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NontonNyaman: a Mobile Application for Mobility-Impaired Individuals to Navigate during Live Sporting Events

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Summary

This technical documentation outlines the development and implementation of NontonNyaman, a mobile application that enables mobility-impaired users to navigate through a stadium while watching a live sports event. In developing this project, it fills the gap in the current market for event-based mobile applications by making it more accessible and inclusive, thus giving people with mobility impairments their own navigation and information system.

The application is built using Python and Django for the backend, and Dart and Flutter for the frontend. Users can search for a specific stadium or pick which stadium facilities to navigate to. In an emergency, users are just a button press away to be assisted by their warden. In case the user has any query regarding the stadium, they can effectively reach the stadium authority using the app.

Additionally, this technical report documents the ethical, security, and data privacy considerations when making the application. It also elaborates the potential risks that were identified during the planning process and the mitigation strategies. Finally, the application was evaluated using several methods of user usability testing. These evaluations and feedbacks from stakeholders are the foundation of future development of the project.

Keywords: Accessibility, mobility-impaired, sports events, mobile application.

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1. Introduction

Live sporting events are commonly found in Australia, which has its fair share of stadiums. Sports such as soccer, rugby, and Australian football have garnered many fans, filling the tens and thousands of stadium seats. The groups of people are also diverse, which includes people with disabilities.

However, established event-based applications have lacked information about the accessibility features available in sporting venues. The specific objective of our application, NontonNyaman, is to provide a more inclusive and accessible platform for disabled individuals to have a better experience when going to live sporting events. The name of our application itself was derived from our native language, Bahasa Indonesia, which directly translates to “Comfortable Watching”, representing our application’s emphasis on accessibility and inclusivity. The development of NontonNyaman presented here is focused solely on mobility-impaired individuals. Therefore, they use wheelchairs, walkers, and other assistive technology that might require them to navigate venues differently than able-bodied people.

The overall structure of this technical report takes the form of seven sections. The following section explains our development team's background research, including on-site research in different stadiums and stakeholder interviews. The third section details NontonNyaman’s features and the development team's considerations when developing them. The fourth section details the tools and technology used in developing the mobile application. The fifth section discusses our approach to implementing security and data privacy features and our ethical considerations. The penultimate section reports our stakeholders' feedback. Lastly, we finish the report with our conclusion section, which also discusses the improvements that can be made for future development.

2. Research and Methodology

Before we developed our application, our team realised that we needed to do more research on our target demographic to justify our project’s goals and create features that our users would want.

2.1. Methodology

Our research used a mixed-methods approach. We first reviewed various literature about disabled people in stadiums. Secondly, we compare our idea with other applications in today's market. Next, we did interviews to understand our users' needs. Finally, we surveyed a nearby stadium.

2.1.1. Literature Review

Our literature review aimed to understand better the challenges faced by spectators with disabilities (SwD) (Kitchin et al., 2022) when navigating live event venues. We identified relevant studies that have brought up this topic, with keywords such as accessibility, disability, and mobility.

2.1.2. Market Comparison

We must compare our application idea to similar alternatives to better understand how our application fills in existing gaps in the market. We limit our scope of applications to event-based applications widely used in Australia's competitive market.

2.1.3. Interviews

In total, we conducted five interviews. We limited our participants to people who are or have been mobility-impaired as per our problem scope. Our team constructed open-ended questions that focused on two key aspects: their experience and challenges faced at live event venues and what features they think would be helpful in our application.

2.1.4. On-Site Survey

We visited two of Brisbane's major stadiums: Suncorp Stadium and The Gabba. Our primary purpose for visiting these stadiums was to record the coordinates of the important facilities in the stadium, such as bathrooms, exits, and ramps. The data will then be stored in the form of the latitude and longitude of each coordinate in the backend and frontend of our application for our navigation feature.

2.2. Findings

2.2.1. Literature Review

We discovered a key journal during our initial investigation that compiles a variety of research on SwD by Kitchin et al. in "Exploring the accessibility of sport stadia for people with disability: towards the development of a Stadium Accessibility Scale (SAS)". The idea that research should cover their whole experience attending stadium events, from their departure to their return home, was first presented in this journal. Several key themes are brought up in the journal, which are then backed by further research:

2.2.1.1. Accessibility Guidelines and Laws

Firstly, it was noted that studies should be directed toward adherence to accessibility regulations and laws. Similarly, (*Focusing on Disability and Access in the Built Environment: Disability & Society: Vol 13, No 3*, n.d.) has criticised public policies and practises and stated that the needs of disabled people are often not well taken into account when these places are designed and regulated.

The Mobility Assist program implemented during Super Bowl XLV was analysed in (*Facility Planning, Design, and Management of - ProQuest*, n.d.). It can be regarded as a case study that shows the effectiveness of properly adhering to a set of accessibility guidelines. In this case, it was the Americans With Disabilities Act (ADA).

2.2.1.2. Available Resources in Stadiums

The research has shown that by having additional physical and human resources, venues should be able to provide better accessibility for SwD. Supporting this view, (*Disability, Access, and Inclusion in the Event Industry*, n.d.) highlights the need for wheelchair-accessible seating, accessible communication channels, and adequately trained staff to assist SwD.

A study on soccer stadiums (Yazigi et al., 2015) revealed recurring infrastructure challenges for SwD, specifically navigation and accessing specific amenities. These findings emphasise the importance of providing better accessibility features in live events venues.

2.2.1.3. Journey Beyond the Stadium

As previously stated, recent literature has also highlighted the importance of looking beyond the experience inside the stadium. It is also important to consider how accessible SwD can be to reach and leave the venue. Therefore, factors such as available commute options, parking, and entrance queues also affect the overall experience of SwD.

2.2.1.4. Broader Accessibility Challenges and Technology's Role

Lastly, (*House of Commons - Accessibility of Sports Stadia - Culture, Media and Sport Committee*, n.d.) notes that there is a clear need for enhanced accommodations for SwD. This is because of the challenges SwD face in terms of wayfinding, effective use of facilities, and general access within stadium structures.

By adopting a holistic approach and employing standardised measures, stakeholders can significantly enhance the accessibility of sporting events for all spectators. These findings align with the purpose of our application, which aims to solve the challenges that SwD face during live sporting events. By providing a better navigation system and facilitating an effective communication channel with stadium staff during states of emergency, our application offers a technology-driven solution to persistent accessibility issues.

2.2.2. Market Comparison

We chose three of the most popular live events apps in Australia. The analysis of our competitors can be seen below:

Application Name	Advantages	Disadvantages

Ticketmaster Australia	Manages a significant share of tickets	The accessibility information provided lacks depth
	Has the bare minimum accessibility information	No dedicated feature to assist mobility-impaired individuals
Ticketek	Caters to a wide spectrum of audiences	Lacks information on accessibility
	Seamless ticket buying experience	No dedicated feature to assist mobility-impaired individuals
Eventbrite	Showcases a variety of events, such as educational and work-related events	Severely lacking information on accessibility
	Intuitive and user-friendly interface	Does not have a personal recommendation feature

Table 2.2.2.1.: Market Comparison

It is apparent from the table that NontonNyaman fills in an existing gap in today's event-based application market. So far, none of the major applications implement features that truly consider a crucial segment of their demographic. This is where NontonNyaman comes in. It provides an inclusive and enjoyable experience for people that these applications have overlooked by providing instant navigation and other accessible information about the venue.

Furthermore, it also considers the advantages of the previously discussed applications. Our development team strived to have a user-friendly application with features such as real-time updates and personalised recommendations for a better experience.

By focusing on accessibility and inclusivity, we can have a distinct value proposition that would shake up the market and overhaul the experience of mobility-impaired users during live sporting events. Our development team believes that NontonNyaman can compete with the

market that is both oversaturated yet still overlooks a vital customer segment.

2.2.3. Interviews

The interviews gave us some insight into our proposed application features, and the key findings will be discussed in this section. The interview participants will be written as A, B, and C in this analysis for anonymity, based on the chronological order of the interviews.

First, Participants B and C agreed that features such as emergency assistance and stadium navigation would be helpful based on their experiences.

For participant C, who uses a traditional wheelchair, they recommended that our mobile application should have a feature that lets them contact their guardian either by calling or chatting.

Participant A raised a valid point regarding data privacy, as our initial solution was to alert nearby people in the event of an emergency by using pinging sounds from the user's device. They suggested that our application should instead alert the stadium's staff to protect their privacy from strangers better.

2.3. User Personas

After analysing our findings from different articles and conducting interviews, our team created several user personas to better steer our developer team to our application's user experience (Matthews et al., 2012). The personas depicted in Appendix A describe our users' goals, pain points, and behaviours.

3. Proposed Solution

Unlike traditional ticketing-based applications, our live events application focuses more on features with accessibility in mind. The selected features resulted from heavy research, discussions, and, most importantly, interviews with mobility-impaired individuals, as described in **section 2.2.** This ensured that the developed features aligned with the project specifications and were features our target demographic would use.

While our team collectively conceptualised these features, I was in charge of developing user authentication functionalities. The features that were implemented in the final version of our application are detailed below:

3.1. Stadium Navigation

Detailing each stadium's available accessibility features is an essential feature of our application mockup, allowing users to navigate the stadium and quickly get the information they need. The user can start by using the search bar on the application's homepage to select their current stadium. Suppose the user wants to go to a particular facility in the stadium or locate the nearest exit. In that case, they can select it from the list of facilities that the stadium has, and a navigation arrow will appear on the screen to help guide the user.

3.2. Emergency Assistance

This feature allows users to request assistance in an emergency efficiently. After pressing the emergency button, the user is redirected to call the stadium's emergency number.

3.3. Request Assistance

In addition to requesting assistance during an emergency, we provide our users with a general request feature. The user can select from a list of the available staff members designated to help. The application will notify the stadium's staff immediately and come to the user's location.

3.4. User Profile

Next is our user profile feature, which I was in charge of developing. This feature lets users view and change their profile details, such as their name and the type of mobility-disability the user has. This ensures that should the user require any assistance the stadium staff will better understand what kind of help the user might need.

3.5. Newsletter and Accommodation Suggestion

Users can keep up with current sports news on the application's homepage. The application suggests accommodations near the selected stadium because many fans watch out-of-town games.

4. Design and Development Approach

The tools for developing NontonNyaman were chosen because they would be scalable, high-performing, and user-friendly. Our team decided from the start that NontonNyaman would be a mobile application, given our members' skills and expertise; we all had experience developing mobile applications from previous courses. Below is a detailed explanation of all the tools we used during our development of NontonNyaman and how we used them:

4.1. Prototyping

Our program of choice when creating the design library, wireframe, and high-fidelity prototype was **Figma**. Our team decided to use Figma because we were all familiar with it, and it provided a space for our design and development team to collaborate instantaneously. This made creating our application's initial design easier because I could give feedback to the design team, such that our application interface was user-friendly yet feasible to implement, given our short timeframe.

4.2. Backend Development

Our development team used **Python** as our primary programming language, with **Django** as our backend framework, and both were tools with which all development team members were familiar. I favoured using these tools when discussing with the development team. Django already provides several key modules that would help us in the developing process, such as authentication, admin panels, and ORM.

4.3. Frontend Development

The frontend team decided to use **Dart** with **Flutter** as the framework because both combined resulted in a robust environment for developing mobile applications.

4.4. Version Control

GitHub was our preferred method for version control. At the start, I was in charge of creating our GitHub repositories, as well as the initial deployment of our project. GitHub's features, such as branching, pull requests, and forking, were essential to organise our codebase. We structured our project with two separate GitHub repositories: the backend and the frontend.

4.5. Deployment

Heroku was our hosting platform because it is easy to use. We did not have to stress ourselves about the deployment process because Heroku lets us automate the deployment process whenever someone pushes to our staging branch in our GitHub repository. In addition, it was very adaptable to our project structure, which used Django and **PostgreSQL**. The entire process of setting up the deployment environment was simple because Heroku is well-documented.

4.6. Project Management and Documentation

Our team followed the **Agile methodology** to manage our project's development progress. Whilst considering our short timeframe, we decided to have weekly sprints. At the start of the sprint, we hold a meeting to delegate tasks and further discuss the features of our application based on newly gathered data. Our project manager delegated the tasks viewable on our chosen software, **Trello**. During the rest of the week, all team members do their tasks while keeping the team updated in case any roadblocks occur so that we can solve the problem collaboratively. Finally, at the end of the week, our sprint ends. We held a sprint review meeting to discuss what happened during the current sprint and if anything went wrong and plan the subsequent iterations of our project.

We did most of our meetings offline but took advantage of instant messaging apps such as **iMessage** and **WhatsApp** for quicker daily updates. Finally, we organised our documentation using platforms such as **Google Drive**, **Google Docs**, and **Google Sheets** for various stages of our development process. We kept track of important files such as interview transcripts, meeting notes, and design specifications in a centralised directory so that everyone could access anything they needed at any point in time.

5. Ethics, Security, and Data Privacy

This section highlights the ethical, security, and data privacy considerations during the development process of NontonNyaman.

5.1. Ethics

The fundamental principle we applied during the development process was ensuring that our application was as inclusive and accessible as possible. This

means that NontonNyaman does not discriminate against our users and is accessible to everyone, including those who use any assistive technology.

5.2. Security

Our development team made sure to implement several security measures throughout our application. The first measure is our choice of framework, as Django has several built-in security features. Our choice of hosting platform is another security measure because Heroku provides data encryption for sensitive information like user passwords.

5.3. Data Privacy

Our application complies with the Australian Privacy Principles (APPs) encapsulated in the Privacy Act 1988. Therefore, we make sure to gain the user's consent to collect their data, all of the data we gather is the bare minimum, and our application encrypts any sensitive information.

5.4. Risk Matrix

Throughout the planning stage in our development process, we identified several risks that could potentially happen, as well as our plans to mitigate them. These risks range from the developer team side to our software and device compatibilities, fully elaborated in Appendix B.

6. User Testing and Evaluation

To assess the usability of our application, we held user testing and evaluation sessions. This section discusses the user testing and evaluation methods, the results, and the analysis.

6.1. Evaluation Methodology

We selected five participants from various backgrounds and collected two data types for our evaluation. The first part of our evaluation method was to give the participants the final version of the application. Our team would ask the users to complete specific actions and report on their experience. The users' feedback provided us with qualitative insight into the usability of our application.

The evaluation stage was after the testing session had finished. The users were given a ten-question questionnaire that revolved around features available on NontonNyaman. The users would then answer the questions using a 5-point Likert

scale to provide us with quantitative data. The full questionnaire can be read in Appendix C.

6.2. Results and Analysis

Based on the questionnaire results, we generated a Usability Testing Graph better to visualise the overall satisfaction of our users' experience. From Figure 6.2.1, it is clear that the participants could mostly navigate and use our application well. However, the lowest score was a 3 out of 5 on the Likert scale, meaning that some improvements can be made to the application.

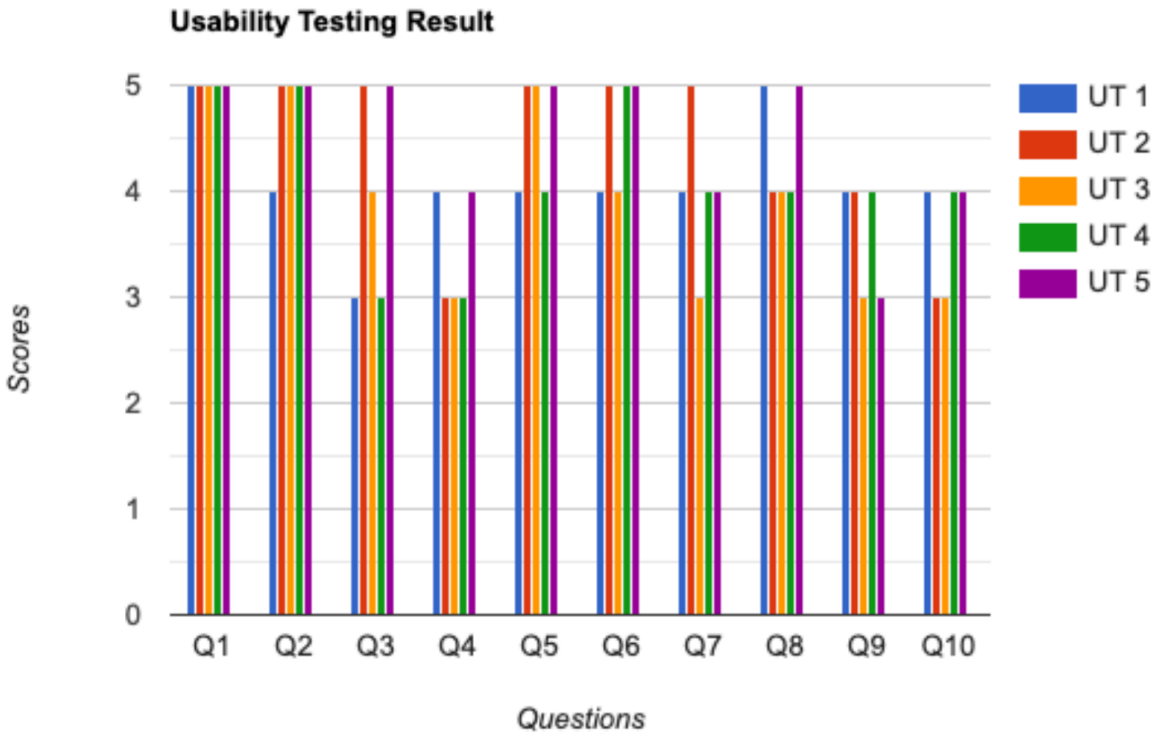

Figure 6.2.1.: Usability Testing Graph

Turning to the qualitative data, we analysed the feedback from our user testing sessions, separated based on NontonNyaman's features.

6.2.1. Homepage

Most users were satisfied with this feature as it was easy to navigate. However, some mentioned that they would prefer to have a shortcut to the stadium page, have more in-depth information on the homepage, and for the homepage to have a higher contrast.

6.2.2. User Registration and Authentication

This feature was by far the easiest for users to understand. The only critique was by one of the participants who requested to be automatically logged in after registering instead of having to log in to the application again manually.

6.2.3. Search Bar

Even though the users felt that the search bar feature was quite intuitive, they struggled to distinguish between the labels for newsletter and accommodation recommendations.

6.2.4. Stadium Page

Being one of the more vital features of our application, we are glad to report that the participants feel it is quite straightforward. Some feedback was about better navigation and a clearer distinction between the buttons.

6.2.5. Emergency Assistance

This feature was well regarded as all users agreed that this feature was necessary. However, since this feature links to getting assistance from the user's warden, the feedback we received asked for an option to contact the stadium staff directly. In addition, some were concerned about the design of the buttons, which led to this feature being unclear and lacking visibility.

6.2.6. Request Assistance

This feature was received well, with some minor feedback for future development. For example, some users would appreciate a field to add details on what they need assistance with and a chat feature for better communication with the venue staff.

6.2.7. User Profile

While most users were satisfied with the profile section, some recommended adding more useful information to the emergency contact details field.

Outside of the feature-specific feedback, while all users noted that they enjoyed the application's design and interface, aspects could still be improved for better readability and accessibility. These aspects include better sizing of text and images. However, overall, we received positive feedback on our application, with some minor suggestions. This includes new or improved features for future instalments of our application, such as a chat feature and simplification of the search bar.

7. Conclusion and Future Development

NontonNyaman aims to provide an inclusive and accessible application for mobility-impaired people to have a more enjoyable experience during live sports events. The application was crafted with extensive research and direct suggestions from our target audience, such that the features developed were aligned with user needs. With features such as stadium navigation, emergency assistance, request assistance, user profiles, and personalised recommendations, NontonNyaman is distinct in its emphasis on accessibility compared to other event-based applications. The tools and technologies provided a scalable and flexible environment, making it easier for future developments to build upon. In addition, we took different ethical, security, and data privacy considerations into account to make NontonNyaman as inclusive and safe as possible. Continuous user testing sessions and the iterative process were imperative to the development of our application, resulting in overall positive feedback from our user testing and evaluation sessions.

However, we acknowledge that there are a lot of improvements that can be made, especially considering the feedback we received. First, the stadium page should include more in-depth accessibility information. Next, adding a live chat feature would be beneficial for users to contact any stadium staff efficiently when they request assistance. Better design can be considered for future development, such as addressing issues with image and text cropping and balancing the visuals of the UI elements. Lastly, our application scope has only included individuals who have physical disabilities. For future iterations of our application, we would strive to include more disabilities such as visual, hearing, and mental disabilities. This can be done by making our application more accessible by incorporating voice commands using Siri.

We are confident that NontonNyaman has the potential to give people with mobility disabilities a better experience during live sports events. With future development and continuous user testing while incorporating user feedback, NontonNyaman can even improve.

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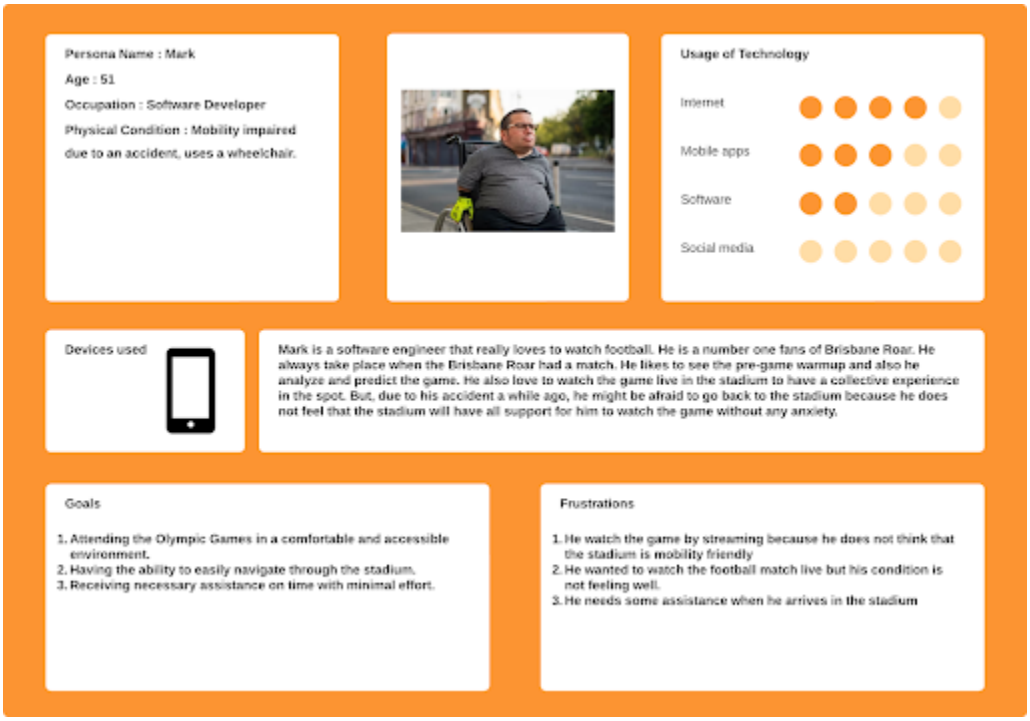
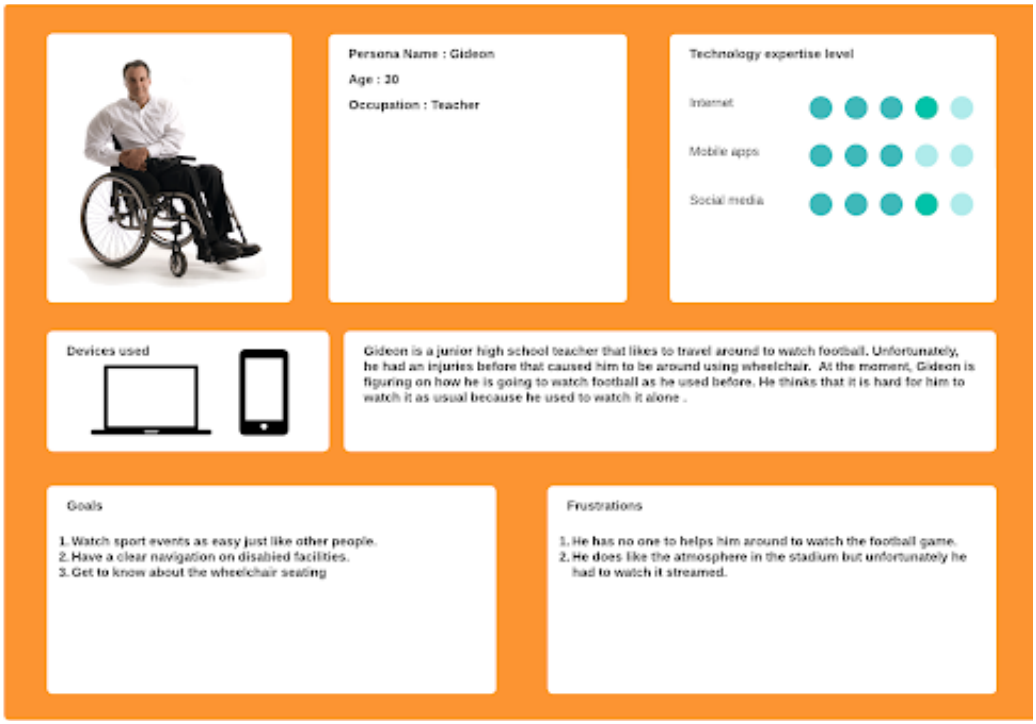
Appendix

Appendix A: User Personas



Persona 1: Mark



Persona 2: Gideon

Persona 3: Emily

Appendix B: Risk Matrix

Risk	Probability	Impact	Mitigation Strategy	Explanation
Lack of Expertise	Low	Medium	Promote an environment of learning and education among the team members.	Developers may not possess the required skill set or familiarity to comprehend the specific requirements of this user group, which could lead to the creation of an app that fails to hit the mark.
Scope Creep	Medium	Medium	Identifying a different rendition of the feature and initiating a discussion among the developers.	The project's scope might expand beyond its original blueprint, resulting in unexpected tasks, increased costs, and postponements, particularly if the initial specifications are not well-articulated.
Time Constraints	Medium	Medium	Continue performing the task in accordance with the timeline.	The issues could be further exacerbated by time limitations; the urgency to

Risk	Probability	Impact	Mitigation Strategy	Explanation
				meet a rigid cut-off date could lead to hasty work and missed mistakes.
User Testing	High	High	Consistently conduct user testing for each sprint to ensure the feature's utility.	Since the application is specifically designed for individuals with mobility challenges, finding suitable users to test its features could be challenging. If this process becomes too time-consuming, the project might face delays.
Device Compatibility	Low	Medium	Develop a comprehension of how the implementation works across different devices.	Guaranteeing a seamless user experience by making the app compatible across various devices could present challenges and potentially require extensive testing.

Appendix C: Usability Testing Results

Question	Feedback 1	Feedback 2	Feedback 3	Feedback 4	Feedback 5
On the first page of the application do you think it is easy?	Easy (5/5)	It is very easy to use (5/5)	Easy to understand for the landing page (5/5)	It easy to understand (5/5)	Yes, understand (5/5)
By using the application for the first time, do you think its easy to register and login to the application? Is every needed	Register harusnya gausah login lagi Karena lebih ribet The information of the register user is already clear.	Easy and very clear (5/5)	Easy to understand for registering an account and highlighted, (5/5)	It's very easy, to create new account and login because it's simple. The information needed to register is explained truly. (5/5)	Easy to use and understand (5/5)

information provided?	(4/5)				
On the home page, do you think that every information in the homepage is useful for you?	Detail Stadium harusnya jadi landing page ato ada shortcut dari homepage. It is unnecessary to show our profile in the homepage. The text sometimes is overflowed (3/5)	Berguna karena informatif (5/5)	Harusnya ditambahin category buat tiap cabang olahraga, The design is quite simple, easy to understand. (⅘)	It's useful for general information only, but I think it needed more information regarding upcoming match and the location. (⅗)	Yes, the news and the accomodation suggestion is pretty useful (5/5)
Do you find it is hard to use the search bar etc?	Search bar notice tp color palette nya to similar with the text and different with color palette (4/5)	Berguna tapi kalau stadiumnya sedikit lebih ke gaguna (3/5)	Search bar is not highlighted enough (⅗)	Search bar is too detailed to use. We need to write the exact stadium name instead just some key word. It will hard for people who forgot the exact name. (⅗)	Very easy to find stadium (4/5)
Is the navigation bar informative enough by only seeing the symbol?	Its clear but labeling the news is confusing. (4/5)	So far so good and easy to understand (5/5)	Its clear enough (5/5)	Everything is Ok instead of the stadium is a little bit confusing maybe. (⅘)	It is enough and compact (5/5)
Jumping to the next page on the	Its clear and easy to understand.	Already good (5/5)	Button is not really distinguishabl	It's very easy and I can find the place i	Easy as it is all below the other

stadium, do you think it is easy to look for the stadium that you wanted to go and the information stored?	Navigation is not really logic atleast the shortcut on the front page. Icon gede banget. (4/5)		e (⅘)	want to go easily and the navigation is good. (5/5)	stadiums (5/5)
Do you think that everything that is provided is informative and help you to understand the stadium?	Foto nya kurang banyak buat stadium photos. Better to know the accessibility for disabled people before arriving (4/5)	The information already enough since the user doesn't want difficulty when using it (5/5)	Information yg dishow pas navigate kurang jelas (⅗)	Yes, it's already descriptive enough but using just an arrow with no given roads can make people confuse. (⅘)	The provided stadium features is complete as well as the navigation (4/5)
Now the next feature is the request assistance feature, do you think that it is useful? By calling the warden?	It's useful and really helpful for the person that needs helps. Explanation that the warden will be for the user only (5/5)	Feature chatting will be good since the user can express what they need (4/5)	Information is not enough like what did the user through now (⅘)	Maybe before choosing the warden, user can input phone number to be contacted or live chat feature to have better communicati on. (⅘)	The redirected screen to the warden's number is fast and reliable (5/5)
For emergency assistance, will the emergency assistance be really necessary to call the warden to ask for help?	Its unclear for the button by switching the text and the button to add more understandin g that its a button. But the Idea for making this	The idea is very good but the design was just okay (⅘)	The button is clear but the button looks like a sign, if the user does not read the text they won't know (⅗)	Maybe you can change different approach for the button because it really looks like just a sign for me. (⅘)	If the situation is really emergency, why not have a feature where the staff can be called straight away rather than

	emergency is really helpful (4/5)				waiting to be accepted (⅗)
What do you think about the profile page? Are the profile needed in this case?	Add emergency contact in the profile so that it will be easier to reach their family or else. (4/5)	Just enough but can be improving the design (⅗)	Just missing the users phone numbers, add more personal information for the users. (⅗)	Add more information to the profile to make it more impactful/useful, especially for the request assistance like contact number. (4/5)	It is standard (⅘)
For the application design please give a feedback that is need to be improved	Book beforehand because it takes time, not only on the current meantime	Nothing just adding chat feature will be more useful to the user	Easy to use, due to the lack of information and the button does not look like a button, looks like a sign. It should provide more information on each page.	Try to fix the cropping of the picture and words. Sometimes the sentences/words are exceeding the box. Add live chat for assistance. Make the search bar easier to use by looking the similar words instead of the whole thing. Eg (can find The Gabba just by typing “Gab)	The rectangle that says g'day user and search bar is a big too big