

# Development and Design of a Mobile Application System for Studying Sports Nutrition Knowledge as a Prototype for Thai National Soccer Players

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The aim of creating a popular nutrition knowledge and food recommendation app, designated as the mobile application for personal nutrition system (MPnutris), is to improve knowledge, attitudes, and behaviours. This study involves the development and design of this system with a focus on expert perspectives, which addressed the limitations and opportunities for app implementation and integration and resulted in acceptance outcomes. To examine the application's components, a focus group discussion was conducted with eight experts at the Football Association under the Patronage of His Majesty the King in order to identify the needs and gaps based on Fogg's motivation principle and Davis's theory of innovation and technology acceptance from the aspects of perceived ease of use and perceived usefulness. The MPnutris prototype was used in the study, and the results showed that most participants found that there were no problems in its trial and use, the app was easy to use, and the functions of MPnutris were acceptable. Therefore, the app could be a feasible and acceptable solution to support nutrition promotion interventions in primary care.

**Keywords:** personal nutrition system; mobile application; apps; nutrition knowledge

## I. INTRODUCTION

Mobile technology has become increasingly popular in recent years, as people carry their mobile devices with them all the time, and thus, mobile platforms can be an important source of information and motivation for engaging users in nutrition and dietary advice interventions. Apps can promote healthy eating behaviours, and nutrition and diet apps are currently among the fastest growing health promotion apps as they enable the tracking of healthy diets. However, although there are many nutrition and diet advice apps for athletes, there are still no apps that specifically recommend food for soccer players based on the various types of Thai food categorised according to local Thai dishes in order to promote the nutritional value of Thai cuisine, similar to the study by Pushpa *et al.* (2018), who developed

a prototype by adjusting the calorie requirements and dietary details based on local Malaysian food. This nutritional support has been discussed, and there is a sports nutrition management strategy that is ready to be addressed and improved in a tangible way. Therefore, the Football Association of Thailand under the Patronage of His Majesty the King (FA Thailand) has included sports nutrition management in the main category of sports science management in the 20-year national soccer master plan to promote development of soccer players (Football Association of Thailand under the Patronage of His Majesty the King, 2017). This led to a study on the appropriate sports nutrition management model, which is based on the various needs of active individuals, as providing nutritional knowledge and advice on correct individual diets will help

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enhance and improve the health of soccer players. To adapt to the present level of technology implemented globally, the MPnutris prototype development initiative was conducted in order to replace the traditional document-based training model so as to provide flexible and fast use and to play a leading role in the current era of information technology. The management of technology and innovative systems can be linked between the athletes and mobile platforms, websites and social networks. These variables are significant tools for staying up to date with changes in nutritional knowledge and providing adequate dietary recommendations (Jospe *et al.*, 2015; Vrontis *et al.*, 2019). The management of sports nutrition knowledge, starting from the process of developing an effective MPnutris prototype, is therefore important for the exploration of opportunities to create future technologies using mobile applications to motivate and influence correct eating behaviour changes for improvement of physical health in order to achieve its highest potential and lead to successful athletic competition. Therefore, MPnutris was developed with evaluations based on experts, users and requirements. In addition, López *et al.* (2016), Munandar (2021), Pushpa *et al.* (2018), and Griffiths *et al.* (2018) also studied features that are similar to those in this project, such as the login, usability, appropriate use, and logout pages. However, these studies investigated a variety of applications, objectives and methods used in different systems. Nevertheless, from these case studies, the researcher gained an interest in developing the MPnutris prototype as a guideline to promote nutrition knowledge and modify eating behaviours. It can also enable the relevant agencies to play a role in nutrition operations to improve the quality of life of athletes and help developers understand the system requirements as a guideline for future system improvements. Therefore, the objectives of this study were to create an app to help athletes gain more nutrition knowledge and follow appropriate dietary recommendations and to test the feasibility, usability, satisfaction, and acceptance of the app among experts in the field of athletics.

## II. MOBILE APPLICATION FOR PERSONAL NUTRITION SYSTEM (MPNUTRIS)

Many interesting challenges involving comprehensive operating systems for nutrition care, including individualised data awareness, reliability, and adaptive system functionality, are presented along with several high-level solutions. In addition, the research problems are identified and proposed for future research.

### A. *Exploration of Target Users' Problems and Needs*

Regarding user persona, or the characteristics of the target group, these characteristics are defined in order to identify the usage behaviour and needs, visualise these needs, and be able to achieve the goals based on the target group's requirements. When the overall picture is seen, it can be possible to define the working format more clearly.

An example of the details of the user persona or target group is "Mr. Thanadol," a 23-year-old male who lives with his parents and whose occupation is professional football (soccer) player. He has a personality type that is able to use new things but will not use them if it involves taking a risk, trying to use equipment or technology by himself before others, or being the first in a social group to try it. The group that is meant to be the first to use it will be the pioneers or innovators. As for the target group of users in this study, it includes the early adopters, which is considered the leading group within the larger group because the national athletes will have a desire to use the app and be interested in this knowledge or want to do the activities before all other athletes. However, this group also has a personality characteristic of changing their lifestyle. Although it is not easy, it is possible because this group is willing to start using new things that provide them with some type of benefit. At the same time, this target group is afraid of not being accepted and wants to become more successful in their career, which involves being on the senior soccer team in the future. If there is an activity that can develop their own physical potential or any new activities that must be done together with other soccer players, they will certainly participate every time. They have a medium to high level of awareness and implementation of health technology and can use communication tools and applications well. They also

follow health news and play games on various channels in their free time. In addition, if the Football Association organises health promotion activities for this target group, they will receive good to very good levels of cooperation. Normally, the main communication devices commonly used are smartphones with iOS or Android operating systems. Needs include good competence in one's own profession and technology or devices that can be easily used to respond to one's own needs. Problems include the lack of a regular nutritionist, although there is usually a dietitian but not regularly, and training is provided only occasionally. In Thailand, there are various mobile applications, but they do not focus on providing information specifically for soccer players. The subjective norm and behaviour include using the LINE application to chat and plan activities with others and the ability to learn how to use new applications from people close to oneself, such as the group of soccer players in the club that one belongs to and the group of soccer players within the Football Association, as shown in Figure 1.

age	23 years old
occupation	soccer players
status	Living with parents
Stereotype	This group is the Early Adopters, considered to personality be the leaders in their group, with personalities ready to take the initiative to use something new for their own benefit.
Life satisfaction	
Job satisfaction	
Readiness to adjust behavior for one's own career	
Interest level	
Awareness and use of health technology	
Smartphones, both iOS and Android systems.	

- (Needs)
- The body has good physical fitness for a long career.
  - Equipment or technology that is easy to use to answer your own questions
- (Pain points)
- There is no permanent nutritionist.
  - There are many Mobile Application but they do not focus on providing information specifically for football players.
- (Subjective Norm & Behavior)
- learn how to use new applications from people close to you, such as football club groups and football association groups.

Figure 1. Sample of the target group data (user persona)

### B. Research Design Process

To ensure that the development and design of MPnutris is performed effectively, a study was conducted based on the design thinking process because this approach can be used to sequence the steps and processes of thinking, solving problems, prototyping and testing to achieve the development of innovative and creative technology. This design thinking process or the “design thinking” popularised by David Kelly, Tim Brown and Roger Martin at IDEO, a

consulting firm, in the 1990s was further publicised in the Harvard Business Review in 2008, resulting in the current familiar form of the Stanford d.school. Figure 2 shows the thinking process is divided into five steps: Empathise, Define, Ideate, Prototype and Test.

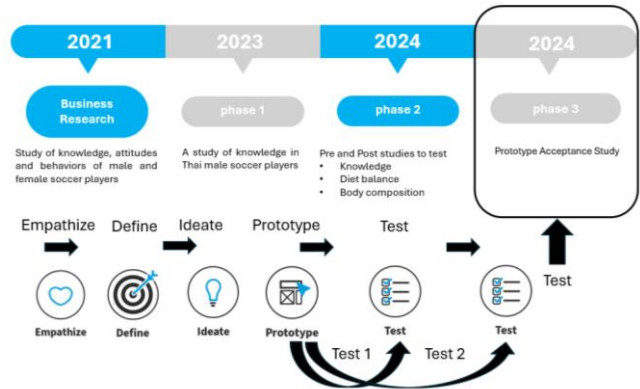


Figure 2. Design thinking Process from d.School at Stanford and the steps of creation applied in the current study.

The research design process starts from design thinking, which consists of five steps as follows: **(1) Empathise** involves understanding the target group by studying the knowledge, attitudes and behaviours of male and female soccer players to find the gaps and identify the problems that need to be solved. **(2) Define** involves identifying the problems that need to be solved, in which it is sometimes possible to design and solve all problems at once. However, if this is not possible, it is necessary to prioritise what to do first and what to do later before proceeding. **(3) Ideate** involves brainstorming to propose a solution for the management and/or design. **(4) Prototype** means creating a life-size model in the case of products or writing a plan in the case of service work. This study serves as the prototype for testing and evaluation of the MPnutris app in real target groups by conducting pre- and post-tests. **(5) Test** includes conducting pre- and post-tests in a sample group, which in this study comprised a test group of Thai male national athletes conducted in early 2024. This provided the advantage of being able to be used for further development and acceptance testing in the group of experts in mid-year to late 2024 in order to identify the weaknesses, so that they could be corrected or improved. Based on the case studies, only the development and design steps of the first and second rounds were discussed and tested with the group of experts.

### III. STUDY DESIGN & METHODS

Design planning does not necessarily start big. Many great developments, such as successful consumer Internet services, start small. For example, Google started off as a simple search engine, Yahoo was merely a list of links, and Facebook began as a directory created for finding and communicating with friends. When small steps were accomplished, these services expanded. Thus, small, measurable successes should be recognised as a motivating form of progress. MPnutris started by influencing a group of Thai male national soccer players to adjust their source of motivation, which subsequently affected their ability and desire to develop sports nutrition principles. The main factors were as follows (Fogg, 2009b): Target Behaviour involved recognising and creating a model for better nutrition knowledge and eating principles, along with promoting awareness of their own food intake among Thai male national soccer players. Motivation resulted from creating knowledge, use, and accessibility, as well as making the app easy for Thai male national soccer players to use and access, along with providing useful information to motivate them to develop themselves more effectively. Ability and willingness was created by designing the process innovation to provide simple nutritional knowledge details and making it easier to understand the principles of formula calculation for each person on the Thai male national soccer team by using interesting pictures of food types divided by category to make the information memorable in knowledge development, as well as using pictures of athletes and of food and additional uncomplicated methods of introducing knowledge for the further development of each person. Triggers included the current trend in daily life of everyone using a smartphone as a necessity that must be with them when doing activities, and there is a large amount of new technology, especially applications on smartphones. Therefore, there should be a mobile application for individual diets to facilitate the changes in the environment of eating, such as the details regarding the selection of food that is suitable for an individual, and to create motivation to adjust eating behaviours from a low level of care to a higher one. The design of the interconnection between these tasks that transfer information to each other in the process of persuasion must consider two important decision-making approaches according to Davis *et al.* (1989), who explained that an individual will accept technology based on

two main initial factors: (1) perceived usefulness and (2) perceived ease of use. This is because individuals will perceive the usefulness and ease of use that are related to new technology acceptance behaviour, which is the result of the expectation of being able to use the technology without much difficulty and finding that the technology is useful.

This study was conducted in three phases. Phase 1 was the development and design of the pioneer prototype in which the core functional prototype for the pilot test was developed. Phase 2 was the development and design of the remodel prototype, which was defined based on Fogg's motivational technology design process (Fogg, 2009) and to which functionalities were added. In addition to the nutrition education tool, an online food log feature was added to MPnutris, and a food database was developed by the Ministry of Tourism and Sports (MTS) under the name The Sports Food and Nutrition Book to ensure that the food options are applicable to athletes. Phase 3 was a focus group discussion with experts from FA Thailand to explore the acceptability of the prototype and to test the functionality of MPnutris for soccer players. The results from this focus group were used to further modify and improve MPnutris.

#### A. Phase 1 Pioneer Prototype: Development of The Mobile Application for Personal Nutrition System (MPnutris)

The design of the system connection for providing knowledge of sports nutrition and menu recommendations consists of three parts: the user, the demo application that shows the screen image (screen), and the database management (backend). Figure 3 shows the process which included five main steps: 1) the System for creating and accessing the demo application, 2) Logging in and accessing data, 3) Registration and recording, 4) Confirming successful registration, and 5) Displaying the main menu category entry page of MPnutris, including registration and recording of login registration, filling in the first and last names, weight and height, and position such as forward, midfielder, defender or goalkeeper. Athletes have a need for more energy in the form of calories than normal people, and the amount of energy varies for each person. Therefore, information regarding gender, age, weight, height and position is required. After filling in all the information, the success of the registration is confirmed, and the system records the registration information of each person. Figure 4 shows an

image of the steps in the knowledge category. The design of the system connection in providing knowledge of sports nutrition and menu recommendations consists of two main parts and one additional part behind the backend database. The usage steps display the knowledge, content format, reading confirmation and reading progress of each knowledge category. The main part includes 1) importing the data in each knowledge category and 2) displaying the weekly category page with data confirmation and the backend database. The additional part is 1) storing and updating the data. The guidelines for importing the data in each knowledge category have been set, which will cover the

comprehensive knowledge provision guidelines for the sample group, totalling four main nutrition knowledge topics.

The development and design are specifically tailored for Android and iOS smartphones because they are open-source mobile operating systems with a large user base and a simple mobile application development process that can be easily customised and integrated with other web or mobile applications. In addition, users can easily and quickly adjust the settings. The system connection in the nutrition education and food recommendation platform consists of three parts: the users, applications, and backend processes.

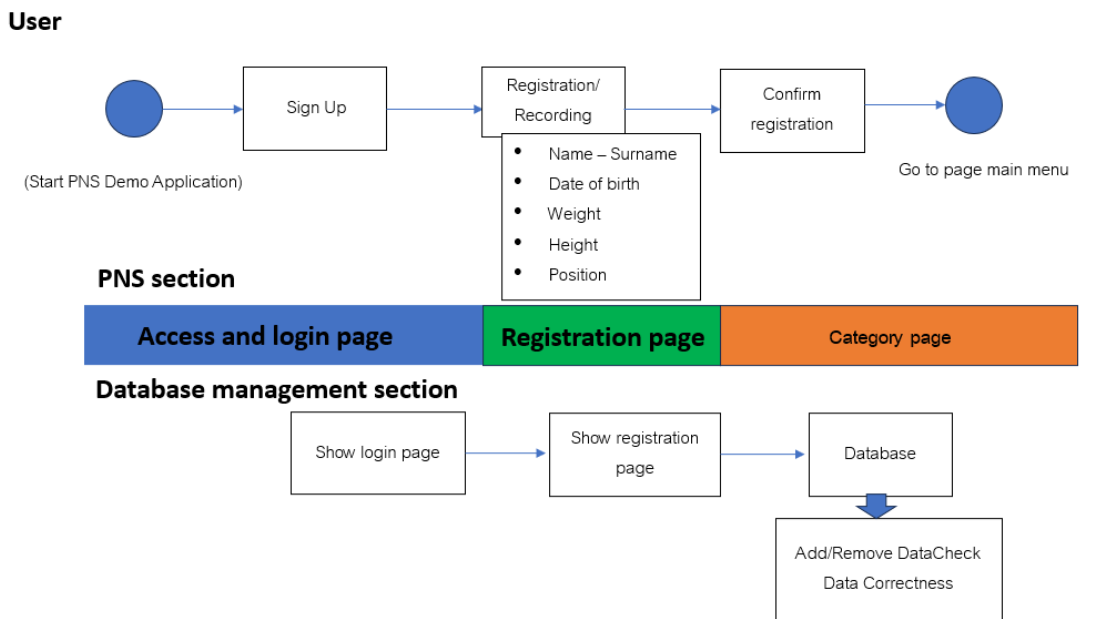


Figure 3. System creation steps with usage images

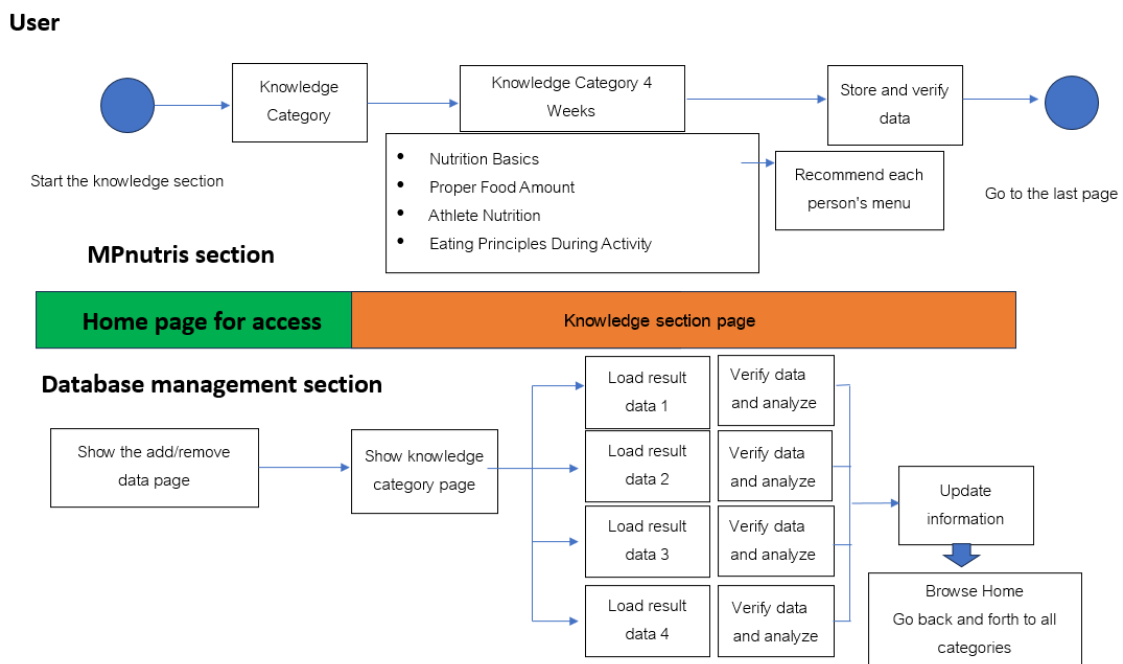


Figure 4. Knowledge Category Steps

**B. Phase 2 Remodel Prototype: Development of The Mobile Application for Personal Nutrition System (MPnutris)**

In this phase, further improvements are made from the first development and design phase within the database management section and the user section. Figure 5 shows the additional details of the backend analysis data and optional information. More functions were added in both main sections: 1. The MPnutris user section was modified to record activities and specify the purpose, such as ‘main menu,’ ‘how to use the program,’ ‘my menu,’ ‘search for menus and energy,’ ‘summarise analysis and recommendations,’ ‘Q&A,’ ‘search for menus by category,’ and ‘display analysis results and recommendations.’ 2. The database management section was modified to show the data addition and removal page, display the menu category page, upload the processed data, and confirm and analyse the data. Users are identified in the database and can review and change the data. There are explanations at the beginning of registration as well as filling in and saving information. Once completed, there is confirmation and registration and then the main menu section appears, as shown in Figure 6. The main menu consists of three sections as follows: ‘My menu’ is a section where users can press to type the name of the food or take a photo of the food that they eat during their actual meals every day, such as specifying where they eat breakfast, lunch, and dinner, as well as specifying where they eat snacks. Users can

specify the actual food they eat each day until they have eaten it for one week, or users can specify their food intake for each meal each day but store their food intake data for the entire week. However, the system in the menu category can store the user’s food intake even if the food intake is recorded for a month. ‘Search for menus and energy’ is a category that can be selected based on the user’s needs according to the list of food types categories that they want to specify each day as follows: ‘Your food list’, ‘single-dish menu’, ‘side dish menu’, ‘snack/dessert menu’, ‘fruit menu’, ‘beverage menu’, and ‘other menus’. Users can click to select according to their actual food intake and then specify the type of food they eat in each meal of each day without having to type or take a picture of the food that they eat.

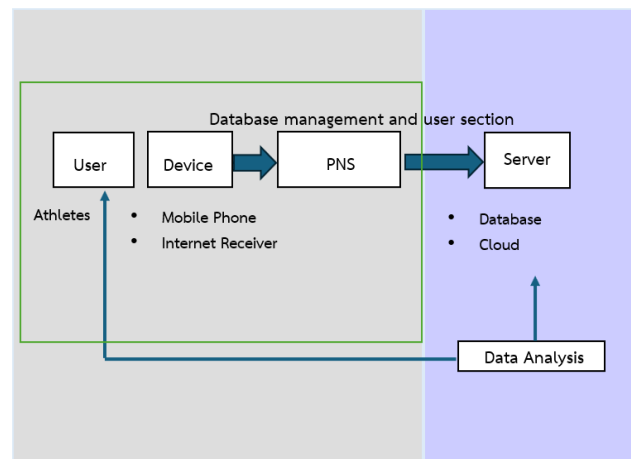


Figure 5. Details of backend analysis data and optional information

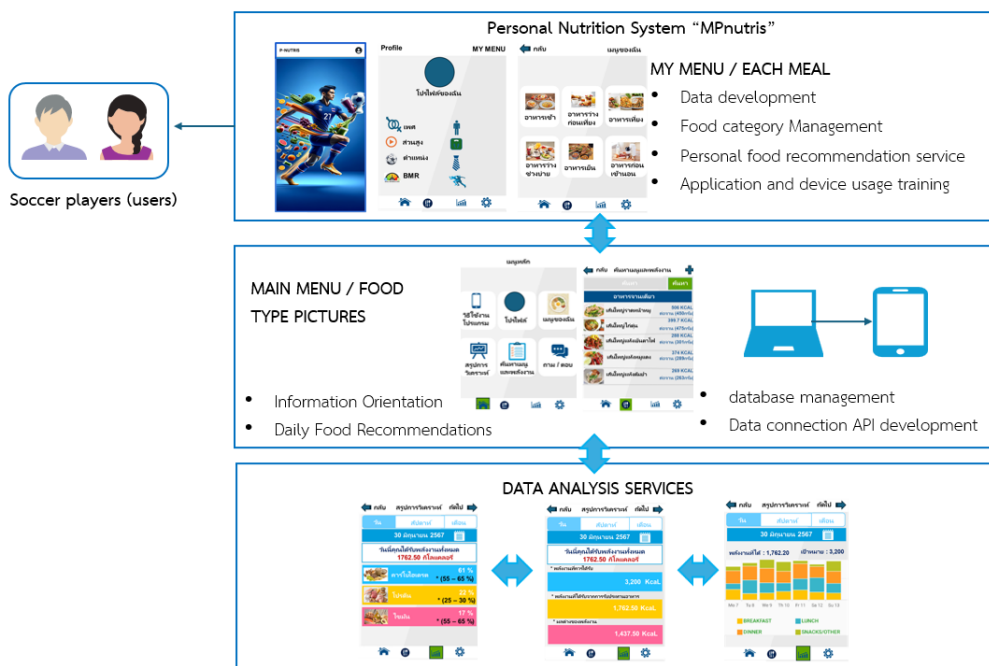


Figure 6. Main menu section

‘Summary, analysis and recommendation’ is a section that will process each person’s data and recommend foods according to the needs specified in the first part of the individual’s diet. The summary will be displayed as a percentage and a graph along with information on the appropriate diet according to the needs and an explanation of the recommendations, as shown in Figure 6. The result of this system is the generation of a report on the athlete’s food consumption compared to the desired standard, based on Figure 7. It shows the user and the database management sections. All functions in MPnutris have a flow diagram of

that function. The flow diagram of the login function is shown in Figure 7. The user opens a web browser and goes to the system website by registering for the first time. After that, the user can access the system by entering their username and password. In this step, an activity diagram is created that shows all the main activities in the use case. A flow diagram is created for each use case to describe the processes that the user is expected to go through when using the proposed system, the interactions that the user must perform, and some of the messages that the user will receive.

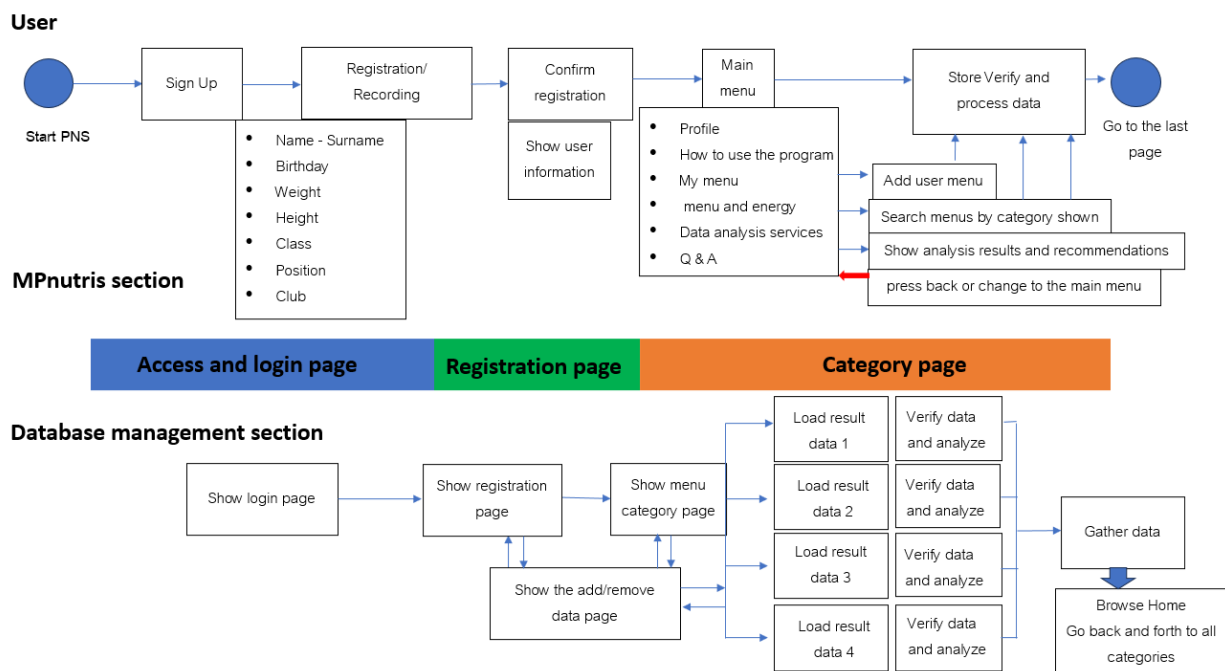


Figure 7. User section and database management

### C. Phase 3: Focus Group Discussion

In the focus group discussion, there were eight participants, consisting of representatives from the executives of FA Thailand, who have the appropriate expertise in each area. These experts were invited to join the focus group to ensure that the MPnutris prototype was usable. All experts had smartphones or laptops that could access the MPnutris prototype through any Internet tool. A short demonstration of how to use the system was presented, and the MPnutris

system trial page was available for 60 minutes during the focus group study. The opinions of all experts were recorded in Figure 8, and the researcher adapted the discussion points based on the concepts of Davis (1989) regarding innovation acceptance, divided into perceived ease of use and perceived usefulness. The results were summarised as an overview of the informants without specifying who they were, their positions, or their roles. The results from the innovation and technology acceptance study with the focus group were used to improve the system.

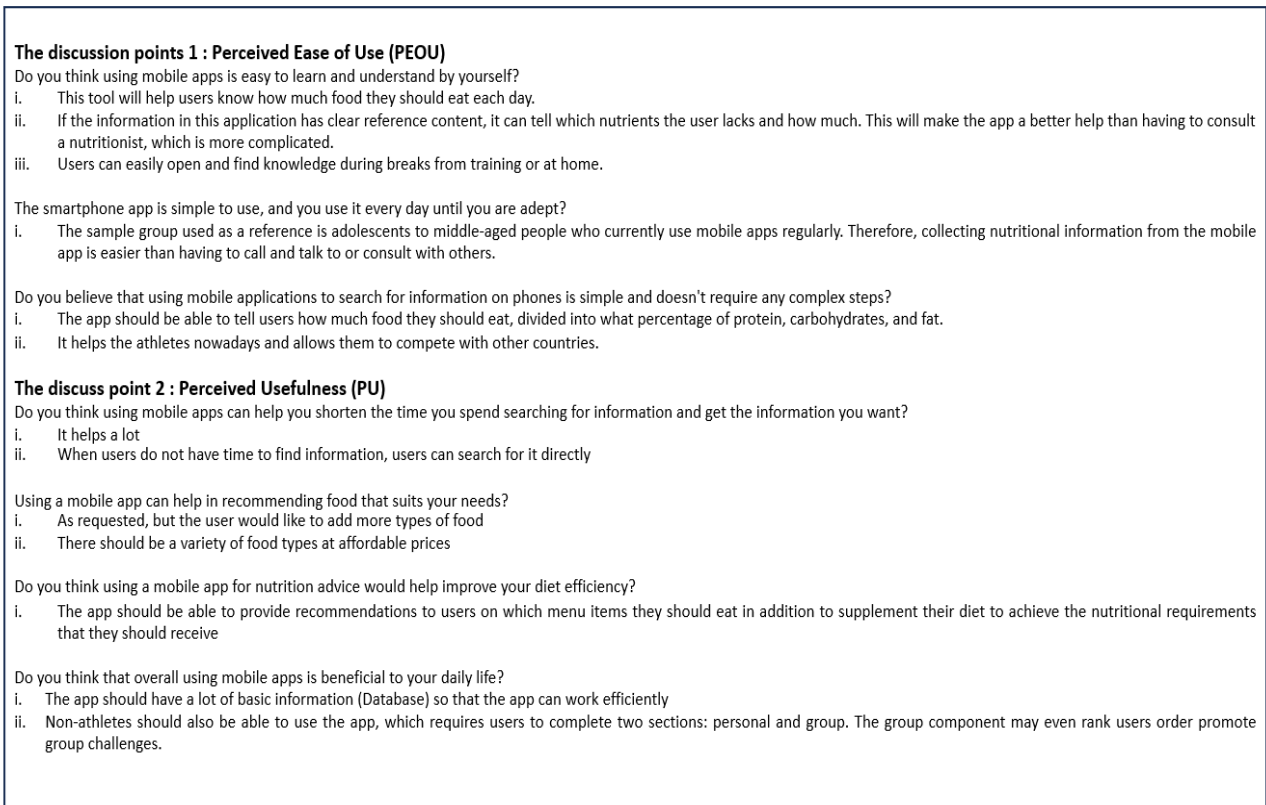


Figure 8. Focus group discussion summary

#### IV. RESULTS AND DISCUSSION

This research investigated the development and design of an Android and iOS smartphone application in order to explore its acceptability and make more informed design decisions for conducting a full-scale follow-up study in the field of nutrition. The current study aimed to investigate whether the availability of an application could improve nutrition knowledge and alter eating behaviours. In the research, a design perspective to support positive attitudes or behaviour changes based on user and expert experiences to understand the platform was used. For the user persona, the needs, pain points, tasks, and behaviours were defined prior to the platform design, and the application testing methods were established following Fogg's persuasive technology design process (Fogg, 2009b). The results of this study indicated that an application could change perceived usefulness and ease of use, defined as "the degree to which an individual believes that using a particular

system will improve his or her work performance" (Davis, 1989). The third phase of the user acceptability testing was conducted on the usability of the MPnutris system among eight experts in FA Thailand as well as a group of male Thai national athletes. The focus group discussion was divided into two aspects with the results of the focus group discussion being able to summarise the first issue, perceived ease of use (PEOU) and the second issue, perceived usefulness (PU), as summarised in Table 1. According to the total list of questions, the responses regarding acceptance issues from the focus group discussion tended to be the same, and the only suggestions were that the correct information should be provided in the introduction, the system should not have frequent failures, and the initial budget for the MPnutris development should not be high. For this study, the criterion of .80 and above according to Davis was used; therefore, when calculating the formula for the content validity index (CVI), the resulting value could not be less than .80.

Table 1. Results of perception of ease of use and perceived usefulness

Focus Group Discussion Points	Results	Suggestions
1. Using MPnutris is easy to learn and understand by yourself.	Accepted	
2. Becoming proficient in using MPnutris is easy to do.	Accepted	
3. Searching for information with MPnutris is easy and does not involve complicated steps.	Accepted	
4. Using MPnutris shortens the time it takes to find the information you need.	Accepted	Provide correct data
5. Using MPnutris can help in recommending food that meets your needs.	Accepted	
6. Using MPnutris will help improve the benefits of eating food.	Accepted	
7. Using MPnutris is useful for daily life.	Accepted	

As seen in Table 1, the results of the acceptance test from the focus group discussion including all experts show agreement at the level 3 or 4 for six items, which are items 1, 2, 3, 5, 6, and 7. When divided by the total number of questions, 7 items, the total from the focus group discussion from all questions is equal to 0.85 or converted to a percentage of 86%, which passes the criterion set by Davis, established by Hambleton and Coulson (1978).

The results from this discussion indicate that when users perceive a system as useful, it is more appealing to them, and they will be more likely to have the intention to use the system in the future. This finding is consistent with studies that found perceived usefulness to be the most influential predictor of innovation and technology adoption (Trakman *et al.*, 2019; Cyprus, 2019; Yuanyuan *et al.*, 2018; Zuniga *et al.*, 2017). However, despite users providing positive feedback on the MPnutris system, this study has some limitations, including the limited sample size. Thus, future research should use a larger sample size and be expanded to other sports teams in order to obtain more robust results.

## V. CONCLUSION

The MPnutris system for providing nutrition education and self-recommendation for athletes can be used within the

Football Association of Thailand under the Patronage of His Majesty the King (FA Thailand) and can be applied in other sports to promote nutrition, including the basic practices included in the use of the MPnutris system. It can also be a model for managing diets that improve the health and fitness of athletes.

This system has features for logging in, filling out forms, deleting options, selecting the purpose of use, recommending food, analysing results and exiting the system, and it can be useful for athletes and those involved in sports, such as team managers, coaches, physiotherapists and others. For future work, this MPnutris system can be further improved by integrating existing systems and adding more features to meet the needs of the users appropriately and keep up to date with future technological advancements.

## VI. ACKNOWLEDGEMENTS

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