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At

Oxford Brookes University

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BSc Computing Project

Final Report

Vim & Vigour: Power Efficient Nutritional Website with Net Zero Carbon Emissions

Table of Contents

Google Drive

https://drive.google.com/drive/folders/1QEp7ZrLcAusNO-iSzWc9r7I_n6wTo1n7?usp=sharing

Glossary

Algorithm A procedure that solves computational problems.

API An application programming interface which is a connection between computers and a program.

Bootstrap Open-source framework containing templates for designs.

Code Testing Examining and running tests on written code to view its execution.

CPU A central processing unit that is the “brain” of a computer.

CSS A style sheet language used to describe the presentation of a document written in HTML.

DOM Programming interface for HTML and XML documents. Defines structure of documents.

E-waste Devices that are thrown away as they are unwanted when new products are being produced.

GitHub Software development platform for code management and version control.

HTML5 5th version of Hypertext Markup Language, standard language for documents designed to be displayed in a web browser.

JavaScript A programming language that is used to add automation and animations, as well as incorporating third party libraries.

kWh A kilowatt hour is a measure of how much energy is being used.

mAh Ampere hour which is a unit of electric charge. Higher number means more energy storage.

Repository A place to store data and maintain it in an organised way.

URL The unique address of a internet resource.

Version Control A system of tracking and saving software, using programs such as Google Driver and Github.

Web application A software that runs on a web server.

Wireframe a schematic or diagram representing the design of a product, in this case a website.

XML A document formatting language designed to store and transfer data.

Abstract

"Energy measurement of web service" talks about how media content and advertisements have a significant influence on energy consumption. This study found that there are techniques to optimise content and media to reduce device power consumption while browsing websites that use Adobe Flash - this paper continues the research into HTML, CSS, and JavaScript now that Adobe Flash is no longer used. Modern websites are quicker and more efficient than ever before, but there are still ways to make them more energy efficient. In this study we use tools to measure power consumption on mobile devices, CPU utilisation, carbon emission calculator and the performance of a webpage. By developing a website, using optimised solutions, and finding big competitors that do the same and then compare them to the developed website, as a benchmark. The findings of this research conclude that the websites tested are not considerate of any optimised content, emitting thousands of kilos of carbon dioxide every month from users visiting their websites, to affecting users' battery health and utilising far more processing power than it needs to. They can lessen their environmental impact by optimising coding, lowering image quality, and compressing videos.

Acknowledgements

To reflect on my time studying BSc IT Management for Business, I have learned quite a lot of IT related skills that I would not have if I did not apply for this university. I am grateful for everything I have learned, and I hope to learn more in the future and find out more about myself and what I am passionate about. I have learned what I like and what I dislike about IT and business, and that to me is important to know as it shapes me into the person I want to be.

I would like to thank all my lecturers who have helped me through my time at university, with my disabilities in mind. Abusaleh Jabir was the first lecturer I met when I began at university back in September of 2019, and now he is my supervisor on this project and has helped me with writing this dissertation at my own pace and helped me turn an idea of a nutritional website into an analysis of power consumption. Without his input I do not think I would have created something as in-depth as this project and for that I am grateful.

I would also like to thank Bob Champion, he has not been involved in this project but he has been a wonderful lecturer to me from year 1 and been a wonderful motivation.

Chapter 1: Background

Fast food, quick meals, and a processed-food diet have become far too common in the Western world in the twenty-first century. On a global scale, the world is on the verge of reaching dangerous levels. According to a study conducted by the World Health Organization in 2016, 39 percent of adults worldwide are considered overweight. Obesity affects 13% of the population. (2021, Obesity and Overweight)

Body Mass Index, or BMI, is a "simple weight-for-height index that is commonly used to classify overweight and obesity in adults" (Obesity and overweight, 2021) A BMI (body mass index) of more than 25 is considered overweight, while a BMI of more than 30 is considered obese.

Although BMI is an easy way of measuring the index of weight globally, it should be used as a rough estimate as fatness is different in everyone (*Obesity and overweight*, 2021)

The main motivation for this project is that global warming has become a political issue of who is right and who is wrong, with the younger generation bearing the brunt of the consequences. Common people are already experiencing extreme temperatures around the world, as well as some of the effects of the massive carbon footprint that we humans create simply by existing. Green energy must be a part of our future, and while this small project will not have a large impact, it will at least start a conversation about how much energy our everyday devices consume. To reduce carbon dioxide (CO2) emissions from devices, we must consider green energy.

Using resource monitor on the Opera web browser, here is an example of CPU usage.

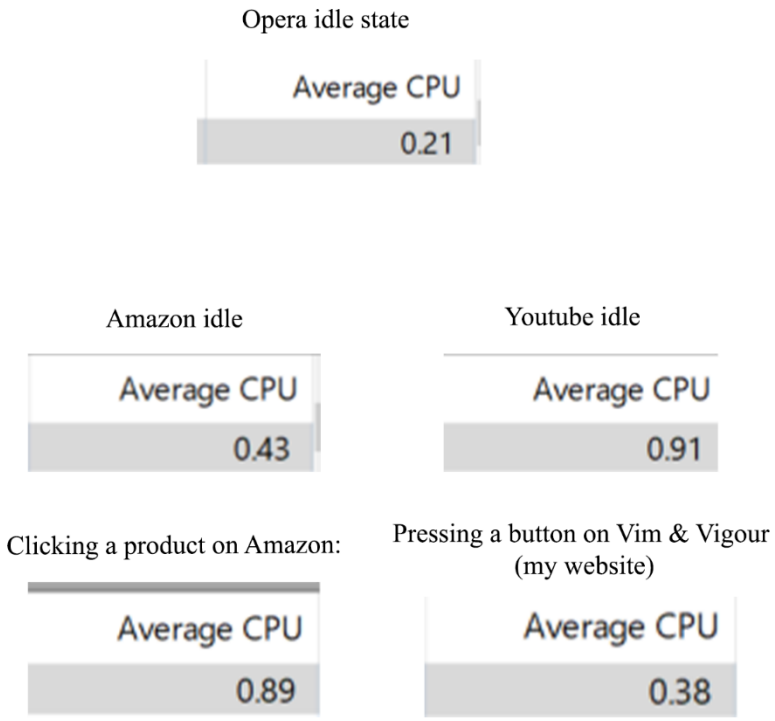

Figure 1

As well as a more personal motivation regarding this project is that 39% of adults in the world are considered overweight and with the addition to the COVID-19 pandemic, there is an increased risk of illness or death by being overweight. A 40% increase, if an individual has a BMI of 35 or higher. (England, 2020) this motivated the author into creating an application that is meant to provide users with a healthier and easy option to cooking meals in their daily lives as the author has struggled with obesity for many years and decided to try and change that during the pandemic. The project aims to give a posssolutionhelp with a problem that can stem from poor diets. The application will show users an easy and minimalistic overview of different foods that look good in the images they are presented in to show that healthy food can be appetizing, and a straight-forward recipe. The application will focus on implementing power efficient methods such as lightweight code and compressed images to make it consume less power and to be energy efficient.

The internet is consuming a lot of power, it consists of millions of computers and each computer consumes a good chunk of power. In 2011, B. Raghavan and J. Ma of the university of California researched how much electricity the internet requires, everything

including hardware, software, computers, networks, and communication towers. The researchers made a rough estimate of:

- 750 million desktop computers
- 750 million laptops
- 1 billion smartphones
- 100 million servers

Categorizing them into which consumes the most and less power, as well as average life cycle of the machines. Their results ranged from a minimum of 170 GW (gigawatts) and a maximum of 305 GW (gigawatts) and concluded that laptops and desktop computers compromise half the internet's total power consumption, suggesting that "decreasing the energy and emergy (= embodied energy) footprint of the end-user devices."(Raghavan and Ma) This suggests that making a lightweight website is a step in the right direction, decreasing power consumption of the user's device. Although this website itself won'will notnge anything in the grand scheme, the study conducted in this report will hopefully cause thoughts to emerge, thoughts on change. This is an application that focuses on the health of the people and the environment.

1.1 Aims and objectives

The aims and objectives of this project is to develop a website to help combat the obesity and lowering power consumption of the application comparing to other similar websites. The project was originally going to create an entirely new application that would be a great competition to existing websites but after some discussions with my supervisor, it has been concluded that the main aim of this project is to research power efficiency of these websites and testing them to see the difference in what inconsiderate companies do compared to those who are considerate of what they are deploying. The difference is immense.

There is estimated to be a demand of such a product in the light of the pandemic, raising awareness to one's self health, especially when people struggling with obesity are in the risk factor of severe or even fatal consequence. There is by no means a lack of other health related products on the market, however, this project tries to make a person's diet healthier and less expensive by using simple designs and appealing food imagery to guide them in the right direction.

The technical side of the project is to develop a website that consumes minimal amounts of power, this can be done writing “clean code.” Avoid duplication, redundant code, using less JavaScript and writing efficient queries. As well as efficient and simple frameworks that delivers the functionality needed. Compressing image files without losing visible quality.

To achieve these aims, these objectives must be completed:

- Complete a competitive analysis and review existing applications that are like this project.
- Create a repository, using both GitHub and Google Drive.
- Design the website using wireframes.
- Write HTML, JS, and CSS to website.
- Optimise images using ShortPixel and Imgbot.
- Run tests on code to remove code that is not in use, especially JavaScript.
- Test the system and its competitors using Mobile efficiency index, Websitecarbon, CPU and Memory performance monitor extension for Google Chrome and Lighthouse.
- Test the system on different devices.

1.2 Product Overview

This section will provide an overview of the product's scope.

Who is it for?	The product is intended for use by users who are struggling with weight, weight loss, or simply want to eat healthier meals that are simple to prepare with a clear conscience because it runs on green energy and contributes to Net Zero Carbon Emissions.
What will it do?	Every week, from Monday to Thursday, the app will display images of various meals. By selecting a meal, the user will be taken to a new page where they can view the recipe and ingredients required to prepare the meal. It will function as a benchmarking tool

	to compare less code and reduced images in a website that adopts power optimization and a website that does not adopt these changes.
How will it work?	The final product will be a weekly meal website that is free of ads and unnecessary bloat to reduce device load. It saves the user's CPU usage by being minimalistic. This reduces the load and energy consumed by the user's device.

Chapter 2: Literature Review

Climate change has been focused on in politics for a few years now. We come to realize that we need to change our ways to be able to save what is left of the earth's climate system. Carbon dioxide makes up most greenhouse gas emissions because it is used to produce electricity. As discussed by (wholegrain digital, 17 ways to make website efficient) the internet uses a lot of electricity, the internet consisting of data centres, telecom networks and end-user devices (such as laptops and mobile phones). Developers and designers can help improve efficiency before deploying an application. A paper written by (T. Kim, Y. Lee, and Y. Lee, "Energy measurement of web service,") talks about how media content and advertisements have a significant influence on energy consumption. They investigate how heavy content websites waste energy and how to save energy by modifying the web content format. However, this is an old study regarding web content running on Adobe Flash. Flash has not been updated since 2015 and is outdated. HTML5, CSS and JavaScript have replaced Adobe Flash. As this study is outdated there is room for new findings. Although HTML5 is better than Flash overall, as its faster and more power efficient than its predecessor, there are still ways to reduce the power consumption. Images, code, fonts, less JS, and web hosting are all different ways of reducing power consumed by the device. As researched by (Everman and Zong, 2018) that high load websites are being hosted on high-end servers which are energy-hungry is a waste of energy and money. They explore how using low-power servers to host high load websites using certain software optimizations (caching and content delivery network) enabled low-power servers to host these websites without degrading any quality of the service. Nonetheless, taking the findings of Everman and Zong and "Energy measurement of web service" by (Taeseong, Yeonhee and

Youngseok, 2012) there is room for conducting a study on how much power modern websites consume, and this project will test this by creating a website from scratch to accommodate these optimizations and understand if it does make a difference by comparing it to similar websites that don't "care" about power consumptions.

For websites, JavaScript and HTML are used instead of Flash. The best way to create a website that consumes little power is to optimise the code without losing any noticeable content.

2.1 Background review

A healthy diet will make a positive change in a person's life. Tracking your diet, or your nutrition intake, will give you greater control over your life. With the access to the internet everywhere you go, your phone or laptop can help you track your diet and what to eat. There are endless of meal ideas out there and it can all be very overwhelming, especially when one is looking for healthy and cheap meals that are not that difficult to cook. In this section the report will look at existing applications and understand the competitive aspect of Vim & Vigour and research how these websites treat power efficiency.

Yummly.co.uk

Yummly is a recipe app "that learns what you like." According to their about page, it has over 2 million recipes and food related articles & videos. Users can share their meals and recipes. It labels itself as "the ultimate kitchen tool" (*What is Yummly?*, 2018) Yummly is a website that allows users to search for food and recipes based on ingredients, dietary needs, allergies, nutrition, and price. Their website employs a patent-pending algorithm that learns what users like and dislike and then uses this information to make recommendations.(Goldfisher, 2010)

BBC Good food

BBC Good Food is a subsidiary of the British broadcaster BBC. BBC Good Food is a cookery brand that curates new recipes for their users every month with ease in mind. It receives millions of visitors each month and prides itself on being the ultimate cookbook and for over 30 years, this has been the preferred brand among home cooks. It marks itself as the number one food website in the United Kingdom. (BBC)

Chapter 3: Development of the website

Developing the software for this application will be efficient, systematized, and simplistic. There will be documented logs of meetings with the supervisor with reviews and comments all saved to Google Drive. All progress will be saved using Google Drive and having everything in one place will ensure that there will not be any flaws in the development regarding the categorization of documents and files.

There will be wireframes showing off the designing of the website to show clarity throughout the report, as simplicity is important to consumers that are already struggling with their health, an intimidating site can scare off people who are looking for change as any excuse to not get healthier is often a trait in those that struggle with their weight. The website aims to be simple to use, no heaps of text and placements of unnecessary information. Showing off the development cycle of the design. The main importance of the website is the content.

3.1 Technology

Software that has been used when developing this website is HTML5, BootStrap, CSS, and JavaScript. The project has been programmed in Visual Studio Code and is being hosted on Google Cloud services with its own custom domain obtained from name.com.

A bucket was created in Google Cloud to store the files, and the bucket was linked to the domain obtained from name.com. A bucket is a container that stores all data and is stored by default as "storage.googleapis," which anyone can access if the developer publishes it to the web. The developer can add a custom domain to the bucket so that anyone can visit www.vimandvigour.live.

3.2 Research

To help reduce power consumption and CO2 emissions from the website, research was undertaken to find the tools utilised in the project analysis. Following up on Microsoft's blog post "How To Measure The Power Consumption of Your Frontend Application" (Sara, 2020), where they explain how to use tools like Windows' Task Manager and other online tools like Mobile Efficiency Index and Google's Lighthouse application to measure CPU utilisation. These are some of the tools that were used to research Vim & Vigour as well as its competitors.

3.2.1 Database and hosting

According to (Energy.gov) data centres are among the most power consuming buildings in the world. As seen in the report (Darrow and Hedman, 2009) these centres consume “10 to 50 times the energy per floor space of a typical commercial office building” which is a total of 2% of the USA’s electricity use.

We will compare the big three data centres, Amazon web service, Microsoft Azure, and Google cloud.

- **Amazon**
  Amazon has committed to power all their data centres with 100% renewable energy, as well as Jeff Bezos, CEO of Amazon, promised to achieve net zero carbon emissions by 2040. (Amazon, 2019) They have achieved 50% renewable energy usage, although they increased their operations by 59% without having renewable energy in mind. (Craighill, 2019) Amazon has been accused of abandoning their commitment and according to (Merchant, 2019) are withholding data on how they will reach renewable energy.

- **Azure**
  Microsoft has been carbon neutral since 2012, and running on 60% renewable energy and are planning on 100% by 2025 (Microsoft) Although Microsoft is a part of the fossil fuel industry and has been accused by their own employees of “complicit in the climate crisis” which caused a global climate strike. (Oberhaus, 2019)

- **Google cloud**
  Google has done the most to fight carbon emission and has reached a 100% renewable energy. All data processed through Google cloud has “zero net carbon emissions” (Brandt and Talbott, 2019). Google uses machine learning to optimize their data centres, by tweaking the cooling system by the environment. By sampling weather conditions, if there is a drop in temperature they know when to use less energy to cool their servers.
  Google also has ties to the fossil fuel industry, to make up for it they buy RECs (renewable energy certificate) (Matthews, 2018)
  After researching these companies, the developer went ahead with Google Cloud to host the website as it is the greenest of the big three.

The website is therefore hosted on Google Cloud, on a static webpage service to reduce the energy in generates every time a user tries to load a page. The datacentre used is in London to reduce the distance the information must travel. The longer the distance between the server and the client, the more energy consumption is used to transmit that data through telecommunication networks. As the website will be accessed by UK citizens, London was the obvious choice.

3.2.2 Code

The website consists of HTML, CSS, and JavaScript.

JavaScript is a technology that can make front-end interactions look beautiful with animations and functionality that is efficient. It does however increase the user's CPU usage, which increases power consumption, refer to (Coyier, 2020).The website uses some JavaScript, but it is reduced

Fonts have a role in energy consumption as well. Using a custom font can affect file size of the website by 97%. Of course, that is a couple of kb (kilobytes) but that is 97% file size reduction by using modern font formats such as Times New Roman that is already on the user's device. No need to load any fonts, which will consume less power. The whole website uses Times New Roman as its font.

Writing "clean code" refers to the removal of redundant and unneeded code that does not add to the application's functionality. The website's coding has stripped out unnecessary code and prepared the content such that it loads correctly and with minimal jargon.

It also prioritises accessibility for individuals who require it, therefore photos will continue to contain text to describe them for screen readers. The website strives to be as basic as possible, so getting around it should not be difficult.

3.2.3 Image optimization

As the website is concentrating on being appealing to the users by showcasing images of tasty & healthy food, it is also limiting power consumption. Large and detailed images can take up a lot of space and in turn consume a lot of resources to load them in. By doing some research on how to properly optimize images for the website, there are tools that specialize in optimizing images.

- **Imgbot**
  Imgbot is a tool that optimizes your images from GitHub by compressing them automatically. By simply scanning your repository it will create a pull request with all the changes.

- **ShortPixel**
  Shortpixel is a similar tool to Imgbot, optimizing images and compressing them. It is a tool that is accessed online.

Both tools will be used to optimise the images for the website, with ShortPixel being used first, followed by Imgbot, which collects the images and compresses them further if possible.

3.2.4 Design

The design of the website is not complicated. It tries it best to use minimalistic content and “eye-candy” colours.

Wireframes Designs

These wireframes were made before the finishing designs of the website.

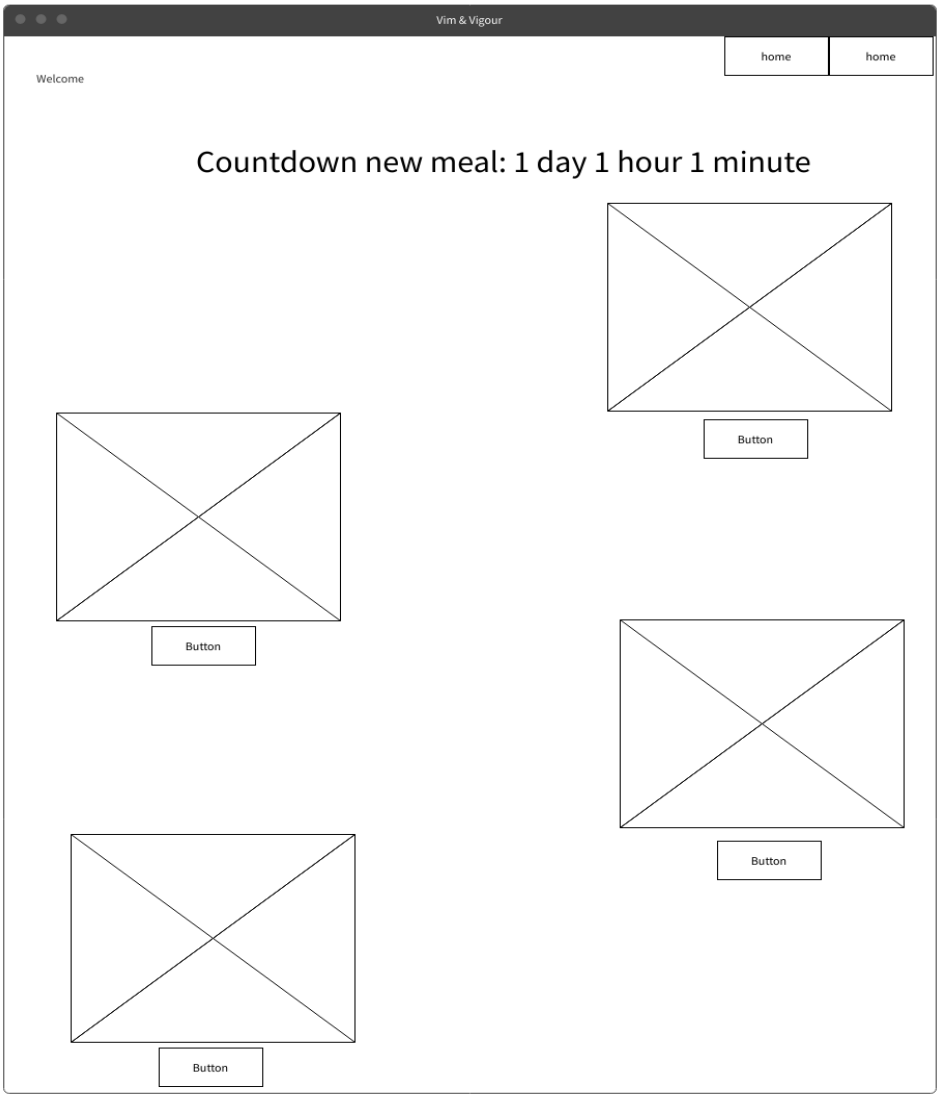

Figure 2

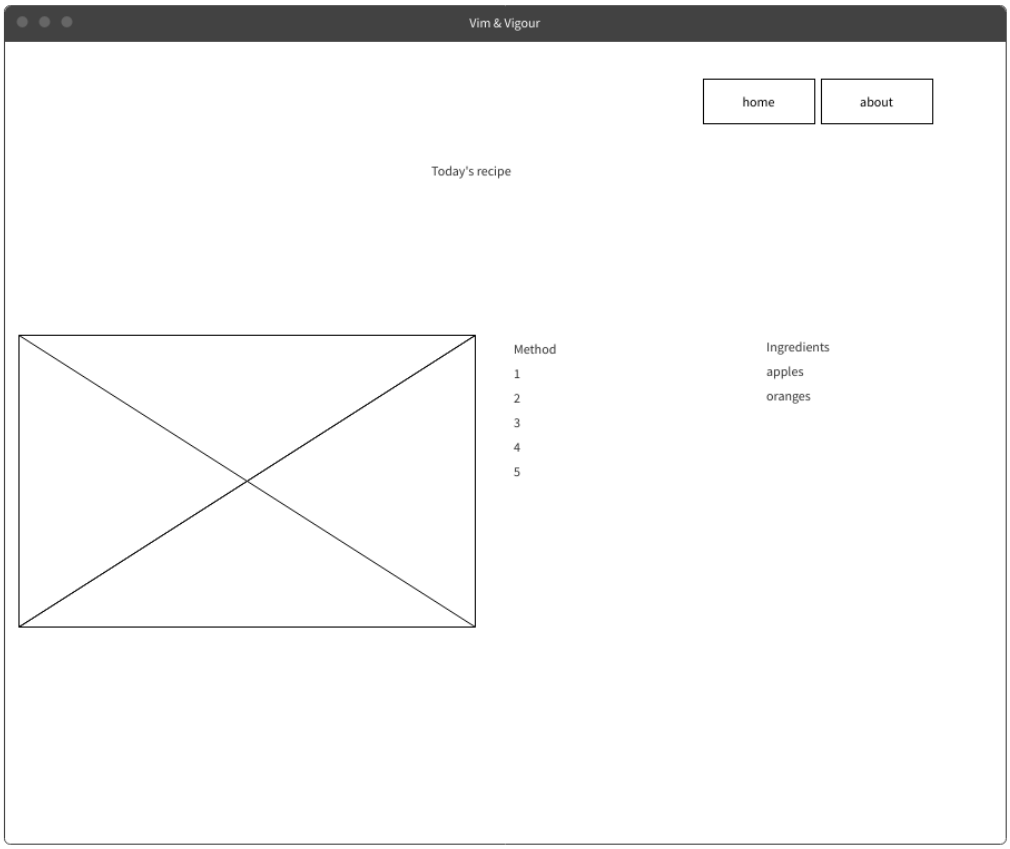

Figure 3

The final design resembled the wireframes that had been prepared prior to the final design.

Bootstrap

Bootstrap was utilised to assist design the website because it provides friendly and responsive CSS frameworks for creating beautiful websites.

Bootstrap is a responsive CSS framework that works on both computers and mobile devices. Web developers utilise it a lot to make modern-looking websites and apps.

3.2.5 Measuring the power consumption

There is a lot of different ways to optimize a website to consume less power, but how would we measure it?

There are two different ways of measuring power consumption of an application or a website. There is physical way of doing it and a digital way. Using a watt-hour meter gives you a reading of the power consumption of the entire device you are using. Connecting your laptop to this device and visiting our website and then comparing it to other websites you can note the difference in the energy consumption of your device. This needs precise planning by creating a baseline energy consumption as all devices consume some power. As well as making sure your device is fully charged when doing tests or it will measure your power consumption of charging the battery. As this is a but tedious work and it also requires a budget to do this experiment, I have chosen to do it the digital way.

Google offers an open-source application called Lighthouse. Lighthouse analyses deployed

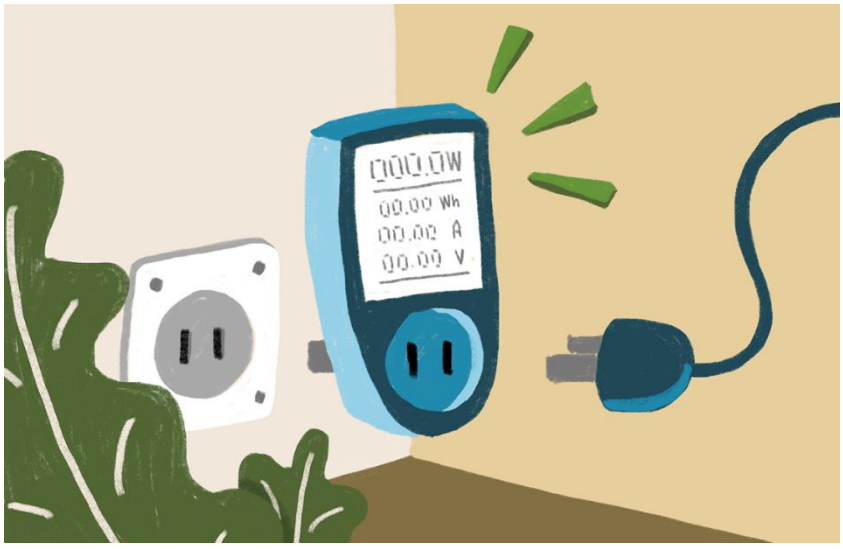

Figure 4

webpages and aims to improve quality of your website. Taken from Google's own developer website (Google, no date) "Give Lighthouse a URL to audit, it runs a series of audits against the page, and then it generates a report on how well the page did. From there, use the failing audits as indicators on how to improve the page" the tool does not directly state the detailed power consumption of the website, but it analyses things that have an association with power consumption.

The second tool I will use is called Greenspector and measures the efficiency of a website and its power consumption by using a mobile device. According to Greenspector

(Greenspector, no date) their Mobile Efficiency Index measures the energy consumption of your website and assesses its impact on battery life. By getting a score between 0 – 100, zero meaning more power consumption and a 100 meaning next to “perfect” power consumption.

Then, using an extension from Chrome Web Store called CPU and Memory Performance monitor which will measure the CPU usage in percentages of the website that is being browsed.

Lastly, a tool that measures your websites carbon footprint. Websitecarbon.com measures any website you input to their site and gives a result on how much carbon footprint it produces every time someone visits the webpage. (WebsiteCarbon, no date)

Figure 5

Chapter 4: Tests

This section of the paper will include a test of how the website performs under various conditions. Because the website is based on a static web application, it is manually updated each week with methods and ingredients. As a result, bugs can occur on a weekly basis. The section will include screenshots of users navigating the website on various computer monitors and mobile devices. When bugs occur, they must be resolved prior to the website's deployment.

4.1 Testing on laptop

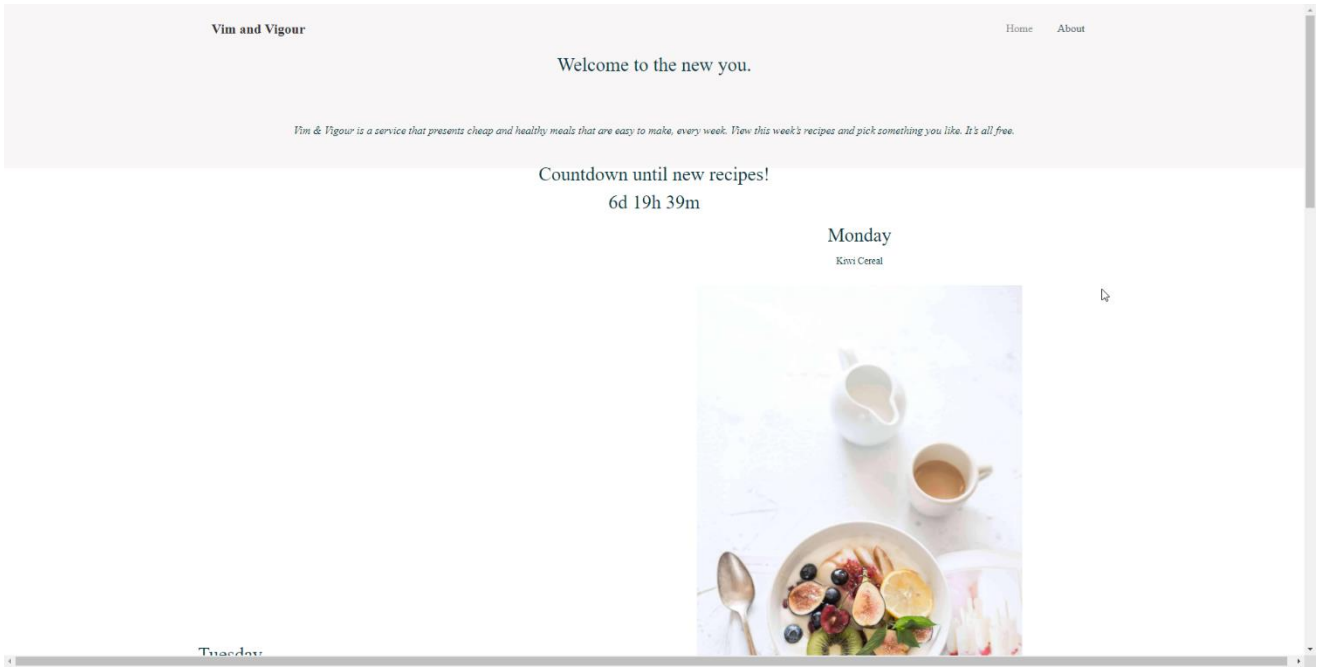

Figure 6

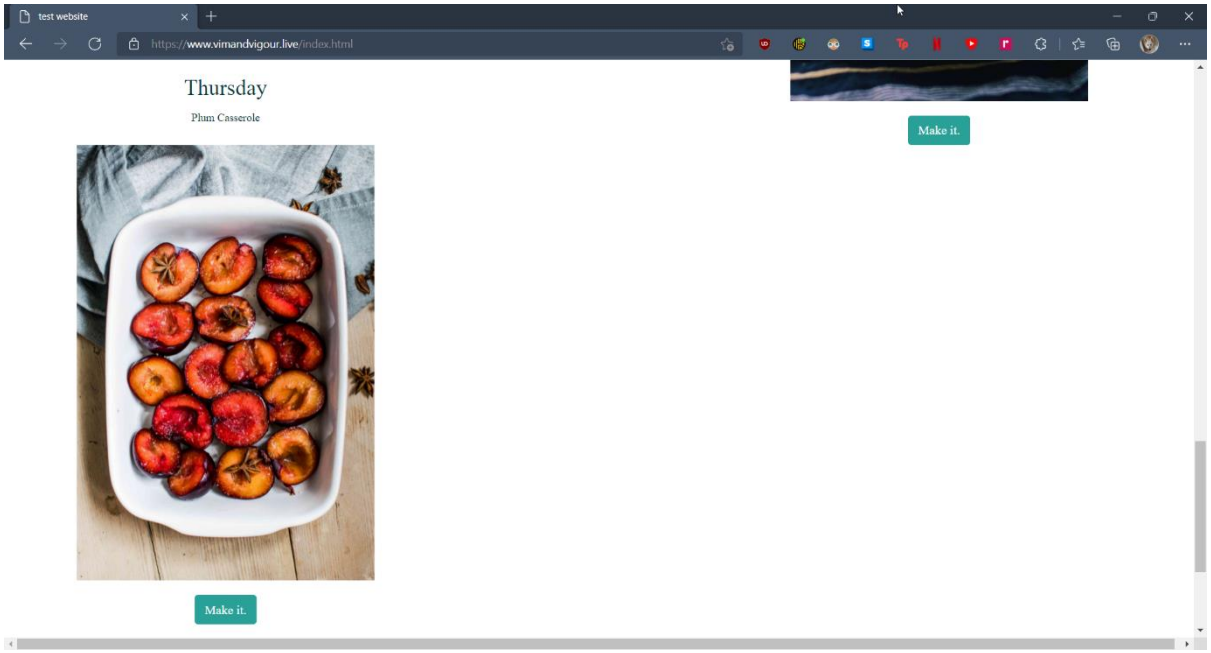

Figure 8

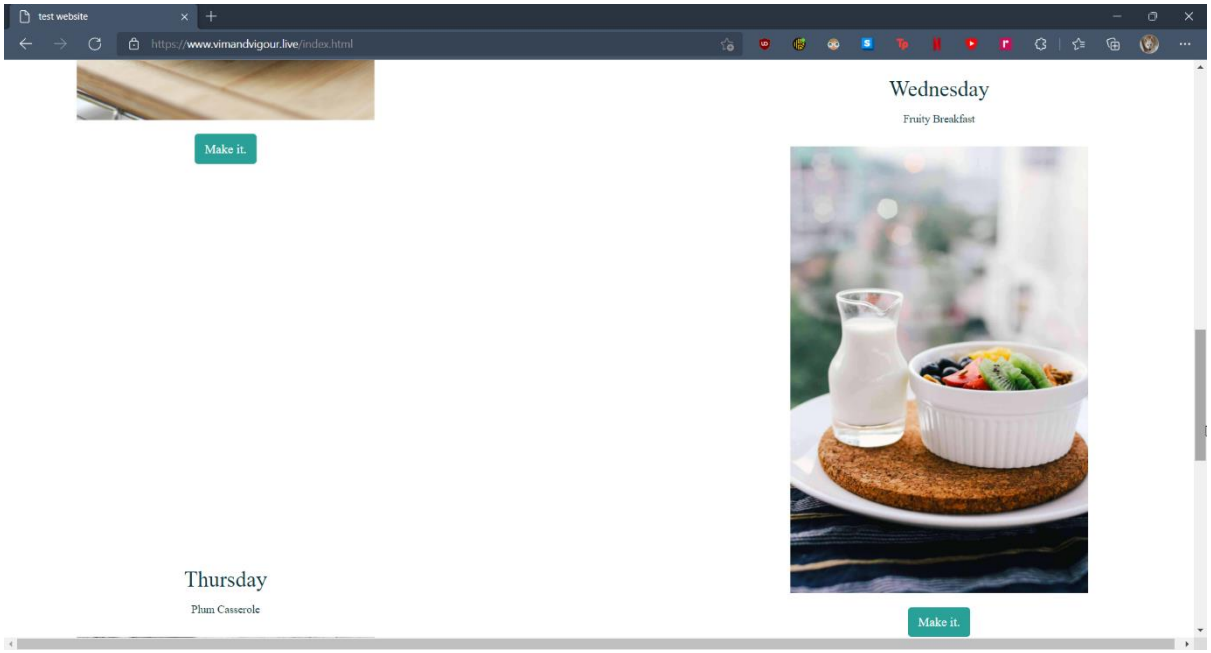

Figure 7

This is the main page of the website; it has six sections of content. The navbar, 4 meals containing images and buttons, and the footer linking to home and projects.

The content is displaying as intended, with no visual errors visible.

When adjusting the zoom on the website, however, the images begin to behave erratically.

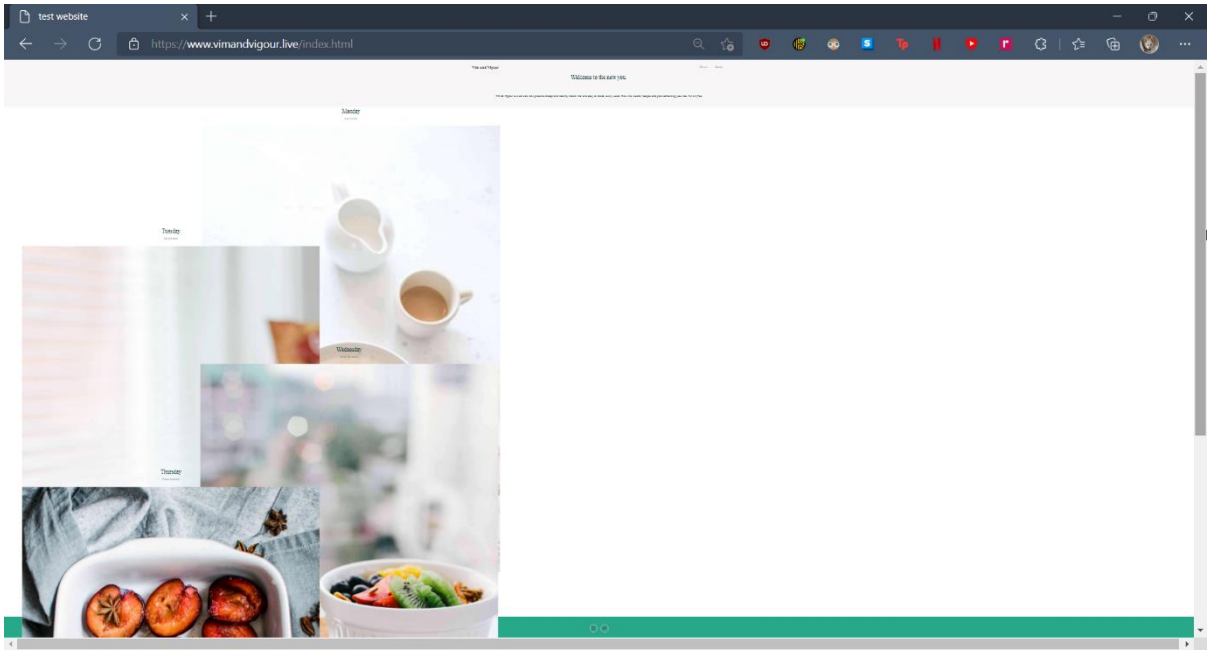

Figure 9

The images are not being displayed as intended, stacking on top of each other and hiding buttons and text, rendering the webpage inaccessible.

Moving onto the displaying of the meal page itself, where ingredients and methods are displayed:

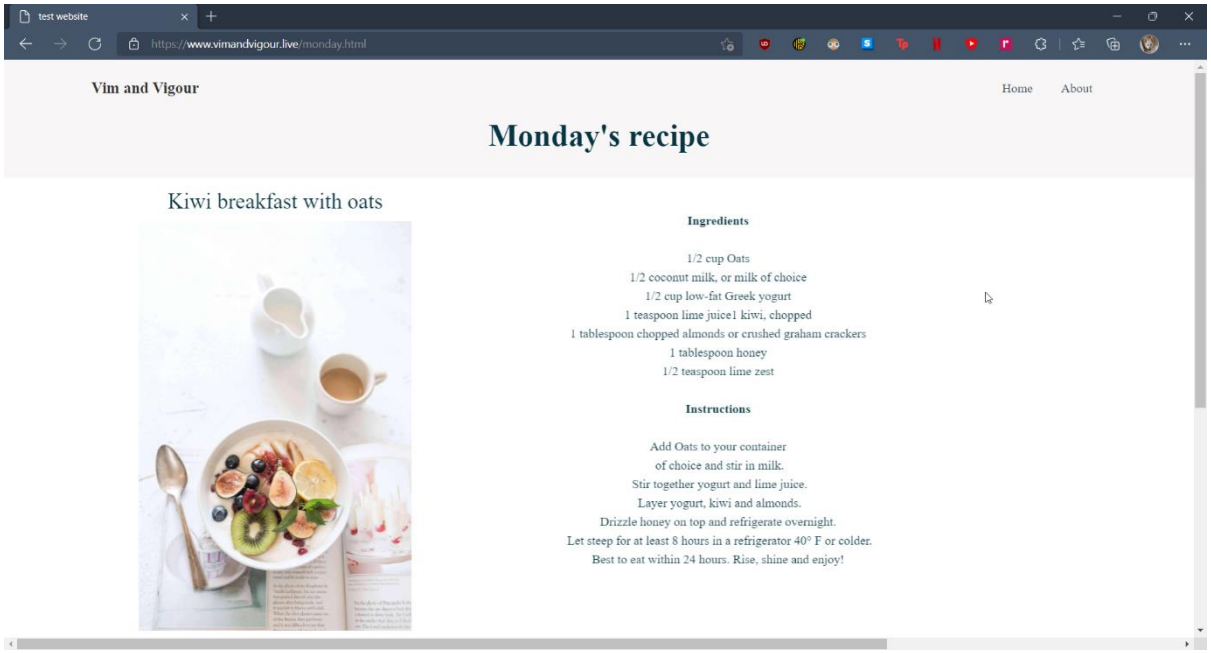

Figure 11

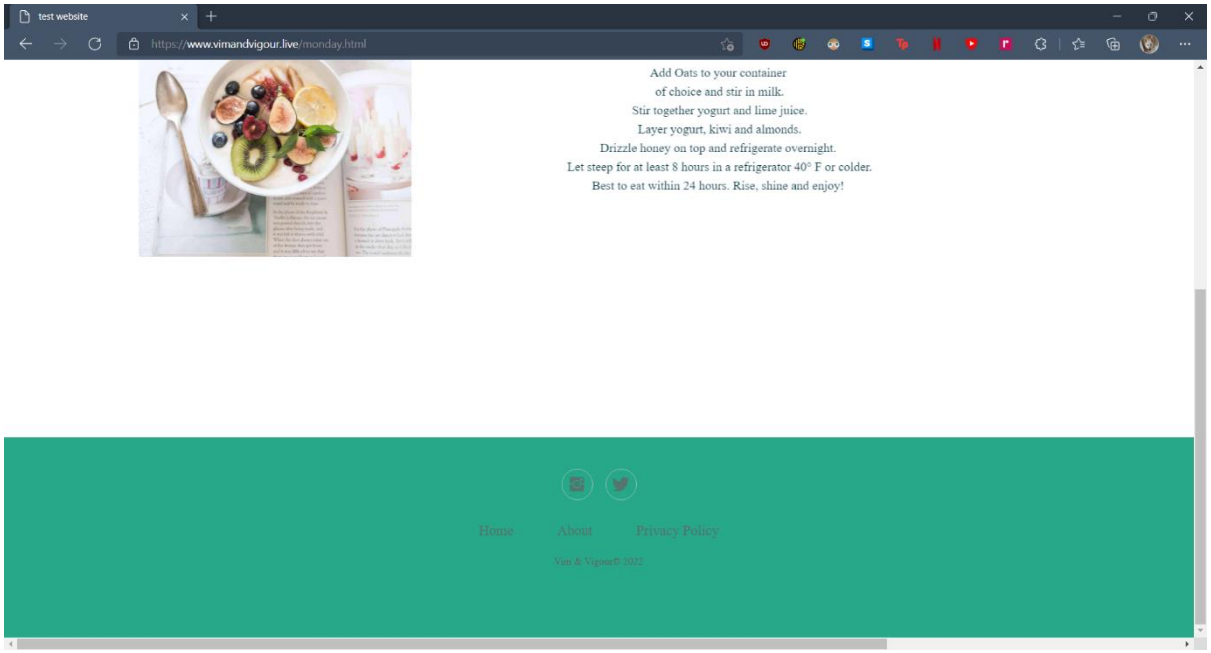

Figure 10

The webpage displaying the recipe itself is functioning properly, with no visual glitches.

4.1 Mobile Testing

iPhone:

https://drive.google.com/file/d/1fWbe2LUNOu4OkvPQp_sCAXFvg8r1O7Oc/view?usp=sharing

The mobile version of the website is also not working quite as intended; the navbar is fine, but the content is spread out quite a bit, giving the website a jarring appearance when a user visits it.

iPad:

https://drive.google.com/file/d/1Ck6OltSiLvUgMfmsWppwqU_GLrPilpY9/view?usp=sharing

The iPad, like the iPhone version, displays content that is disjointed and inconsistent with the computer version of the website.

The mobile devices are displaying visual errors and bugs, which will need to be updated and fixed before they are made available to the public. The website is usable, but it will not attract users in this case; the goal of the website is to be easily navigable, and the mobile version falls short of this goal.

Chapter 5: Performance Analysis and Evaluation

To test how the application that is being presented in this report is in contrast with its competitors, tools will be applied to measure its performance and power efficiency. Firstly, there will be an analysis of all webpages, then when the analysis has been presented there will be a conclusion of results and histograms. The testing of Vim & Vigour and its competitors, Yummly & BBCgoodfood, will be conducted in four ways.

- Measuring the CPU load of the website using the CPU and Memory Performance Monitor.

- Mobile Efficiency Index, which is similar to websitecarbon, it assesses websites on a mobile device and analyses the site and its contents and how it affects the battery life of the mobile device. It analyses the consumption in four stages, taken from (ICTFootprint, no date) website loading, idle, page scroll and application running in the background. It uses real smartphones located in a data centre. It gives a score between 0-100, smaller score meaning worst performance.

- Websitecarbon.com which audits whichever URL that you input and displays results of how clean the website is compared to other websites, on a scale to 0% to 100%. 0% being the website is one of the worst producers of carbon dioxide emissions. It displays how much Co2 produced every time someone visits the page. There will be more in-depth explanations of how this is done in websitecarbons analysis section.

- Lastly, Google's Lighthouse tool that is run on any webpage using Chrome DevTools. We will be looking at the performance check and best practices. It runs a performance check which evaluates load time, and best practices check which verifies the use of HTTPS and attributes of images. Scores between 0-100, where 0-49 is considered poor, 50-89 is average and anything above 90 is good.

It is important to remember that Vim and Vigour is a very lightweight website, with far less code and content than its competitors. The purpose of the analysis is to demonstrate how lightweight code, green hosting, and image compression can help a website perform better on several devices.

5.1 Measure CPU load of websites

Firstly, we begin with measuring the idle state of the websites. By running the extension in Google Chrome, one can observe the memory and CPU usage of the website that is being browsed. After every test, the browser's data is reset and cleared to get as accurate test results as possible.

Vim & Vigour

Starting off with Vim & Vigour, the test first measures how much it consumes to load the page and then staying idle on the homepage.

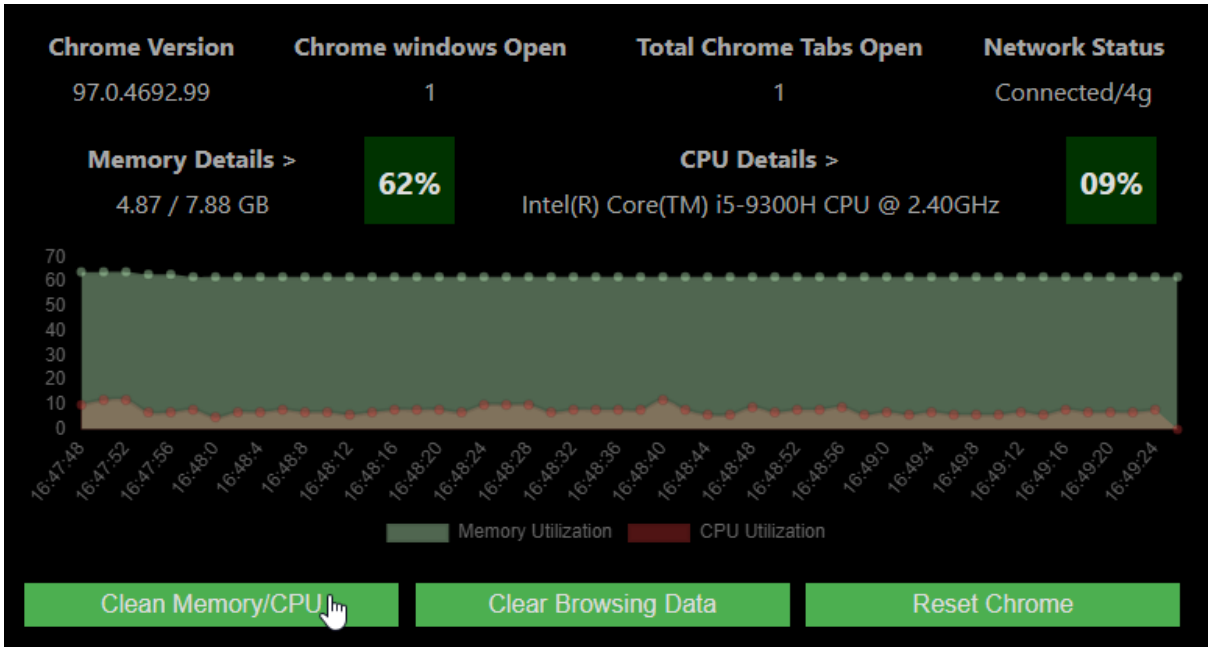

Figure 12

From 16:47 to 16:49 the website utilizes between 5-9% of CPU power staying idle on the homepage of Vim & Vigour. The highest peak was 11%. This result is quite impressive as the aim is to reach lowest amount of CPU load.

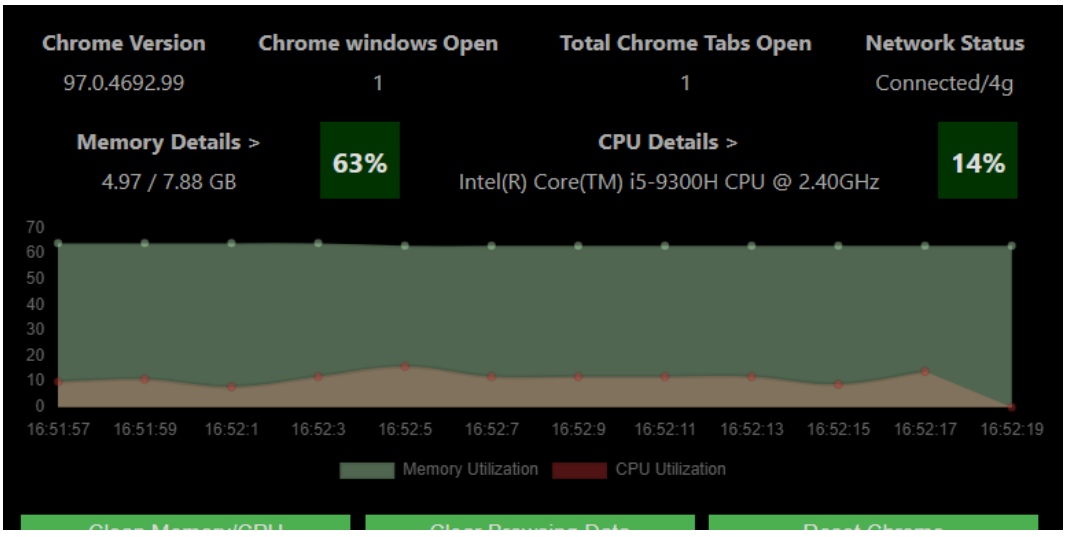

Figure 13

After scrolling through the page for a minute, it stayed around the same percentages but did reach a peak of 15%. Between 5% - 13% was the overall result of scrolling from top to bottom.

Yummly.co.uk

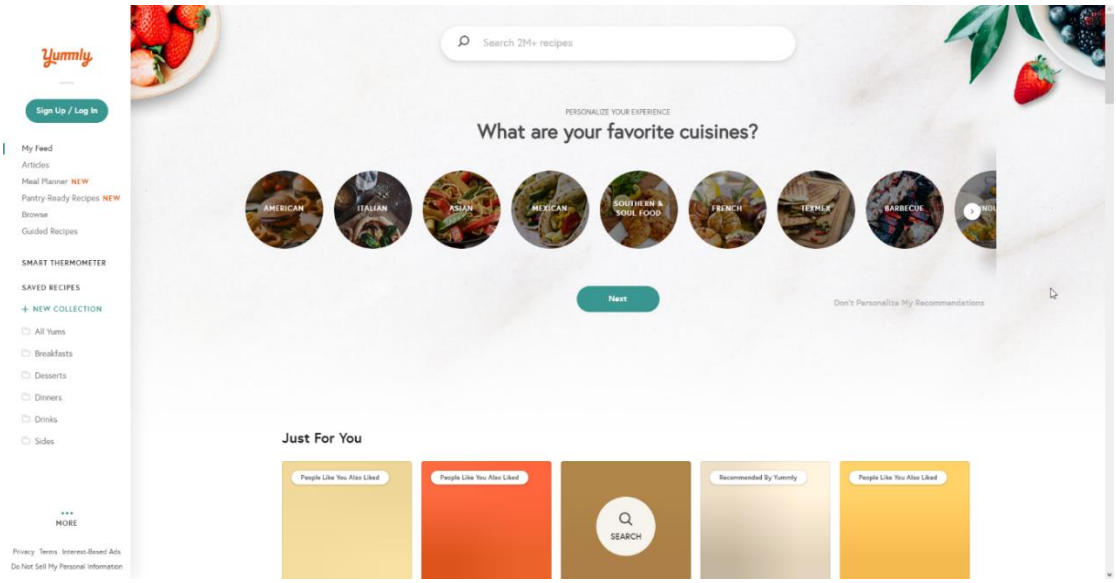

Figure 14

Secondly, same testing's will be applied to yummly.co.uk.

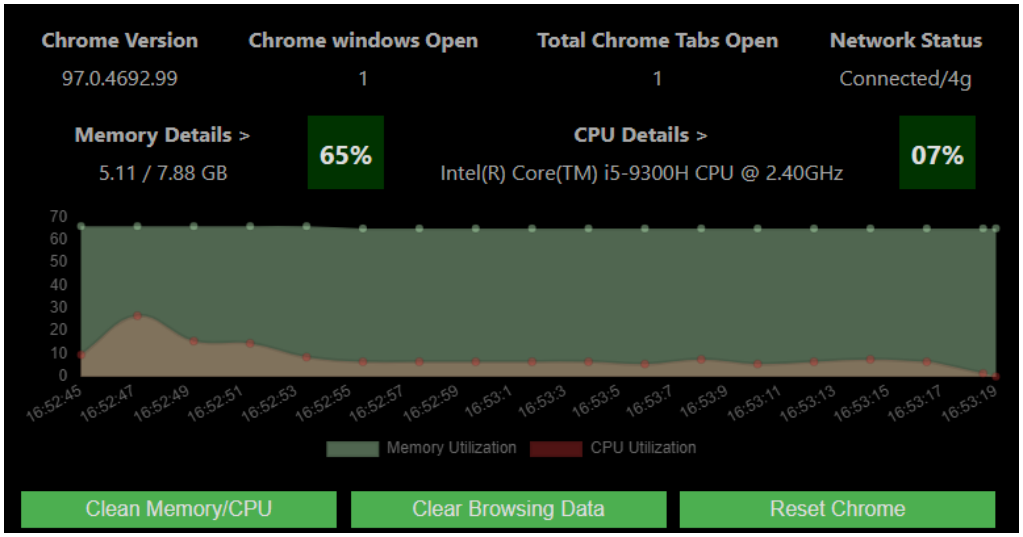

Figure 15

Loading up the website gives a spike that reaches a peak of 27% CPU utilization, but it mellows out staying idle on the homepage. It needs to load all its content which consumes a lot of CPU power, but manages to keep it 5% to 10% on idle.

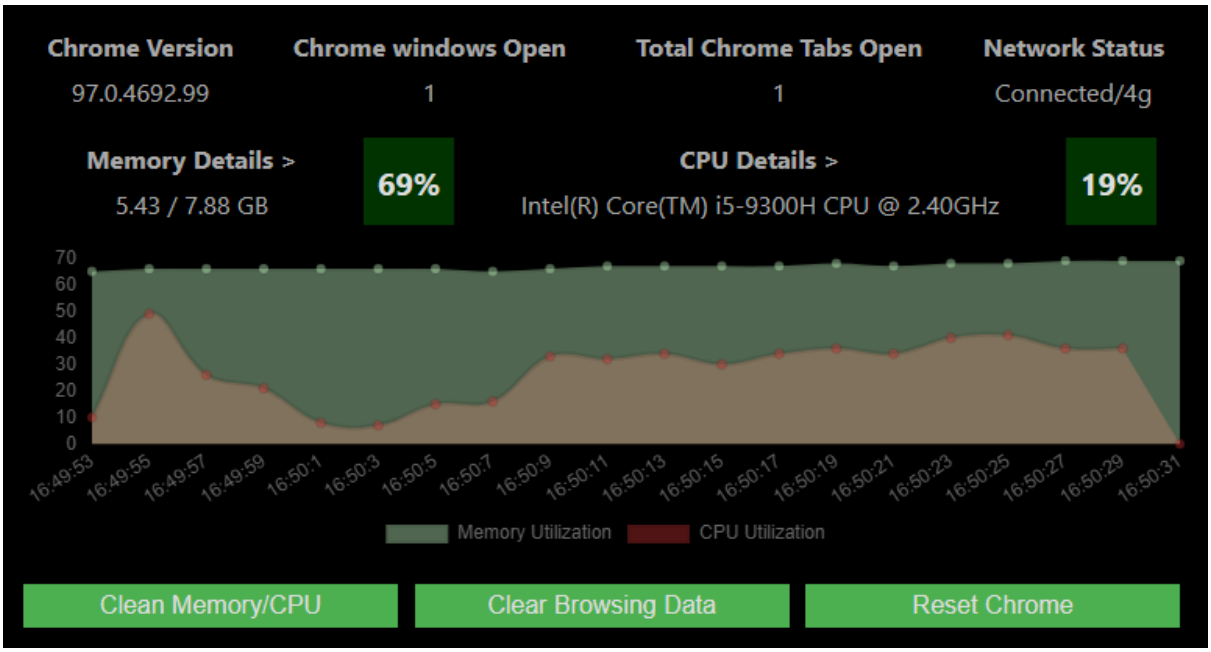

Figure 16

However, when one starts to scroll through their website its apparent it is drawing quite a lot of CPU power. It peaked right below 50% and went between 10% to 30% when it reaches new content that is being loaded in and applying animations.

BBC GoodFood

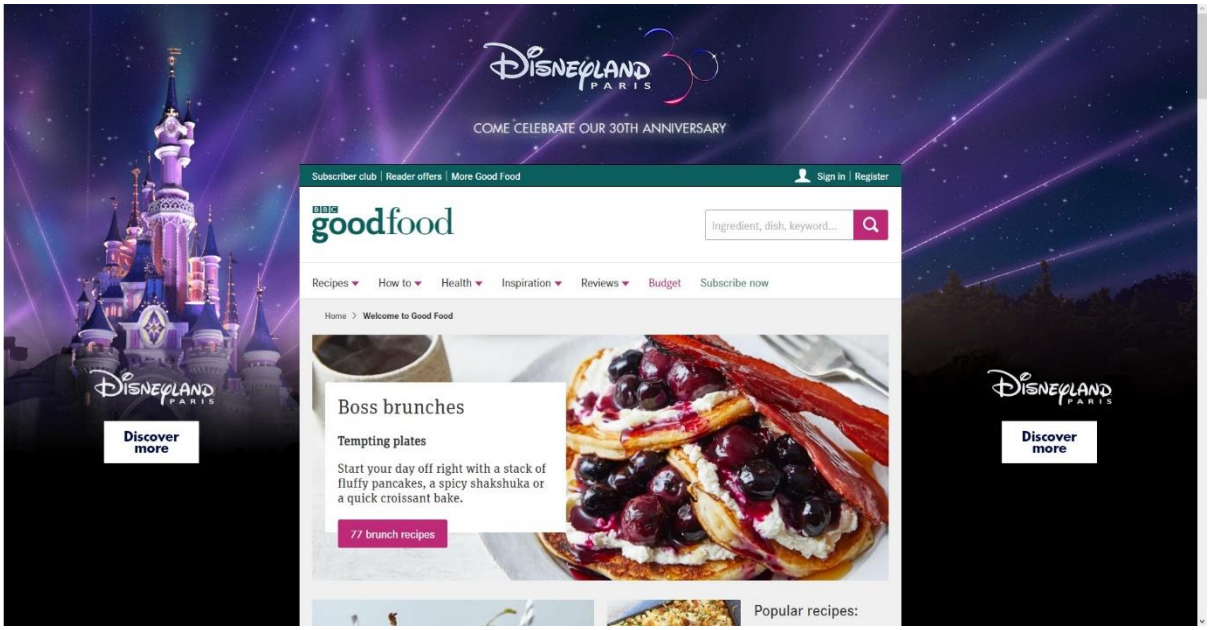

Figure 17

Lastly, testing of BBC's recipe website. Using the same rules as when testing the other websites, cleaned and cleared all data for a fresh test.

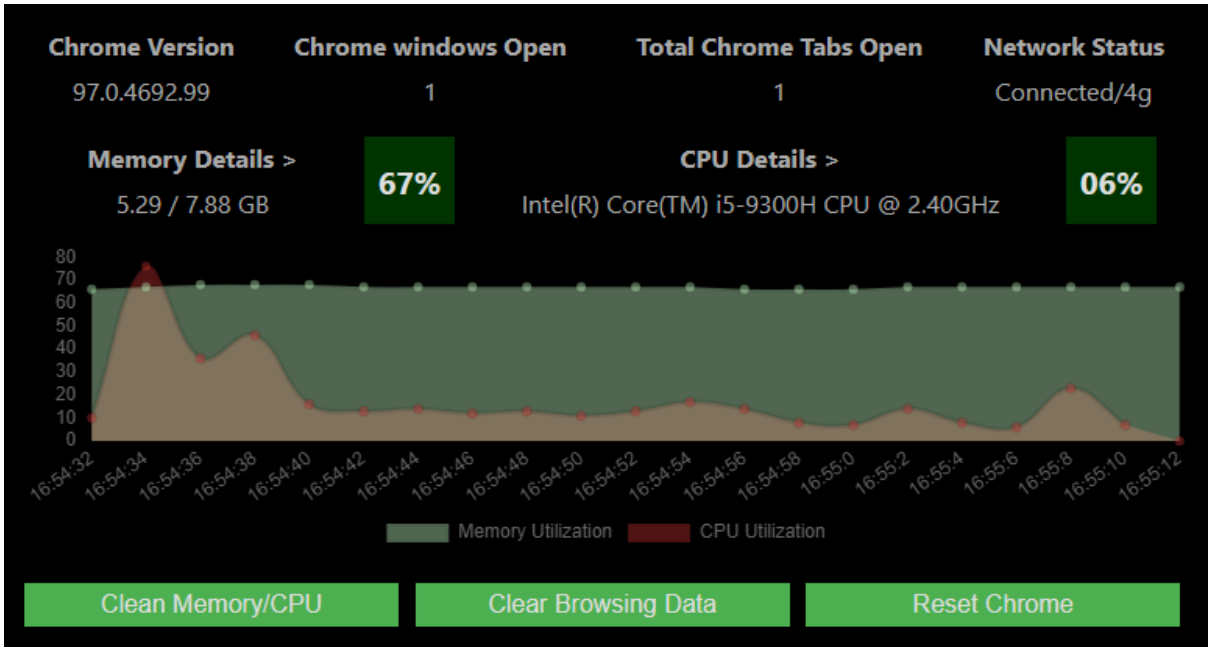

Figure 18

BBC on idle is utilizing a lot of processing power when loading into the website, it reached a 79% peak when loading onto the website as its loading its content to display to the user. Then it slowly descended to 40% to 45% and then further to 15% and kept a stable load of 10%. This might seem acceptable at first, but this is only the idle version. If it takes BBC 79% CPU utilization to load the content, then how will it perform when a user is scrolling through it?

The answer is as expected. BBC peaks and reaches a 99% CPU load which only descends

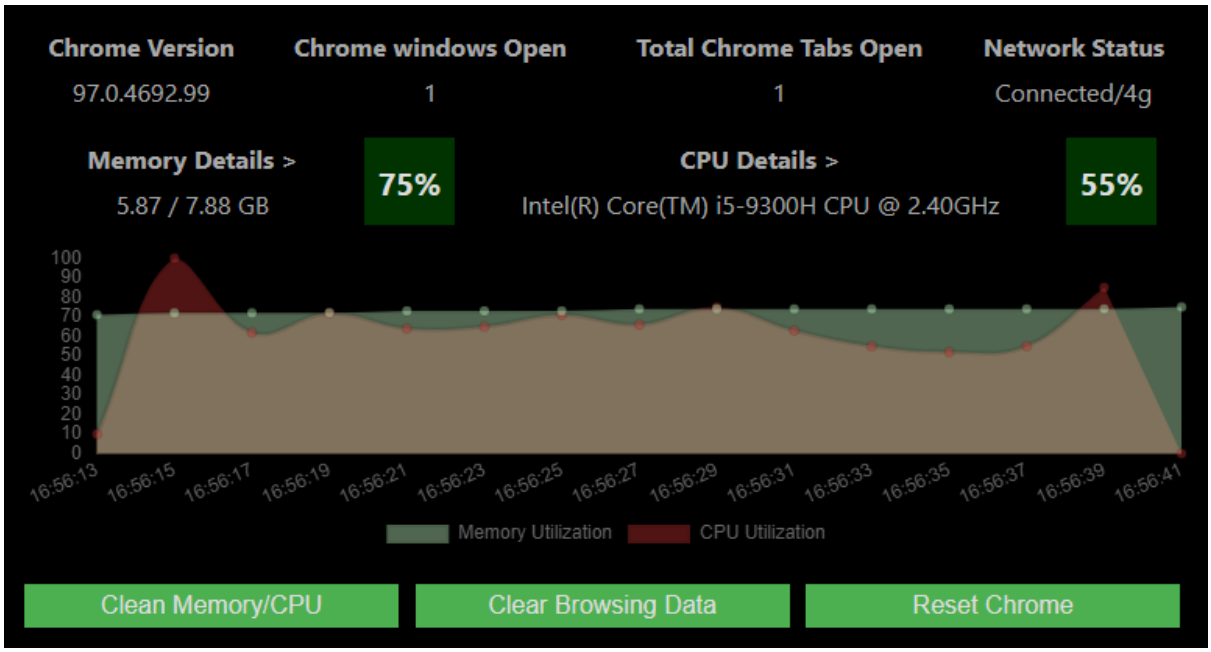

Figure 19

to 60% and is stable throughout. When a user is scrolling through this website, 60% of their CPU is utilized to load and view its contents.

5.2 Mobile Efficiency Index

The mobile efficiency index gives discharge speed results that come in 4 different bars, in 3 different colours. Green means good, orange means ok and red means bad.

Inputting the URL of the website being tested returns the results. Following a concise layout, starting with Vim & Vigour.

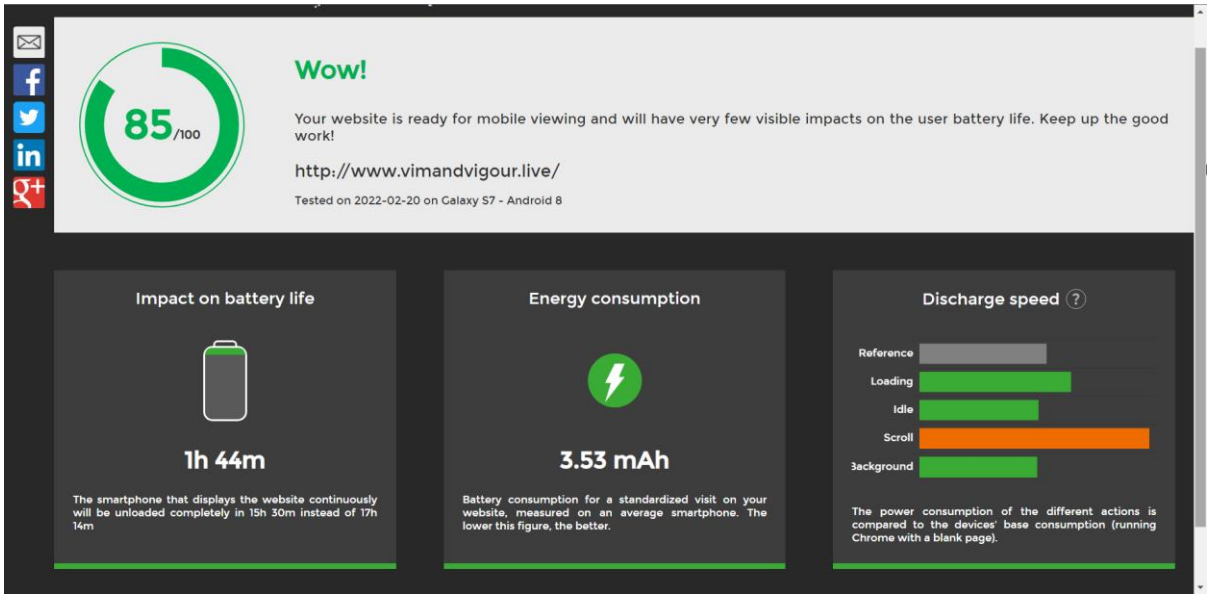

Figure 20

Vim & Vigour has little impact on battery life, scrolling through the website is the main reason it consumes battery. Scrolling through the webpage makes the device load more content, hence the scroll bar being indicated in an orange colour. The energy consumption of Vim & Vigour is 3.53 mAH per visit on the average smartphone.

Yummly.co.uk

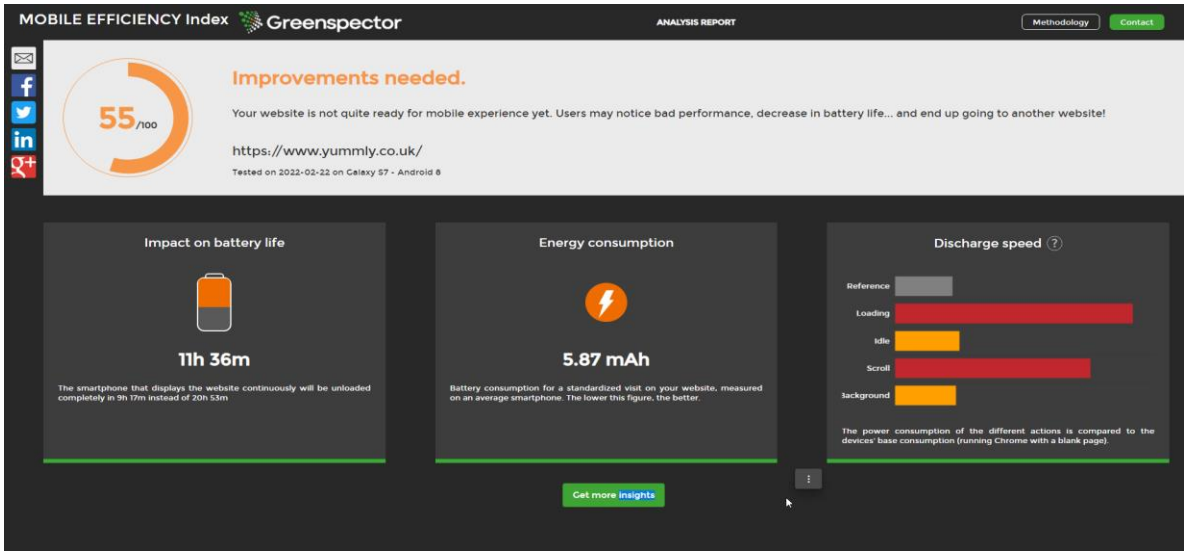

Figure 21

Yummly is scoring much lower, resulting in a score of 55. The loading and scrolling of their website are being indicated in red, which means the majority of their energy consumption is loading of content. Per visit, Yummly consumes 5.87 mAh.

BBC GoodFood

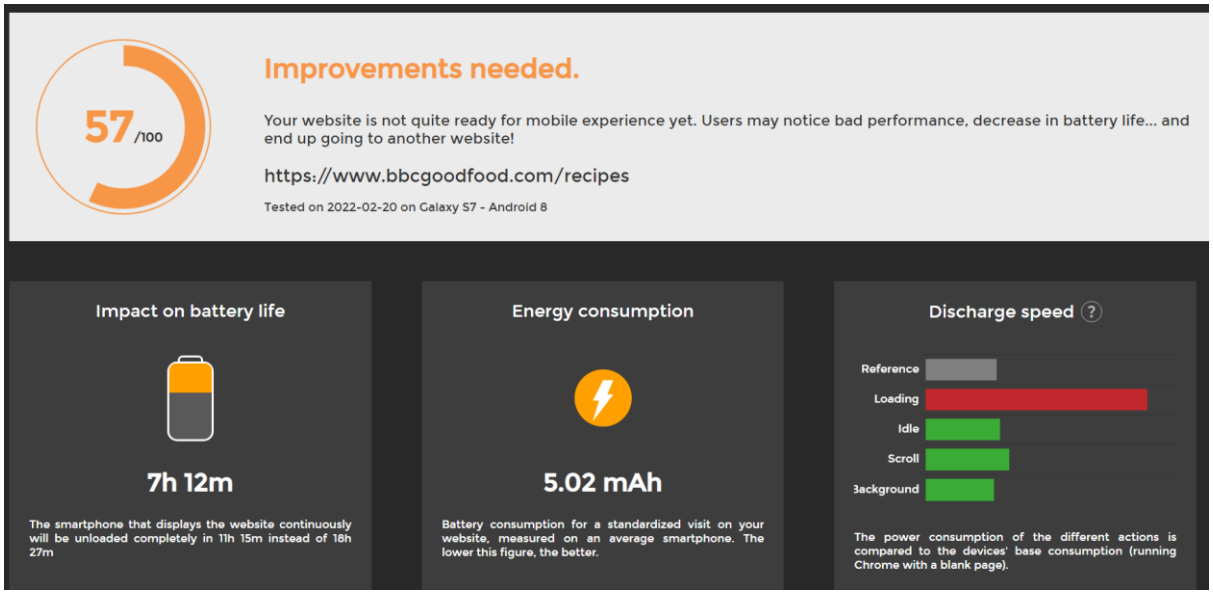

Figure 22

Lastly, BBC GoodFood is performing better on mobile than on desktop, beating Yummly by two points. BBC has a lot of advertisements on their webpage and the loading of content is in the red zone. Their website consumes 5.02 mAh per visit.

5.3 Websitecarbon: measuring carbon emissions

Websitecarbon measures the carbon emissions of a website. Similar to the Mobile Efficiency Index, the user inputs a URL and returns a result after running their tests.

According to their website (WebsiteCarbon, no date-a)Their calculator works by using five key pieces of data that gives a good estimate:

1. Data transfer over the wire
   Measure the data transferred when a web page is loaded and multiply that by the energy usage data that is stored by them.

2. Energy intensity of web data
   They divide the total amount of energy used by the total annual data transfer over the web. A figure of 1.8kWh/GB.

3. Energy source used by the data centre
   They check the Green Web Foundation (*Home - The Green Web Foundation*, no date) *database to determine if a data centre is using green energy. They estimate the proportion of energy used in data centres to be 10% by comparing the global data centre energy usage.*

4. Carbon intensity of electricity
   The average carbon intensity of grid electricity, reported to be 475 grams CO2e per kWh and renewable energy reported as 33.4 grams CO2e per kWh.

5. Website traffic
   Compiling all the information together, they get an average result of emissions associated with the average user. Multiplying carbon per page view, with the typical number of annual page views, they get an estimate of the total annual CO2 emissions of that website.

Vim & Vigour

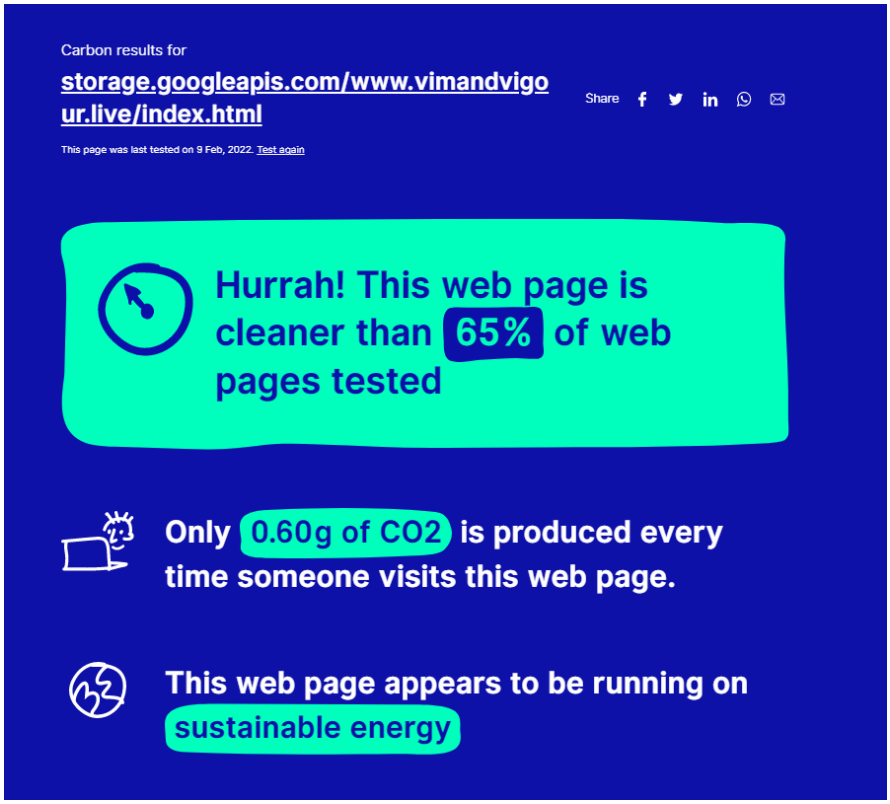

Figure 23

Vim and Vigour is running on sustainable energy, because the decision was made to use Google Cloud, and is resulted to be cleaner than 65% of web pages that has been tested. The result to concentrate on is much CO2 is produced every time someone visits the website, 0.60g of CO2.

Yummly.co.uk

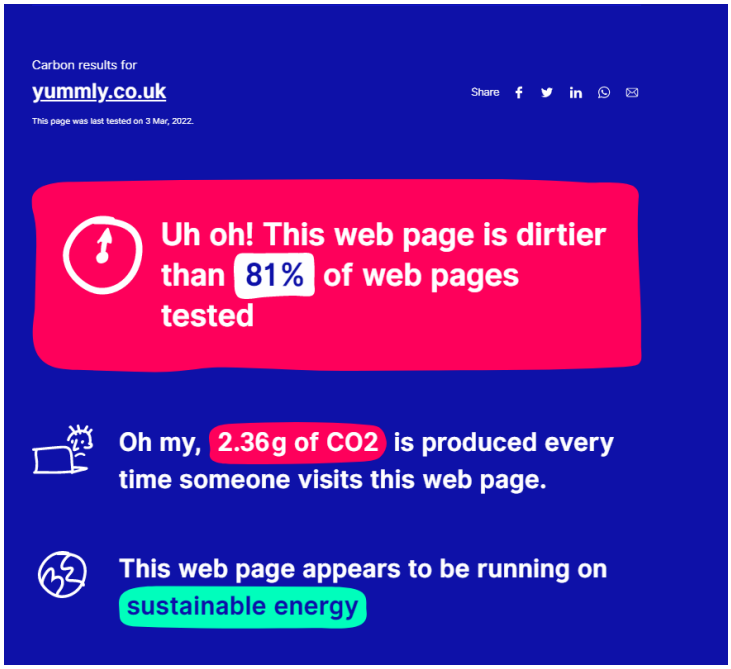

Figure 24

Yummly, like Vim and Vigour, appears to be powered by sustainable energy. Their results being 81% dirtier than web pages tested and producing a total of 2.35g of CO2 every visit.

BBC GoodFood

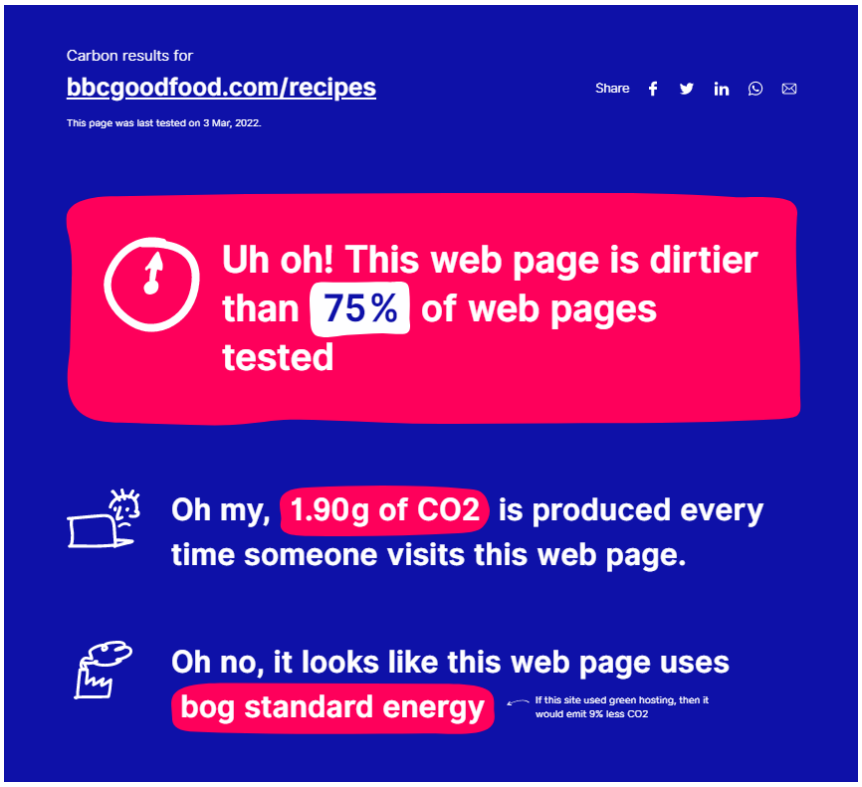

Figure 25

BBC is not powered by renewable energy, and as a result, it is dirtier than 75% of tested web pages. They do not produce as much CO2 as Yummly, but they do produce 1.90g CO2 per visit.

4.4 Lighthouse

Lastly, using Google's Lighthouse application in the development console the user view performance of the website, following Google's performance score which measures time between starting the page load and rendering content and images.

This image taken from (Muras, 2019) visualizes how a website is loaded. This is the process of Google Lighthouse.

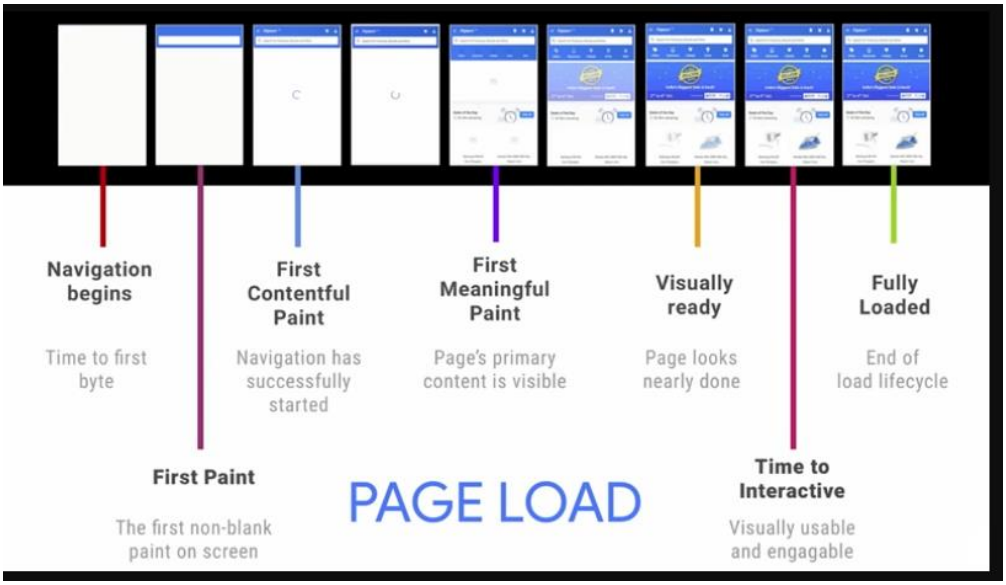

Figure 26

Vim & Vigour

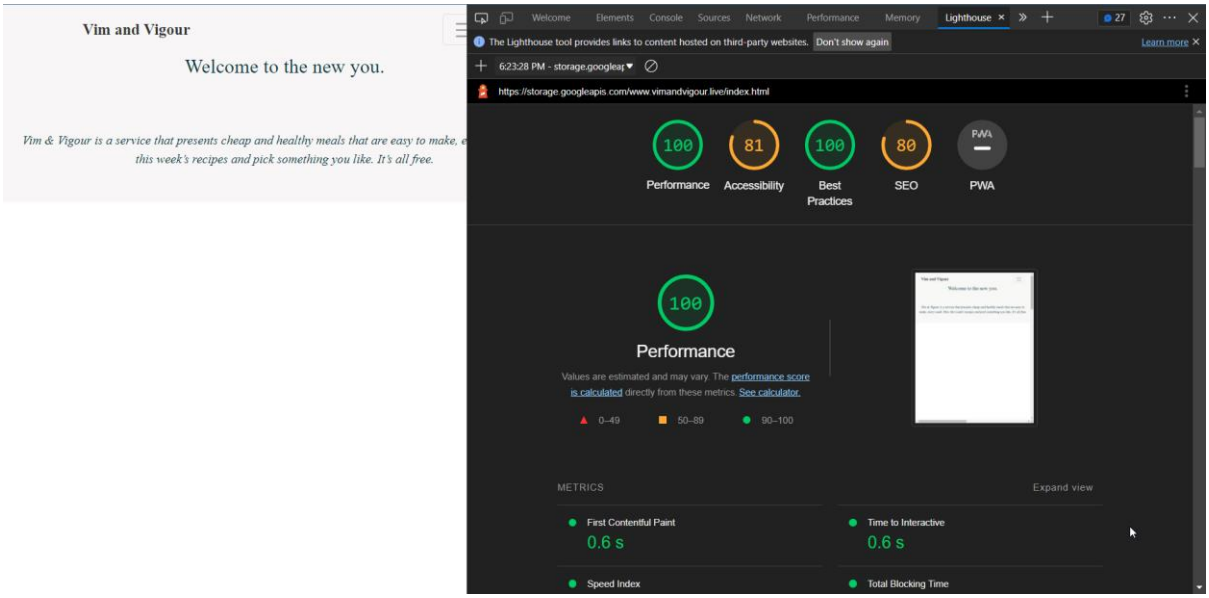

Figure 27

Vim & Vigour gets a perfect score for performance because there are no unnecessary blocks of code or unused JavaScript on the website.

Yummly.co.uk

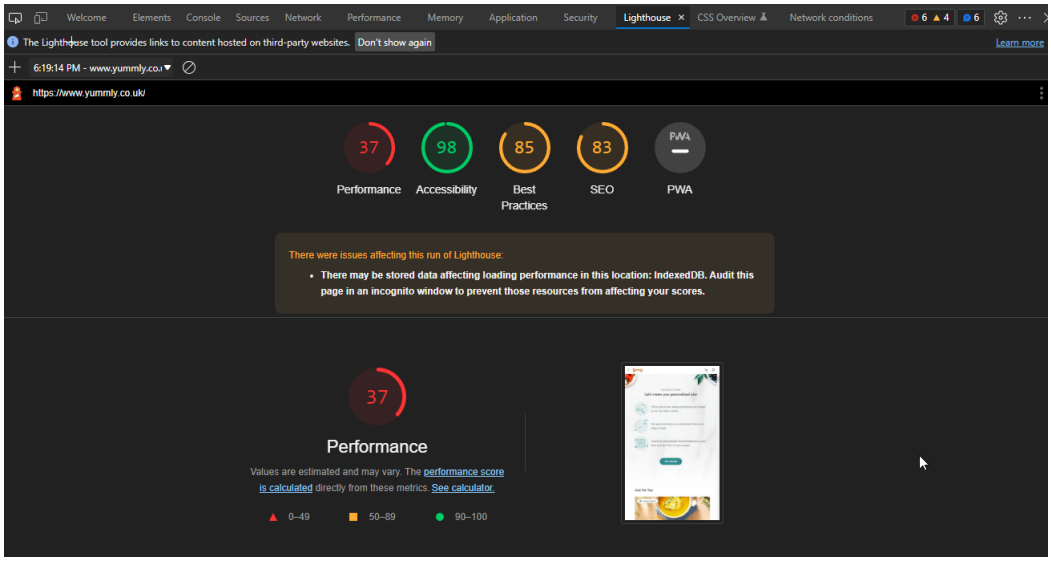

Figure 28

Their website is in poor condition and underperforming. Google gives diagnostics as of why:

1. Reduce unused JavaScript
2. Image elements do not have explicit width and height – this reduces layout shifts.
3. Avoid excessive DOM size – DOM is an API for XML and HTML documents; it defines structure of documents.
4. Avoid enormous network payloads – files that are being transferred on a user's network.

Which results in Yummly receiving a score of 37, which is considered poor.

BBCGoodFood

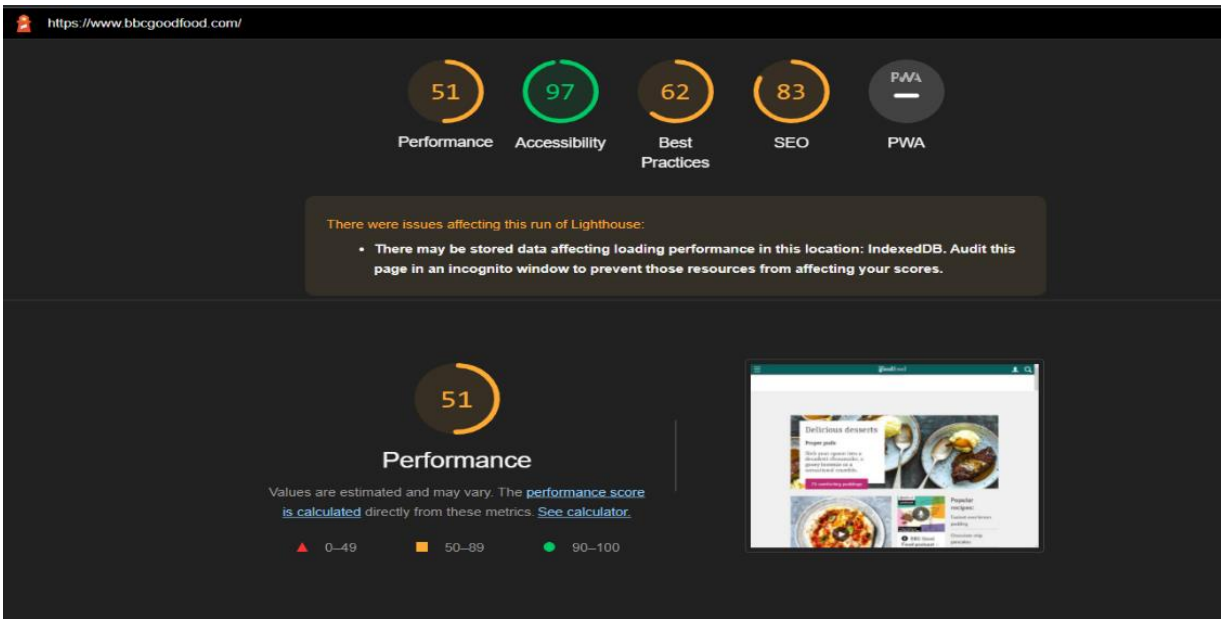

Figure 29

BBC outperforms Yummly but falls short of a good score. According to Google diagnostics, BBC should use less unused JavaScript and reduce the size of DOM. As a result, BBC receives a score of 51, which is considered acceptable following Google's performance calculator.

5.5 Viewing the Data

In the analysis section of this project, an in-depth analysis of how each website that has been identified as a competitor to Vim & Vigour performs in terms of power efficiency, CO2 emissions, and CPU utilisation was performed. Below there will be histograms of the result regarding CPU Utilization peak and scroll, and CO2 emissions from each website.

Histogram of CPU Utilization in Its Peak

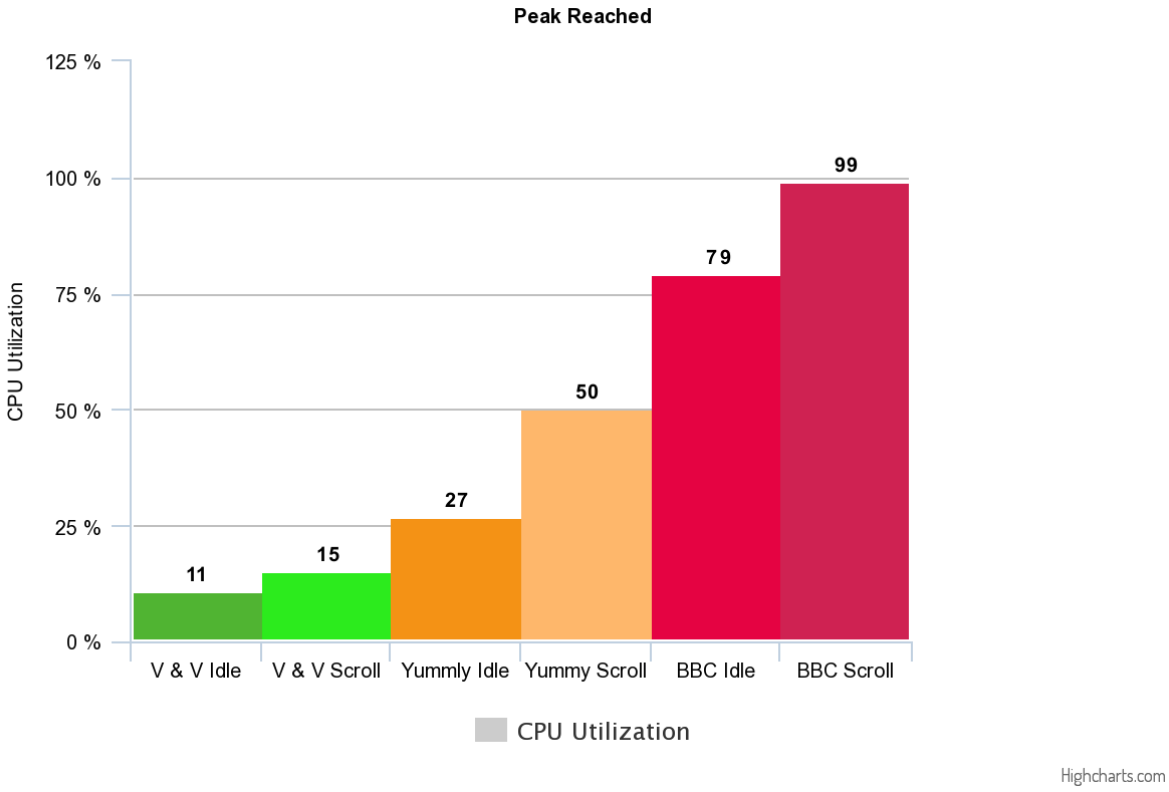

Figure 30

Histogram of CPU Utilization in Idle

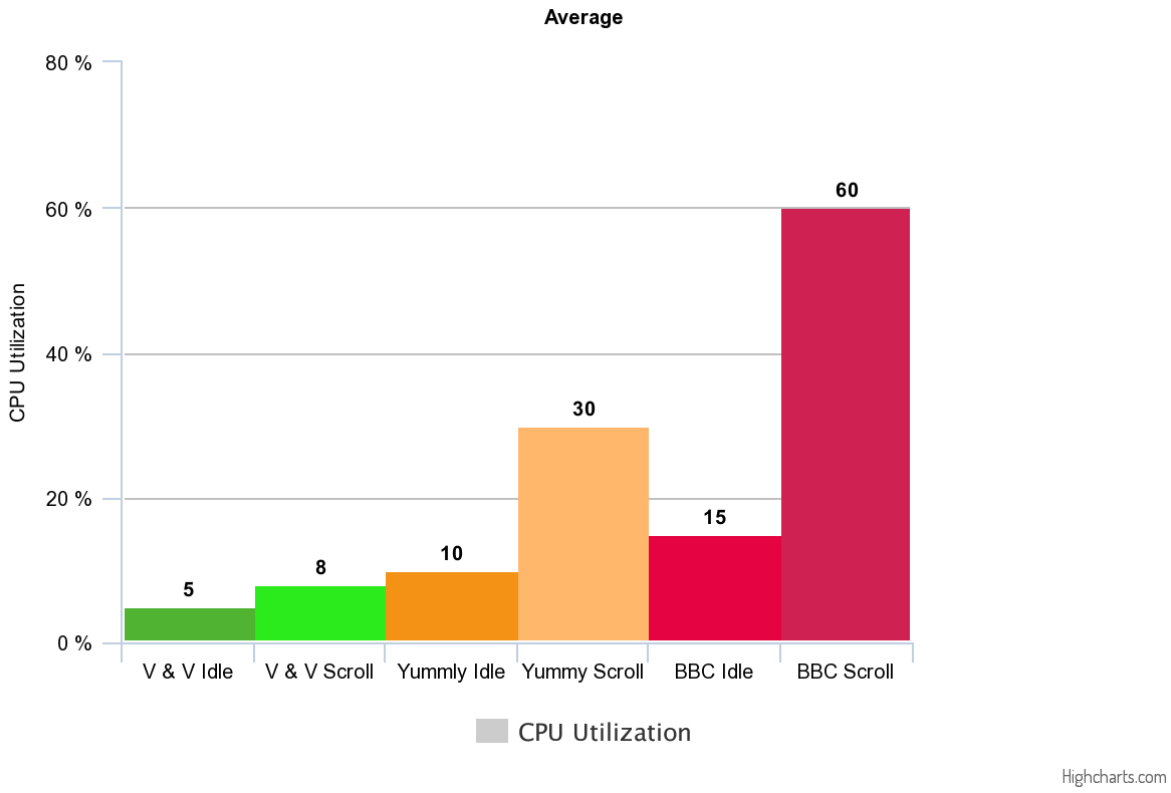

Figure 31

Histogram of CO2 Emissions

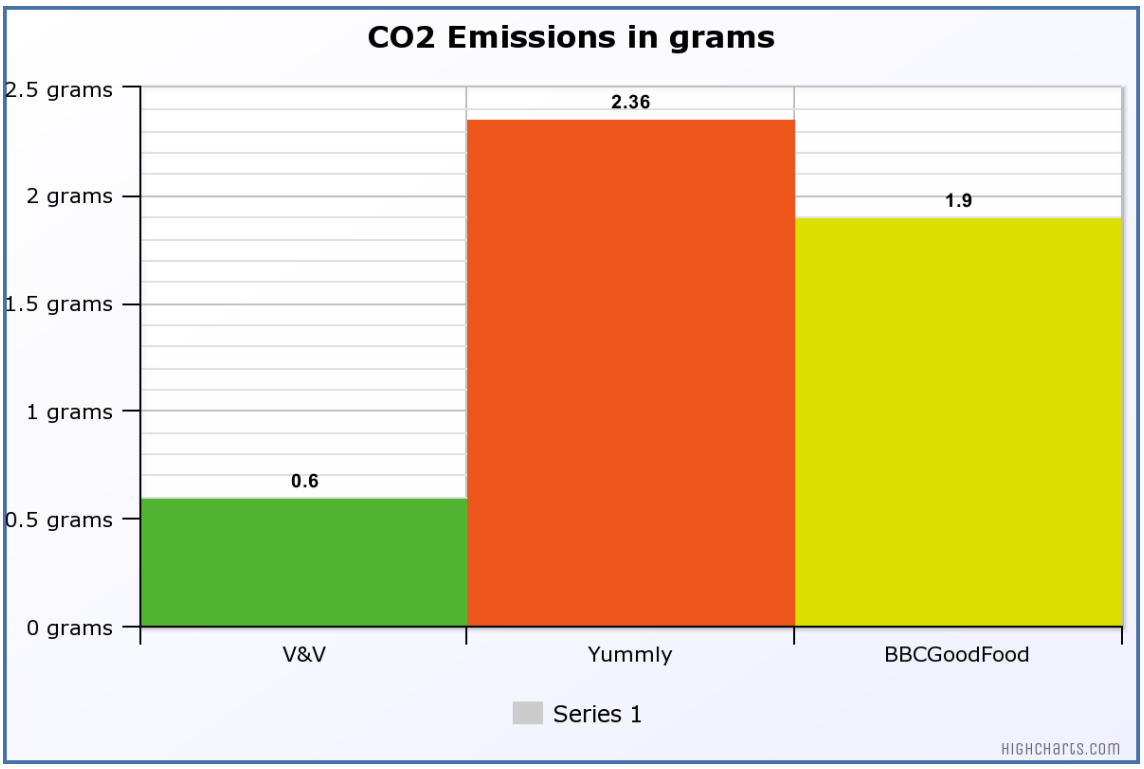

Figure 32

What can be viewed in the histograms is that Vim & Vigour is outperforming the competitors by quite a lot in all aspects. Vim & Vigour consumes less CPU on both the peak and idle and emits the least CO2. According to the results of BBC's CPU utilization, it was expected that BBC would be the winner of the worst performing website, but this proved to be incorrect. Yummly outperformed BBC in terms of CPU utilization but lagged in terms of mobile battery life and CO2 emissions, producing 0.46 grams more than BBC. That is as much CO2 as Vim & Vigour emits per visit. How many visitors do these websites get in a month?

Using Similarweb (Similarweb, no date) to view the page visits. This website scans traffic and engagement on each website that a user inputs to their search field.

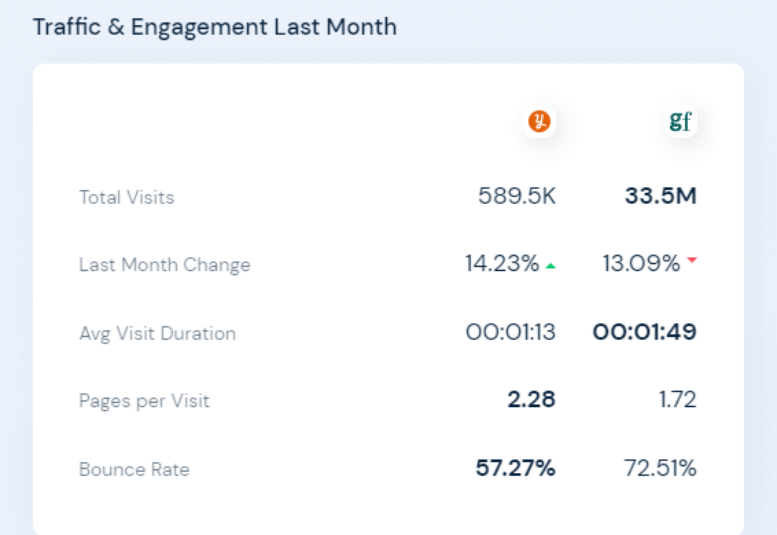

Figure 33

This is a side-by-side comparison of Yummly and BBC GoodFood. Yummly received 589.500 visits in January 2022. 2.36g multiplied by 589.500 equals 1 391 220. For one month, that equates to 1400 kilogrammes of CO2 emissions.

The BBC has a higher figure, 33.5 million. 1.9g multiplied by 33 500 000 equals 6 365 000. That equates to 6365 kilogrammes of CO2 emissions in a single month.

5.6 Solving the problem

Using Google's Lighthouse application, one can view how to make a website perform better. Regarding BBCGoodFood, there is a lot of unnecessary JavaScript in the web application that does not need to be there. The figure below represents the many sorts of JavaScript files that are loaded but execute nothing.

URL	Transfer Size	Potential Savings
…js/vendor-f5eebe8….js (www.bbcgoodfood.com)	221.0 KiB	147.9 KiB
…/node_modules/moment/moment.js	17.5 KiB	12.9 KiB
…/node_modules/react-dom/cjs/react-dom.production.min.js	34.3 KiB	9.3 KiB
…/node_modules/buffer/index.js	6.4 KiB	6.4 KiB
…/node_modules/pikaday/pikaday.js	5.1 KiB	4.6 KiB
…/node_modules/readable-stream/lib/_stream_readable.js	3.4 KiB	3.4 KiB
/serve/load.js (s.ntv.io)	114.6 KiB	83.8 KiB
…bbcgoodfood/vendor-478f7d2….js?ver=1 (www.bbcgoodfood.com)	115.8 KiB	71.0 KiB
…/node_modules/buffer/index.js	5.2 KiB	5.2 KiB
…/node_modules/piexifjs/piexif.js	7.8 KiB	2.8 KiB
…/node_modules/@immediate_media/components/dist/molecules/FormImageUpload/index.jsx	3.0 KiB	2.8 KiB
…/node_modules/react-scroll-sync/dist/index.js	4.2 KiB	2.8 KiB
…/node_modules/readable-stream/lib/_stream_readable.js	2.7 KiB	2.7 KiB
/userreport.js (cdn.userreport.com)	71.3 KiB	51.7 KiB
/gpt/pubads_impl_202….js (securepubads.g.doubleclick.net)	120.9 KiB	50.6 KiB
/api/tinypass.min.js (cdn.tinypass.com)	79.9 KiB	48.6 KiB
/modules.7d3f952….js (script.hotjar.com)	62.1 KiB	41.8 KiB
…dynamic/7959.js (micro.rubiconproject.com)	116.1 KiB	38.4 KiB
…swiper/swiper.min.js?ver=5.3.6 (www.bbcgoodfood.com)	34.8 KiB	31.3 KiB
…012…/amp4ads-v0.mjs (cdn.ampproject.org)	60.3 KiB	29.2 KiB
…src/service/action-impl.js	2.6 KiB	2.0 KiB
…src/custom-element.js	4.0 KiB	2.0 KiB
…src/service/url-replacements-impl.js	2.4 KiB	1.5 KiB
…src/service/history-impl.js	1.9 KiB	1.5 KiB
…src/error-reporting.js	1.1 KiB	1.1 KiB
/gtag/js?id=G-DHGVGHHXFP&l=dataLayer&cx=c (www.googletagmanager.com)	63.1 KiB	28.4 KiB
…v1/ua-sdk.min.js (aswpsdkus.com)	36.0 KiB	24.7 KiB
/gtm/optimize.js?id=OPT-KM54MS7 (www.google-analytics.com)	40.4 KiB	23.2 KiB

Figure 34

As well as removing unused CSS that does not contribute to anything. Even if these files are in kilobytes, they add up and reduce the load time of a website, as well as taking more processing power to load the content.

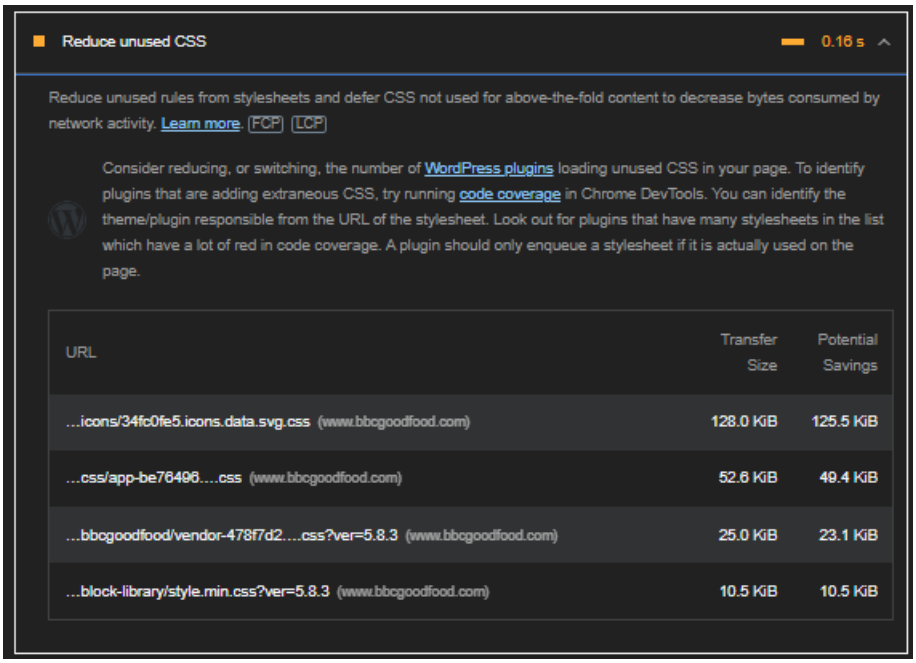

Figure 35

Other files that can be reduced and compressed, such as photographs and videos. All these factors have an impact on the website's power efficiency and load time.

5.7 Conclusion of the Analysis

To conclude the analysis of Vim & Vigour and its competitors, one can see that these websites are producing extreme amounts of CO2 every single month. They are utilizing a lot of CPU power and mobile battery. These websites are real companies, with real visitors that use their websites daily, compared to Vim & Vigour which is part of the project and supports the analysis. As previously stated, Vim & Vigour is intended to be a benchmarking tool that demonstrates the significant difference that lightweight content and code can make in helping to reduce CO2 emissions. Websites with advertisements, such as Yummly and BBC, are large corporations with employees. The project's goal is to assist businesses in recognising the differences in how they operate their websites.

Chapter 6: Professional Issues

6.1 Project management

Everything that has been discussed and worked on has been logged on Google Drive.

Attached to this report is a Google Drive folder with subfolders to organize the project, that includes:

- Website code, containing all the code and assets of the website.
- Reports, all reports written for this project.
- Images used during analysis.
- Ethic forms.
- Useful links to Endnote and sources used.

Task	Duration in days
Project proposal	
Ethics form	1
Background and motivation of project	2
Set up GitHub & Google Drive	1
Design website – wireframes	3
Product overview	2
Methodology of the project – originally was going to use Agile but only one individual working on this project	5
Creating code – set up web app directory and HTML base files	1
Research cloud services for hosting the website	2
Midpoint – progress report	
Writing HTML, CSS, and JS	11
Connecting GitHub repository to Azure and deploying website	7
Code testing	5

Researching hosting services – again. Google Cloud runs on greener energy, switches to Google	6
Competitive analysis – Yummly and BBC GoodFood.	6
Researching how to make a website produce less carbon emissions and utilize less power consumption	10
Final Report	
Image optimization	4
Optimize code	16
Final testing of code	8
Analysis of website and competitive websites using tools found in research of reducing power consumption	20
Histograms	3
Analysis of carbon emissions	4
Professional issues	
Appendixes	13
Conclusion	
Finishing references	62
Creating poster	7
Creating video presentation	1
Uploading finished work to Google Drive	2

6.2 Version Control

The project was backed up locally, as well as on Google Drive and GitHub. GitHub has been used to deploy updates when writing code and fixing bugs. All code, text, images, and documents have been saved on Google Drive and can be accessed at any time by the reader.

6.3 Summary of Professional Issues

Professional concerns are present to ensure that this project complies with multiple professional bodies in the computer degree industry. Because the project is based in the United Kingdom and will be deployed there, it must adhere to BCS: The Chartered Institute for IT standards. Other professional bodies will be recognised, as the project may be used outside of the United Kingdom.

6.4 Legality

The UK implemented the General Data Protection Regulation (GDPR) in 2018, (Gov.uk, 2018). As of now, the project does not store any data on individuals, but it intends to implement a subscription service for premium members in the future. Data on individuals would be used in a way that is adequate, relevant, and limited to what is required.

6.5 Accessibility

Web accessibility is important for users who are struggling with visual impairments. Navigating the website is clear and clear language has been used. The fonts used are the widely recognised Times New Roman, and alternative text has been added to images so that screen readers can view and read the images aloud.

6.6 Environmental

The website created takes pride in using green energy, consuming little power, and emitting almost no carbon dioxide. The hardware used in the website's development is a laptop and cloud hosting from Google, which is the greenest of the big three (Amazon, Microsoft, and Google). There was no e-waste generated while developing this application, and it is accessible to anyone with an internet connection and does not require a special type of device.

Chapter 7: Conclusion

This project's findings suggest that there is space to improve each websites' power consumption in individual devices around the world. Moving from Adobe Flash to HTML & JavaScript has been a positive step toward improving website functionality and efficiency while also reducing power usage. Many websites, on the other hand, seem unconcerned with their users' CPU usage and power consumption. Running adverts on a website uses a lot of electricity, and there are ways to limit the amount of power used by the website's content, but this has not been adopted yet.

Everyone is affected by environmental changes, and scientists have warned the public and governments that if the world does not begin to address global warming and CO2 emissions, irreversible changes will occur. Electric cars and planes, for example, are two approaches to minimise world emissions and plastic waste. The goal of this experiment was to see how much electricity desktops and mobile devices consume when they visit ordinary websites. As seen in the analysis, Yummly and BBCGoodFood consume a lot of energy to run their websites, which in turn emits tonnes of carbon dioxide every month. There would be a tremendous reduction in carbon footprint from devices all around the world if websites concentrated on decreasing code, JavaScript, and hosting on green energy.

Vim & Vigour is running on google cloud, which is a green energy data centre. Google has done a lot to make their data centres environment friendly. Competitors are close to follow, but not there yet. Unlike Amazon, who are withholding information on their transformation to green energy. If more companies moved onto Google or even Azure as their webhosts, this would create a large competitive environment for data centres like AWS to start implementing green energy solutions.

For the artefact created for this project, the website is working as an example of how barebones and minimalistic a website can look while running on green energy. For future work, the design would be better as there are improvements that could be done. Adding more compressed pictures to make it look more welcoming and vibrant, creating a mobile app and developing it into a commercial product where it implements a premium service for users that want more recipes each week and a shopping list that saves to their mobile device.

The study has demonstrated how much environmental damage a website can cause, especially when considering the number of devices around the world that have limitless access to material that was not created with power efficiency and green energy in mind. The website was established to provide individuals with healthier options and to demonstrate the impact of green energy.

Chapter 9: References

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Chapter 10: Appendices

Appendix A – BCS Code of Conduct and ethical issues IEEE guidelines.

BCS Code of Conduct:

- Have due regard for public health, privacy, security, and wellbeing of others and the environment.
- Have due regard for the legitimate rights of third parties.
- Conduct your professional activities without discrimination on the grounds of sex, sexual orientation, marital status, nationality, colour, race, ethnic origin, religion, age, or disability, or of any other condition or requirement.
- Promote equal access to the benefits of IT and seek to promote the inclusion of all sectors in society wherever opportunities arise.
- Only undertake to do work or provide a service that is within your professional competence.
- NOT claim any level of competence that you do not possess.
- Only undertake to do work or provide a service that is within your professional competence.
- NOT claim any level of competence that you do not possess.
- Avoid injuring others, their property, reputation, or employment by false or malicious or negligent action or inaction.
- Reject and will not make any offer of bribery or unethical inducement

IEE Code of Ethics conduct:

- to accept responsibility in making decisions consistent with the safety, health, and welfare of the public, and to disclose promptly factors that might endanger the public or the environment.
- to avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist.
- to be honest and realistic in stating claims or estimates based on available data.
- to reject bribery in all its forms.

- to improve the understanding of technology; its appropriate application, and potential consequences.
- to maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations.
- to seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others.
- to treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin.
- to avoid injuring others, their property, reputation, or employment by false or malicious action.
- to assist colleagues and co-workers in their professional development and to support them in following this code of ethics

Appendix B – View the Website Code.

Index.html

```
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0,
shrink-to-fit=no">
    <title>Vim & Vigour</title>
    <link rel="stylesheet" href="assets/bootstrap/css/bootstrap.min.css">
    <link rel="stylesheet" href="assets/css/styles.min.css">
</head>


<body style="color: var(--bs-gray-dark);background: rgb(255,255,255);font-
family: Times New Roman;">
    <nav class="navbar navbar-light navbar-expand-lg navigation-clean"
style="background: rgba(198,191,191,0.12);">
```

```
        <div class="container"><a class="navbar-brand" href="#">Vim and
Vigour</a><button data-bs-toggle="collapse" class="navbar-toggler" data-
bs-target="#navcol-1"><span class="visually-hidden">Toggle
navigation</span><span class="navbar-toggler-icon"></span></button>
            <div class="collapse navbar-collapse" id="navcol-1">
                <ul class="navbar-nav ms-auto">
                    <li class="nav-item"><a class="nav-link active"
href="#">Home</a></li>
                    <li class="nav-item"><a class="nav-link"
href="about.html">About</a></li>
                </ul>
            </div>
        </div>
    </nav>
    <h3 style="text-align: center;background:
rgba(198,191,191,0.12);">Welcome to the new you.</h3>
    <p class="text-center" style="text-align: center;padding:
19px;background: rgba(198,191,191,0.12);margin: -8px;"><br><br><em>Vim
&amp;amp; Vigour is a service that presents cheap and healthy meals that are
easy to make, every week. View this week's recipes and pick something you
like. It's all free.</em><br><br></p>
    <h3 style="text-align: center;background: rgba(255, 255, 255, 0.12);">
Countdown until new recipes!</h3>
    <h3 id="countdown" style="text-align: center;background: rgba(255,
255, 255, 0.12);"></h3>
    <script>
        var countDownDate = new Date("March 20, 2022 14:00:00").getTime();
        var x = setInterval(function() {
            var today = new Date().getTime();
            var distance = countDownDate - today;
            var days = Math.floor(distance / (1000 * 60 * 60 * 24));
            var hours = Math.floor((distance % (1000 * 60 * 60 * 24)) /
(1000 * 60 * 60));
            var minutes = Math.floor((distance % (1000 * 60 * 60)) / (1000
* 60));
```

```
            document.getElementById("countdown").innerHTML = days + "d " +
hours + "h " + minutes + "m ";
            if (distance < 0) {
                clearInterval(x);
                document.getElementById("countdown").innerHTML = "New
Meals!";
            }
        }, 1000);
    </script>
    <div class="col-sm-6 col-md-4 col-lg-3 col-xxl-3 offset-lg-2 offset-
xxl-5 text-center item" style="height: 561.462px;margin: 14px;transform:
perspective(0px) translate(1000px);">
        <a href="assets/img/desk.jpg"></a>
        <h3 class="text-center visible">Monday</h3><small class="text-
center">Kiwi Cereal<br><br></small><img class="img-fluid"
src="assets/img/img-05.jpg"><a class="btn btn-success" role="button"
href="monday.html" style="font-family: 'Times new roman', sans-
serif;color: var(--bs-white);margin: 18px;">Make it.</a></div>
    <div class="col-sm-6 col-md-4 col-lg-3 offset-md-0 offset-lg-3 offset-
xxl-5 text-center item" style="height: 551.45px;margin: 52px;transform:
translate(41px);">
        <h3 class="text-center visible" style="font-family: Times New
Roman;">Tuesday</h3><small>Oat pancakes<br><br></small><img class="img-
fluid" alt="" src="assets/img/img-02.jpg"><a class="btn btn-success"
role="button" href="tuesday.html" style="font-family: 'Times new roman',
sans-serif;color: var(--bs-white);margin: 18px;">Make it.</a></div>
    <div class="col-sm-6 col-md-4 col-lg-3 text-center item"
style="margin: 52px;transform: perspective(0px) translate(952px);height:
573.1px;">
        <a href="assets/img/building.jpg"></a>
        <h3 class="text-center">Wednesday</h3><small>Fruity
Breakfast<br><br></small><img class="img-fluid" src="assets/img/img-
06.jpg" style="border-style: hidden;"><a class="btn btn-success"
role="button" href="wednesday.html" style="font-family: 'Times new roman',
sans-serif;color: var(--bs-white);margin: 18px;">Make it.</a></div>
```

```
    <div class="col-sm-6 col-md-4 col-lg-3 offset-md-0 offset-lg-3 offset-xxl-5 text-center item" style="height: 700.45px;margin: 52px;transform: translate(41px);">
        <h3 class="text-center visible" style="font-family: Times New Roman;">Thursday</h3><small>Plum Casserole<br><br></small><img class="img-fluid" alt="" src="assets/img/img-11.jpg"><a class="btn btn-success" role="button" href="thursday.html" style="font-family: 'Times new roman', sans-serif;color: var(--bs-white);margin: 18px;">Make it.</a></div>
    <footer class="footer-basic" style="background: rgb(39,168,137);color: rgb(101,102,102);">
        <ul class="list-inline">
            <li class="list-inline-item"><a href="index.html">Home</a></li>
            <li class="list-inline-item"><a href="about.html">About</a></li>
        </ul>
        <a href="https://tree-nation.com/profile/impact/simen-walle#co2" target="_blank" style="position:relative;cursor:pointer;display:block;z-index:999;">
            <img src="https://tree-nation.com/images/tracking/label-co2-website-white-en.png" style="width:157px;height:auto;">
        </a>
        <script src="https://tree-nation.com/js/track.js"></script>
        <script>
            treenation_track("6228ae57102f5");
        </script>
        <p class="copyright" style="color: rgb(105,94,94);">Vim &amp;amp; Vigour© 2022</p>
    </footer>
</body>

</html>
```

About.html

```
<!DOCTYPE html>
<html lang="en">
```

```
<head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0, shrink-to-fit=no">
    <title>About</title>
    <link rel="stylesheet" href="assets/bootstrap/css/bootstrap.min.css">
    <link rel="stylesheet" href="assets/css/styles.min.css">
</head>

<body style="color: var(--bs-gray-dark);background: rgb(255,255,255);font-family: Times New Roman;">
    <nav class="navbar navbar-light navbar-expand-lg navigation-clean" style="background: rgba(198,191,191,0.12);">
        <div class="container"><a class="navbar-brand" href="#">Vim and Vigour</a><button data-bs-toggle="collapse" class="navbar-toggler" data-bs-target="#navcol-1"><span class="visually-hidden">Toggle navigation</span><span class="navbar-toggler-icon"></span></button>
            <div class="collapse navbar-collapse" id="navcol-1">
                <ul class="navbar-nav ms-auto">
                    <li class="nav-item"><a class="nav-link" href="index.html">Home</a></li>
                    <li class="nav-item"><a class="nav-link active" href="#">About</a></li>
                </ul>
            </div>
        </div>
    </nav>
    <section class="projects-clean">
        <div class="container">
            <div class="intro">
                <h2 class="text-center">Vim and Vigour Project </h2>
                <p class="text-center"> At Vim & Vigour we run on green energy, so whenever you visit us you can have a happy mind. An environment friendly website. </p>
            </div>
```

```
            <div class="row projects">
                <div class="col-sm-6 col-lg-4 item"><img class="img-fluid"
src="assets/img/carbon.png" alt="This webpage is cleaner than 65 percent
of web pages tested.">
                    <h3 class="name">Carbon Emission</h3>
                    <p class="description">This website emits 0.60 grammes
of carbon each time you visit us.</p>
                </div>
                <div class="col-sm-6 col-lg-4 item"><img class="img-fluid"
src="assets/img/mobile.png" alt=" When visiting on a mobile device, it
consumes 3.53 mAh per visit.">
                    <h3 class="name">Mobile Battery</h3>
                    <p class="description">This website only consumes 3.53
mAh of your phone battery when you visit us.</p>
                </div>
                <div class="col-sm-6 col-lg-4 item"><img class="img-fluid"
src="assets/img/vim.png" alt="When visiting on a computer, it utilizes 8
percent of your processor">
                    <h3 class="name">CPU Utilization</h3>
                    <p class="description">Your processor barely gets
utilized when viewing us.</p>
                </div>
            </div>
        </div>
    </section>
    <footer class="footer-basic" style="background:
rgb(39,168,137);height: 255.3px;color: rgb(101,102,102);">
        <ul class="list-inline">
            <li class="list-inline-item"><a
href="index.html">Home</a></li>
            <li class="list-inline-item"><a
href="about.html">About</a></li>
        </ul>
        <a href="https://tree-nation.com/profile/impact/simen-walle#co2"
target="_blank" style="position:relative;cursor:pointer;display:block;z-
index:999;">
```

```
            <img src="https://tree-nation.com/images/tracking/label-co2-website-white-en.png" style="width:157px;height:auto;">
        </a>
        <script src="https://tree-nation.com/js/track.js"></script>
        <script>
            treenation_track("6228ae57102f5");
        </script>
        <p class="copyright" style="color: rgb(105,94,94);">Vim &amp;amp; Vigour© 2022</p>
    </footer>
</body>

</html>
```

Monday.html

```
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0, shrink-to-fit=no">
    <title>Monday</title>
    <link rel="stylesheet" href="assets/bootstrap/css/bootstrap.min.css">
    <link rel="stylesheet" href="assets/css/styles.min.css">
</head>

<body style="color: var(--bs-gray-dark);background: rgb(255,255,255);font-family: times new roman;">
    <nav class="navbar navbar-light navbar-expand-lg navigation-clean" style="background: rgba(198,191,191,0.12);">
        <div class="container"><a class="navbar-brand" href="#">Vim and Vigour</a><button data-bs-toggle="collapse" class="navbar-toggler" data-bs-target="#navcol-1"><span class="visually-hidden">Toggle navigation</span><span class="navbar-toggler-icon"></span></button>
            <div class="collapse navbar-collapse" id="navcol-1">
```

```
                <ul class="navbar-nav ms-auto">
                    <li class="nav-item"><a class="nav-link"
href="index.html">Home</a></li>
                    <li class="nav-item"><a class="nav-link"
href="about.html">About</a></li>
                </ul>
            </div>
        </div>
    </nav>
    <h1 style="text-align: center;background: #c6bfbf1f;height: 78px;font-
weight: bold;">Monday's recipe</h1>
    <div class="col-sm-6 col-md-4 col-lg-3 col-xxl-2 offset-lg-2 offset-
xxl-6 text-center item" style="height: 780.462px;margin: 14px;transform:
perspective(0px) translate(53px);width: 558px;">
        <a href="assets/img/desk.jpg"></a>
        <h3 class="text-center visible">Kiwi breakfast with oats</h3><img
class="img-fluid" src="assets/img/img-05.jpg" style="height: 522px;">
        <p style="height: 28px;padding: 7px;width: 2242px;margin: -
542px;text-align: center;transform: perspective(640px)
translate(265px);"><strong>Ingredients</strong><br><br>1/2 cup Oats<br>1/2
coconut&amp;nbsp;milk, or milk of choice<br>1/2 cup&amp;nbsp;low-fat Greek
yogurt<br>1 teaspoon&amp;nbsp;lime juice1 kiwi,&amp;nbsp;chopped<br>1
tablespoon&amp;nbsp;chopped almonds or crushed graham crackers<br>1
            tablespoon&amp;nbsp;honey
            <br>1/2 teaspoon&amp;nbsp;lime
zest<br><br><strong>Instructions</strong><br><br>Add Oats to your
container<br>&amp;nbsp;of choice and stir in milk.<br>&amp;nbsp;Stir together
yogurt and lime juice.<br>&amp;nbsp;Layer yogurt, kiwi and almonds.
<br>Drizzle
            honey on top and refrigerate overnight.<br>&amp;nbsp;Let steep for
at least 8 hours in a refrigerator 40° F or colder. <br>Best to eat within
24 hours. Rise, shine and enjoy!<br><br><br></p>
    </div>
    <footer class="footer-basic" style="background:
rgb(39,168,137);height: 255.3px;color: rgb(101,102,102);">
        <ul class="list-inline">
```

```
            <li class="list-inline-item"><a
href="index.html">Home</a></li>
            <li class="list-inline-item"><a
href="about.html">About</a></li>
            <li class="list-inline-item"><a href="#">Privacy
Policy</a></li>
        </ul>
        <a href="https://tree-nation.com/profile/impact/simen-walle#co2"
target="_blank" style="position:relative;cursor:pointer;display:block;z-
index:999;">
            <img src="https://tree-nation.com/images/tracking/label-co2-
website-white-en.png" style="width:157px;height:auto;">
        </a>
        <script src="https://tree-nation.com/js/track.js"></script>
        <script>
            treenation_track("6228ae57102f5");
        </script>
        <p class="copyright" style="color: rgb(105,94,94);">Vim &amp;
Vigour© 2022</p>
    </footer>
</body>

</html>
```

The other webpages are similar to Monday.html and will be on Google Drive.

CSS

https://drive.google.com/drive/folders/1H6kHhDgpqG_OxeJTyeTfSrlNp8Fid4XH?usp=sharing