# DIPLOMA PROJECT

**iOS Application for Nutrition and Activity Monitoring with Wearable Integration**

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**DIPLOMA PROJECT THEME FOR:**

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**Theme title:**

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iOS Application for Nutrition and Activity Monitoring with Wearable Integration

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# Academic Honesty Statement

I, Tea-Eliza TATOIU, hereby declare that the work with the title "iOS Application for Nutrition and Activity Monitoring with Wearable Integration", to be openly defended in front of the diploma theses examination commission at the Faculty of Engineering in Foreign Languages, National University of Science and Technology "Politehnica" of Bucharest, as partial requirement for obtaining the title of Engineer is the result of my own work, based on my work.

The thesis, simulations, experiments and measurements that are presented are made entirely by me under the guidance of the scientific adviser, without the implication of persons that are not cited by name and contribution in the Acknowledgements part.

The thesis has never been presented to a higher education institution or research board in the country or abroad.

All the information used, including the Internet, is obtained from sources that were cited and indicated in the notes and in the bibliography, according to ethical standards. I understand that plagiarism is an offense and is punishable under law.

The results from the simulations, experiments and measurements are genuine.  
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Tea-Eliza TATOIU

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List of Abbreviations

|  |  |
| --- | --- |
| Abbreviation | Definition |
| HDD | Hard Disk |
| RAM | Random Access Memory |

1. Introduction
   1. Context

T

HE use of mobile applications for monitoring health and lifestyle information has been increasing with each year. These applications can act as a significant support in maintaining an individual’s healthy habits and raise awareness of their behavioral patterns and lifestyle choices. Mobile applications are being used for monitoring a growing number of lifestyle aspects, such as grocery shopping, eating habits, physical activity, mental health, and sleep management. This increasing interest in lifestyle applications is due to a global awareness of health and wellness, as more and more data and statistics reveal high obesity rates, sedentary lifestyles, and how these issues can be prevented.

A graph of a market size

Description automatically generated with medium confidence

**Figure 1.1.** Projected Global Growth of the Lifestyle App Market (2023–2033)  
[Source: Reproduced from https://market.us/report/fitness-app-market/ [3]]

Figure 1.1 illustrates how the demand for lifestyle apps is expected to rise quickly. This statistic classifies lifestyle apps as exercise and weight loss, diet and nutrition, activity tracking, and lifestyle management.

There are multiple factors that make these applications so appealing to the average user, such as convenience, motivation, accountability, and a structured method for improving their habits.

Various studies show that mobile applications can be effective in supporting long-term health behavior changes. For instance, by using data from over 35,000 users of a commercial weight-loss application, a study published in JMIR mHealth and uHealth has discovered that regular use of features like meal logging and weigh-ins was highly associated with positive results [1].

In addition to that, a systematic review published in the International Journal of Behavioral Nutrition and Physical Activity found that techniques such as goal setting, self-monitoring of behavior, and feedback on outcomes were associated with the strongest results both short term (≤6 months) and long term (≥12 months) [2]. This review has also shown that user-centered communication is associated with long-term effects. User-centered communication means that the application focuses on the individual's personal goals and preferences while also encouraging the user to feel in control of their decisions.

These results demonstrate how mobile applications can support significant and long-term improvements in lifestyle.

* 1. Problems

Although these mobile applications are good tools for improving an individual's habits and lifestyle, there are several issues in existing implementations that lead to users giving up on their goals.

Because of the problems they solve, this type of application is destined for a very wide audience. Age, occupation, and technical skills do not matter, so lifestyle applications should be designed to be used by anyone, regardless of these criteria. A relevant issue that occurs especially in nutrition tracking apps is the complexity of the interface. The input of meals in some nutrition apps can often be time-consuming and too complex, especially for older users that want to track their eating activity but do not possess modern tech-using skills. In addition to that, if the input process of the application takes too long, users with a very busy life would be discouraged from using it long-term.

A study highlighted that the most important factor in choosing a nutrition and diet application was ease of use [4]. Figure 1.2 presents application selection criteria reported by study participants. Ease of use, the automatization of processes like calorie and nutrient calculation and reducing the effort of manual input being among the top criteria in choosing such an application further push the idea that usage complexity is an important factor in designing it, and some existing implementations do not take it into consideration enough.

A graph of a diet

Description automatically generated with medium confidence

**Figure 1.2.** Criteria for Selecting a Nutrition and Diet App (User Survey Results).  
[Source: Adapted from Vasiloglou et al. [4]]

Figure 1.3 brings to attention that the most frequently reported barriers in selecting a nutrition and diet application are related to lack of data integrity, reliability, and inclusivity. It is very challenging to cover all food data, as there are numerous variants of the same items, each with different nutritional information, based on factors such as brand, country of origin, packaging, and manufacturing processes. Building a database that fully encapsulates the diversity of food items would require a significant amount of effort and would inevitably leave something behind.

A graph of a nutrition bar

Description automatically generated with medium confidence

**Figure 1.3.** Barriers to Selecting a Nutrition and Diet App (User Survey Results).   
[Source: Adapted from Vasiloglou et al. [4]]

In order to solve the problem of incomplete databases, applications are required to rely on the user's help. Although this feature speeds up building the food database and makes it easier to include more specific items, it raises some issues. Inaccurate nutritional data is a major issue that is caused mainly by faulty user inputs. When the system leaves the responsibility of building the food database to the user, the risk of inaccurate data rises. With incorrect data, users cannot analyze their eating behavior properly and will not know what changes to do to improve it. After seeing good numbers on the application but no change in real life, users will be more likely to quit using the app or even give up on their goals.

A feature that multiple existing applications lack is smart feedback. Although having a place to store and visualize data about everyday behavior like eating and physical activity is in itself a useful feature, it is still not enough for long-term effects. Many users lack basic nutrition knowledge, and visualizing their data is not enough for correctly implementing changes in their lifestyle. These users could benefit from a structured method or a guidance system to achieve their proposed goals.

While these lifestyle applications may promote healthier behavior, they have the potential to raise some issues related to mental health. Nutrition applications can bring a lot of awareness to an individual's eating habits, and with a design that overemphasizes appearance and weight, they can trigger higher anxiety about eating behavior, weight, and shape in vulnerable users. Health apps are not inherently harmful, but the way they are designed can have a great impact on the user's mental health.

These considerations highlight the importance of adopting a more holistic perspective in the design of lifestyle applications. Typically, lifestyle applications focus on only one domain, whether it's nutrition, fitness, mental health, or pantry management. Therefore, if a user wants to track them all at the same time, they must install and use a separate app for each domain. Each lifestyle application has a different design, user interface, and interaction logic, which can become exhausting to handle. This overload would lead to giving up on at least one of them. Research suggests that applications approaching multiple domains at the same time can be more effective in supporting user engagement and achieving meaningful outcomes compared to single-domain applications [5].

* 1. Motivation

One main reason I chose this domain for my bachelor project is that I have been interacting with it for a very long time. It started from a personal goal to change my body composition for health reasons, and it evolved into a genuine passion and curiosity for nutrition.

After trying multiple approaches and so-called "shortcuts" and after doing research continuously over the course of many years, I have arrived at a certain conclusion: making body composition changes does not depend on a deterministic recipe.

* 1. Objective

Having stated the context and existing problems related to lifestyle applications, this paper will now outline the objectives of the project.

This application aims to merge multiple lifestyle aspects, including eating behavior, physical activity, and management of pantry and fridge inventory, as well as grocery list planning. Nutrition tracking by itself is a useful feature to some extent, but in daily life, eating behavior is heavily influenced by other external lifestyle factors such as physical activity, what food is available, and meal planning. Whether the user is planning to make changes to their body or simply wants to maintain a healthy lifestyle, there is no single path to achieve that. Monitoring and planning multiple aspects besides simply what the user eats could give a clearer image of what they must do in order to achieve their goals. Furthermore, as mentioned earlier, multi-domain applications are more effective in preventing the user from quitting the application early and may achieve better results compared to single-domain applications.

More specifically, this application focuses on the following objectives:

* To offer easy-to-use in-app interactions fit for any type of user, disregarding the level of technology comprehension and available time to use the application.
* To provide a nutrition system that allows users to input, monitor, and visualize their eating activity.
* To keep track of available foods the user has in their pantry or fridge, their shelf life and inform the user of the current stock.
* To generate grocery lists based on recipes and user preference in order to simplify meal planning.
* To offer a personalized meal recommendation system that uses pantry data and the user's goals and preferences to help reduce food waste and inspire their food choices.
* To monitor physical activity, either manually entered or imported from third-party sources, and assist the user in modifying their behavior by taking this information into account.
* To facilitate the visualization of user history and progress data related to nutrition and fitness so it can maintain users' motivation and to support reflection.
* To provide a user-driven public food database with light verification mechanisms, contributing to improved data quality and addressing common user frustrations regarding incomplete or inaccurate food databases.
* To have a design that doesn't induce eating or weight-related anxiety in the more vulnerable users.

Although simple, by integrating all these features in a single nutrition application, this project aims to serve as a straightforward tool for improving one's habits while optimizing the tracking process, including external factors, and creating a complete profile of the user's lifestyle.

1. State of the Art

W

ITH people becoming more and more conscious of their dietary choices and embracing physical activity as part of their daily routines, the nutrition app market is currently highly saturated.

There are many applications that offer similar functionalities, and most of them offer a single-domain approach, as opposed to the application presented in the paper. To better understand how the application fits in today's market, a set of current approaches will be analyzed and compared to it.

*2.1. MyFitnessPal*

Nutrition aspect:

- Simple mean of inputting eating activity

- Simple, reliable food database that cover most common foods

- Meal recommendation system

- Simple pantry management

- Grocery list generator from meal

This project has as objectives to :

- merge multiple domains in one app

- because i think what is in the pantry is relevant to managing nutrition and physical activity is relevant to managing nutrition i create multiple domains in one app

Make managing nutrition and physical activity easier with perdefined values and an easy interface

- Integrate wearable beacause they are very used and it is very useful

- Even though i cannot provide robust database, i have Verification for some reliability

\*

while data-related issues, including missing major foods, inaccurate nutritional data, missing local foods, and incorrect portion size estimations, were the main reasons for user lack of satisfaction and giving up on using the application [4].

\*

- Interface complexity ✅

- No guidance ✅

- Reliability on user input - inaccurate entries ✅

- Lack of personalization

- One app for each domain, too many apps to handle, at least one domain will be neglected ✅  
- There are multiple factors affecting one's eating behavior, such as what's in the fridge

- Pressure from numbers?

\*Although these lifestyle mobile applications have the potential to help users improve their habits and lifestyle, there is also a trend of people abandoning their goals due to the complexity of interacting with the application.\*

\*Tracking one's habits over a period of time can reveal unhealthy behavior that would not get noticed in the moment or short term. The speed of inputting information into an application provides convenience for the user. \*

\*complete image, frame the info, ca gen vezi in general obiceiurile tale\*.

\*in prezent sau in momentul efectuarii\*

\*obiceiuri proaste\*

\*pandemic?\*

\*Lifestyle applications are usually aiming to make the input of data as easy and fast as possible. Furthermore, the whole visualization of data \*

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The paper must be structured as according to the following guidelines. Please note that unless otherwise specified, the chapters presented in italics are mandatory.

The *Contents* section must comprise the titles of all the chapters and subchapters together with the number of the page where each chapter starts, including Bibliography, Appendices, List of Figures, List of Tables and Glossary. For this it is recommended to use the automatic feature Table of Contents built in with Microsoft Word. Position the cursor at the desired location and press References | Table of Contents | Custom Table of Contents. Press Options and under Styles select only the following styles: *Thesis\_Chapter, Thesis\_SubChapter, Thesis\_SubSubChapter*. Another alternative is to overwrite the contents of this template and update the existing contents section by right clicking and selecting Update Field.

If applicable, the *List of Tables and Figures* section must comprise the titles of all the tables and figures contained within the thesis, together with the number of the page where they appear. Use the feature Table of Contents to create a table and select only the style *Thesis\_Figure*. Repeat the procedure for a second table underneath and select only *Thesis\_Table*. Alternatively, overwrite the contents of this template and update the existing section.

If applicable, the *List of Abbreviations* section must comprise the list of abbreviations contained within the thesis.

The *Introduction* chapter should place the thesis topic in a broad context and explain why it is important, motivating its choice; the structure of the thesis must be briefly presented, as well as a brief summary of each chapter.

You may choose the titles of all the next main chapters, subject to the following criteria. If applicable, the national and international level state-of-the-art of the developments in the field of the topic shall be presented, on the basis of a documentary study interpreted by the author. In this sense, the current state of the research field should be carefully reviewed and key publications cited. At least one of the chapters shall refer to the candidate’s contribution. The theoretical description of the topic shall be approached, as well as the description of the application.

The *Discussions* chapter must underline under what conditions, and with what accuracy the proposed methods, procedures, etc. operate; strong/weak points of the method, algorithms, etc., with reference to related results in the literature; the summary of the project, concrete results, personal contributions; what work the candidate intends to carry out further within the topic.

The *Conclusions* chapter should comprise the most important conclusions in the project and the personal opinion as to the results obtained in the research, regarding the researched topic.

The *Bibliography* chapter must contain all the cited references contained within the thesis. The bibliography comprises the list of all the sources of information used by the graduate in drafting the graduation project/dissertation. Alongside books and papers, online (Internet) sources may also be included. A Bibliography containing only internet sources is strongly discouraged.

If applicable, the *Appendix* sections shall contain information that is part of the work but is not crucial for the readability of the thesis. It is strongly recommended that these sections be kept much smaller compared to the number of pages in the rest of the thesis.

Final printing of the pages shall be done only on one side of the sheet of paper.

1. Formatting Guidelines

T

HE paper must be written in the study program language of the candidate. Page margins must be set to top 20 mm, bottom 20 mm, left 25 mm, right 20 mm. The titles of the sections Contents, List of Tables and Figures, List of Abbreviations, Discussions, Conclusions, Bibliography and Appendices are not numbered and must be written with font Times New Roman, 16pct, bold. The markup style for these sections is *Thesis\_Contents*. Each section should start on a new page. It is recommended to insert a Page Break at the end of each section, from the Insert menu.

Main chapter titles are numbered with single digits and must be written with font Times New Roman, 16pct, bold. The markup style for chapter titles is *Thesis\_Chapter*. Each chapter should start on a new page. It is recommended to insert a Page Break at the end of each chapter, from the Insert menu.

Body text paragraphs must be written with font Times New Roman, 12pct, with line spacing 1.15. The markup style for body text is *Thesis\_Body*. The first word within the text body of each chapter must be formatted with capital letters, while the first letter must be written with Times New Roman, 34pct. Copy-paste a first letter from this template to the desired location in order to more easily achieve this. There should be no tabs or spaces between the first letter and the subsequent letters.

Subchapter titles can be created as exemplified below. The maximum depth of subchapters is 3, meaning only second and third level subchapters are allowed.

* 1. Second level Chapter

This is a second level subchapter. Titles are numbered with double digits and must be written with font Times New Roman, 16pct, italic. The first digit should be the same as the numbering of the containing chapter, while the second digit starts from 1. The markup style for subchapter titles is *Thesis\_SubChapter*. Adjust the numbering by positioning the cursor on the title and selecting Set Numbering Value.

* + 1. Third level Chapter

This is a third level subchapter. Titles are numbered with triple digits and must be written with font Times New Roman, 16pct. The first two digits should be the same as the numbering of the containing subchapter, while the third digit starts from 1. The markup style for third level subchapter titles is *Thesis\_SubSubChapter*. Adjust the numbering by positioning the cursor on the title and selecting Set Numbering Value.

Equations, Tables and Figures

A

LL stand-alone equations in the main text must be numbered with double digits, enclosed in brackets and aligned to the utmost right side of the main body text. The first digit corresponds to the numbering of the main chapter it is contained in, while the second digit starts at 1. Equations should be cited in the main text as Eq. 3.1, etc. It is recommended to use an enclosing table with 2 columns in order to properly center the equation and align its numbering to the right. Click on the table containing the equation below and select Borders | All Borders in order to understand this better. Note that all final equation tables must not contain any visible borders. All equations must contain exactly font 12pct. For this purpose it is recommended to use the Equation Editor built into Microsoft Word. Equation numberings must be written with font Times New Roman, 12pct. Equations and equation numberings that span beyond the left and right margins of the main body text are strictly prohibited, as are equations displayed as images rather than using an equation editor. If the equation together with its numbering are larger than the width of the main body text, do not decrease the size of the equation font, instead adjust the equation so that it spans several lines.

|  |  |
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|  | (3.1) |

Inline equations are also allowed, such as this example . In this case the equation must contain exactly font 12pct and must not be numbered.

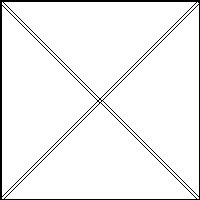
All figures must be numbered with double digits, the first digit corresponding to the numbering of the main chapter it is contained in, while the second digit starts at 1. Every figure must have a caption that starts with Figure <numbering.> written with font Times New Roman, 11pct, bold, followed by the title with font Times New Roman, 11pct. If applicable, the data source should be mentioned on a new line after the figure caption, between square brackets and following the same style font. The entire figure caption must be centered and located below the figure. Each figure must be centered horizontally relative to the margins of the main body text. It is possible to have one or more images in each figure. If there are more than one image, these should be labeled with (a), (b), etc. centered underneath each image and the figure caption should describe each image accordingly. Figures should be cited in the main text as Fig. 1.1, etc. Examples are given in Fig. 3.1 for a figure with a single image, respectively in Fig. 3.2 for two images and a reference to the data source. Both these figures are contained within a text box without visible borders, while in the second figure the images are in turn contained within a table with two columns and no borders. To simplify construction of your figures, it is recommended to use this type of formatting. Figures can be placed anywhere in the main body of the text, provided they do not overlap with other text or figures. The images contained within the figures may contain text – in fact, when presenting a graph the captions for the x and y axis are mandatory. The size of the text within the figures must be within reasonable limits and clearly readable. Figures that span beyond the left and right margins of the main body text are strictly prohibited.

All tables must be numbered with double digits, the first digit corresponding to the numbering of the main chapter it is contained in, while the second digit starts at 1. Every table must have a caption that starts with Table <numbering.> written with font Times New Roman, 11pct, bold, followed by the title with font Times New Roman, 11pct. The text content of the table must use font Times New Roman, 11pct. The table caption must be centered and located above the table. If applicable, the data source should be mentioned below the table, between square brackets and following the same style font. Each table must be centered horizontally relative to the margins of the main body text. External upper and lower borders should be double line; the internal lower border of the header should be single line; external left/right borders should not be visible. Internal vertical single line borders may be inserted but are discouraged. Tables should be cited in the main text as Table 1.1, etc. Examples of tables are depicted in Table 3.1 and Table 3.2, where the tables and captions are contained within a text box with no visible borders. Tables that span beyond the left and right margins of the main body text are strictly prohibited.

|  |  |
| --- | --- |
| C:\Users\martin\Downloads\testFigure.tif  (a) | C:\Users\martin\Downloads\testFigure.tif  (b) |

**Figure 3.2.** This is a double image. If there are multiple figures, they should be listed as: (a) Description of what is contained in the first figure; (b) Description of what is contained in the second figure.

[Source: Reproduced from http://website.com]



**Figure 3.1.** This is a single image.

Table 3.2. This is a table with internal horizontal borders

|  |  |  |
| --- | --- | --- |
| Metric | Value1 | Value2 |
| Temperature | -10 | 30 |
| Rate | 2.5 | 3.6 |
| Energy | 3 | 5 |

Table 3.1. This is a table with double external horizontal borders and a header.

|  |  |  |
| --- | --- | --- |
| Metric | Value1 | Value2 |
| Temperature | -10 | 30 |
| Rate | 2.5 | 3.6 |
| Energy | 3 | 5 |

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Formatting the Bibliography

R

EFERENCES must be numbered in order of appearance in the text (including citations in table and figure captions) and listed individually within the Bibliography section. Use IEEE citation style. In the main text, reference numbers should be placed in square brackets [ ], such as [1], [1–3] or [1,3]. It is recommended to prepare the references either with the bibliography tool built into Microsoft Word (go to References | Managed Sources) or using a software package such as Mendeley or Zotero.

The following formatting should be applied when referencing a journal article [1]:

A. B. Author 1, C. D. Author 2 and E. F. Author 3, “Name of Paper”, *Abbreviated Journal Name*, Volume, Issue, pp. page range, Month, Year

The following formatting should be applied when referencing a book [2]:

A. B. Author 1, C. D. Author 2 and E. F. Author 3, *Book Title*, Edition; Publisher: Publisher Location, Country, Year, pp. page range.

The following formatting should be applied when referencing a URL [3]:

Title of Site. Available online: URL (accessed on Day Month Year).

Discussions

T

HIS section should contain a discussion of the work.

Conclusions

A

DD your conclusions here.

Bibliography

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Appendix 1

This is a first appendix. Subsequent appendices should be numbered as Appendix 2 etc.