SAPIENZA
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Facoltà di Ingegneria Informatica
Master Degree in Engineering in Computer Science

Tesina For Human Computer Interaction Course

FitMe

Mobile Application for Calories Consumption and Personal Statistics

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Contents

Chapter 1

Introduction

1.1 The idea behind FitMe

FitME is a mobile application that was created with the aim of simplifying the control of one's diet and aims to educate on healthy and fair eating. We live in a world that runs fast, full of "I don't have time for", where our nutrition and consequently our body suffers. It is often difficult to keep track of what you eat, whether it is because it was a doctor who told us or because of our will, but it is important to always pay attention to calorie consumption.
At the moment, the fact of "gamification" is very popular, that is "making a game" activities that are not really a game. FitME also sets itself this goal, providing the users with an easy way to take into account their body and their goals, which, carefully and consistently, will surely be achieved. FitME focuses on the average calorie consumption of certain foods and, thanks to artificial intelligence algorithms and mass use, it will be able to be more and more precise and accurate in the future.
It's easy. It's fast. It's FitME.

Chapter 2

Requirements

This chapter presents analysis that we made when developing FitMe application

2.1 Competitor Analysis

The main competitors to our application are:

- **Foodvisor:** a mobile application focused on diet and health/weight goals with photo calorie counter
- **CalorieMama:** an instant food recognition mobile application whose goal is to retrieve to users a good food recognition and calories calculator

	FitME	Foodvisor	CalorieMama
Download	Free	Free version	Free version
Unlimited version free	✓	✗	✗
Account	✓	✓	✓
Dish Recognition	✓	✓	✓
Nutrition Information	✓	✓	✓
Statistics	✓	✓	✓
Pros	Easy to use, simple, few but good features, calorie goal	Stats, diet integration, barcodes, customized plan	Rapid Analysis, customized diets, detailed nutrion infos
Cons	Not too much nutrition infos	Trial version with few features, high premium plans costs	No calorie counter

Figure 2.1: Comptetitor Analysis table

2.2 Questionnaire Analysis

In this section there are the questionnaire results used to understand the target of potential users. These data were so important in order to validate our idea, improve and outline some profiles for personas and scenarios

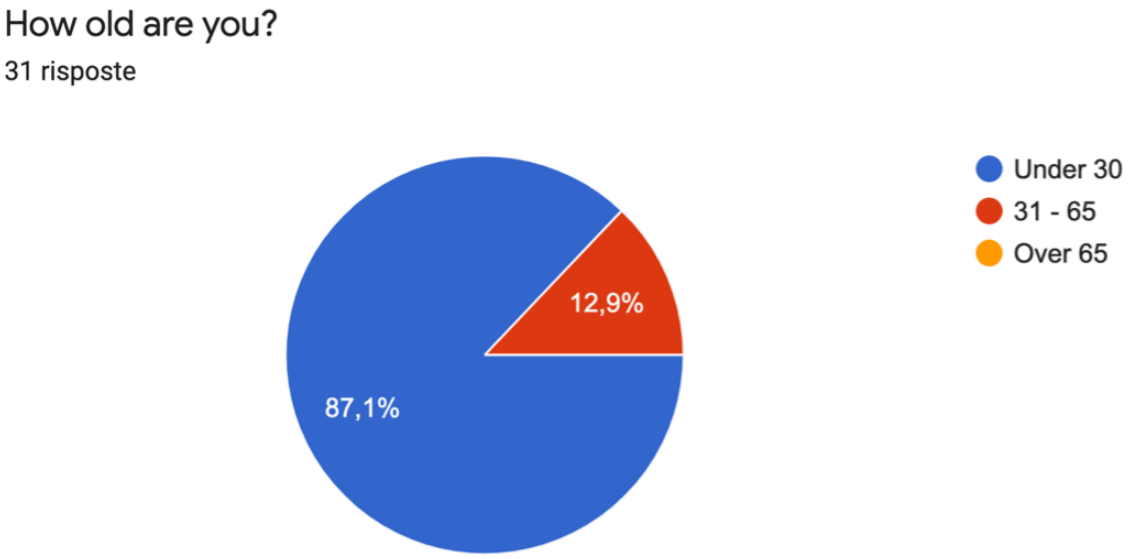

Figure 2.2: Age form responses

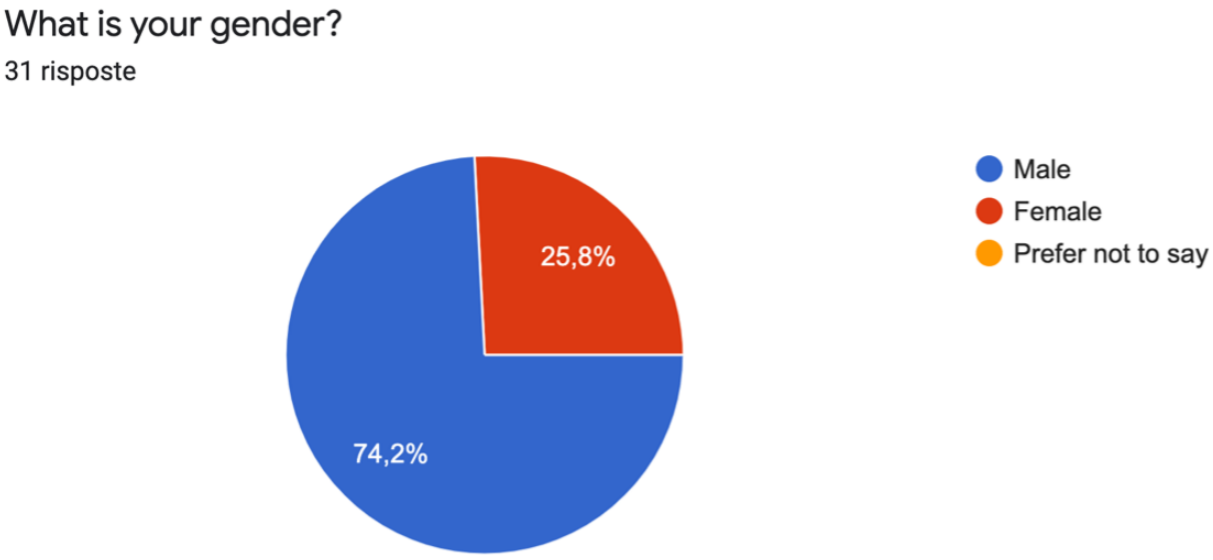

Figure 2.3: Gender form responses

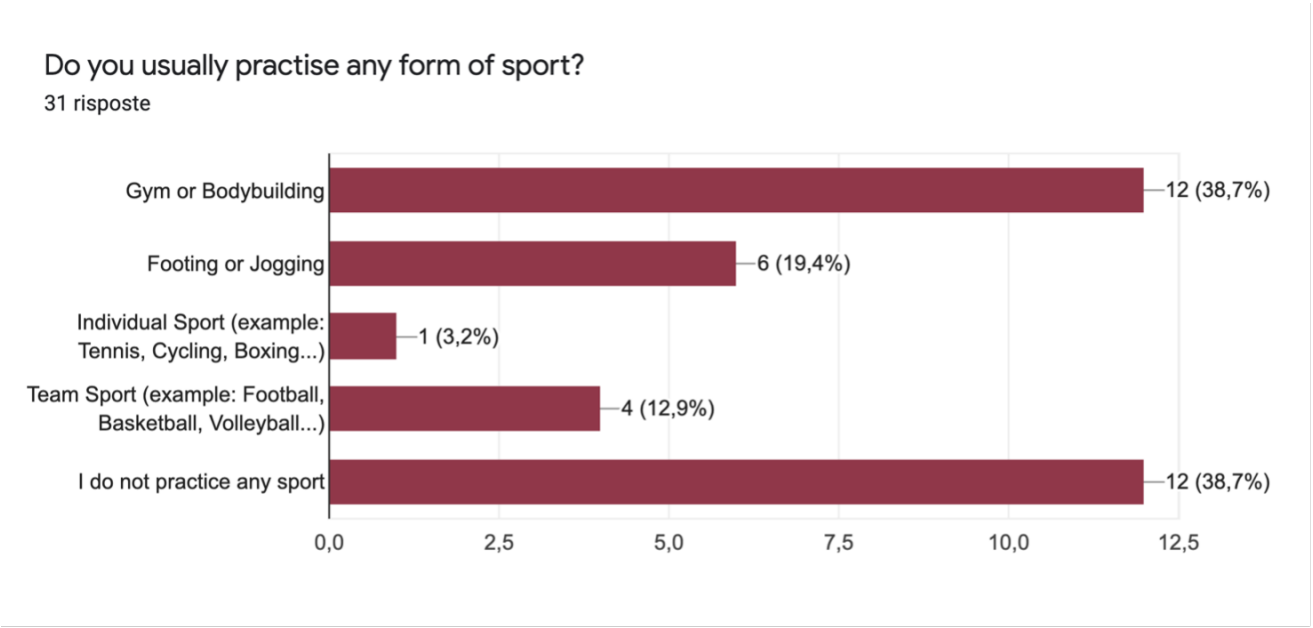

Figure 2.4: Sport form responses

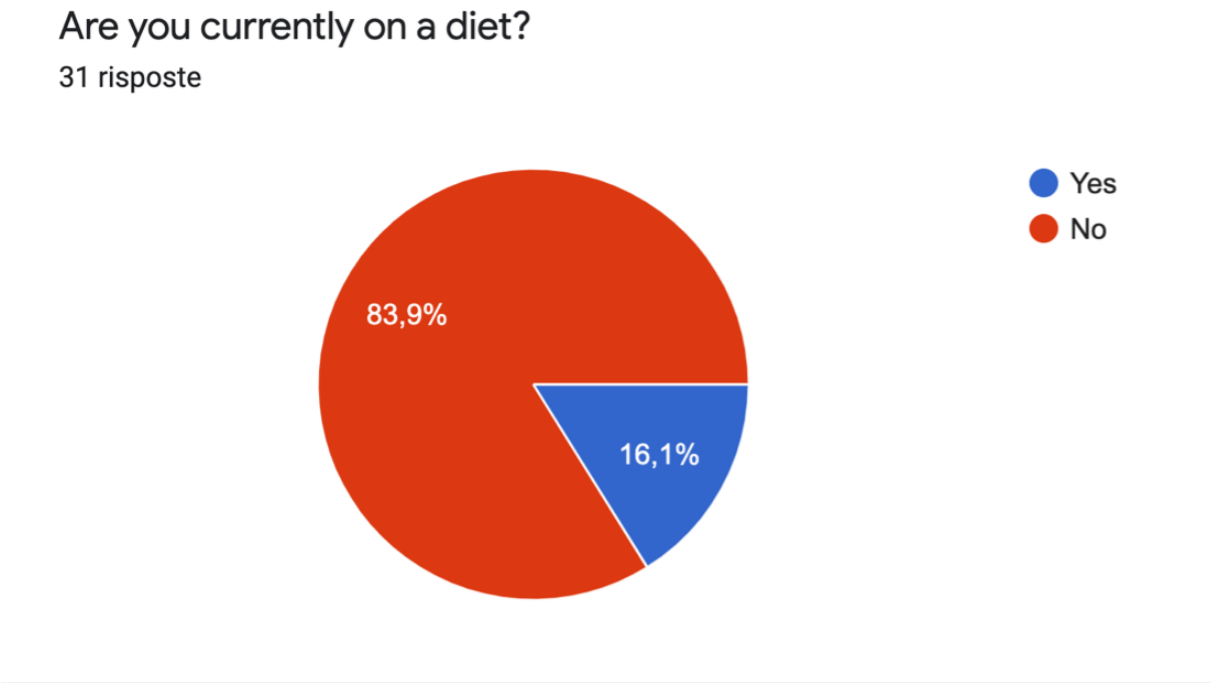

Figure 2.5: Diet form responses

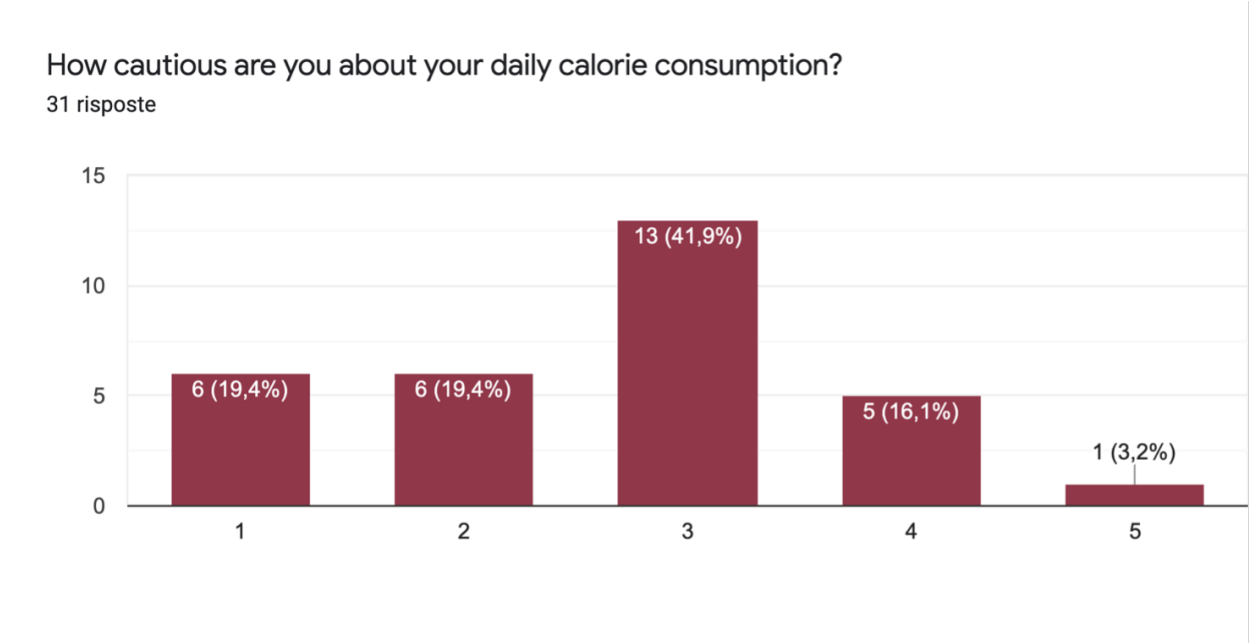

Figure 2.6: Calorie count form responses

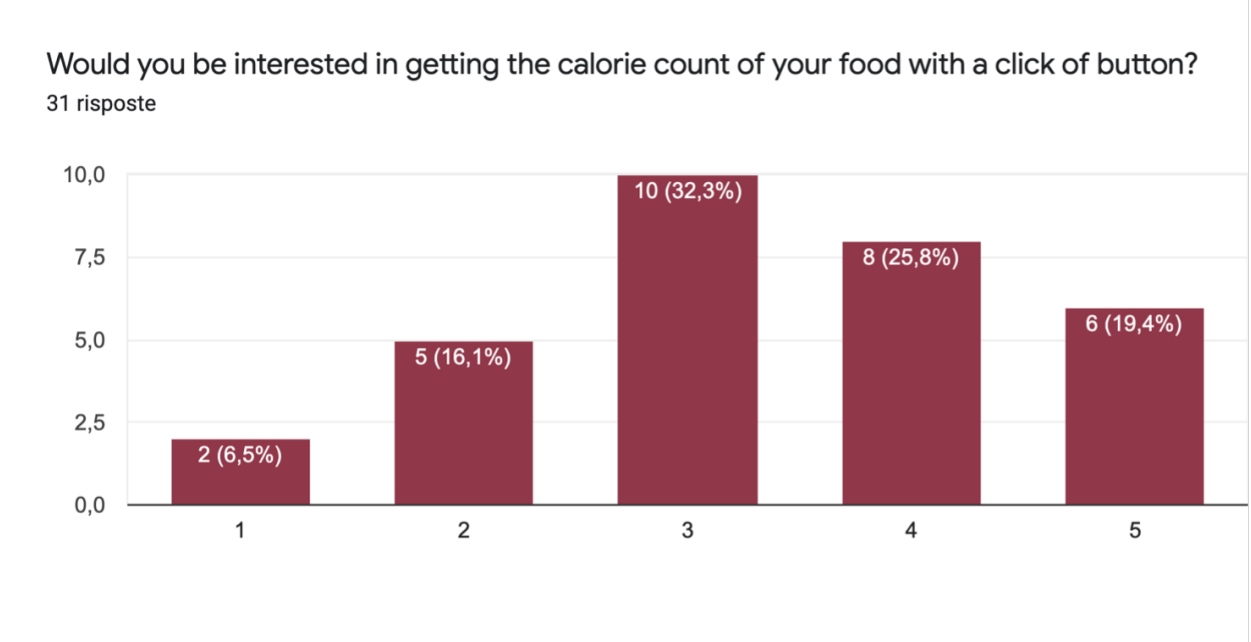

Figure 2.7: Calorie button form responses

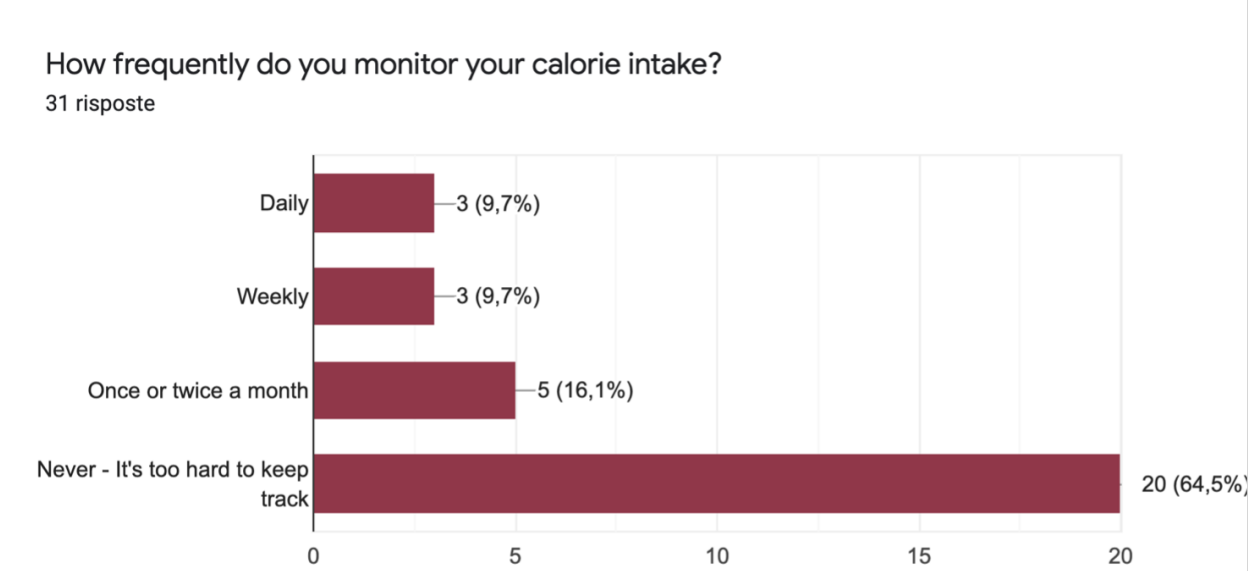

Figure 2.8: Calorie monitor form responses

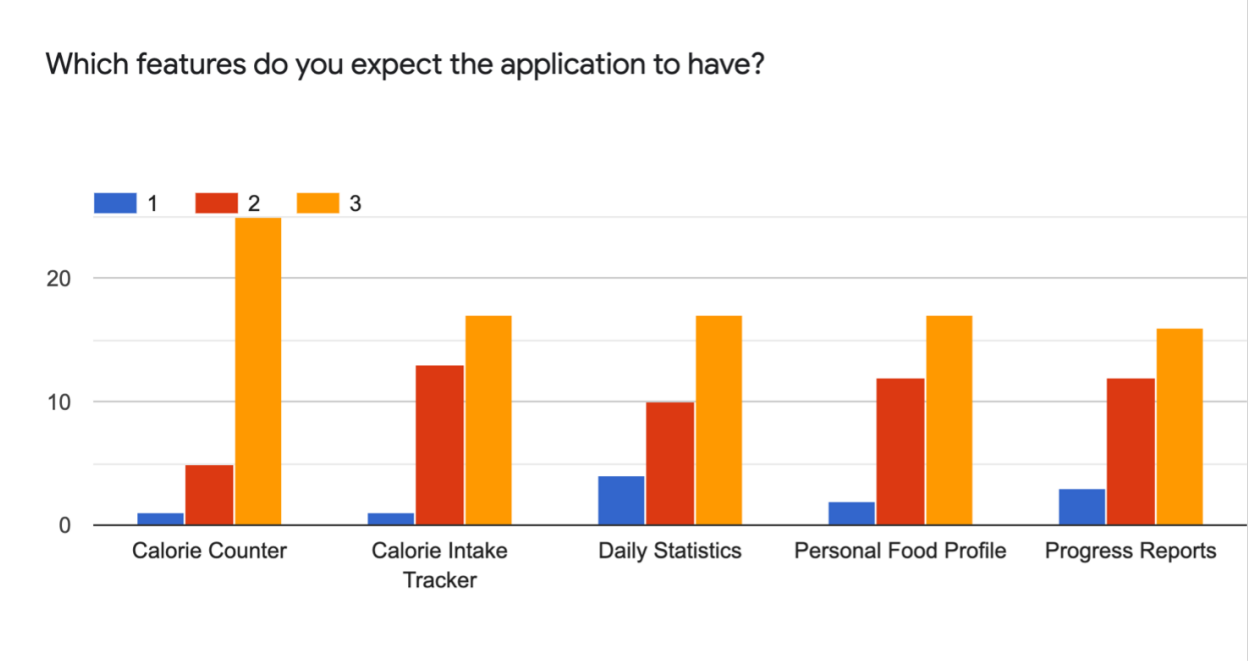

Figure 2.9: Features form responses

2.3 User Analysis

From the analysis of the data coming from the questionnaires, we have come to certain conclusions:

- People who are interested in the application are mostly under 30 years old, principally males
- The half part of the sample practices gym, bodybuilding or aerobic activities like footing or jogging and just over a third of the participants do not practice sports of any kind
- The majority of them are not currently on a diet and think that it's too hard to keep track of daily calories consumption
- Just under half of the analyzed sample is little or not interested in daily calorie consumption, while more than 75% would be interested, on average to strongly, in getting the food calorie count with a button click
- FitMe main features choosen are calorie counter, intake tracker and other sort of statistics like progress reports and daily statistics

Analyzing there results, it was possible to define a good user profile, from which we have extrapolated two "personas" and two "scenarios"

- Age: Under 30
- Gender: Principally Male
- Diet profile: Mainly not currently on a diet
- Calories consumption interest: 40% not interested, 60% interested
- Sport: Sport - No Sport, equally distributed

2.3.1 First Persona and Scenario

User Profile

Name: Leonardo

Age: Under 30

Gender: Male

Diet profile: Not currently on a diet

Calories consumption interest: Interested

Sport: Gym

Persona

Leonardo is 24 years old guy who usually practice gym. At the moment he is not on a diet but is interested in daily calorie consumption. He is fascinated by the idea of being able to have, with a few clicks, an idea of his calorie intake.

Scenario

Leonardo trains a lot during the week, but he realized that a balanced diet is essential for having a sculptural physique. He wants to keep more track of calorie consumption in order to improve and balance his metabolism

2.3.2 Second Persona and Scenario

User Profile

Name: Chiara

Age: Under 30

Gender: Female

Diet profile: Not currently on a diet

Calories consumption interest: Low Interest

Sport: No sport

Persona

Chiara is a 24 years old girl who does not usually play sports. At the moment she is not on a diet and she has a low interest in daily calories consumption, but she wants to be more observant to her diet.

Scenario

Chiara wants to get back in shape for the summer, because she think that continuing to eat so much and not doing sports, her sedentary life will lead her to gain weight.

Chapter 3

Task

This chapter presents the HTA and STN diagrams made for task analysis. These ones we are going to present in this section are related to the main tasks of our application:

- Register/Login: Fill the form and access to the platform
- Take a Photo: Take a photo of what you're eating
- See and modify user Profile: Updated profile informations
- See stats: Progress tracking

HTA Definition
A hierarchical task analysis (HTA) describes an activity in terms of its specific goals, subgoals, operations, and plans. Once the analysis is complete, the task activity is described in detail.

STN Definition
A state transition network is a diagram that is developed from a set of data and charts the flow of data from particular data points (called states or nodes) to the next in a probabilistic manner

3.1 Sign Up - Sign In

In order to obtain access to the application, the user must register first. After this operation, he can login to and use FitMe

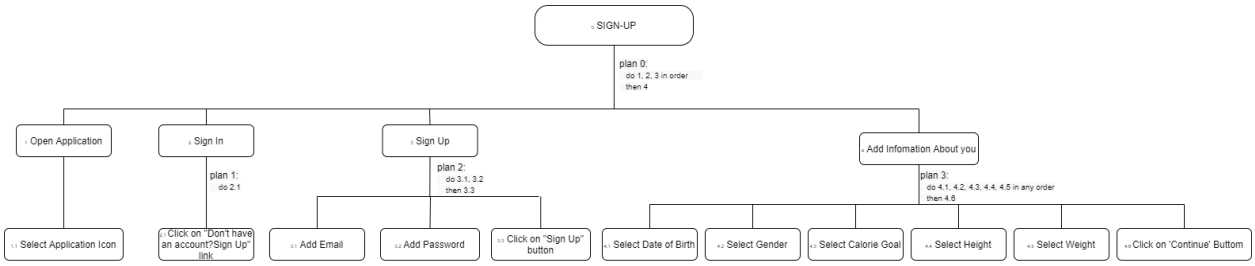

Figure 3.1: HTA - "Sign up" task

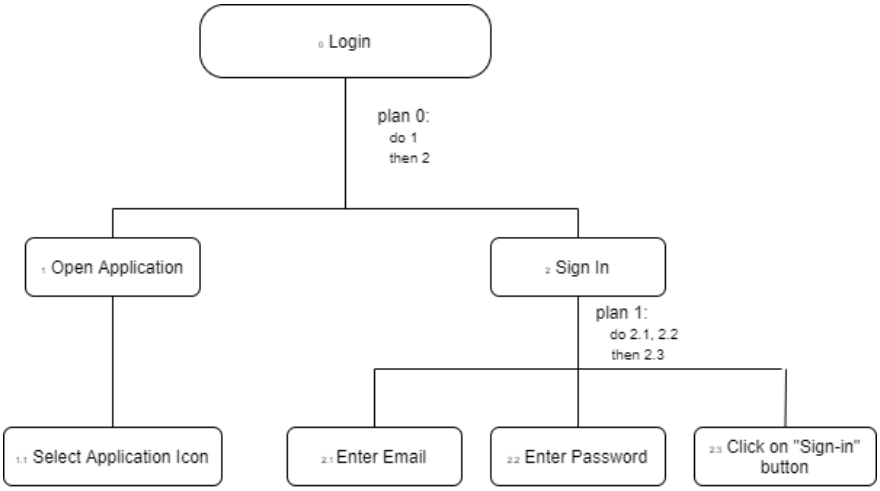

Figure 3.2: HTA - "Sign in" task

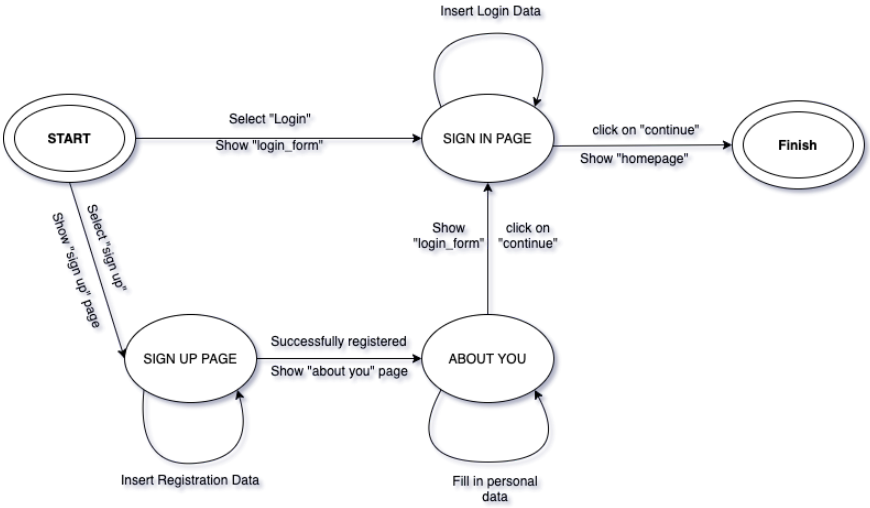

Figure 3.3: STN - "Sign up - Sign in" task

3.2 Take a Photo

To perform this task, the user must be logged in. From the homepage, he only has to click on the central button, take a photo and select the food from the list menu.

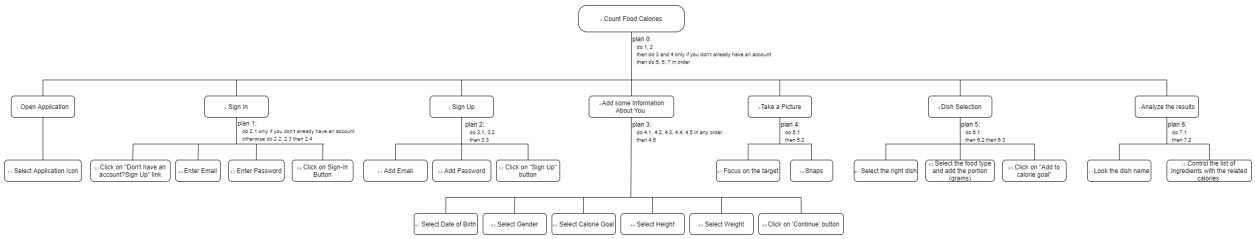

Figure 3.4: HTA - "Take a Photo" task

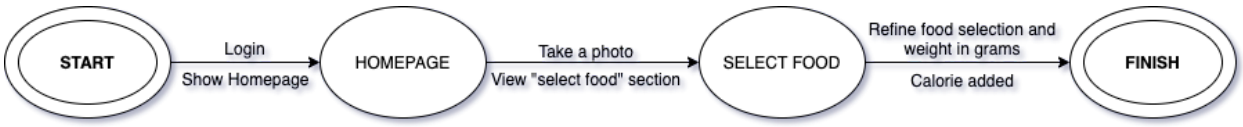

Figure 3.5: STN - "Take a Photo" task

3.3 View - Profile

After logging in and accessing the homepage of FitMe, the user, clicking on the “profile page icon”, is redirected to the corresponding page. After this, he can choose to see profile informations

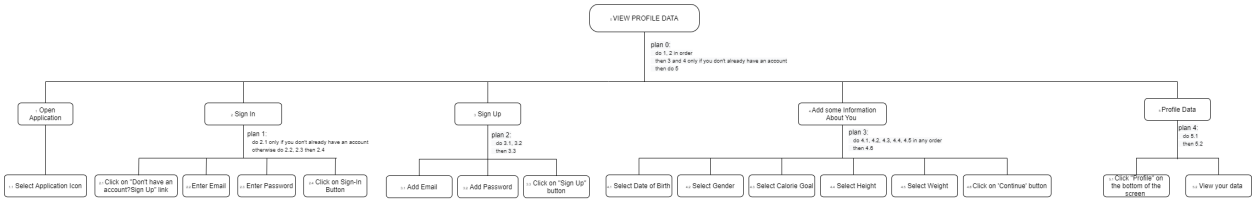

Figure 3.6: HTA - "View Profile" task

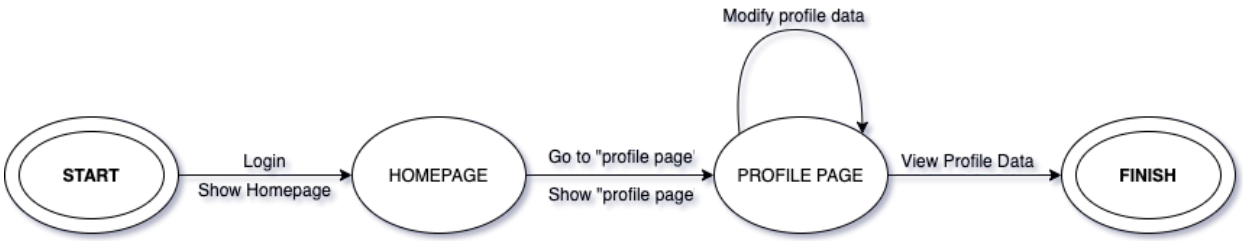

Figure 3.7: STN - "View Profile" task

3.4 View Stats

To perform this stats, after logging in and take a photo, the user, clicking on “stats icon”, is redirected to corresponding page. In this section of the application, he can view all the stats referring to his account

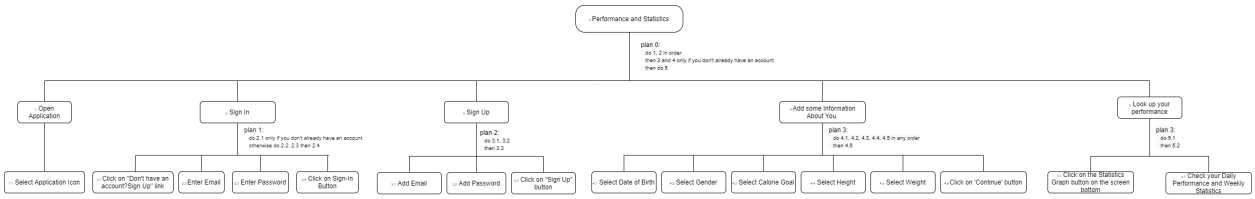

Figure 3.8: HTA - "View Stats" task

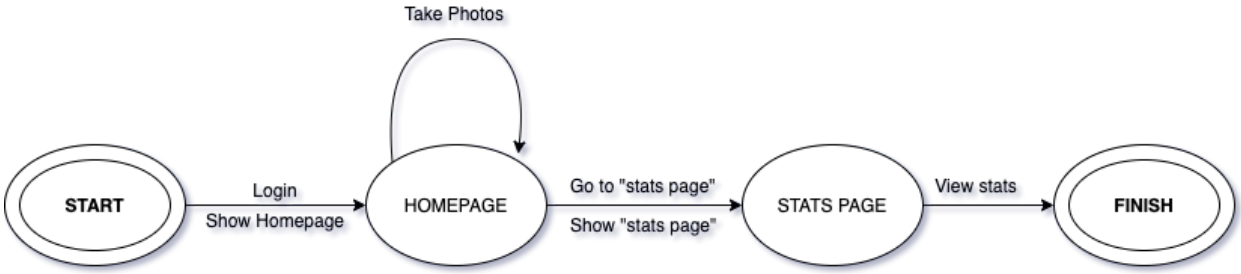

Figure 3.9: STN - "View Stats" task

Chapter 4

Prototyping

In this chapter we are going to present the mockups and prototypes. Analyzing the questionnaire's results, we decided which functions and features to put in the application, also according to the relative section in the google form. Starting from the HTA and STN diagrams in the previous section, we develop the application by this way and the main features exposed are the same of the diagrams:

- Register/Login: Fill the form and access to the platform
- Take a Photo: Take a photo of what you're eating
- See and modify user Profile: Updated profile informations
- See stats: Progress tracking

4.1 Prototype

The prototype we develop is based on the HTA and STN diagrams

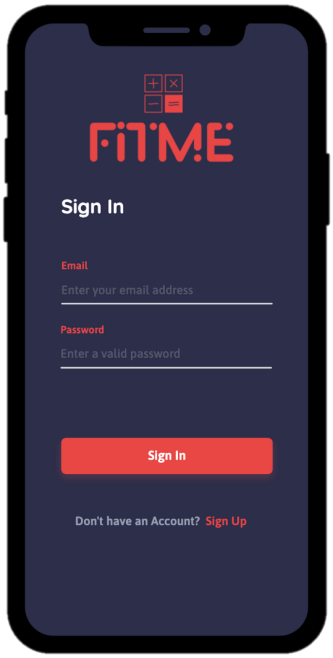

Figure 4.1: Prototype - "Sign In"

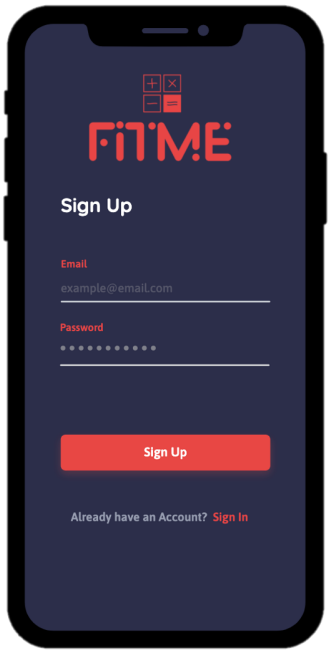

Figure 4.2: Prototype - "Sign Up"

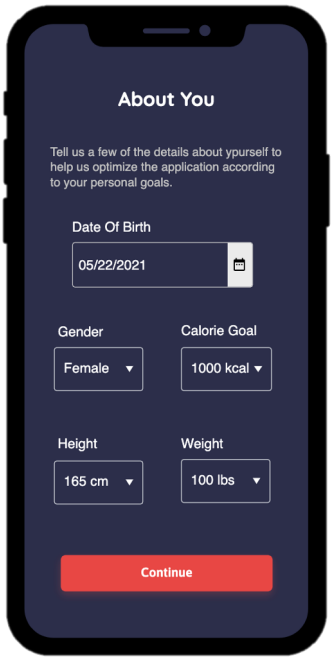

Figure 4.3: Prototype - "About You"

Figure 4.4: Prototype - "Home"

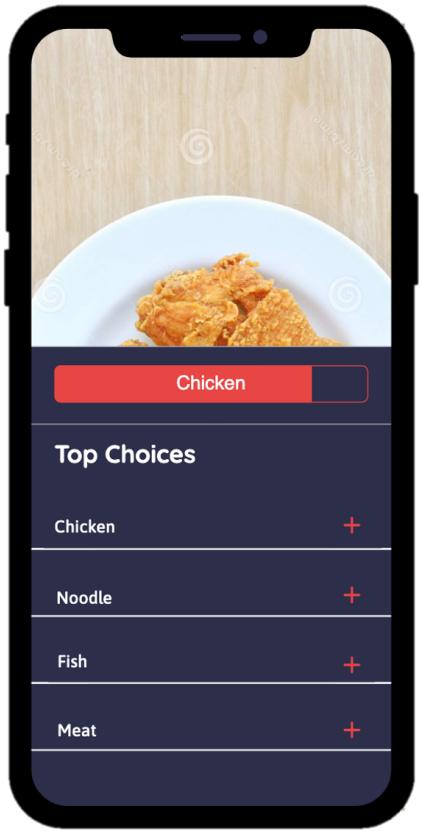

Figure 4.5: Prototype - "Select Food"

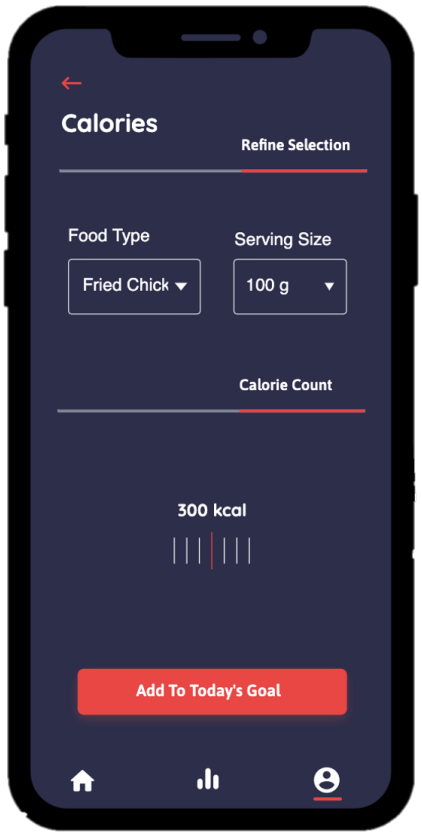

Figure 4.6: Prototype - "Select Calorie"

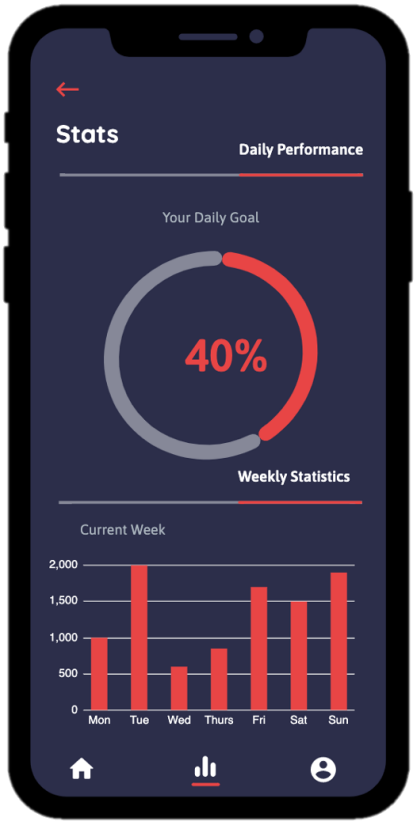

Figure 4.7: Prototype - "Stats"

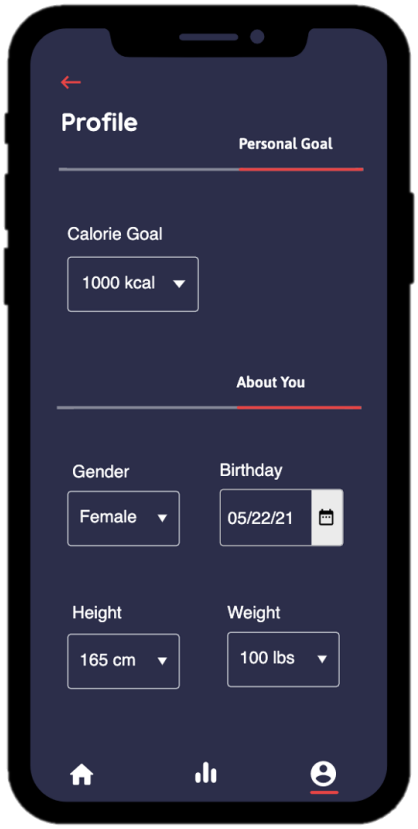

Figure 4.8: Prototype - "Profile"

Chapter 5

Evaluations

In this chapter we look at several evaluations performed to analyze and test the usability, design, and functionality of our application. The evaluations are divided into two sections: Expert and User based. We look at each of them separately followed by the methodology, report and analysis of the evaluation approaches.

5.1 Expert based Evaluation

In this section we explore the evaluation methodology relying on expert feedback to evalute the usability of our application. Expert based evaluation relies on a subject-expert who inspects the usability and design of a system under consideration, which is an application in our case. The evaluation is performed to inspect if the paradigm relating the learning cycle of users to using a system over reading a verbose manual holds true. To analyze our application under this paradigm, an expert performed cognitive walkthrough of certain tasks pertaining to our application. We discuss the walkthrough and the report in detail of the expert.

5.1.1 Heuristic Evaluation

Heuristic evaluation is an expert evaluation methodology that critiques a system using a set of relatively simple and general heuristics. Nielsen's 10 heuristics are used to perform the analysis, and those are listed below.

1. Visibility of system status.
2. Match between the system and the real world.
3. User control and freedom.
4. Consistency and standards.
5. Error prevention.
6. Recognition rather than recall.
7. Flexibility and efficiency of use.
8. Aesthetic and minimalist design.
9. Help users recognize, diagnose and recover from errors.
10. Help and documentation.

The analysis is performed frame (screen) wise and for each of the violation, a description and severity is listed. The severity scale ranges from 0 to 5, where 0 = *I don't agree that this is a usability problem at all*, 1 = *Cosmetic problem only*, 2 = *Minor usability problem*, 3 = *Major usability problem* and 4 = *Usability catastrophe*. Our professor Ing. Valeria Mirabella performed the heuristic evaluation and the report is given in the Table 5.1.

Frame	Heuristic Violated	Severity	Comment
Sign In	Users recognize, diagnose, and recover from errors	3	Include a Forget Password? link
Profile	Match between the system and the real world	2	The most common label for the date of birth is “date of birth”. “Birthday” is usually the anniversary of the birth of a person.
Profile	Consistency and Standards	3	You use “Date of birth” in About You section and “Birthday” in Profile section for the same data.

Table 5.1: The report of heuristic evaluation done by the expert.

There were 3 issues raised in the heuristic evaluation. Two of them were of severity 3 which indicates that they were major usability problem and one was of severity 2 which was a minor usability problem.

5.1.2 Cognitive Walkthrough

In a cognitive walkthrough, a task analysis is performed first which specifies the steps or actions that should be taken by a user to accomplish a certain task and the system response to these actions. An expert then walks through the steps and answers a set of questions at each action/step. These responses are collected and used to prepare a report of potential issues. For each task, walkthrough considers the following questions.

1. What impact will interaction have on user?
2. What cognitive processes are required?
3. What learning problems may occur?

The analysis portion of the walkthrough focuses on goals and knowledge and tries to answer if the design leads the user to generate correct goals? To conduct a cognitive walkthrough there are certain things that are required. Since it is performed on a prototype or a specification of a system, a prototype is required. A description of task and a complete list of actions needed to perform that task are required as well. For each action in the list, an expert answers the following questions.

1. Is the effect of the action the same as the user’s goal at that point?
2. Will users see that action is available?
3. Once users have found the correct action, will they know it is the one they need?

We prepared a evaluation form for the assessment. We divided the evaluation form into 8 sections depending on the different tasks that are to be performed as a part of operating the application. The 8 different tasks, based on screens of the application, were as follows: *Sign Up*, *About*, *Sign In*, *Camera Activity*, *Food Select*, *Refine Selection*, *Statistics*, *Profile*.

Actions

Each of the 8 tasks had several actions associated with them. We list each of the actions against the tasks.

Sign Up

1. Enter your email and password.
2. Press the Sign Up button.
3. Already registered user? - Sign in.

About

1. Select date of birth.
2. Select your gender.
3. Choose your daily calorie goal.
4. Select your height.
5. Select your weight.
6. Press the continue button.

Sign In

1. Enter your email and password.
2. Press the sign in button.
3. Not registered user? - Sign up.

Camera Activity

1. Click a picture.
2. Click a stats icon.
3. Click a profile icon.

Food Select

1. Display food prediction card.
2. Show score progress bar.
3. Show top result on progress bar.
4. Display top five predictions.
5. Select the correct prediction.

Refine Selection

1. Refine your food category.
2. Select serving size.
3. Display the calorie count.
4. Add calorie count to daily goal.

Statistics

1. Click on stats icon.
2. Display daily calorie goal progress.
3. Display weekly progress graph.

Profile

1. Click on profile icon.
2. Display user information.

5.1.3 Expert Report

This evaluation was done by our professor Ing. Valeria Mirabella. The evaluation form was submitted and she performed the assessment on 07/08/2021 and reported *yes* to each of the actions against each task. The detailed Google form and the evaluation results can be found here.

5.2 User based Evaluation

The other aspect of evaluation is user based assessments. The user based evaluation is divided into three types of assessments and we conducted all three of them to test our application.

5.2.1 Think Aloud

The first type of user based evaluation is called the Think Aloud where a user is observed while he performs the task. The user is also asked to described simultaneously what he is doing and why and also what he thinks is happening. This is the simplest method since it allows an insight regarding the functioning of the system and requires almost no extra input and expertise. We performed a think aloud assessment and the analysis of that is given in the Figure 5.1. We incorporated these changes in our application.

#	RELATED INCIDENT	INCIDENT PRIORITY	DESCRIPTION OF INCIDENT	HOW THE INCIDENT WAS FOUND	GOOD OR BAD	POTENTIAL SOLUTION TO THE INCIDENT, IF BAD
1	none	1	User had problems navigating using the side slideopen dashboard. "the dashboard is such a nuisance, it's hard to navigate when you have to open it every time you need to switch to another screen.	User entered the home screen, after logging in and wanted to took a picture of the food. Once the picture was taken, he wanted to switch to statistics to see his progress but for every switch he needed to open the dashboard all over again. He got frustrated on it.	Bad	Change the dashboard view to a bottom navigation bar to enhance system usability.

Figure 5.1: The analysis of performing the Think Aloud assessment.

5.2.2 Controlled Experiments

Another type of user based evaluation is controlled experiments which involves statistical analysis to test a hypothesis formulated by the evaluator. Initially, an evaluator chooses a hypothesis to test and some attributes of the user behavior are measured. Furthermore, a number of experimental conditions are considered differing only in the values of certain controlled variables. Any changes in the behavioural measures are attributed to the different conditions. Most importantly, in a controlled experiment, subjects, variables, and hypotheses should be selected very carefully. Ideally, the subjects (users) should be real humans who would perform the task, however computer based simulations can also be used. The sample size should be large enough to be representative and a minimum of 10 subjects should be present. In our controlled experiment, we test two hypotheses and each of the experiment is described below in detail.

Test # 01: Users will interact better and more easily with a bottom navigation bar

The first test aims to check if users can better interact with the applicaiton with a bottom navigation bar or if a side navigation is a better option. Our first hypothesis is that *users will interact better and more easily with a bottom navigation bar*. The null-hypothesis in this case is that there is no difference between interaction with the application regardless of the navigation bar option. The experimental method is within-subject whereby each user performs under each different condition). To reduce the learning effect we addressed order (half the subjects A–B and half B–A). We then specify the dependent variable which is the navigation bar style: Bottom Nav Bar and Side Nav Options Dashboard. The independent variables are time spent to select and manoeuvre between different application views using either of the navigation options and also the number of errors that occur while using either of the two options.

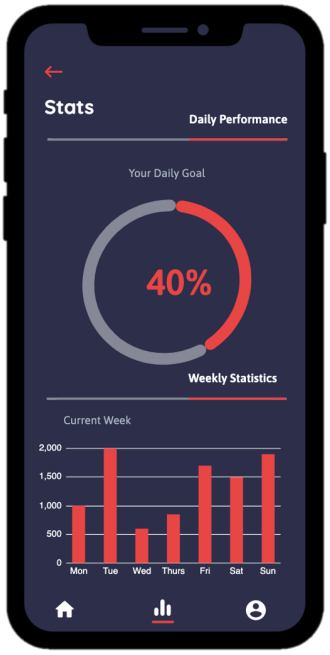

Figure 5.2: Stats View with Bottom Navigation Bar

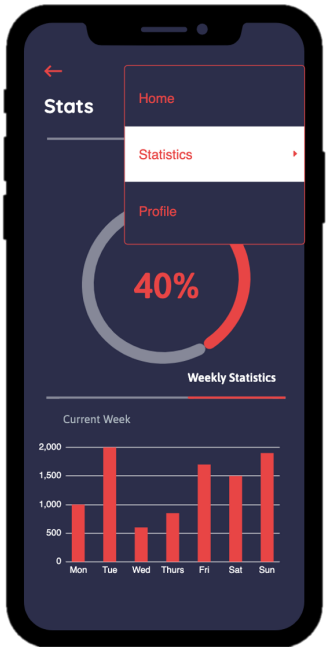

Figure 5.3: Stats View with Side Nav Options Dashboard

For each of the independent variables, we perform the controlled experiment and run analysis of variance (ANOVA). ANOVA provides a statistical test of whether or not the means of several groups are equal. Table 5.2 indicates the time spent to selecting and manoevuring between different application views. Table 5.3 indicates the number of errors occurred when selecting or manoevuring between different application views using both the navigation options.

Bottom Nav	Side Nav
14	42
19	34
20	41
18	26
22	38
29	40
10	30
25	40
53	29
18	37
20	25
15	28

Table 5.2: Table for time spent to select & navigate between different application views.

Bottom Nav	Side Nav
0	3
0	1
1	0
0	2
0	1
0	2
1	0
0	1
1	3
0	2
0	0
0	1

Table 5.3: Table for error occurred in selecting between different application views using both navigation options.

The results of running ANOVA on both the obtained experiment outcomes are given in Figure 5.4 and in Figure 5.5. As we can see that $F > F_{\text{crit}}$ i.e. $11.2 > 4.3$ so our hypothesis that users will interact better and more easily with a bottom navigation bar is true. Similarly, for the second case (errors ocurred) we can see that $F > F_{\text{crit}}$ i.e. $10.38 > 4.3$ so our hypothesis that users will interact better and more easily with a bottom navigation bar is true.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Interface style with bottom nav	12	263	21.9166667	120.44697
Interface style without bottom nav	12	410	34.1666667	39.2424242

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	900.375	1	900.375	11.2765786	0.00284164	4.3009495
Within Groups	1756.583333	22	79.844697			
Total	2656.958333	23				

Figure 5.4: The results of running ANOVA on evaluating the time spent between selecting different views using different navigation views.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Interface style with bottom nav	12	3	0.25	0.20454545
Interface style without bottom nav	12	16	1.33333333	1.15151515

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	7.041666667	1	7.04166667	10.3854749	0.00391719	4.3009495
Within Groups	14.91666667	22	0.6780303			
Total	21.95833333	23				

Figure 5.5: The results of running ANOVA on error occurred in selecting between different application views using both navigation options.

Test # 02: Users will interact better with values having units (kcal, grams etc)

In the second test, we check if users will be able to swiftly fill-up the dropdown menus if the units associated with the values in those dropdowns were also presented to the user. Our second hypothesis is that users will interact better with values having units (kcal, grams etc). The null hypothesis in this case would be that there is no difference between the user interaction regardless of the units present in the dropdown menu. For this test, we chose within-subject experiment method i.e. each user performs under each different condition). To reduce the learning effect we addressed order (half the subjects A–B and half B–A). The dependent variables are styles of values in dropdown menus i.e. values with and without units. The independent variables are same as the previous test i.e. the time spent in filling up the information from the dropdown menus containing values with and without units and also the errors generated in each case. The two different views are given in Figure 5.6 and in Figure 5.7.

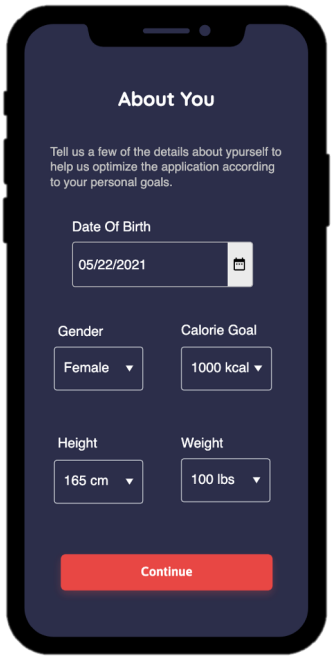

Figure 5.6: About view with units in dropdown menus.

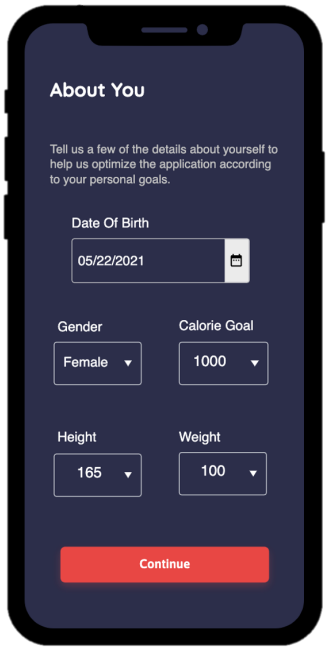

Figure 5.7: About view without units in dropdown menus.

Table 5.4 and Table 5.5 indicate the outcome of the experiments. We then run analysis of variance on the outcomes and the results of are given in Figure 5.8 and Figure 5.9. As we can see that $F > F_{\text{crit}}$ i.e. $7.26.2 > 4.41$ so our hypothesis that users will interact better with values having units (kcal, grams etc) is true. Similarly, for the second case (errors ocurred) we can see that $F > F_{\text{crit}}$ i.e. $6.51 > 4.41$ so our hypothesis is true.

With Units	Without Units
51	123
30	55
48	42
54	36
32	74
22	55
65	92
24	82
49	53
16	47

Table 5.4: Table for the time spent in filling up the information from the dropdown menus containing values with and without units.

With Units	Without Units
0	4
0	2
0	3
2	1
1	2
1	1
2	1
0	2
0	2
1	0

Table 5.5: Table for error occurred in filling up the information from the dropdown menus containing values with and without units.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Interface with units	10	391	39.1	266.544444
Interface without units	10	659	65.9	721.433333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3591.2	1	3591.2	7.26979914	0.01476859	4.41387342
Within Groups	8891.8	18	493.988889			
Total	12483	19				

Figure 5.8: The results of running ANOVA on evaluating the time spent between selecting from dropdown menu with units and without units.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Interface with units	10	7	0.7	0.67777778
Interface without units	10	18	1.8	1.28888889

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	6.05	1	6.05	6.15254237	0.02323299	4.41387342
Within Groups	17.7	18	0.98333333			
Total	23.75	19				

Figure 5.9: The results of running ANOVA on error occurred in selecting from dropdown menu with units and without units.

Chapter 6

Conclusions

We developed an android application, FitMe, which aims to simplify diet and calorie intake of users and allows fine-grained control. FitME also sets itself this goal, providing the users with an easyway to take into account their body and their goals, which, carefully and consistently, will surely be achieved. Our application focuses on the average calorie consumption of certain foods and harnesses the power of AI to help users take decisions necessary to help them shape their body and change their lifestyle. We hope that the application will provide an alternative to many calorie monitoring applications by providing a hollistic view and consistent control of what we eat everyday.

6.1 Future Work

One of the major directions that we hope to work on in the future is working to add more recipes and calories in our database to learn a better AI backend which would help provide more accuracte predictions. We also hope to add daily personal targets where users can compete with their friends and race to achieve their goals since this would provide a motivation to the users to focus on their dietary intake.