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Abstract

Currently, mobile applications are an important medium, particularly for their use in assisting various activities, including extreme ones. For instance, mobile applications can assist with activities requiring GPS tracker functions, emergency calls, and health monitoring during the execution of activities. However, every mobile application that is created must undergo a development process that adheres to stringent standards. User Interface (UI) and User Experience (UX) testing is also essential for the efficiency and usability of an application. Using a tracking system based on the Design thinking development model, this study focuses on the creation of mobile applications. Next, the application's mobile usability test is tested and set.

Keywords: Mobile Application, Tracking System, Trail Run, Lost Safety Application, User Interface

Introduction

According to International Train Running Association, Trail run is similar sport to road running but trail run takes place through nature track such as wooded area, mountain area or catchment are such as lake or river rather than on paved, sealed, surfaced or concrete road. It also involves uphill, downhill and horizontal trail in duration marathon long distance. The tracks or paths must be quite simple to follow. The path may or may not be indicated, but it often offers a choice of directions. Checkpoints frequently provide aid stations and carrying a kit may or may not be necessary. A runner performing just concerned with their distance, pace and heart rate however must also worry about navigation skill in uneven or otherwise unpredictable track areas. The organizer creates uneven and challenging track that will make the runner difficult level to recognize direction of track.

In additional, if the track or path difficult to follow its may have some issues which participant lost from the track to go the checkpoint or suffer injury if separated from their group. On 24 March 2019, Acap or known as Mohammad Ashraf Hassan was reported missing when the organizers and his friends failed to find him after trail running competition in the Gua Tempurung area in Kampar, Perak for 25Km category. Until now, Acap's searching mission effort are still being continued by his family members and volunteers. There are also

cases of missing in Madeira, Portugal. Madeira is known for stunning trails, rugged terrain, high cliffs, volcanoes and rocky beaches. British trail runner Darren Kay of Sedbergh, U.K has been missing on Portuguese island of Madeira. Therefore, organizer need to provide mobile application with new features of tracking systems to participant track their paths or direction for avoid missing case or accidents during trail run competition.

This research will focus on analyzing for user interface (UI) for tracking systems in mobile application. The mobile application will become more popular and easily use if user interface is attractive, friendly to use, responsive in short time, easy to understand and consistent on all interfacing screens. Next, also focus on analyzing for user experience (UX) for tracking systems in mobile application. User experience (UX) design includes components of branding, design, usability and function in design of process of obtaining and integrating the apps. According to Interaction Design Foundation, designers need to deeply understand of user behaviour when using the mobile apps.

Nowadays, it has been seen that an increasing number of people especially younger generation are starting to enjoy extreme and sports activities to lead health and more active lifestyle. Furthermore, most mobile application in sports using old style of design user interface (UI) design that make user downgraded the app meanwhile the application very useful for daily life. This show design with applied design such as modern, futuristic, and minimalist interface will attract more user to use the application. According Dalbir Singh (2013), said interface most significant to marketability of software has seen important modifications compared to features. In addition, study by Grabham (2012), come with conclusion that designing user interface is one of the most important steps in the application or software development process.

The significant of study is to reduces lost when run trail events run smoothly with study and research of User Interface (UI) and User Experience (UX) design that implement to mobile application. In addition, the existence of this design interface application can attract user to download and also can reduce the rate of accidents or health problems. This is due to the help of an application that provides notification to the organizers about the safety of participants.

Research Objective

This research is intended to meet three (3) research objective as follow

i. To analyze User Interface (UI) for tracking systems in mobile application.
ii. To analyze User Experience (UX) for tracking systems in mobile application.
iii. To develop new mobile application to track participant in trail run competition.

Literature Review

Each mobile application to develop has own experience and design interface such as visual design, layouts, colors, typography and interaction design. This information about the study of objective to make sure the design of mobile application can help participant to use mobile application easily find the paths or tracks. In additional, the second objective this study is analyzing the User Interface (UI) and User Experience (UX) able to help user use tracking system when applied that features in mobile application. Therefore, this literature review in

this chapter will discuss with related topic or objective for better knowledge and understanding in this research.

Mobile Application

Mobile applications are commonplace in the current era of information and communication technologies. Mobile application usage and development, however, is a relatively new and rapidly growing sector of the economy. According to Arafhin et al (2010), the majority of mobile applications, even entry-level and cheap ones, are basic, user-friendly, affordable, and straightforward to use. Due to the mobile application's extensive capability, which includes calling, messaging, browsing, chatting, social network communication, audio, video, games, and more, it has a wide variety of uses.

Mobile app development has a positive impact on the environment. Rich countries are making themselves more accessible by using mobile applications, while people in developing countries are modernizing their society and building new types of IT infrastructure. Mobile applications are operated on small, mobile devices that may be carried around, utilized conveniently, and accessible from anywhere. Many people use mobile applications, according to Islam et al (2010), among other things to interact with friends, surf the internet, manage files, produce and handle papers, and for enjoyment. A mobile application may be accessed from any location. For both their everyday and professional lives, people have several possibilities.

Injury in Trail Running

Running and ultrarunning are becoming more popular. Likewise, an increasing number of individuals are taking up trail running, a distinct kind of road or track running states by Hoffman in 2009. According to the International Trail Running Association, trail running is done mostly on unpaved or asphalt surfaces (no more than 20% of the entire distance in competition), on natural terrain like mountains, deserts, or forests. It can include uphill, downhill, and horizontal routes and lasts about as long as an ultra marathon, which is defined as any event longer than 42.195 kilometers.

Previous research and related outcomes by (Carvalho, 2011) have concentrated on ultrarunning injuries. There is, however, a lack of data about overuse injuries that occur in trail runners, according to the most recent research. The objective of the study was to examine injuries and associated symptoms in order to estimate the prevalence of lower leg and lower back musculoskeletal injuries in extreme trail runners (Junior, 2011). In order to help with injury prevention and recovery during trail running, the predictive variables connected with these injuries were also looked at.

The Importance of User Interface (UI) Design

Each mobile application to develop has own design interface such as visual design, layouts, colors, typography and interaction design. This information refer to aesthetic design of elements digital product such as mobile application, website or so on. A user interacts with a software through a user interface, which is a collection of menus or instructions. One of any software's most important parts, the user interface defines how simple it is to get the computer to accomplish what you want. According to Joseph (2004), a powerful application with a terrible user interface is of little value. There are certain established guidelines that are

helpful for developers and also ensure that the same standard is being used when creating a good user interface. Developers design the UI designs in set of mockup assets by created in commercial design tools which Adobe Illustrator, Adobe XD, Figma, UXpin and so on. By suggested Carl Cahill in 2022, this all software tools help the UI designer to research, design and test their work and has high demand in industry.

In additional, importance of User Interface (UI) design is user can only interact you mobile application through the interface, thus how it is designed will largely affect how they feel about it. (UI) designer already understand how frustrating a badly designed User Interface (UI) can be if not give full effort in design interface apps or websites. Actually, designer don't have much time to impress users because now apps are competing for impress a user. According Localytics, 71% of all apps user has stop using apps after 90 days. Brand awareness is another important element in UI design. The apps will be easier to recognize if all of your designs follow to the same guidelines. The creation of a single asset is only the beginning of UI design. Designers are prepared to design for the bigger picture of how everything will design and function together in the finished product when it is a strong focus of the project. There are certain established guidelines that are helpful for developers and also ensure that the same standard is being used when creating a good user interface. A user-friendly user interface may attract users to an application, preventing them from becoming frustrated and abandoning it.

One of the main factors in attracting more people to encourage more mobile application or websites downloads is the User Interface (UI). It is one of the criteria that determines whether or not website visitors are interested in examining it. Users will come back to the website to further explore it if they like the user interface. Not only the overall appearance, even as small a detail as a button can actually affect the users experience when using the website. Wagner (2002) states that if the software interface is developed without consideration for the abilities of the users, it confuses the users and makes it impossible for them to develop a good conceptual model. It means that they are unable to understand the structure of software and interact with it. Therefore, it might be said that the application is useless for them (Wirtz et al., 2009). According to Nielsen (2003), a good user interface designer should try to reduce the complexity of software and provide a working environment that is simple, effective, and attractive.

The Importance of User Experience (UX) Design

User experience describes how a person feels while interacting with a product under situations. In the specific context of usage that social and cultural elements are shaping, the user and the product interact. The user possesses a variety of characteristics, including values, emotions, expectations, and previous experiences. Hiltunen et al (2002) said the experiences that user product contact generates are influenced by all of the elements. Everybody has a different user experience. The most important thing to remember when developing a mobile application is that even though you may have developed it, you could not really be one of its users. Therefore, we cannot presume what a user wants or needs. Refer to figure 2.0, finding the issue and directing all ideas to address it are the first steps in smart user experience design. First of all, before solving the problem the developer needs to study and do some research about persona, problem, strategy, objective, features and solution that called UX design process.

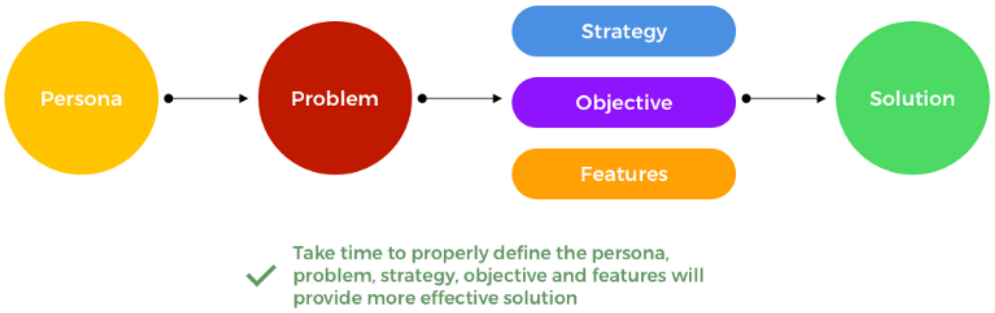


Figure 2.1: Finding Issues And Step In User Experience Design

User Persona

When creating a design, system, or interface, designers must identify who their target users are. The demographic such as characteristics, interests, cultural norms, gender, social groups, and lifestyle are considered while creating these user profiles. The target profiles may sometimes be chosen based on fashion statements and market trends. With the use of surveys, discussions, and interviews some of which are assigned must analyze the potential users of their proposed design (Wong, 2012). To capture existing user task models, some interface designers are known to create task analysis and workflows at this stage.

Functionality Mapping

Map applications should ideally be simple to use for all potential map users and in all situations where maps are intended to be used. To address the objectives arising from various map application areas, the application's design should aim for a positive experience (Roth et al., 2017). To ensure the application's usability and utility, the design is consequently essential and should conform to established human-computer interaction (HCI) principles (Newman et al., 2010).

Process in Design Thinking

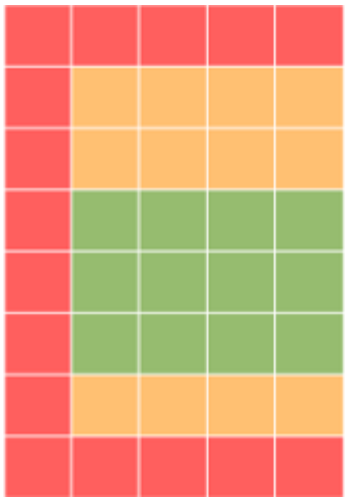
Design thinking is typically described as a creative and analytical process that offers chances for experiment, model creation and prototype, feedback gather, and redesign. Design thinking is the term for the mental and physical procedures that assist businesses in developing innovative design outcomes (Chen & Venkatesh, 2013). The steps of issue identification, ideation, concept creation, and concept implementation are all included in various design thinking methodologies (e.g., Best, 2015; Design Council, 2015), although there are many different approaches to this methodology. According to Chen and Venkatesh (2013), the term "design thinking" refers to several techniques that help with the development of a mobile application. Depending on the specific model of design thinking, the process of implementing design thinking may involve several stages. For instance, a five-stage process is described by the Stanford D. School, which provides executive design education which is empathy, define, ideate, prototype, and test.

Usability of Navigation Design

To make information on a website simple to discover, navigation is an important element of website design. According to the users view, navigation menus should be developed to help

for easy, efficient, and effective navigation and to encourage exploration of application. According to Vera Hollink, that despite all the efforts made to design navigation menu that enable users to browse the mobile application effectively, initial designs for these menus are frequently far from optimal since designers are unaware of the objectives and usage strategies for future users.

This is important for mobile applications. Although users' fingers aren't usually slim, the app must be usable by everyone. Nobody wants to waste time tapping on an icon repeatedly to accomplish something. It ruins the carefully thought out experience that the design team had worked so hard to create and is annoying and distracting. This means that links or buttons size must be big enough for most users to correctly tap them on the first try. The fact that mobile applications mainly utilize their fingers for data entry and the mobile context in which they are used means that while designing, the limited reach of one hand must be taken into consideration. Reaction time, hit rate, and hit offset magnitude were examined by Zhang et al. for targets that were placed at various points on the screen. Figure 2.1 provides a summary of their results.



Red = Poor, Orange = Okay, Green = Good
Figure 2.2: Accessibility of Different Position of Smartphone Screen When Using One Hand

Impact of Colour Behaviour In User Interface Design

A lot of research has been discuss about colour to develop mobile application. The colour given impact and effect human behaviour such as corporate marketing, identity, recognition, mood also effect on sports and health application. Based on the impact on human behaviour, especially in regards to both immediate and long-term impacts on mood and emotion. According to the research by Faber Birren found that colours may impact people's emotions in a variety of ways including warm, strength and weak, hard and soft, and activity and calm (Birren, 2006).

For example, when and how blue may be avoided if it is helpful to do on Apple's deliberate avoidance of it in some of the pre-installed applications on IOS. In Figure 2.2, the Bedtime feature of the system clock application on IOS 11, the dark background of the design is contextually appropriate by being easy on the eyes, especially when paired with the less offensive contrast of a yellow/orange typographic colour system instead of stark white on

black. The app has no blue at all, which is a clear break from the overwhelming majority of IOS and Apple's overarching design aesthetic.

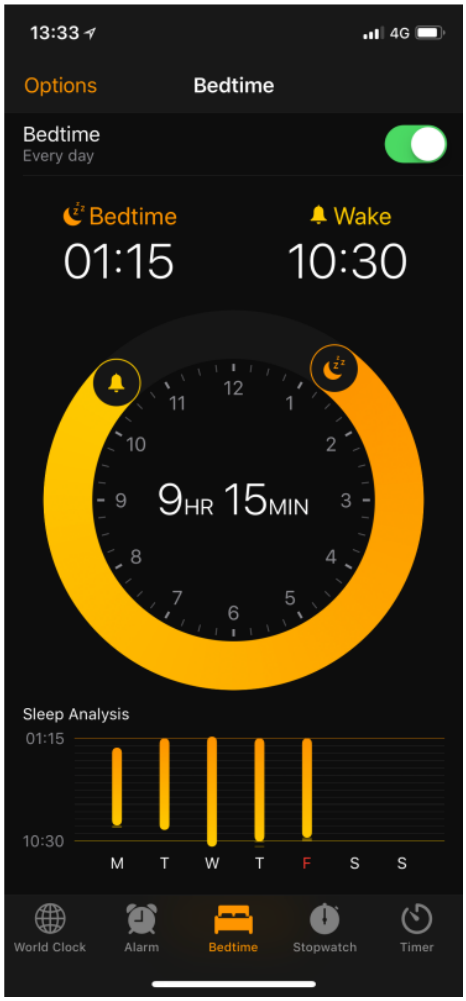


Figure 2.3: Colour in Bedtime Features

Colour is an incredibly potent tool that can be used in user interface design, as well as other aspects of product and service design, to create experiences that convey or enhance specific moods, feelings, and identities. It can also act to create hierarchies and prompt user actions to help them navigate through said experiences in an effective and worthwhile way (Nicky Hope,2017).

Prototypes

Prototypes in the topic of instructional design come in a variety of format. They can be simple demonstrate that only show how the final product of development mobile application will look or can be more complex models that include some or all the main features of the application (Jones & Riche, 2000). Regardless of their formats, prototypes instructional designers test ideas, functions, and features of the final mobile application early in the design process, when expenses are minimal and changes are easier to develop (Wilson et al., 1993).

With actual data from the research, prototypes not only direct the design process but also make it easier for designer, developers, content experts and target users. An explanatory framework “that specifies expectations that become the subject of research throughout

following cycle of inquiry" would be provided by outcome of previously constructed prototype. According to Cobb et al (2003); Whitten et al (1989) in the context of engineering design argues about the similar benefits also implement in context of education.

Methodology

The objective research methodology utilized in this study is testing the usability and acceptance of this mobile application, research using the user experience questionnaire (UEQ) developed by (Schrepp, 2015). In this research, questionnaire are an easy method for collecting this kind of user feedback (Ali & Ramlie, 2021; Ramlie et al., 2022; Ramlie et al., 2020). They can be communicated quite effectively to larger user groups, especially if they are made into online surveys. Additionally, such surveys' numerical data analysis is very standard and effective. In this research study, also discuss the design and analysis of a simplified version of the User Experience Questionnaire, a popular method for evaluating user experience.

The User Experience Questionnaire (UEQ)

The objective of the UEQ is to enable end users to quickly evaluate the user experience, preferably in a comprehensive way. It should make it very easy and quick for users to convey any thoughts, impressions, or attitudes that they have before using the mobile application in Trail Run Competition. Although the UEQ has a paper-and-pencil version, but it is also brief enough to be used online. Each question on the UEQ consists of two words with completely opposite meanings, such as:

Table 3.1
Example of User Experience Questionnaire

Not understandable	o o o o o o o	Understandable
Efficient	o o o o o o o	Inefficient

Each item is rated by participants on a 7-point Likert scale. The responses are graded from -3 (completely disagree with the phrase) to +3 (completely agree with the term). The majority of the things begin with a positive term, while the others begin with a negative term (in randomized order) (Ramlie et al., 2022).

Design and Development

This research uses the Design Thinking approach as a guideline to develop an application that helps trail runners in locating and identifying directions, preventing incidents like being missing or getting injury during competition.

Design Thinking

Design thinking is an iterative process where designers try to understand the user, question assumptions, and redefine issues to find alternate approaches and answers that might not be immediately obvious given our initial level of understanding. In addition, design thinking offers a problem-based approach to solving issues. Along with a variety of practical ways, it is a method of thinking and functioning by refer at figure 4.1

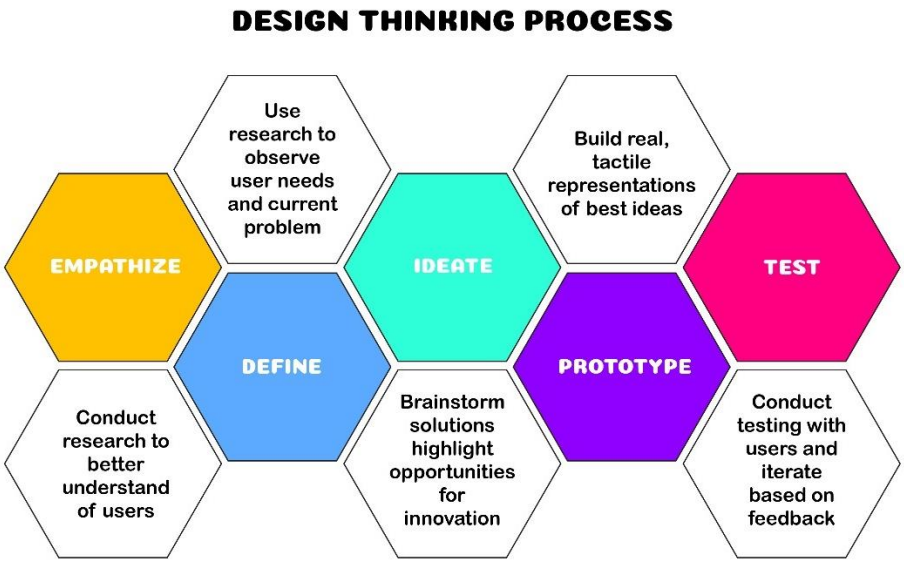


Figure 4.1: Design Thinking Process

a. Empathize

Empathy is where the Design Thinking process starts. For more understand who the users are and what they require to provide attractive products and services. What do they expecting from the apps designing? What difficulties and problems do they encounter in this situation? During this phase, Developer will spend more time and interacting with participant users or individuals who represent target group conducting by interview, seeing how it use an existing design and generally attract the attention to facial expressions and body languages.

Empathy is the first phase of the design thinking process in the context of this study. To design a mobile application that fits the goal, this decisive step is essential. In this study, users who have problems identifying the direction of the track are the target audience for the Trail Run mobile application. Researchers also understand consumer attitudes and needs throughout the empathy phase. As a result, this study proves that the target user is made up of Trail Run participants who find it difficult to identify the track route in a Trail Run.

b. Define

Designer will identify the user problem that must be solved in the second step of the Design Thinking process. To put your findings from the empathy step together, start by gathering all the findings. The problem statement that creates at the end of the define phase will serve as a guide for the whole design process. Designer thoughts and potential answers will be developed on this.

It has been observed that a growing number of individuals, particularly the younger generation, are beginning to pursue extreme and sporting activities to lead healthier and more active lifestyles. Furthermore, most sports-related mobile applications feature dated user interface (UI) designs, which cause users to downgrade the apps even if they are still highly helpful in daily life. More users will utilize the application because of this show applied design features, such as its modern, futuristic, and minimalist interface.

c. Ideate

Idea generation or ideation is the third stage in the Design Thinking process. Currently with a solid understanding of target market's needs and desires. Additionally, clearly understand the problems that trying to resolve in problem statement. This stage is time to brainstorm with come up possible solution.

The ideation phase is a judgment-free environment when the group is encouraged to deviate from the plan, investigate fresh perspectives, and think creatively. Regardless of whether or not they are practical, with ideation sessions to produce as many. Ideation sessions are frequently done in unique settings to increase creativity.

i. User flow Develop Application Trail Run

The user's journey to fulfil a certain objective is referred to as user flow in UX design. From the start to the finish, it describes every step. App and website design benefit from good user flow in UX design. It also can improve or create a design with a better user experience to help participant Trail Run to easily understand feature and workflow of application.

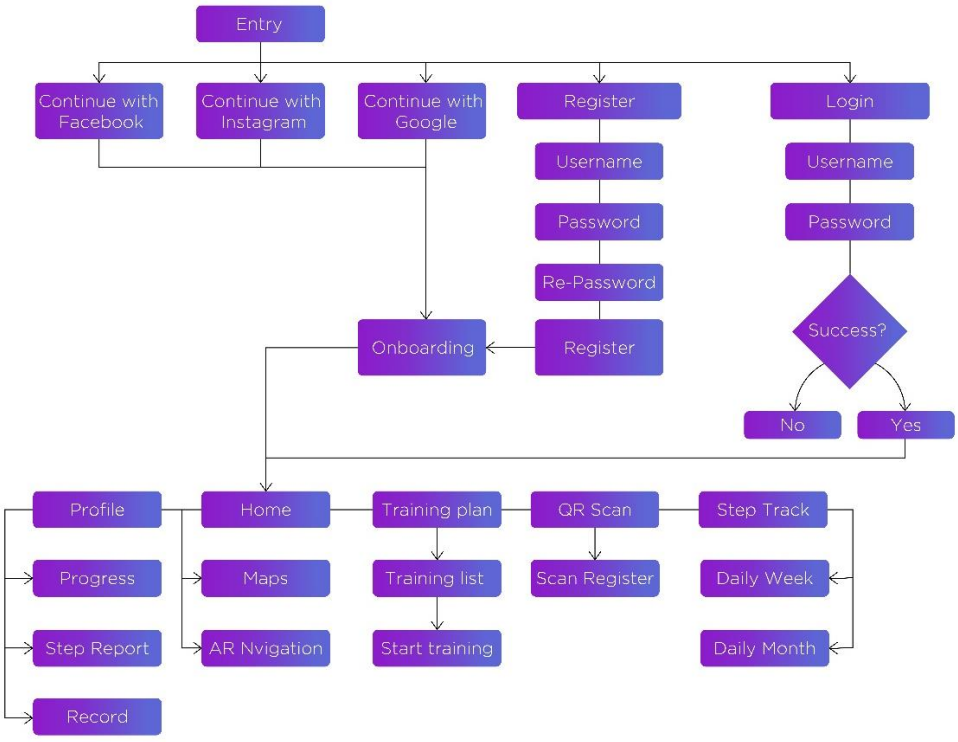


Figure 4.2: User Flow Diagram

ii. Color in User Interface

Designers can develop mobile application by using of the concept that colors have a strong psychological influence on people's behavior. Besides, Eye-tracking research was done by Choi and Suk (2015) to identify which color combinations of icons produced the most conspicuity. The findings revealed that foreground and background graphics with a high contrast were the most striking. The effect of color contrast and brightness difference on the perception of icons was studied by Shen et al. in 2021. Additionally, their findings suggested that strong color contrast increased the effectiveness of icon recognition.

Color scheme that using in this mobile application is darker color as main color and gradient color as icon and elements. Darker color choices are often a bit more on trend. Any of these user interfaces tends to favor mobile application that don't need much reading. Also, the users are alerted by gradient color to other and give more improve the pages and icon readability. For example, while users focus on trail running, they will easily recognize the gradient color at navigation icon in apps.

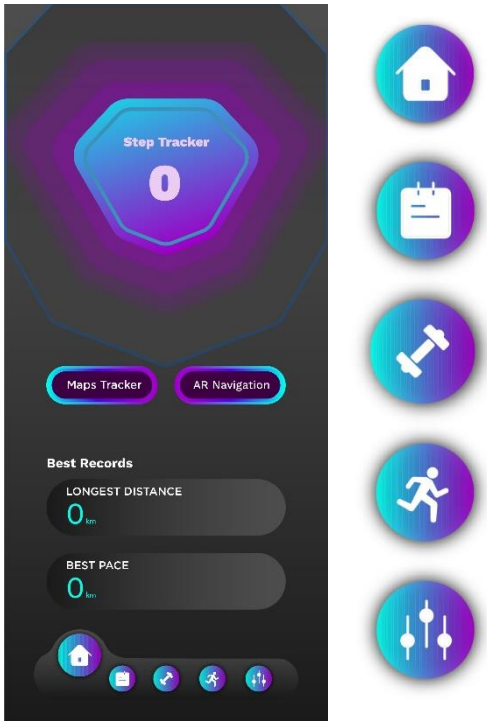


Figure 4.3: Gradient Colour in Interface

iii. Placement of Navigation Button

Placement of navigation button is bottom. A navigation button containing the main or secondary navigation links. Users can navigate and explore top-level views with only a single tap.

Figure 4.4: Bottom Navigation Bar

Mostly users will be able to comfortably use their thumbs to access mobile apps while gripping their smartphone when trail run when grip the smartphone. It needs less effort and reduces the need to switch up how users grip the smartphone, also enhance overall usability of application.

iv. Layout Design

Layout design can be used into typography components, which can link the meanings. Across the smartphone screen, these components must be connected. Screen sizes must be standard

for mobile application and can be separated into menu, navigation and content areas that display the course content (Darcey and Conder,2012). The user behaviour of Trail Run participant will get the usability of interface visual impact and colour.

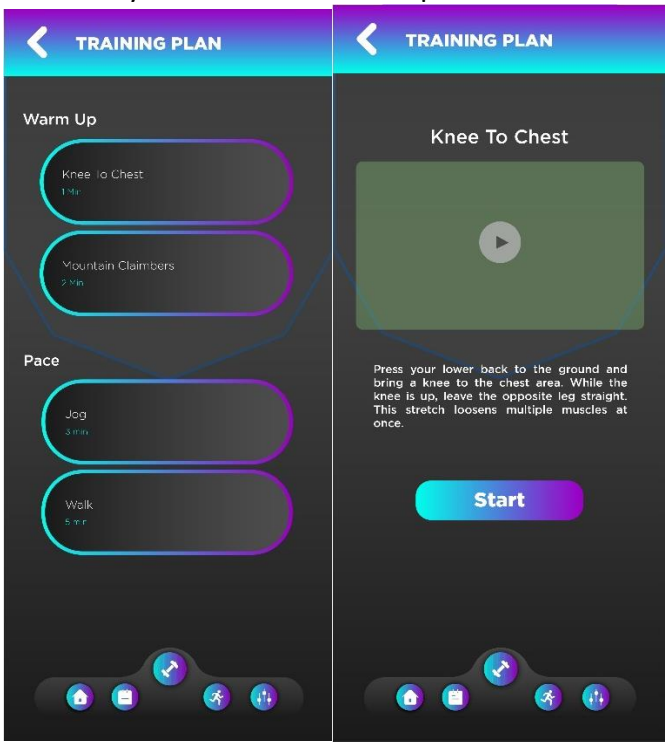


Figure 4.5: Layout Interface

Layout design and graphic design should have the same look. Elements such as columns, margins, and icons should be placed on the screen must be consistently. That way, when the user understands how to use one screen, participant of Trail Run will be able to understand other screens and how they work so that easily to use the application although first use this apps. Colors can be used to complement information to accomplish the purpose of tracking systems application but should be used in moderation.

V. Navigation Features in Mobile Application

Understanding the key features that, when put into practice, make good mobile apps useful and advantageous is crucial for designing successful mobile applications, as (Flora et al., 2014) state in this article. It is necessary to look at the unique development of mobile applications and to consider new features and techniques for the development process, which includes designing, developing, testing, deploying, and managing mobile apps, due to the wide variety of tools and platforms used by mobile applications.

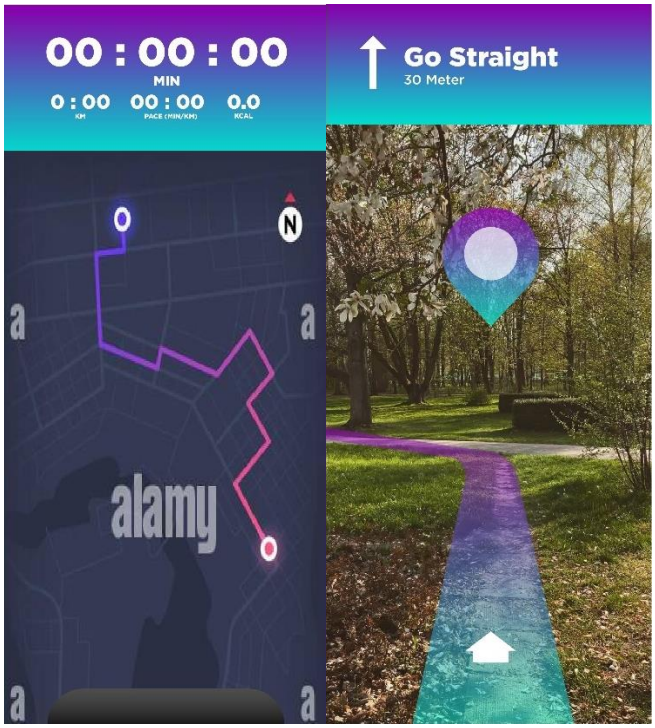


Figure 4.6: Navigation Features

When users choose to utilize map services, it's because they are having trouble navigating from point A to point B. One of a navigation features fundamental jobs is to assist the user in following the path, and their job is to make entering destinations into the system simple.

Because of this, the user may easily go around complicated track in Trail Run without need to bring any map or other guides but only use this feature on mobile application. This features navigation make it more convenient, more easier, and also more efficient to participant or user.

d. Prototype

In this experimental stage, which follows the first three, the objective is to identify the best solution for each of the problems that were identified. To test the problem solving ideas created in the earlier stage, design teams will create a number of low-cost, scaled-down prototypes of the goods or specific features found inside the product.

The objective of the prototype stage is to develop the concept into prototype that target audience which participant of Trail Run can be test on it. This is essential to keep the user centric approach since it enables to receive input before proceed the develop the whole design of mobile application. This is to make sure that the final design of mobile application that can help to solve the user problem and effective to use.

i. Wireframe

The visual design and strategic factors of the mobile application are illustrated in the wireframe. Wireframes are simple line drawings of user interface. Without really caring about colors, placement of layout, or other design elements, they just demonstrate how it should be created. Additionally, it is a method of communicating the product's vision to the company and gathering input on potential design and functionality changes. In this case study, a

wireframe was designed to show early project concepts for develop mobile application's design and functionality that show in Figure 4.7.

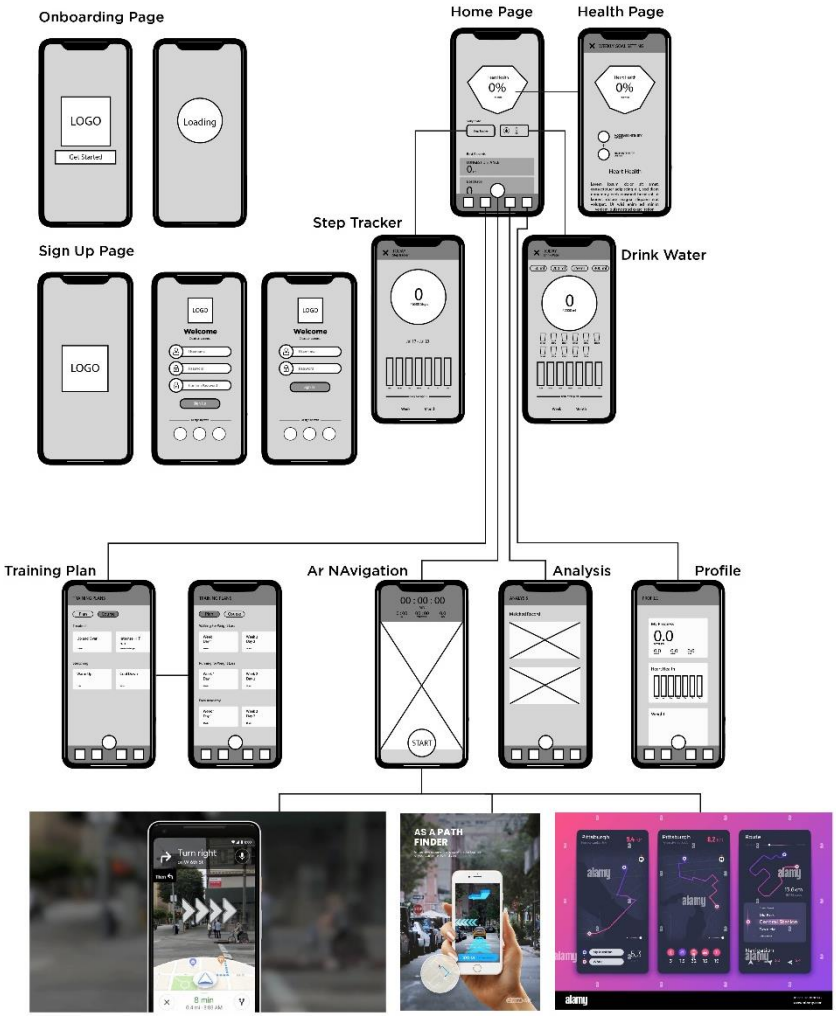


Figure 4.7: Wireframe

e. Test

The final process is carefully test by designers or evaluators utilizing the best options found during the prototype process. Although this is last stage of model, a iterative method like design thinking frequently use the outcomes to redefine one or more additional issues. Designer can choose to redo to earlier steps in the process to make adjustments or improvements to make suitable solutions.

In this phase, based on feedback user of Trail Run if any suggest or improvement need to change, the developer need to fix or adjust to improve the usability of mobile application features or interfaces design to easily to user when attempt Trail Run Competition. So, the participant can avoid any problem or issue when using the mobile application.

Finding and Discussion

This chapter concludes the findings, discuss and conclusion of development mobile application tracking systems for Trail Run. This chapter also explain about the importance of User Interface (UI) and User Experience (UX) for develop mobile application.

The finding of research study found that analyze of user interface (UI) and User Experiences (UX) can help developer to design and develop new mobile application that focus on target audience which participant of Trail Run to solve the problem of locating and identifying directions, preventing incidents like being missing or getting injury during competition. This research are explain of development of mobile application for Train Run based of 5 stages of design thinking process which empathize, define, ideate, prototype and test to develop and design mobile application of tracking system for Trail Run.

The research study about development of mobile application has given big impact to the participant of Trail Run such as the mobile application can help Trail Run participant to easily find the track direction by using tracking system features such as maps direction and AR Navigation. By using this feature, risk any accident can avoid and safety is guarantee by organizer. This research also found that the design of user interface helps participants to overcome the problem of lost and missing cases as a new step in running sports innovation to reduce lost cases during trail run competition.

Conclusion

Conclusively, the research study shows the process from start until finish to design and develop a mobile application with tracking systems to help participant find the direction of track from any missing cases in Trail Run Competition. Before proceed with design of mobile application study literature review with related study to help researcher understand previous research study in related topic to improve understanding of study. The mobile application was develop based on analyze User Interface (UI) and User Experience (UX) to utilized in this study is testing the usability and acceptance of this mobile application can help participant of Trail Run. In additional, this application will provide advanced features which Maps Direction and AR Navigation to guide users find their direction. The developed mobile application was develop by using design thinking process for make it easy to use for users. Last but not least, this developed tracking system in mobile application will help and convenience to use the features easily and efficiently because of usability and interactive feature that very helpful for the users especially participant of Trail Run.

This study is important to conduct because it makes participants and organisers of running events more concerned about participant safety. Furthermore, this research is necessary in order to create a sports application based on a more thorough and effective design thinking model. This is because application development guided by the design thinking model has a more positive impact on its use in terms of user interface (UI) and user experience (UX). User acceptance is critical in determining the long-term viability of a phone application. This research contributes to theories and models that are frequently used in application development, particularly in the activity of developing tracker applications for running activities. Existing applications primarily provide information to participants, such as health information and progress in sports activities, but applications used by organisers to track the movement of large numbers of participants and track participants with issues are rarely discussed. Discussions can continue as a result of this research.

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