Interactive Nokia Arena Application

- A Case Study of Nokia Corporation

Joel Kontro, Sampo Koskela, Emilia Malmi, Eero Mäkelä

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Joel Kontro

Sampo Koskela

Emilia Malmi

Eero Mäkelä

Business Information Technology

Thesis

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The purpose of this thesis was to develop a proposed solution for Nokia Corporation that utilizes 5G and Network as Code in the arena context. The challenge given by Nokia was titled Next Generation Stadium and the focus was to figure out what opportunities contain in the arena business for the next 3 to 10 years.

The development part of the project was done by using a five-day long Design Sprint workshop method. The workshop is divided in five different themes one for each day. The challenge began by choosing the base idea for the work, with each day developing the idea further. The team chose to develop an application for Nokia Arena to provide improved event experiences for visitors and open new possibilities commercially for the service providers at the arena.

To gain knowledge about the visitors the team used benchmarking and conducted a survey. Benchmarking was focused on smart stadiums around the world and stadiums or arenas that use an application for visitors. The survey questionnaire focused on event visitors to understand how they behave during events. During the Design Sprint week, we also discussed our plan with Nokia employee specialists and gained useful feedback that helped to shape the direction of the project.

The team developed a prototype of an application for visitors to utilize during events at Nokia Arena. The plan was to create a beneficial application for first time visitors and regular visitors. The main functions in the application were implemented based on our analysis from benchmarking and survey results. The user experience was considered during the design part and the interface graphically contain similarities with the Nokia Arena but in a unique way.

During the development week the team came up with several functions to include in the final application. Due to limited amount of time these functions were not involved in the prototype. As a team we are confident that for future development the application should be implemented with features such as memberships with benefits, book a table, queue times at services, feedback possibility and food delivery to seat.

Contents

1   Introduction

This thesis focuses on the development task assigned by Nokia Corporation, focusing on Nokia Arena. The assignment was to develop innovative solutions for next generation experiences and business opportunities in a stadium context. The goal was to come up with a solution that would benefit both Nokia Arena and their partner ecosystems, as well as the visitors.

This work outlines the collaborative team effort, using the efficient five-day Design Sprint Method. Utilizing different development methods, including benchmarking, brainstorming sessions and a widely answered survey. Consultation with Nokia's employees and the conducted survey provided invaluable data essential to the project's direction. Additionally, this work emphasizes the knowledge base such as 5G, User Experience principles and Smart Stadium concepts.

Central to this thesis is a prototype of the Interactive Nokia Arena application created using Figma, as our goal was to create a functional prototype. The concept of the prototype generated a lot of interest among potential users and was built based on the responses of the survey. This led to a decision to focus on the most desired features: event information, navigation, and food pre-ordering. As the name states, the idea was to create an interactive application that would show the user their exact location and a route on how to find their way around the Nokia Arena.

The future scope outlined withing this work offers more potential development targets and features to improve the application and give more freedom and benefits to active and new users during events. During our research, one of the biggest reason visitors may not use any services in an event setting, is that the queuing times are too long. In this future scope, our team ideated a queue time following. With this, the application would show the most active queue in each service provider and with that, visitors could plan their movement and activities around that and a rush amongst the visitors and service workers could be avoided.

Thesis begins with the client description, followed by the knowledge base and development methods based on which the prototype was created. The next paragraph introduces the prototype and what benefits it brings for all parties. The last section includes a conclusion of our work and the future scope, which contains ideas for further development. Chat GPT and DeepL Write have been used in this thesis to modify the language and grammar.

2   Project Background

This project was done for Nokia Corporation and more specifically for Nokia Arena, that is in the center of Tampere. Nokia Arena opened in December 2021. The Arena has 15 000 seats and has over a million visitors a year. Nokia Arena is a versatile experience center and in addition to events, the arena has a world-class hotel, international casino and numerous restaurants and bars. Nokia Arena hosts 140 yearly events that include different sport games, concerts, and stand-up shows. (Nokia 2023.)

2.1   Development Task

The goal of this work has been to ideate and develop an application for Nokia Arena. The purpose has been to understand Nokia's 5G opportunities in the development of the application and how this application would differ from others on the market. The purpose is to get all of Nokia Arena's services and information in one place, so that visitors have a pleasant experience at various events. As this idea developed, our attention was to determine the potential benefits of this application for both Nokia's partners and the visitors.

2.2   Design Sprint Method

During the implementation of a five-day Design Sprint week, the expected schedule for the group was understood. The division of labor for the week was slightly different than Jake Knapp's implementation. Jake Knapp's Design Sprint Method is a five-day sprint, that is divided as follows: Map, Sketch, Decide, Prototype and Test. This method created to determine how to work more efficiently and useful (Filtness 2018). Four full days were allocated to work on the project and the fifth day was for presenting the pitch and finalizing other documents. For the pitch, there were seven minutes to present the idea and show the prototype via a Teams meeting. The week started with brainstorming which led to a mind map being created (Figure 1).

Figure 1: Mind Map

The team used Figma as a collaboration tool during the development week. On the first day of the project week, the idea was refined through analysing our thoughts and opinions via mind mapping. Mind mapping helped to ideate and refine the idea. After the mind map was created, the primary focus for the first day involved a sparring session conducted with Nokia's team, collectively determining the direction for this project. As the mind map shows, the team envisioned an application to address the needs both partners and visitors of the Nokia Arena.

On the second day, two different customer journey maps were created. Customer journey maps allows to ideate visitor's experiences and to predict visitor's behaviour. Creating different personas, allows to predict more accurately their emotions and feelings based on their previous experiences. This allows us to pinpoint the different pain points and gives an idea on how to create an application that is useful for visitors and service providers. (Yasar, Mixon & Horwitz 2023.)

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Actions	Arrives at Nokia Arena and is informed about the app. Reads a QR code to open the app. Match starts in 60 minutes	Inputs seat number to the app and gets a route to their seat. Is also shown nearest wc, restaurants and merch sale. User gets his pinned location in the app to help navigate. Match starts in 55 minutes	Wants to buy fan gear before the match starts. Finds closest merch stand from the app and gets a route to it in the map. Match starts in 40 minutes	Is hungry at the first interval. Opens the app and browses through the restaurants and prices. Chooses the closest suitable restaurant and gets a route to the destination. Match starts in 10 minutes	Game/event is about to start. Customer navigates to the stand and to his seat using the route on the map. Match starts	After the match wants to talk about it with friends. Finds a suitable bar from the app and shares it with friends. Match ends
Questions they had	Which gate is the most convenient? Where is my section and seat?	Where to find this one specific restaurant? Where is the bathroom facilities? Where can I find merch sale?	How long do I have to wait?	What would I like to order?	How to find back to my seat?	What bar is most suitable for home team fans? Quickest way to get out? Where can I find a taxi?
Sentiment	"I want to find my seat" Customer is confused	The app shows a clear route Customer is relieved	Stressed about the lines	Customer is hungry and thirsty	"The match is starting, and I need to get to my seat" Customer is excited	Customer is satisfied
Opportuni-ties	Event information Interactive routes Estimated time to own seat based on location -Location info -Smooth navigation at stadium -Seat location -Nearest toilet -Explore restaurants, compare distances between Reduce queueing time, more satisfied spectators Digital ticket Book a table	Quickest way to seat and estimated time of arrival	Time window for queuing	Food and drink combo packages for bigger groups	Checks out time left to kick-off. Navigates to seat the quickest route	The map shows an outlay of the premises and where the taxi pole is or nearest bus stop

Figure 2: User Journey Map, First-timer

The initial customer journey map was tailored for a first-time visitor, while the second map was designed for someone who frequently visits Nokia Arena.

For a first-time visitor, the aim was to identify possible challenges they might encounter. Navigating and locating specific sections or seats withing a large arena often pose difficulties. As the idea evolved towards an interactive application, we wanted to focus on how the visitor could benefit from that. Not only finding your own seat but to find back after leaving to use the arena's services. Finding the way to different restaurants or restrooms on your own phone using this application would be easier than trying to find all the signs with thousands of people around. This interactive application would show visitors a live map, where the visitor would see their real-time positioning and a direct route to their desired destinations withing the arena.

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Actions	Arrives at Nokia Arena and uses the app to check where their seat is. Match starts in 90 minutes	Visits casino and goes for pre match drink Match starts in 60 minutes	Figures out where to eat this time. Pre-orders the food for the first interval. Match starts in 30 minutes	Wants to visit toilet but unsure of queueing time Match starts in 5 minutes	Navigate to seat using the map Match starts	At the first interval the app shows where to go for the preordered food. A timer shows how long there is for the beginning of the second period
Questions they had	Where is the longest lines at this moment?	How do I kill time before the match/event starts?	"Should I book a table? Is there any new offers or meal deals?"	"Where is the shortest queue?"	"Where is my seat?"	"How much time do I have to eat? Do I have time to go to the wc?"
Sentiment	Happy to be at the game Customer is excited	Meeting with friends Customer is happy	Exploring food & drinks with friends Customer is hungry and thirsty	Time is running out Customer is uncomfortable and in a hurry	Match/event has started Customer is excited	Halftime/break has begun Customer is anxious
Opportuni-ties	Event information Interactive routes Estimated time to own seat based on location -Location info -Smooth navigation at stadium -Seat location -Nearest toilet -Explore restaurants, compare distances between Reduce queueing time, more satisfied spectators Digital ticket Book a table	Routes to destinations and estimated times on queues Location info	By buying the arena products customer gains points in the application that can be used to buy food and drinks for reduced prices	Nearest route to toilet	Checks out time left to kick-off. Navigates to seat the quickest route	

Figure 3: User Journey Map, Active Visitor

While creating a user journey map with active visitors in mind, the focus was also to cater to first-time visitors. As both would have quite different experiences at the arena. As someone who knows the arena, they would also benefit from this application. The visitor can check their seat as normal and then continue to go use arena's other amenities. To make this application more enticing for active visitors, it has a pre-order option. This option allows visitors to avoid queueing and missing any of the events. Even though these options are available for everyone, regardless of how active a visitor you are, our thought was that experienced visitors would know their favourite places and would be more systematic about their own experiences.

On the second day of the project schedule, the team created a comprehensive survey using Google Forms. This survey focused on gathering more general event experiences, not only Nokia Arena's visitors, because not all the respondents have visited the arena. Each team member sent out the survey to multiple people, including work and hobby groups and close friends and families. On the project week's third day, the focus was to start to work more on the prototype. The base was already created for it and knew it would be created using Figma,

since our team's wish was to create an actual interactive prototype to show in the final pitch. When starting to work on the prototype, the team collectively all agreed that the prototype would include specific colours, which would mimic Nokia's theme. On the third day, there was also our team's second sparring session with Nokia's team, and during it we had some basic layout of the prototype to show. During the session, the prototype got great feedback and suggestions and the team continued to work on those.

As the teamwork continued with the prototype, the survey already had a lot of answers and that helped the prototype to be shaped to be more useful and helpful to potential users. On the project week's fourth and final full day, that day was for finalizing our prototype. As a part of the project week, the team also wrote a customer story that included some of the survey results, the prototype and the benefits for Nokia and end users. In preparation for the next day's pitch and presentation, the team created a presentation showcasing the final work and wrote a pitching report that included concept description. At the end of the fourth day, all the teams had a rehearsal and got feedback from this course's teachers. Feedback included mostly some refining regarding the presentation PowerPoint. After rehearsals, the team finished the presentation and rehearsed it a few times together.

As the final day of the project week was coming to an end, the team collectively decided on how the pitch and presentation is going to be divided between team members. Some took a bigger role in creating the presentation for the pitch and others were presenting it. Everyone was included in the work of the script and with that, the presentation was a success. The pitch and presentation were presented via Teams meeting. The team got great feedback from Nokia's team, and gained more confidence from it, knowing that something functional and useful have been created for Nokia Arena that would benefit both Nokia and the visitors.

3 Knowledge Base for Interactive Nokia Arena Application

This section presents the knowledge base the team gathered, relevant to the research topic and concept of the solution. The paragraph contains 5G and indoor navigation, which includes theory about the placement of base stations. Followed by User Experience, which includes points that you need to consider when building an application. Lastly, the team included how smart stadiums can improve the experience utilizing 5G and IoT technology.

3.1 5G and Indoor Navigation

5G is the latest technology for cellular and mobile networks, enabling faster and more reliable connections. Transmission speeds can increase tenfold from around 100 Mbps to 1000 Mbps. This will have many benefits for consumers, but also for industrial use, as it will allow multiple machines to be connected to mobile networks with very low latency. (Mesiä 2023.)

One potential area for 5G is indoor positioning, localization, and navigation (PLAN). The distance between 5G base stations can be very short, even within 100m. This will lead to an increase in base stations and help with signal geometry and non-line-of-sight conditions. 5G also has many features that will help PLAN. MmWave Multiple-Input and Multiple-Output (MIMO) is an antenna technology that uses multiple antennas at the transmitter and receiver. This, combined with beamforming, which maximizes signal power at the receiver by focusing data on specific users rather than a wider area, it will allow multipath signals to be used for better positioning. (El Sheimy & Li 2021; Webster 2021.)

3.2   User Experience

UX stands for user experience, and it's used to create digital experiences that are easy to use and satisfying for users. UX is not about the technology development process, but it's focused on understanding how the user interacts with the technology. It can be used for many different digital experiences and challenges that make the interactions intuitive, helpful, and enjoyable. This leads to UX being a key component in establishing customer loyalty and goodwill. (Chesnut & Nichols 2014, 7-9.)

When building user experience, it's important to start with the user and their needs and work backward from there. The goal is to provide a solution for the users' needs in a simple, effective, and direct manner. The biggest impacts on business value are simple navigation, clear content, and answers to customer questions. One of the most difficult challenges is remembering that you are not the user when building a connection between clear content and simple navigation. This means the stakeholders, designers and developers must gain insider knowledge by user research to understand their realities. User research is a process that can reveal the core user base from the potential user group and help segment them based on specific characteristics. (Kanungo & Dushyant 2022, 23-47.)

If these fundamentals are not considered when designing an application and its' functions, it's very likely that the user will be alienated from the product. This could also lead to the user sharing their experience in social media which can affect the reputation of the application in a negative way. (Chesnut & Nichols 2014, 9.)

3.3   Smart Stadium

A smart stadium utilizes 5G and IoT technology to improve the event experience for visitors, offers physical security within the venue and new possibilities for the venue owner. IoT sensors can improve stadium security, help fans find free parking and reduce the venues maintenance cost by automating ventilation and control lights based on occupancy. Connectivity is an important part of the smart stadium definition from the visitor point of view, as the fans

today expect high-speed internet access during events. (Smart Stadiums: What 5G Means for the Future of Sports 2023.)

4 Development Methods

The team used brainstorming, benchmarking and a survey when collecting research data to understand the potential customers experience during events. These methods helped the team to get a better understanding of what features the application would need to get the customers to download and use the app and improve their experience at Nokia Arena. The team was able to collect a good number of responses through the survey even though the time window was limited.

4.1 Brainstorming

Brainstorming is a very common ideation method. It was invented in an advertising agency by Alex Osborn and is best suited for small groups. It usually starts with everybody writing ideas and then sharing them with each other. It's essential that everyone's ideas are heard and built on. The goal is to come up with as many ideas as possible and wild ideas are recommended. Only after the ideation is finished starts the grouping and choosing of ideas. (Vehkaperä, Pirilä & Roivas 2013, 122.)

This project was started with a brainstorming meeting to find out what could be developed based on the challenges Nokia presented for the Design Sprint. The ideas for Next Generation Stadium, Network as Code for Nokia Arena and Network as Code Anywhere were written up. Then it was noticed that most of the ideas were related to making visiting Nokia Arena more pleasant and at the same time the visits more profitable for the service providers at Nokia Arena. This is how the idea for an Interactive Nokia Arena App was born.

4.2 Survey

When collecting data from potential users, the team decided to use a quantitative research method. The characteristic features of quantitative research include the structuring of information, measurement, presentation of information in numbers, the objectivity of the research and the large number of respondents. This method creates an overall picture of the relationships and differences between variables through numerical data. When doing quantitative research, it's assumed that some underlying factor leads to certain types of consequences in a general way. (Vilkka 2007, 13-23.)

Quantitative research is often done through a survey when collecting data because it's easy to share through different channels. It's an efficient way of collecting responses from a large

sample because each respondent is asked to respond to the same set of questions. When creating a survey, it's important that it will collect the precise data that you require to answer your research questions and achieve your objectives. Objectives and questions must be set clearly because you are unlikely to have more than one opportunity to collect the data from potential customers. The respondents must understand what you are trying to ask them, and the researcher must be able to interpret the answers. The survey works best with standardized questions that can be interpreted the same way by all respondents. With this method the results are easy to be compared and it helps the researcher to identify patterns and trends. (Saunders, Lewis & Thornhill 2009, 361-362.)

The digital survey was the easiest method for the team because the goal was to collect as much customer data as possible in a short period of time. The team decided to use Google forms as the platform because of previous experience and ease of use. The respondents answered the survey anonymously and the answer option was multiple choice including one question that had free text answer if the respondent had visited the Nokia Arena before. The survey included eleven different questions (Appendix 1) and it was kept open for one week so that the team could collect as many answers as possible before the writing part of the thesis.

The team created the survey on Tuesday of the Design Sprint and sent it to the respondents as a website link through messages and emails on the same day. Most of the respondents are from the capital region. The respondents included the team's close family and friends and co-workers who also had the option to send it forward to their acquaintances. This may lead to the objectivity of the survey suffering because the team has a relationship with the respondents. According to Vilkka (2007, 16), the recommended minimum number of respondents is 100. The team received a total of 166 responses.

4.3   Survey Results

A survey was conducted to gain information about our target group. The purpose of the survey was to understand the habits and possible pain points for a regular visitor and a first timer during events and their opinion of a possible application to improve the event experience.

The first question was asked to gain an understanding about how often the respondents attend events and therefore how reliably the answers reflect our target group. The first figure (Figure 4) shows, that 43,4% attends a couple times a year, 42,8% less often than that and 10,2% of respondents never attends events.
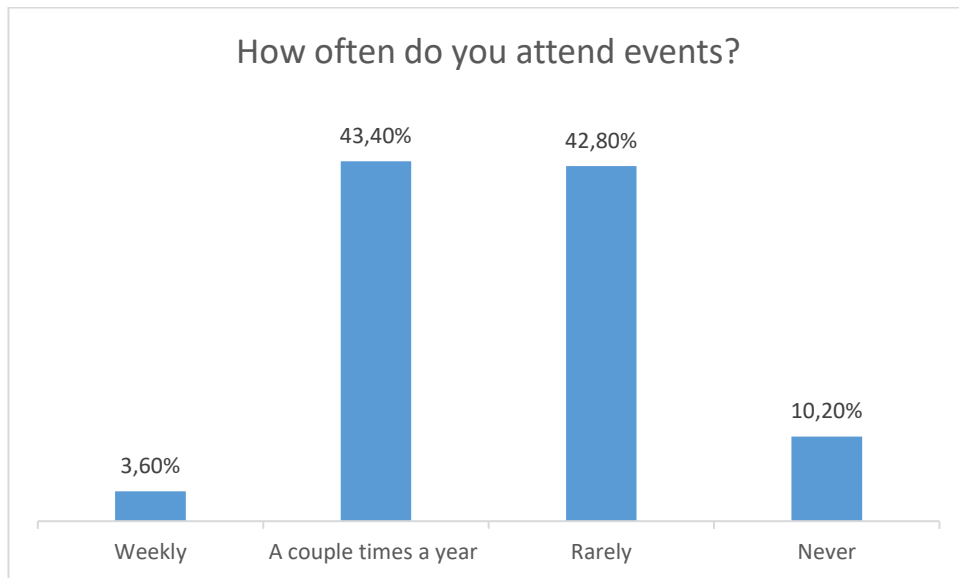
Figure 4: Attending events based on replies

Unfortunately, only 3,6% of the respondents attend on a weekly basis and therefore it is an indication that more research should be done to gain an insight about the regular visitor e.g. an ice hockey fan, who attends weekly or at least monthly.
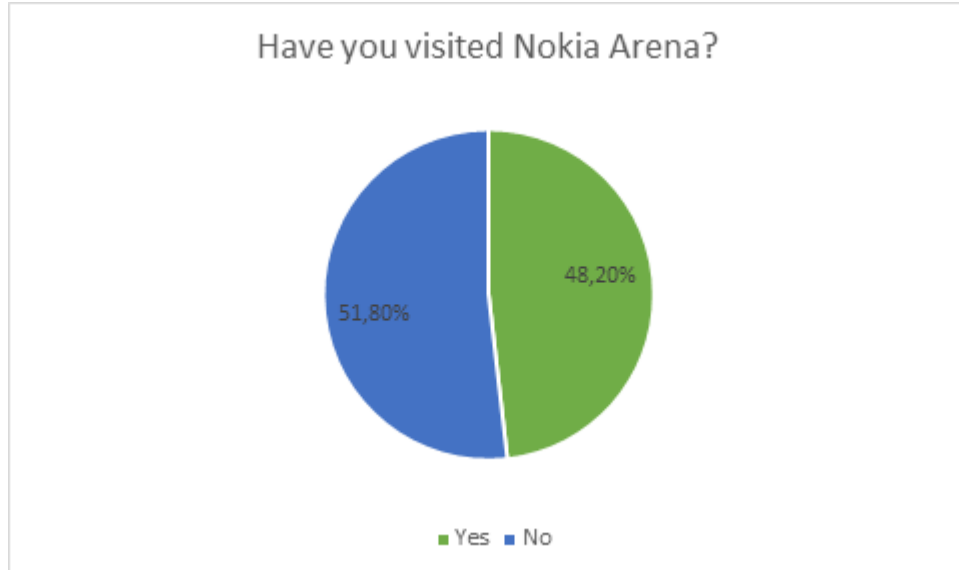

Figure 5: Visiting Nokia Arena based on replies

Nokia Arena is the center of our work; therefore, we asked if the respondent has visited Nokia Arena before. As the figure (Figure 5) shows, 48,4% of the respondents has experienced Nokia Arena in the past.
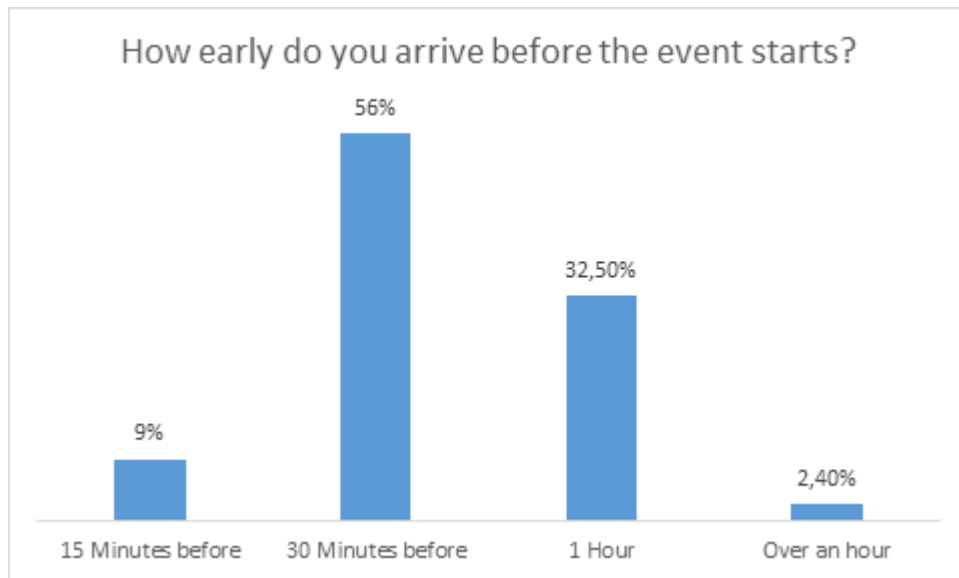
Figure 6: Arriving at events based on replies

To understand how the visitor thinks and acts before, during and after the event the team asked how early they arrive at events. The aim was to see how much time the visitors give themselves to use the services before the event starts. The figure above shows, (Figure 6) that 30 minutes to one hour is the most common time to arrive. In the next section of questions, we asked about consuming during events and what type of services the attendant prefer.
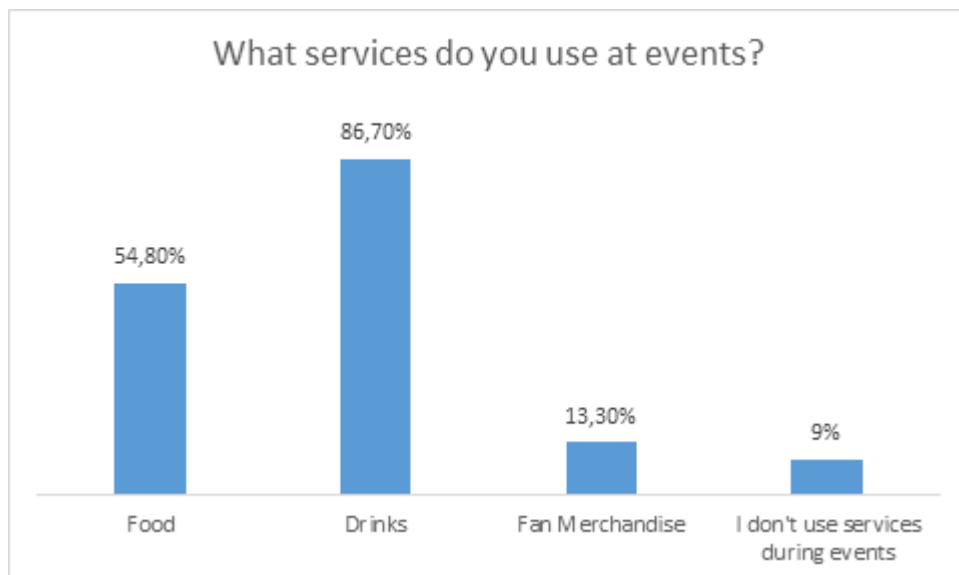

Figure 7: Services used during events based on replies

Based on the survey, food and beverage services are most used during events (Figure 7), with over 85% of the respondents buy drinks and over 50% eat during the event.
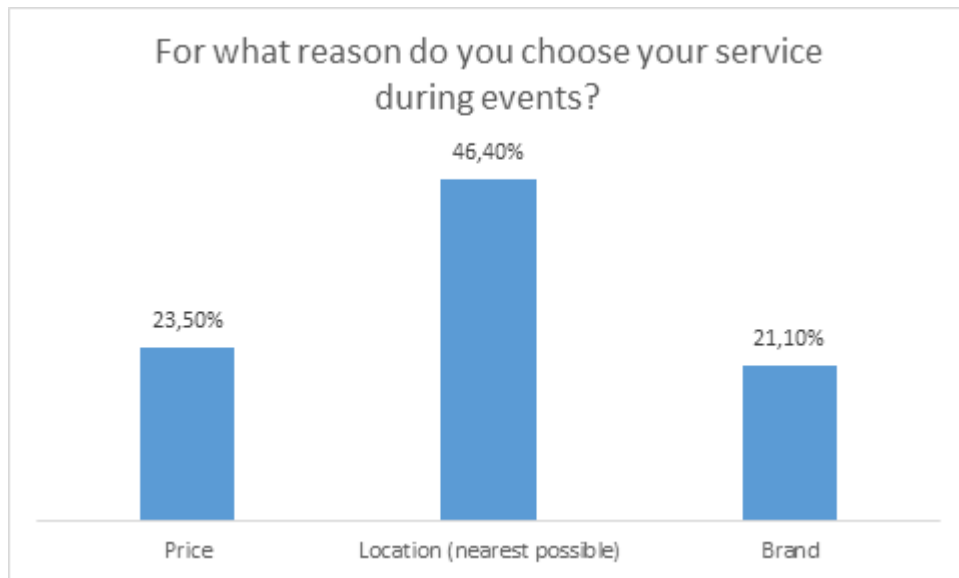
Figure 8: Reason to choose a service based on replies

It seems like the nearest location is the most important factor when choosing a service provider during events, (Figure 8) with 46,4% of answers, price being the second important with 23,5% and brand 21,1% of all replies. In this situation, the brand means that the customer has already dined at the same chain's restaurant and makes their decision based on their experience.
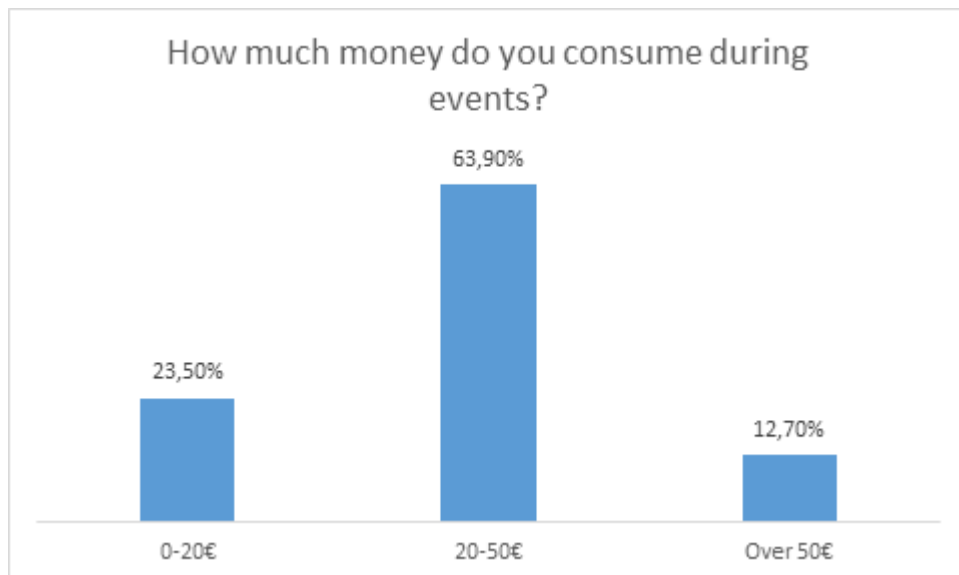

Figure 9: Using money at events based on replies

Based on the survey (Figure 9), the most common amount of money to consume during events is 20-50 euros, 13% of the respondents use over 50 euros. What prevent visitor from using services was asked next with the option to choose more than one answer. As can be seen below

in Figure 10, over 60% (63,9%) mentioned queueing as a reason, 48,8% mentioned that they do not want to miss any of the action and 34,9% chose prices as reason.
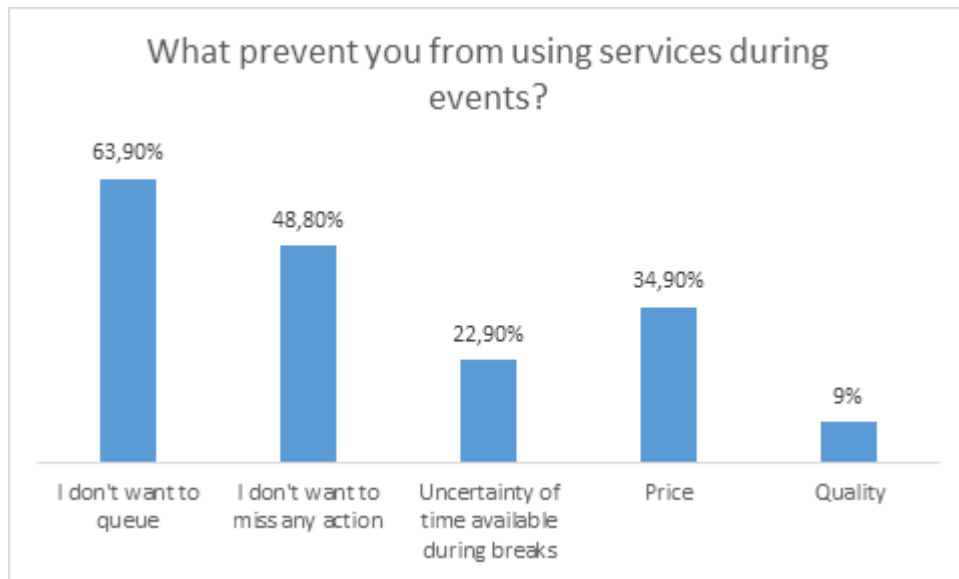

Figure 10: What prevent visitors for using services during events based on replies

In the next question the respondents had a possibility to choose three functions that they would most likely use during events. The most popular function with 60,8% of the answers was Navigation and guidance through the app (Figure 11), following menus from restaurants with 57,2% and information of queue times at services. The fourth popular answer was pre-ordering food with 44,6% of replies.
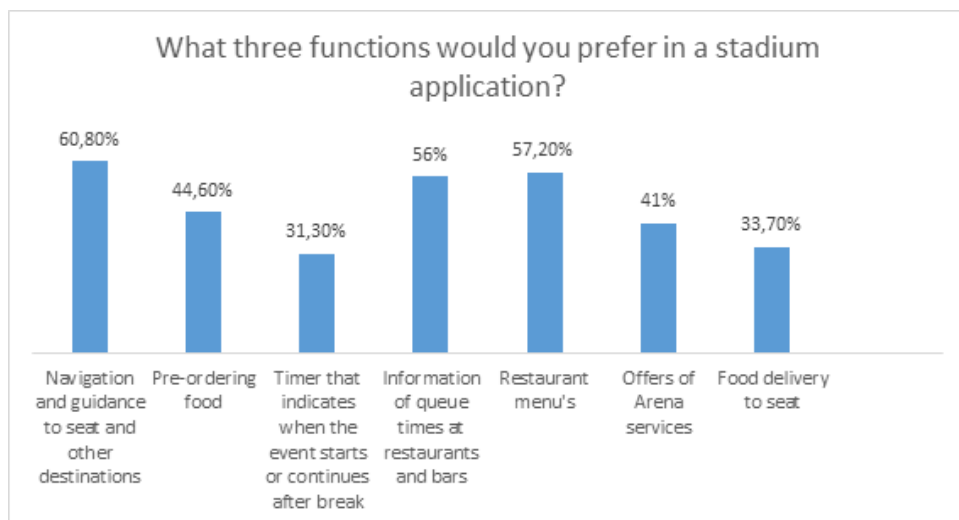

Figure 11: Functions to improve event experience based on replies

In the last section of the questionnaire the respondents had the possibility to share their experience of Nokia Arena. 64 replied and most of the comments were positive. The Arena

facilities and location were praised in many replies but also the long queues were mentioned several times. Some of the answers also mentioned difficulties in finding the right place and unclear signs that show the way at the arena.

4.4 Benchmarking

Benchmarking is a method of studying what others are doing and why they are successful. It allows you to learn from the success of companies and their products. It is best used to develop goals that can be clearly defined. First you identify what you want to develop, then you find something successful to compare it with, and then you systematically gather information about the successful product. There are many ways to gather information. Once you have done the benchmarking, analyze the results and try to apply them to your product. It is important to recognize what can be applied to your product, because some good aspects cannot be transferred to other products. (Ojasalo, Moilanen & Ritalahti 2015, 186.)

There are four different types of benchmarking. Strategic benchmarking is used to compare strategic choices made by companies. Product benchmarking is used to study successful products to create a better one. Process benchmarking is used to compare processes to change and improve the processes used by the company. Competence benchmarking is used to find out how a company's competence has been built up and how it could be developed. Out of all these types, product benchmarking was the most appropriate for this project. (Niva & Tuominen 2021, 12-15.)

The process of benchmarking can be presented in many ways. One way to do so is to use a 10-step-process. This can be used to develop many different things from products to competence of personnel. (Niva & Tuominen 2021, 33–35.)

1. Define a benchmarking target

2. Identify companies to benchmark

3. Measure the difference in performance

4. identify the factors behind success

5. Learn how we do it

6. Learn how they do it

7. Set goals

8. Apply and implement

9. Establish and develop further

10. Start the process with new goals

Figure 12: 10-step-process for benchmarking

4.5   Benchmarking Results

After the brainstorming session and based on the survey result it was decided to focus on an app that would help visitors navigate the venue and enhance their overall experience. The app should also benefit the arena and its service providers. The selected applications for benchmarking purposes were OVO Arena Wembley and Gatorade Center. Due to being unable to attend events at the venues, some of the findings may have inaccurate results. The apps and their features were researched and tested and compared to the team's vision for the Nokia Arena app. The pros and cons of the applications are listed in Table 1.

Benchmarking targets	Pros	Cons
OVO Arena Wembley	• Promoting events • Ticket Purchasing • Ticket resell • Ordering food and drink • Food and drink delivering (only suites) • Automatic seat location based on your ticket	• Navigation at the venue was not found • Must register to two systems for tickets
Gatorade Center	• Upcoming events • Food, Drink and Merchandise ordering • Order delivering to your seat • Forced seating input at the start of the application • Tickets can be purchased through a link in the app	• No navigation or map • No automatic seating information based on ticket

Table 1: Benchmarking results

Wembley Arena is an indoor arena in London next to the Wembley Stadium. An app called OVO Arena Wembley is available for it, which is said to combine tickets, food and drink ordering and an arena map and a seating plan. When using the app, the existence of the arena map or seating plan was not confirmed, so those might be only available with a ticket registered in the app. The app promotes upcoming events at the arena and tickets can also be purchased through the app, but this requires registration to two different services. You can also resell your ticket through the app. From the bottom of the app, you can navigate to four different views: Home, Events, Shop and Wallet. Home has information about allowed bag size, upcoming events, access to tickets, food and drink ordering and essential information. Events has a list of upcoming events. In the Shop view, the user needs to set a location and after that, it is possible to place orders. If your seat is in the suites, you are offered the possibility to order food for delivery and if you have a ticket in the app your location will be set automatically but otherwise you must set it manually. In the wallet you can access your tickets, orders, and ticketing support. (OVO Arena Wembley 2023; AEG Europe 2023.)

The Gatorade Center is the home arena of ice hockey team TPS and it's located in Turku. The Gatorade Center app can be used to order food, drinks, and fan merchandise straight to your seat. The app can be used from any part of the stands. At the very beginning the app asks you to register or log in. After that you must fill in where you are sitting, and the app will automatically save your seating information for future use. From the bottom you can access the apps five different views: Events, Stand Restaurant, Burger, Products and Wallet. The Stand Restaurant view is used to order drinks and it has categories for different kinds of drinks. After deciding on the drink, you can choose the amount and then pay for the order. The Burger and Products views work the same way but for food and merchandise. From the Wallet you can see your orders and tickets. On the top row the app shows buttons for your seat, search, and menu. From the menu you can access your payment methods, users' information, contact information for the arena and information about the app. (Gatorade Center 2023; Livelaboratorio Oy 2023.)

The benchmarking gave us a lot of information about event venue apps. Most surprising was that they are not as common as they could be. The benchmarked apps had good features that we thought could also make Nokia Arena more pleasant to visit. When the biggest gripe people have in most big events is queuing, an app to reduce it sounds very welcoming. Because of that the food ordering seemed like a necessary feature for the app. It was not considered necessary to have the orders delivered to customers' seats because that would require personnel to do and maybe cause inconvenience to other visitors. It would also not take long for visitors to fetch their order without queueing. Also there seems to be very little development put into navigation with an app in big arenas. With 5G you can produce very precise positioning indoors. It would make it easier and faster for customers to find their seat and services. That would also leave them with more time to use the services and that could lead to more purchases at the venue. Combining these features would be good for both the customers and the service providers at the arena.

4.6 Findings

After the survey was completed, the team observed the data and discussed how to utilize it efficiently in the project. Every team member did their analysis and observation individually and then shared their opinions and key points that were collected from the data.

As a conclusion, the main pain points that the team found out was that first time visitors might struggle to find their seat at the arena and long queues might prevent visitors from buying food or beverages at the arena. The information about the event should be found in one place and the visitor should have the possibility to explore options without the need to queue. Based on the results, over 55% answered they arrive 30 minutes before and over 30% answered they arrive one hour before the start of the event. Just 2,4% answered that they

arrive over an hour before kick-off. Based on the result, this customer group could benefit from the application by pre-ordering food and drinks and use their time more efficiently at the arena, potentially consuming on services and spending less time in queues.

Based on our benchmarking and survey results the navigation function could also be beneficial for event visitors, especially people who visit for the first time. Feedback from the survey contained a few mentions of difficulties to smoothly find the right place at the Nokia Arena. With the help of an application in a fully crowded arena environment, the help to find the route from your seat to your favorite restaurant could possibly save time and improve the visitor's experience at the arena. For the first timer the possibility to get familiar and explore the Nokia Arena with an interactive map before an event starts could be useful for getting to know where the restrooms and services are and what is the shortest route to the destination. The fact that Nokia Arena consists of several floors this feature could benefit the service providers as well, as the exploring of the stadium become easier for the visitor.

All team members agreed and considering our brainstorming, benchmarking and survey replies the team decided that the functions that need to be included in the prototype to improve the event experience is the interactive map to help event visitors to navigate at the arena easier and faster. The possibility to pre-order food during events would benefit the visitor and the service provider as the visitor can avoid queue too long and the service provider possibly getting more sales or at least preparing food for the customers can be served more through the event and less focusing on breaks and time before and after the event. The event information including important times during events and the order status must be included in the work.

5 Prototype

The design of the prototype began on day three of the sprint week. The team used Figma to create mockups of the prototype. To move further and develop the idea at this point the solution included three main functions for the event visitor. Pre-order, virtual queue number and navigation. The purpose is that the application includes useful functions for the first-time visitors and regular visitors. The prototype was created for Nokia Arena which is located at Tampere, Finland.

5.1 Landing Page, Seat Number and User Views

After downloading the application on the smartphone, the user has two options to continue in the application. Logging in and signing up includes all available functions such as pre-ordering, queue status of orders and the step-by-step navigation with interactive map. With *continue as a visitor* option, the visitor can use the interactive map function and gain access only

to event information such as important times of the event, menus, and information about opening hours (Figure 14).
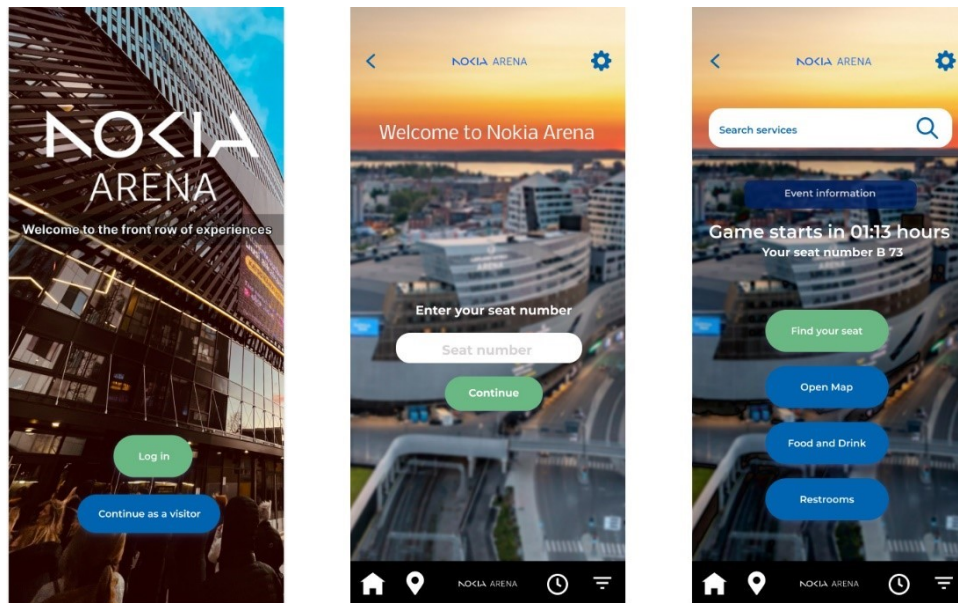

Figure 13: Landing page, login, and user

By entering the seat number, the user logs in the Nokia Arena application and the user view page opens (Figure 13). This page is where the user navigates through the sections in the application. The page includes search function, seat number information and kick-off time of the event or match.

5.2   Arena, Map and Service Views

As the event visitor arrives inside the fully crowded arena and opens the application, after few simple steps and choosing *Find your seat* option, the arena view page opens and locates the visitors seat at the arena. By choosing the *Navigate* option, the application shows the visitor the shortest route to the seat and the navigation page opens that include full guidance with estimated time of arrival.
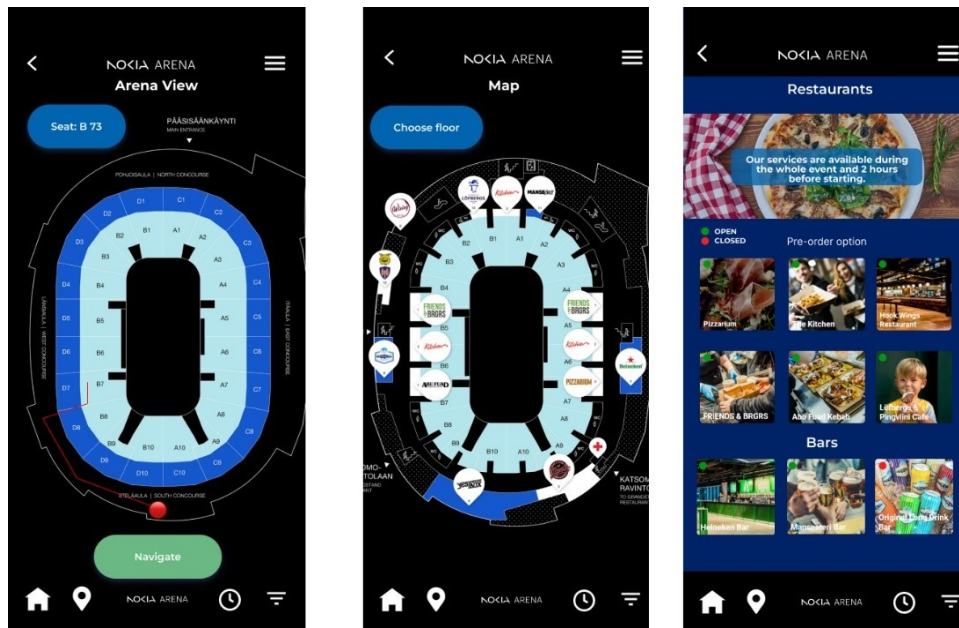
Figure 14: Arena, map, and services

The map view includes all services at the arena including restrooms where the user can explore options and locate the service location quickly. As can be seen on the restaurant page, the services can be easily explored. The green and red dots indicate the availability of the services at given time (Figure 14).

5.3   Menu, Restroom and Order Views

Information on meals and prices can be found on the menu page. The visitor can pre-order or locate the service on a map or join the queue. The nearest restroom can be located or navigated to from the restroom page, shown in the figure below (Figure 15).
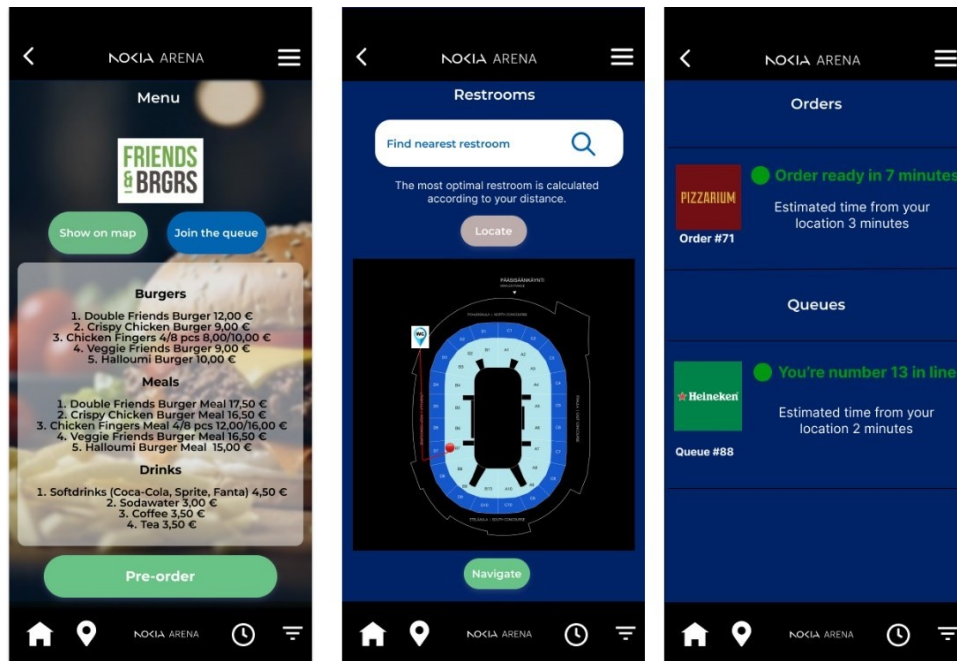
Figure 15: Menu, restrooms, and orders

The visitor can follow the state of orders or possible queues on the orders page. The time re-
maining for the order to be ready and estimated time to pick up the order can be followed
from this page and the visitor can avoid queues (Figure 15).

5.4   Navigation, Event Info and Pre-order Views

As can be seen in the figure below (Figure 16), the navigation function performs step-by-step
guidance to destination. The event information page offers all relevant information for the
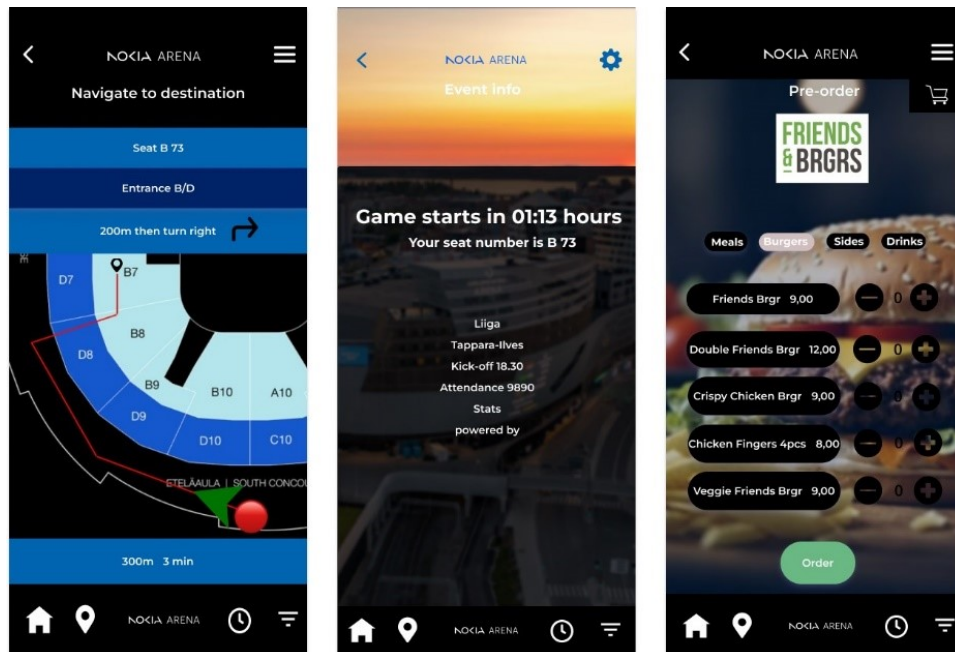visitor. At sporting events, this page could include match statistics with implementing API.

Figure 16: Navigation, event info and pre-order

Exploring contactless menus and pre-ordering food with the application and following order status in real-time makes a difference for event visitors as the application notifies when the order is ready for pick-up. With the location function, the application gives an estimated time of arrival to the pick-up point based on users' location at the arena.

6   Next Steps in Development

To look further at development, in this section can be found solutions and ideas on how to meet smart stadium visitors' expectations in the future with the help of an application. The solutions are based on the team's brainstorming, benchmarking, and survey results. The team picked key features to be considered for the next steps in developing the application.

Due to most respondents' residences being located in the capital region, Nokia Arena could conduct a similar type of research in Tampere. This would bring more insight into active local visitors and their experiences and needs.

Making the solution possible would require Nokia Arena to build an application or outsource the service. By outsourcing the application Nokia Arena can free up valuable resources for other tasks. Nokia Arena would save money in the long run because they wouldn't need to hire an entire staff to develop and maintain the application. Using this type of service could also improve the quality of the product because they have the competence and experience in building one.

6.1 Book a Table

Due to the wide selection of restaurants at Nokia Arena, the application could make it possible for users to reserve a table in advance and during or after the event. In this case, users can dine in peace and don't have to travel around the arena looking for free tables. This would ensure the users access to food and beverages, which would bring Nokia Arena's services guaranteed sales. With the data collected from bookings through the application, Nokia Arena and its partners can optimize their seating layouts and make the service more predictable. By making the service more predictable, restaurants can plan their staff better and minimize food waste.

6.2 Food Delivery to Seat

The food delivery to seat feature gives the users an opportunity to order food and non-alcoholic beverages straight to their seat for an additional fee by using the application. This enables a better experience during the event because the users can enjoy the entire event without leaving their seat. As found out in the survey, many respondents don't use the services because they don't want to miss any of the action. The users also don't have to stress the continuity of the event and long queues or getting lost when using this feature. Navigating through the Nokia Arena would be easier because the routes and services wouldn't be as crowded.

6.3 Queue Times

With this feature, the users can see the lengths of queues for all services, including entrance gates and toilets. They can plan their activities better even before arriving at the arena and during the event. When choosing a service or toilet they can choose the best possible option in terms of time use. The plan was to monitor the length of the queues using sensors or thermal cameras that send active data to the application. This would distribute the crowd more evenly around the services and toilets, which would lead to less crowds in certain areas and easier navigation. Such service providers are already available and in use in Kaseya Center and Los Angeles Dodgers stadium. (WaitTime 2023.)

6.4 Customer Feedback

To improve the Nokia Arena experience after the event is by giving the users the opportunity to give feedback through the application. This gives users the opportunity to have an influence on the experience and Nokia Arena would be able to improve its operations through customer feedback. To know the users for e.g. at the hockey game, can give valuable information of how certain groups act, want to eat, and drink during events. The possibility to customize events and service supplies can make an impact on sales and revenue at the event.

This also improves Nokia Arena's relationship with the users and shows that they are being listened to.

6.5   Memberships & Payments

With the help of an application there are several ways to improve the event experience. Commercially the application can offer users customized ads and offers related to the event. The more the visitor uses the arena's services, there could be a rewarding system point that would inspire visitors to use more services. By creating a profile for visitors, every receipt could be digitalized, instead of a paper receipt. As Nokia Area is cashless, they offer a service where the visitor can download cash to an Arena Food & Beverage-card that is valid for a year and cannot be changed back to cash. Visitors can do this in a cash exchange point or in the Casino. To avoid extra cards that visitors need to carry, this card could be included in this application.

6.6   Benefits For Nokia and Event Visitors

For this project, our team's mind was on how to create a beneficial application for everyone. This includes the service providers, workers, first-time and regular visitors. Providing the visitor an easy solution to find all event information such as seat and section number, when the event is starting, navigation function to find restaurants and pre-order option in one place improves the visitor experience and makes it more time efficient. The visitor would be able to avoid queueing times and enjoy the event to the fullest. Benefits for visitors would be efficient and smoother experience.

For Nokia Arena and their service providers, the benefits would be more potential customers with the pre-order function, repeat customers and easing the rush for service workers. This application can bring all the service providers to one place, and it would increase the visibility of the services. With the pre-order option, Nokia Arena's service workloads are distributed more evenly and not only during breaks.

7   Conclusion and Future Scope

The purpose of this thesis was to develop an application for Nokia Corporation that utilizes 5G and Network as Code. The work was done by using a five-day Design Sprint method. The idea was to create a prototype of an application for Nokia Arena, based in Tampere, Finland. The main goal was to improve the event experience for visitors and provide new opportunities for service providers. The team brainstormed ideas and solutions to improve the visitor experience at events. As the work continued, the focus moved to the service providers at the arena

and how they could benefit commercially from the application. The challenge was to ideate an application that benefits both parties, event visitors and service providers.

To gain an understanding of the potential event visitors the team created user journey maps of two different types of visitors, first timer and regular visitor. The team benchmarked stadiums around the world that offers an application for visitors. The focus was to understand what functions these applications include. In the next step the team conducted a survey that focused on event visitors. The aim was to understand how the visitor thinks and what the pain points are during events. The survey received a total of 166 responses, but more research should be done on the solution. The target should be residents of Tampere, who are more potential active users.

The pain points were considered during the design phase and the team tried to create a solution that benefits the visitor. To make the experience more fluent for visitors, the team concluded that a navigation function in a fully crowded arena could benefit the visitor and make the experience potentially less confusing. By pre-ordering food and following order status leads to less queueing and leaves more time to focus on the event. All relevant information should be found in the application that can be helpful for visitors before, during and after the event.

To solve visitors most common issues a FAQ Chatbot should be implemented in the application in the future. A Chatbot recognizes questions that are usually asked about services, arena premises, ticketing, parking and offers advice to visitors during events. A FAQ Chatbots are based on artificial intelligence (AI) and natural language processing (NLP), and the response times are fast (Wroblevski 2023). The bot operates based on the question-answer format that is a user-friendly way and replicates a real conversation (Wroblevski 2023).

These types of applications already exist around the world. Based on the responses from the survey, there is a demand for this type of service, and It's assumed that in the near future similar solutions will become more common during arena events.

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Figures

Tables

Appendices

Appendix 1: Survey Questions

Nokia Arena interaktiivinen karttasovellus

Nokia Arena kartta applikaatio, joka auttaa navigoimaan paikasta toiseen ja tarjoaa käyttäjälle ajankohtaista tietoa jonotusajoista, sekä nopeimman reitin haluttuun kohteeseen (oma paikka, wc, ravintolat, fanitilat, info, mahdollisuus ennakkotilauksiin ja pöytävarauksiin

:::

Kuinka usein käyt areena tapahtumissa? esim. keikat ja urheiluottelut *

○ Viikoittain

○ Pari kertaa vuodessa

○ Harvemmin

○ En ikinä

Mitä palveluita käytät tapahtumissa? *

☐ Ruokailu

☐ Fanituotteet

☐ Virvokkeet

☐ En käytä tapahtumissa palveluita

Kuinka ajoissa tulet paikalle ennen tapahtuman alkua? *

○ 15 min ennen

○ 30 min ennen

○ tuntia ennen

○ yli tunti

Millä perusteella valitset palvelun tapahtumassa? *

◯ Hinta

◯ Sijainti (lähin mahdollinen)

◯ Brändi

◯ Muu…

Kuinka paljon rahaa käytät tapahtumissa? *

◯ 0-20€

◯ 20-50€

◯ Yli 50€

Mikä estää sinua käyttämästä tapahtumien palveluja? *

☐ En halua jonottaa

☐ En halua olla näkemättä osaa pelistä/esityksestä

☐ Epätieto tauon pituuden riittämisestä

☐ Hinta

☐ Laatu

☐ Muu…

Tapahtuman päätyttyä, kuinka nopeasti lähdet areenalta? *

◯ Ennen tapahtuman loppua, välttyäkseen ruuhkalta

◯ Heti tapahtuman päätyttyä

◯ Odotan ruuhkan vähenevän

◯ Jään vielä nauttimaan palveluista

Kuinka todennäköisesti lataisit applikaation, joka parantaisi areena tapahtuma kokemusta? *

	1	2	3	4	5	
Epätodennäköistä	○	○	○	○	○	Todennäköistä

Mitä kolmea ominaisuutta todennäköisesti käyttäisit Nokia Arena applikaatiossa? *

☐ Opastus istumapaikalle ja muihin kohteisiin (reitti ja arvioitu matkan kesto, interaktiivinen kartta)

☐ Ruoan ennakkotilaaminen

☐ Ajastin kertomaan tapahtuman jatkumisesta

☐ Tietoa ravintoloiden ja baarien jonojen pituudesta

☐ Ravintoloiden hinnastot

☐ Tarjouksia Arenan palveluista

☐ Ruoan toimitus istumapaikalle lisämaksusta

Jos tapahtumissa tehdyistä ostoksista saisi etuuksia tulevaisuudessa vaikuttaisiko se ostopäätöksiisi tapahtumassa? *

○ Kyllä

○ Ei

○ En tiedä

Oletko käynyt Nokia Arenalla? *

○ Kyllä

○ En

Jos olet käynyt, millainen kuva sinulle jäi kokemuksestasi?

Lyhyt vastausteksti