Sea&Surf

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Abstract—The evolution of surf over the years has encouraged meteorologists to find new methods to improve weather and sea conditions predictions. Nowadays surfers have all the information they need to know when and where are the best conditions to practice. Several websites and apps have emerged to display the data surfers need with some of them already being adapted to modern web technologies. This document reviews existing solutions and attempts to reach an optimized solution based on all the requirements needed. The solution takes advantage of the weather and maritime data that is already being modeled and retrieved by MARETEC. As an ultimate goal, it provides information to surfers in an efficient way and implements a responsive design that adapts the visualization of the information to the most common devices' size in the present days. In order for this project to stand out from the different solutions available on the market, a ranking for the surf conditions on each beach was developed. This ranking will allow surfers to interpret the data available in a easier way, since they will be able immediately identify if the beach is providing good conditions for surfing.

Index Terms—Web Development; Responsive Design; Weather Forecast; Surf.

1 Introduction

SURF is a water sport where the practitioner, surfer, stands up on a surfboard and rides a wave towards the shore. This is a sport that is only possible whenever appropriate waves are formed in oceans, lakes or rivers. In order to know if there are favorable conditions to practice it, surfers need accurate information of sea conditions in real-time.

Information of sea conditions comes nowadays from forecasts, which are predictions of the future taking into account past and present data. This historical data is analyzed by specialists to identify trends and produce estimates for the future. Most of the time these estimates are produced in a way that can only be understood by specialists. Thus, with the evolution of the internet and with the emergence of mobile devices, several different solutions emerged to create visualizations that allowed users with no experience at interpreting forecasts to understand those estimates. Surfers can then take advantage of these visualizations to extract the information they need regarding the sea and weather conditions for the locations they intend to go surfing.

Although no forecast is 100% accurate, surfers can use the estimates for the different variables (wind direction, wind speed, wave direction, etc.) to have a better sense of how the sea is behaving. With this, they can better plan if it is worth to go to another beach or not worth to go surfing at all.

The previously mentioned forecasts are being produced by people and organizations from all over the globe to every location of the world. The Maritime Environment and Technology Center, Maretec[1], located in Portugal is one organization that does research on weather and maritime forecast models. For weather forecasting, Maretec uses three different models (GFS model, MM5 model, and WRF model) to create predictions of the different weather variables (temperature, humidity, rain, etc.) for Portugal. The outputs of these models can be seen on a visualization in the website **meteo.tecnico.ulisboa.pt** that allows users to access it and get the information they need. Regarding maritime forecasts, Maretec has been developing MOHID, a three-dimensional wa-

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1. http://www.maretec.org

ter modeling system that allows modeling of almost all phases of the water cycle from watersheds to rivers, estuaries, and oceans. Thus, it is possible to conclude that Maretec is producing nowadays all the data needed to create weather and sea forecasts.

Although the weather forecasts are already being displayed in the form of visualization on a website, the maritime forecasts are not. Therefore the main motivation for this work is to use the data that Maretec is collecting regarding both weather and maritime conditions and make it available in one visualization. More specifically, create a visualization adapated for surfers so they can know when and where are the best conditions to go surfing.

The first objective of this work was to analyze from the data that Maretec is already producing, which metrics are relevant for the practice of surf and which are not. Then, we moved to the main goal of this work which was to develop a website that enables users to access information in their own devices (smartphones, tablets or computers) in an effective way and having the same ease of interaction. It should be noted that conditions like devices' size and orientation, and sun exposure will influence the decision of the solution.

It is worth to note that the main feature of this application is a ranking of surf conditions that will be displayed for each beach location.

The end product is a solution for the visualization of information, from sea conditions forecasts, oriented to the practice of surf.

2 SURF

Before analyzing the several solutions available for forecasting we must state some important information that underlines surf which is the main focus of this project.

Generally, for surfing, a good wave is the one that gradually evolves and breaks along the wall to one of its sides.

There are 2 types of wind conditions in surfing: onshore and offshore.

Onshore. The direction is from the ocean towards the shore. This is the worst one for surfers since it causes an uneven water surface which makes it harder to surf on. Nevertheless, a little bit of onshore wind is good because it helps surfers to keep their surfboards under their feet while performing maneuvers.

Offshore. The wind direction is from the shore towards the sea. This is the best kind of wind for surfers since it makes a smooth water surface which is easier to surf on. However, a strong offshore wind is not recommended since it can pushback surfers when performing aerial maneuvers.

Lastly, it is important to refer to a commonly used term in surf: the swell[2]. It is the energy that is transferred by the wind into the water. It is largely talked about by surfers since waves are formed by the strength of the wind over the ocean, thus the better the swell the better the waves.

2.1 Optimal Conditions

It is important to note that optimal conditions for surfing are subjective since they depend on the surfers' experience, style of surfing, location and kind of break. Surfers look forward to 4 main conditions when looking at a forecast[3]: wave height, wind direction, wave direction, and the tide.

Wave Height. It is based on the swell height and period. The swell height is the distance between the flat surface of the water and the peak of the wave. The period is the time a wave takes to pass past a certain point. For example, a forecast showing a 2ft wave at 15 seconds shows that powerful waves will be formed since it has a 15 seconds period which means the wave is traveling from far away. If instead, the forecast showed a period of 5 seconds, it would result in weaker waves.

Wave Direction. This helps to predict how the waves are hitting a particular spot the surfer is looking for. For example, a location facing West with a swell direction from North would not be good since the waves would evolve to the left side of the beach, probably leading surfers to rocks which can be really dangerous.

2. https://www.surfertoday.com/surfing/how-is-a-wave-formed-understanding-swell-and-surf-forecasts

3. https://learntosurfkona.com/featured/how-to-read-a-surf-report/

Wind Direction. The best conditions for surfing normally require that the wind is barely existent. Most surf spots are calmer in the morning and evening and with stronger winds in the afternoon. Thus, it is important for surfers to check the type of wind (onshore or offshore) together with the spot they plan to surf to know if the wind is favorable or not.

Tide. Tides are dependent on the rotation of the Earth and the forces exerted by the Moon and the Sun, thus making it a predictable variable. The tide has a big impact on how waves break. Surfers need some experience to understand if it is better to have a low tide or a high tide for each spot. For example, in beach breaks, high tides are preferred since sand bars need to be deep for the waves not to break at once. While in reef breaks, low tide is preferred although it can be dangerous due to shallow rocks.

2.2 Users Characterization

It is essential to identify and describe who are the users and what are their demands to develop a system whose ultimate goal is to satisfy surfers' needs. Since we, the developers, are not going to be the end-users of the system this is an important step to be performed at the beginning of a study for an optimized solution. Users are the ones who know what information is needed and which is the best way to display it.

Thus we must know how certain users' characteristics might influence the way they use the system, how they learn to perform certain tasks, and how motivated are they to change habits. Overall, this analysis will influence the design solution to better address users' necessities.

In order to begin this study of users, we performed structured interviews with 4 different users. The interviews followed a specific set of short and concise questions that not only gave us the information we were looking for but also allowed some exploration of new ideas.

When we were talking with users we realized that there are 2 user characteristics that need to be taken into account:

Users with vision problems. Since this is a condition that some users might have, smaller objects and text should be carefully examined before being used on the solution.

Color-blind users. Since we might have surfers that can not distinguish some colors, color paletes should use a scheme of colors that address these difficulties.

From the interviews it was also possible to notice that there is an environment characteristic that will influence the design, which is the glare. Since surfers mentioned that sometimes they consult forecasts at the beach, which is an environment subject to bright sunlight, we must create high contrasts in our interface so that different elements can be seen.

In regards to users' satisfaction, Muneera Bano and Didar Zowghi [1] define it as a "psychological state that comes when users perceive that they have control over the system development process". This leads us to other activity developed with the users: sketches.

In Figure 1 we see a sketch made with the help of a user. By involving the users in the creation process we did not only increased their motivation but also defined a good starting point for the development of our interface.

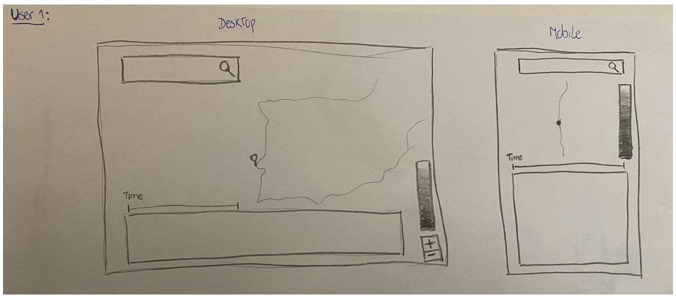

Figure 1. User Sketch

3 Concepts, Principles and Existing Solutions

3.1 Principles of Web Design

To facilitate the interactions users might have with our website we must develop a good design and provide a good user experience. There are lots of principles and guidelines to follow when building for the web but we are only going to focus on five: responsive web design, effective homepage, minimalist design, interactivity, and navigation. This decision was based on what we considered the most important according to the several guidelines that Manuel Fonseca, Pedro Campos, and Daniel Gonçalves presented in ”Introdução ao Design de Interfaces” [2] as good practices for the web.

- **Responsive Web Design**. Also called Adaptive Web Design, is a set of approaches that programmers and designers should apply when building websites. It focuses on having a website that is capable of resizing itself depending on screen size, resolution and orientation of the device that is being used to access the website [3].
- **Effective Homepage**. A homepage is the most important page of a website because it is the one with the most affluence of users. A well thought and designed homepage should elicit a good first impression from users, facilitate navigation and focus on the main topic.
- **Minimalist Design**. Having a minimalist design is a way to facilitate the identification of the relevant parts of a webpage. Since the web is not a static environment there should be an even balance between aesthetics, functionality, and usability [2].
- **Interactivity**. Interactivity is a key feature of websites since it is what makes users to be actively engaged while navigating on a website. According to research made by Yang & Fuyuan [4], ”web interactivity could lead to increased user enjoyment, positive attitudes, and favorable behavioral intentions”. Having interactive features such as map flows can not only make the experience of the website more fun but also present the information in a more meaningful way as well as give more control to users. Also, users are more likely to come to revisit and recommend interactive websites, since they feel more intrinsically motivated to perform tasks.
- **Navigation**. The structure of a website and the navigation inside of it are two fundamental aspects of web development. Normally, websites have a hierarchical structure that helps the user when searching for specific information. This way, the information is organized and lets users immediately find and go to the section of the website that they are looking for.

3.2 Forecast Websites

There is a considerable amount of forecast websites available on the internet, but for this analysis, we are going to focus on only three websites: Windguru, Windy, and MagicSeaWeed. This selection was made taking into account two factors: popularity and different design solutions. By looking at the answers from the interviews we can see that Windguru is the most used website by surfers. Windy and MagicSeaWeed are other websites used by interviewees that were chosen because of the different design solutions they present.

A detailed analysis of these 3 websites was performed based on the principles earlier defined. Besides that we also described specific features of the different solutions if they are worth to note.

3.3 Data

Taking into consideration the previous three websites and the interviews with surfers we can create a list with the meteorological and hydrographic information that is needed for such visualizations. Table 1 details the attributes and respective units that are essential for producing a surf forecast website.

Table 1
Meteorological and Hydrographic data and corresponding units.

	Magnitude	Units
Meteorological	Temperature	ºC
	Wind Speed	km/h
	Wind Direction	Cardinal Coordinates
Hydrographic	Water Temperature	ºC
	Wave Height	meters
	Wave Period	seconds
	Wave Direction	Cardinal Coordinates

3.4 Web Development Technologies

Three languages make up the core of the World Wide Web and thus are essential in the web development world. Hypertext Markup Language (HTML) is the language used to provide the content to be displayed by web browsers. Cascading Style Sheets (CSS) is the language used to change the presentation, formatting, and layout of web pages. Javascript (JS) is a scripting language used to control the behavior of the different elements on a web page and provide interactivity [5]. These three languages combined make up the foundation for the technologies we are going to study in the following subsections.

An extensive analysis was performed regarding the technologies available on the following categories: Responsive Design Frameworks, JavaScript Frameworks, Server Side Development, Database, Web Map Libraries.

Based on this analysis it is possible to justify every decision regarding the technologies used on the implementation of this project.

4 SOLUTION

It is first important to describe the architecture of the project in order to understand how the entire system works together to produce the final result, which is the visualization of surf forecasts. By looking at Figure 2, we can understand that there are 5 components that make up this project. On the left side and with the connections represented as dashed lines we see the 2 components that are external to us and therefore the only thing that was developed by us was the connection to their APIs to retrieve data. On the center and right side we have the 3 components developed by us which are the server, the database and the client application.

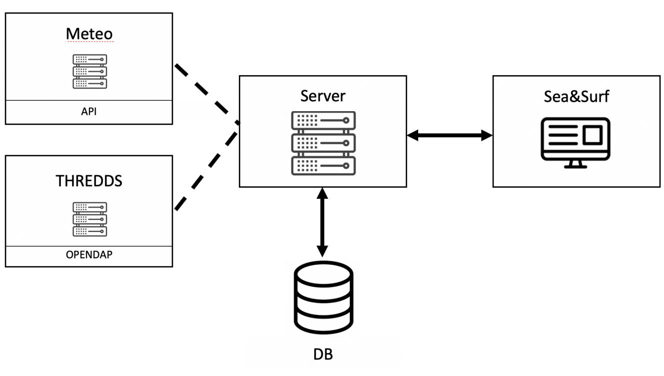

Figure 2. System architecture

As we previously mentioned, we took advantage of both weather and maritime forecasted data that Maretec produces. Both these data are coming from the external components previously mentioned, namely the weather data is retrieved from the meteo—Técnico server, and the maritime data from the Maretec THREDDS server.

The Sea&Surf component is the client-side of our application, which in this case will be a single-page application (SPA). This means that the website will consist of a single page that will be dynamically rendered based on user interaction.

The flow of data is as follows: the client requests information for a specific beach in Portugal to the server, which will check if it already has the data stored in the database. If the data is already stored on the database, the server can immediately return it to the client. If it does not have the data it will send requests to both Meteo and THREDDS servers to get the data needed and after receiving it, the server stores it in the database and sends it back to the client. In the next subsections we will look into more detail each of the components of the system architecture.

The last aspect that is important to note is the hosting. This project will be hosted in a server owned by the project sponsor (Maretec) and therefore there will be no costs associated with this project. The application will be available at https://hawking.tecnico.ulisboa.pt/surf/ and the 3 components (database, server and client) will be running on this machine.

4.1 Calculation of Surf Rankings

In order to take advantage of the collected data and to make this project to have something that really distinguishes it from the other solutions on the market, we decided that one of the goals was to develop a surf ranking.

From the analysis in Chapter 2 we were able to understand the different components of surf and which variables affect the quality of a beach for surfing. By considering this analysis and the corresponding collected data we were able to develop an algorithm capable of defining for each beach and for each day a ranking from 0 to 5, where 0 means the beach is not good for surfing and 5 means that the beach is excellent for surfing.

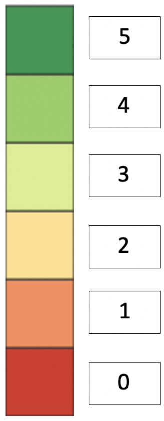

Figure 3. Surf Ranking Color Scale

With this ranking we are able to give the users more information regarding the beaches for surfing purposes. Surfers can look at this ranking and realize faster whether it is good or not to go surfing without having to look at all the variables. This ranking is also helpful when users intend to go surfing to a beach they normally do not go and therefore do not know which are the best conditions for that beach. Another positive aspect is the fact that not all surfers know how to interpret a surf forecast and therefore need extra help to understand how the beach is for surfing. Although there are lots of different types of surfers we developed a standardized ranking that can be used by any surfer.

In Algorithm 1 we have the core functions executed in order to calculate the surf ranking. This algorithm takes advantage of the data retrieved from the models and already stored on the database to calculate individual rankings for each of the variables. As shown in Chapter 2 the main variables that allow us to determine if a beach has favorable conditions are wind speed, wind direction, wave direction, wave height and wave period. Beach orientation is an important variable to determine if the wind and wave directions are favorable for the beach as we will explain in more detail later in this section.

Thus our algorithm is divided in 5 functions (one for each of the main variables) where we perform individual calculations of each variable. Each of the functions will return a value from 0 to 1, where 0 corresponds to the fact that the variable values are considered to be bad, while 1 corresponds to good variable values. After those calculations are done we sum all the results to get our final ranking for each hour. In the following sub subsections we will detail the functioning of each of the 5 functions.

Algorithm 1: Calculation of Surf Ranking

```
begin
    beachOrientation ⟵ beach['Orientation']
    windDirection ⟵ beach['WindDirection']
    windSpeed ⟵ beach['WindSpeed']
    waveDirection ⟵ beach['WaveDirection']
    waveHeight ⟵ beach['WaveHeight']
    wavePeriod ⟵ beach['WavePeriod']
    for hour in arrayOfHours do
        if windDirection! == undefined then
            checkWindDirection()
        if windSpeed! == undefined then
            checkWindSpeed()
        if waveDirection! == undefined then
            checkWaveDirection()
        if waveHeight! == undefined then
            checkWaveHeight()
        if wavePeriod! == undefined then
            checkWavePeriod()
        FinalRanking = windDirectionRank + windSpeedRank + waveDirectionRank + waveHeightRank + wavePeriodRank
```

5 Evaluation

Evaluating an interface is an essential step to make end products and services more usable and easier to learn for users. We evaluated the developed interface to guarantee that the system works as expected and satisfies the users' requirements with two approaches. First we performed a functional evaluation of the system in order to understand if the application is responsive and therefore is adapting to different screen sizes and orientations. Next we did a system evaluation to understand how our application is performing regarding usability.

5.1 Functional Evaluation

This evaluation was done by us, and focused on testing the behavior of the website for the most used browsers and screen resolutions.

Since it is not feasible to address all existent device's resolutions we must first analyze which are the most used screen resolutions for each platform (Desktop, Tablet and Mobile). In order to obtain this data we resorted to the website StatCounter[4] and the results were:

- **1 - Desktop**. For the period between October 2019 and October 2020 the most used desktop screen resolution worldwide was 1366x768.
- **2 - Tablet**. For the period between October 2019 and October 2020 the most used tablet screen resolution worldwide was 768x1024.
- **3 - Mobile**. For the period between October 2019 and October 2020 the most used mobile screen resolution worldwide was 360x640.

Figures 4, 5, 6, 7, 8 show how the application behaves for each of the screen resolutions. Since on tablets and mobiles users can change the orientation of the device we have included both portrait and landscape screenshots of the application.

When comparing the interface on the different devices we are able to check how components adapt in order to better adjust to the screen's available space. The components on the top bar of the application decrease in size when moving from desktop to tablet and then to mobile view. It is even possible to see in the mobile portrait view that the input on the search component and the date on the calendar component disappear because there is not enough space (they can be seen whenever we click on each of the components). Also the zoom of the map component increases when we use smaller screen sizes.

Based on these evidences we are able to say that this application is responsive since it adapts based on the screen size we are using.

4. https://gs.statcounter.com

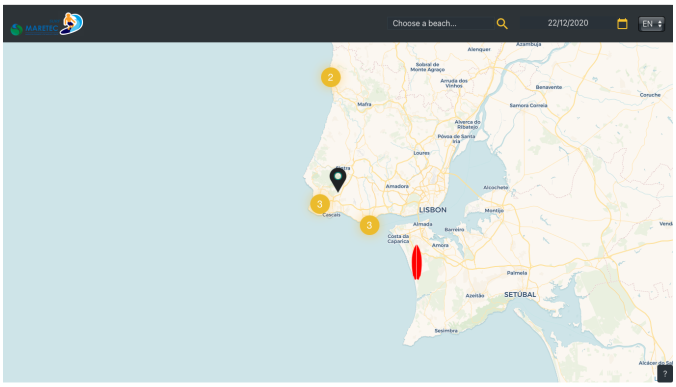

Figure 4. Desktop View

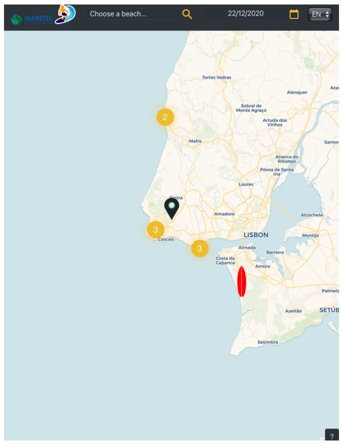

Figure 5. Tablet Portrait View

5.2 System Evaluation

System evaluation is an essential step since it helps us in identifying possible problems regarding the functionality and usability of our solution.

According to Fonseca, Campos, and Gonçalves [2], one of the methods that

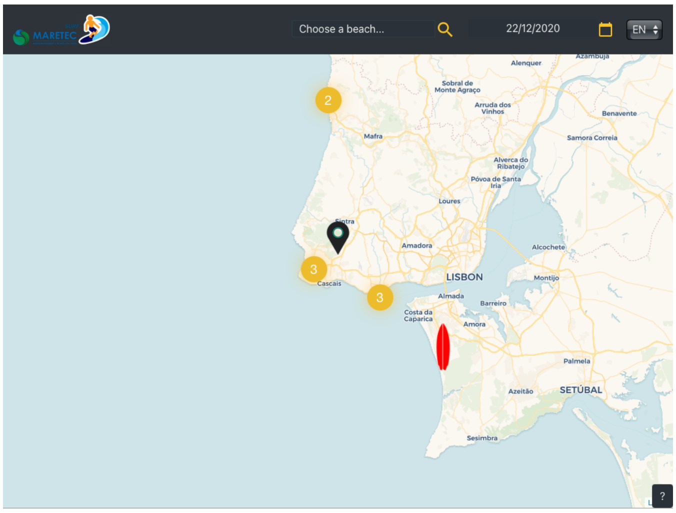

Figure 6. Tablet Landscape View

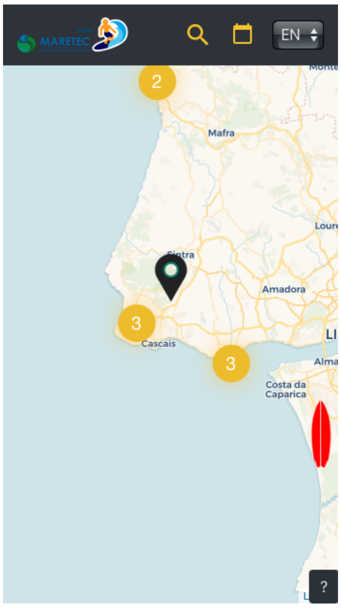

Figure 7. Mobile Portrait View

can be used to evaluate our system is User Testing. This is a technique that involves measuring the performance and satisfaction of users when performing certain tasks. The big advantage of this technique is that we deal with the end-users of our system, and they are the ones who can give us more information about the problems they may encounter.

For this technique, it is essential to develop a protocol to explain to the users that were going to test the application the conditions and the objectives of these tests. It is important for users to understand that we are testing the system and not them and therefore every difficulty or mistake they make, it is the system's fault.

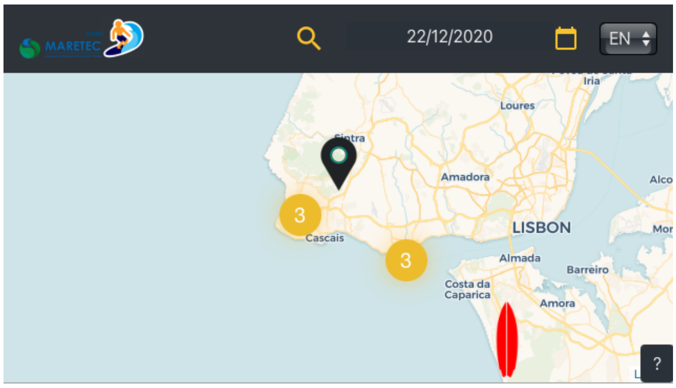

Figure 8. Mobile Landscape View

The complete protocol which is divided in 5 different sections: Environment and Equipment; Introduction; Initial Information; Tasks; User Satisfaction Questionnaire. With this protocol we were able to carry out the tests with 20 different users with the following age distribution: 18 users between 19-34; 2 users between 35-54. In regards to the gender distribution 12 were male (60%) and 8 female (40%). All of them have practiced surf at least once in their lives, and the frequency which they surf nowadays is: 5 users rarely practice (25%); 7 users monthly (35%); 4 users weekly (20%); and 4 users everyday (20%). All users affirmed they use touch devices everyday and the distribution of operating system they use is: 11 users use IOS (55%); 9 users use Android (45%).

In Table 2 we show which are the criteria of success for each of the 5 tasks. Table 3 shows us the statistical data regarding the time in seconds to complete each task. With the information on both of these tables we are able to say if the success criteria of efficiency and effectiveness defined in the protocol were accomplished or not for each task.

Table 2
Criteria of success defined for each task.

	T1	T2	T3	T4	T5
Efficiency	<20s	<20s	<30s	<20s	<15s
Effectiveness	<25s	<25s	<35s	<25s	<20s
Satisfaction	Easy	Easy	Easy	Easy	Easy

The following list analyzes the values obtained in Table 3 in order to justify if the efficiency and effectiveness criteria are met for each task.

- **Task #1 - Say which is the wave height for Praia de Carcavelos today at 3pm.** For this task we got an average of 16.1 seconds to complete the task which is under the 20 seconds mark defined for the efficiency criteria. We got 90% of the users under 23.1 seconds which is also under the mark of 25 seconds defined for the effectiveness criteria. Thus, we can say that for this task the criteria of efficiency and effectiveness were met.
- **Task #2 - Say which is the wave height for Praia de Carcavelos tomorrow at 3pm.** For this task we got an average of 14.2 seconds to complete the task which is under the 20 seconds mark defined for the efficiency criteria. We got 90% of the users under 18.0 seconds which is also under the mark of 25 seconds defined for the effectiveness criteria. Thus, we can say that for this task the criteria of efficiency and effectiveness were met.
- **Task #3 - Firstly select Portuguese as the defined language and then say which is the wave height for Praia do Guincho today at 4pm.** For this task we got an average of 18.2 seconds to complete the task which is under the 30 seconds mark defined for the efficiency criteria. We got 90% of the users under 25.4 seconds which is also under the mark of 35 seconds defined for the effectiveness criteria. Thus, we can say that for this task the criteria of efficiency and effectiveness were met.
- **Task #4 - Analyze the surf ranking for Praia de Carcavelos for today and say if it is good to go surfing.** For this task we got an average of 19.1 seconds to complete the task which is under the 20 seconds mark defined for the efficiency criteria. We got 90% of the users under 30.1 seconds which is above the mark of 25 seconds defined for the effectiveness criteria. Thus, we can say that for this task the criteria of efficiency was met but the criteria of effectiveness was not met. This can be explained by the lack of knowledge of some users regarding the concept of surf ranking.
- **Task #5 - Without using the search bar choose Praia de Carcavelos and say which is the wave height today at 3pm.** For this task we got an average of 10.4 seconds to complete the task which is under the 15 seconds mark defined for the efficiency criteria. We got 90% of the users under 16.1 seconds which is also under the mark of 20 seconds defined for the effectiveness criteria. Thus, we can say that for this task the criteria of efficiency and effectiveness were met.

Table 3
Statistical Analysis of the time in seconds to complete each task.

	T1	T2	T3	T4	T5
Minimum	8	7	5	8	5
Maximum	26	55	34	35	18
Average	16.1	14.2	18.2	19.1	10.4
90th percentil	23.1	18.0	25.4	30.1	16.1
Standard Deviation	5.07	9.96	7.03	8.02	4.10

Table 4 shows us the statistical data regarding the degree of satisfaction of users on each task. With this information we are able to say if the last criteria of success (Satisfaction) is met for each task. As it can be seen on the table, all tasks scored above 4 in a scale of 0 to 5, which allows us to say that users were in general satisfied with the tasks and therefore the criteria of satisfaction was met for all tasks.

Table 4
Statistical Analysis of the degree of satisfaction on each task.

	T1	T2	T3	T4	T5
Minimum	5	4	4	3	4
Maximum	5	5	5	5	5
Average	5	4.95	4.7	4.35	4.8
Standard Deviation	0	0.22	0.46	0.65	0.4

Lastly, we used the Satisfaction Questionnaire to ask participants to score from 1 (strongly disagree) to 5 (strongly agree) the ten questions. Based on those scores we were able to calculate a SUS score by performing the following steps:

- **1** - For each odd numbered question, subtract 1 from the score.
- **2** - For each even numbered question, subtract their value from 5.
- **3** - Sum all the new values and multiply by 2.5.

Although it is not a percentage score it will give a score out of 100 which helps to understand better how our system is behaving in terms of usability. As it can be seen in Figure 5 this system obtained a score of 96.75 which according to Jeff Sauro [5] can be graded as an A+. What this means is that our system was evaluated by the users with a good usability and therefore we can say that our system was accepted by the users.

Table 5
Statistical analysis of the System Usability Scale scores.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Score
Score	5.0	1.15	4.9	1.05	4.7	1.2	4.8	1.05	4.75	1.0	96.75

Although our application failed to meet the criteria of effectiveness on Task #4, by successfully meeting all the other success criteria for each task and with a high SUS score we are in position to say that our system satisfied the user requirements defined in the start of this project, making this a successful project.

6 Conclusion

With this project, we sought to take advantage of the already collected data from Maretec regarding both weather and maritime variables to provide surfers a solution for the visualization of forecasts oriented to the practice of surf. This work had the main goals of developing a responsive web application for displaying surf reports that would adapt to any viewing screen size and that would make available a ranking to help users to better understand the conditions of surf for each beach.

By dividing this project in 3 phases (Investigation, Development and Testing) we were able to reach a solid and optimized solution at the end. The Investigation phase turned out to be a major aspect of this project because it allowed us to construct a theoretical foundation around this work, where every decision made was clearly justified and compared with other alternatives. Also, by studying alternative solutions already existent on the market, we were able to understand what were the users requirements and what were their difficulties, which lead us to address both aspects on our solution. The testing phase lead us to quite exciting results, where we got a 96.75 score on the System Usability Scale, and only failed one criteria for one of the tasks. Although these are really good results we believe that there is still room for improvement, namely the fixing of the errors listed in Chapter 5 and other interesting features that were identified.

Throughout the development of this project we faced several obstacles, mainly due to problems involving the server that runs the forecasts models, but with the help of the several people involved these obstacles were surpassed.

Overall, at the end of this work we believe that the main goals were achieved making this a successful solution that can be used by surfers.

5. https://measuringu.com/interpret-sus-score/

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