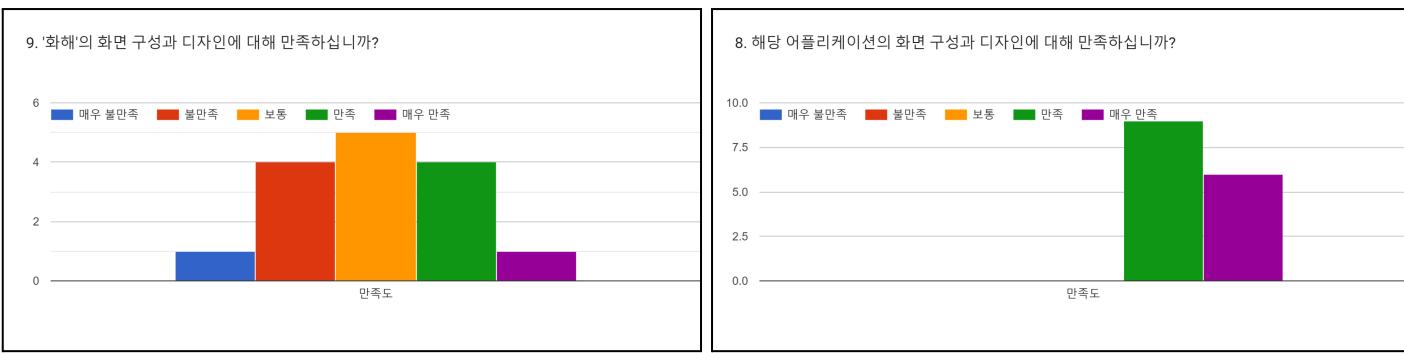
2 people who chose ‘화해’ chose ‘somewhat difficult’ for our application’s recommendation method.



The reason for this result can be seen in the two pictures below. We can see that most of the 13 people who chose our application felt uncomfortable in ‘화해’ with the complicated structure and small text that made it difficult to know where to do the ingredient analysis. On the other hand, we can see that the two people who chose ‘화해’ were disappointed that the shortcoming of our application was that it had a simpler structure compared to ‘화해’.



We also surveyed all users about their satisfaction with the screen composition and design of both ‘화해’ and our application. ‘화해’ contained a relatively large number of dissatisfied opinions compared to our application, and the range of satisfaction was widely distributed. Looking at the difference values when comparing the two applications, you can see that 1 person was ‘very dissatisfied’, 4 people were ‘dissatisfied’, and 5 people were ‘average’ regarding ‘reconciliation’.



Through two comparison results with the ‘화해’ application, we can see that ‘화해’ has a UI structure that is relatively more inconvenient to use than our application. Therefore, our application can be considered to be easier to use than existing recommendation systems and satisfies the conditions of simplicity. From the above results, it can be seen that not only functional aspects but also UI aspects are related to having competitiveness over existing applications.

5.3. User Interview - Qualitative Analysis

5.3.1. Analysis of post-survey results: Analysis of the cause of users who failed to check their cautions

From the post-survey results above, we could not find any ingredient results that were not suitable only for users in ‘10대’ and ‘40대 이상’. We conducted interviews about this and assumed that either they didn't have cosmetics that didn't suit them, or their ingredient filters weren't working properly. Representatives in ‘10대’ did not know what cosmetics did not suit them, and representatives in ‘40대 이상’ and older responded that there was no cosmetic product that did not suit them well. Therefore, we need to think about how to proceed with component analysis for these users. We believe that we can solve this problem if we can obtain accurate data on ingredients to watch out for by skin type and age group, and provide more thorough options.

5.3.2. Skin concerns of interviewees

After conducting interviews with a total of 7 people, we conducted keyword analysis on the interviewees.

In the picture on the right, the skin concerns of ‘10대’ and most people in ‘20대’ were skin problems (ex. acne) due to dry or oily skin types, and among them, some in ‘20대’ and women in ‘40대 이상’ had concerns about whitening.



It has been found that people in ‘10대’ and ‘20대’ mainly developed these skin concerns during puberty, when hormone secretion is at its peak and interest in appearance increases. However, it has been confirmed that people in ‘40대 이상’ are showing interest in wrinkles and whitening as aging begins to progress.

5.3.3. How to solve interviewees' skin concerns and Difficulties in choosing cosmetics

The picture on the right shows that interviewees make efforts to solve these skin concerns by visiting a dermatologist and receiving treatment, or purchasing cosmetics that are good for sensitive skin through recommendations from others, reviews, and personal experiences.



And looking at the picture on the left, you can see that most people go through the hassle of finding the right cosmetics for themselves.

Additionally, we were able to identify a tendency that when new cosmetics were released, people were reluctant to purchase new cosmetics due to lack of information compared to other famous cosmetics.



5.3.4. Interviewees' viewpoint of our application

(1) Positive comments about our application

In the keyword analysis on the left below, it can be seen that the main opinions are that reliability can be gained by directly analyzing ingredients that do not suit one's skin and showing the results, and that it is convenient to use because it has only the necessary functions. It appears that many users who are not good at using complex applications or are curious about ingredients that do not suit them will use our app.

(2) Improvements to our applications

In the keyword analysis on the right below, there is an opinion that it would be cumbersome to always edit information that can change frequently, such as skin concerns. In terms of the ingredient analysis function, we also pointed out the risk that if you always use the same cosmetics, the products to be compared and analyzed may be limited, and therefore it may be difficult to identify cautionary ingredients for all types of cosmetics. Also, We can see various opinions, some people wish there were more diverse filter functions, such as being able to set different skin concerns for each category or checking frequently used cosmetic brand products, and some people wanted to add not only the ability to take pictures, but also the ability to search ingredients by the name of cosmetics in our application. When developing the app in the future, we expect that if we can supplement and improve these aspects, we will be able to secure more users.



6. Discussion

After conducting user tests and analyzing post-survey and interview results, we concluded that the aspects we emphasized during system development are effectively felt to users. As we mentioned, our system development focused on cosmetic ingredient analysis-based product recommendations (1) and a user-friendly, straightforward UI design (2).

Firstly, regarding (1), most users expressed satisfaction with ingredient analysis-based recommendations. Additionally, there were positive comments on aspects we hadn't anticipated. Through interviews, we figured out that our team's proposing recommendation method increased users' trust. Many users of existing product recommendation apps felt that even when filtering recommendations based on their information, the suggestions seemed like advertisements. However, because our system recommends products based on the ingredients of the user's actual used cosmetics, it leads users to perceive the recommendations as more reliable.

Next, regarding (2), users felt inconvenience in the complexity of screen layouts and small text in existing recommendation applications. In contrast, our implemented application received positive feedback for its simple screen layout and user-friendly design with minimal buttons. However, despite this, as indicated by the post-survey results, there may be a need for UI adjustments, such as adding a back button or making warning signs more noticeable to the user.

7. Conclusion

7.1. Key Takeaways

We were able to proceed with the project by designing the structure and design of the application based on the scenario.

In the needs analysis stage, a preliminary survey was conducted to gain an understanding of the behavior and perception of users who purchase and use cosmetics, and the functions of the cosmetics recommendation system and the needs of users were analyzed. Based on this, a scenario was created to create personas for virtual users by age and skin type.

In the design stage of the project structure, guidelines for the application structure, including application details and constraints, were established through technical HCI theory and task analysis, and the system was designed based on these. Using the scenario from the previous step, we created a user design by creating a persona for a virtual user.

A prototype of the proposed system was produced in two parts: functional and UI design. Our application, which is differentiated from existing cosmetic recommendation systems, was created to easily analyze ingredients with a photo-taking function, inform users of unsuitable ingredients for their skins that they do not know about, and automatically filter them out of recommendations.

Afterwards, we evaluated our applications by conducting user tests and post-surveys (Quantitative) and interviews (Qualitative) for each. As a result, in terms of UI, our application provides users with convenience of use, and in terms of functionality, we were able to obtain reliability for cosmetic recommendations through analysis of ingredients of interest to users. If we compare only the functional aspects with the existing system, our application will be lacking, but if we improve our application based on the feedback obtained through interviews, we expect to achieve better results.

7.2. Limitations

The main limitation was the lack of cosmetic data. We conducted a crawling project on the top 100 rankings by category on the Olive Young website, but there was no information on skin concern in any of the categories except the skincare category. Also, because the main users of cosmetics are people in their 20s and 30s, there was a lack of cosmetics data for people in their teens and 40s or older in the rankings collected.

Another limitation is the problem of increasing the accuracy of character recognition of the 'pororo' OCR model applied to the function. Although Hangul recognition is better than other OCR models currently in use, more accurate character recognition technology is required for accurate ingredient analysis.

Additionally, due to difficulties in linking the OCR model and dataset to the app, we created the functional and UI aspects separately and conducted user tests. The app's UI was implemented in Figma, and the app's functions were coded to apply a recommendation system based on user input by applying OCR.

7.3. Future Research

If we proceed with further research, the problems presented in the limitations must first be resolved. For insufficient data, we can adopt a method of additionally collecting not only Olive Young's ranking data but also cosmetics data by category and re-assigning rankings according to new standards. Here, the number of reviews by filter such as skin type, age, etc. can be used as a criterion for ranking. However, during this process, it is necessary to collect data on newly released cosmetics, and in the case of cosmetics with a small number of reviews, it is necessary to consider what weight can be assigned to rank them.

Next, we can focus on improving the accuracy of our OCR model. For more accurate character recognition, it may be necessary to add detailed image preprocessing to increase the clarity of the text.

And we can explore how to create an app that applies the code for the functional parts of the project system. At this time, it is necessary to build a database that stores the information of each user, and modification work must be done with code that can dynamically process incoming data in real time. Additionally, our application must include the ability to take photos to apply the OCR model. After this supplementation work has been completed, additional features of the application can be tried based on the feedback on improvement directions obtained from the interview.

References

- [1] Kim, H., Shin, W., Shin, D., Kim, H. & Kim, H. (2021).Beauty Product Recommendation System using Customer Attributes Information. *Information Systems Review*, 23(4), 69-84.

[2] Park, G., Kim, Y., Mo, H. & Park, D. (2013). A Personalized Cosmetics Recommendation System Based On The Collaborative Filtering. Korean Society for Information Processing Conference, 20(1), 1100-1102.

Appendices

A. Websites & Applications

1. Oliveyoung Website: <https://www.oliveyoung.co.kr>

We used this website for data crawling.

2. 화해 (application)

We conducted a survey comparing the UI of our app and 화해's UI. From the ingredient dictionary, we extracted information (1) dangerous components for different skin types, (2) allergen-triggering elements, and (3) 20 cosmetic ingredients of caution.

B. Surveys

- Preliminary survey link: <https://forms.gle/yqzntvTxLxdvsQTX7>
- Post survey link: <https://forms.gle/w4Y5fDEH6ThJtCHf7>

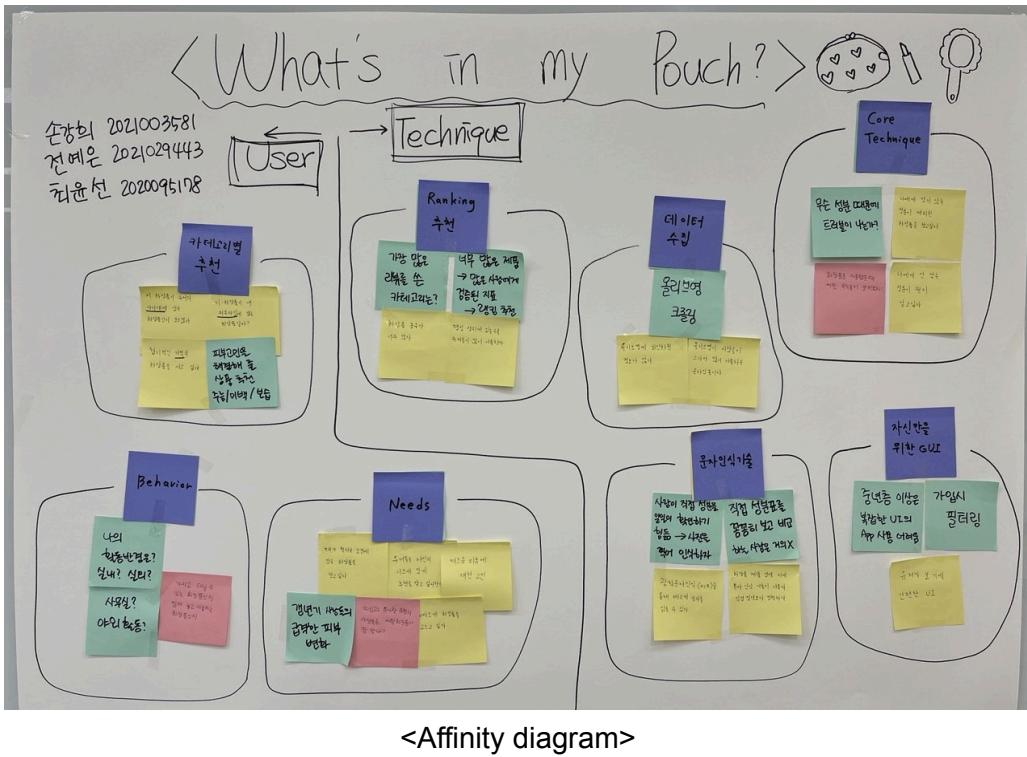
C. Interview questions

- 1) Please share your concerns about your skin.
- 2) Do you have any concerns related to the choice of skincare products for addressing those skin issues?
- 3) After briefly experiencing our app, feel free to share your opinions on it.

D. Code

- github link: <https://github.com/esthyj/WIMP>

E. Design Thinking process



<Affinity diagram>

Theme	Topics
Recommend cosmetics after removing unsuitable ingredients for user's skin	<ul style="list-style-type: none"> + Instead of users having to check the ingredients of cosmetics one by one, we can only show cosmetics without ingredients that do not suit the user's skin. + If there are ingredients that are not inappropriate but need to be careful, they can be displayed to the user. - Even if there are cosmetics that are suitable for the user, it is difficult to recommend products that are not listed on Olive Young because there is no information. - When most cosmetics data contains ingredients that do not suit the user, the types of cosmetics that can be recommended to the user are greatly limited.
Construct the app based on data crawled from Olive Young	<ul style="list-style-type: none"> + Using Selenium, we can obtain actual cosmetic product information (product name, price, ingredients, review information, etc.) by ranking each category from Olive Young. + Crawled data consists of options that users may be curious about when purchasing cosmetics, and is used as a recommendation filter based on user information (gender, age, skin type). - It may be difficult to obtain accurate option information (age, skin type) for newly released cosmetics compared to existing cosmetics sold to many people. - Information on skin type, skin concerns, and age must be collected through reviews, but if a product with few reviews is ranked, it may be difficult to collect proper data.
Show only the personalized screen UI gotten filtering when joining membership	<ul style="list-style-type: none"> + Because of the simplified screen UI, people over middle-aged can easily use the app. + Users can find the content they want more quickly. - If personal information changes, such as skin type or concerns, there may be a hassle of having to change member information once again. - It is difficult for users to find recommendations for cosmetics used by people with different skin conditions.
Recommend cosmetics based on the ranking of each category (Skin Concerns, Cosmetic Types, Price, Skin Type)	<ul style="list-style-type: none"> + Users can check the cosmetic rankings based on their unique preferences, such as skin concerns, types of cosmetics, price range, and skin type. + This functionality caters to users' specific needs, so it sets our app apart as a distinctive offering not provided by other cosmetic apps. - Very specific categories such as spreadability are not provided. - It's important to note that highly ranked products are not necessarily the best fit for individual users, as they are often determined by sales volume, not personalized suitability.
Analysis of cosmetic ingredients through OCR	<ul style="list-style-type: none"> + Users don't need to input each ingredient one by one, providing convenience to users. + Even for cosmetics not found on the Olive Young website, ingredient analysis is possible. - When users are in a poorly lit environment, taking photos can be challenging. - Taking photos can be difficult when users don't have the cosmetics directly on hand.

<Claim Analysis>



Name : Seokjung Min
 Age : 26
 Gender : Male
 Couple : Y
 Job(Main place of activity): Dog Trainer,
 Mainly outdoor activities
 Attitude:
 Active only with close friends.
 Usually shy

Skin Information	
1) Skin type :	oily skin
2) Characteristic :	Dark circles, tanned skin with slight blemishes
Cosmetic information	
1) Cosmetic use type :	sunblock, all-in-one skin lotion
2) Cosmetics currently used :	Uros, IOPE Men UV shield sun protector
3) Things to consider when buying cosmetics :	Effectiveness
4) Replacement period :	Until used up

Behavior

As a dog trainer, I often work outdoors, so my skin gets burned and rough due to exposure to the sun. When I meet my girlfriend, I want to cover up any blemishes I get while working or pay attention to my makeup and do it well.

Troubles or difficulties while buying cosmetics

It's hard to find sunscreen that isn't sticky. I don't know what cosmetics I need for make up to look good. Buying cosmetics alone at a store feels difficult. There are so many different types, so just choose the representative ones.

How to use this app

1) What you want through the app:
 I hope that uncomplicated options are provided. Since I spend a lot of time outside, I need a sunblock that lasts a long time and is not sticky or slippery. I want a recommendation for cosmetics to use when I have an appointment with my girlfriend or when I need to look good for something important day.



- Name: Gwen
- Age: 51
- Gender: Female
- Couple: Y (Married)
- Job: Housewife
- Attitude: Very sociable and family-oriented personality
- Interest: Workout, Children Education

Skin Information

- Type: Dry
- Characteristics
 - Menopause
 - Fever and flush on the face
 - Wrinkles around the eyes and the nasolabial folds
 - Sensitive to ultraviolet rays

Behaviors

- With a social personality, she has many meetings, so she pays a lot of attention to her appearance.
- She likes to exercise such as jogging, so she gets a lot of sunlight.

Needs

- Wants to easily recommend cosmetics that fit well with middle-aged skin and are cost-effective.
- Wants to know what components of cosmetics she should avoid for her current skin condition.
- Needs a simple screen app.

Pain Points

- She's not sure what cosmetics to use on her skin changed by menopause.
- There are few cosmetics stores for middle-aged people on the street, so it is cumbersome to purchase cosmetics suitable for age.
- Cosmetics for middle-aged people are expensive, so they are burdensome to use steadily.
- Cosmetics apps are too complicated for her to use.

Cosmetic Information

- Cosmetics currently in use
 - Skincare: ESCAROSE Snail Skin Care Set (Toner, Cream, Serum), Dr.Wonjin(Moisture), AHC(Eye), HERA(Sunblock)
 - Color: HERA(Cushion), Innisfree(Eyebrow), Dior(Lipstick)
- Important things when buying cosmetics
 - Moisture, Wrinkle Improvement Effect, Cooling, Price
- When to replace
 - She uses up the skincare products in about 3 months.
 - She may use color cosmetics for more than a year.

<Behavior>

<Personal information>



Name: Gayoung Kim
 Age: 18
 Gender: Female
 Couple: N
 Job(Main place of activity): Student
 Attitude: timid

<Skin information>

- Skin Type: Dehydrated Oily
- Skin Characteristics: Pronounced pustular acne often appears on the forehead and cheeks.

<Cosmetic information>

- Products Used: Toner, Serum, Cream, Sunscreen, Lip Tint, Eyebrow, Eyeliner
- Current Skincare Products: Anua Aqua Chiffon 77 Toner, Innisfree Green Tea Serum, Dr.G Red Blemish Clear Cream, Innisfree Tone Up No-Sebum Sunscreen, Etude House Dear Darling Lip Tint, KissMe Eyebrow, Lilybyred am 9 to pm 9 Survival Penliner
- Considerations When Buying Skincare Products: Reasonable price and suitability for acne-prone skin.
- Replacement Frequency: Tends to switch to better products when she discovers them, typically every 3 months on average.

<Pain points>

- Applying products with fatty acids as ingredients can clog the pores and trigger acne on her skin, but she's not sure which skincare products contain fatty acids.
- She doesn't have a lot of money, so she cannot try various cosmetic products.

<Needs from this app>

- She'd like recommendations for skincare products that do not contain fatty acids.
- She's a student and she doesn't have a lot of money, so she'd appreciate affordable options.

<Personas>

F. Prototype

- Low fidelity prototype:
https://drive.google.com/file/d/1Jevku8ed3EsnjSH4GWsXdPwl4nhQ8Wb/view?usp=drive_link
- Medium fidelity prototype:
<https://www.figma.com/file/0VjptFTvWC77E1tn8eDonu/What's-In-My-Pouch%3F?type=design&node-id=0-1&mode=design&t=EwywtH9xpFLtIM50-0>

G. Data

We have 5 datasets: skinCare, cleansing, sunCare, makeUp, and men. Below shows the number of main features (skin type, skin concern, age) used to apply filters for each dataset and information for each column.

skinType	skinCare	cleansing	sunCare	makeUp	men
dry	58	26	58	26	20
oily	0	11	3	12	12
combination	98	99	99	91	37
skinConcern	skinCare	cleansing	sunCare	makeUp	men
Soothing skin	49	0	0	0	20
Moisturizing	76	0	0	0	28
Wrinkles/Beauty	0	0	0	0	0
ageGroup	skinCare	cleansing	sunCare	makeUp	men
10s	1	0	0	0	0
20s	67	58	66	75	28
30s	29	45	36	17	18
40s~	3	2	5	2	0
total	98	100	100	94	45

Below is the data type information for 5 datasets.

skinCare.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 98 entries, 0 to 97
Data columns (total 8 columns):
 #   Column   Non-Null Count  Dtype  
--- 
 0   상품명    98 non-null    object  
 1   가격      98 non-null    int64  
 2   성분      98 non-null    object  
 3   나이      98 non-null    object  
 4   피부타입  98 non-null    object  
 5   피부고민  98 non-null    object  
 6   랭킹      98 non-null    int64  
 7   리뷰수    98 non-null    int64  
dtypes: int64(3), object(5)
memory usage: 6.2+ KB
```

sunCare.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 100 entries, 0 to 99
Data columns (total 8 columns):
 #   Column   Non-Null Count  Dtype  
--- 
 0   상품명    100 non-null   object  
 1   가격      100 non-null   int64  
 2   성분      100 non-null   object  
 3   나이      100 non-null   object  
 4   피부타입  100 non-null  object  
 5   피부고민  100 non-null  object  
 6   랭킹      100 non-null   int64  
 7   리뷰수    100 non-null   int64  
dtypes: int64(3), object(5)
memory usage: 6.4+ KB
```

cleansing.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 100 entries, 0 to 99
Data columns (total 8 columns):
 #   Column   Non-Null Count  Dtype  
--- 
 0   상품명    100 non-null   object  
 1   가격      100 non-null   int64  
 2   성분      100 non-null   object  
 3   나이      100 non-null   object  
 4   피부타입  100 non-null  object  
 5   피부고민  100 non-null  object  
 6   랭킹      100 non-null   int64  
 7   리뷰수    100 non-null   int64  
dtypes: int64(3), object(5)
memory usage: 6.4+ KB
```

makeUp.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 94 entries, 0 to 93
Data columns (total 8 columns):
 #   Column   Non-Null Count  Dtype  
--- 
 0   상품명    94 non-null   object  
 1   가격      94 non-null   int64  
 2   성분      90 non-null   object  
 3   나이      94 non-null   object  
 4   피부타입  94 non-null  object  
 5   피부고민  94 non-null  object  
 6   랭킹      94 non-null   int64  
 7   리뷰수    94 non-null   int64  
dtypes: int64(3), object(5)
memory usage: 6.0+ KB
```

men.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 45 entries, 0 to 44
Data columns (total 8 columns):
 #   Column   Non-Null Count  Dtype  
--- 
 0   상품명    45 non-null   object  
 1   가격      45 non-null   int64  
 2   성분      44 non-null   object  
 3   나이      45 non-null   object  
 4   피부타입  45 non-null  object  
 5   피부고민  45 non-null  object  
 6   랭킹      45 non-null   int64  
 7   리뷰수    45 non-null   int64  
dtypes: int64(3), object(5)
memory usage: 2.9+ KB
```