Design and Implementation of a Website about Brazil's Internet Evolution

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***Abstract*—This report describes the development of a website about the history of the Internet in Brazil. The project involved planning, prototyping, and implementation using HTML, CSS, and JavaScript. A key focus is the application of accessibility techniques to improve the user experience.**

1. Background research

This section presents background research for a website whose main content is the history of the Internet in Brazil. The purpose is to provide historical context for the project, identifying key events in the development of the Internet in Brazil. Each subsection will represent one webpage of the website.

1.1 The first steps of the Internet in Brazil

In 1965, Embratel, a major Brazilian telecommunications company headquartered in Rio de Janeiro, was founded. In the same period, it established the first link in national territory, a crucial milestone for the future Brazilian Internet. In the United States, ARPANET had already demonstrated packet switching as a reliable way to connect computers. These early experiments became the reference for many nations, including Brazil, aiming to build their own academic networks. In 1980, REAC (Aeronautic Computers Networks), an experimental network founded by the Brazilian Air Force and inspired by ARPANET, remained isolated and did not communicate with the World Wide Web. A key milestone came in 1987, when DARPA and NSF authorized UFRJ (Federal University of Rio de Janeiro) to officially connect to the Internet in the United States. Soon after, in 1989, the Brazilian government launched RNP, the first nationwide academic backbone, interconnecting universities and research institutions. This created a collaborative scientific environment and laid the foundation for TCP/IP expansion across the country. Later, the ".br" domain was officially created by IANA (Internet Assigned Numbers Authority), the international body responsible for coordinating top-level domains. The person in charge of ".br" was Demi Getschko, a researcher from FAPESP. [1]

1.2 The commercial Internet and popularization

Until 1995, Internet governance was carried out by universities (FAPESP, RNP, etc.); however, the lack of national coordination became critical. Hence, the Brazilian Internet Steering Committee (CGI.br) started to manage the Brazilian domain and the distribution of IP addresses in the country, consolidating the Internet as a public infrastructure. As a result, the Brazilian government authorized private companies to provide internet access, ending its exclusively academic character. Embratel, then a state-owned company, was among the first to offer dial-up services. Soon after, providers such as Mandic, Universo Online (UOL), and Brasil Online (BOL) became familiar names to the first Brazilian internet users. The spread of broadband connections gradually replaced dial-up in the early 2000s. Finally, the rise of Web 2.0 gave users a central role in creating and sharing content. In Brazil, Orkut became a cultural phenomenon, dominating social interactions online. Alongside Orkut, platforms like blogs, instant messaging services such as MSN Messenger, and the first e-commerce websites marked the beginning of digital life for millions of Brazilians. [1]

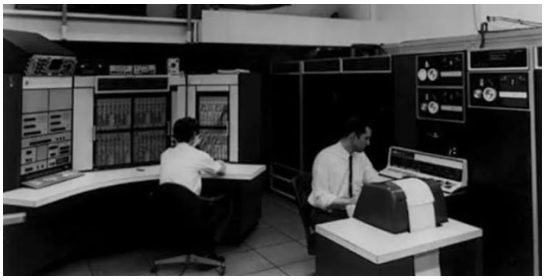

Fig. 1. Researchers working in the ARPANET development. Source: Revista Galileu [3].

1.3 The Internet in contemporary Brazil

Over the past two decades, the Internet has been driven by the growth of mobile access. Mobile phones became the main gateway for millions of Brazilians, especially in regions where fixed broadband was limited. The rollout of 3G, 4G, and more recently 5G networks increased both reach and speed, making mobile the dominant form of internet access in the country. The creation of the Brazilian Internet Steering Committee (CGI.br) and NIC.br established a governance model involving government, academia, the private sector, and civil society. Another key milestone was the Marco Civil da Internet, enacted in 2014, which guaranteed net neutrality, privacy, and freedom of expression, becoming known as Brazil's "Internet Bill of Rights." The Internet today faces several challenges, such as misinformation, cybersecurity risks, unequal access, and the regulation of big tech platforms. [2]

2. Planning

By applying the University of Chicago's website development guidelines [5], the planning of the project followed seven phases (out of 12 mentioned by the university): discovery, architecture,

Fig. 2. President Dilma Rousseff signing into law the Marco Civil da Internet on April 23, 2014. Source: Senado Federal [4].

user experience, wireframes, user interface design, coding, and quality assurance.

For all these steps, the main organization of the time was made applying Agile methodology - scrum [6], defining each sprint being one week, having: sprint planning for "What is going to be done", where tasks were created with time/complexity estimation done using Story Points according to Fibonacci; sprint review for "What is being delivered" to crosscheck how the tasks are being done; and finally the retrospective for "How could it be better", looking for improvements. Daily's were not performed due to no project group.

3. Development Process

The development was divided into two main phases: prototype designs and developing the code.

3.1 Prototype designs

The website structure should be created using wireframes. For this, Figma application [7] was used for the entire process. The website's color palette and the scheme was designed to reflect the national identity of Brazil.

Each page would represent a part of the history mentioned in each section of the Background Research 1. The design for each of these pages is going to be the same, divided into three sections. The homepage will have its own layout.

Most of the CSS was implemented using the grid display property to ensure consistent alignment and responsive layouts.

The color scheme was inspired by the Brazilian national identity for cultural recognition throughout the website, while trying to keep contrast for readability:

- `rgb(240,234,214)`, forfooter and header
- `rgb(60,146,66)`, for banner
- `rgb(253,246,227)`, for body
- `rgb(255,213,79)`, for sections

Playfair Display font was selected. It's widely adopted across websites in different countries due to its readability, neutrality, and modern design.

A Google Forms were [10] to collect feedback about the wireframe. Mainly, the feedbacks were good, with positive comments about color palette, but with negative comment

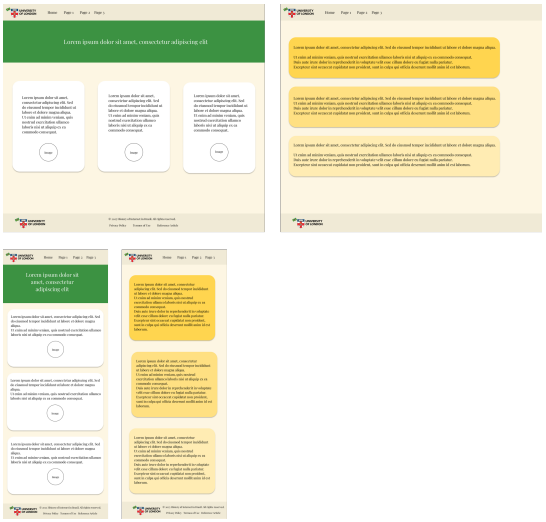

Fig. 3. Wireframes for desktop and mobile before the feedback collected from students. Note that the pages 1, 2 and 3 have the same layout. Source: Own elaboration in Figma [7].

regarding the unordered list used to change among pages and about the homepage, with phrases about internet and not data regarding Brazil itself, and lack of images in the content pages one, two and three. The couple changes could be done, but the time to delivery the project was short, thus no major changes could be done.

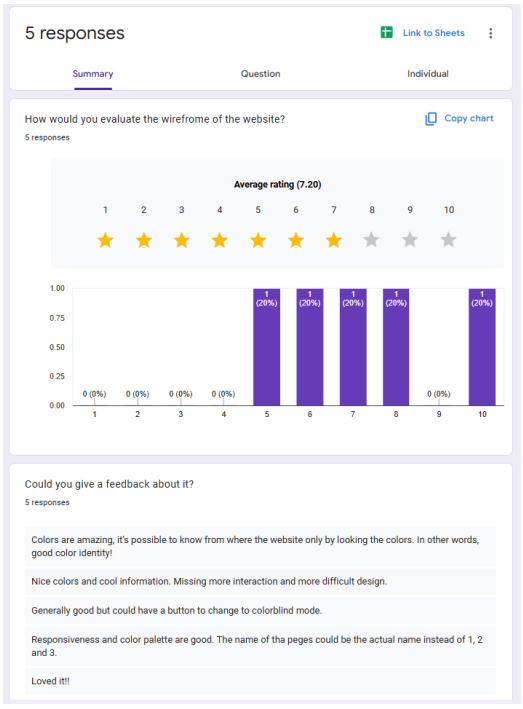

Fig. 4. Feedback developed using Google Forms [10].

After analyzing the negative feedbacks, a major change in

the homepage was made, removing the phrases and adding relevant information about the internet in Brazil in 2021 and adding a sub header with an image in each page.

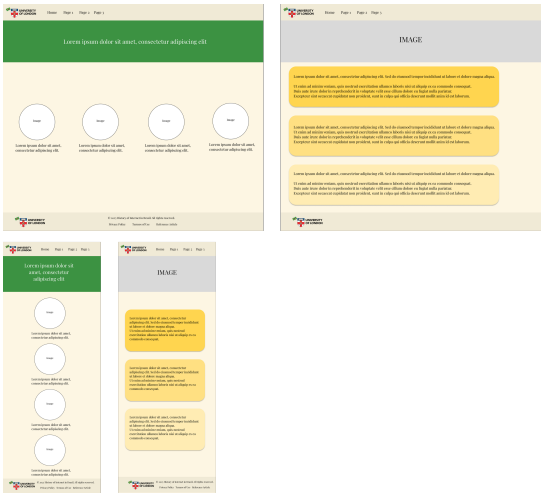

Fig. 5. Wireframes for desktop and mobile after the feedback collected from students. Note that the pages 1, 2 and 3 have the same layout. Source: Own elaboration in Figma [7].

According to the World Health Organization [8], an estimated 1.3 billion people experience significant disability, representing 16% of the world's population, or 1 in 6 of us. In light of this, several researches were performed to improve user experience, with the main goals as:

- Designing clear navigation with semantic landmarks to support screen readers.
- Providing alternative text for all images.
- Ensuring sufficient color contrast for better visualization.
- Planning for keyboard operation, including skip links and logical focus order.
- Maintaining a logical heading hierarchy to structure content consistently.

3.2 Developing the code

The website project was developed using three programming languages: JavaScript, HTML, and CSS. The data used in paragraphs, headers, and other HTML elements were populated from a separate JSON file using Handlebars, following a semantic structure—head, body, header, main, and footer—together with `<section>`, unordered lists, and `<div>` elements for the smaller and more specific parts. Additionally, HTML tags such as `<br>`, `<a>` (anchor), and `<abbr>` were employed to improve readability and semantic clarity.

All code was properly modularized, with a single JavaScript file for DOM manipulation, using key functions like `getElementById`, `querySelectorAll`, and `addEventListener`. This was combined with data fetching and string manipulation in order to properly collect information from the current homepage, and a separate JSON file was generated for each page.

Moreover, a JSON validator was implemented on each page to detect empty files or incorrectly formatted sections, using the `validateJson` function, which is called at the end of the Handlebars rendering function.

Fig. 6. Example of error caused by an invalid JSON. [9].

As seen in the previous section, accessibility is extremely important for inclusion. By using the research done, several coding techniques were applied:

- **Skip link:** A `<a>` element was added at the beginning of the `<body>` to allow keyboard users to jump to the main content, satisfying the WCAG criterion "Bypass Blocks".
- **Semantic landmarks:** The page uses `<header>`, `<nav>`, `<main>` and `<footer>` tags.
- **Accessible navigation:** The navigation bar includes `aria-label="Primary"` and the active page link contains `aria-current="page"`.
- **Language and metadata:** the `lang="en"` attribute was added to the HTML root.
- **List-based menu:** The navigation uses an unordered list.

4. Testing

In the testing phase, AChecks [11] was used to explore accessibility opportunities and identify further improvements. After validating all four HTML pages, there were no known or likely problems; however, 40 potential problems were flagged, such as insufficient color contrast for users with low vision, the absence of a skip link at the beginning of the `<body>`, missing primary headings (`<h1>` inside `<main>`), and images without alternative text.

In response to AChecks [11] test, a descriptive `<h1>` was added in `<main>` for better document structure, and all images were added with a `alt` text to readers.

Thereafter, the W3C Markup Validator Service [12] was used to validate the HTML structure. It reported a single error—an extra comma in an image tag, **which was immediatally fixed since could cause the image to fail to render in some browsers or break HTML parsing.**

5. Reflections on what was learned

The web development project improved several skills and knowledge not only of technical skills but also of national culture. It started with the understanding of general website structure: HTML to create the DOM, properly using semantic

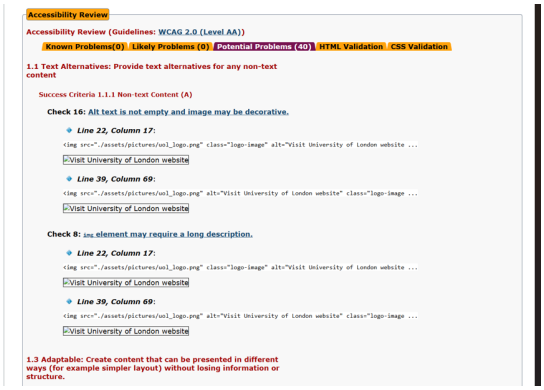

Fig. 7. Potential accessibility problems. [11].

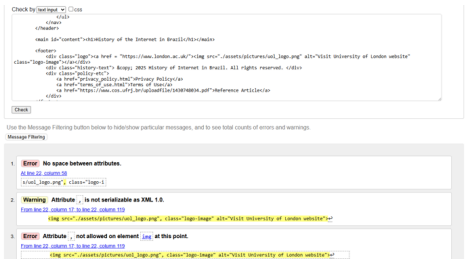

Fig. 8. Validation with W3C, status before. [12].

Fig. 9. Validation with W3C, status after. [13].

tags to improve accessibility; CSS for overall design, colors, and a few animations; and finally, JavaScript for DOM manipulation and how this process is carried out in code.

Furthermore, learning how to implement Handlebars provided a valuable means to explore more recent techniques used in modern websites, such as Content Management Systems (CMS).

Moreover, I acquired knowledge about how data is exchanged on the Internet and the protocols involved, in particular HTTP and HTTPS.

The main challenge of the project was using JavaScript, since all core functions for DOM manipulation were techniques that I had never applied before. Additionally, creating and implementing accessibility tools gave me a more critical perspective when navigating and evaluating websites.

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