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Opleiding Informatica

Experience of events

with data

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Abstract

More and more data has become available each day. This also applies to events. During events, data for security, data for the organiser and data for the visitors can be used to give the specific stakeholders the right information. This thesis focuses on the information that is available for the visitors, to increase the interaction between the visitors and the event.

Our focus is on the finish of the Volvo Ocean Race in The Hague in 2018. This will be an event where many visitors want to see what is happening during the sailing race. This can be hard for them, since sailing is a sport that is hard to follow. Therefore, we decided to give the visitors a second screen, on their mobile device, where they can follow the race. To make it more fun, a gamification element is added; visitors can guess which boat will be at the next buoy firstly, in order for them to earn points and prizes. This idea can be used at other sports events where the location of the athlete is tracked. Although data about the performance of the athletes is not always available, data about the location is neither very private nor sensitive. In consequence of that, the idea given in this thesis can be carried out.

The concept of gamification can be used at all kind of events, and the main recommendation of this thesis is to increase the interaction between the visitors and the event by using gamification for that reason.

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Contents

Chapter 1

Introduction

The Hague will be the host of the finish of the Volvo Ocean Race 2017-2018. There will be a big event of six days around the arrival of the participating yachts. The organiser of the event expects approximately 400,000 visitors.

During a big event like the finish of the Volvo Ocean Race, a lot should be taken into account and many stakeholders would like to get certain information. More data becomes available every day. This also applies to events. For event organisers it can be of added value when they have a standard environment with this information, for instance weather data, data about crowded areas and data where possible first-aid is needed. Different stakeholders can use this environment for every event. There is already an environment that can provide information for these stakeholders, called the EventCloud. The current EventCloud gets its information mainly from people in the festival area that manually give the status of the ambience and the status of how crowded the area is. The EventCloud is an idea of event organiser Prooost, telecommunications company KPN and several other parties, so different parties are involved in the project.

As mentioned above, there are many stakeholders that would benefit from getting certain information, so this project is part of a bigger project. The focus of this thesis is the visitors as a stakeholder. The visitors want to feel involved with the event. In other words, the visitors want to interact with the event. Therefore the research question of this bachelor thesis is:

"How can we use data to increase the interaction between visitors of a big event and the event itself?"

This bachelor thesis is divided into two problems. One part of the problem is about how the interaction can be increased at the finish of the Volvo Ocean Race. The other part is about how the interaction can be increased at big, public events in general.

To give a solution to the problems, the main research question is divided into sub-questions:

1. What has already been done at big events to increase the interaction?
2. Why is sailing a sport that is difficult to follow or understand?
3. Which data is available from sailing yachts and their surroundings?
4. What can we do with this data?
5. How can we use the findings at events in general?

The aim of the research is to make a recommendation on how we can increase the interaction between the visitors and the event by using data. The information will be sent to the visitors via second screen elements in a mobile application of the event and therefore the focus is on increasing the interaction by using the event application. The thesis is divided into two parts. The first part gives an example of a second screen element for the Volvo Ocean Race and is worked out by using information from applications of other big events. The second part discusses what we can do with the findings of the first part to increase the interaction at events in general.

In Chapter 2 we give background information about the Volvo Ocean Race and about the EventCloud. In Chapter 3 we explain the approach taken. After that, we discuss related work on interaction at big events, including an analysis of applications of different events, and work on difficulties of (understanding) yacht sailing in Chapter 4. Thereafter, the concepts of second screen and gamification are discussed in Chapter 5. In Chapter 6 we give an overview of available data of sailing yachts and how this data can be applied to give spectators more insight in a sailing race. Subsequently, Chapter 7 discusses how the findings of Chapter 6 can be used at other events. Finally, Chapter 8 concludes the research and discusses the limitations and explains what can be done in the future.

Chapter 2

Background Information

This Chapter contains background information on the Volvo Ocean Race and on the EventCloud. We discuss the Volvo Ocean Race because this is the event we are partially looking at in this thesis and we discuss the EventCloud since this is the platform that is the foundation of the project.

2.1 Volvo Ocean Race

The Volvo Ocean Race is a sailing competition around the world. The race is held every three years and the first edition was in 1973 [1]. Just like the seven editions that followed, the first competition started in England. From the very beginning the yachts have been improved. They became faster and also technology evolved. The last four editions started in Alicante, Spain [1]. An innovation of the race is that every yacht has an onboard reporter. These reporters are the link between the boat and the shore. They make videos and photographs and they try to tell the story in an interesting way [2].

The route for the race in 2017-2018 will consist of approximately 85,000 km divided over 11 legs [3]. This race starts in Alicante again and finishes in The Hague, The Netherlands.
During the race there are in-port races during the stopovers. Points that can be achieved during these races also contribute to the final number of points per team. When the yachts enter The Hague, there will be in-port races as well [4].

2.2 EventCloud

The EventCloud is an information environment that can be used during public events in the public space of every city in The Netherlands. The EventCloud tries to make events more safe and more profitable. The goal of the information environment is that it can collect any kind of data and that it can process and distribute the data to the stakeholders that need it. Since there might be some information that is not meant to be public,

certain information is open and other information is private. An example of a functionality of the EventCloud is the EventDashboard. The organizer of an event gets an overview of the event as a whole. There is a heatmap that indicates the busy places and the ambience in the different areas. There is also a mobile application with a crowd indicator for the visitors of the event. Additionally, this application consists of all the relevant information for the visitors. Another functionality is the application for security.

The project of the EventCloud is one where several interested parties are involved. The idea of the EventCloud came from Prooost, KPN and several other parties [5].
Prooost is an event organiser of cultural and sports events in The Hague. They organise for example the annual LIFE I LIVE Festival during Kingsnight and Kingsday in The Hague [6]. Prooost also owns The Hague Beach Stadium. This is a stadium where almost all annual Dutch Championships of beach sports take place [7].
KPN is a supplier of telecommunications and ICT-services. KPN is involved in the project to create a lower threshold when scaling up, since all municipalities in The Netherlands are using the KPN network [5].
The municipality of The Hague also supports the project to be able to eventually come up with a reusable platform that can also be used in other cities than The Hague [5].

The EventCloud has already been deployed during some events in The Netherlands in 2015 [5].

Chapter 3

Methodology

To be able to answer the main research question: "*How can we use data to increase the interaction between visitors of a big event and the event itself?*", we divided the main question in five sub-questions:

1. What has already been done at big events to increase the interaction?
2. Why is sailing a sport that is difficult to follow or understand?
3. Which data is available from sailing yachts and their surroundings?
4. What can we do with this data?
5. How can we use the findings at events in general?

To answer the first sub-question, we mostly looked into features of mobile applications of big events. We analysed the applications of Lowlands (a festival in The Netherlands), the Giro d'Italia and the IAAF application (the application of the athletics federation). To get an insight on what has already been done in applications of sailing events, we looked into the applications of the Volvo Ocean Race and the America's Cup. By analysing these last two applications, we can also partly answer the third sub-question.

To answer the second sub-question, we looked into a paper and an article. First of all we used a paper about the relation between the self-esteem of a student and their perception of how difficult they think sailing classes are. Secondly we read an article about sailing at the Olympic Games and the changes the Olympic Games made to make the races more interesting for people to watch. In this article they also give reasons why sailing is hard to follow.

To answer the remaining part of the third sub-question and a part of the fourth sub-question, we went to the Sailing Innovation Centre in The Hague. They shared their ideas on how they think that sailing races can be more interesting to a wider audience, so they also gave some inspiration on how we can answer the fourth sub-question. We also talked with someone from Steam Ocean Racing to get more information on what data is available from the Volvo Ocean Race yachts.

To answer the fifth sub-question, we looked at how the ideas we came up with for the fourth sub-question can be used at other events. We mainly looked at sports events, so we looked at sports where the idea of the fourth sub-question can be used or partly used.

To eventually answer the main question, we made a prototype of a mobile application (for iPhone) that can be used during the Volvo Ocean Race or sailing events in general. The aim of the application is to make a sailing race more fun for the spectators. To make the prototype, we used Apple Xcode (Version 8.2.1). Xcode is a developer program to make applications for all Apple devices, like Mac and iPhone. There are two programming languages we can use for making iPhone applications; Objective-C and the relatively new language Swift. We used the third version of Swift since it is an easy language to understand and to read, and it is also the faster and safer option. A nice advantage about using Xcode, is that we can build and run the application anytime we want (as long as there are no errors) in a simulator or on a real device that is connected to the computer. A disadvantage of the approach taken, is that it is not very easy to convert the application to an Android application.

More about the way in which we built the application and which steps we took, is discussed in Chapter 6, Section 6.3.

Chapter 4

Related Work

This Chapter discusses work that is related to the topic of both interaction at events and difficulties of understanding yacht sailing. In the first part, Section 4.1, we discuss a paper about the user experience of a mobile device at big events. In this part current applications of big events are also analysed. In Section 4.2 we discuss why sailing is a difficult sport to understand and to learn according to a paper about self-esteem and learning sailing, and what the Olympic Games did to make the sailing races more attractive for the spectators.

4.1 Current interaction at big (sports) events

Some research has already been done on the topic of interaction at sports events. An example is the paper by Xu Sun [8]. In this paper, a case study about user requirements and user acceptance of a mobile device at big sports events is discussed. He says that technology is playing a more important role in sports. Think of (slow-motion) replays of a goal or a foul in a football match. What should be taken into consideration is the fact that it is not necessarily good to give the users of a mobile device many features. It is better to give the user the most needed functions only. In his paper, Xu Sun mentions that there are several problems regarding the user experience of a mobile device at an event. Examples are that there is a lack of social integration with other spectators and that there is not enough information on the event taking place. He also mentions some examples that could increase the interaction. These include on-demand action replays and commentary on the match. At multi-activity events like an athletics championship or the Olympic Games, information such as historical and current information of a match or race can be provided. Another example is the schedule of the event.
Xu Sun also describes user groups by making two personas. One of the personas wants to gain personalised information, to help him following and understanding the competition. The other persona is more interested in the social aspect of an event.

4.1.1 Current applications in general

Although this thesis is focusing on mainly public events, it is also useful to explore mobile applications of events that are not necessarily public, since these events might also have a part in the application that provides more information next to what can be seen at an event. We decided to look at the application of the Lowlands festival, the Giro d'Italia and the IAAF.

Lowlands festival application

Lowlands is a three-day music festival in The Netherlands where not only music is performed, but also literature, theatre, film, cabaret and dance, so there are many stages in the festival area. In the Lowlands application [9] there are a few elements that can be seen as second screen features of the application:

- You can see the complete schedule per stage per day, see Figure 4.1;
- You can create your own schedule;
- You can get information about every act;
- There is a bot that gives information about the festival, see Figure 4.2;
- There is a map that gives an overview of the whole festival area (it shows every stage, where the toilets are and where the entrances to the camping sides are).

Most of these features are standard features for a music festival.

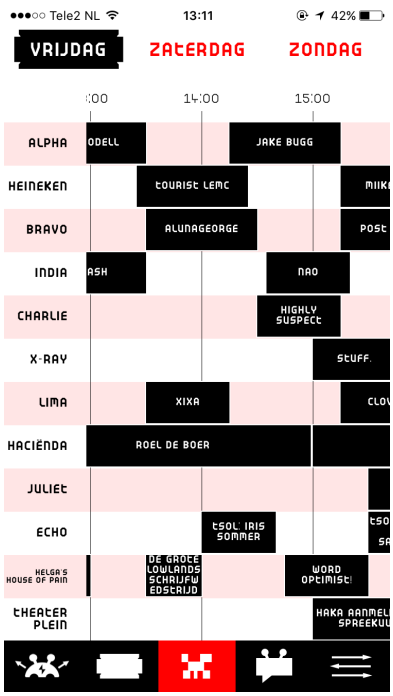

Figure 4.1: Lowlands schedule.

Figure 4.2: Lowlands bot.

Giro d'Italia application

The Giro d'Italia is next to the Tour de France and the Vuelta a España one of the three major cycling races in Europe. The biggest similarity between a sailing race and a cycling race, is that it is hard to follow the race from a distance when you are at the real life event. The difference is however, that a cycling race is not as hard to follow as a sailing race when watching the race on television. We analysed the application of the Giro d'Italia of 2017 [10]. The application contains information about the stages including videos, photos and highlights and about the standings during the race. The standings are displayed per stage, but there is also a general standing where they show who wears the pink jersey for example and which teams are the best over time. They also give information about the different teams and the riders that belong to the teams.

A real second screen feature that the application of the Giro d'Italia contains, is the feature where the user can see live rider data during races (see a screen-shot of the feature in Figure 4.3). In the application we can see four different measurements per rider; the speed, watts produced, heart rate and rotations per minute. This information gives a nice insight in the performance of the riders. We can for example compare the speed to see who is catching up. A disadvantage is that not all information is visible for every rider. For example in the screen-shot in Figure 4.3, only the speed is shown for Vincenzo Nibali.

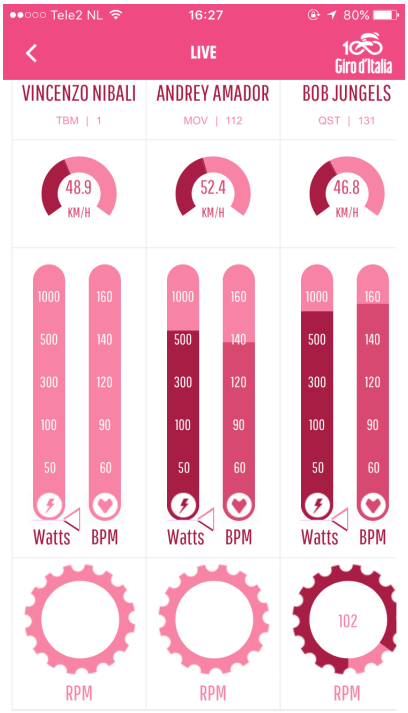

Figure 4.3: Live rider data during a race of the Giro d'Italia.

IAAF application

The application of the International Association of Athletics Federations is the official application that gives the latest athletics results, news, statistics and athlete profiles [11]. Next to the standard elements like timetable, results, information per country, disciplines and information about the athletes, there is a live commentary page where they post textual information about the different disciplines. There is also a page where we can find the records for every discipline and for the different championships. Another way to follow the races is to listen to the IAAF radio. This radio is available during specific races at indicated times and they give live comments in an enthusiastic way.

4.1.2 Volvo Ocean Race application

The Volvo Ocean Race application meant here, is not the application of the event of the finish of the race in The Hague, but the application of the race as a whole [12]. The application has the same kind of elements as the previously discussed applications of the Giro d'Italia and Lowlands, like standings and we can set a few notifications.

At this moment, the application does not have a tracker. This can be due to the fact that the race does not start until October. However, the website of the Volvo Ocean Race does have a tracker [13]. With this tracker we can replay the legs of the previous Volvo Ocean Race. In this tracker we can see the positions of the boats, wind speed and wind direction, isobars to show the pressure, and the water currents.

America's Cup

The America's Cup is a big sailing competition that consists of battles between countries. Bermuda hosted the 35^{th} America's Cup in 2017 [14]. The America's Cup race has a mobile application [15]. In this application there is a possibility to watch replays and other videos of races. The application also has a "Virtual Eye". This is a feature where the user can follow the race live, just like the tracker of the Volvo Ocean Race. Additionally, the user can choose a specific race to replay. The race can be watched from several perspectives. Furthermore, there are different options that can be turned off and on (also see Figure 4.4):

- Wind → Arrows that show the direction of the wind at every moment;
- Advantage → The position of the leading ship;
- Boat labels → Country name and speed per ship in knots;
- Distance → The perpendicular distance between the leading ship to the second best ship;
- Speed arrows → An arrow in the sailing direction, in proportion with the speed;
- Trails → These trails show the traveled route per ship;

- Ladderlines → To make it more clear which ship is leading;
- Distance measure → The distance from the leading ship to the second best ship, as the crow flies.

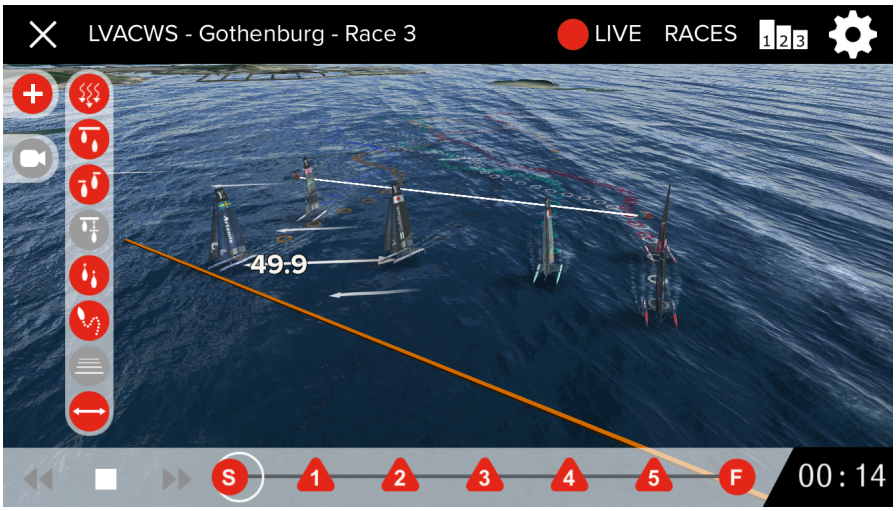

Figure 4.4: A race in the America's Cup application - Virtual Eye.

Another feature that the application offers is the possibility to watch 360 degrees videos. An example of a screen-shot where a 360 degrees camera is placed on the yacht of one of the teams, can be seen in Figure 4.5. Since it is a video with sound, you can also here the crew on the yacht talk, but unfortunately, it is hard to hear what they are saying.

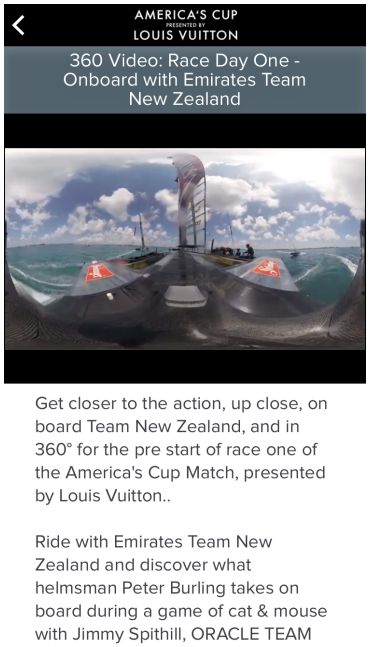

Figure 4.5: A race in the America's Cup application - on board 360 degrees camera.

4.2 Difficulties of understanding yacht sailing

When watching a sailing race on television (for example during the Olympic Games), it can be quite confusing to know which boat is leading and whether that boat is about to be caught up or not.
There is a research from Anna Romanowska-Tolloczko and Piotr Piwowarczyk [16] where they studied whether there is a relationship between the self-esteem of a student and their perception of how difficult they think sailing classes are. The group of students taking the sailing classes came into contact with sailing for the first time in their life. The sailing classes consisted of obtaining knowledge of the construction of the sailing yacht, sailing theory and safety rules. The students also had to sail on the lake and got commands from the instructor. According to the paper, sailing is a difficult discipline since the student requires high knowledge and many skills. As Anna Romanowska-Tolloczko and Piotr Piwowarczyk state, "for people who come into contact with this form of activity [sailing] for the first time and for such a short time, it is a huge portion of new material: vocabulary, theory and practice" (Romanowska-Tolloczko, Piwowarczyk, 2015). People with a higher level of self-esteem see themselves as more gifted and intelligent. The conclusion in the paper is that more confident people learn sailing easier and faster.

A second article is about sailing at the Olympic Games. According to Ben Remocker there have been some changes in the Olympic Games sailing races to make the race more interesting for people to watch and to make the sport align with the Olympic Games business model [17]. Remocker mentions a few elements that have changed in the sailing races of the 49er class. Two examples are:

- Big national flags and sail numbers to make it more clear which boat belongs to which country;
- The fleet size has been scaled down and the time of the race is shorter, since shorter, intense races are more tempting to watch and small fleets are easier to follow by the cameras.

According to Remocker it is necessary that it is clear to the audience how a team wins the race and not only which team wins. As Remocker states "When a sports fan watched highlights of a football match, they don't just show random images of people playing football, they show the goals, the lead up to the goals, and the critical moments... the same is true in all sports" (Remocker, 2014). What is also mentioned in the article, is the fact that the commentary team starts to talk about other business very soon just because very little is happening, and it can be unclear for the commentators who is leading and who is making progress as well.

To sum up, there are a few elements that can make it more difficult to understand sailing. Learning to sail can be hard because it is a difficult discipline where many skills are required. People with a higher level of self-esteem seem to have less difficulties with learning to sail. Next to this, it can be hard to follow a race on for example television because it is clear who is winning, but it is unclear why or how a team is winning. Additionally, it is even hard for the commentary team to see who is making progress, let alone that they can clearly explain it to the audience.

Chapter 5

Second screen and gamification

This Chapter discusses the concepts of second screen applications and gamification. Both concepts are ways to increase the interaction between two parties.

5.1 Second screen

Second screening is the use of a digital device like a mobile phone or a tablet while watching television. The aim of using a digital device is to access the Internet or social networks to get more information about the program being watched or to start a discussion about the specific program [18].

Although we are not watching television while we are visiting an event, the principle of a second screen can be used. Instead of watching television, the visitors are for example looking at a sports race or match or an act at a festival. Next to watching the race or act, it can be interesting to get more information via a mobile phone. We can think of lyrics of the song being played by the artist, split times of the athletes competing in a long distance race at a world championship in athletics and, regarding sailing, the current speed and other information of every participating yacht.

Something can be said for the fact that the use of a second screen can distract people from the first screen. There is a thesis of J. Dolbin about how enjoyment is correlated to using a second screen while watching the Super Bowl in 2015 [19]. In the thesis, three hypotheses are stated, of which two are most relevant for the second screen use at sports events in general. They are:

H1: Related second screen use will be positively related to enjoyment.
H2: Unrelated second screen use will be negatively related to enjoyment.

To find out whether the hypotheses are supported or not, they had a final sample of 453 undergraduate students from a university who watched the Super Bowl in 2015. Table 5.1 shows the most relevant correlations between variables from the thesis of J. Dolbin [19]. What can be noted immediately from the Table is that

Table 5.1: Correlations between variables [19].

Variable	1	2	3	4
1. Enjoyment				
2. Related second screen use	.307			
3. Unrelated second screen use	-.116	.488		
4. NFL fanship	.579	.306	-.076	
5. Watch sports	.520	.288	-.083	.730

related second screen use has a positive correlation with enjoyment and that unrelated second screen use has a small negative correlation with enjoyment. This concludes that hypotheses H1 and H2 are both supported. What is also clear is that both NFL fanship[1] and watch sports have a positive correlation with related second screen use and no real correlation with unrelated second screen use. This means that people that like the NFL and/or watch sports a lot in general, were more likely to use a second screen for related content.

Next to the fact that it is a good thing for an organisation when an application has many users, there is another advantage for the organisation owning the application. The application can require users to log-in via Facebook in order for the user to be able to participate in quizzes and performance ratings for example. By logging in, the organisation can get more information about what a user likes. Marketers can react to these preferences by presenting useful advertisements for the specific user [20].

5.2 Gamification

Gamification is the use of game elements in a non-game context [21]. A research about using gamification elements for learning applications done by Khaleel et al. [21] shows that using gamification in difficult subjects is very valuable. The study by Khaleel et al. also identifies which elements can increase the fun and entertainment level. These are points, a scoring system and stars. In addition they also identify which gamification elements would increase the motivation for students to challenge each other. These elements are badges, top 10 and a leader board. These elements can possibly be used in a second screen application for sailing events.

Another research about using gamification in education is one by Barata et al. [22]. During the research they analysed data from a gamified engineering course. In the data they found types of students and those are described. Barata et al. mention that "gamification has a great potential to help people acquire and improve skills" (Barata et al., 2015). One of the examples they give is CodeCadamy [23]. CodeCadamy is an online platform where we can learn to code in many languages like HTML, Python, Java and jQuery. CodeCadamy teaches in an interactive and gamified way:

1. We get an introduction about a specific part of the programming language;
2. We get an assignment about that specific part;
3. We can type the code that we think is right;

[1] People that like the National Football League

4. We can see hints on how we can solve the assignment;
5. We can run our code to see whether we did a good job;
6. We can earn badges and points when we complete certain tasks.

Especially the fact that we earn points and badges is typical for gamification.

The research classifies mainly three types of students [22]:

- *Achievers*: The achievers wanted to be the best and were mostly found on top of the leaderboard;
- *Disheartened*: The disheartened started like the achievers, but dropped in the leaderboard after some time, so they were mostly found in the middle of the leaderboard;
- *Underachievers*: The underachievers were the worst performing group and had the lowest leaderboard ranks.

As a conclusion they say that the results show that students are more likely to participate in activities with gamification and that gamified courses are more motivating and interesting than non-gamified courses. However, they also mention that the disheartened and underachievers are not taking as much advantage as possible from the gamification elements as the achievers do [22]. In other words, there is still a group of people that should be motivated in another way than by adding a leaderboard and badges.

5.2.1 Gambling

As gambling also gives people a chance to win points or money, it can be seen as a part of gamification, or gamblification[2]. Gamblification is using gambling aspects for non-gambling purposes [24]. We know that gamification can increase the level of participation, but what are the motivations for people to like gambling so much?

A study from Per Binde about why people gamble, gives a model with five motivations for gambling [25]. The model is shown in Figure 5.1. The first motivation as described by Binde is the "dream of hitting the jackpot". This seems to be the biggest motivation for people to buy lottery tickets or participate in games where a small bet can lead to winning a lot of money according to Binde.

The second motivation mentioned is "social rewards". There are three kinds of social rewards [25]:

- *Communion*: People can gamble together, they can for example go to the casino as a socialising activity.
- *Competition*: Gambling gives the opportunity for someone to compete with others, which makes gambling an interesting activity for competitive people.
- *Ostentation*: The gambler can gain social recognition and status.

[2] A term used in the article to describe the use of gambling aspects in a non-gambling context [24]

The third discussed motivation by Binde is "intellectual challenge". Some gambling activities are based on luck. However, there are also games where the choice of the gambler can influence the outcomes. In this case, the gambler can develop knowledge to be able to win the game. Getting the knowledge can become a hobby.

The fourth motivation mentioned in the study is "mood change". Some games can for example increase the level of excitement that the player experiences. Think of the moment when the roulette ball is almost done spinning around and is about to end on a certain number [25]. Another mood that Per Binde mentions is a relaxing mood. Like other hobbies, gambling can be relaxing. An example is when the gambler analyses a sports match to eventually place a bet on who is going to win.

Lastly, Binde mentions the core motivation, a motivation for all kinds of gambling, the "chance of winning". With the chance of winning he means the expectation of winning more than you had in the first place. Per Binde also states that "The anticipation of winning is exciting and pleasant; winning may produce a primordial joyful feeling" (Binde, 2013).

Figure 5.1: Five motivations for gambling [25].

Of course, rules and laws should be considered when using gambling aspects in an application.

Fantasy sports league

Participants of fantasy sports leagues are virtually the managers or coaches of real sports teams. Sports leagues make the players experience all the phases that a coach of for example a football team also experiences, like trading players, appointing agents and determining line-ups [26]. Fantasy sports leagues can be seen as a kind of gamification.

A research about fantasy sports players in the USA and Canada shows that the amount of participants in fantasy sports leagues is growing significantly [27]. The growth of estimated number of players per year in the USA and Canada is shown in the table in Figure 5.2. The amount of players has grown with 85.3% since 2010. This shows that fantasy sports leagues are popular.

Number of fantasy sports players by year	
Year	**Estimated Number of Players**
1988	500,000
1991-1994	1 – 3 Million
2003	15.2 Million
2004	13.5 Million
2005	12.6 Million
2006	18 Million
2007	19.4 Million
2008	29.9 Million
2009	28.4 Million
2010	32 Million
2011	35.9 Million
2014	41.5 Million
2015	56.8 Million
2016	57.4 Million
2017	59.3 Million

Figure 5.2: Estimated number of players [27].

Taking part in a fantasy sports league can also be a kind of gambling. In the most fantasy games, the participants have to pay entry fees or they have to pay for trades or acquisitions. The players can get prize money based on their performance or standings in the rankings [28].

In a research from Lee et al. about the effect of personality and gender on fantasy sports game participation [28], they researched the intention of people to participate in a fantasy football league and whether those people thought they had good fantasy football knowledge compared to the average user. The conclusion of this part of the research by Lee et al. is that people that answered that they had relatively good knowledge about fantasy football also had more intentions to actually participate in such a fantasy game. Lee et al. also say that "participants use their sports knowledge as a tool to outperform other participants" (Lee et al., 2011).

Chapter 6

Sailing data and applications

This Chapter discusses what kind of sailing data is available and what we can do with the data. One idea is worked out in Section 6.3.

6.1 Sailing Innovation Centre

For this part of the thesis, we went to the Sailing Innovation Centre in The Hague [29]. We interviewed managers Cees van Bladel and Lenneke de Voogd. The organisation tries to speed up innovations in the sailing sport. They have a programme called "Sailing race of the future" ("Zeilwedstrijd van de toekomst"). The goal of this programme is making sailing races more interesting and more accessible for a wider audience. To accomplish this, they work together with "Dutch Sailing League" ("Eredivisie Zeilen"). This sailing league works together with SAP Sailing Analytics [30]. This company produces statistics for the races of the Dutch Sailing League. We can also replay races and get information about the speed of the boat, angle from the boat to the wind and the wind itself for example. Unfortunately we could not get raw data from SAP Analytics, since they do not own the data.

The Sailing Innovation Centre also works with the Olympic sailing team. In addition to some other services, they offer an infrastructure to measure, analyse and present measuring data of the sailing yacht (like the position, angle of inclination, speed and direction), video footage of the sailors and data of the environmental factors like waves, wind and current.

The innovation centre had some ideas on how to increase the interaction with the audience. An example is that a well-known person will be on board of the yacht to give commentary on how things are on the ship (Van Bladel, C. (2017, April 13). Personal interview).

6.2 Sailing data

According to the Sailing Innovation Centre, data from the "Dutch Sailing League" will mainly be location data. They also mentioned that probably not all data can become available, since some of the data may be private or sensitive, and the races would not want other teams to get to know their strategies (Van Bladel, C. (2017, April 13). Personal interview).

Unfortunately, we were not able to get sailing data from a real sailing race. However, we got information from Marc-Antony Taminiau from Steam Ocean Racing. He also works with team AkzoNobel, the Dutch participant in the Volvo Ocean Race of 2017-2018. He could provide us with some information about the data that is available from the AkzoNobel yacht at the Volvo Ocean Race and the sailors. According to Marc-Antony Taminiau there are almost 200 sensors that measure certain things on board of the yacht. Next to this, performance of the sailor is measured. Measurements are (Taminiau, M.-A. (2017, June 26). Personal communication):

- *Heart rate variability*: The amount of time between two heart beats.
- The amount of exertion versus rest of the sailors.
- *Cortisol*: More of the cortisol hormone is produced when someone has a lot of stress.
- Sleeping patterns.

This data is unfortunately not available since it contains sensitive performance information.

6.3 What can we do with the data?

As concluded in Chapter 5, gamification can be used for learning. Next to this, the use of a second screen can also influence the way of learning. By taking these two facts in consideration, we can think of ways to make sailing more interesting to a wider audience. Therefore, we want to combine gamification and second screen usage. In other words, we want to design a second screen application with gamification elements to involve the visitors and to make sailing more understandable for them.

We came up with an idea where we will make a map of the race with the participating yachts. We also add the buoys in the sea. The idea is that the visitors of a sailing event can predict which yacht will be the first one to arrive at the next buoy. To help the user of the application, we add some extra information like the distance from every yacht to the buoy, the speed of the yacht and the wind direction. When the user chooses the yacht that actually reaches the buoy firstly, he or she will earn points. These points can be used to buy prizes at the event. An example of a prize is for instance that the visitor can have a look on a sailing yacht with a virtual reality headset. Another example is that a cap or a key-chain of, in this case, the Volvo Ocean Race can be bought with a small amount of points.

The main goal of the feature is to make sailing more understandable for the audience. However, the feature can also be used by people that know a lot about sailing already. As concluded in Section 5.2.1 from Chapter 5 people that have a good knowledge about the sports league have a bigger intention to participate in a fantasy league to outperform other participants. Although this idea is not a sports league, the user can still like to be better than another user and just like in the sports league, the user can choose his or her favourite or best boat. Moreover, users can get excited about the fact that it can be an intellectual challenge while betting on a certain boat, as mentioned in Section 5.2.1.

6.3.1 Approach

First of all, we had to create the database. Since we did not have any real race data, we had to create our own tables. We created two tables with locations of boats with time stamps. Table 6.1 shows the structure of the tables with locations of boats. To test the application, we used locations of two boats. When the prototype eventually becomes a real feature in an application, there can be more tables, one table for every boat.

Column name	Data type	Description
`id`	Integer	Primary key to identify each row.
`date`	String	Time stamp of when the boat was at that location (format: yyyy-MM-dd HH:mm:ss).
`latitude`	Double	Latitude coordinate of the location.
`longitude`	Double	Longitude coordinate of the location.

Table 6.1: Boat locations table in the database.

Table 6.2 shows the structure of the table where user data is saved. When a user creates an account, the user name, password and e-mail address will be saved, so the user is able to log in. As soon as the user earns points, the points will be added to the table.

Column name	Data type	Description
`id`	Integer	Primary key to identify each row.
`username`	String	User name of the registered user.
`email`	String	E-mail of the registered user.
`password`	String	Password of the registered user.
`points`	Integer	Amount of points earned by the user.

Table 6.2: Users table in the database.

Table 6.3 shows the structure where the wind directions and wind speed at certain moments in time are saved.

Column name	Data type	Description
`id`	Integer	Primary key to identify each row.
`date`	String	Time stamp of the measured wind (format: yyyy-MM-dd HH:mm:ss).
`direction`	Double	Direction of the wind at certain times in degrees.
`speed`	Double	Speed of the wind at certain times in knots.

Table 6.3: Wind table in the database.

While creating the prototype, we worked according to an iterative method. This means that we tried to finish a feature before moving on to the next feature. The next paragraphs describe the main features. Screen-shots

and descriptions of the remaining features can be found in Appendix A.

Positions of the boats

After the database was created, we started with plotting the boats. Figure 6.1 shows a screen-shot of the plotted boats. The positions of the buoys and the travelled route are also displayed. By clicking on a yacht, the user can get some details like current speed (in knots) and current distance (in meters) to the next buoy. In the top left corner, the wind speed (in knots) and wind direction is shown. The user can vote for one of the boats by first clicking on the boat and subsequently pressing the "Vote" button in the bottom right corner.

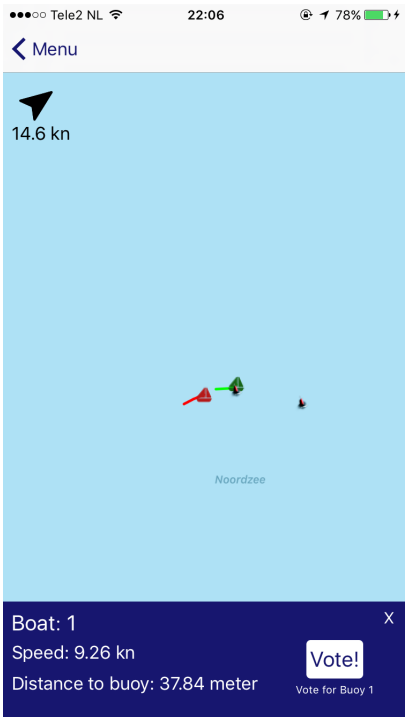

Figure 6.1: Positions of the yachts.

Voting for winning boat

If the user pressed the "Vote" button as described in the paragraph above, he or she will get a confirmation of voting, like in Figure 6.2. The user can only vote when logged in. This is required to be able to add the points to the account of the user. A notification will also be given as soon as the yacht the customer voted for, is indeed arriving at the buoy firstly.

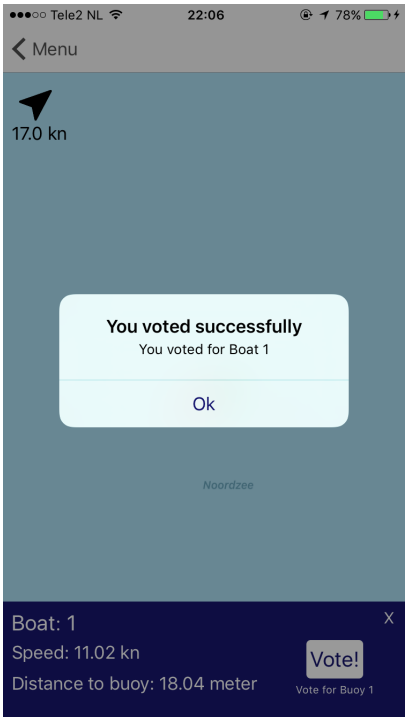

Figure 6.2: Notification when the user votes for a boat.

Leaderboard

If the users want to see how many points are won, they can go to the leaderboard page. The leaderboard page is also shown in Figure 6.3. The number one player is always visible in the yellow row. The logged in user is displayed in a blue-green colour. Users can scroll though all the players and when they want to go back to their own position, they can press “Find me”.

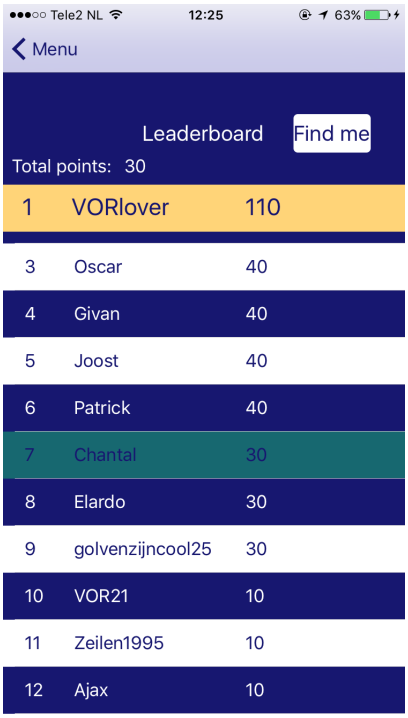

Figure 6.3: The leaderboard.

Chapter 7

Interaction at big events

This Chapter discusses, in Section 7.1, how the idea of gamification of Section 6.3 of the previous Chapter can be used during other sports events. In Section 7.2 we give other ideas of features that can be used during other kinds of events.

7.1 Sailing application

The idea mentioned in Chapter 6 is about guessing which yacht is arriving at the next buoy firstly. This idea is specifically made for sailing events. However, the idea is also useful for the EventCloud. The feature can be added to applications of other sports where the location of participants is tracked. We can think of a cycling stage where the rider that reaches the top of the mountain firstly can be predicted, or a marathon where the participant that firstly passes the 5 km sign should be guessed. However, now it seems easy to earn points when one participant in the race has a big lead. Therefore the feature can be extended by taking the chance of a participant reaching a point firstly into account.

An example of how points can be divided during a cycling stage:

- Vincenzo Nibali is leading with 30 seconds with respect to the chasing racers.
- Tom Dumoulin and Nairo Quintana are chasing Vincenzo Nibali.
- Bauke Mollema and the other participants are cycling in a big group at one minute behind Tom Dumoulin and Nairo Quintana.

This situation is drawn in Figure 7.1. The possibility of Vincenzo Nibali winning the stage is bigger than that Tom Dumoulin will win the stage. The chance of Tom Dumoulin winning the stage is subsequently bigger than that Bauke Mollema will win the race. If the user guesses that Bauke Mollema wins the race, and the user is right, it seems fair that the user will get more points than when he would have guessed that Vincenzo Nibali wins the race and he or she is right. An example of the distribution of points is shown in Table 7.1. The

points in the Table are based on the amount of seconds the rider is away from the finish. However, there are more properties we can base these points on. The chance of Tom Dumoulin or Bauke Mollema catching up 90 or 30 seconds respectively with respect to Vincenzo Nibali before Nibali reaches the finish is very close to zero, since the distance to the finish is only around 500 meters for the leading rider.

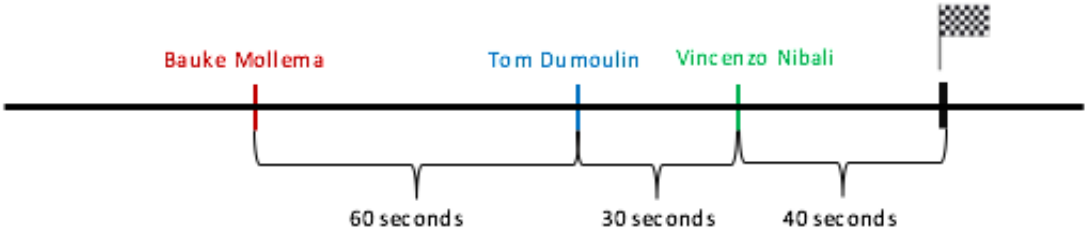

Figure 7.1: Cycling race positions.

Table 7.1: Points earned for every rider.

Rider	Distance to finish	Points
Vincenzo Nibali	40 seconds	10
Tom Dumoulin	70 seconds	17,5
Bauke Mollema	130 seconds	32,5

This concept is used by sports betting websites in general as well. An example is Unibet [31]. On websites like Unibet, we can place bets on athletes or teams that we think are going to win a race or match. An example of the odds for a tennis match can be seen in Figure 7.2. In this match, Sam Querrey is leading with one set against Cameron Norrie. Querrey is more likely to win the match and therefore we can earn €1,03 when we place a bet of €1 on Querrey, and he actually wins. We can earn €12,50 when we place a bet of €1 on Norrie and he wins. This big difference in odds is in this case not only based on who is leading, but also on the chance of a player winning at the beginning of the match. In other words, the player with a higher place on the world rankings, is more likely to win the match. In this case, Sam Querrey is number 28 in the world rankings and Cameron Norrie is 235 in the world rankings, so the big difference in the odds is probably mostly based on the ranking.

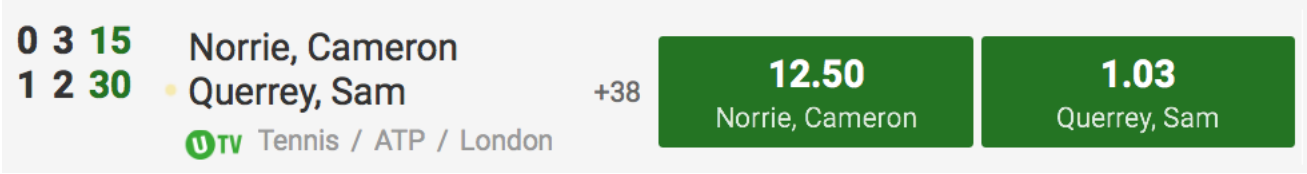

Figure 7.2: Match odds - Unibet.

7.2 Other features

Of course there are many other second screen features that can be added to the mobile applications of big events. This Section shortly describes some other ideas.

Second screen features can be invented for every kind of event. Think of for example a congress where presentations are given. The audience can use an application on a mobile device to ask questions to the presenter, so the presenter can answer questions during the presentations without being interrupted. If the speaker does not want to answer the questions during a presentation itself, it is still an advantage for someone in the audience to ask the question already during the presentation through the mobile application, because in that way he or she will not forget the question. The application can also be used to get certain information of the presenter, since the visitor may not know the person that is presenting beforehand. Moreover, the presenter can ask the audience certain questions. People in the audience can answer the question via the application. In the end of the presentation, the person that answered the most questions correctly, can win a nice present. This is actually a scoring system with points as described in Section 5.2, which would cause the fun and entertainment level to rise according to Khaleel et al. [21].

During a music festival, the visitor can also benefit from certain second screen features. An example is that when a performer is singing a song, the user can see the lyrics of the song on the screen of a mobile device and sing along. A scoring system can also be added to music festivals. Questions about the performer or band can be asked in the application. People in the audience can answer the questions and at the end of the performance, the top 10 people with the most points can for example get a signature from the artist.

All in all, there are different kind of second screen features that can be added to the mobile applications of events. Many features can be invented that have gamification aspects. These features can make life easier and more fun for the visitors.

Chapter 8

Conclusions and future work

8.1 Conclusions

This thesis was written to find ways of increasing the interaction between visitors of an event and the event itself by using data. We focused on increasing this interaction by encouraging the visitor to use a mobile application. For this mobile application we wanted to think of second screen features that can give the user more information to the act, race or presentation that he or she is looking at. To create an idea, we mainly focused on the finish of the Volvo Ocean Race in The Hague in 2018. To increase the interaction, we had to find something that would make the sailing sport more interesting to a wider audience.

We came up with the idea to use gamification, the use of game aspects in non-game environments, as part of the second screen. The final idea is to make the visitor guess which boat is reaching the next buoy firstly. If the player is right, he or she earns points to eventually get prizes on the event.

This idea can be used at many other sports races where the location of the athlete is tracked. This location data is mostly available and not private or sensitive. However, other data, like performance data of the athlete, can be private and this should be taken into account when using data to increase the interaction.

All in all, gamification is a good tool to give the visitors of events an experience that is more fun. Therefore, the main recommendation of this thesis is to use gamification elements inside the event application to increase the interaction.

8.2 Limitations

There are some limitations to the idea for the Volvo Ocean Race. First of all, the current prototype is only available for iPhone, and not for Android. Secondly, we were, unfortunately, not able to use real location data to built the application. Furthermore, the application is just a prototype. This means that it is not ready to

implement in an application of a real event yet. However, the idea worked out, is useful for many events. Next to this, we could not test the final prototype at a real event. Therefore, the application is not built for real-time data at this moment. The fact that we could not test the application probably also brings the biggest limitation; apart from that we know that second screen and gamification can be contributory to increasing the interaction, we are not totally sure that this idea actually increases the interaction at events. We could have done a survey to check this among people that regularly go to sports events. A last limitation is the availability of the data. Data can be private or sensitive. The athletes do not want to disclose their tactics. We know that location data of sailing yachts is available, since there are applications where the date is used to display the locations of the boats already, so the idea given in this thesis will be possible.

8.3 Future work

As the limitations are discussed, there is future work that should be done to optimise the application. First of all, a lot should be done about the design, especially about the view of the boats. Secondly, more information form the boats or the surroundings should be displayed. We can think of currents, distances to other boats and the position of the sails. Furthermore, the application should become able to process real-time data in order to make it possible to test the feature during a real sailing event. Then fourthly, when the application is properly tested and optimised, it can become available in the application stores of the various smart phone platforms. It is clear that this feature is not ready yet. However, as soon as it is ready, it is recommended to work out more features. It is advised to start with features that can be used at many different events, so the EventCloud can benefit from it the most.

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Appendix A

Screenshots of the application

Main menu

Figure A.1 shows the main menu. This menu shows up when the application opens. From this menu, the user can reach all the other pages.

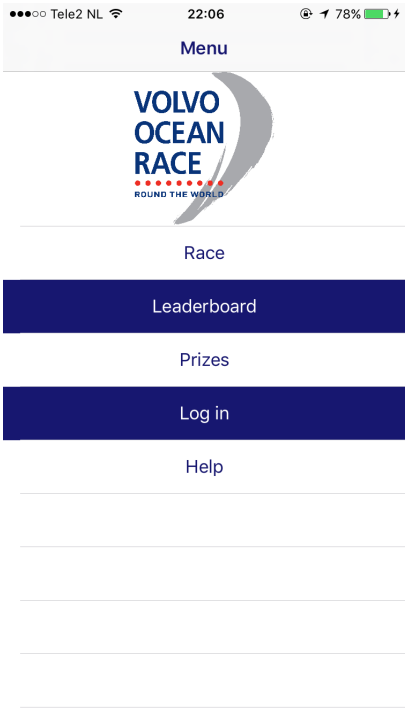

Figure A.1: Main menu.

Help page Figure A.2 is the help page of the application. This is a short description of how the application can be used and how the game works.

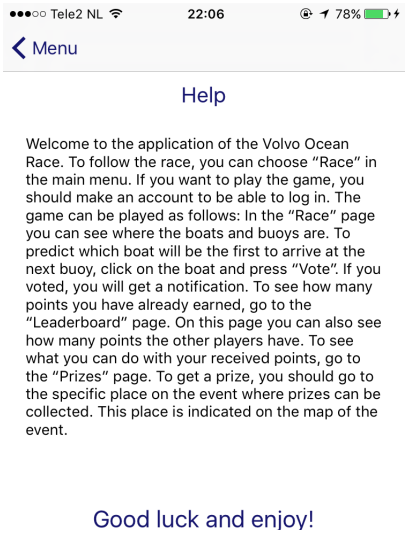

Figure A.2: Help page.

Registration page Figure A.3 shows the registration page. The user can get to this page by going to the log in page in the main menu. The user should register and log in before he or she can participate in the game.

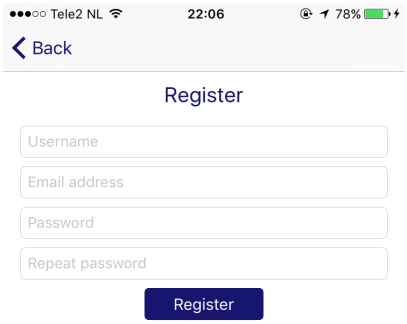

Figure A.3: Registration page.

Log in page Figure A.4 shows the log in page. As soon as the user is registered, he or she can log in with this page. When logged in, users can see play the game, see their points and see what prizes can be earned.

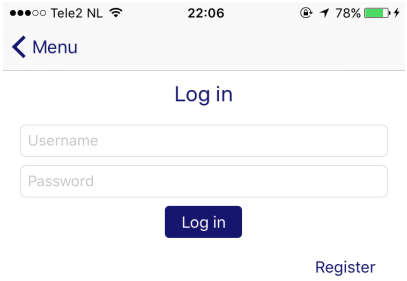

Figure A.4: Log in page.

Winning points Figure A.5 shows the notification that a user gets when the right boat was guessed. The points are also immediately added to the account and to the leaderboard.

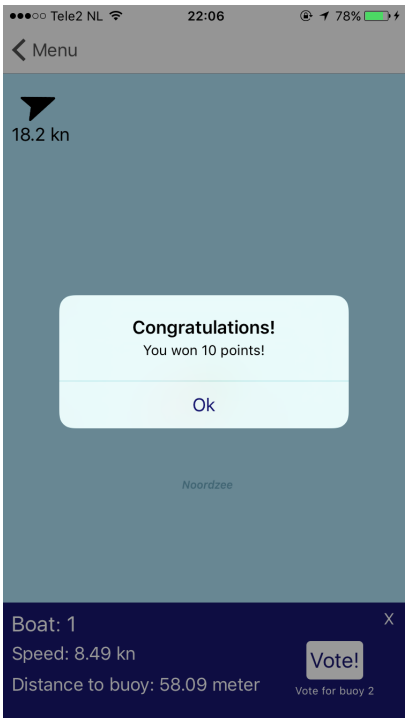

Figure A.5: Notification of winning.

Prizes page Figure A.6 shows the page where the available prizes of the event can be seen. This can be different for different events. The user can also see the points earned. Furthermore, the price of the prize is displayed in either red or green. A green colour means that the user can buy the item and red means that the user can not buy the item.

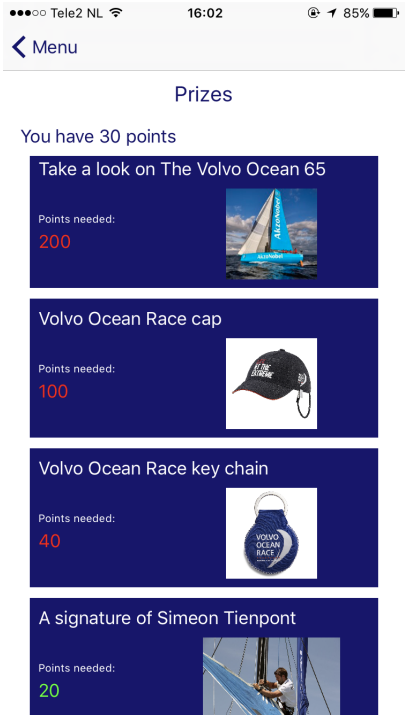

Figure A.6: Page with the prizes.