# Graduation Work/Thesis Final Report

2025 Fall Semester

Blockchain Visualiser (BV)

José Miguel Bastos Antunes
2021313406

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| Plan(10) | Theme(20) | Concept(20) | Detail(30) | Report(20) | Total(100) |
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**Abstract:** Initially conceptualized in 2008, blockchain technologies quickly gained traction especially in the financial sector. Because of this, they are now ubiquitous in the world of decentralized finance mainly through their role as cryptocurrencies and NFTs. Promising more transparency and liquidity than traditional financial assets, blockchains quickly became an area of interest for many. However, as of 2025, the momentum of blockchain technologies has subsided, due not only to the emergence of AI, but also due to high profile financial fraud cases tied to them, and concerns over their environmental impact. Blockchain Visualiser (BV) was proposed in March of this year as a platform that would offer its users easy access to Bitcoin and Ethereum transaction and energy consumption data to increase the transparency of these blockchains and raise awareness of their environmental impact. This paper is the final report for this project that seeks to explain its motivation and goals, as well as the development process of BV.

# 1. Introduction

## 1. 1. Proposal Background

On January 12th, 2009, the first bitcoin transaction took place between Satoshi Nakamoto, the creator of this novel currency and another user identified as Finney. 16 years have passed since this first transaction, and what was initially a pipe dream, has become part of mainstream culture. Today, blockchains have cemented their place as facilitators of alternative currencies or services in this new digital era.

In the current decade of the 2020s, these technologies have become associated with decentralized and transparent economies, promising a world where no single entity can control the value of currency or the flow of the economy. This promise has become the main talking point for those who have adhered to the world of blockchain powered finance. Even though other uses have been proposed for these technologies, none have gained the same traction as cryptocurrencies and similar products like NFTs.

However, the projection of blockchain technologies into the mainstream has been accompanied by controversy, becoming a hot-button issue in recent years. Despite being promoted as more transparent than fiat currencies

(currencies issued, backed, and regulated by a governmental institution), cryptocurrencies enabled by blockchains have become associated with scams and other types of financial fraud, a problem that has been increasing over time [1]. Moreover, concern has also arisen about the environmental impact of these technologies, centered around their significant energy expenditure. For example, research on this topic indicates that, between 2020 and 2021, the Bitcoin blockchain alone consumed around 173.42TWh of electricity, an amount greater than that of most countries [2]. These two issues served as the main motivation for this project, the development of Blockchain Visualiser (BV) as platform to raise awareness about these issues.

### 1. 2. Project Goal

As mentioned in the previous subsection, blockchain technologies have become associated with financial fraud and environmental degradation. However, their use has continuously increased since their inception, and blockchains are now an integral part of the financial industry. This project, the development of BV, intends to improve the transparency of blockchains by simplifying the access to information about them, specifically focusing on information related to the current points of contention of these technologies.

The use of blockchain enabled cryptocurrencies to perpetrate different types of financial fraud is a relatively recent problem, but one that is increasing in scope and severity as more people seek out these technologies [1]. Cryptocurrencies are currently underregulated in most countries, and, as such, they are considered high risk investments. However, this is also perceived by certain investors as an advantage, due to the decentralized nature of this asset. Moreover, most blockchains‘ information is publicly available, creating a sense of security and transparency that is perceived as greater than that of fiat currencies or investments in stocks and bonds. These perceived advantages of blockchains have attracted investors from all backgrounds, both those with experience in investments, but also a new kind of investor interested in the notoriety and particular characteristics of cryptocurrencies. Usually, those seeking to commit fraud target these new inexperienced investors, by exploiting gaps in financial literacy and the aforementioned lack of regulation.

The mitigation of these crimes necessarily requires a multidisciplinary approach,

including regulation, financial education, and education about the blockchain's themselves. BV aims to be a part of the solution by simplifying the existing information about blockchains, in order to improve users' understanding of these technologies and token transactions. At launch, BV will include transaction information about two of the most used blockchains, Bitcoin and Ethereum. By navigating BV, users can, for example, track previous transactions of individuals they intend to exchange tokens with and check for suspicious behavior. Also, BV users can use the platform's information to veto potential investments and transactions by checking for association with known defrauders.

Another concern surrounding blockchains is their environmental impact, specifically regarding the energy needed to keep the blockchains running and to mine new tokens in the case of cryptocurrencies that utilize a mining system. Research has shown that blockchains' energy expenditure is significant and rising, raising questions about these technologies' contribution to the climate crisis, which will be explored further in the next section of this report. Although this problem has become a well-known aspect of blockchains, this is not understood by all users. Furthermore, even when users are aware of that these technologies have a negative environmental impact, they may not be aware of the full scope of the problem.

BV's goal on this front is to promote public awareness by presenting comprehensible data and relevant metrics that enhance understanding of this issue. For example, instead of simply providing raw energy expenditure figures, BV includes an interactive graph that will allow users to check the evolution of the energy expenditure of Bitcoin and Ethereum over time and compare it to the energy expenditure of certain countries and industries, thereby providing users with a sense of scale. Additionally, BV will also improve users' awareness by translating blockchains' impact data into different metrics such as water usage, number of trees cut, and amount of e-waste generated, in order to create a more global understanding of the true influence of blockchains on the environment.

### 1. 3. Overview

At the beginning of this year, Blockchain Visualiser (BV) was proposed as a

platform to help cryptocurrency investors by improving transparency and access to transaction data; and a platform to improve the general public's awareness of the environmental impact of blockchain technologies.

Because of this, BV's main identity as a platform is its goal of improving access to information. This goal is reflected in the platform's design, which heavily focused on ease of use, with significant development time being dedicated to eliminating redundancy, improving flow between features, and simplifying how information is presented without sacrificing accuracy.

As the final report for this project, this paper serves as a detailed description of the entire process of developing BV. The two previous subsections have described the main motivation for the project, and the following sections provide a broader understanding of the development process. Section 2 focuses on research related to financial fraud involving blockchains and the environmental impact of these technologies, section 3 describes the development process, section 4 explains the platform's features, and lastly, section 5 serves as the conclusion of this report.

# 2. Related Research

## 2. 1. Blockchain-enabled Fraud

The problem of blockchain-enabled fraud is relatively recent, but one that is currently growing in scope and severity, according to A. Trozze et al.'s research [1]. The rising interest in blockchain enabled assets attracted investment from many different sources, and the unique characteristics of these novel currencies have made them attractive not only to experienced investors but also to those with no previous experience. As previously explained, it is this new investment paradigm that has created new opportunities for those seeking to defraud investors.

One of the most common types of fraud that has become associated with blockchains and cryptocurrencies are rug pull scams. According to H. Wu et al.'s, rug pull scams with cryptocurrencies usually consist of a new token creator, or those who control the liquidity pool of a new token to take advantage of the moment a token attracts investors, to quickly sell their share

of the tokens and drain the liquidity pull, usually rendering the tokens worthless [3]. Another important component of these kinds of scams involves the use of social media influencers or other public figures to promote the token and incentivize users to make a risky investment [4].

These types of financial fraud expose a fundamental weakness of decentralization. As already stated, the lack of government regulation or control over cryptocurrencies has been one of the reasons many are attracted to these blockchain-enabled investments; however, this creates opportunities for token creators or high influence public figures to act as the centralized authority controlling currency exchange and value.

### 2. 2. Environmental Impact

In the almost two decades since their advent, the environmental impact of blockchain-enabled cryptocurrencies has become a significant concern. One of the main points of contention is the energy expenditure of these technologies. According to S. Chamanara et al., the Bitcoin blockchain alone spend around 173.42TWh of electricity between 2020-2021. This figure matches the energy expenditure of most countries on Earth during the same time period, leading the researchers to draw attention to the role the use of these technologies plays in the current climate crisis [2]. Digiconomist‘s current estimate for Bitcoin’s annual electrical energy expenditure is around 200 TWh, comparable to the power consumption of Thailand [5].

The consensus mechanism of different blockchains has been highlighted as a significant contributor to these technologies’ energy expenditures. One of the main reasons for this is tied to a significant event in blockchain history, called “The Merge”. On September 15, 2022, the Ethereum blockchain, which was estimated to have had a power demand of around 9 GW, changed its consensus mechanism from proof of work (PoW) to proof of stake (PoS). This led to a significant drop in its annual energy expenditure, with research citing a reduction of almost 99% in the years after the merge, even though the use of this blockchain continued to increase. “The Merge” has become a significant event in blockchain history, showing that significant reductions in the power demand and environmental impact of blockchains can be achieved, and that consensus mechanisms play a significant role in each blockchain‘s energy

expenditure. However, it is also important to note that, while Ethereum significantly reduced its power demand, but the energy consumed by each Ethereum transaction remains much higher than that of other services such as Mastercard [6].

# 3. Platform Implementation

## 3. 1. Figma Design

The implementation of this project started as stated in the previous reports and in the implementation plan with designing the platform‘s UI using Figma. This design step served as the blueprint for the rest of the project, allowing for careful planning of the platform’s features and styling before its implementation.

During this step, BV‘s logo was created utilizing Sunat Azimov’s Figma Design Tutorial “How to create 3D Cube from 2D Images”. The link to this tutorial can be accessed in the references of this report [7]. Following the logo design, the homepage, the blockchain transaction list pages, and the environmental impact pages were created.

An important part of the design process was ensuring smooth and intuitive flow between platform features by eliminating redundant pages and selection menus. The final version of BV’s design made with Figma can be seen in the picture below or accessed via the link: https://www.figma.com/design/0V19E8XN1wbo38sx065cEr/BV-UI-Design?node-id=0-1&t=xzv6dbY5J6bVT83w-1

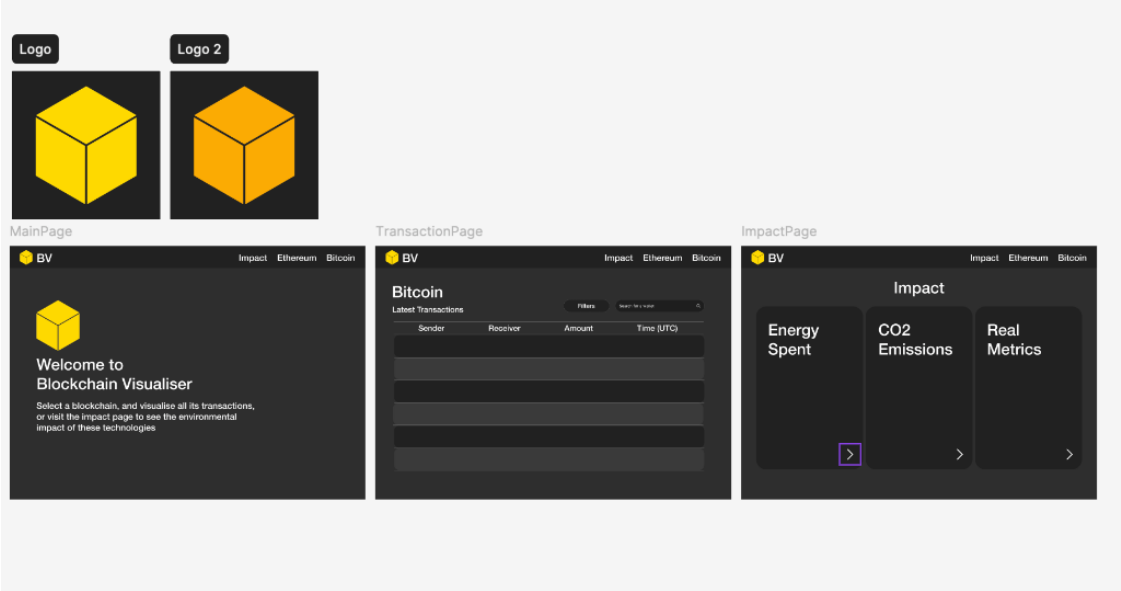


Figure 1. BV's design made with Figma

Lastly, it is important to stress that, although the final version of BV significantly differs from the Figma design, this was still a vital step of the platform's creation.

### 3. 2. UI Implementation

After completing the UI design, the next step was to create the project and implement it. As stated in the initial project proposal, the Figma design served as the blueprint for this step. The project was initialized as a Next.js application, with Tailwind CSS included. This allowed for easy implementation of the elements' styling.

An important aspect of this step was the focus on creating reusable components, which was facilitated by Next.js. All components created were stored in a components folder, which allowed them to be used in all the website's pages as needed. For example, the website's navigation bar, which is displayed at the very top of all pages, is one of these reusable components. This allowed for the same code be reused, significantly reducing implementation time and improving code readability.

### 3. 3. Vercel Deployment

After UI implementation, the website was deployed using Vercel, making it accessible anywhere via an URL. With this, the first testing phase started with the main goal of testing BV on different screen sizes. Through testing, it was apparent that the implementation was not suited for smaller screens, and the website was unusable on most mobile devices because of this. With this insight, the entire code was revised to improve the website's responsiveness, which was achieved mostly through Tailwind's utility classes.

### 3. 4. PWA Implementation

One of the goals stated in the project proposal was the creation of a PWA in order to make the website accessible on mobile devices. This was not achieved by the time the intermediate report was written. Since responsiveness was achieved through Tailwind, it was deemed that mobile device users could already use BV without the need for a PWA. For this final version of the platform, the goal of PWA implementation was abandoned to focus on other aspects of development.

### 3. 5. Adding Blockchain Transaction Data

As stated in the intermediate report, adding blockchain data to the platform was already attempted through the use of APIs, but failed due to the constraints of the free APIs available. Because of this, the plan changed to adding example data to demonstrate the features of BV. Since BV includes two different blockchains (Bitcoin and Ethereum), two different approaches were used to collect data for each blockchain.

For Bitcoin data, Blockchain.com was used to track the transactions made by Satoshi, the creator of Bitcoin [8]. The data was collected manually and written onto a JSON file. This specific data was chosen to show how BV can be used to track the transactions of high-profile users of cryptocurrencies.

For the Ethereum data, a Python script was used to sample transaction data utilizing the Etherscan API [9] and write it onto a JSON file. The volume of data was significantly larger than the one used for the Bitcoin page, and no specific users were tracked. The main goal for the Ethereum page was to demonstrate how a user would normally use BV. The large volume of random

data is all accessible to the user and can be filtered using the search bar. This mimics the real-world application of BV.

Lastly, the transaction list component code was altered to fetch the data from the JSON files and to change the list according to which blockchain the user has selected. At this stage of development, pagination was also added, and the search bar's functionality was implemented. The filter button was abandoned as a feature, as it was deemed unnecessary for transaction list.

### 3. 6. Environmental Impact Metrics Implementation

With the transaction list finished, the next phase of development focused on completing the impact metrics page. As planned, the goal of this page was to display metrics about the environmental impact of different blockchains in a way that could be easily understood. This page was meant to complement the energy expenditure graph that would be developed later. The aforementioned graph focuses solely on energy expenditure as that is the main focus of BV; however, the impact metrics page was created with the idea of also showing users other metrics with the intention of making the real impact of these technologies easier to understand. By displaying not only energy expenditure but also water consumption, e-waste, etc., users can have a broader understanding of this issue.

The metrics page UI had already been implemented before, but the data had yet to be added. The data was sourced from Digiconomist [5] [10], and the metrics card component code was altered to reflect the metrics of different blockchains according to user selection. In this page,

### 3. 7. Creating Energy Expenditure Graph

The last step of BV's development focused on the energy expenditure graph, one of the core features of the platform. For this, a new energy graph component was created, and Recharts, a charting library built for React was utilized.

The graph consists of 2 lines, each one indicating the energy expenditure over time of Bitcoin or Ethereum, and some scatter points indicating the energy

expenditure of certain countries. The graph's x-axis indicates the years from 2008-2025 forming a timeline of these blockchains since their launch, and the y-axis indicates the energy expenditure in TWh. An important note about the blockchain lines displayed in the graph is that they should be interpreted with caution, as they may not accurately reflect reality. The lines were built using recharts by connecting the energy expenditure data points to help visualize trends in energy expenditure. While the data points reflect real data, the lines between them are only an approximation to help visualization and could be further improved by adding additional data points.

The blockchain data points in the graph were sourced from research already cited in this paper [2] [6], and Digiconomist [5] [10], and in some cases figures had to be converted to match the graph's y-axis unit of TWh. The data points related to countries were created utilizing World Bank's "Electric power consumption (kWh per capita)" [11] and "Population, total" [12] datasets by multiplying the per capita electric power consumption by the population figures of a country for a specific year to get the annual power consumption value, which was then converted from kWh to TWh to match the graph's y-axis. An image of the graph can be seen in subsection 4.3.

### 3. 8. Testing and UI Changes

After all features were developed, the platform was tested, and changes were made to the UI in order to keep BV a platform that is easy to navigate and understand.

## 4. Platform Features

### 4. 1. HomePage

BV's home page is the user's first interaction with the platform. A simple design was chosen, and a description of the platform is displayed on this page. This allows users to easily understand the purpose and features of BV. This page also includes the navigation bar that can be used to access all other BV features.

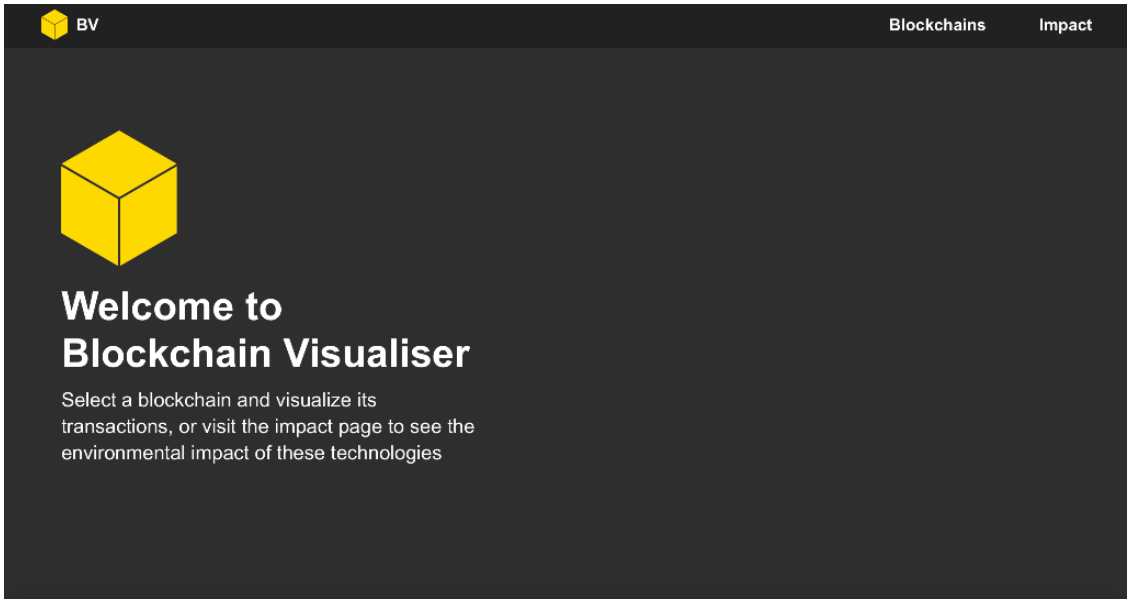


Figure 2. BV's HomePage

### 4. 2. Transaction List

BV includes two transaction lists, one for Bitcoin and another for Ethereum. The default state for these lists will be to show the latest transactions from each blockchain, but users can search for specific transactions by using search bar included in the page to search for specific wallet addresses. This feature aims to improve the transparency of these blockchains by easily providing users with access to transaction data and with a convenient way to filter through it. For example, this will allow users to verify the transaction history of someone they are planning to exchange tokens with.

This feature will also allow anyone to monitor how public figures use these blockchains. As previously explained, a significant problem of blockchain-enabled cryptocurrencies is public figures leveraging their influence to promote a certain token to drive investment, increasing the value of the token, and later selling their tokens and draining the liquidity pool, rendering the tokens worthless. BV aims to allow any user to check how a certain public figure has previously engaged with the blockchain in order to help determine whether they are a reliable source of financial advice. Moreover, this feature will help mitigate insider trading. Even though this is mostly an issue with stocks, it can also happen with cryptocurrencies, so BV's goal is to increase awareness of this practice.

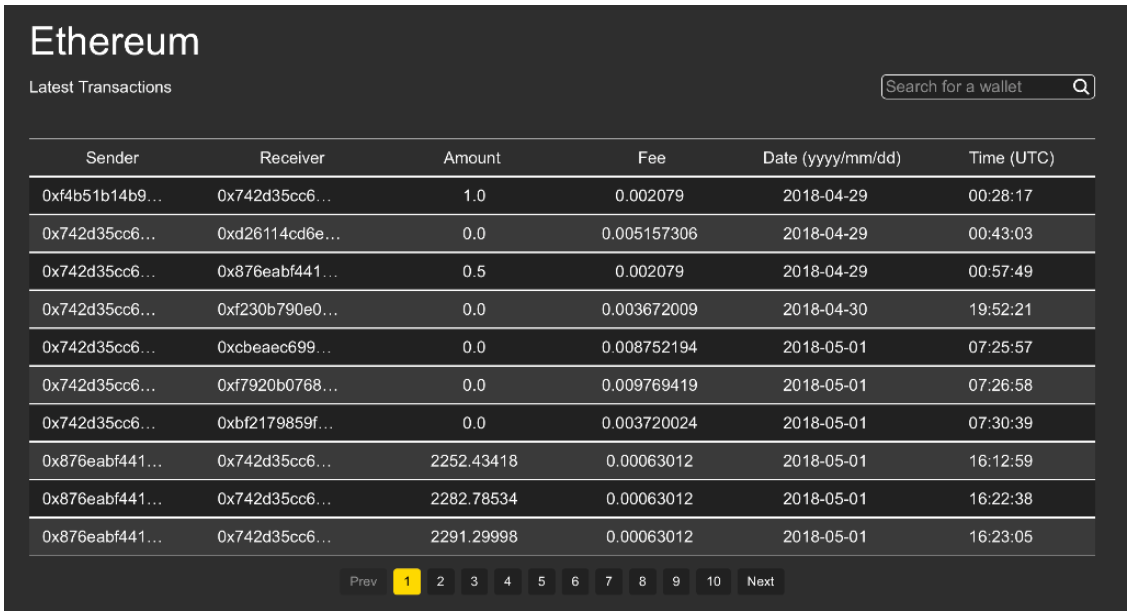


Figure 3. BV's Ethereum transaction list

Since BV only features two blockchains, this feature's goal cannot be fully achieved; however, if BV's development were to continue past the timeframe of this project, development efforts would be geared towards including other blockchains in the platform. The current version of BV serves as a first step towards this goal of transparency.

### 4. 3. Energy Consumption Graph

BV also gives users access to an energy consumption graph. This feature's main goal is to give users a visual representation of how the Bitcoin and Ethereum blockchains energy expenditure is comparable to each other and to the energy consumption of different countries. Additionally, through this graph users can also see how successful Ethereum's efforts were at reducing their energy expenditure.

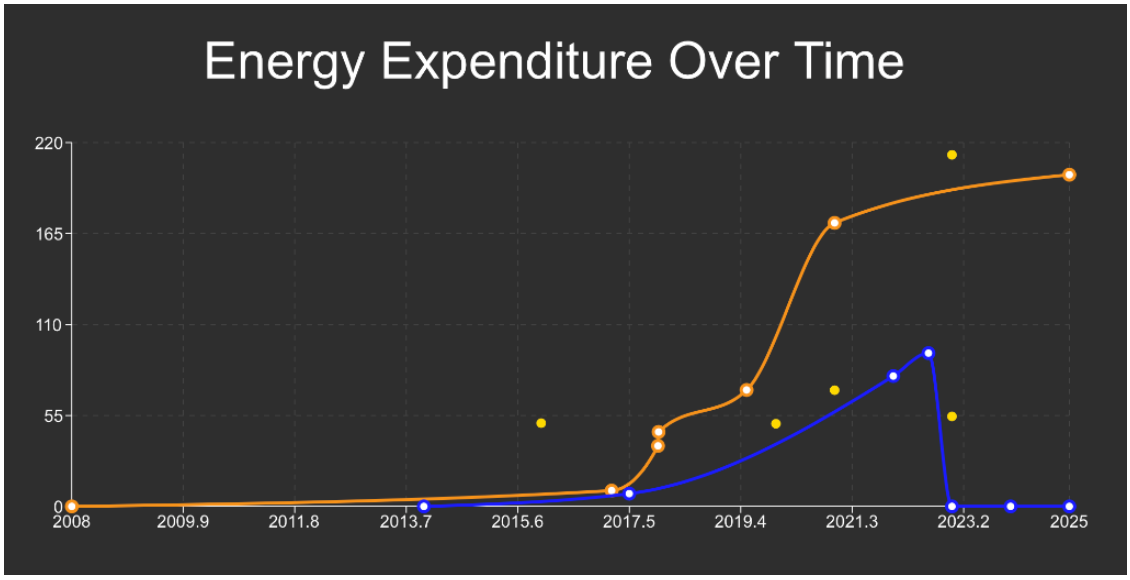


Figure 4. BV's Energy Consumption Graph. The orange line represents Bitcoin, the blue line represents Ethereum, and the yellow points represent the energy expenditure of certain countries. The x-axis serves as a timeline, while the y-axis represents the energy expenditure in TWh

### 4. 4. Environmental Metrics

While energy consumption is an important metric to track, it might be difficult for all users to meaningfully understand the data presented in the graph in the previous subsection. Because of this, to further improve users' understanding of Bitcoin and Ethereum's impact on the environment, the environmental metrics page was created. Its goal is to translate harder to understand data (for example, energy consumption) into data that the average user can better understand (for example, amount of e-waste produced). With this information, the environmental impact of these technologies will be brought closer to the user by giving them data they can better relate to. This page allows users to toggle between Bitcoin and Ethereum, so users can also compare how the two.

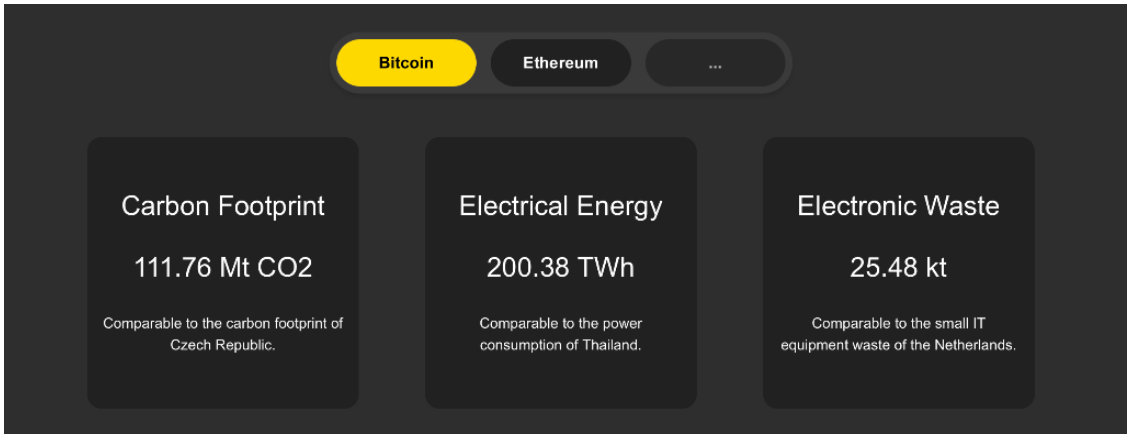


Figure 5. BV's environmental impact metrics page

## 5. Conclusion

The experience of developing Blockchain Vizualiser (BV) was both challenging and interesting. It was my first time developing a project of this scope by myself, and it allowed me to understand my strengths and weaknesses as a computer science and engineering student. This project was also a great learning opportunity for me, as it allowed me to explore and improve certain skills such as writing and literature review; web development and UI design; as well as version control using git and GitHub. Additionally, through this project I was also able to improve my knowledge about blockchains, their use in the financial world and their environmental impacts. Since these where areas of interest for me, they served as my motivation for this project, and now, after development, I believe I have developed a deeper understanding of these topics.

BV's development is mostly followed the plan set out in the project proposal at the beginning of this year, but it was not without challenges and setbacks. The integration of blockchain data into the platform was more difficult than initially expected, and the development plan had to be altered when utilizing APIs to get this data failed. There were additional changes to the plan, namely the implementation of PWA being abandoned, as well as small tweaks to features. However, this also taught me how to overcome challenges in the development process. For example, the idea of a PWA was abandoned once I learned about TailwindCSS classes, which allowed me to optimize BV to different screen sizes without the need of implementing a PWA.

Overall, the development of Blockchain Vizualiser (BV) as my undergraduate graduation project at Sungkyunkwan University was an opportunity for me to test the skills I have acquired during my studies for the past 5 years and helped me become more confident in my skills and ability to see a project through to the end.

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