Intergoodies

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***Abstract*—This document contains a report of the final project for Interactive Systems and Technologies. The final project consist of creating an online product sales application, where the user will be able to order exotic products from his country and other countries using only his/her phone. The name of the application is InterGoodies and it will have available products from the following countries, Brazil, China, India, Japan and Korea.**

***Index Terms*—Online Product Sales, E-commerce, Sales Platform, User Experience, Digital marketing, Interactive Systems.**

I. Introduction

Nowadays, in the costumer landscape, E-commerce and online sales have become and essential part of the shopping experience. The majority of costumers are expected to be able to search and purchase products online, providing to the costumers flexibility, convenience and a wider selection of products, making them easier to find, combine and purchase. E-commerce, buying and selling products or even services using the internet, has being growing in recent years and the COVID-19 pandemic has accelerated the process, as more consumers have turned to online shopping due to the lock downs and social distancing measures. According to a report be eMarketer, global e-commerce sales are expected to reach 6.38 trillion of dollars by 2024, and this growth i being driven by factors such as the rise of mobile commerce. The purpose of this report is to describe the application that we developed and explain the components developed, the architecture of the application, together with the input and output methods used and as well to show the results of the user testing, focusing on the usability. In the following sections will be described the development process, key features and the user experience.

II. Prototype

In the design fase we chose the interaction styles focusing in reducing the possibility of errors the users could commit, in reducing the complexity of using the app, but still giving the functionalities needed and expected of an application of this type.

We also had to consider some principles of design, the design principles of an user interface (UI) and the color palette to be used in the app, so that we could help the users in using the app, while at the same time reducing the cognitive load, the amount of errors they could do and inducing them to return and use the app again later.

In regards to the interaction styles, in this application two interaction styles were applied, we will present them and some components where they were applied.

The first is the Menu-driven interaction style, this interaction style, is characterized by giving the user the choices in the form of a set of options, with the possibility of the items having hierarchies. The action of choosing and/or selecting one or more of these items will change the state of the interface of the systems.

This type of interaction style gives the opportunity of reducing the cognitive load of the user if the options given are easy to understand, turning the tasks with more emphasis in recognition.

Some of the advantages this style gives are that, as the choices are defined it avoids user errors and it helps structuring the decision making. One of the disadvantages is that with more options the complexity increases.

This interaction style was applied in the application in the interactions whose objective is selecting the countries and the categories in the first flow of the application, being also applied in the secondary flow in the product list where its possible to change countries or categories.

The second interaction style, the WIMP Interfaces — that stands for Windows, Icons, Menus, Pointers — is characterized by using the widgets that compose its name, this interaction style is the most used of the interaction styles, specially in desktops and notebooks.

This interaction style was applied in the Popups that are called in the application, examples are the cart and sig-nup popups.

Besides these two interaction styles we can also consider as having implemented another interaction style albeit in a very low frequency, the form-filling interaction style.

This interaction style is seen in three popups in our application, where the user is needed to give some input, namely the login, sign-up and account settings popups.

Moving on to the design principles, we developed our application focusing on Consistency, Minimal Surprise and Diversity, with the objective of reducing the cognitive load and increasing the chances of recognition while using the app.

We used consistency to maintain the functionalities within the system the most uniform possible so that the users would be able to use them without having to think what a certain interactor will do. One of the examples where we can observe this is in the following functionalities: add to/remove from the cart and the functions to increment/decrement the quantity of products, the interactors with these responsibilities where maintained consistent following the objectives we defined.

The minimal surprise principle was used in conjunction with the consistency principle, with the objective of giving the users the ability to predict what other interactors will do, based in previous interactors information. An example of where this can be seen is in the cart functions where the user may predict what the other actions are based in one of them.

The third design principle we focused on was the diversity principle, one of the biggest focus on the design of this application was to make it so that it wouldn't overwhelm the user with difficulty in using the system, but we wanted to provide another way to find the products people want when they already know the name of the product or the country of origin, thus we made possible for the users in those groups to search for those products without having the necessity of going through the hierarchical steps of choosing the country, then one type of category and then the category, getting a list of all the products that fit the search.

Considering the UI design principles, we focused in 6, namely the Proximity Principle, the Alignment Principle, the Repetition Principle, the Contrast Principle, the Proportion Principle and the Ordering Principle.

Beginning with the Proximity Principle, this principle like most of the UI Design Principles were applied in all the app, but one obvious example where this principle is applied is in the Product List Page, where the upper half contains two groups, one with the search bar and two icons, one icon to access login/sig-nup/settings and another to access the cart, and a second group with the buttons to change the filters of the products to be shown as the countries, or the categories.

In the bottom half of the screen its where the products filtered appear in a grid with 2 products horizontally and a vertical slider. This principle, helps in segmenting the information shown in the screen in groups helping reducing different stimulus intersections.

Following the Proximity its the Alignment Principle, again this principle is used in all the app, but an example where it is flagrant is in the login and sig-nup popups more specifically near the text inputs for the users, as they are aligned its easier for the user to understand what is supposed to be written in each input.

Regarding the Repetition Principle, it can be found in three examples, the first is the countries selection and categories selection, where the widgets layout are the same, creating repetition and consistency between the layouts, the second one is in the popups, where most of them have the same design base, and the last example is the Products Page that are all defined in a consistent way.

The Contrast Principle was used mostly to differentiate active and inactive filter buttons in the Product Page, and to make the users focus in the important parts of the UI, as for example, when a popup appears on the screen, the background page is blurred and the colors of the popups contrast with the blurred background to help the user focus on the popup.

Moving on to the Proportion Principle, this principle was used mostly in the principal flow in the app giving more importance to the countries and categories selection buttons than the search, cart and login/sig-nup/settings buttons.

As for the last UI Design principle, the Ordering Principle, this was applied in the principal flow of the app, as its first applied the more general filter (countries) and goes to the more specific (category).

Regarding the color palette, we chose the palette based in red and some tones of red, considering that red is a warm color and can symbolize courage, desire and can stimulate our senses being able to increase appetite, possibly being able to persuade the users to buy something in the app if they feel hunger. It can too arouse desire in the users about certain products in the app, or arouse courage to try something new.

III. Results and Evaluation

Regarding the Evaluation of our application, the process we followed was: 17 participants ($n = 17$) were asked to accept a Consent Form to be eligible to participate in the study, and to be informed that the study is anonymous.

After this consent form, the participants were asked to answer some demographic questions, providing us with some previous information regarding their country of birth, their knowledge and practical skill on using technology, if they have an interest in other countries cultures and which ones, and if they would be inclined to experiment different food products from other cultures.

Following the demographic questions, the participants were asked to try the application, where they were given the following tasks:

- Go to the Brazil Products Page;
- Go to the Fresh Products Page;
- Change the Page to the Drinks Page;
- See the description of one product that you choose and add it to the Cart;
- Search for the Product "Açaí" and add it to the Cart;
- Increment the Quantity of a product in the Cart;
- Create a user account;
- Remove a product from the Cart;

At the end of the tasks the participants were asked to answer each item of the "Short User Experience Questionnaire", this Questionnaire has 8 items that evaluate several aspects of the application.

First, we will present the results of some of the demographic questions, Fig. 1 shows that all the participants have at least some basic knowledge and practical skills on using technology, this can create some bias in our results as some of the target group of our application may or may not have a solid knowledge and solid practical skills on using technology.

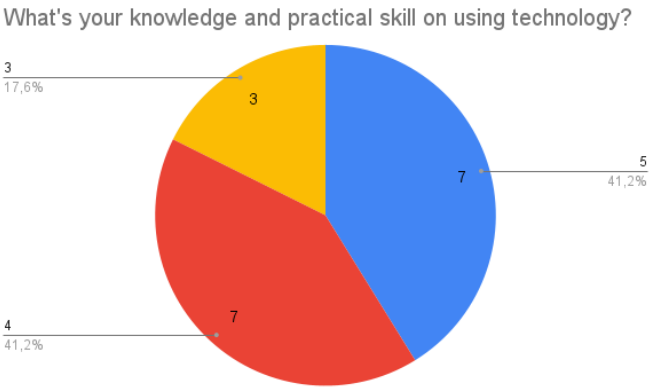

Fig. 1. Results for knowledge and practical skill on using technology (1 - Beginner, 5- Expert).

Fig. 2 presents the birth countries of the participants and Fig. 3 shows what countries where identified by the participants as they have interest in their cultures.

Regarding the question "Would you be inclined to taste new and different food products if given the opportunity?", the answers were on a 5-point scale, with 1 meaning "Not Interested" and 5 meaning "Very Interested", Fig. 4 shows the results obtained in this question, we can see that most of the participants were interested with only one participant not being interested in trying different food products.

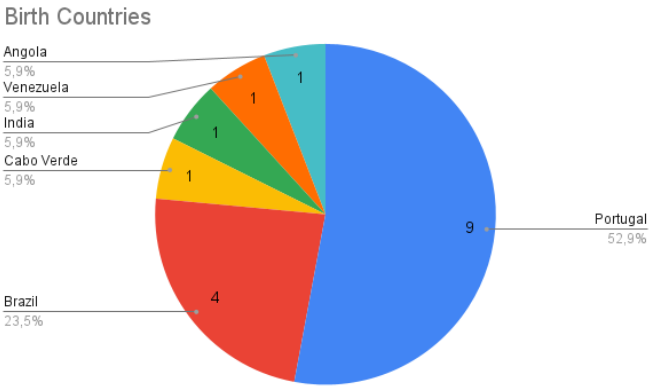

Fig. 2. Birth Countries of the participants.

With these questions we can observe that most of the participants in the study were interested in trying different products from other cultures and what countries cultures they were most interested in with Brazil, Japan and China having the higher values.

It also showed that almost 50% of the participants are not from Portugal, thus possibly meaning that as they are already in a country with a different culture than their origin country it may be easier for these participants to be open to try different things.

Moving on to the Short User Experience Questionnaire results, this questionnaire provides a data analysis tool, that

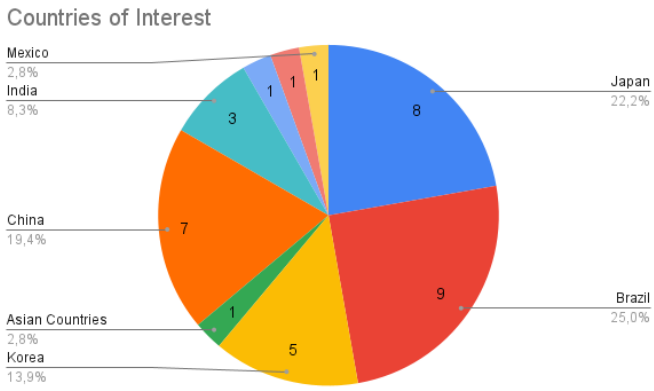

Fig. 3. Countries that the participants have an interest in their culture.

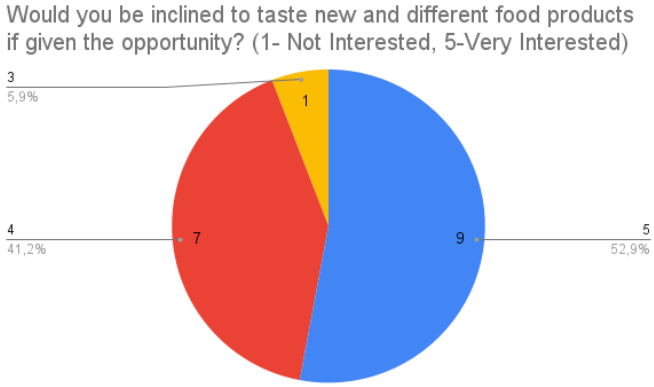

Fig. 4. Results for Interest in trying different food products.

provides the results of the test. Nonetheless, there are some results that this tool provides that should be analysed and considered before getting a final result, as the sample of participants is small ($n = 17$) there is an effect in some of the values that will be shown and thus they may not have the same importance as when the sample is of a higher dimension.

First we will present the results for each item of the questionnaire, Table I shows the mean values for each item in the questionnaire, presenting the scale quality and the possible positive and negative values for each item. It also shows the evaluation of the result considering the value of the mean for each item. The evaluation ofd the result is defined as:

- For mean values between -0.8 and 0.8, the evaluation is considered as Neutral for the corresponding scale;
- For mean values higher than 0.8, the evaluation is considered as Positive for the corresponding scale;
- For mean values lower than -0.8, the evaluation is considered as Negative for the corresponding scale;

We can observe that all the items have a neutral evaluation, meaning that in general the users don't find either strengths or weaknesses in the application.

Regarding each scale mean value and the overall mean value, Table II presents that just like with each item of the

TABLE I
MEAN VALUES FOR EACH ITEM IN THE QUESTIONNAIRE

Item	Negative	Positive	Mean	Evaluation	Scale
1	obstructive	supportive	0.1	Neutral	Pragmatic Quality
2	complicated	easy	0.5	Neutral	Pragmatic Quality
3	inefficient	efficient	0.3	Neutral	Pragmatic Quality
4	confusing	clear	-0.1	Neutral	Pragmatic Quality
5	boring	exciting	0.1	Neutral	Hedonic Quality
6	not interesting	interesting	0.4	Neutral	Hedonic Quality
7	conventional	inventive	-0.4	Neutral	Hedonic Quality
8	usual	leading edge	-0.4	Neutral	Hedonic Quality

scales, each scale, Pragmatic Quality and Hedonic Quality has a neutral evaluation, with an higher positive value for the Pragmatic one than for the Hedonic one. Overall the mean value is 0.051, meaning that overall the application has a neutral evaluation.

TABLE II
MEAN VALUES FOR EACH SCALE AND OVERALL IN THE QUESTIONNAIRE

Short UEQ Scales		
Scale	**Mean**	**Evaluation**
Pragmatic Quality	0.191	Neutral
Hedonic Quality	-0.088	Neutral
Overall	0.051	Neutral

Following the items and scales values we can verify that none of the items or the scales is irrelevant for the evaluation of the application.

However if we observe Fig. 5 we can see that for the blue bars, the Pragmatic Quality items, there is only one item with a negative mean (item 4 - Confusing-Clear), this may mean that this item is not directly applicable or that it isn't important in the application or that the users may have perceived it with a different meaning thus creating this difference with the other items of this scale.

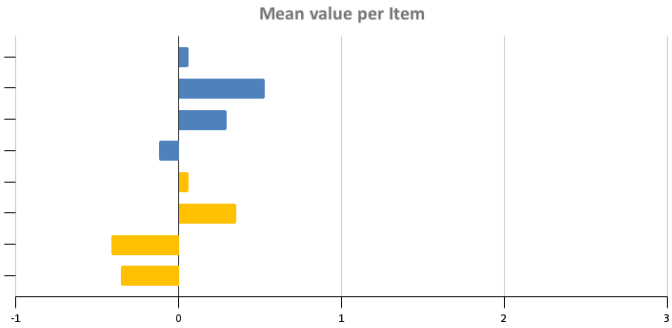

Fig. 5. Mean Values per Item.

It can be also seen that in the yellow bars, the Hedonic Quality items, there are two items highly negative (items 7 - Conventional-Inventive, and 8 - Usual-Leading Edge), and two items in the positive side, one highly positive (item 6 - Not Interesting-Interesting) and the other a lower positive mean (item 5 - Boring-Exciting), this may mean that the two positive items are not very important for the application or they were given different meanings by the participants.

Moving to the Scale Consistency results, as define in the questionnaire these results evaluate the consistency of a scale, i.e. they indicate that the items of the same scale evaluate similar things. For values of alpha higher than 0.6 or 0.7, we can consider the scales consistent, it is to say that all the items evaluated are concerned with the evaluation of similar things, however having values smaller than these two possibilities for the threshold will imply the necessity for a more careful interpretation of the scales, as the lower value of alpha can be derived of three different situations:

- Some items of that scale may have been misinterpreted by a high number of participants;
- The scale may not be relevant for the application, thus the items in the scale will be more difficult to evaluate by the participants.
- This situation may occur, when the sample is small, e.g. when the number of participants is lower than 40. This occurs because the alpha coefficients are sensitive to sampling effects.

Table III, shows the values for the correlation of the items of each scale, the average values and the alpha values.

TABLE III
SCALE CONSISTENCY

Pragmatic Quality		**Hedonic Quality**	
Items	Correlation	Items	Correlation
1.2	0.34	5.6	0.20
1.3	-0.09	5.7	0.23
1.4	0.40	5.8	0.32
2.3	-0.14	6.7	0.05
2.4	0.14	6.8	0.02
3.4	-0.07	7.8	0.18
Average	0.10	**Average**	0.17
Alpha	0.30	**Alpha**	0.44

We can see that the alpha values for both scales, the Pragmatic Quality and the Hedonic Quality Scales, are lower than the threshold, like was said before this can be a sign that the scales are not appropriate to be used to evaluate this application or the scales are not important, other option is that there is some item(s) that were given perceived as having a different meaning by the participants, or it can be because of

the sensitivity of the alpha values towards sampling effects, whose origin can be in the small number of participants.

Considering this and what was seen before in regards to the items results we are not able to confirm if the low alpha value is occurring because of a lack of consistency in the scales or because of the sampling effects, or if its a combination of both.

IV. Discussions and Recommendations

To broaden the reach of our app and cater to a wider user base, it is recommended to consider translating the content into other languages. By localising the app, we can attract users from different regions who may not be familiar with the English language. This can be achieved by hiring professional translators or utilising translation APIs to automate the process. Conducting market research to identify the most suitable languages, along with languages derived from the countries we sell the products from, is crucial in order to prioritise the target regions effectively.

Implementing a Frequently Asked Questions (FAQ) section in our app can significantly improve user experience by addressing common queries and providing relevant information. This section should cover topics such as app usage, payment methods, shipping options, and any other pertinent details. Regularly updating and expanding the FAQ section based on user feedback and support inquiries will ensure that users can find answers to their questions conveniently.

In order to enhance user engagement and promote the utilisation of ingredients available in our app, it is recommended to provide recipe recommendations and guidance on combining the ingredients effectively. This can be achieved through the following steps:

1) Ingredient Pairing Suggestions: Provide suggestions on ingredient combinations based on user preferences and cultural food practices. For example, recommend popular pairings in Brazilian, Indian, Chinese, Korean, and Japanese cuisines.
2) Recipe Collections: Curate collections of recipes using the ingredients available in our app, categorised by country and dietary preferences. Include step-by-step instructions, cooking tips, and nutritional information to facilitate the cooking process.
3) User-Submitted Recipes: Encourage users to share their own recipes utilising the ingredients from our app. Implement a user-generated content feature that allows users to upload and share their recipes with the community.

As our app gains popularity and the user base grows, it is essential to scale our database infrastructure accordingly. One of the first steps should be to plan improvements to ensure a robust and efficient database. Having said that, the following improvements should be considered:

1) Scalability: Implementing sharding, replication, or cloud-based database solutions can help handle increasing data volumes and user traffic.
2) Data Integrity and Validation: Regularly perform data integrity checks to identify and rectify any inconsistencies or errors in the database. Implement proper validation techniques during data entry to maintain the integrity and accuracy of the information stored.
3) Performance Optimisation: Continuously monitor the database performance and identify bottlenecks or slow queries. Utilise indexing, caching, and query optimisation techniques to improve the overall speed and responsiveness of the app.

Last but not least we should also consider (UI/UX) enhancements. Improving the UI/UX of our app can significantly enhance user satisfaction and engagement. In order to ensure intuitive and easy-to-understand menus and categories, conducting user testing, to gather feedback on the app's navigation, simplifying the app's navigation structure, and helping it iterate accordingly.

Visual appeal and aesthetics of the app by using appealing colour schemes, high-quality images, and intuitive iconography are a must to ensure a consistent design language across all screens to maintain a cohesive user experience.

Another implementation could be related to personalisation and customisation: Implement features that allow users to personalise their app experience, such as preferred language settings, dietary preferences, and bookmarking favourite recipes. Together with these suggestions there is also a need to do a seamless integration with social media by implementing sharing capabilities to allow users to share recipes, ingredients, and their culinary creations effortlessly. Enable easy integration with popular cooking and meal planning apps to enhance the overall user experience.

By considering these recommendations and addressing them in future updates of our app, we can ensure its continued growth, user satisfaction, and long-term success in the market.

Appendix

A. *Application Pages*

Fig. 6. Application Screen - Splash Screen.

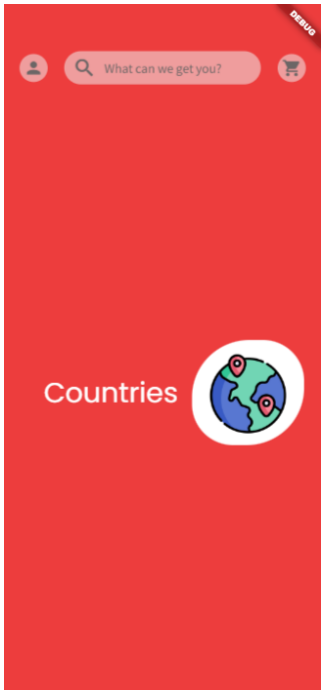

Fig. 7. Application Screen - Home Page.

Fig. 8. Application Screen - Countries Selection Page.

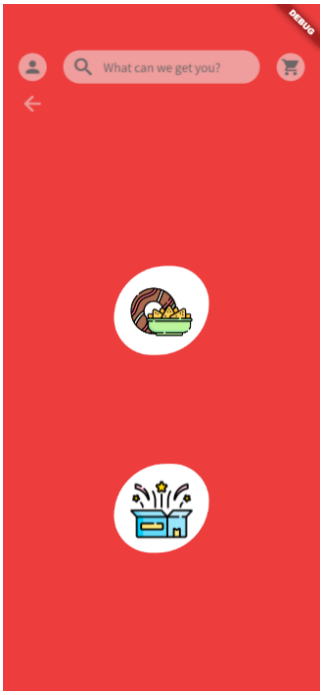

Fig. 9. Application Screen - Category Type Selection Page.

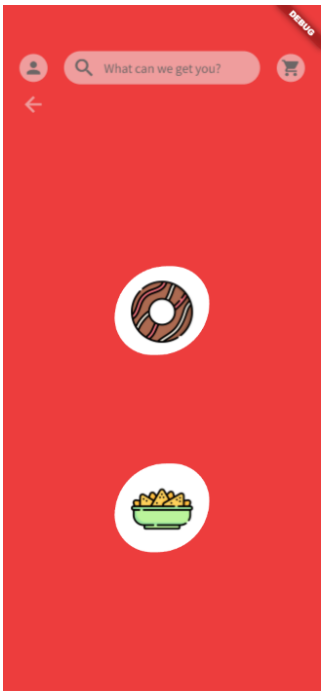

Fig. 10. Application Screen - Savory and Dessert Selection Page.

Fig. 12. Application Screen - Product List Page.

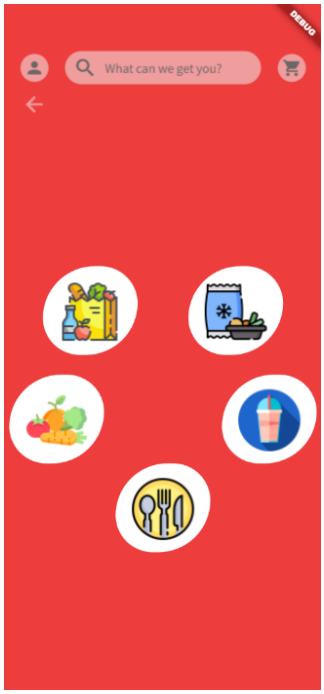

Fig. 11. Application Screen - Food Categories Selection Page.

Fig. 13. Application Screen - Product Page.

B. Application Popups

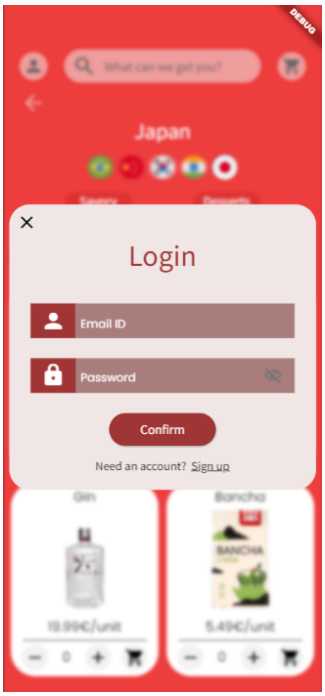

Fig. 14. Application - Login Popup.

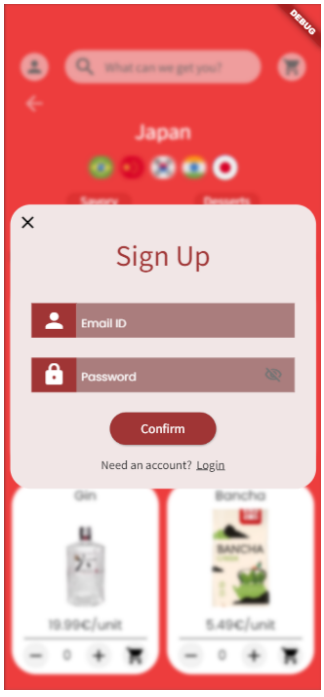

Fig. 15. Application - Sign Up Popup.

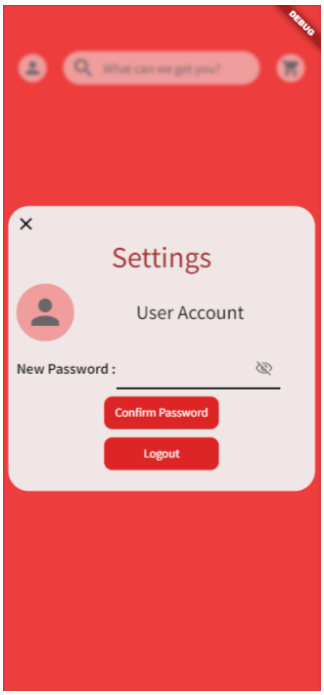

Fig. 16. Application - Account Settings Popup.

Fig. 17. Application - Search Popup.

Fig. 18. Application - Empty Cart Popup.

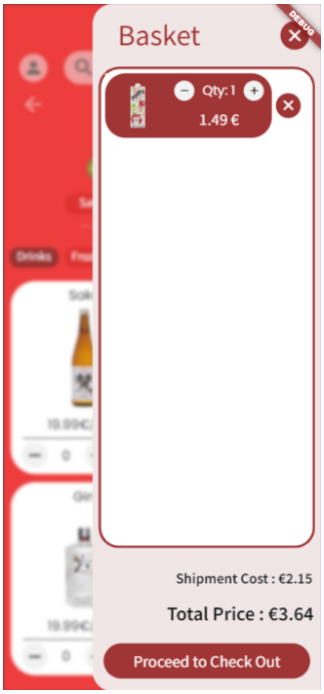

Fig. 19. Application - Cart Popup.