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#Greener by GreenTech

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Greener

by **GreenTech**

Year 3, Group B

CCT

2019

Ana Ospitaletche – Larissa Roseno – Jose Miguel Gonzalez – Amanda Brelaz

Acknowledgements

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The team would also like to thank lecturer Amilcar Aponte for his help and guidance throughout the year.

Lastly, we would like to thank our classmates, friends and family for their support and encouragement.

Abstract

In recent years there has been growing concern about the negative impact humankind has on the planet. Companies and individuals are making efforts to mitigate their environmental impact. In this context and as individuals that care about the environment and try to lead a more sustainable life, we decided to research which elements could be stopping individuals from trying to implement changes in their daily habits.

One of the key conclusions of this research was that there is too much information, sometimes even conflicting, on how to lead a sustainable life.

#Greener aims to make a contribution by giving clear tips to reduce the negative impact on the environment on an individual basis, by stimulating practices that are accessible and safe for everyone to do in a fun manner.

In order to do this we developed a mobile application and a website that proposes challenges to be completed, and encourages you to submit evidence as pictures to the platform and to social media, so as to motivate others to also lead a more sustainable life.

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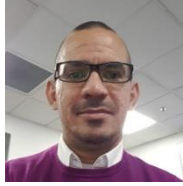
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CHAPTERS

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- 3. SYSTEM DESIGN**
- 4. IMPLEMENTATION**
- 5. CONCLUSIONS AND FURTHER WORK**
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- 7. REFERENCES**

Chapter 1

1.a GreenTech Members



I am **Jose Miguel Gonzalez** and my student number is **2017104**.



I am **Larissa Roseno** and my student number is **2017191**



I am **Amanda Brelaz** and my student number is **2017291**



I am **Ana Ospitaletche** and my student number is **2017253**

1.b - What is #Greener?

#Greener is a **Website and Mobile app** that focuses on spreading awareness on Sustainable Life Habits.

#Greener's mission is to provide facts and science-based tips to improve our daily habits so as to make them more sustainable, to bring awareness to the positive and negative impact of our own actions and to provide a platform where a sense of community and achievement in this regard can be attained.

We propose a platform that focuses on four key areas that are deeply connected to sustainable practices: **Energy, Water, Waste and Diet**. Each of these categories will contain 2 challenges, which are very easy and safe to do.

1.c - Justification: Hashtags and Social Media Challenges

- **The “Trashtag Challenge”**

As very concisely described by the BBC in their article [#Trashtag: The online challenge cleaning places up](#): *“In the Trashtag Challenge users pick a place filled with litter, clean it up, and post before and after pictures”*.


This challenge generated over **25.000 posts in a week** in social media, as reported by the NY Post in their article: “The new social media challenge that’s saving the environment”.


This is a great initiative to solve short term issues which is important by itself, “It can raise awareness for litter and other environmental issues, and make people more aware of the products they use and the waste they produce” as Mark Butler, Ecology Action Centre (EAC) policy director mentions to The Star. However, Butler argues *“There’s the waste hierarchy, which is to refuse, reduce, reuse, recycle. If we don’t do that stuff, then all we’ll be doing is cleaning up the litter with no end in sight.”* in allusion to the importance of implementing collectively better habits regarding waste – and ideally laws and company regulations-

- **Greta Thunberg: #FridaysForFuture #SchoolStrike4climate**


Greta Thunberg, a 16 year old Swedish girl, sparked a whole movement that unites young -and not so young- people worldwide, demanding governmental action on Climate Change issues. She has met with the Pope, testified before the US congress and the European Parliament and ‘(...) inspired **4 million people** to join the global climate strike on September 20, 2019, in what was the largest climate demonstration in human history’ as reported by Time magazine.




 **gretathunberg** • Siguiendo ...





 **gretathunberg** One year ago I started school striking for the climate outside the Swedish parliament, simply because something had to be done. Since then I have continued every Friday alongside millions of others. And we will go on for as long as it takes. #FridaysForFuture #SchoolStrike4climate


8 sem



 **bartolomeo.buo** @_corsigiacomo_ porca madonna viva la plastica

2 sem Responder

 Les gusta a i_weigh y 415,255 personas más

20 DE AGOSTO

Picture taken from Greta's Instagram Account (20-08-2019) "One year ago I started school striking for the climate outside the Swedish Parliament, simply because something had to be done. Since then I have continued every Friday alongside millions of others. And we will go on for as long as it takes. **#FridaysForFuture** **#SchoolStrike4climate**"

1.d - Problem definition

At a time when words such as *climate change*, *sustainability*, *sea pollution*, *plastic waste*, or *greenhouse effect*, seem to be everywhere from the press to podcasts to social media, we realised that it was hard for us not to experience both a feeling of overwhelm and a desire to help, to be part of the solution. Talking with friends and classmates, it seemed they were also having this problem.

Also, as mentioned previously, the environment is a rising concern among people; one solid proof is that on the 20th of September the biggest environmental march in history gathered 4 million people all around the world, as reported by Charlotte Alter, Suyin Haynes and Justin Worland (2019) for Time magazine.

Other simpler examples are that when going to some cafés in Dublin you will be given discounts for bringing with you your own travel mug (9th degree, Marks & Spencer for example). ATMs no longer print receipts unless you explicitly ask for them. Supermarkets sell plastic bags, they don't give them out for free anymore. Examples like these are abundant and they speak of a positive shift in many people mind-sets, in regulations, and in companies being more environmentally aware.

However, even though many people would like to improve themselves, to make a contribution even if small to reduce their negative impact on the environment, is not always easy to know how to start (Rajapaksa, Rajapaksa, Managi, 2018). Many feel blocked or find it difficult to feel motivated to engage in environmentally friendly actions. This difficulty responds in part to a struggle understanding the extent of the impact of their choices, but also to climate change being a slow process that can't be observed directly (Rajapaksa, Rajapaksa, Managi, 2018).

In addition, many people can feel that their action won't be meaningful because the results of only one person's actions are not visible and are insignificant at a global scale. Also, 'focusing on individual habits and changes seems to be the slower possible route to take to a more sustainable world' as mentioned in the academic paper *The Psychology of Sustainable behaviour* (Manning, 2009).

Ozkula, 2017, argues that even though social media has '*created more diversity through integrating new actors, media channels, platforms, and contents*', which can be viewed as something positive, this diversity also means that there is more fragmentation, information overload and a lack of formal control or filters. According to Ozkula, 2017, this overload and fragmentation of the information available to users make it increasingly difficult for experts in climate change to participate and follow online debates.

Summarily, we seem to have on the one hand too much information and fragmentation of it, generating confusion on the legitimacy of it. On the other hand, people can feel their actions as individuals won't have an impact, either positive or

negative, and that therefore is not worth implementing new habits. If we consider how slow processes such as climate change or ocean pollution can be, and how negligible one person's action can be on global terms, it makes sense that many of us feel blocked or confused. Making new and improved decisions to start implementing environmentally friendly habits does not come easy to many as individuals.

1.e- Solution proposed

#Greener proposes a small, but consistent, contribution to help people making informed, science based changes in their daily habits in order to live a more sustainable life.

A key feature of **#Greener**, inspired by the Thrashtag challenge, is that you can actually 'challenge' those around you to complete sustainable actions.

Our platform also provides information from reputable sources about the reasons behind the challenges we propose and how they can have a positive impact. The challenges will involve very simple actions that everybody can do at very little or no cost and that do not present any risk of harm.

This platform is about informing users and prompting them to implement sustainable practices but also about creating a sense of community. We want to promote the idea that individual actions do matter and do have a positive impact in our environment, as seen previously on a larger scale, but less realizable in the long term, with the **Thrashtag** example.

Another important aspect of this platform is that a user will learn but will also be able to share the knowledge, and involve others in making meaningful practical changes in their lifestyle. When individual actions add up real changes can be achieved. Building a community, knowing that others are taking the same measures and sharing a common goal is important to potentially lead to bigger, more visible changes as discussed by Manning, 2009.

Studies have shown that even though people do not like to admit that they follow trends, as *'we all want to think that we form our own likes and dislikes without interference from broader social opinion (...) we are all constantly modifying our behaviour based on social signals from others'* (Cialdini, 2007). These signals can be positive -someone smiling at us or complimenting us - or negative – someone looking at us disapprovingly or shaking their head - . In both cases these signals shape the way people behave and think and help set what is believed to be socially normal and acceptable. As growing numbers of individuals adopt sustainable behaviours and are vocal about it, the behaviours become normalized. The more often we see a particular behaviour, the more it becomes "normal" and we internalize it as a norm, as Manning (2009) explains. Also, as AJ Agrawal (2016) puts it in the article, 'It's Not

All Bad: The Social Good Of Social Media': *'Using social media allows teens to follow organizations and causes that they believe in. (...) Social media is one of the best outlets to reach the minds of young people to make a real difference.'* Even though this article focuses on teens, we believe it applies to everybody regardless of their age.

In conclusion we believe #Greener could help individuals making changes by positively reinforcing sustainable behaviour, by proposing science based challenges and by being built around the desire to involve others in leading a more sustainable life.

1f.-Existing technologies

Researching the **Appstore** and **Google Play Store** to check what existing technologies are already in the market we found that there are a large number of apps that make their focus on the environment. There are some that allow you to keep track of your carbon footprint, for example Oroeco. We also found an app called Poolmyride that helps you find people with whom to share a car and save Carbon emissions and fuel. There are also apps to check how sustainable products or stores are, and to find vegan/vegetarian restaurants and stores.

However, the most similar apps to ours we found were Ecosia, Go Green Challenge, Joulebug. When we downloaded these apps in our phones we realised their concept was quite similar to the one we wanted to develop with one key difference, that our idea is centred in challenging others, and these apps have a more individual focus, as the challenges are intended to be done by the user that downloaded the app only.

The innovative aspect of #Greener will then be that our challenges are intended to be completed by others, and by doing so it has a more collective approach. Another innovative aspect of #Greener is that we propose the evidence based system, in which people have to prove the action was completed through pictures or videos in order to get points.

1.g - Objectives

By the end of the year we hope to achieve the following objectives:

System

- Our main objective is to build a robust, intuitive and responsive website and mobile application powered by a database.
- To develop a well-designed User Interface
- To implement a Registration and Login system
- To provide positive feedback and encouragement to users through the implementation of a points system

Abstract

- To provide a platform that will allow people to learn but also to share this information to others.
- To build a community of people around Sustainable practices
- To inspire positive changes in daily habits

1.h How #Greener works, a high level explanation

When a user registers with #Greener they only need to provide a user name and password, which would be used to log in to the platform. Another option would be to set up a profile using Facebook.

After successful registration/log in the person would be able to see 4 sections which are: Water, Waste, Energy, Diet and choose one of them in order to see the challenges available.

The next steps are simply choosing the challenge they liked the most and selecting another person from the app to send it to. If the other person accepts it, they would have to provide evidence of its completion by sending a picture or video to the person that challenged them. Once the evidence is marked as valid by the user that issued the challenge, points are allocated.

As we understand exchanging this type of information in the evidence part can arouse issues related to GDPR and give place to misconduct between users, we won't propose this project to go live. Alternatively, we propose the live version of this project to post the evidence directly to **Twitter** in #Greener's official account, as this allows for moderation of the content of the pictures and videos posted to be done by Twitter and not us.

Another feature of #Greener is that users are able to see in their profile how many points they have and the challenges that are pending completion.

1.i - #Greener: The Challenges & the science behind them

A.Energy Section:

WHY? Climate change and our use of energy are closely related. 'Globally, the use of energy represents by far the largest source of greenhouse gas emissions from human activities (...) *The more we release greenhouse gases into the atmosphere, the less likely we are to limit the harmful effects of climate change* ' reports The European Environment Agency.

According to the Sustainable Energy Authority for Ireland '*Irish homes account for over a quarter of our total energy use in Ireland, even more than industry*'.

They also point out that at around 40%, transport is the largest energy user in Ireland, and private cars *account for about one fifth of all the energy use.*

Carbon dioxide is released when using fossil fuels such as gas, oil or coal and these fuels are used by all of us in our daily lives, for example using electricity, turning on the heating, driving cars. Taking these facts into account, it seems that if enough individuals start implementing changes energy-wise we could achieve a collective improvement in the emissions of greenhouse gases.

THE CHALLENGES

These are tips from the Sustainable Energy Authority of Ireland

Save Electricity

For one day don't turn on the heater, avoid turning on your lights as much as you can, batch cook (this is a great way to save energy but also time). This challenge addresses the need to be mindful of our usage of electricity. For example, by batch cooking instead of turning on the oven many times during the week. It also applies to other gadgets that are energy consuming but that we need for cooking

Hashtag: #GreenerEnergy

Tips to provide Evidence:

- Take a picture of your food once is all cooked or of the fridge with all the containers with food you prepared.
- Take a picture of you or film a short video of yourself while cooking
- Take a pic of the candles or the screen of the heater turned off
- Safety first: if you are using knives, boiling water or oil, or anything that could potentially harm you, do not use your mobile phone at the same time.

Walk or Cycle to work/college

If possible implement these activities as your daily commute option. This would contribute reducing CO2 emissions from cars. If is not possible to walk or cycle, using public transport is always a more sustainable option than driving.

Hashtag: #GreenerCommute

Tips to provide Evidence:

- Take a picture of yourself in the bus or walking
- Film a short video of yourself walking or using public transport to get to work/college
- Remember to use the challenge's hashtag to earn points
- Be mindful of traffic! Do not take pics or film while crossing streets or cycling!

B. WASTE:

WHY? According to The Guardian, in an article on plastic bottles pollution, annual consumption of plastic bottles will top half a trillion by 2021, if we continue to consume plastic bottles at this pace, the current efforts of recycling will not be sufficient, and this would endanger oceans, coastlines and other environments, some predict that plastic pollution will be as serious a threat as climate change. They report that '*most plastic bottles used for soft drinks and water are made from polyethylene terephthalate (Pet), which is highly recyclable. (...) But fewer than half of the bottles bought in 2016 were collected for recycling and just 7% of those collected were turned into new bottles. Instead most plastic bottles produced end up in landfill or in the ocean.*' The Guardian also reported in this article on plastic waste, that over 480bn plastic drinking bottles were sold in 2016 across the world, up from about 300bn a decade ago. They also report that by 2021 this will increase to 583.3bn, according to the estimates from Euromonitor International's global packaging trends report.

According to Harvard University on an article called "Reduce disposables: reuse reusables" the majority of plastic bottles used across the globe are for drinking

water, citing Rosemary Downey, head of packaging at Euromonitor and one of the world's experts in plastic bottle production.

The United Nations warn that **by 2025 there will be more plastic in the ocean than fish**. This was reported in their Clean seas campaign, launched in 2017. The Clean Seas campaign has been joined by 57 countries, *'pledging to cut back on single-use plastics, protect national waters and encourage more recycling'*. But the UN emphasizes that only governments being responsible and committing to making improvements in this direction is not enough. **People have to also commit to cutting single-use plastics from their lives** and they signal the importance of social media in this regard. According to this article more than 100,000 people have taken the Clean Seas pledge to reduce their plastic footprint.

THE CHALLENGES

GO REUSABLE

AVOID PAPER AND PLASTIC MUGS, BOTTLES & BAGS– Get your takeaway coffees in a reusable mug. Keep your own mug at work or college, start a mug collection in your office. Offer visitors and guests coffee in reusable mugs. By doing this you avoid generating paper and plastic waste. Avoid buying disposable water bottles. A million plastic bottles are bought around the world every minute! Take a tote bag with you to the supermarket. Avoid using plastic straws. (These are tips from Harvard University)

Hashtag: #GreenerReusable

Tips to provide Evidence:

- Simply Take a picture of you getting your Latte in a reusable mug
- Take a pic of you carrying your groceries in your reusable bag
- Take a pic of you using your reusable water bottle
- Take a picture of the new mug collection at work
- Remember to use the hashtag to earn points

CLEAN A PUBLIC SPACE AND/OR RECYCLE

Get containers for your home, college or work to start recycling and classifying waste.

You can also go to a park, square or any public space that is easy and safe for you to access and pick up residues. This activity was inspired by the #Thrashtag challenge.

Dispose of cigarette butts correctly and spread the word. **Cigarette butts are the most littered item on the Planet**. According to an article in National Geographic on

Cigarette Butts Pollution two thirds of the approximately 4.5 trillions of cigarette filters generated every year are thrown in the street, in the beach or out of a window. This means that these end up getting in waterways and eventually in the oceans, where they leak toxic substances that can remain for 10 years.

Hashtag: #GreenerWaste

Tips to provide Evidence:

- Simply take a pic of you disposing of these residues correctly in the containers
- Film a short video either cleaning up a space or recycling
- In Dublin some bins have been placed by Dublin City Council for the specific disposal of cigarette ends.
- Take a before and after picture of the place you cleaned
- Appropriate equipment is required when cleaning public spaces, always wear gloves and be mindful of the waste you will be in contact with.

C.Diet:

WHY? The choices we make concerning the way we eat have an impact on the environment. Different diets, such as being vegan, vegetarian, omnivore, etc have different environmental footprints. For example, the production of animal products uses 10 times more water than vegetal ones. One 1kg of meat needs 15.000 litres of water, to produce one burger 2,400 litres, whereas 1 bag of potatoes uses 185 lt, each tomato 13lt, or one egg 135lt.¹

According to the report Water pollution from agriculture by the Food and Agriculture Organization of the United Nations, *'the increase in demand for food with high environmental footprints, such as meat from industrial farms, is contributing to unsustainable agricultural intensification and to water-quality degradation'*. However, in this same report they argue that this can be changed with the correct regulations and incentives to encourage more sustainable and healthy diets. [pg 19]

In the article Change your diet to combat climate change in 2019 by the CNN, Marco Springmann of the Oxford Martin Programme on the Future of Food at the University of Oxford was interviewed. He conducted a study for the Nature journal that found that the production of animal products generates the majority of food-related greenhouse-gas emissions -- specifically, up to 78% of total agricultural emissions.²

He also explained to CNN that "beef is more than **100 times as emissions-intensive as legumes**," "This is because a cow needs, on average, 10 kilograms of feed, often from grains, to grow 1 kilogram of body weight, and that feed will have required water, land and fertilizer inputs to grow."

Additionally, the scientific community has warned that animals as cows and sheep emit high amounts of methane during digestion, which is a potent greenhouse gas.

THE CHALLENGES:

BE VEGAN FOR ONE DAY

Moderate your consumption of dairy and meat. Adopting more plant-based diets for ourselves could reduce the greenhouse gas emissions of the food system by more than half, studies say. In case you were wondering Protein can be found in beans, mushrooms, quinoa, etc.

(Tip recommended by a large number of scientific studies³)

Hashtag: #GreenerVegan

Tips to provide Evidence:

- Take a picture of all your food. You can explain what you are eating in each case
- Remember to use the hashtag

DAIRY FREE DAY

Try having your Mocca or hot chocolate with coconut milk. Capuccinos are delicious with almond milk or oat milk. You can try out a vegan pizza or have your toasties with vegan cheese. **(Tip recommended by a large number of scientific studies³)**

The dairy industry is equally damaging for the environment as the meat industry. Many scientific studies have shown that it is necessary to consume these products in moderation.

Hashtag: #GreenerNoDairy

Tips to provide Evidence:

- Take a picture or film a short video of yourself buying vegetal milk or cheese
- Take a pic of yourself preparing your coffee, oats, etc with vegetal milk
- Take a picture of your vegan pizza or toastie.
- Remember to use the hashtag!

D.WATER

WHY? As stated by **the UN WATER website** 'water is at the heart of adaptation to climate change, serving as the crucial link between the climate system, human society and the environment'.

We seem to think that water is an endless supply, especially when coming from countries where there are no water shortages. The earth surface is covered by a 72% of water. We call earth 'the blue planet' in allusion to this. However, the fact is that only less than 1% of the world's water is accessible for human use in a direct way. 'Given human water consumption patterns and the world population growth rate, these fresh water reserves have been shrinking all over the world at an alarming rate' (Ida Ferrara, 2008).

Water conservation is an urgent topic. Even though regulations need to be implemented on water consumption, especially for large scale consumers like industry and agricultural producers, individuals can make contributions too. According to Harvard University's article '5 ways to measure a 5 minutes shower', using less water not only helps people reducing their energy consumption and costs, but also allows them to conserve water. This water will stay in the environment for natural geological and ecological cycles.

The challenges:

Brush your teeth with one glass of water

This is a very simple but effective way of saving water. According to the U.S. Environmental Protection Agency, as quoted **by Colgate in their website** nearly four gallons of water can be wasted if the faucet is left running while brushing your teeth

Hashtag: #GreenerTeeth

Tips to provide Evidence:

- Take a picture from your glass and toothbrush
- Use the hashtag

Always use full loads in your washing machine and dishwasher –

This cuts out unnecessary washes in between. Also, keep in mind that cleaning waste water or 'grey water' is an energy intensive process. By doing your laundry on full loads you reduce your impact in this sense as well. (Tip from Eden project)

Hashtag: #GreenerWashes

Tips to provide Evidence:

- Take a picture from your fully loaded machine

1.j – Project requirements

A. Technologies:

In order to develop this project we will work with the following languages and technologies:

*This is an overview of the technologies we intend to use, for an in depth discussion please refer to Chapter 4.

For the Design stage:

To produce the **Diagrams** we will use **draw.io**. This is an online resource completely free to use that allows designing different UML and Database diagrams. Once you complete a diagram you can export it to a JPEG format.

Front-End development –WEB -:

Initially, we believe we are going to be working with the following technologies, as these were the ones used during previous Modules at CCT and therefore we feel more comfortable with them.

HTML – We will structure our Web document with HTML. HTML is the standard mark-up language for Webpages, as explained in the w3 schools website⁴. We have been working with HTML since 1st year and we feel confident with it.

CSS – This is a tool for styling our Website. We started working with it in 1st year. The purpose of CSS is to “describe the style of an HTML document, and how its elements should be displayed” as explained in the w3 schools website⁵.

Javascript – This is “the programming language of HTML” as explained in w3 schools⁶, and what it does is to determine the behaviour of the elements in a website. We only started working with Javascript this semester, but we feel that with the help of tutorials and online courses we will be able to implement it.

Bootstrap 4 – This is an HTML, CSS and Javascript framework and its purpose is to make websites responsive, so that when opening it in smaller devices like mobile phones, it will adjust to the screen, as stated in w3 schools⁷.

Back-End development –WEB-:

PHP: We will use PHP for the Web connections to the Database and to implement Sessions/Cookies. We worked with this language in second year and therefore have some experience implementing it. PHP is a server scripting language⁸.

Database:

MySQL – This is a database management system developed by Oracle. We have been working with MySQL since second year and this is the main reason why we chose to stick to it for developing the database.

Workbench- We chose to use this tool because we have been working with it in our Database module in 3rd year and is easy to understand for us. Also, it not only allows the development aspect of a database but the design, as it has some functionalities to create diagrams, etc.

Mobile App:

Android Studio – To develop the mobile application we will work with Android Studio. This tool is the official IDE for Android app development. We decided to work with it because we found that it has very convenient tools such as an emulator, it supports Version Control systems such as Github, it allows drag and drop of widgets, and you can develop for all Android devices, and it has built in support for Google Cloud Platform.

To build an app in Android Studio you work with Java, which we are also familiar with as we've been working with it since first year.

This information was found at the official Android Studio website (<https://developer.android.com/studio/intro>)

B. Abstract requirements:

In order to complete all the aspects of this project we think is necessary to have weekly meetings which we have set for Wednesdays at noon. We feel is important to get together on a weekly basis to check our progress, discuss new ideas and to stay on track with deadlines. Also, we feel is important to be able to help each other as a group and do things collaboratively as much as is needed.

Another requirement, given our lack of experience with some of the technologies mentioned in the previous section such as Android Studio, Javascript, Bootstrap etc we feel we would need to sign up to online courses and follow tutorials before moving to the implementation stage.

We also need to research UX design in order to submit a professional looking project, as none of us has design experience.

1.k – Project schedule

Phases		Time in Weeks											
		1 22-Sep	2 06-Oct	3 13-Oct	4 20-Oct	5 27-Oct	6 03-Nov	7 10-Nov	8 17-Nov	9 24-Nov	10 08-Dec	11 15-Dec	12 22-Dec
FIRST SEMESTER	Define Problem	█	█										
	Define Solution		█										
	Theoretical Research		█	█	█								
	Technologies research		█	█	█								
	Analyze research												
	Process and compile data in report					█	█	█					
	Decide Challenges					█	█	█					
	Design System - High level-					█	█	█					
	Compile requirements							█	█	█			
	Finish 1st Chapter										█	█	█
	Proposal's Design												
	Diagrams												
	Use Case										█	█	
	Class Diagrams										█	█	
	Activity Diagrams										█	█	
	Program Specifications										█	█	
	Design Database										█	█	
	Tables										█	█	
	Relationships										█	█	
	Data Dictionary										█	█	
	UX research								█	█			
	HTML Prototype									█	█		
	Check usability, gather users' input										█	█	
	Design Website												
	Flow diagrams											█	█
	Generate Wireframes											█	█
Design App													
Flow diagrams											█	█	
Generate Wireframes											█	█	

Phases		Time in Weeks												
		1	2	3	4	5	6	7	8	9	10	11	12	
SECOND SEMESTER	Implementation													
	Coding													
	Backend	█	█	█	█	█	█	█	█					
	Frontend	█	█	█	█	█	█	█	█					
	Testing													
	System testing									█	█			
	Process results									█	█			
	Compile Documentation	█	█	█	█	█	█	█	█	█	█	█	█	
	Elaborate Presentation												█	█

1.1 - Project risk analysis

Abstract

- Needs enough users registered at #Greener in order to work
- Would need a big amount of challenges to stay interesting in the long term
- People using incorrectly the app challenging the same person over and over
- Incorrect use of evidence process, the nature of it could allow inappropriate exchange of pictures and videos. Moderation would be required 24/7, as is not possible to implement AI automation that would detect this type of content.
- GDPR could be an issue regarding the evidence process if the system goes live

Technical:

- We are not able to provide a robust system and code all aspects of the Web/app that we propose
- The user interface is not intuitive and attractive enough for users to engage in it
- The system does not keep track of evidence or points correctly

1.m Future developments

- The amount of challenges for this project will be of only two per category. Ideally, a future development would contain a more extensive list of challenges to be chosen from.
- We do not intend to go live with this project, as there might be some issues with GDPR or people might use the platform to exchange inappropriate content through the evidence process. As we wouldn't be able to monitor this type of content 24/7 we would consider a future development to be the project going live.

For this project the live version will consist of posting the evidence through the app/web to #Greeners official Twitter account, as the moderation aspect will be left to Twitter.

Chapter 2

System Analysis

CHAPTER 2- System Analysis & Design

Introduction

#Greener project aims to submit both a Website and a mobile application.

In order to complete the Analysis and Design aspects of the project we used different technologies, some of which we have already outlined in the previous chapter.

All **diagrams** in this section were created using the website **draw.io**. This website allows you to use a number of tools when creating a different range of diagrams. We chose it because it's extremely intuitive and easy to use and it allows editing diagrams online and then to export them to .jpg and .png formats.

Another technology we used was a website called **balsamiq.com**. With this platform we created our **wireframes** for the website, as doing some online research we found that it allowed creating wireframes quite quickly, as it's a low fidelity UX wireframing tool and it allowed us to model the screens according to our ideas very easily.

Please refer to Chapter 3, the Implementation Chapter, to read a more in depth consideration of the languages and platforms used to develop both the #Greener Website and the Mobile app.

2.2 USE CASE SCENARIOS & DIAGRAMS

A use case diagram describes a **single goal** while the user interacts with the system and represents a good practice so as to visualize the functionalities of a system.

USE CASE 1

Registration and Login

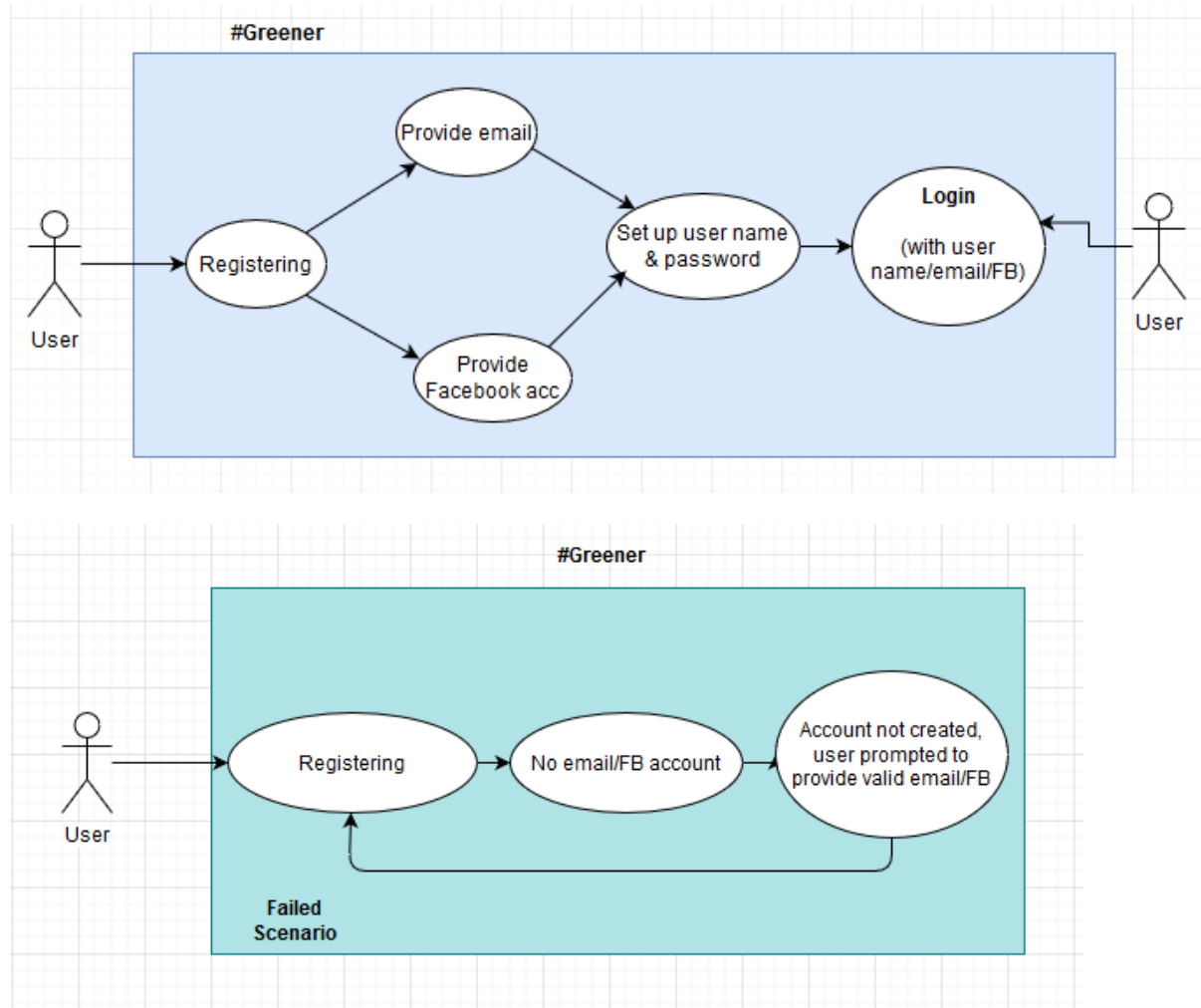


Figure 1. Use case Diagram: Registering

Use case name: Registering

Scenario: The user registers by providing an email, user name & password, or alternatively, with a Facebook account

Preconditions: The customer has to have an email or Facebook account

Main Success Scenario: The user has no issues setting up a new account. All data is stored in the database so that the user can access #Greener securely and without issues in the future

Failed-End scenario: The user fails to provide the data needed to create an account

USE CASE 2

Selecting a Challenge

As mentioned at previous stages, we plan on presenting the user with 4 categories of challenges. These categories will be Energy, Water, Diet and Waste. Each category will contain at this initial stage of our project only two challenges each. After selecting the desired challenge the user will be able to choose from a list of users whom to send it to. The process of selecting a Challenge would be completed.

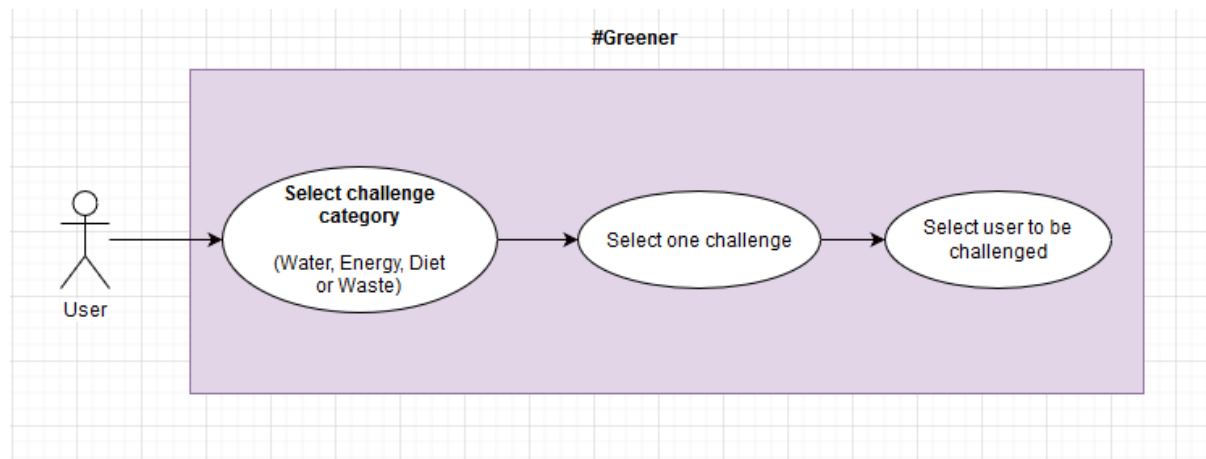


Figure 2. Selecting a challenge Use Case Diagram

Use case name: Selecting a Challenge

Scenario: The user selects a challenge from one of the four challenge categories available (Water, Energy, Waste, Diet).

Preconditions: The user has an existing #Greener account and has Logged in.

Main Success Scenario: The user is able to choose a challenge and send it to another user to be completed.

Failed-End scenario: The user can't select a challenge or can't select/find another user to send it to

USE CASE 3

Accept or Reject a Challenge- Users should be able to decide whether to complete a challenge sent to them or not

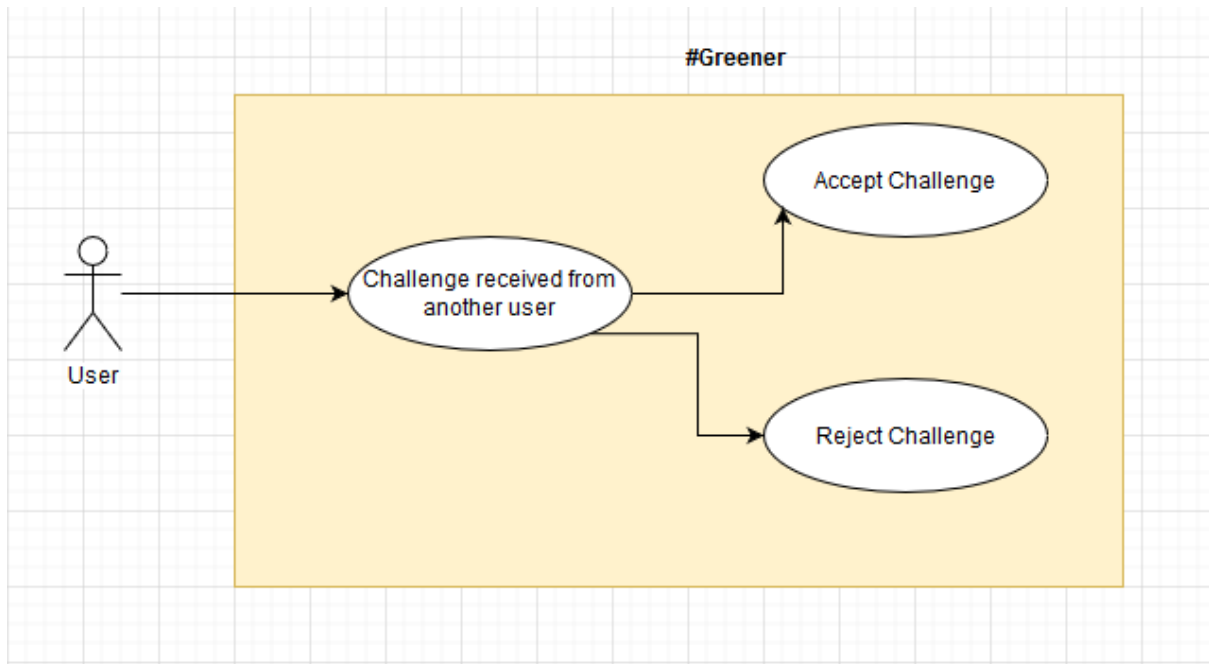


Figure 3. Accepting or Rejecting a Challenge Use Case Diagram

Use case name: Accepting or Rejecting a Challenge

Scenario: The User accepts or rejects a challenge sent to them by another user

Preconditions: The user has an account and is logged in to #Greener

Main Success Scenario: The user can read the challenge sent to them and is able to either accept it or reject it.

Failed-End scenario: The user cannot access the challenge, cannot accept it or reject it.

USE CASE 4

Submit Evidence – Once an user has accepted and completed a challenge, they should submit evidence in the form of a picture of having successfully completed the challenge.

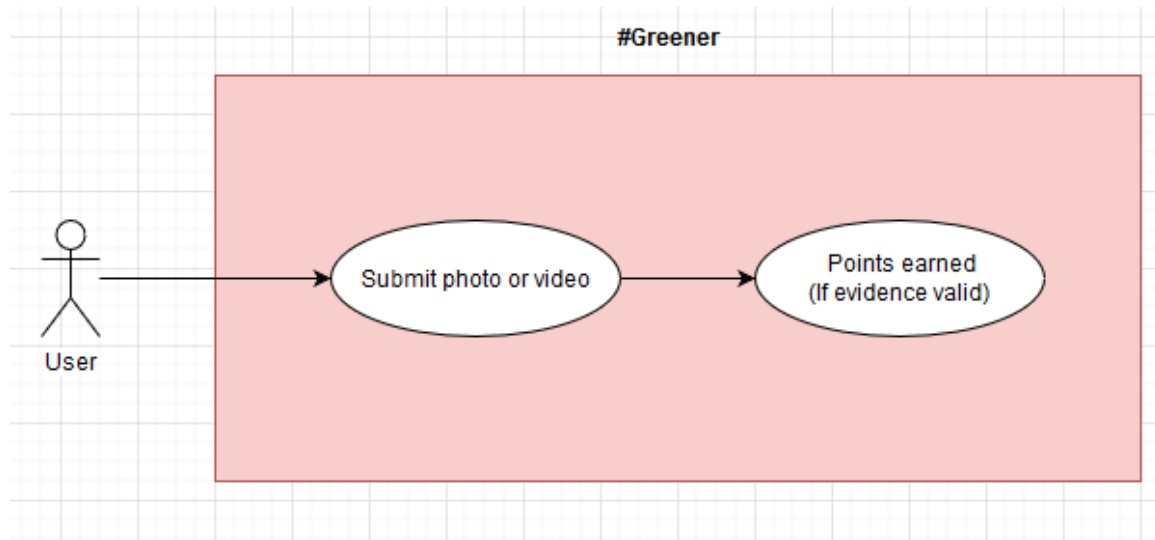
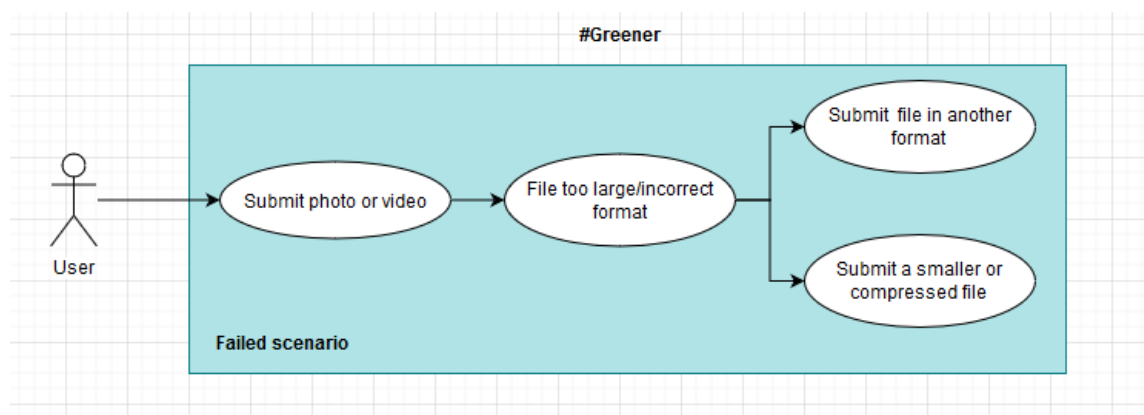


Figure 4. Submit Evidence User Case Diagram



Use case name: Submit Evidence

Description: The user needs to submit evidence of having completed a challenge to get points

Preconditions: The user has an account, is logged in and accepted a challenge

Main Success Scenario: The user is able to submit photos/videos as evidence of having completed the challenge sent to them by another user

Failed-End scenario: The user cannot submit evidence (the file is too large, incompatible format, etc)

USE CASE 5

Update details – The user should be able to change their username from their profile. If the password has been forgotten or they simply desire to change it they will be able to update it too.

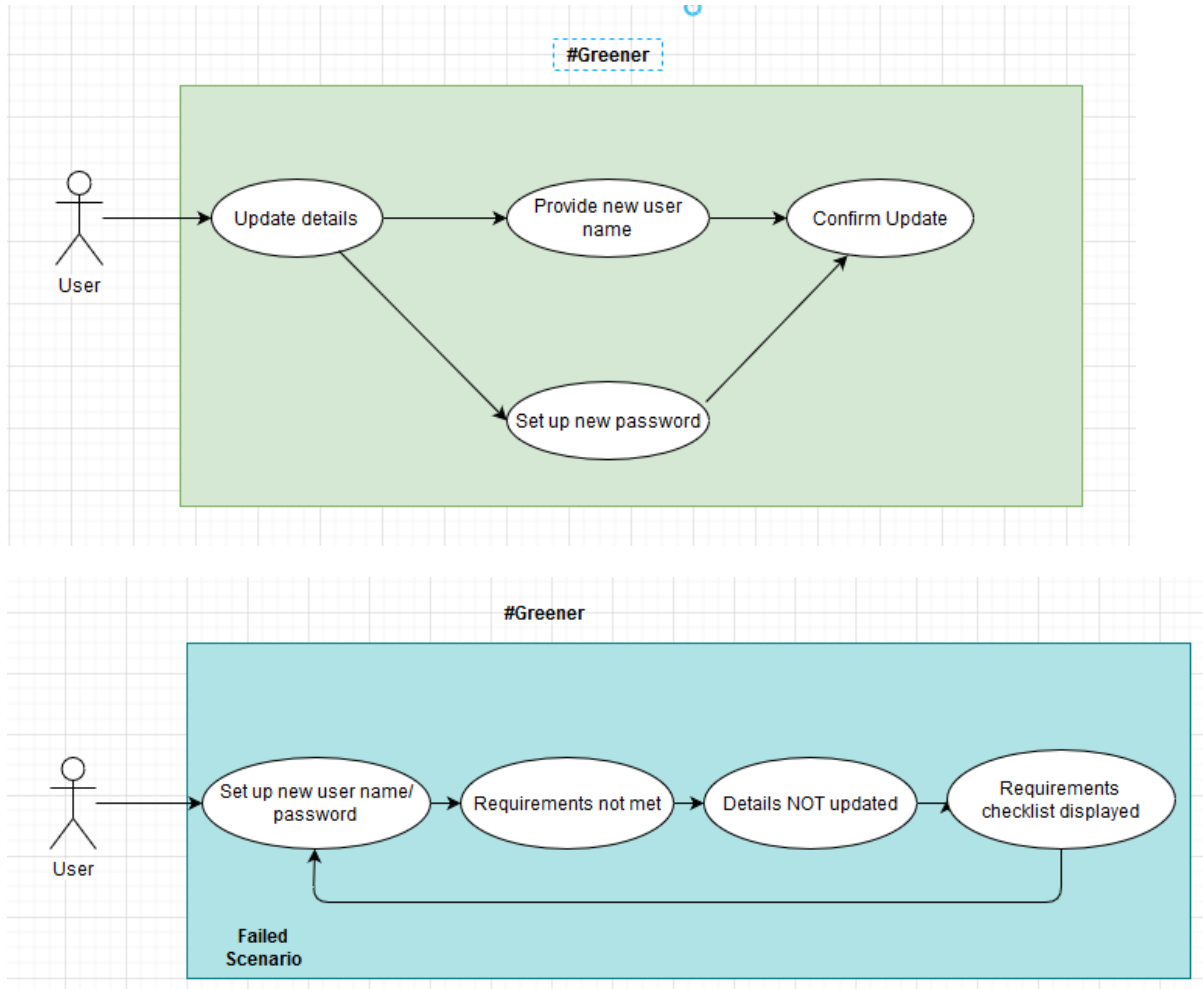


Figure 4. Updating Details User Case Diagram

Use case name: Update Details

Description: The user needs to change his/her details. The changes can be in the password or user name

Preconditions: The user already has an account

Main Success Scenario: The user has an existing account and the details can be updated (user name and /or password).

Failed-End scenario: The user cannot update their details, this could be due to not meeting password/user name requirements (length, characters, previous password not matching, existing user name, etc)

USE CASE 6

View Challenges – The user should see after login the completed, pending and sent challenges

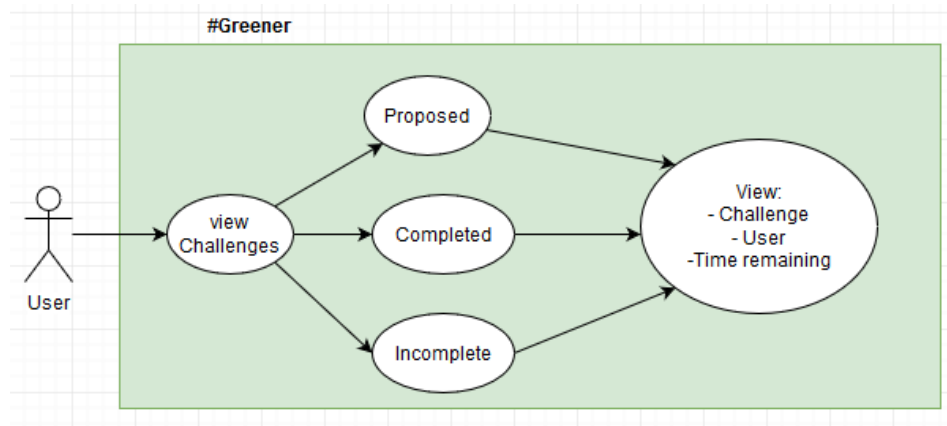


Figure 6.1 Viewing Challenges details

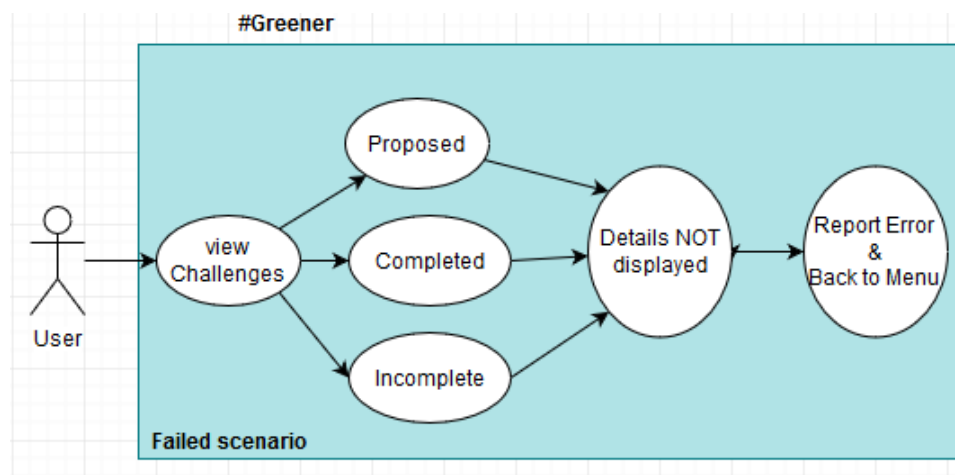


Figure 6.2 Viewing Challenges details Failed scenario

Use case name: View Challenges

Description: The user can access his/her own incomplete and completed challenges plus the challenges sent to other users that are pending completion.

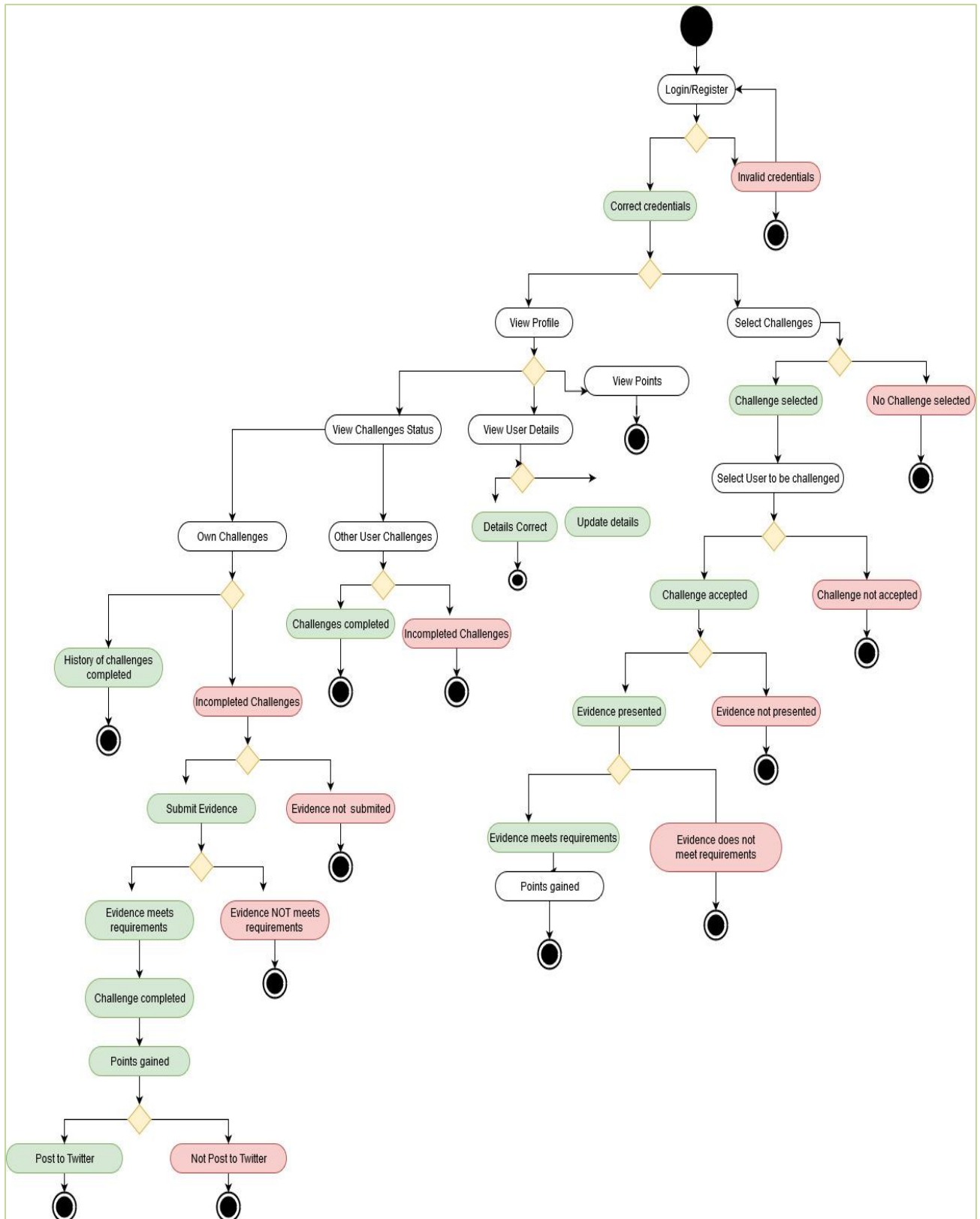
Preconditions: The user already has sent challenges to others, or has received challenges

Main Success Scenario: The user is able to view all details in each of the options.

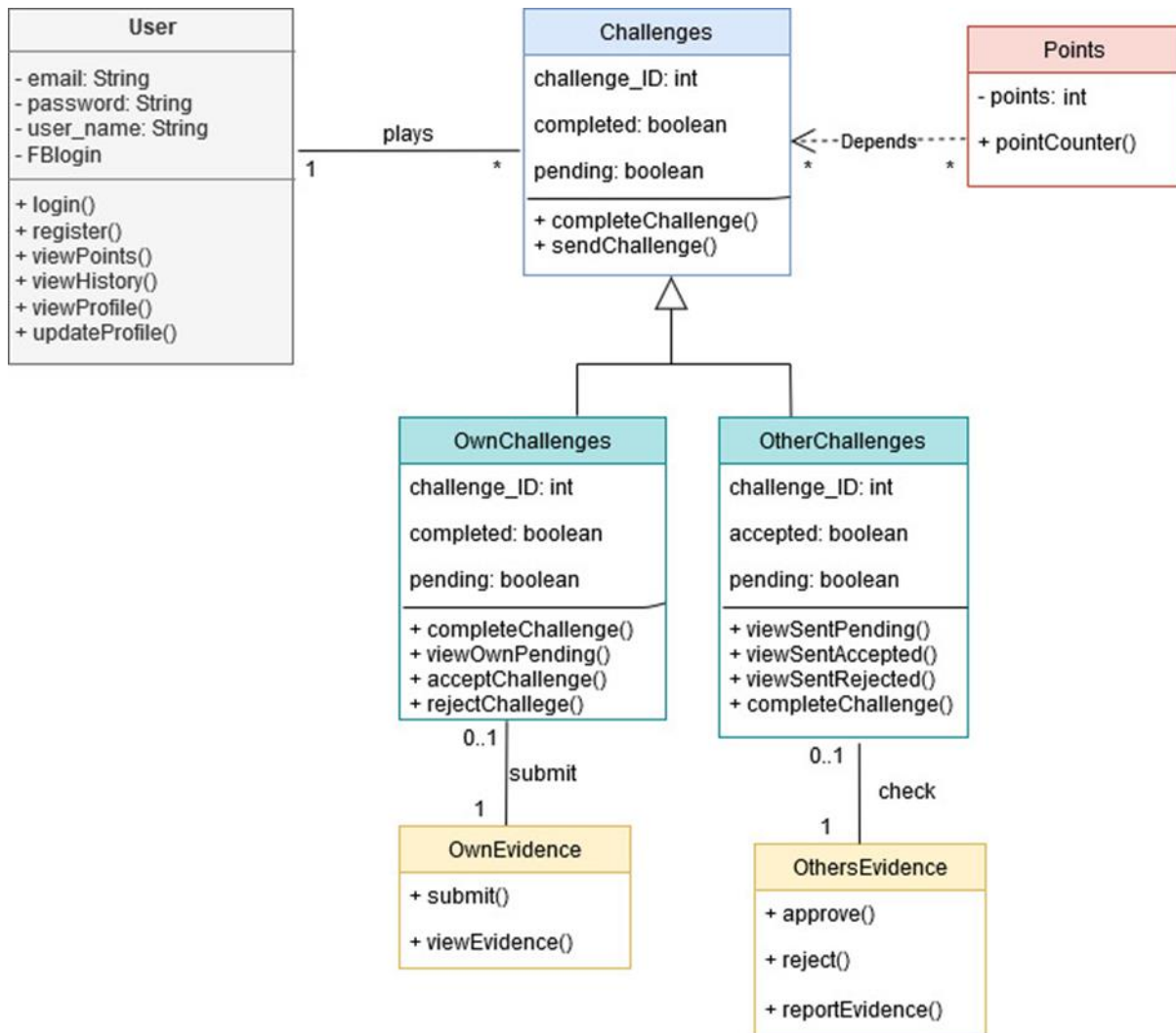
Failed-End scenario: The user cannot access a particular information that he/she wishes to see

2.2 Action Diagram

The purpose of this diagram is to show clearly the different paths the system will follow.



2.2 Class Diagram



2.3 Functional & Data requirements

This section discusses the data types the system will be operating with and how we will aim to design and implement the pages in our project.

For UX design considerations, such as colour palettes, spacing elements, etc. please refer to Chapter 3.

Page 1: index.html

Functional Requirements:

- This page displays **information** about the team **GreenTech**, it should display our names, a picture and a brief description of our role.
- This page will include brief **information** about **#Greener**, inviting users to sign up and briefly explaining what the purpose of the system is.
- This page will have a navigation bar containing the previous options
- This page also contains two buttons: **Login** and **Register**.
- If the user credentials are valid access is permitted to protected pages and sessions are implemented.
- If an empty field is left in the Login or Registration forms the user must be prompted to fill it.

Data requirements

Login/Register

Registration:

- The user will be able to register with an **email** and **username**
- The **username** has to be **unique**; no two users can register with the same username.
- The user needs to setup a **password**
- The password will not be stored in plain text, **hashing** will need to be implemented as a security measure.

Login:

- The user will login with the **username** and **password** setup when registering.

Page 2: Categories of Challenges

Functional requirements

- This is a protected page, only accessible after login.

- This page displays the FOUR **categories** of challenges: Water, Energy, Food, Waste
- The user can select one category at a time to view the available challenges inside it.
- The page will contain a navigation bar with options of profile settings, logging out and the Challenges History

Data requirements

- The **categories** will be displayed as four **pictures** representing Water, Energy, Diet and Waste

Page 3: The challenges

Functional requirements

- Once the user selected one of the four categories this screen would allow them to view **two** challenges per category
- There will need to be 4 pages of challenges, one page per category
- The user is able to select one challenge at a time
- Each challenge contains information on how this helps the environment
- Each challenge contains tips on how to submit evidence
- The navigation bar should be present in all 4 challenges pages
- There should be a button to let the user go back to categories
- These are protected pages, sessions must be established

Page 4: The users

Functional requirements

- Once the desired challenge is selected, this page will display a list of people registered in the app
- The user chooses one person of this list so as to send them the challenge
- The navigation bar is present in this page as well
- Should contain a button to go back or cancel the process
- This is a protected page

Data requirements

- The list of users should display the **username** and the **profile picture**

Page 5: Completed process

Functional requirements

- This page confirms that the challenge was sent to the person and is waiting to be accepted

- The user should be redirected to the categories page
- This is a protected page

Page 6- Settings

Functional requirements

- This page contains the navigation bar
- This page contains two forms: one for updating the username and the other to upload a profile picture
- The user is able to change their username
- After setting up the new username they will be redirected to the login page
- The user can upload from their computer a profile picture
- The profile picture is displayed in the upload picture form
- This is a protected page

Data requirements

Updating username:

- The current username will be displayed
- The user has to enter a new username
- The new username must be unique
- If the username is already registered in the database, another must be chosen.
- The user will need to confirm their email

Uploading a profile picture:

- The picture can be a png, jpg, jpeg, gif file.
- It will be stored in the database as a varchar 255 data type

Page 7- Challenge History

Functional requirements

- This page will contain the navigation bar
- This page will display information to the user about completed challenges
- This page will display the points accumulated
- This page will display challenges pending completion
- This page will also display challenges sent to other users that are pending approval of evidence.
- This page gives the option to submit evidence for a pending challenge

Data requirements

- The evidence must be submitted as a single picture
- The format can be jpg, jpeg, png, gif
- The file cannot exceed 1000000 kb

Page 8- Logout

Functional requirements:

- This page will give the user the option to logout
- This page will contain the navigation bar to go back
- Once the logout option is selected all sessions are destroyed
- The user will be redirected to the login page.

Other considerations for the system

- When a user gets challenged they receive a notification visible in their home page
- Users must always be able to accept or decline a challenge
- The evidence is sent to the user that issued the challenge for approval
- If the evidence is approved points are allocated
- Users must be able to keep track of their points and ideally be able to post them to social media

2.4 Database Modelling

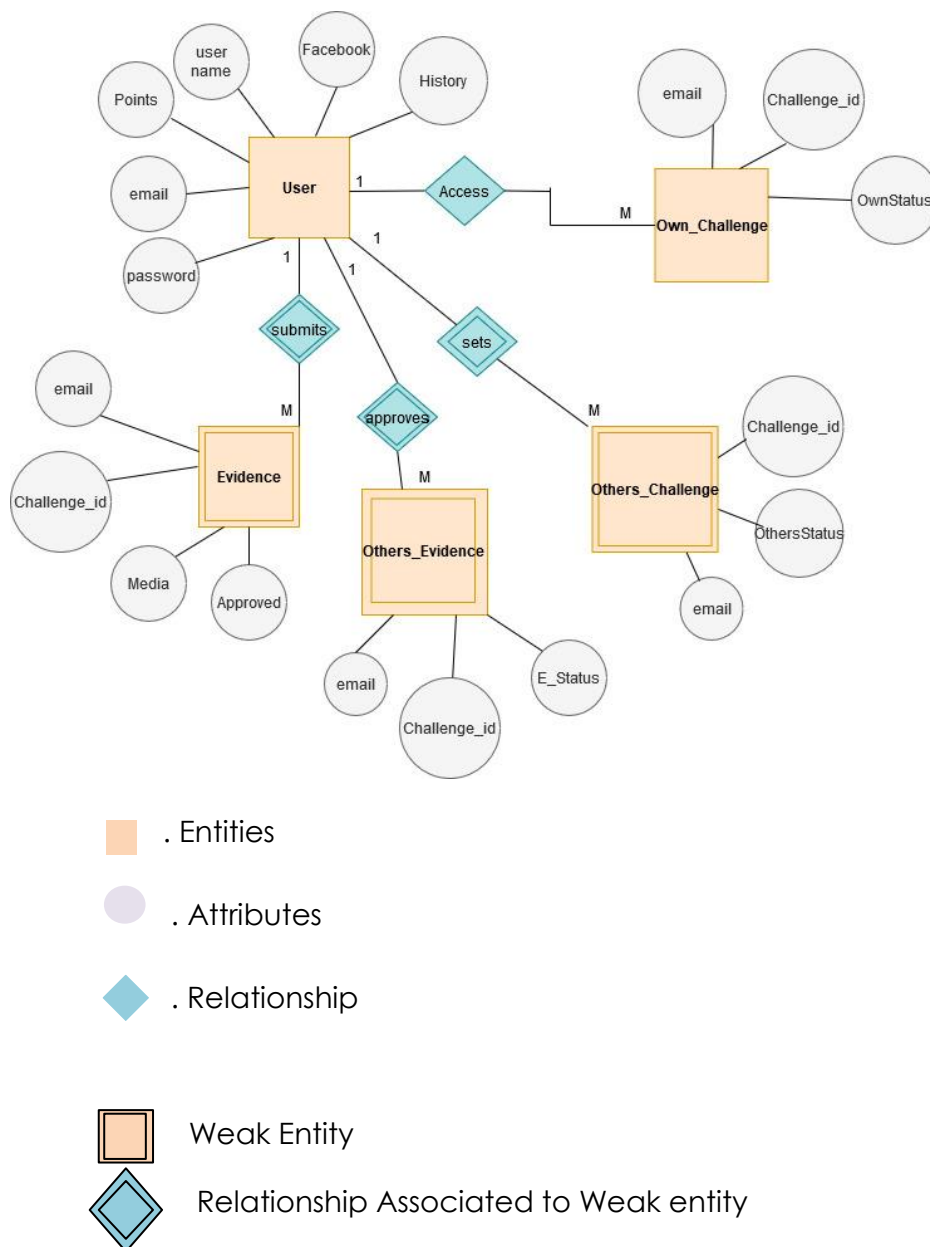
Conceptual Design

Using draw.io we created a diagram using CHEN notation as seen in Fig 1.1.

At this stage we did not work with constraints or data types, only with the entities and attributes we believed we were going to need to implement, and what relationships they will have.

We tried keeping in mind already at this first stage concepts such as Normalization of tables and avoiding data redundancy. We will do a more in depth analysis in the section named *Database Functional design*.

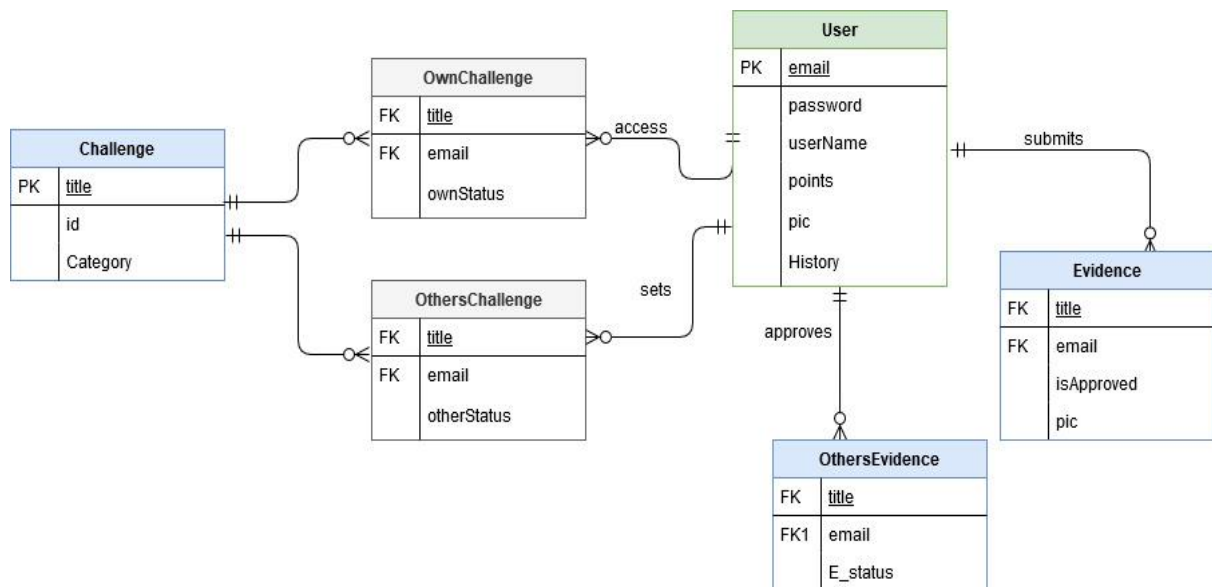
Fig 1.1



Entity relationship diagram

For the following ER diagram we used Crow's feet notation.

While making this design we realized that we would need to add a table called 'Challenge' that is not in the previous diagram, as the need for this table only became apparent at this stage of the design.



Chapter 3

System Design

3. System Design

3.1 User Interface Design

The first screen designs we did were intended to show the general look and flow of the app and website. For this reason we kept them as simple as possible, as we created them in order to help us visualize better the way the platform would work.

Fig 3.1- Shows the process of challenging someone else and also the information that should be displayed when entering to the menu in the left corner

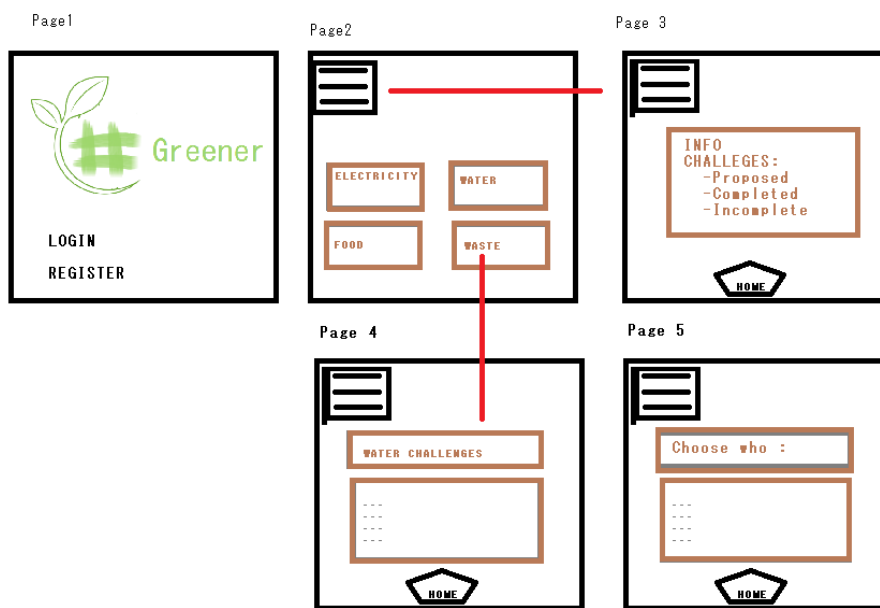
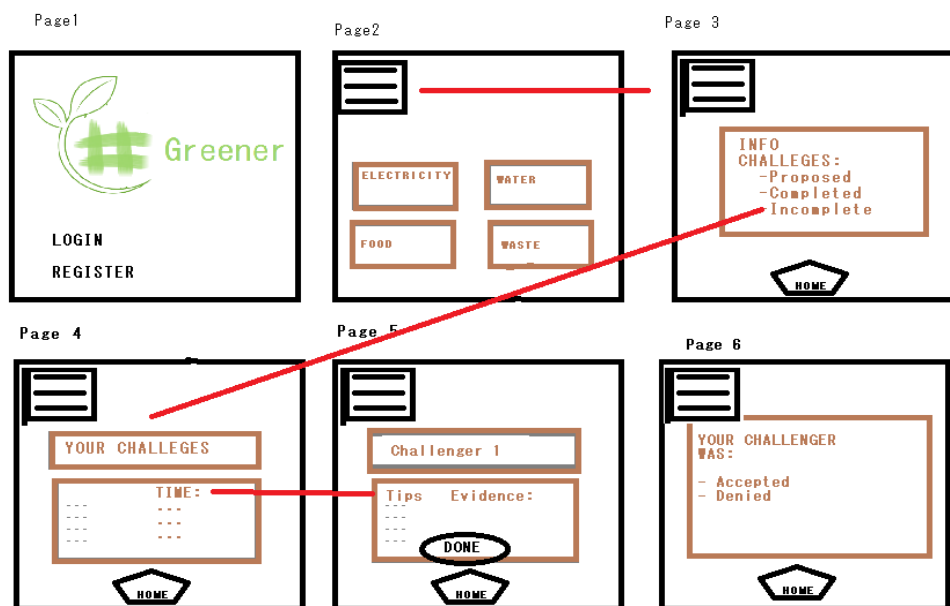


Fig 3.2 – Shows the process of checking the status of own challenges and/or to submit evidence



3.5 Screen designs & research

Introduction

In order to start our process and get some direction we conducted some research on UI-UX design.

As part of any application developing process, colours play an important role, due to the fact that they can make this app interesting, or simple call the attention of people and about this. Jill Moore (2019) cites in her article 'Why Color Matters a research conducted by CCICOLOR - Institute for Color Research': **“Research reveals people make a subconscious judgment about a person, environment, or product within 90 seconds of initial viewing and that between 62% and 90% of that assessment is based on colour alone.”**

Colour Scheme

There are a number of predefined colour scheme standards that make creating new schemes easier, especially for beginners.

Monochromatic schemes are created by taking each colour from a base one, and as a result, they are the simplest schemes one can create, as explained in the article 'The Underestimated Power Of Color In Mobile App Design' (Babick, Nick). In this article, it is also explained that a Monochromatic schema usually has calming properties.



Image source: <https://smallbiztrends.com/2014/06/psychology-of-colors.html>

Analogous colour schemes use colours in a way that they don't stand out from each other (Babick, Nick 2017); this scheme is composed by a dominant colour that uses other colours to enrich the scheme. As the monochromatic scheme, it is quite easy to implement as long as the vibrancy of the colours align with the purpose of the application, as in some cases it can have an exaggerated effect. An example of an app that uses this scheme is Clear, this app design's is thought in a way that allows the user to clearly visualize the more urgent set of tasks to perform, as it looks like a heat map, where red stands for the most urgent task to be completed.

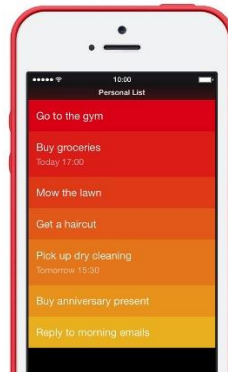


Image source: <https://smallbiztrends.com/2014/06/psychology-of-colors.html>

The **complementary scheme** uses opposite colours. Even though they are contrasting this does not necessarily mean that they are at odds with each other. In fact, this strong contrast allows catching the user's attention.

When using a complementary scheme, it is important to choose a dominant colour and use its complementary colour for accents. As explained by Nick Bobich (2017) when we have an object primarily green, just a bit of red works very well to attract the human eye attention.

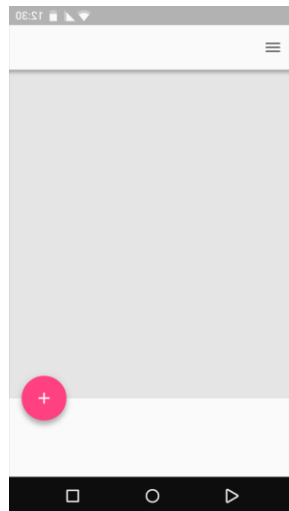


Image source: <https://smallbiztrends.com/2014/06/psychology-of-colors.html>

Two key elements that can help drawing a user attention to a wanted element on screen are having readable text and using contrasts, Nick Bobich (2017) also mentions that "users are much more likely to click a call-to-action button that strongly contrasts with its background" highlighting the importance of using high-contrast.

#GREENER Colour Scheme

We will be using an **analogous** colour scheme for our platform

→ **Green** is the dominant colour in the #Greener app, while **white** and **grey** are used to enrich the scheme.

We decided to use these colours following some research on colour psychology and the input from potential users that we gathered in Surveys. We found that:

Green – Is generally associated with health, tranquillity, and nature. Used for promoting environmental issues. Green stimulates harmony in your brain and encourages a balance leading to decisiveness. Also, in the survey we conducted, people replied that they associated the colour green with nature and the environment. [ADD EXACT SURVEY RESULTS REFERENCE]

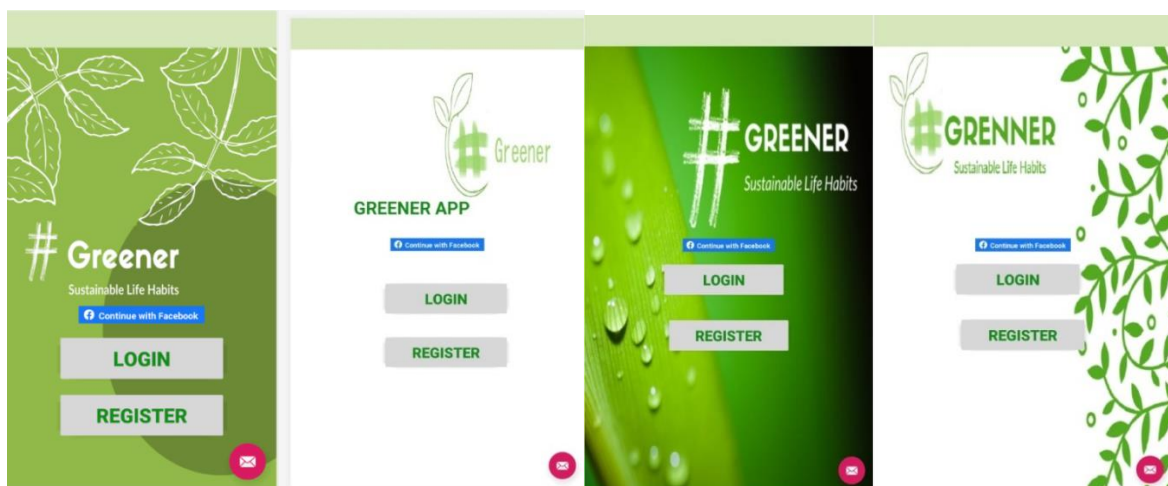
Grey – Symbolizes feelings of practicality, old age, and solidarity.

White – Associated with feelings of purity, cleanliness and safety. White space helps spark creativity since it can be perceived as an unaltered, clean state.

In order to generate the contrast mentioned previously, that would help us draw attention to specific elements of our app, we will use the colour pink

→ The **pink** email symbol is used to drag attention in the #Greener app. We will aim to use pink for notifications, error messages and sharing functionalities.

Mobile App trial designs using the analogous Scheme.



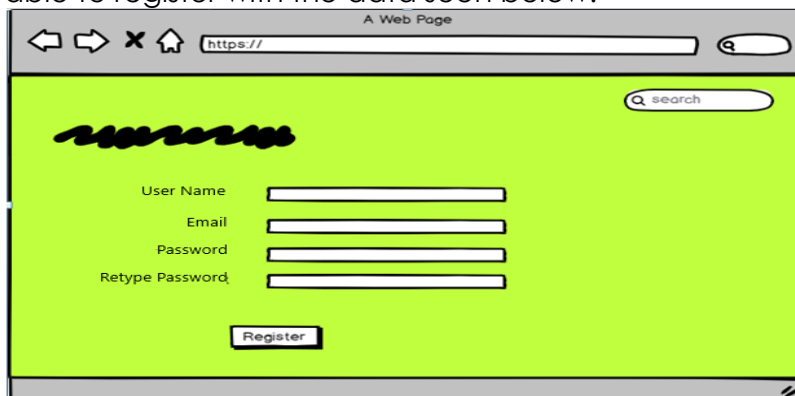
Website Wireframes

The following section shows how we would like our website to look. After trying different options we selected the option that we thought looked better and in accordance to the topics discussed previously regarding colour schemes and overall design. We also took into consideration the output of surveys. These surveys allowed us to check with potential users if our website is intuitive and attractive. These surveys can be found in the Appendix.

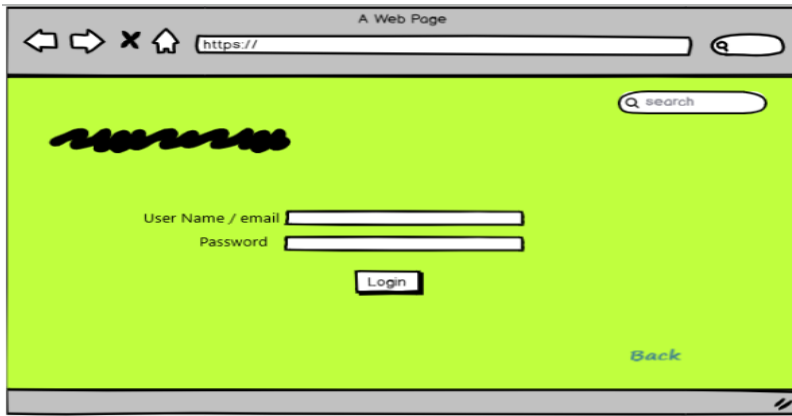
Wireframe 1 - Shows the first page of the web. The user should be presented with the option to Login or Register, as seen in Figure 3.1 in the previous section.



Wireframe 2 – Shows the form that should be completed in the web in order to Register. This would support the **Use Case 1**, where it was stated that User should be able to register with the data seen below.



Wireframe 3 – Shows the Login Section. The user should be able to Login either with an email or the user name they setup during the Registration. This supports to **Use Case 1**.

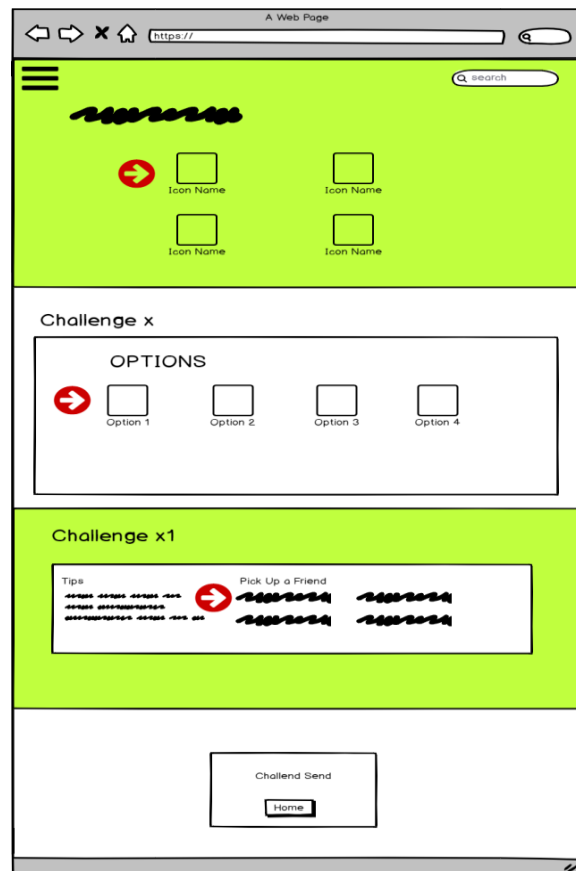


Wireframe 4 – This image shows the process of selecting a Challenge and each screen that should be presented to the user. This wireframe supports **use case 2**.

Screen 1 – Displays the 4 icons of the categories Water, Energy, Diet, Waste

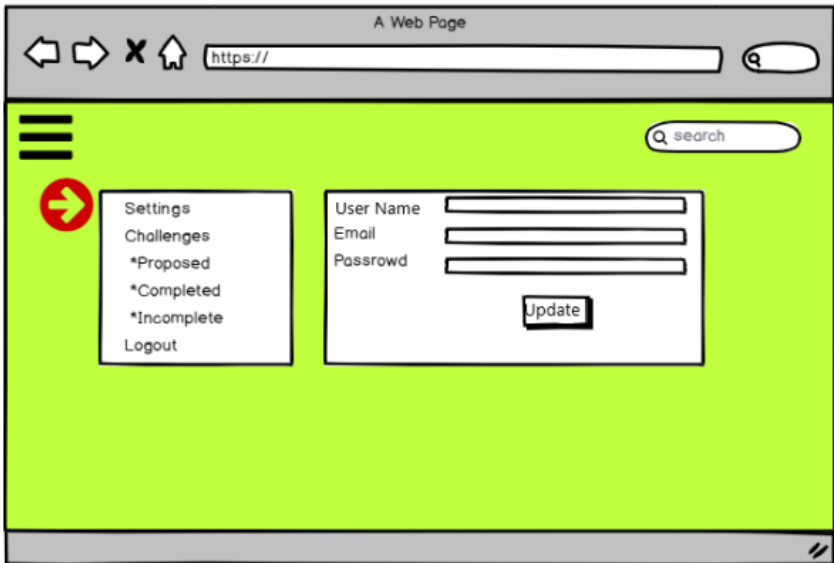
Screen 2 - Displays the options of Challenges available inside each category.

Screen 3 – This is an example of how it would look like once you selected a challenge. You would get tips on how to complete it And will be presented with the option of who to send the challenge to.

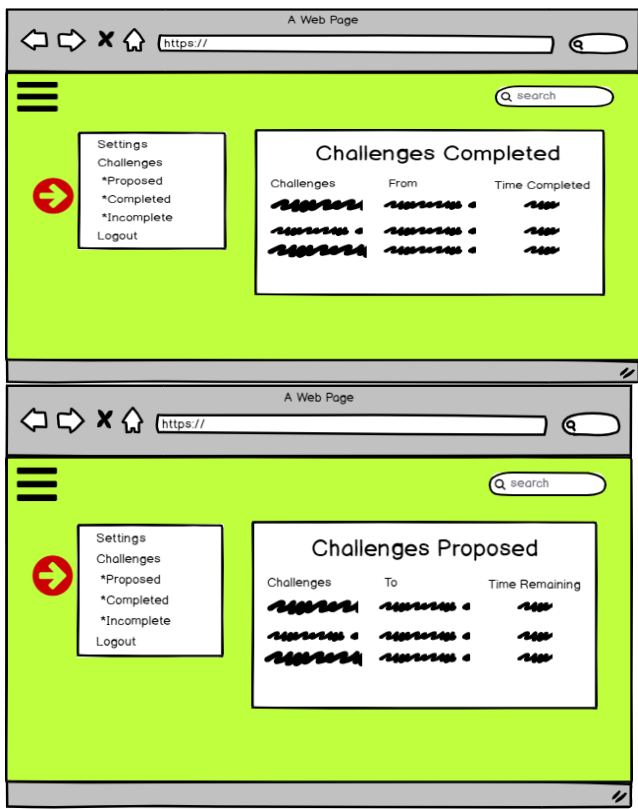


Screen 4- This image shows the confirmation received by the user that the Challenge was sent to the person.

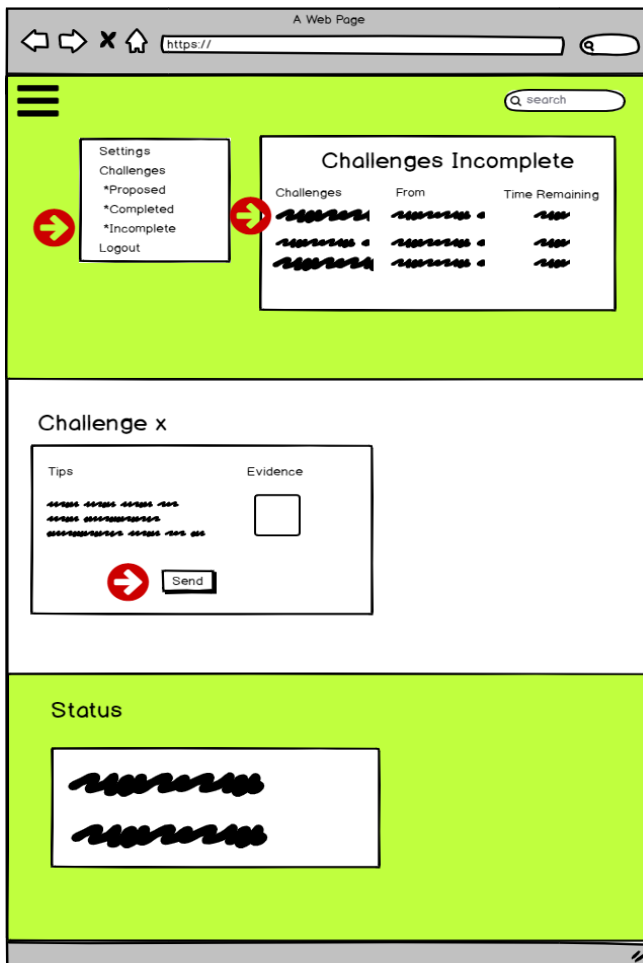
Wireframe 5 – This image shows the Menu that should be displayed at the left corner of the screen and the options available. In this image the option selected was the Settings. It can be seen that the user data can be updated. It supports **Use Case 5**, specifically the changing of User Name option.



Wireframe 6 & 7- Show the screen displayed once the option “Completed”, “Proposed” or “Incomplete” is selected inside the Challenges Menu option. This supports **Use Case 6**.

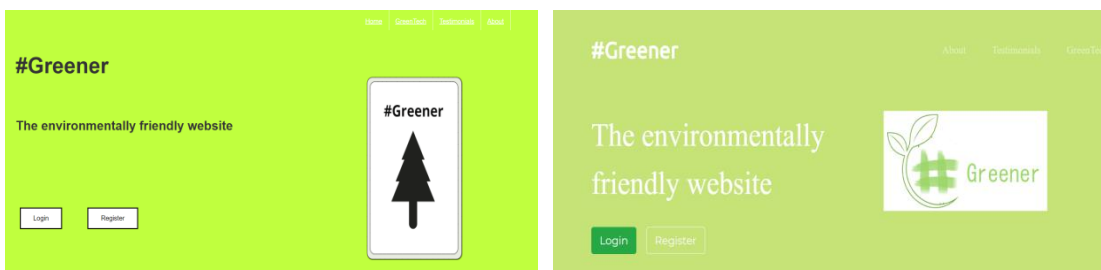


Wireframe 8 - This image shows the screen that should be displayed once the option to view incomplete challenges is selected. In this section the user is able to provide the evidence that the challenge has been completed. This wireframe supports Use case 4 and 6.



We also decided to use a minimalist design. According to Jakob Nielsen, from the Nielsen Norman Group, in his 10 general principles for interaction design, the site should have only things that are relevant for it, while less irrelevant dialogues or images the site has, the better understanding and surfing for the user (Nielsen, Jakob 1994).

Website trial designs using the analogous colour Schema and following wireframes



Database Functional design

In order to design our database we tried keeping in mind Normalization principles, understanding by normalization the process by which “we identify the optimal grouping of related attributes to identify a set of suitable relations that supports the data requirements of the enterprise” (E.F Codd).

To design our database we used a **top down** approach, we did ER modelling first. **Normalization** can be used to validate this design, and to check if the attributes and relations are appropriate.

As an important part of the #Greener system consists of updating tables, such as the whole evidence and points process, we had to be careful that there would not be **data redundancy** when doing these updates.

A simple example of a scenario where our tables wouldn't be normalized would be if we had grouped together in one table the user information and the information of every evidence submitted by the user since registering.

If we had done this, the table user would end up having a lot of redundant and unnecessary information that could be stored in a separate table and only accessed by the user table, rather than stored.

Another aspect we tried to be mindful of was of **data consistency**. We wanted our design to allow for each insertion or update of data to be as simple as possible, so that all records are consistent.

Regarding **functional dependency**, we wanted to make sure that there are no repeated emails stored in the database, so for each user registered there would be a single user name in our records. This was essential so that when the challenge & evidence process gets started among users, there are no difficulties allocating points or conflicts on who to actually send the challenge to, for example.

We also wanted that the challenges were clearly distinct, for the same reasons mentioned previously. Each challenge has a unique name and id.

1F Normalization

“A relation that is in 1NF and every non-primary-key attribute is fully functionally dependent on the primary key.” (Advanced Normalization, Iqbal, Muhammad)

2F Normalization

This is the process by which partial dependencies are eliminated, and is a way of further avoiding redundancy of data.


3F Normalization

3F is 2F plus no transitive dependencies.

An example of how our database supports 3F normalization is by having separate tables for the challenges and the challenges processes by the users.

Lets remember that the same challenge can be undertaken by many different users, and at the same time each user might be at a different stage (completed, pending)



The following figure shows the structure of our table challenge.

challenge		
1	title 	varchar(100) utf8mb4_general_ci
2	category	varchar(100) utf8mb4_general_ci
3	id	int(11)

By having separate tables for the challenges the users themselves are doing, and the particular information of each challenge we ensure no transitive dependencies or no dependency of non-key fields on other non-key fields.

Another example in our database that supports 3NF is our table evidence.

In this table we have the Foreign keys email (primary key of the table user) and title (Primary key of the table challenge). By doing this we ensure during the evidence submission process with the database there are no data inconsistencies or redundancies generated, as it wouldn't be possible to change the title of a challenge, for example. Also, there are no partial dependencies, as each evidence submitted needs to be linked to a single email, a single title of challenge, and must have the picture and some text describing said evidence. All the attributes in this table concern exclusively the evidence process.

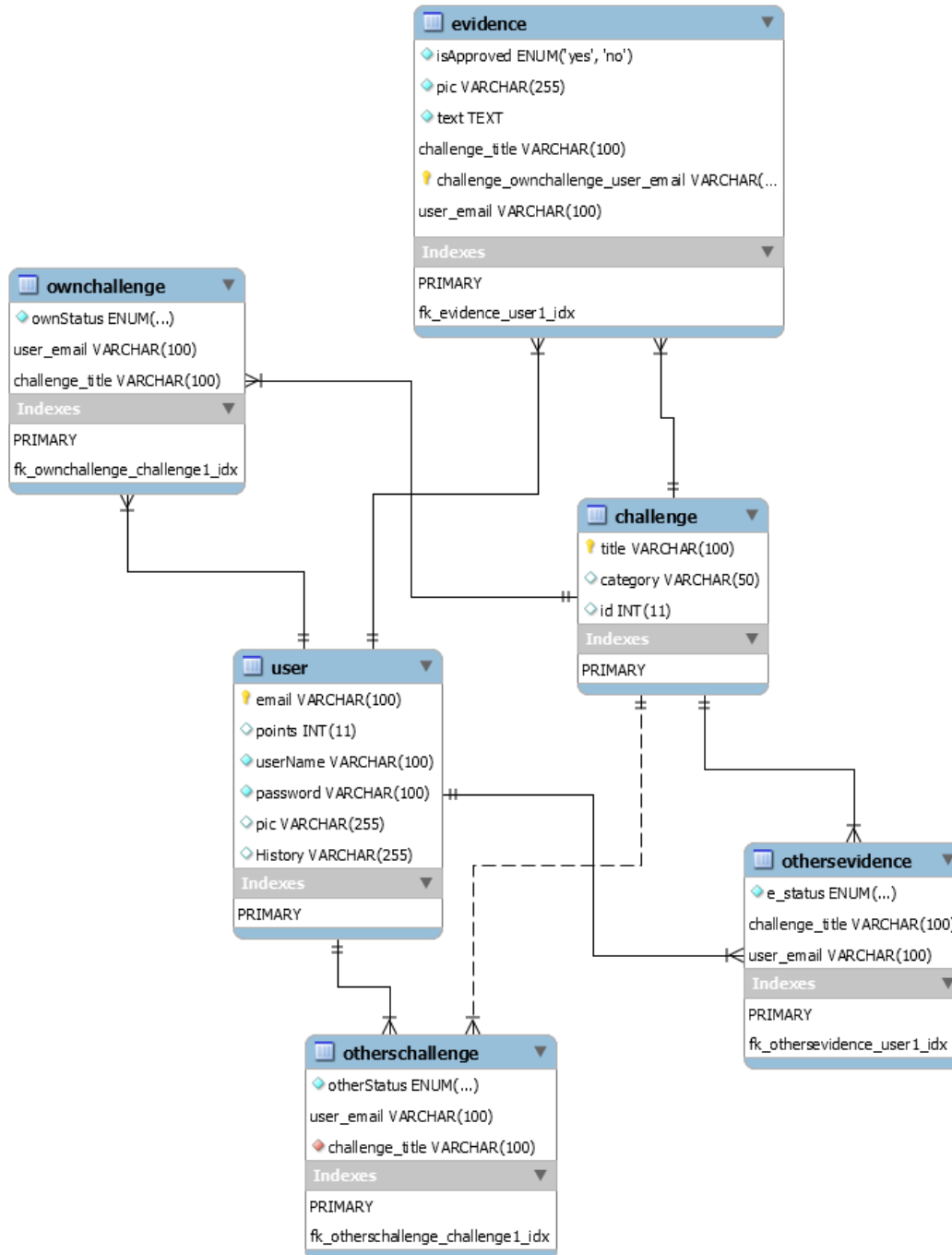
evidence		
email 	varchar(255)	utf8mb4_general_ci
title 	varchar(50)	utf8mb4_general_ci
isApproved	enum('yes', 'no')	utf8mb4_general_ci
pic	varchar(255)	utf8mb4_general_ci
text	text	utf8mb4_general_ci

In the following section we provide an Enhanced Entity Relationship diagram with the Normalization of tables discussed.

EER DIAGRAM

This diagram shows the final tables and the relationships between them containing the data types and constraints. This is the final diagram for the database and we implemented the database with attributes and data types seen in the following figure.

As it can be seen, some changes have been added in comparison to our Entity Relationship diagram in the previous section.



Database Data dictionary

Table name	Attribute name	Contents	Type	Format	Required	Primary or Foreign Key
User	userName	User name	varchar(100)	xxxxxxxxxxxxxx	Y	
	email	email	varchar(100)	xxxxxxxxxxxxxx	Y	Primary Key
	password	password	varchar(100)	xxxxxxxxxxxxxx	Y	
	points	Total points earned	int	xxxxxxxxxxxxxx		
	pic	Profile picture	varchar(255)			
	history	list of own challenges completed	varchar(255)	xxxxxxxxxxxxxx		
Challenge	Challenge_id	Challenge ID	int	xxxxxxxxxxxxxx		
	Title	Title of the challenge	varchar(40)	xxxxxxxxxxxxxx		Primary Key
	Category	Category of the challenge	varchar(50)	xxxxxxxxxxxxxx		
OwnChallenges	title	Challenge name	int	xxxxxxxxxxxxxx	Y	Primary Key & Foreign Key
	OwnStatus	status of the challenge	enum	("Completed", "Pending")		
	email	email	varchar(100)	xxxxxxxxxxxxxx		Primary Key & Foreign Key
OthersChallenges	title	Challenge name	int	xxxxxxxxxxxxxx		Foreign Key
	otherStatus	status of the challenge	enum	("Completed", "Pending")		
	email	email	varchar(100)	xxxxxxxxxxxxxx		Foreign Key
Evidence	title	Challenge name	int	xxxxxxxxxxxxxx		Foreign Key
	email	email	varchar(100)	xxxxxxxxxxxxxx		Foreign Key
	pic	evidence as a picture	varchar 255			
	isApproved	own evidence status (approved/rejected)	enum	("Y", "N")		
OthersEvidence	title	Challenge name	int	xxxxxxxxxxxxxx		Foreign Key
	email	email	varchar(100)	xxxxxxxxxxxxxx		Foreign Key
	E_status	evidence status (approved/rejected)	enum	("approved", "rejected")		

Chapter 4

Implementation

Technologies Used

In this section we will discuss the technologies used for developing the website and the mobile application. We have divided this section of the report in two categories: Languages and Platforms.

PLATFORMS

GitHub

Thanks to the advancement of technology and the development of multiples tools, nowadays can be found on the market many options that help developers in their responsibilities, one of them is GitHub Repositories.

GitHub (N/D) defines itself as an open-sourced and a collaborative development platform created based on the way that developers can work, where it can be hosted and reviewed code, manage many projects and build software.

Breaking down this concept, it means that GitHub is a platform that stores projects and its history, by keeping copies before the new pieces of code are added on, and also allows other member of the team who are working on the same project to share this and clone it to work on separately and once the new blocks of codes are confirmed, they can be pushed to the master branch.

Understanding better what is GitHub and how to benefit from it, it was found an interesting article on CodeInstitute.Net (N/D), which split the whole name in two parts: the Gib and the Hub, and referring to them, Gib is the part that works as a version control system, it means that this is the one in charge of keep track on the history of the files and changes to the code. On the other hand Hub is the part that gives the collaborative feature, allowing all the individuals involved in the project to participate on the development of the code.

CodeInstitute.Net (N/D), also explains that for the repository treatment there are allowed two main process: forking which is the way how somebody can copy its own file and give a try on it without damaging the master branch. And the second main process is Pushing, which allow users to add new changes to the master branch.

According to Novoseltsev (2017), among the main benefits that can be listed from GitHub are:

1. GitHub is a free platform for open source projects and this offers wiki and issues trackers that help out managing projects easily by including in-depth documentation and giving feedback about the project.
2. Documentation: the usage of GitHub provides enough documentation that help sections and have articles of anything related to.
3. Showcasing work: GitHub gives the chance to share the code of projects and advertise your skills.
4. Markdown: this tool also provides the chance to use a simple text editor where it can be written formatted documents.
5. A perfect Repository: although it has been already explained above, it is important to mention it again, due to is one of the best benefits of it.

6. The possibility of track changes on the code across many versions and also the possibility of remake it again from any of those previous copies.
7. Integration options: GitHub also has the feasibility of integrate with other applications and clouds.

ANDROID STUDIO – Mobile APP

To develop the mobile application we will work with Android Studio. This tool is the official IDE for Android app development. We decided to work with it because we found that it has very convenient tools such as an emulator, it supports Version Control systems such as Github, it allows drag and drop of widgets, and you can develop for all Android devices, and it has built in support for Google Cloud Platform.

To build an app in Android Studio you work with Java, which we are also familiar with as we've been working with it since first year.

This information was found in the official Android Studio website.

FIREBASE – Mobile APP

Firebase is a mobile (and web) development platform, with a focus on being a complete and easy-to-use back-end, this tool provides several different services that assist in the development and management of applications.

It is integrated with android studio and provides a series of tools that help in the process of registering users and saving them.

To use these tools you need to implement them in Android Manifest (xml file that contains all the information about the project.)

XAMPP - WEBSITE:

In order to achieve all the previous process, it is necessary to select a good software that can offer all the functions that a web server has to do and in this case is when XAMPP comes up as a strong option, due to it not only includes Apache, considered by WpBegennir.Com (N/D) as the web server software running on 67% of all web servers of the world, also this package combine other three software for helping out all the funtionabilities of the web application, such as MariaDB, PHP and Perl.

Conforming to a video about XAMPP posted on apachefriends.org (N/D), XAMPP is the most popular PHP development environment for Windows, Linux and OS X platform contending MariaDB, PHP and Perl. Bringing another concept of XAMPP, it can be referenced Shashidhar (2016) points it out as an open source web server with tools and language support built-in to it, ready to be used and it helps out developers to create local web servers for testing purposes.

After reading all this concepts about XAMPP, then it comes up questions about what are the other elements included in XAMPP and what are they used for, questions to be answered by giving a brief explanation of each of them and their integration.

Languages

Nowadays, there is a vast range of programming languages orientated to the web development and many of them have been restructured dynamically to give user better experiences interacting with those web services. So that is one of the reasons why few of them have been taken into account for Greener project.

JavaScript

In the hierarchical level of building a web site, after structuring all the content on a HTML file and styling it through CSS file, the next step it is referred to give to the animation needed on the new web application, that is when JavaScript functionality is incorporated.

Thus a conceptualization of JavaScript is required and for that it is taken what is sitting on Developer.Mozilla.Org (2020) which says that JavaScript is programming languages that allows implementing complex features in web pages, such as displaying timely content updates, interactive maps and so on. Also, its own webpage, Javascript.Info (2020) defines it as an initially language created to “make web pages alive”, constituted by scripts that can be written within HTML web' files and run straight away when the web site does it.

Nowadays, JavaScript can not only run on the browser, it also can do it in any device provided with the program called JavaScript engine. The most recently update version of JavaScript is safer and based on its original tenet of running on the browser it does not supply access to low level of memory of CPU. Another great functionality of JavaScript, mentioned by Developer.Mozilla.Org (2020), is that JavaScript can perfectly work with Application Programming Interfaces (API).

Java (Mobile app)

Within the context of languages that can help out building a better web site, Java is another of those that offers to add on its benefits. Quoting Java.com (N/D) Java is a programming language fast secure and reliable, well used from laptops to datacenters, games consoles to scientific supercomputers.

However, the statement taken from Java.com it might not explain better what it is and its benefits, therefore it becomes imperative to add another author who can broaden it and its definition and it is here when is quoted what has been exposed by CodeInstitute.Net (N/D) that Java is a programming language created to be concurrent, class-based and object-orientated.

Among the benefits of using Java, CodeInstitute.Net (N/D) points out that Java has historically provided an exhaustive testing, updating and consistency of delivery versions. Java has been evolved over the 20 years after its creation, and possible the next more important benefits is the possibility of running across all type of platforms. Some other benefits of using Java are:

1. Programs created with Java can run within a web browser and approach available web services.
2. It is possible to develop server-side applications.
3. Java allows combining applications in order to customize them and services.
4. Java also empowers developers to strong and highly efficient applications for wide range of devices.

MySQL

An extra and external element that a web site needs once is built and runs perfectly, is to interact with a database system that can hold and retrieve the data provided by users, therefore it needs to use a database management system and it is there when in this project was included MySQL.

Taking the definition from its own site (N/D), MySQL is a database management system which adds, accesses, process and stores data in a computer database. This site also points out that MySQL is a relational due to store the data in separate tables and which structured is organized in physical files optimized for speed. Contrasting this MySQL's conception to the one given by w3schools.com (N/D), which says that is used on the web and runs on the server, that also compiles on a number of platform.

Going back to MySQL site, it is necessary to mention first of all that MySQL is an open source system that can be modified by anyone to suits their needs. On another hand, also important to bring up the SQL part stands for Structure Query Language, being this the most common standardized language to work with databases.

Cascading Style Sheets (CSS)

Among all the elements that intervene to make a web page work, it is crucial to find Cascading Style Sheets (CSS), which conforming to w3schools.com (N/D) CSS is in charge of how HTML elements will be displayed either way on screens, paper or any other media. Referring Morris's opinion (N/D) CSS deals with your document's style, such as: page layouts, colors and fonts.

Interpreting these sources and some others readings, CSS is the second pillar when creating a web site; so HTML is the first where all the content is structured in a simple and drab text, and then CSS is the one that styles all that content. It came up after having a long HTML document, where also the code to style the page was in some cases repeated, so that was the main reason why CSS was created.

Bootstrap4:

According to its own home page (N/D), Bootstrap is defined as an open source toolkit for developing websites, which works with HTML, CSS and JavaScript (JS). This technology helps building a whole app by using the advantages of Syntactically Awesome Styles Sheet (SASS) variables and mixins, which is a CSS metalanguage that defines variables in some location and then reuse as blocks of codes then as

many times as needed, based on the idea of object orientated programming (Nabors, 2019).

However, the best benefits that this technology can offer are features such as extensive prebuilt components, powerful JQuery built plugins and the most important characteristic for this project, is the fact to give the responsive web design.

Interpreting another concept of Bootstrap, in this case taken from w3school.com (N/D), which defines it as a free front-end framework, composed by designed templates on HTML and CSS orientated to all the different elements used on a website, such as forms, buttons, tables, modals, images, carousels, and so on, concatenated with optional JavaScript plugins.

This site also highlights the fact that Bootstrap makes the web side responsive in any device, thanks to the property of adjusting it, by shrinking or expanding it as the browser window resizes. So, based on this particular quality is that this technology is implemented on the current #Greener project, due to if the web would be opened either way on a desktop or a mobile, it will perfectly show on the screen.

PHP

Quoting from its site, php.net (N/D), PHP is "a popular general-purpose scripting language that is especially suited to web development." However, as this concept it sounds very abstract, it is necessary to bring another definition. In agreement to CodeInstitute.net (N/D), PHP stands for Hypertext Preprocessor and it is considered as a programming language being generally used for web development and can be set-in HTML, making it easier to manage it.

Within the multiples functions that PHP performs, it can be mentioned that PHP concedes users the power to collect, process and use data to get outputs, in other words, it allows users to interact with all pages. One of the benefits, or in this case an advantage of this over using JavaScripts is that PHP runs on the server side and performs HTML that is sent to the client making it more secure, while JavaScript runs on the browser, it means in the client side. Being a server-side scripting language PHP give the benefit of effectively customizing the web page and provides dynamic websites, conforming to TechDifferences.Com (2018). This is a benefit for an amateur programmer, such as us that we haven't had much experience developing websites or applications.

IMPLEMENTATION

This section discusses the steps taken to develop our project. It is divided in two sections: the first one will explain the process of implementation of the Website, and the second section will discuss the implementation of the Mobile App.

WEBSITE IMPLEMENTATION

DATABASE

In order to have ready an essential aspect of our web we firstly left ready the database we were going to be working with.

Following the design visible in the EER diagram and the Data dictionary, we implemented the database using Workbench.

The images below show as a way of examples the creation of our tables using Workbench.

```
CREATE TABLE evidence (  
  email varchar(100) NOT NULL,  
  title varchar(50) NOT NULL,  
  isApproved enum('yes','no') NOT NULL,  
  pic varchar(255) NOT NULL,  
  text text NOT NULL  
);  
  
CREATE TABLE challenge (  
  title varchar(100) NOT NULL,  
  category varchar(50) NOT NULL,  
  id int(11) NOT NULL,  
  Primary key (title)  
)  
  
ALTER TABLE evidence  
  ADD CONSTRAINT email FOREIGN KEY (email) REFERENCES user (email),  
  ADD CONSTRAINT title FOREIGN KEY (title) REFERENCES challenge(title);
```

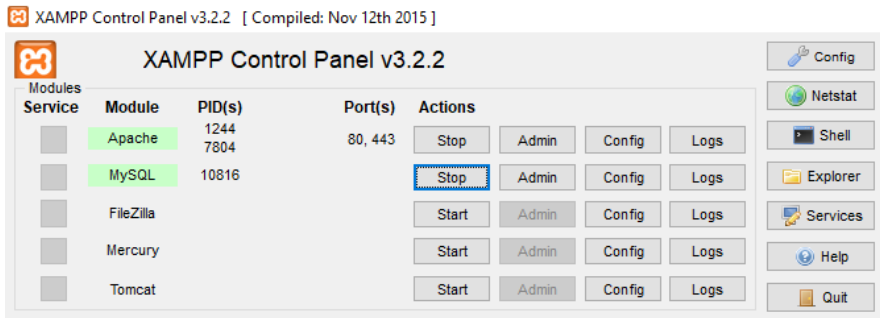
*For an explanation of the attributes please refer to the Data dictionary in Chapter 3

Part of the work involved in setting up this database, was researching ways in which we could store our images, since we hadn't worked with storing pictures in previous modules in CCT. After watching many tutorials and reading articles and guides online, we decided that the best way for us to store the profile pictures and the pictures that would be submitted for the evidence process, we would generate an attribute called "pic" and use a data type of varchar(255). The whole process of upload of pictures will be explained in more detail in the following section.

After setting up our database we started the work of the Website.

As the database was stored locally, we used Xampp to be able to view how our code was working and the database updates and insertions.

When using Xampp you have to "Start" Mysql and Apache as a first step.



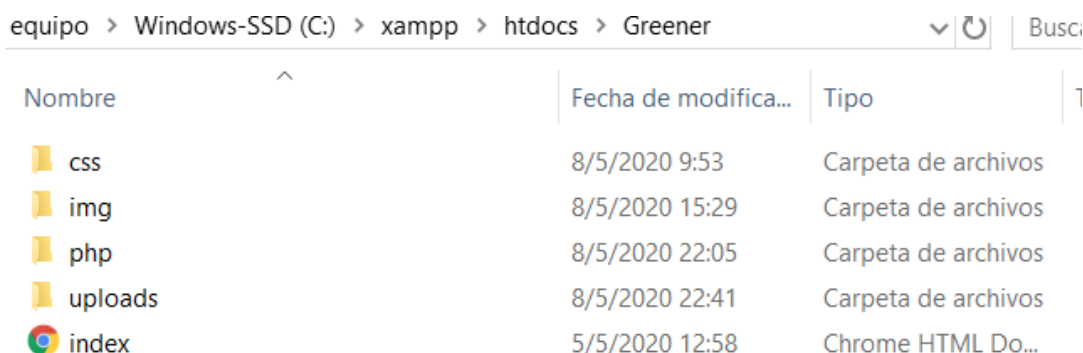
After doing this, by going to the url `phpmyadmin/localhost/folder_name`, you gain access to the database. Below it can be seen our database "greener" and its tables.



What we found very useful of this platform PHPMyAdmin is that it's very easy to view the changes done to the database, plus it gives you the option of manually updating the structures of tables, adding/deleting entries and of exporting/importing sql code.

For accessing and trying out our website as we were developing the code we just typed in a browser **localhost/greener/file_name**.

The folder with the whole code must be placed inside the root folder for Xampp called htdocs, as seen in the figure below. These two steps are necessary for the browser to be able to display the PHP files correctly, otherwise the browser would only display the PHP code, and not render our website.



To develop the code for the front end we used the following languages:

- Html
- Css
- Bootstrap 4
- Javascript

The images used for the website & mobile app were downloaded from the website pixabay.com, that offers a range of free from copyright pictures for developers and designers.

1st step: HTML

The Front end code for the website was done starting with the HTML code. We started just with plain HTML to make sure the 'skeleton' of our web matched with the navigation goals we had setup for the project during the analysis and design stage. It was important for us that the navigability of the website was intuitive for new users as explained in previous chapters.

ONLY HTML:

- [Back](#)

Register

Username

Email

Password

Confirm password

Already a member? [Sign in](#)

2nd step: CSS & BOOTSTRAP

After the navigation aspect was completed we started the styling of our project with CSS and Bootstrap. We created our stylesheets and placed them in the css folder of the project and proceeded to work with Bootstrap templates and adding classes to the structures that had been created already in Step 1.

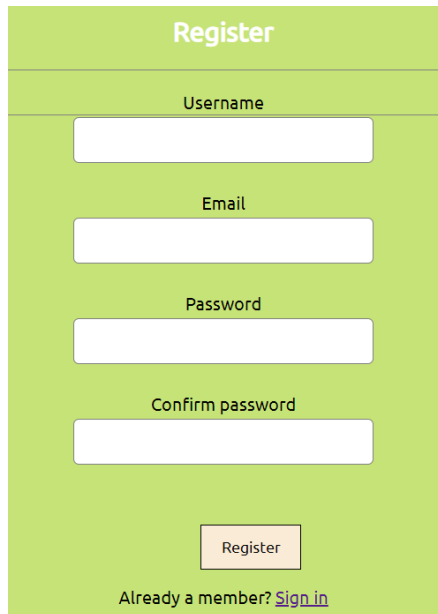
*Steps 1 and 2 were repeated in all pages of our website, we will however only demonstrate the progress in this report with the registration section.

The following images show the implementation of **Use case 1** (Registration)

- **Registration form**
- **Registration button**

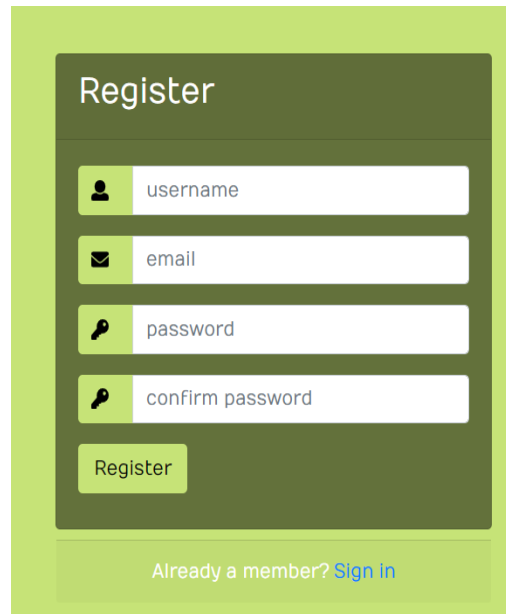
- **Option to Login if the user is registered already.**

With CSS only:



A simple registration form with a light green background. The title 'Register' is at the top. Below it are four input fields labeled 'Username', 'Email', 'Password', and 'Confirm password'. A 'Register' button is at the bottom, and a link 'Already a member? Sign in' is at the very bottom.

Adding BOOTSTRAP:



A registration form using Bootstrap styling. The title 'Register' is at the top. Below it are four input fields with icons: a person icon for 'username', an envelope icon for 'email', a key icon for 'password', and another key icon for 'confirm password'. A 'Register' button is below the fields. At the bottom, there is a link 'Already a member? Sign in'.

3rd STEP:

After having completed the front end code, we started the **back end** development.

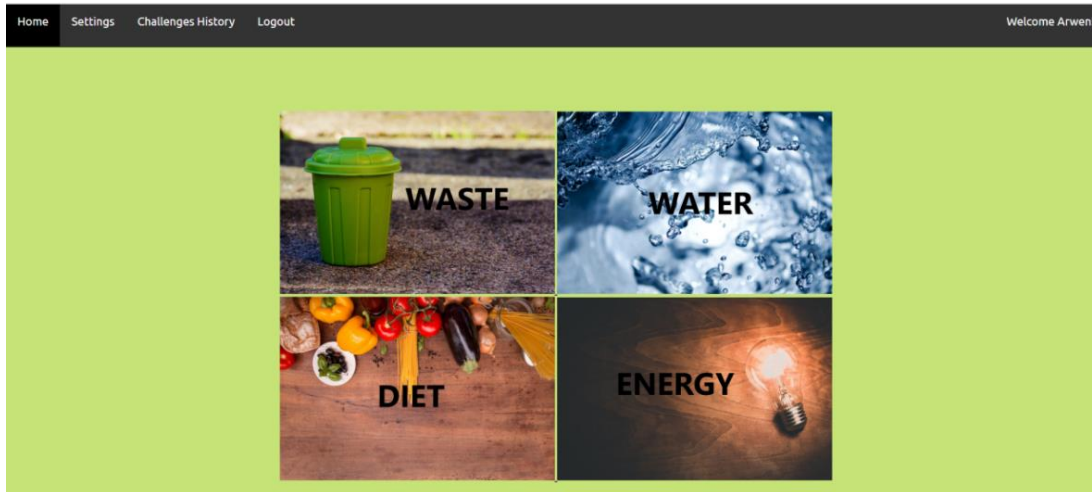
Using PHP and MYSQL we took the information entered in the Login/registration forms by the user to insert it or validate it against the records in our database.

After doing the login, **Sessions** are established in all protected pages.

The following is the page where the user views the 4 categories of challenges (**use case 2**). It can be seen in the top right corner that the system welcomes the user. This was done with the `$_SESSION['userName']` variable.

This page displays

- Navigation bar
- Welcome to user
- 4 categories of challenges



Another functionality we wanted to present our users with was uploading a profile picture and updating the username, this refers to **Use case n° 5** (Updating details) We added this characteristic to the settings page.

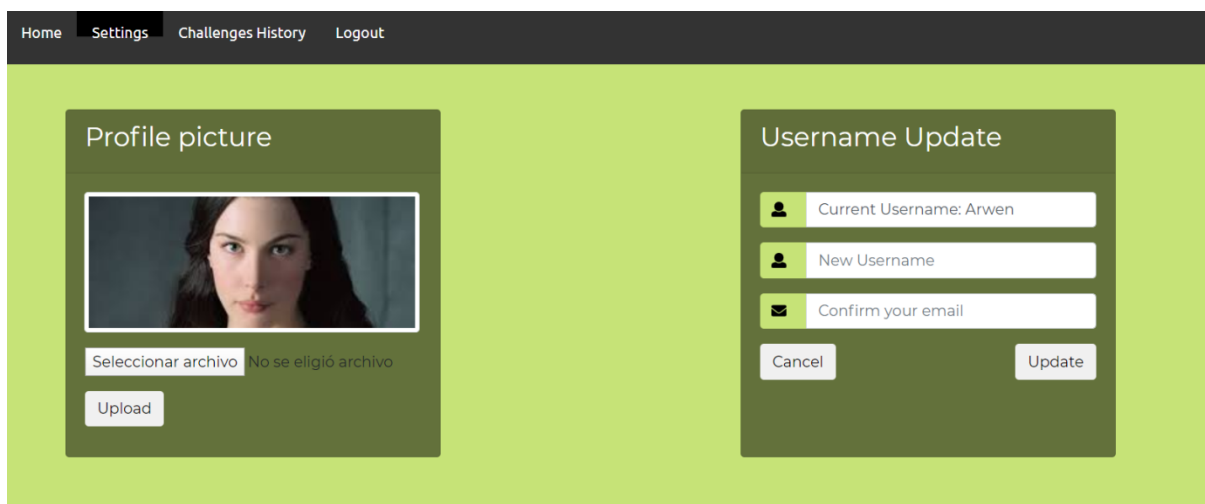
The profile picture is displayed as soon as it is uploaded, below it can be seen the code snippet for this and the actual output to the user.

```

<!--Querying the table to display current profile image if there is one or default if there isnt-->
<?php
$conn = mysqli_connect('localhost', 'root', '', 'greener');
$q = mysqli_query ($conn, "SELECT userName, pic FROM user WHERE userName = '". $_SESSION['userName'] ."'");

while($row = mysqli_fetch_assoc($q)) {
    if($row['pic']!= ""){
        echo "<img src = '../img/placeholder.png' alt = 'default image' class = 'img-fluid fit-image img-thumbnail'>";
    }else{
        echo "<img src = '../uploads/".$row['pic']."' alt = 'Profile image' class = 'img-fluid fit-image img-thumbnail'>";
    }
}
?>

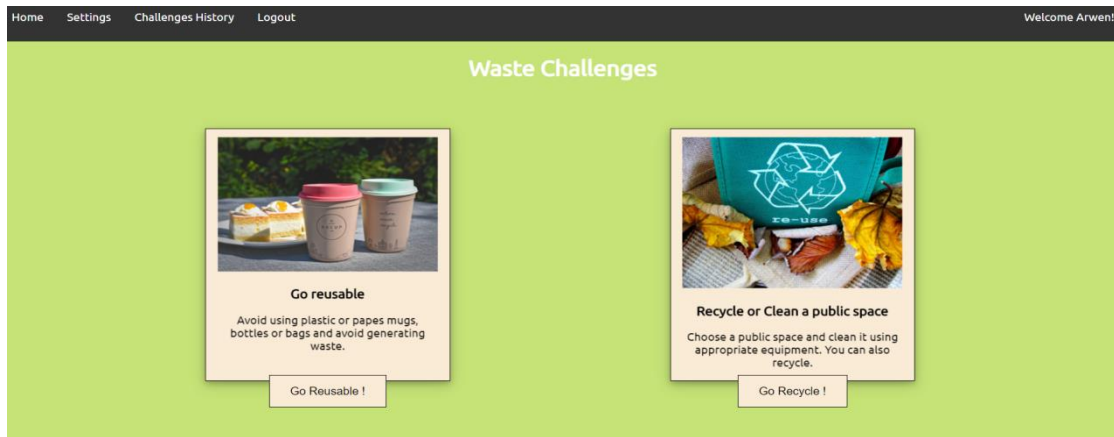
```



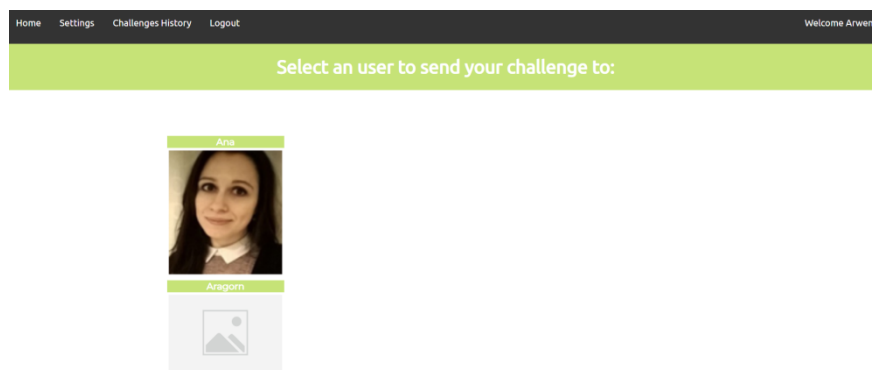
The following image shows one page as an example of what the actual challenges inside each category looks like. The 4 challenges categories each has inside a page with the same structure as the one in this example. Each challenge was

implemented as a flip card, so that when you hover on them, you get tips on how to submit evidence and why doing this helps the environment.

By clicking the button in each card, the user gets redirected to a page in which they can choose the user to send the challenge to, as was specified in the requirements in previous sections (and **Use case n°2**).



The following image shows the listing of users in the database to choose to which send the challenge to. It displays the username and the profile picture.



Security considerations

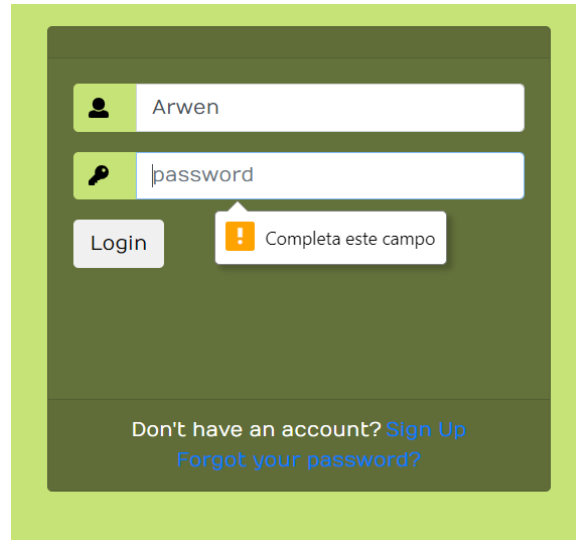
We decided to implement certain security aspects both from the front end and the back end. Some security aspects that were implemented from the front end were for example "requiring" important fields such as passwords, emails, or usernames, so that they would not be left empty. This aspect is also enforced in the back end with php scripts.

The following image shows a code snippet containing the required fields for the login and the output to the user.

```

<input type="text" class="form-control" placeholder="username" name="userName" required >
</div>
<div class="input-group form-group">
<div class="input-group-prepend">
  <span class="input-group-text"><i class="fas fa-key"></i></span>
</div>
<input type="password" class="form-control" placeholder="password" name="password" required>
</div>

```



From the back end perspective, we needed to implement a number of validations and security checks.

- The password should be hashed and not stored in plain text, so as to offer protection of the credentials. We used MD5 hashing at this stage of our project.
- The username and the email MUST be unique within our database

The image below shows some snippets of code of the backend validations implemented for the process of updating an username from the Settings section. This same process was also implemented for the Registration process.

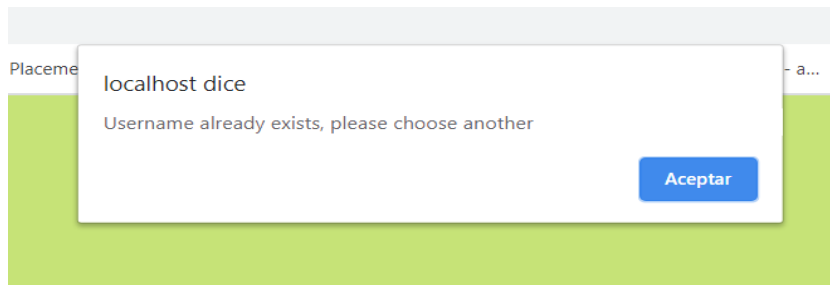
Update_user.php file

If the username is not unique, don't update and warn user.

```

//if the username exists already warn user and redirect them
if ($user) {
  if ($user['userName'] === $userName) {
    array_push($errors);
    msg("Username already exists, please choose another");
  }
}

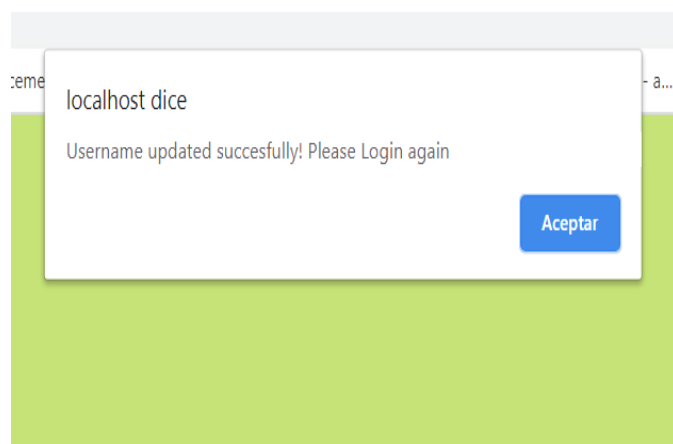
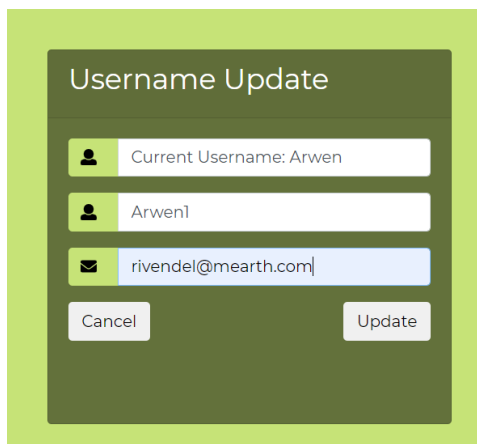
```



If the user name is unique, update it, redirect the user to the login page and display an alert message with javascript that the update was successful.

```
//if the username does not exist already update it
else if (count($errors) == 0) {
    $query = "UPDATE user SET userName ='$userName' WHERE email='$email'";
    mysqli_query($database, $query);
    alert("Username updated successfully! Please Login again");
}
$_SESSION['userName'] = $userName;
}

//Javascript to send confirmation or alert to user
function alert($message) {
    // Display the alert box and redirect to settings.php
    echo "<script>
    alert('$message');
    location='login.php';
    </script>";
}
```



We also did not want that after a user logouts of the website for protected pages to be accessible.

In order to do this we implemented the PHP code that unsets and destroys sessions. If a user wants to access for example a settings page after logout, they will need to go through the login page again and have their credentials validated in order to access it.

```

<?php
if(isset($_POST['logout'])) {
unset($_SESSION['userName']);
session_destroy();
header('location:login.php');
}
?>

```

To summarize this security considerations, we have included the below image of our database table 'user' in which it can be seen that

- emails and usernames are unique
- No plain text passwords are stored

	email	password	userName	points	History	pic
	aragorn@earth.com	7d0b0c8e9e0f41ca2ff9fb53cdc29fbd	Aragorn1	NULL	NULL	Aragorn.jpg
	baggins@me.com	4dc837316b617489ed7a124be67fbbbc	potter	NULL	NULL	frodo.jpg
	baggins@shire.com	0c08c53f457c244946380316f0c054a	Frodo	NULL	NULL	
	gal@gmail.com	33b63211a39f5a8c65732bc9719bfb965	Gal	NULL	NULL	arwen.jpg
	granger1@magic.com	f8a6bd9fdffb1f4e82463b8451f3584	Hermione	NULL	NULL	hermione1.jpg
	hagrid@hotmail.com	e658030cfbc9cc2e7bb2ec18111693e1	hagrid	NULL	NULL	hagrid.jpg
	lego@earth.com	03f690195f59c32d566cfb79383e01c8	Legolas	NULL	NULL	legolas.jpg
	Menadoc@shire.com	20f2575b6e7081d1888f1fce44f73cbf	Merry1	NULL	NULL	
	morina@outlook.com	a207f4345a59e7f067abf171c4830bde	g	NULL	NULL	gimli.jpg
	onering@middleearth.com	e7863d92652c331504653872c50fb91ce1d630a9	Gollum	NULL	NULL	
	rivendel@mearth.com	cde81aca70824fd27072f2d901bac979	Arwen	NULL	NULL	arwen.jpg

Problems encountered

The following section will briefly exemplify some of the issues we faced while developing our platform.

Website

One of the problems we encountered when developing the website was that the logout function was not terminating the sessions established and even after clicking logout you could access protected pages. In order to solve this we had to implement the following snippet of code: **unset(\$_SESSION['userName']);** before the `session_destroy();`

Another issue we faced was that when changing a username the first time we tried this action it changed the usernames of all users registered, in addition to this issue, it also didn't validate against the requirement of unique usernames. This was a mistake in the code. We hadn't added the 'where' clause necessary in MySQL so that a field could be compared to the one in the database and apply changes only if those

fields match. Below the updated code can be seen checking that the username doesn't exist already and updating only where the user email matches.

```
//if the username exists already warn user and redirect them
if ($user) {
    if ($user['userName'] === $userName) {
        array_push($errors);
        msg("Username already exists, please choose another");
    }
}

//if the username does not exist already update it
else if (count($errors) == 0) {

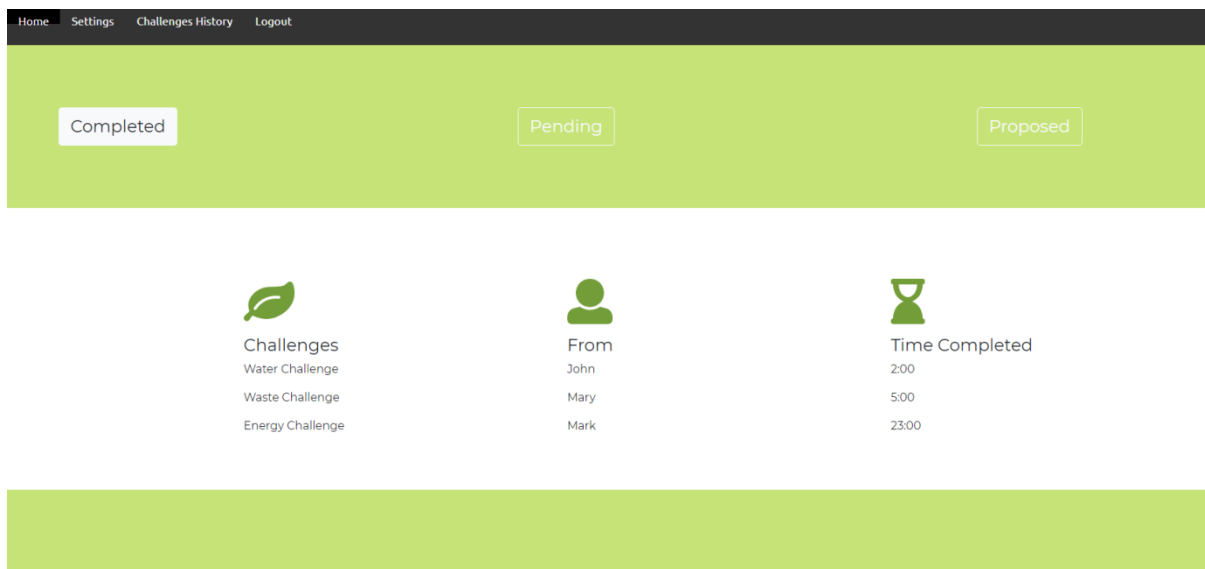
    $query = "UPDATE user SET userName ='$userName' WHERE email='$email'";

    mysqli_query($database, $query);

    alert("Username updated succesfully! Please Login again");
}
```

Developing all aspects of the website that we had intended to develop at an initial stage proved to be more difficult than we had hoped and we were not able to code the functionality in use case 2, in which you send the challenge you chose to another user. As a result of this problem we were not able to code the functionalities mentioned in **use cases 3 and 4**.

Referring to **use case n° 6** we have done only the front end code as seen in the image below.



In the following section, Larissa walks us through her process of implementation of the Mobile app.

GREENER APP

Technologies used:

IDE platform: **ANDROID STUDIO – compile Sdk Version 29**

Emulator: **Physical device = Samsung Galaxy S10 plus (android)**

Code language: **JAVA**

Database: **Google Firebase FireStore – cloud-based database**

Deployment: **Google Firebase**

At our first meeting with the supervisor, it was decided that we would make a website and an application for android mobile. After showing it as a possibility to the Supervisor he agreed with our idea. After researching the platforms used to develop an application, we decided to use **Android Studio**.

Android Studio is an IDE for development on the Android platform based on the version of the IntelliJ community. With the same goal of Eclipse + ADT (Android Developer Tools), it provides a development, debugging, testing and multiplatform profile environment for Android.

As Android studio is a heavy platform with many tools, it was not viable for everyone in the group to download it. My laptop has a better development and a bigger memory, so I decided to be responsible for this part of our project.

Below I'll give more information on how the first part of the project was developed:

Greener App first part: FRONT-END

At first, a research was done on what is android studio and how it works. The first part of the project was based on collecting data to create it. To achieve it we made app colours research, diagrams, questionnaires to possible users.

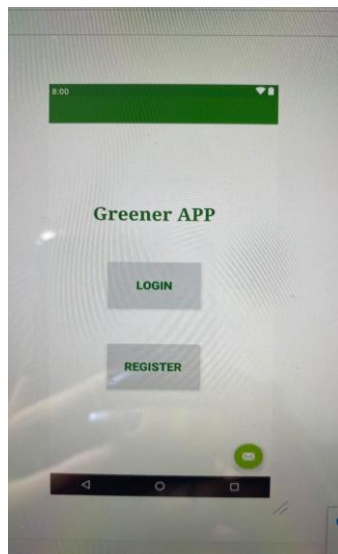
This first part of the project would be based on deciding how the project's FRONT-END would look like and the technologies used to achieve this. But before starting creating pages on android studio, I created html pages to help on visualize how would be the flow of the app.

HOME

[LOGIN](#)
[REGISTER](#)

After visualizing the flow of the project, I created **my first page** in Android Studio using the emulator of the application itself to view it.

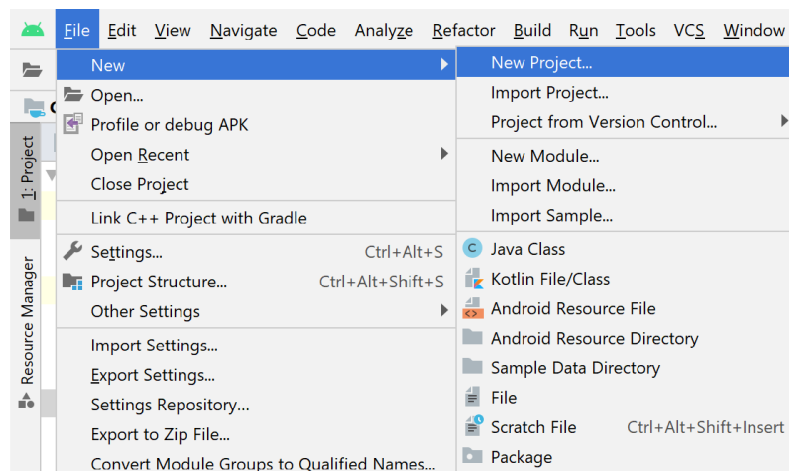
First page:



How to create pages in android studio?

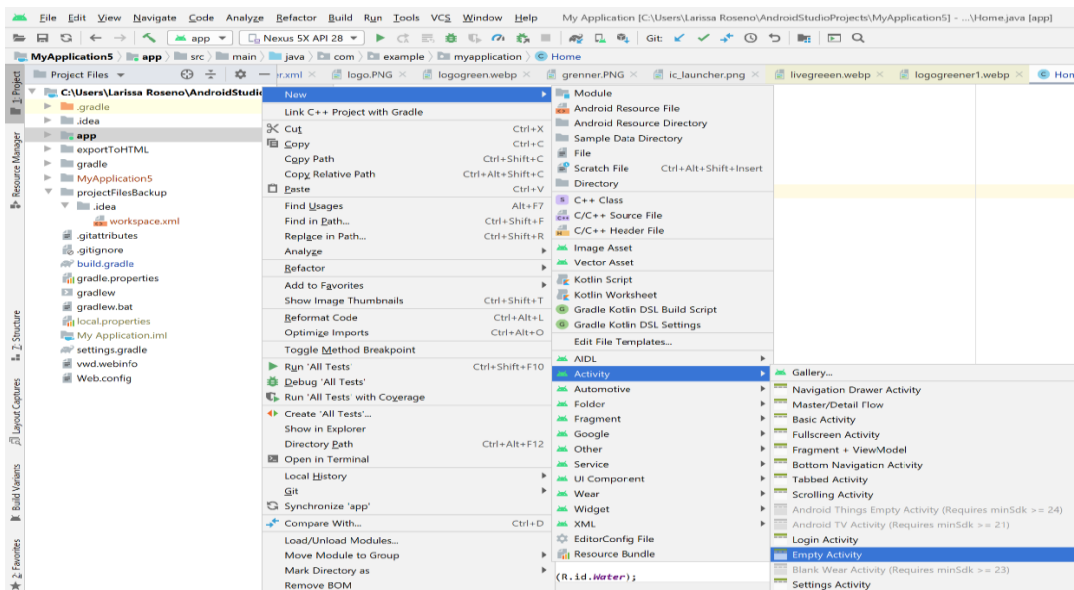
1. Create a project:

Click on file -> new -> new project - Choose a name for the project.

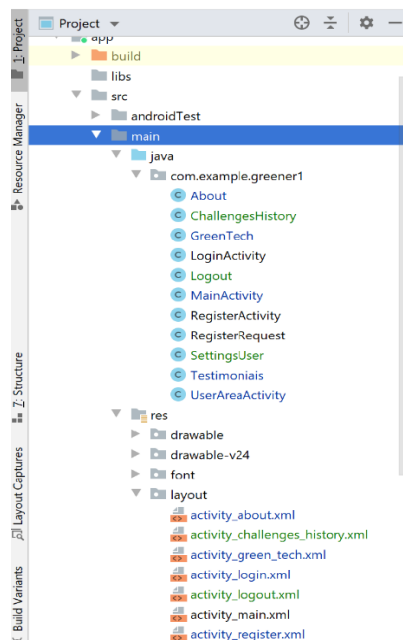


2. Create activities (pages):

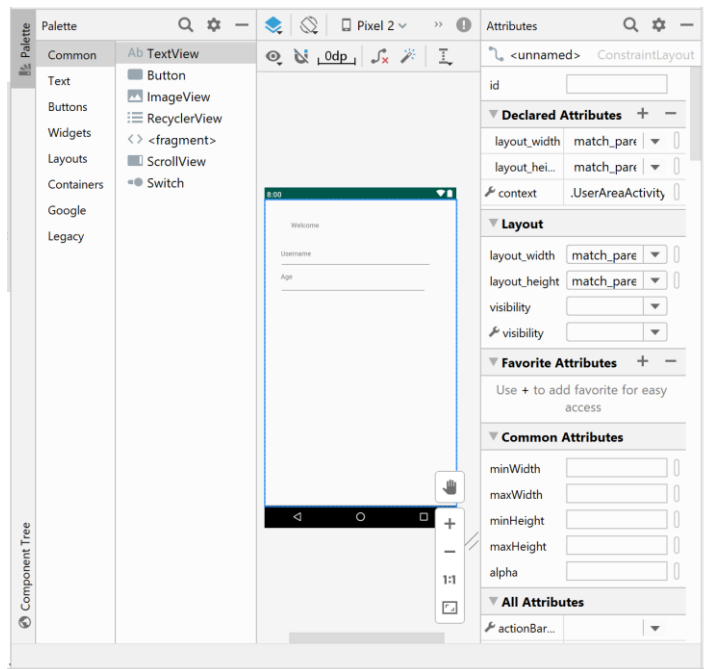
Click on app -> new -> new activity -> choose the desired type of activity



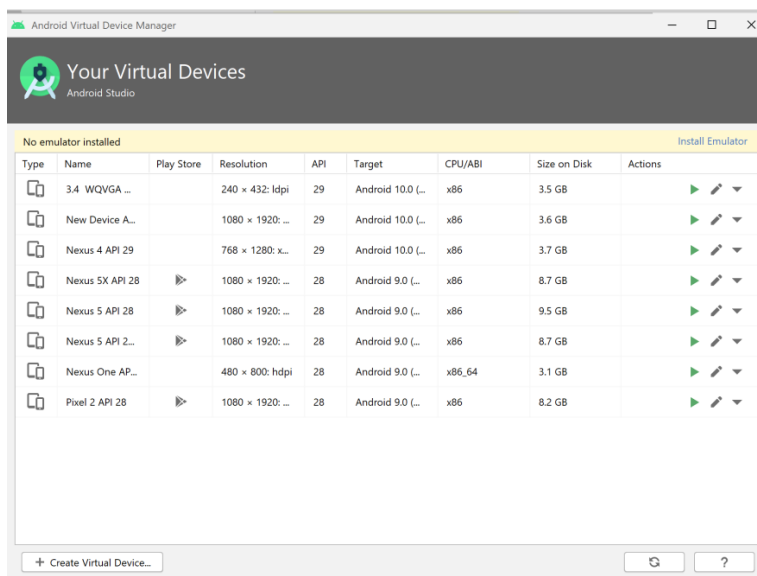
2 files will be created. 1 xml file for design and 1 Java file for development.



3. Design the page using buttons, texts, etc., that the application itself offers.



4. Create emulators so that you can view these pages. The application itself offers options for emulators.



Greener APP second part of the project: BACK-END

The second part of the project would be the development of the application back-end.

How would it have functionality?

Android Studio can be developed in 3 different languages: **Java, Kotlin and C +.**

Java was the language we decided to use. Java was the best option for this project because we have been studying java since the first semester so it would be easier to develop.

Android Studio provides a series of tools that facilitate the development of the Back-end. Among them there are Java classes and methods that make it possible to start coding without major problems. As in the following example:

This part of the java code is provided by the Android Studio when you first create an activity.



```
1 package com.example.greener1;
2
3 import ...
4
5
6 public class SettingsUser extends AppCompatActivity {
7
8
9     @Override
10    protected void onCreate(Bundle savedInstanceState) {
11        super.onCreate(savedInstanceState);
12        setContentView(R.layout.activity_settings_user);
13    }
14 }
15
```

Following I'll demonstrate how I developed this part of the project:

By this time I have created the Main Page Login Page, Register Page, About the project Page, Green Tech professionals Page, Users Testimonials of the project Page.

Main page:

To create the Main Page, I chose an image written "#Greener APP- Sustainable Life Habits" that I created in the CANVA application to serve as the background of the page.

I created a **Text view** saying: "Greener the environmentally friendly app" so that it was cohesive with the website's first page.

2 buttons: Login and Register

Menu bar with 3 Items (Pages) = About - GreenTech – Testimonials (Those pages are visible before logging in or registering).

Main Page:



About page:

For the creation of the About Page I chose a green image as a background that was used on all the following pages.

I created **2 TextView** where was included some information about the app.

1 Button = This button has a functionality to return to the main page.

Menu bar with options to view the GreenTech page and Testimonials page.



Testimonial page:

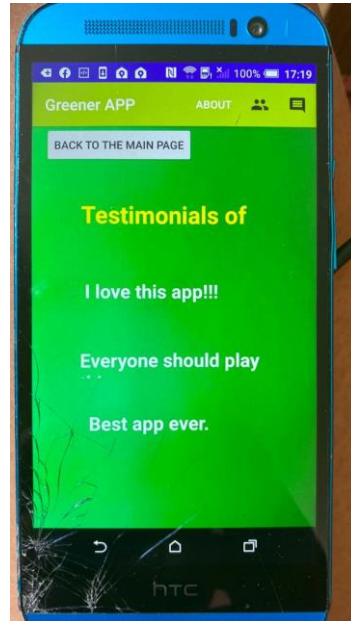
To create the page I used a green image as a background that was used on all the following pages.

3 TextView – User testimonials about the application

1 Button = This button has a functionality to return to the main page.

Menu Bar with options to view the GreenTech and about pages.

Testimonials Page: This page is still not well formatted - it will be fixed in the next steps



Green Tech page

To create the page, I used a green image as a background that was used on all the following pages.

I created 4 TextView – Those textview has a description of the project developers

4 images – Our group is made of 4 developers

1 Button = This button has a functionality to return to the main page.

Bar menu with options to view the About page and Testimonials page.

Green Tech page:

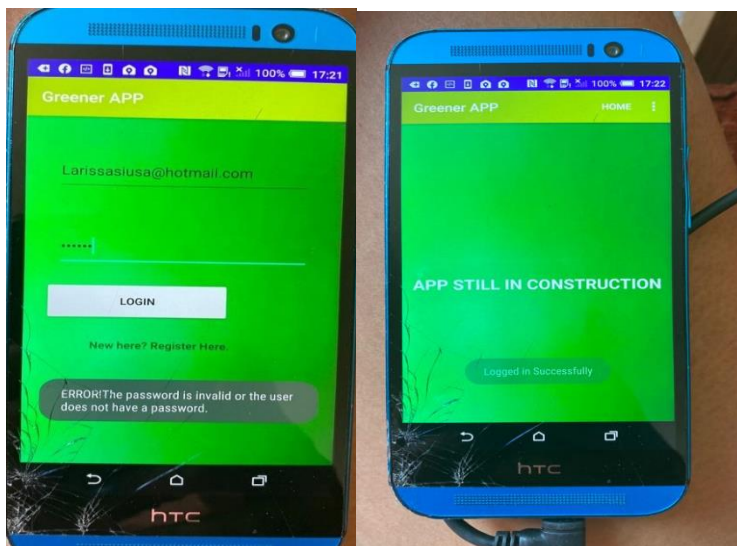


Login page

To create the page I used a green image as a background that was used on all the following pages.

2 plain text fields to insert data such as: *Email & Password*

2 Buttons = 1- Login to enter the application - if you have already registered with the application, this button will take you to the **home page**. If you have not registered, the Login page will inform you that the user needs to register.



2-Register button if you don't have a previous registration. This button will take the user to the registration page.

Register page:

To create the page I used a green image as a background that was used on all the following pages.

3 plain text fields to insert data such as: *username, Email & Password*

Email & password will be used to login to the app and **username** to be identified inside the application.

2 buttons = 1-Register to enter the application - if the information is correct, such as: email in correct format and password with a minimum of 6 characters, this button will take you to the Login page so that the user can enter the registered data and be able to access the home page.

Register Page:



2-Login Here button if you already have a previous registration. This button will take the user to the Login page.

How was the registration data stored?

The data created in the Register Page were stored using the **FIREBASE database**.

Firestore is a mobile (and web) development platform, with a focus on being a complete and easy-to-use back-end, this tool provides several different services that assist in the development and management of applications.

It is integrated with android studio and provides a series of tools that help in the process of registering users and saving them.

Problems encountered and Updates to the system

By the end of the development of the project (17-05-2020) I have changed few things and included others.

Changes in the design of the project:

The image used to design the pages before was not suitable for the cell phone screen, causing the image to become distorted.

Using the CANVA website I developed an image that leaves the site looking clean and professional.

I chose the WHITE, **DARK GREEN** and **LIGHT GREEN** cores.

The same image was used on all other pages.



Changes in project development:

The initial project was based on a game where users could challenge their friends to have more sustainable habits. It turned out that developing the game has become a difficult task for students who are developing the first application.

In this way we chose to change the idea of the application so that it was a social interactivity application where users could challenge themselves. The idea is that users choose the challenge they want to do, provide evidence that the challenge has been carried out and an initial page showing the evidence in a post format where all users could see and interact.

Inclusions:

- Profile page where the user can change the profile picture, update password.
- Challenges page where users can view the available challenges.
- Logout page where the user chooses whether to stay or leave the application.

- Page to add evidence that the challenge was made.
- Page to show the challenges made in post format.

Pages updated with the new format:

MAIN Activity page:

- Page has been updated with new image and font. MenuBar was updated to just show the ABOUT page, GreenTech professionals and a back sign to come back to main activity.



ABOUT Activity page:

- Page has been updated including 2 slides.



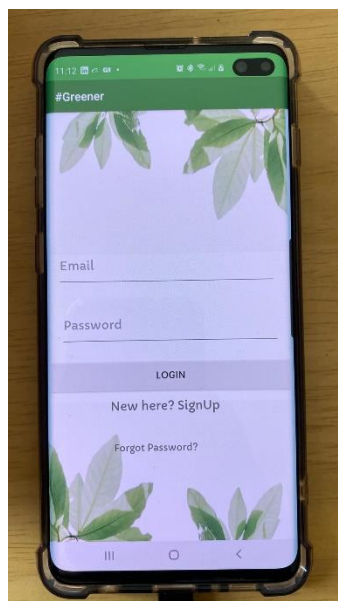
GreenTech Activity page:

- Page has been updated with pictures and name of the students using scroll down page.



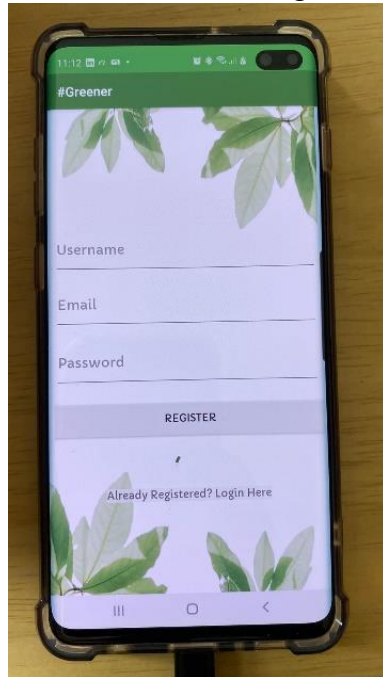
LOGIN Activity page:

- Page has been updated with new background, font and button flow.



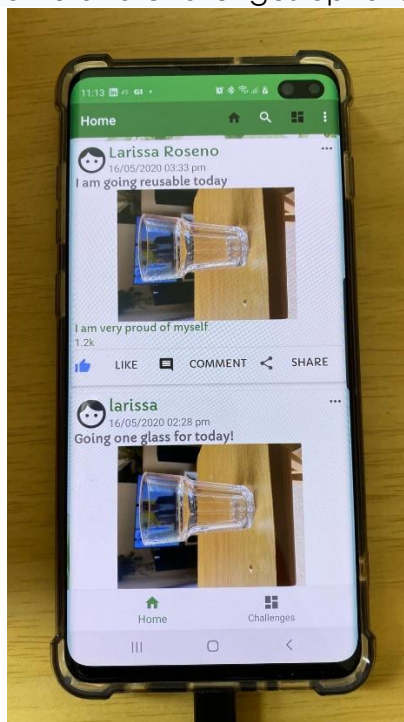
REGISTER Activity page:

- Page has been updated with new background, font and button flow.



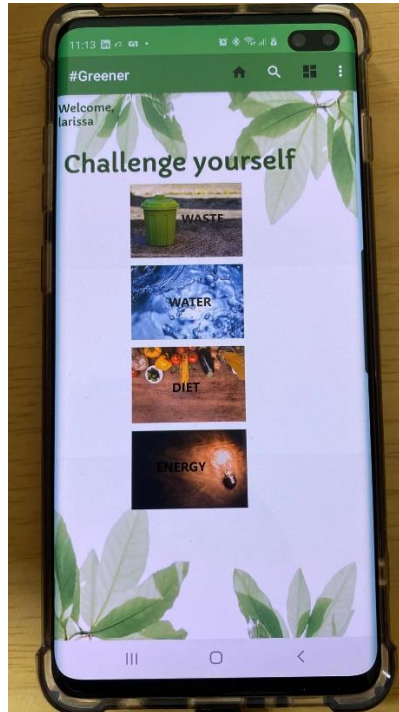
HOME Activity page:

- The home activity now contains user posts.
- Photo - Username - Evidence uploaded, Time that it was uploaded - Number of Likes - Like, Comment, Share buttons
- New MenuBar with 4 options
- New NavBar with home and challenges options



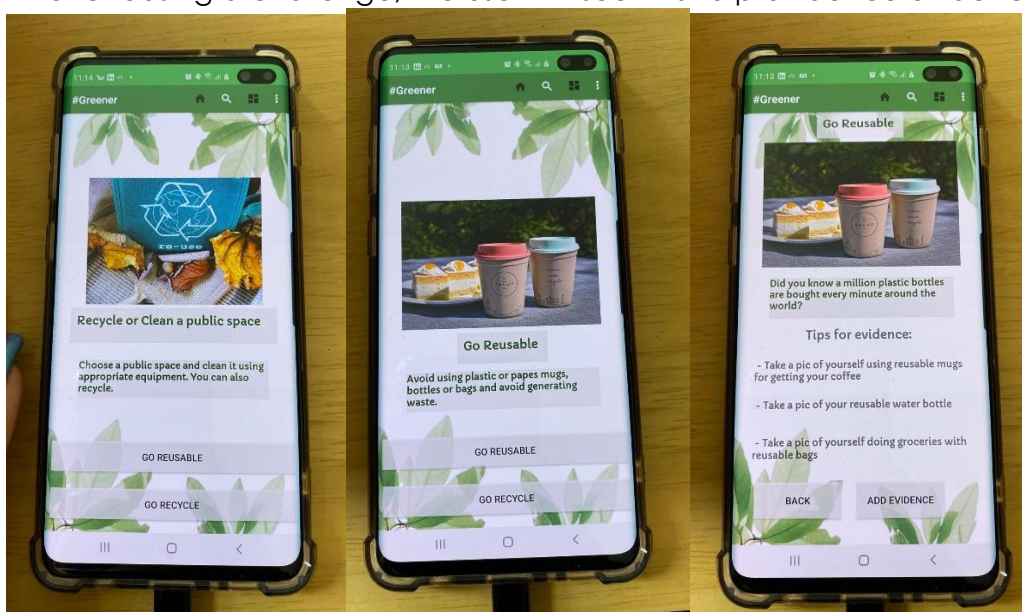
CHALLENGES Activity page:

- This page contains a Welcome message to the user that is signed In.
- Challenges WASTE, WATER, DIET, ENERGY



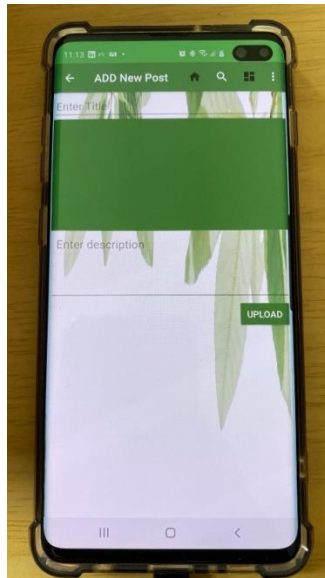
Each challenge will contain page that specifies what the challenge is about as specified in the Requirements and Use case number 3.

- Each of those pages will have slides where the user can see both options of challenges.
- After choosing a challenge, the user will see TIPS to provide evidence.



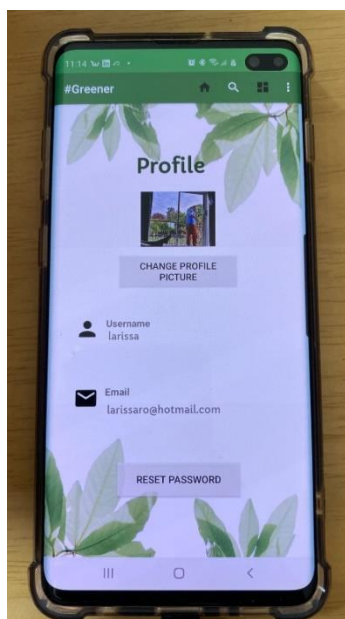
ADD Evidence page:

- This page contains option to upload evidence with title and description.
- After uploading this evidence, it goes to the Home page in a post format.



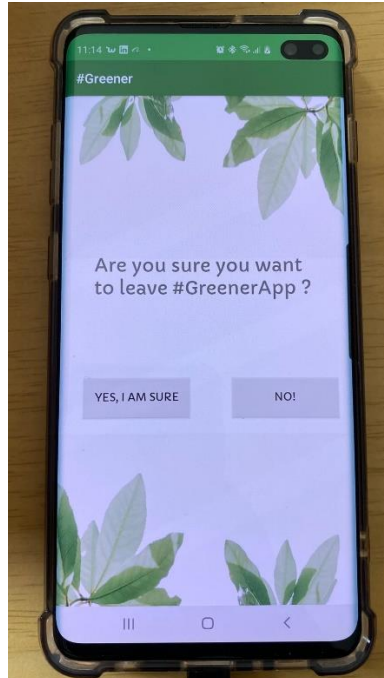
PROFILE Activity page:

- This page contains the user information – Username, Email and profile picture.
- User had two options to upload profile – Change Profile picture, Change Password.

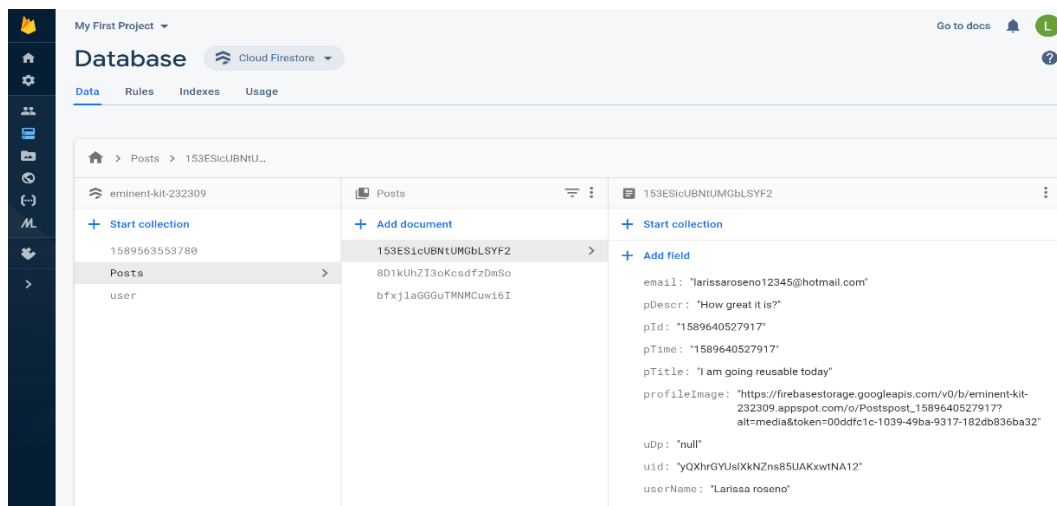


LOGOUT Activity page:

- This page contains two buttons where the user can choose on staying or leaving the application
- If Yes button is clicked the Login page appears. If the No button is clicked user will see home page.



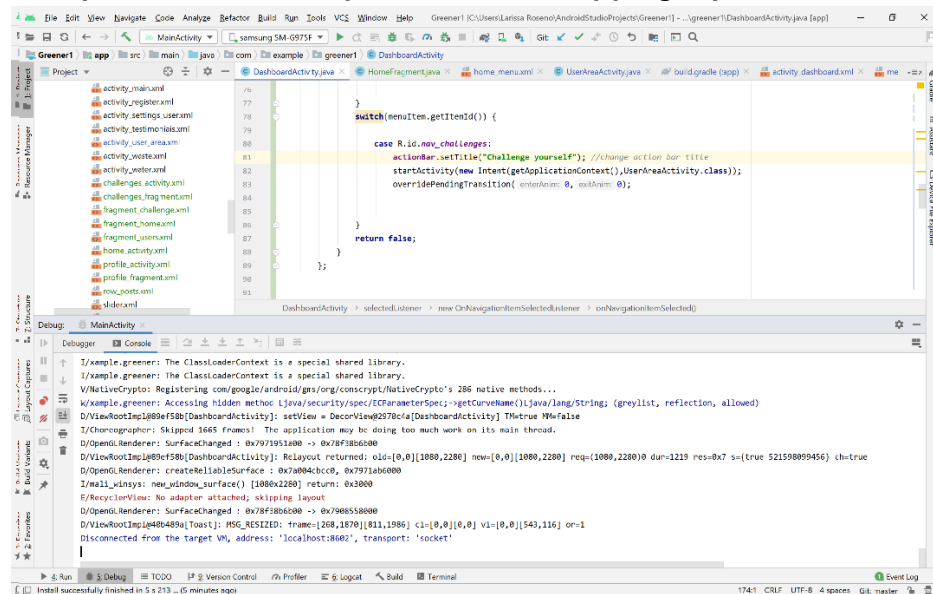
Firestore now contains 1 more collection called POSTS – where every post with all information is included and can be retrieved in home page.



Debugging errors:

This was one of the errors that I encountered while testing the application.

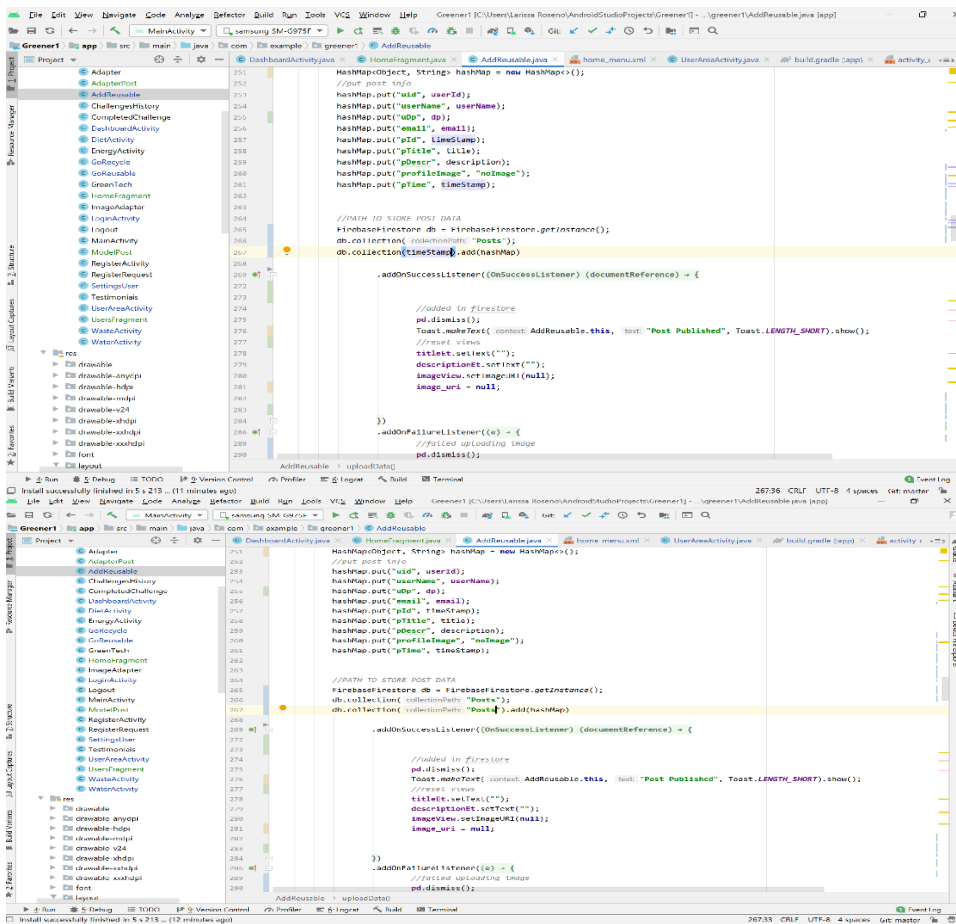
“RecyclerView: No adapter attached: skipping layout”



How did I fixed it ?

The adapter was returning null, because I defined the collection of the path wrong.

Db.collection_users should get "Posts" COLLECTION but it was trying to get "TIMESTAMP" collection which didn't exist in my firebase.



Chapter 5

Conclusions & Further Work

CONCLUSIONS

Overall we achieved most of the aims we had set out to do: We implemented a database, a Login and registration system, we displayed the categories and challenges we had planned, and also the evidence submission tips, the user can update their details and can keep track of the challenges they did.

However, implementing our project had many drawbacks that we hadn't anticipated when we set our aims and objectives. At an initial stage, we set out to develop a platform that would allow users to interact with each other. This aspect of the project wasn't possible to implement due to our own limitations as developers and we had to readjust our plan for our platform.

We decided to implement it so as the user that logs in sees the challenge suggestions but completed the challenge themselves and posts the evidence to the platform, instead of sending it to someone else. This new approach was fully implemented on the mobile app, but would need to be developed at a future stage for the website.

Completing this project was difficult for us both from a technical point of view and a personal one. Working in groups is always challenging, as you need in addition to the technical skills a set of soft skills that contribute to the dynamic of group work. We faced many challenges from this point of view that we explain in more detail in the Project Planning review section of the Appendix.

To conclude, we believe we set out to do an ambitious project for our technical skills level and this impacted directly the final result. However, we are proud of our hard work and even though we had to give a new direction to our project that does not cover all the functionalities we aimed to cover initially, we are happy with the final result.

Further Work

As analysed in the Risk analysis section of this report, in Chapter 1, we are aware that the whole evidence process proposed by this app could potentially have some risks for users in terms of privacy and inappropriate content.

As users have to submit pictures to prove they completed a challenge and to earn points, it would be very important to establish controls on the files that are uploaded, as there is the possibility of inappropriate behaviour. At this stage the project is not intended to go live, but if it were to go live at some future stage this aspect needs serious consideration.

Unfortunately, we haven't been able to implement all the functionalities we wished to for the Website. So a further development of the system would be necessary for a fully working system in the following areas:

- The user should be able to select an user and send them the selected challenge to be completed
- The user should be able to accept or reject a challenge sent to them
- The user should earn points after completing a challenge
- The user should be able to share this to social media.

We also consider necessary to have **more challenges** inside each section, as users could easily get bored over time of #Greener given the limited amount of options.

Another aspect that could be worked on at future stages is a friends or **contacts system**, such as the one seen in social media platforms like Instagram or Facebook, so that the process of listing the users available to send a challenge to is more efficient and has less security problems. At the moment all users registered are displayed, this is not an issue while the platform doesn't go live and there are only a few users registered, but it needs to be considered if the platform were to go live in the future. Expandability and efficiency would be a problem.

We would also like to add both to the website and app an option to **recover the password**.

We would like to make the app **compatible** across different OS. At the moment it will only be available for Android. At a future stage we would like to have it also for IOS.

Lastly, we implemented md5 hashing for the passwords. This encryption type is no longer the most secure, so it would be recommendable at future stages to implement **stronger hashing** techniques if the app is to go live.

CHAPTER 6

APPENDIX

6 – APPENDIXES

Appendix A: Project Planning

During the first semester we assigned responsibilities to each member of the group considering our technical strengths and weaknesses. Members of the group that weren't good with UX design got other tasks, or members that felt no confidence in back-end skills asked to work with front end. We set a timetable, we had meetings every Wednesday and overall during the first semester the group worked efficiently. We regularly kept each other updated on our respective tasks; minutes of our meetings were uploaded to basecamp after each reunion.

At initial stages we had set very clear goals and plans of action to be followed during the year and during the first semester we adhered to them. Unfortunately, these were not respected during the second semester and as a result we fell behind in the implementation aspect of our project.

Being critical of our approach as a group to this project, there are several things that could have been done better, as we weren't as effective as we could have been.

Looking back, we realize that we didn't get as much out of Basecamp as we could have, for example. It would have helped us a lot to use features such as "To-do's", "Over up to date's", to name a few.

We also realize that we did not have the coding skills required to complete this project in time, and perhaps, setting up to do a less ambitious project would have allowed us to submit a fully working application.

Soft skills required for working effectively in a group also have room for improvement in our group.

An example would be learning to respect the deadlines set by the group. This was a recurrent issue, as some members of this team had issues delivering their tasks or delivering them on time.

Being the first time we developed code in a group we also faced issues such as learning to respect legacy code. It would happen that someone uploaded files to Basecamp, that somebody else added functionalities to it and then the application would stop working, causing us to work less efficiently, as we had to do two or three times the same thing.

Having a team manager monitoring this type of situation, or deadlines, would definitely have been useful to work more efficiently.

As a result of the issues mentioned previously we definitely feel we could have worked better in our Project Planning in order to obtain better results.

APPENDIX B Individual contributions reports 1ST SUBMISSION SEMESTER 1

Ana Ospitaletche

I contributed to the group project by **writing this report** and editing the project **schedule** that can be found in section **1.k**.

I also did the **theoretical research**. This involved reading books, articles and publications on subjects such as Sustainability, climate change, social media and the environment, individual behaviour and the environment, etc. As our project involves giving tips to users on sustainable practices I also gathered this information so as to include it in the web/app and make our "challenges" science-based and recommended by reputable sources.

I contributed to the **technologies research**, by researching what similar apps are in the market and to check if our idea is original and what could bring to the table that is different to these other apps. I also did some research and gathered the research done by other team members on the technologies that the group will be using to complete the project. Mostly I checked W3Schools in order to do this (for PHP, Bootstrap, Javascript, CSS) and Android studio official website.

The four of us contributed, in weekly meetings, with ideas on how this web and app should work and did the flow diagrams all together.

I am currently doing online "The complete Web developer Course 2.0" by Rob Percival on Udemy so as to gain a bit more confidence with my PHP and Javascript skills, as I'll be the one developing this aspect of the project.

Amanda Brelaz

I came up with our first idea, about an application to improve small daily behaviors to help the environment. Later we found out an app that was similar and we gave up this one.

I came up with the name 'GreenTech' for our enterprise. I created the Project Proposal that we had to send. I created our profile on BaseCamp.

I came up with the **name** '#Grenner' for our application. I created the **logo** for our application.

I created the **1° questionnaire**, with mine and Larissa's questions, to have a feedback about our project, and what people are thinking about environment.

I created our meeting **Minutes**, that describes our meetings, can be found on BaseCamp. I researched about **online web development courses** that could be useful for our project, and I found out the 'Complete 2020 Web Development

Bootcamp' by Udemy that is useful and has most of the technologies we want to improve.

I created the **2° questionnaire** about our application interface.

Larissa Roseno

I contributed to this project so far by **researching** existing **technologies** that could be similar to our idea.

I also created an **HTML prototype** to check with people that's not involved in this project if we designed the flow of the platform in an intuitive way.

I also read about **Android studio** and decided that I will be developing the **Mobile App** for this project using this tool.

I built a simple **App prototype** with the same purpose of the HTML one. As this prototype has some colours and buttons we decided to use it to gather users input on the design too. We are using questionnaire 2 for this purpose.

Attending the weekly meetings, I participated in the decision making and planning done so far by the 4 of us (creating the flow diagrams in the library room boards, deciding which challenges to set up, etc).

José Miguel Gonzalez Correa

As part of the process of developing a formal degree project, a varied group of activities must be fulfilled that can be divided between the initial investigations that support it, the different elements that compose it, concepts, relationship with the project and contributions, as well as its planning and its implementation. Therefore, these activities must be distributed among the team members, in addition to staying related to the research and its implications.

So far, the contribution that my person has given to this work, are:

- Research on global and major pollution, causes and effects thereof, explained from the statistical point of view, which illustrates the relationship of what is done day by day and how it affects global pollution, with the sole purpose of Understand the individual contribution to these problems, and more importantly, the power you have to start reducing it. For example:



Apart from all the relation between daily human been behaviour and actual pollution, it was necessary to investigate the about the theory of colour and how it could help to penetrate this web side that is to be developed, supported by the colors to be used for its design: what each color can represent and what kind of people can arrive or what colors to use to reach the target group. As well as a small research also about Nielsen Norman Group and its contributions to the development of web pages.

Another big contribution was related to the initial programming developing project, creating a kind of GANTT Diagram draft, where it could be distributed the time remaining according to the activities that supposed to be done to achieve the main aim within the less time possible, or at least, not longer than that.

The most recent contribution is made up of developing a database to support this project, where all the information related to the proposed challenges can be stored, as well as the participants.

Currently, I am investigating about what may be the best option to store this database, whether to work with a cloud provider or another more beneficial and economical option.

APPENDIX C- Individual contributions reports FINAL SUBMISSION, SEMESTER 2

Ana Ospitaletche - 2017253

My contributions during this second semester to the project were as follows:

I wrote this **report** (excepting for the Mobile App implementation and technologies section in Chapter 4). This involved not only writing but doing **research** in technologies, Database Normalization, etc. In order to incorporate the research done by other team members I had to do the **editing** work as well to the research submitted by them so that we would have a cohesive report.

I did the **diagrams** for the **design and analysis** chapter. The diagrams are:

- Use cases with text descriptions and failed scenarios
- Action diagram
- Class diagram
- Logical design for the database diagram
- ER diagram
- EER diagrams.
- I also did the Database Dictionary.

I implemented the **database**. The first database contained originally 3 tables, in order for our database to support 3F Normalization I had to add 3 more tables to the database, change and add data types and attribute names, and add constraints.

I also had to do the **Front end code** for the Website. In order to do this I used **HTML, CSS, Bootstrap** and **Javascript**. I did the front end code for all pages of this website. Some of the pages for the website were improved by another team member, which added some bootstrap classes and css to some of the pages I created.

The front end was not my task to complete when we assigned roles but it had to be done, as weeks prior to the final submission this had not been started and I was not getting replies for a long time.

I also did the **Back end code** using **php** and **mysql** for the following pages/functionalities: Registration and Login, Update of username, Upload and display of Profile Picture, Display of all users within the database the challenge sending process (page sendchallenge.php), I implemented the Sessions & Logout.

I did the **screencast** for the website.

Larissa Roseno - 2017191

Individual Deliverable 6 – Self Evaluation Report 2

In the first semester, it was decided that the group would make a website and a mobile application. After some targeted surveys and questionnaires, we directed

what each of the group would be responsible for doing. Since my knowledge was not as vast on websites neither in mobile applications, I chose to remain responsible for the application, as I was more curious about learning and developing it.

The platform chosen to develop was Android Studio. As I had a greater interest in the application, I was responsible for creating the application and the other 3 people from the group would be responsible for the website. Always in communication with my colleagues we decided to use the same website content in the application. So, in this way we would be able to work together.

The first months of the second semester were crucial for the development of the application. We did not expect to have to deal with video calls and online studies. In the first weeks I had difficulty in organizing my studies, I was unable to give the due attention to the application. Even though we were all dealing with our own difficulties we had to deal with the group as well.

After meeting with the Supervisor, it was decided that the attention would be turned to the website and that if my 3 colleagues responsible for the website needed my help, I would leave the application aside to help them. Always in contact with the group, I made myself available in case they needed my help when creating the website. While they didn't need my help, I continued to make the application and within days I had an amazing result.

As soon as they needed my help, I put the application aside and went to help them with few pages that they could not finish. I confess that I felt totally lost with PHP, HTML, that was not my area. For 2 days working 12 hours a day on the website I was unable to develop anything, I felt very frustrated, I didn't understand the code and I realized that it would be very difficult for me to continue a code that was started by someone else. So, I decided to let the 3 responsible for the website continue the code and went back to work on the application. With the little time I had left I worked 12 hours a day and I have got incredible results in the application. It still was not the way I wanted it to be, but I felt it was enough given the work I had to do. At the end of this project I am feeling very happy for my participation as a member of a group and for the work I have done. I learned a lot of things and I think I finally found the area where I want to work in life.

Jose Miguel Gonzalez

Referencing to my personal contribution was mainly focused on doing an in-depth investigation into the levels of pollution, and those causes associated with simple routine behaviours of individuals, in order to list all those potential actions that strongly impact positively environmental pollution.

As a result of that, I could contribute with a lot of information related with and fairly representative statistics that indicate evidence of the inherent impact of our simple daily decisions as a population, which ends up being thrown largely into our oceans.

I also focused on researching on the use of social networks, their impact on the population and also this new trend of "challenges" and how effective is their penetration in the world population. The results, once again, were quite surprising from a statistical point of view, which led us to consider the implementation of this innovative trend of "challenges" in a possible solution to encourage the general population to mitigate the negative effects that we can generate in our day to day as individuals.

Voluntarily and considering my strengths and weaknesses in the different stages of a web development, I decided to be in charge of developing the database model to be used and also the construction of the application's front-end. I designed a first database model to use, based on the implementation of 3 initial tables, created in a MySQL environment, due to the advantages that the information in these tables offered to the structural.

It should be noted that, like any development process, this model had to be modified once the Normalization's rules had been applied, in order to obtain a better database model, efficient and with greater agreement for the operation of the application.

Already for the front-end creation stage, great personal problems began to arise, as I felt strongly about my lack of development and web programming, despite previous studies of this matter in previous subjects. For this moment also and making a parenthesis, the whole world was already living the threats of the pandemic that currently plagues us, so we were in a totally different study scheme and based on social distancing, limiting myself to the online interaction.

I must admit that instead of looking for more help, I let myself be carried away by the anxiety and despair of not being able to elaborate my technical part of the front-end work, few times I asked for information and help to one of mine colleagues, and also to an important and confident lecturer, Amilcar Aponte, to have some ideas on how to do this part of the job. I thought about contacting the supervisor, however, I also thought that this technical advice but quite explicit would not be given by him, since it would require a lot of time and in addition to perhaps very basic explanations.

I must also emphasize that for this moment, I still have to repeat the subject Web Design next summer, and although I personally proposed myself to work on this part of the project even though I was aware of my lack of knowledge in this matter, I also thought which would be the least complicated thing that I could work comparing it to the backend. Apart from this, and without intending to use it as excuse, at the time of distributing the responsibilities of the project, I considered that I could count

on more help being at college, in my day to day classes, but the reality was totally different when we were submerged in this mandatory quarantine.

Another great learning that I think I have gained is that I must admit that I am a type of person who definitely works better when I am in a face-to-face work group and I can interact face-to-face with both my lectures and my co-workers, therefore, it has made extremely difficult, not only in this project neither in this quarantine time, but also during the entire career, to be able to research very technical topics on the internet, either in material to read and / or tutorial videos, where I still feel lost by not being able to transfer what was explained in them to what I can be doing, thus wasting the great help of the internet.

All this resulted in a long delay in my work and that part was, on its own initiative, developed by my partner Ana Virginia, in order to not affect further its development in the back-end, and on the other hand Amanda managed to make a contribution as well to the work we should have both done. At this point in the project, I have also contributed more research on the different technologies to be used and their advantages for the project, such as HTML, CCS, different languages like PHP and JavaScript, the usage of XAMPP and GitHub, so he tried to contribute at least part of the final report.

Having said all this, I feel totally obliged to assume the responsibility of not having finished the development of the prototype, leaving important pages of the application uncreated, and also to release my group companions from the pain of not complying with the initially proposed project.

I think that without wanting to be a victim, I should have been more honest with myself and with my partner and seek more help, not only during this semester, but also in the previous break and even in previous semesters, in order to decrease my lack of knowledge. Today I really have to ask myself why I decided to take the challenge of studying a career quite different from my profile and also not having focused in a more intense way in order to achieve a better result.

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For the second semester, my group divided the tasks about developing the web site and the app. My task was to create the Front-end development with another colleague and together, develop the web page with the requirements that we had previously searched about.

Before the creation of the web pages I created wireframes to design them, based on the feedbacks we had with the questionnaires and researches we had done previously. The platform to develop the wireframes is Balsamic, which I recon is quite difficult to understand, but with the help of some tutorials the wireframes were produced.

Once we had the design done, was time to develop the web site.

To help create it I used the technologies searched on semester one: HTML, CSS and Bootstrap.

Although we had a module about it, I felt a little bit lost in the beginning. Specially using Bootstrap. Then after some research about it and tutorials I could develop them.

The development of the web pages took longer than I expected and without proper communication between me and another Front-end partner I had to deliver it alone with few weeks before the due date of this project.

In the end we achieved what was expected for some of us.

APPENDIX D- Glossary

***All definitions were taken from Cambridge's Dictionary.**

Sustainability: "The quality of causing little or no damage to the environment and therefore able to continue for a long time"

Greenhouse effect: "An increase in the amount of carbon dioxide and other gases in the atmosphere (mixture of gases around the earth), that is believed to be the cause of a gradual warming of the surface of the earth"

Greenhouse gas: "A gas that causes the greenhouse effect, especially carbon dioxide"

Climate Change: "changes in the world's weather, in particular the fact that it is believed to be getting warmer as a result of human activity increasing the level of carbon dioxide in the atmosphere"

APPENDIX E

Questionnaire 1: The aim of this questionnaire was to check if there was an interest among our classmates in the environment and in changing habits. We also wanted to check potential challenges to include in the platform. 29 people completed the questionnaire.

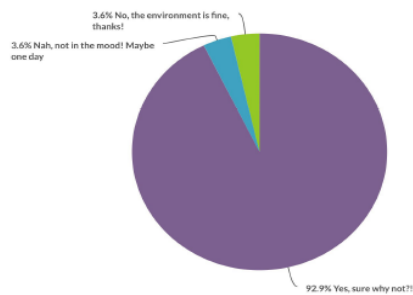
3. How often do you:

	Never	Sometimes	Very often	Always	Total Checks
Hear about global warming?					
Checks	0	4	10	14	28
Row Check %	0.0%	14.3%	35.7%	50.0%	
Care about the environment?					
Checks	0	7	14	8	29
Row Check %	0.0%	24.1%	48.3%	27.6%	
Think environmental measures work?					
Checks	1	10	8	9	28
Row Check %	3.6%	35.7%	28.6%	32.1%	
Take short showers (up to 10 minutes)?					
Checks	3	8	10	7	28
Row Check %	10.7%	28.6%	35.7%	25.0%	
Recycle your trash?					
Checks	6	12	9	1	28
Row Check %	21.4%	42.9%	32.1%	3.6%	
Use habits change apps?					
Checks	11	10	7	0	28
Row Check %	39.3%	35.7%	25.0%	0.0%	
Mind reducing electricity consumption?					
Checks	1	9	8	10	28
Row Check %	3.6%	32.1%	28.6%	35.7%	
Post on social media?					
Checks	6	14	6	2	28
Row Check %	21.4%	50.0%	21.4%	7.1%	
Follow challenges on social media					
Checks	9	10	7	2	28
Row Check %	32.1%	35.7%	25.0%	7.1%	
Total Checks					
Checks	37	84	79	53	253
% of Total Checks	14.6%	33.2%	31.2%	20.9%	100.0%

5. Would you be willing to:

	Never	1-3 days in a week	Everyday	Total Checks
Dairy free day				
Checks	5	20	3	28
Row Check %	17.9%	71.4%	10.7%	
Plastic free day				
Checks	2	18	8	28
Row Check %	7.1%	64.3%	28.6%	
Meat free day				
Checks	7	18	3	28
Row Check %	25.0%	64.3%	10.7%	
Recycle trash				
Checks	2	16	10	28
Row Check %	7.1%	57.1%	35.7%	
5 minute showers				
Checks	3	18	7	28
Row Check %	10.7%	64.3%	25.0%	
Total Checks				
Checks	19	90	31	140
% of Total Checks	13.6%	64.3%	22.1%	100.0%

6. Would you try new small daily behaviors to help the environment?



Value	Percent	Responses
Yes, sure why not?!	92.9%	26
Nah, not in the mood! Maybe one day	3.6%	1
No, the environment is fine, thanks!	3.6%	1
Totals: 28		

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