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Ever Growing Effects of Climate Change

Technical Report



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# Executive Summary

Climate change is one of the biggest talking points in the world at the moment. Some people think it’s fake even though there is indisputable evidence that our climate is changing. There are going to be major repercussions, animal groups going extinct, water levels rising, ice caps melting and an increasing temperature that at the moment scientists are saying that it won’t be a steady rise.

Who cares about this? Scientists and the average person who wants a better future for the younger generations to come. There are such small things we can all do to chimp in to help, more people using trains to get to work meaning less cars on the road, using solar panels if possible and using renewable if possible. I want to try help more people learn about it. I myself am learning as I go and it really is an interesting topic if you take the time to read it.

My project will help people be more knowledgeable about the topic and will be aimed at all age groups. The overall aim of this project is make an aesthetically pleasing to look at website that will aim to teach visually rather than being very heavily text based. I will also have separate pages for people who want to see my predictions for the next few years to come. I want to show people what is happening and what we can all do to help.

In this technical report, I will set out the aims, ambitions and requirements to analyse my climate change datasets and create my website. I will achieve this by using React integrated with Bootstrap as my front end framework. I will use animation libraries such as AOS and Anime.js, Tilt.js for my advanced animation.

The “further development” aspect of this project would be to build on the data and allow other users to contribute to my findings and possibly allow user logins where we could start storing all our findings in once place.

# Introduction

## Background

Climate change has been a hot topic over the past few years, with the likes of Greta Thunberg making huge strides bringing the topic to an even bigger debate for me it was a great time to try to learn about it myself. There has been a lot of mixed opinions on Greta Thunberg and I see both sides of the story, but in my opinion, she has done a great job for many reasons. She has got so many people out and about talking about the topic, which is great, showing age really is only a number. She challenged higher up people that are declining that cause of climate change even though the fact is out there. For a big project like this, the more data you can look into the easier your life will be, and the overall project will be enjoyable. The main goal at the end of this project is to highlight the effects of climate change that have occurred over the past 10 years. I then want to predict into the future and try to estimate the effect it will continue to have if we continue to live the way we do. There is already a lot of proof, ice caps melting, trees blooming earlier than usual and changes in animal behavior. To me all of this data is very interesting, and I want to make the reader interested in it by having all the data condensed and shown in a much better way. I have taken a lot of inspiration from apple as a company. They are great at selling their project and make the user interested to learn, fancy imagery good web page movement all help keep the user engaged. I want to follow their approach and use it for this very controversial topic. I think my project is a good idea because there is so much information out there and I would like to do my part and raise awareness for this serious topic. This finished project will have data pulled from multiple websites and I will make the website with react using a bootstrap framework. I love web design so I want to bring those skills to this project as well and have somewhere people can learn all they need to know about climate change. Quoted from Clean, Clean is a resource for introducing youth to the topic.

*“Changes in the climate have been happening for hundreds of thousands of years, and until recent centuries, most of these changes were naturally occurring – for instance, because of ice-ages and then post-glacial periods. The present-day is not the first time carbon dioxide (CO2) levels in the atmosphere have been high. So what’s the difference now?*

*Starting with the industrial revolution of the 19th century until today, changes in the climate have been mainly the result of human activity. (This is a 95% certainty according to the Intergovernmental Panel on Climate Change or IPCC.) The industrial revolution meant a shift from human labour to machinery, and kickstarted the era of combustion engines – including the automobile – and, as a result, the excessive burning of fossil fuels.*

*Over the past century, human activities have released large amounts of carbon dioxide and other heat-retaining greenhouse gases into the atmosphere, which in turn causes the global surface temperature to rise.”*

Useful common terms that are brought up a lot in regards to climate change also summarised from the same website

*“****Fossil fuels (FF)*** *– there are three main types: coal, oil and natural gas. All were formed hundreds of millions of years ago by dead trees and plants that have died, broken down, have become compacted and covered by additional materials over time. Since plants produce and store carbon dioxide during photosynthesis, this gas is released when fossil fuels (which are formed through organic material) are burned. This is the main concern regarding human-caused climate change.*

***Greenhouse gas (GHG)*** *– simply put, they are gases that absorb and trap heat in the atmosphere. The main GHGs are CO2, methane, nitrous oxide and water vapour.*

***CO2*** *– Carbon dioxide is a naturally occurring gas fixed during photosynthesis into organic matter such as trees and plants. This gas is also released when fossil fuels and biomass are burned.*

***Anthropogenic*** *– relating to or resulting from the influence of human beings on nature.*

***Adaptation*** *– adjustment in natural or human systems in response to actual or expected changes in order to moderate/reduce harm (for example, building a seawall to protect against storm surge and erosion).*

***Mitigation*** *– an intervention used to reduce negative effects and lessen their impact, such as the impact of greenhouse gas emissions on the climate system (For example, geoengineering removal of C02 from the atmosphere, Carbon Taxes or reducing our individual carbon footprints).*

## Aims

My aim for this project is to gather a sufficient amount of data access this data and produce any useful information in a very easy to understand way by making it very visual rather than the report being completely text based

## Project Plan

Below is a Gantt chart which sets out a guideline for the project to ensure that milestones and deliverables of the projects are met.

For the first semester of college, I plan on laying the foundation work for my project. My goal is to have completed the required research on datasets, techniques and methods.

For the presentation I wanted to have some of the data I got cleaned and squashed and load the data up on graphs locally instead of from the database.

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**Figure 3: Project Plan**

## Resources Required Throughout the Project

For the research section on my project, I looked over the main aspects of climate change to get a better understanding. There was a lot to take in so having a basic understanding of what was going on was essential for moving the project forward. I also looked at a study published in 2013 by Met Éireann which was done by “Aidan Kelly, Kilian Harford, Brendan Noonan and Sandra Spillane”.

Nasa also give a really good insight to climate change and regularly update their web page with new articles about it. I also read through a few reports on Google Scholars as a starting point but the two above are the main ones that I will be using as reference points throughout the cycle of this project.

I used KDD methodology as the basis to plan my project.

I will be going over my notes for using that I used in certain modules here in college such as introduction to data and web mining, advanced business data analysis and data application development. I did a project back in data application where I studied the various climate across two main states in America.

I have also taken courses on treehouse, skill share and Ihatetomatoes (this is run by one person who goes over advanced animation effects with Anime.js and AOS (animate on scroll) such as:

* R Programming for Data Science
* Scrapy: Web Scraping/Crawling with Python
* Python for Data Science
* Scrollmagic Workshop
* Flask

What?

## Technologies

Bootstrap 4.5: Bootstrap is an open source CSS framework

JavaScript: Used for animations on my web page.

CSS: Used for styling the content on my web page.

Anime.js: animation library

AOS: Animated DOM level objects into the viewport.

Chart.js: Used to display my data.

JQuery: A Javascript library.

# System

## Requirements

This section will be similar to your original requirements specification. Requirements have probably evolved somewhat since. Where this is the case explain what changed and why.

### Functional requirements

Below are the use cases that I will need to make my project fully functional by accessing the different data sets I will need. All the different methods I will use to reach my final goal will be listed below.

### Requirement 1 <Web Scrape datasets >

#### Description & Priority

The data is the most important part of my project. Without it nothing will be possible. Once the data is pulled it will be a lot easier for me going forward

#### Use Case

**Scope**

The scope of this use case is to retrieve data for my climate change project.

**Description**

This use case describes the process of web scraping data from different websites.

**Use Case Diagram**

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**Precondition**

The system is in initialisation mode when the data is ready to run by the script which will be done with Python

**Activation**

This use case starts when the user runs the code to pull data of the websites

**Main flow**

1. The system identifies the scrape has started
2. Various websites respond with the relevant data
3. Data is collected
4. Data is stored on database
5. Database linked to website
6. Predictions made with data

**Alternate flow**

A1 : Failed to scrape data

1. The system knows the script has started for the web scraping
2. Web scraping starts
3. Different domains respond and there is an error with collection the data

**Termination**

The system presents the data.

**Post condition**

The script is ready to run again for more web scraping.

This was my original use case diagram for web scraping the data, I found while searching for my relevant data sets that I didn’t have to web scrape anything and all data across the websites was open source and free to download. Some of the datasets had been cleaned but I have a python script to clean some of the dataset. I also decided not to use react.js as I didn’t need any of the components from it

### Requirement 2 <Prepare Database>

#### Description & Priority

Prepare database to be connected to React website.

#### Use Case

**Scope**

The scope of this use case is to prepare all the data to be stored on the amazon web services database. I will then connect the database to my react website.

**Description**

This use case describes the preparing the data to be connect to my website.

**Use Case Diagram**

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**Precondition**

The system is in initialisation mode when the database has all the data stored on it and is ready to connect to the website

**Activation**

This use case starts when the data is store on the AWS database and the data is populated on the website

**Main flow**

1. Flask database is prepared
2. Pulled data is stored on the database
3. Connect the database to the website
4. Load data on to the site
5. Graphs loaded from the data

**Alternate flow**

A1 : <Database encounters errors >

1. Database isn’t set up correctly
2. Data won’t store on the database
3. Data won’t load on to the website
4. Data wont’ work with graph library

**Termination**

The system presents the database to be working correctly and everything is linking up without errors to the website

**Post condition**

Database is ready to be queried and load or delete data.

I had originally Decide to use AWS but instead went for Flask which ended up causing me quite a bit off trouble.

### Requirement 1 <Style Website >

#### Description & Priority

Style the website to make it more appealing so the overall user experience will be better for everyone. I will use a mix of CSS and JavaScript for styling my website.

#### Use Case

**Scope**

The scope of this use case is to style the website after all the data is added to my database.

**Description**

This use case describes the process of styling and designing my website.

**Use Case Diagram**

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**Precondition**

The system is in initialisation mode when the website is fully designed and ready to be fully deployed

**Activation**

This use case starts when the user starts styling the website

**Main flow**

1. Add bootstrap framework to my react application
2. Style the website with css
3. Load additional libraries that I will use for styling and animations
4. Initialize all loaded libraries
5. Use all loaded libraries
6. Make it mobile responsive

**Alternate flow**

A1 : Failed to make it responsive for all screen sizes

1. Website will not look as good on all screen sizes.
2. Desktop will be priority and I will be presenting it on bigger screen sizes.

**Termination**

The website is live with correct styling

**Post condition**

The website is ready for additional changes.

### Data requirements

In this section I will explain and describe the data requirements of the application which are essential to the applications features mentioned above.

The type of database server I will be using is a Flask database with Chart.js. using SQL and JQuery. The database ended up being the only component I couldn’t get working. I was able to load data but was struggling to position it in the bootstrap framework. I had a fall back by using chart.js. Chart.js is great because it works really well with the bootstrap framework. I am sad that it was hard coded into the site but I got the same visual looks that I would have achieved using Flask anyway.

### User requirements

How I wanted the user to interact with my website was actually quite different to a normal website. After some feedback from my friends and family down in Cork I had a few suggestions that they all agreed on. I originally had more interaction on my website but they told me that they weren’t really learning enough about climate change. They suggested giving less options and more reading which isn’t what I originally had planned, I wanted a more visual based website but after looking at the other top Climate Change websites more information seemed the better way to go. I want the user to scroll from top to bottom and read everything that comes up to learn about the topic. I thought I could make it more visual based but it wasn’t to be.

### Availability requirement

The website is hosted on a site called netlify and is available 24/7 as long as the user has internet access and the netlify servers are up and running. I thought about local hosting it but that would mean having something constantly running which was very sustainable in the long run. Netlify is a great site and is one of the best hosting services I have ever used for a website. The set up was fast and I had the site uploaded within minutes. To change the website it’s a simple drag and drop of the work files and the site is updated.

### Usability requirements

To use the site all you need is internet access and device that can access the internet to search for the site. It runs on all browsers and runs on mobile as well.

### Maintainability requirements

I will run the npm file once a month to make sure that all current libraries I have are up to date and ready for deployment. I will also keep an eye on Netlify and if it went down would be prepared to local host it for demonstration purposes.

### Reusability requirements

The great thing about bootstrap is that the framework is so easy to work with. Once you have your style sheet set up and all the libraries imported that you want to use. It’s as simple as adding class and id names to your elements to instantly apply the predetermined style that I had set

### Performance/Response time requirements

One of the reasons why I love working with bootstrap so much is because it’s test for websites and runs really well across all screen devices. Response time will depend on the users internet strength at the time. Netlify have really good servers and from friend and family using it they said that the website has been loading super quick for them without any hassle.

## Design and Architecture

The website design is based around the bootstrap grid system which has become ever so popular for web developers. Since the update of Bootstrap 4 it is using a flexbox instead of floats and to handle the layout. Flexbox is one of the best things to come around for developers and makes making grid layout so much easier using the different classes. Trying to center content was always a nightmare without flexbox using margins to center the content, now you have such simple classes such as the align-content-center which does it all for you.

## Implementation

Describe the main algorithms/classes/functions used in the code. Consider to show and explain interesting code snippets where appropriate.

The Main code would be based around the bootstrap framework. One of my favourite things I learned that I always wanted to be able to do with the line background to add a nice minimal look and feel and a different layout that you don’t see so often. It is done with the anime.js library which comes with tons of options. By making a new line variable we start by giving it a position of fixed we then create the lines by styling them with normal css variables. Commented in the code are the different options we can use below

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## Graphical User Interface (GUI) Layout

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This is some of the layout for my website. After feedback said they really enjoyed how the content flowed, each section goes into each other and outlines all the major points in climate change that people want to see.

## Testing

My main testing tool was user feedback for design and google speed test for my website, Google speed test gives back a ton of very valuable information that I used to get my site ready when it was deployed. My Speed test originally came back as 50 but now I am hitting upwards of 90-95 which is really good. I did this by optimizing the code and following their recommended steps

## Unit – System – Integration – End User testing

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Using Google Speed test I could see what I needed to improve on for my project. It’s a great tool for any web developer and can help you spot loads of things that you wouldn’t spot. For example I had the wrong version of the library and was calling the non-minified version.

## Technologies

HTML5, Bootstrap, JavaScript CSS

HTML5 is a programming language whose acronym stands for Hyper Text Markup Language. It is a system that allows the modification of the appearance of web pages, as well as making adjustments to their appearance. It also used to structure and present content for the web. With HTML5, browsers like Firefox, Chrome, Explorer, Safari and more, can know how to display a particular web page, know where the elements are, where to put the images and where to place the text.

Bootstrap is a free open source CSS Framework directed at responsive, mobile-first front-end web development. It contains CSS- and JavaScript-based design templates for typography, forms, buttons, navigation, and other interface components. It scales your sites and application using one code base. It works across phones all the way up to big monitors. It’s based on flexbox now and uses a 12 column layout.

JavaScript is a dynamic High-level programming language. I used JavaScript on the libraries I imported into the project set up with npm.

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## Evaluation

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I wanted to get a grasp on how my family down in Cork knew about the topic.

A screenshot of a social media post

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I gathered from this that people wanted a more text based website rather then what I had originally thought off.

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The majority of them wanted to learn a lot more on climate change.

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I was surprised by this answer, I personally think it could be to do with them not having enough exposure to the topic.

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# Conclusions

The advantages of having this project done now is that I have learned a ton about climate change what is going to happen in the future. Disadvantages would be that I found it hard to condense all the important information. I honestly had no idea what I was getting into when I took this on. I think after finishing it all that with all the data and information for me personally it was just too big for one person even with the extra time I had. Opportunities would be to grow the website out and use the skills I learn from my job at Press Up and try run some ads and bring users to the website to help people in Ireland Learn more about Climate change. Limits of the project would be that there is honestly so much data that it’s hard for one person to try analyse it on their own. I really enjoyed making this website and I am super happy with how it turned out for me. I am annoyed about the database but really happy that I found a fast alternative that I could substitute it for the same results.

# Further development or research

With more resources, where could the results of this project lead to?

Better analysing of the data is where the project could would need to go first, having a team of people who were interested in the topic would be super fun and really helpful. Possibly looking at the design in the future again but I had really good feedback so I would have to think hard about that one.

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# Appendix

## Project Plan

## Monthly Journals / Meeting Minutes

## Other Material Used

Any other reference material used in the project for example evaluation surveys etc.