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Final Deliverable

“WebChain”

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Abstract

This document presents the information necessary to gain a good understanding of WebChain. The system provides its users the ability to customize a ballot and vote on ballots created by others. This voting system is unique because it is backed by blockchain technology. The contents of the document include the system that was implemented, but more importantly the conceptual design of the system.

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INTRODUCTION

WebChain is an online computer software system designed to create customizable ballots that are saved on blocks within a Blockchain. A user will create a poll that other users will vote on and all of those actions will be recorded as blocks within the Blockchain. The Blockchain will allow other users to audit actions whenever they need to, in order to verify the integrity of everything occurring.

Current System

This is the first developmental iteration of WebChain. WebChain is an exciting new computer software system that was started in January 2023. Developing a software system like WebChain required a comprehensive planning and design process as well as a lot of learning of new technologies for most of the members. The planning process includes identifying the requirements of the system, defining the scope of the project, and determining the resources necessary to complete the project. In the design phase, the team created a detailed architecture for the software system, including the user interface, the database schema, and the algorithms used for implementing blockchain technology. The team then started implementing the software. Due to the prolonged planning, much of the software necessary to make the application fully functional is not implemented. However, there is a strong structure for each component of the system.

Purpose of New System

The purpose of a voting system with blockchain is to provide a secure and transparent way to conduct online voting. By leveraging the properties of blockchain technology, such as decentralization, immutability, and transparency, a voting system with blockchain can ensure that every vote is recorded accurately, and that the integrity of the voting process is maintained. With that integrity maintained, there would be a good sense of trust in the product due to its transparency.

USER STORIES

The following section provides the detailed user stories that were implemented in this iteration of the WebChain project. These user stories served as the basis for the implementation of the project's features. This section also shows the user stories that are to be considered for future development.

Implemented User Stories

User Story #1:

As a developer, I want to conduct research that is vital for the development of this project.

User Story #2:

As a developer, I want to develop a comprehensive list of the steps and timeline for creating a website with blockchain technology.

User Story #3:

As a user, I want the design of the website to be visually pleasing, efficient, and easy to use.

User Story #4:

As a developer, I want to have access to the base code and be able to upload my changes of the code.

User Story #5:

As a developer, I want the front-end of the website to be up and running.

User Story #6:

As a service maintainer, I want to be able to maintain a reproducible build for my service.

User Story #7:

As a designer, I want to implement blockchain technology into the website.

User Story #8:

As a developer, I want to have a database up and running.

Pending User Stories

User Story #6:

As a service maintainer, I want to be able to maintain a reproducible build for my service.

PROJECT PLAN

Our project plan was relatively simple, in that we had the idea of hosting a voting website that would be integrated into Blockchain Technology. The goal was to integrate each poll created and vote cast as blocks that would be added after chain verification, and then also store that data into a Database that can be referenced later on by the user. Our Front End was designed in HTML and CSS (originally with React in mind), while the Back End was Javascript and MySQL.

During the first sprints we focused on developing the design of the project, as well as all the specifics for how we wanted to build the website and the hardware and software we needed. We also focused on getting familiar with the technologies necessary to develop the project. Then started the development of the front-end, while at the same time continuing research on how to implement the blockchain component. The rest of the sprints consisted of continuing the development of the front-end and the blockchain. The last thing completed during the semester was the creation of the database.

Hardware and Software Resources

The following is a list of all hardware and software resources that were used in this project:

- Figma to create and design each page of the webpage.
- Git to host our codebase on GitHub and for code distribution and version control.
- GitHub for a kanban board to track progress of our project.
- NPM to install packages to give our code more libraries to work with.
- Visual Studio Code to write our code for the frontend, blockchain and backend
 - The Front End was written in HTML, CSS, and React.
 - The Back End and Blockchain were written in JavaScript with the crypto-js NPM library installed.
- Our Database was made using MySQL in MySQL Workbench.
- Our project ran on a Windows 11 PC and a Mac OS 13 Late 2020 Mac Mini.
- Discord and Slack were used as a main means of team communication.
- We used starUML to create the UML diagrams for the project.

Sprints Plan

The following section contains the plans for each sprint. For each sprint there is a list summarizing the work and progress done. Following that, are the user stories that were worked on during that sprint.

Sprint 1

During the First Sprint of the semester:

- Worked on setting goals for the project.
- Made decisions on the purpose of the system.
- Started making a plan for the semester.
- Created Github repository and Google Drive.

The product owner requested the following user stories to be completed this sprint. They are ordered by priority:

- User Story 1 - As a developer, I want to conduct research that is vital for the development of this project.
- User Story 2 - As a developer, I want to develop a comprehensive list of the steps and timeline for creating a website with blockchain technology.
- User Story 3 - As a user, I want the design of the website to be visually pleasing, efficient, and easy to use.
- User Story 4 - As a developer, I want to have access to the base code and be able to upload my changes of the code.

Sprint 2

During the Second Sprint of the semester:

- Focused on getting familiar with React.
- Worked on getting familiar with Blockchain Technology.
- Started the system and architecture design.

- Started the user interface design on Figma.

The product owner requested the following user stories to be completed this sprint. They are ordered by priority:

- User Story 1 - As a developer, I want to conduct research that is vital for the development of this project.
- User Story 2 - As a developer, I want to develop a comprehensive list of the steps and timeline for creating a website with blockchain technology.
- User Story 3 - As a user, I want the design of the website to be visually pleasing, efficient, and easy to use.

Sprint 3

During the Third Sprint of the semester:

- Completed design of user interface on Figma.
- Started the front-end development with React.
- Conducted research on how to implement the blockchain component
- CSS files were created based on the design from the figma

The product owner requested the following user stories to be completed this sprint. They are ordered by priority:

- User Story 1 - As a developer, I want to conduct research that is vital for the development of this project.
- User Story 2 - As a developer, I want to develop a comprehensive list of the steps and timeline for creating a website with blockchain technology.
- User Story 3 - As a user, I want the design of the website to be visually pleasing, efficient, and easy to use.
- User Story 5 - As a developer, I want the front-end of the website to be up and running.

Sprint 4

During the Fourth Sprint of the semester:

- Conducted more research on implementing blockchain and began the process
- Development of the frontend continued with React but lack of knowledge and experience with the framework caused delays.
- Went back to the design of the project to resolve issues in development.
- Project development started to come along, but had a lot of delays.

The product owner requested the following user stories to be completed this sprint. They are ordered by priority:

- User Story 1 - As a developer, I want to conduct research that is vital for the development of this project.
- User Story 5 - As a developer, I want the front-end of the website to be up and running.
- User Story 6 - As a service maintainer, I want to be able to maintain a reproducible build for my service.
- User Story 7 - As a designer, I want to implement blockchain technology into the website.
- User Story 8 - As a developer, I want to have a database up and running.

Sprint 5

During the Fifth Sprint of the semester:

- Continued to implement the Blockchain feature for our project. This was very new to all team members so implementation was difficult.
- The frontend development took a turn as our expertise with React were not enough to make the frontend work and look nice.
- Due to this, the frontend development was turned to be developed with just HTML and CSS.

The product owner requested the following user stories to be completed this sprint. They are ordered by priority:

- User Story 5 - As a developer, I want the front-end of the website to be up and running.
- User Story 6 - As a service maintainer, I want to be able to maintain a reproducible build for my service.
- User Story 7 - As a designer, I want to implement blockchain technology into the website.
- User Story 8 - As a developer, I want to have a database up and running.

Sprint 6

During the Sixth Sprint of the semester:

- Progress was achieved with the front-end, and three out of the four required pages were completed with HTML and CSS.
- Converting html to react was attempted, and some completed.
- Functions were added to the blockchain component.
- The database schema was created with MySQL, as well as a query that returns the count of the votes for a ballot.

The product owner requested the following user stories to be completed this sprint. They are ordered by priority:

- User Story 5 - As a developer, I want the front-end of the website to be up and running.
- User Story 6 - As a service maintainer, I want to be able to maintain a reproducible build for my service.
- User Story 7 - As a designer, I want to implement blockchain technology into the website.
- User Story 8 - As a developer, I want to have a database up and running.

Sprint 7

During the Seventh Sprint of the semester:

- All the project documentation was put together.
- The videos, user manual, shortcoming/wishlist documents were all completed
- The project code was organized for submission

SYSTEM DESIGN

This section contains information on the design decisions that went into this project. The architecture patterns are outlined and explained. The entire system is shown in a package diagram and the subsystems are explained. Finally, the design patterns used in the project are discussed.

Architectural Patterns

The architecture of WebChain is divided into multiple layers, each with a distinct role, which ensures the separation of concerns and easy maintenance. The three layers are: the Client, the Blockchain, and the Database. It is important to note that our implementation includes the structure for each component but lacks the connections between them.

Client: HTML and CSS

The Client layer is a visual way for the user to interact with the service. The user requests to create either a poll or partake in a poll with a ballot, information that can be recorded into the Blockchain and referenced later on.

Our implementation at the moment is the actual navigation and access to the web page with the frameworks we mentioned,

Blockchain: JavaScript

The Blockchain layer serves two functions. The Client sends requests to the blockchain layer, which processes them and responds accordingly. This layer is also responsible for creating the blocks that make up the blockchain. This implementation includes verification functions to the chain for any time before a block is about to be added, along with referencing the last block of the chain, a function to add a block, and a function to create a Genesis Block (a block that acts as the first block in the chain). The blockchain network provides a secure and immutable ledger to store the votes, ensuring transparency and integrity in the voting process.

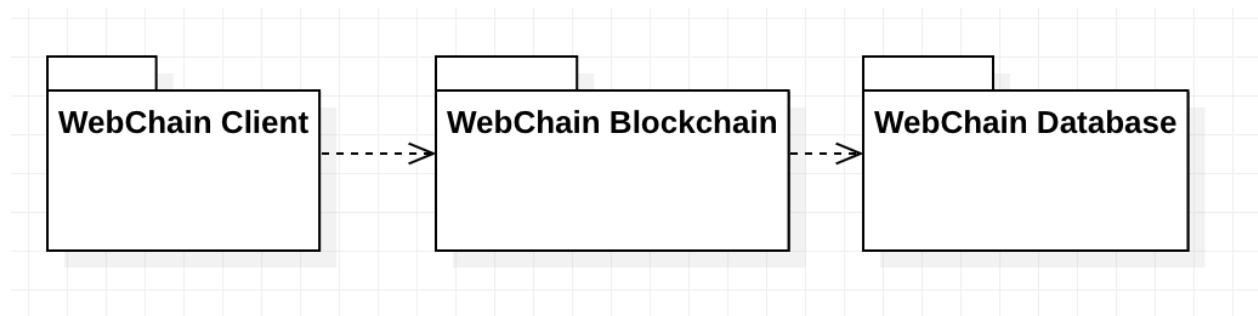
Our implementation only includes the block creation aspect of this layer. Since this component is written in Javascript, it is compatible with the code needed for communication to be established between the Client layer and this layer.

Database: MySQL

The database is a crucial component of the system. Blockchain technology provides an immutable and transparent ledger of transactions, but it still requires a database to store and manage the information related to the voting process. In our implementation, the database stores all the information relating to the ballot, including the votes casted.

At the moment, we have the Database established in some sense, but the problem is that we haven't figured out how to properly integrate the Blockchain into the Database for recording everything.

Package Diagram



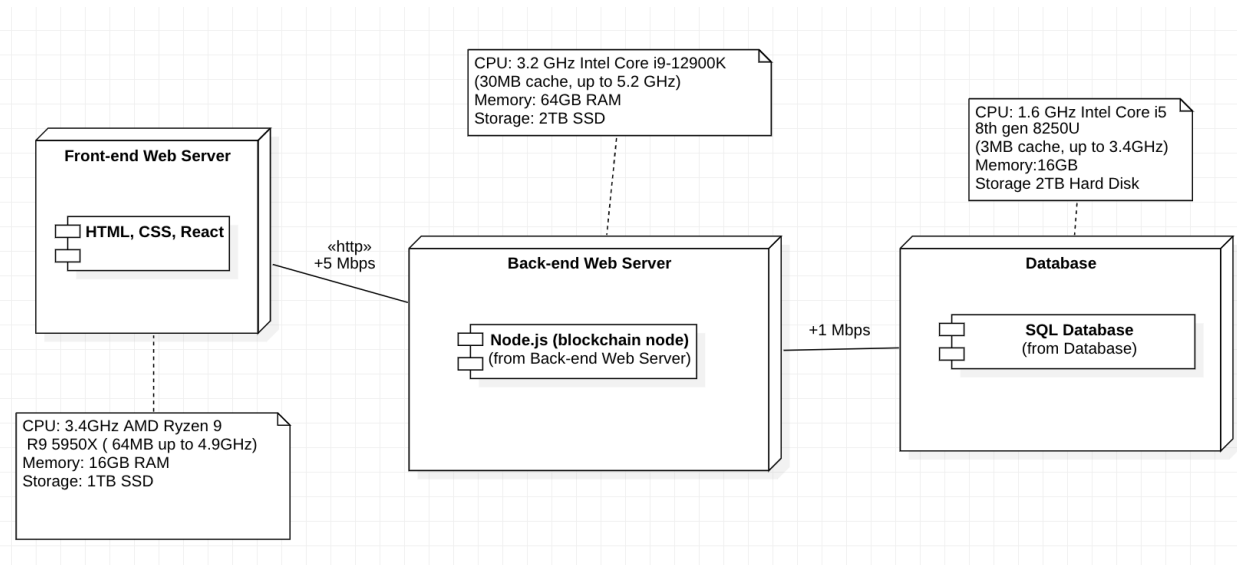
System and Subsystem Decomposition

Client (User Interface): Provides the frontend application that the user interacts with.

Blockchain Network: The server-side layer that provides the logic for the voting system and the underlying blockchain network that stores the votes and ensures their immutability.

Data Storage Layer: The storage layer that stores all the data needed by the system.

Deployment Diagram

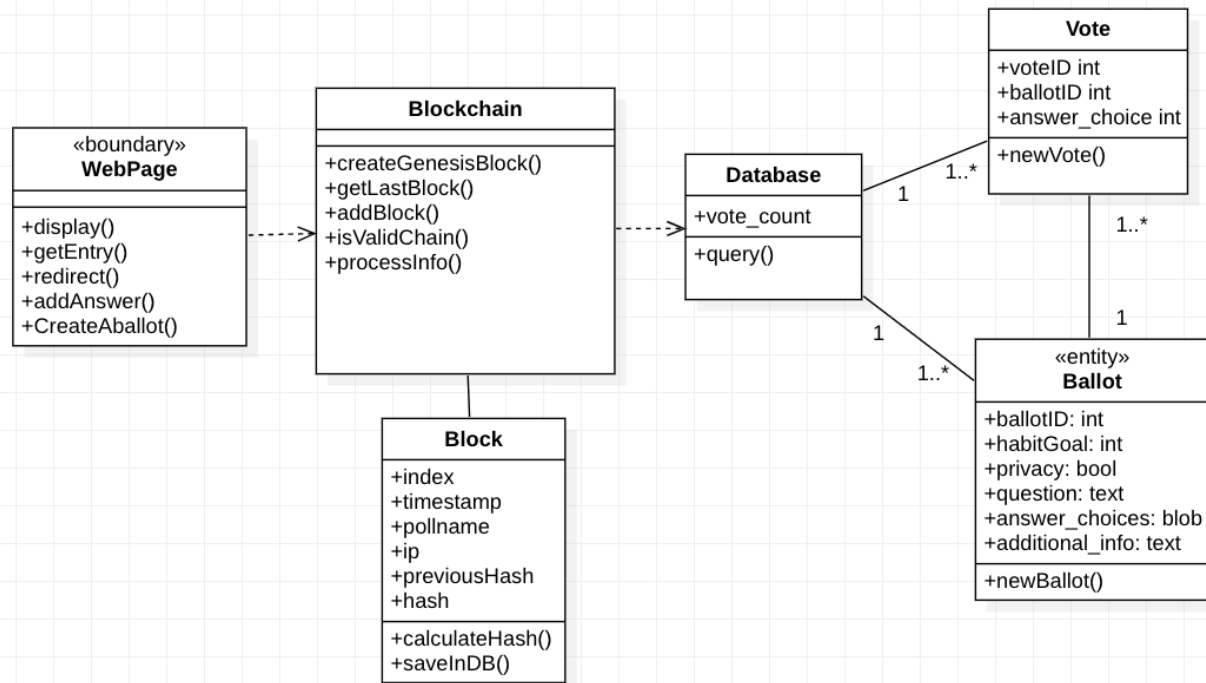


Design Patterns

Observer Pattern: This is used to monitor the blockchain network for new transactions and update the user interface accordingly. In a blockchain-based voting system, the observer pattern is particularly useful in providing real-time updates to the user interface as new transactions are added to the blockchain network. This can help ensure that the voting system is transparent and that the users can monitor the progress of the voting process in real-time.

Facade pattern: The Facade pattern is a design pattern used to provide a simplified interface to a complex system. In the case of a voting system backed by blockchain technology, the Facade pattern could be used to simplify the interaction with the blockchain technology by providing a simple interface to the underlying blockchain functionality. This would make it easier for developers to work with the blockchain technology and would help to ensure that the voting system is secure and reliable.

Class Diagram



SYSTEM VALIDATION

In this section, test cases are proposed. These were not tested on the system since the system is not completed.

Capstone 2 Development

Test Case ID: Display_Ballot

- **Purpose:** To render the ballot to the user.
- **Setup:** Activate virtual environment, run server and frontend, and access localhost:3000 on a web browser.
- **Input:** html/css files opened on a web browser.
- **Expected Output:** Ballot page is displayed.
- **Status:** Fail

Test Case ID: Display_Search

- **Purpose:** To authenticate a student through CES GUI login page.
- **Setup:** Activate virtual environment, run server and frontend, and access localhost:3000 on a web browser.
- **Input:** html/css files open on a web browser.
- **Expected Output:** Search page is displayed.
- **Status:** Fail

GLOSSARY

Blockchain - A system in which a record of transactions, especially those made in a [cryptocurrency](#), is maintained across computers that are linked in a [peer-to-peer](#) network.

Ballot - a process of voting, in writing and typically in secret.

UML - The **Unified Modeling Language (UML)** is a general-purpose [modeling language](#) that is intended to provide a standard way to visualize the design of a system.^[1]

UML provides a standard notation for many types of diagrams which can be roughly divided into 3 main groups: behavior diagrams, interaction diagrams, and structure diagrams.

Modeling Language - Any [artificial language](#) that can be used to express [information](#) or [knowledge](#) or [systems](#) in a [structure](#) that is defined by a consistent set of rules. These rules are used for interpretation of the meaning of components in the Structure Programming language.

SQL - Structured Query Language, abbreviated as SQL, is a domain-specific language used in programming and designed for managing data held in a relational database management system, or for stream processing in a relational data stream management system.

React - React.js, more commonly known as React, is a free, open-source JavaScript library. It works best to build user interfaces by combining sections of code (components) into full websites. Originally built by Facebook, Meta and the open-source community now maintain it. One of the good things about React is that you can use it as much or as little as you want! For example, you can build your entire site in React or just use one single React component on one page.

JavaScript - often abbreviated as **JS**, is a [programming language](#) that is one of the core technologies of the [World Wide Web](#), alongside [HTML](#) and [CSS](#). As of 2022, 98% of [websites](#) use JavaScript on the [client](#) side for [webpage](#) behavior, often incorporating third-party [libraries](#). All major [web browsers](#) have a dedicated [JavaScript engine](#) to execute the [code](#) on [users'](#) devices.

HTML - is the standard markup language for documents designed to be displayed in a web browser.

CSS - Cascading Style Sheets is a style sheet language used for describing the presentation of a document written in a markup language such as HTML or XML.

Block - The hash of the block (the **block header**) is formed from the **six elements that make up a block**

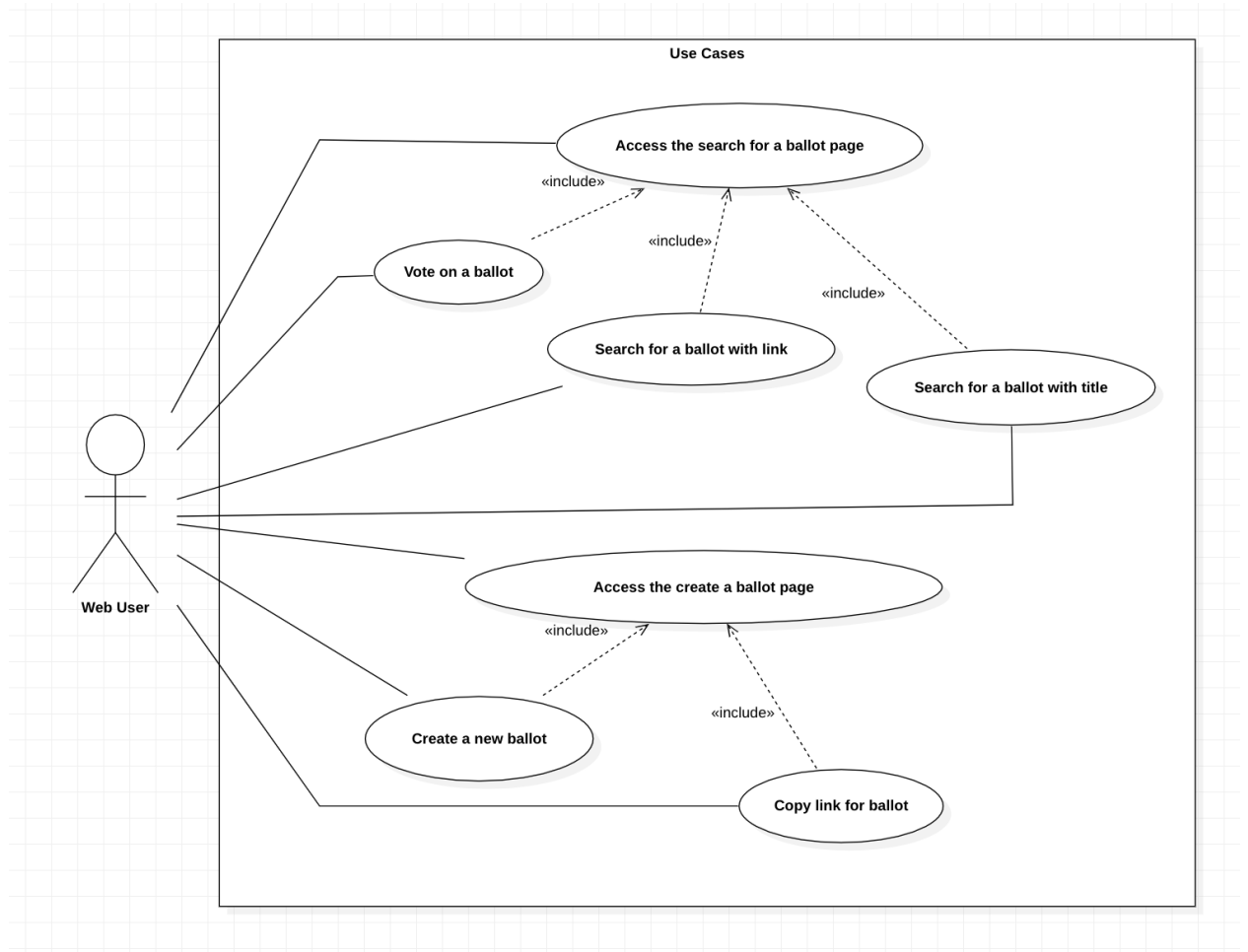
Figma - A collaborative web application for interface design, with additional offline features enabled by desktop applications for macOS and Windows.

Hashing - To secure information and make the ledger immutable.

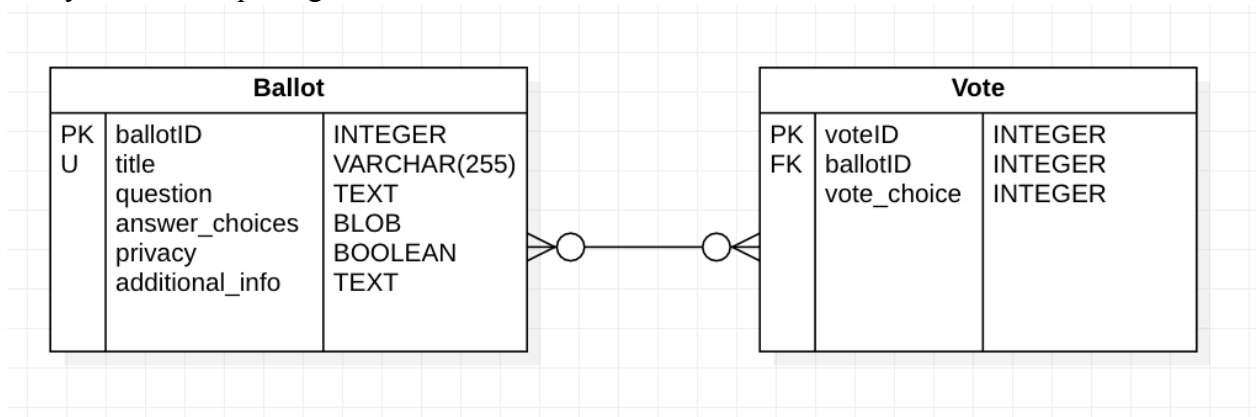
APPENDIX

Appendix A - UML Diagrams

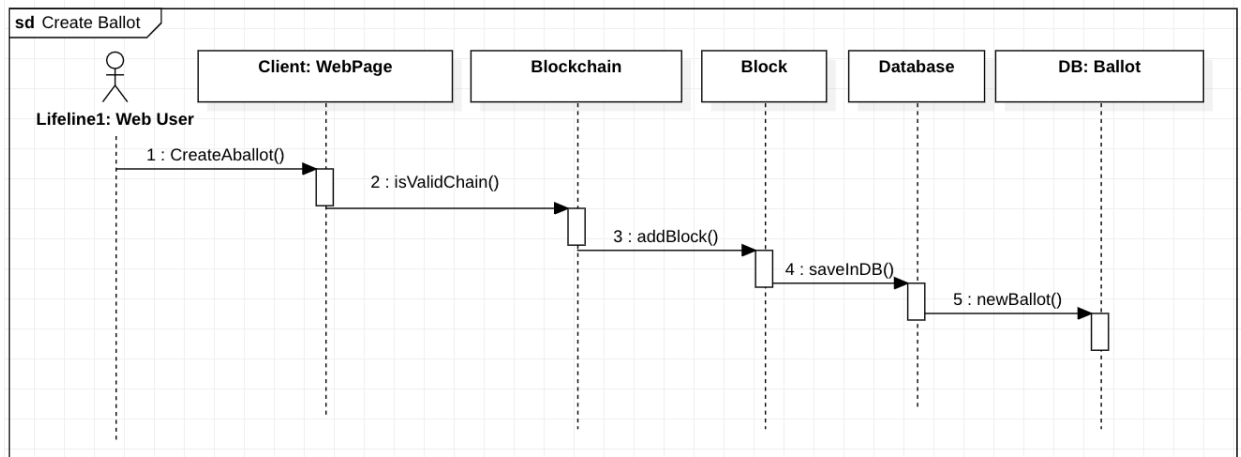
1. Use Case Diagram



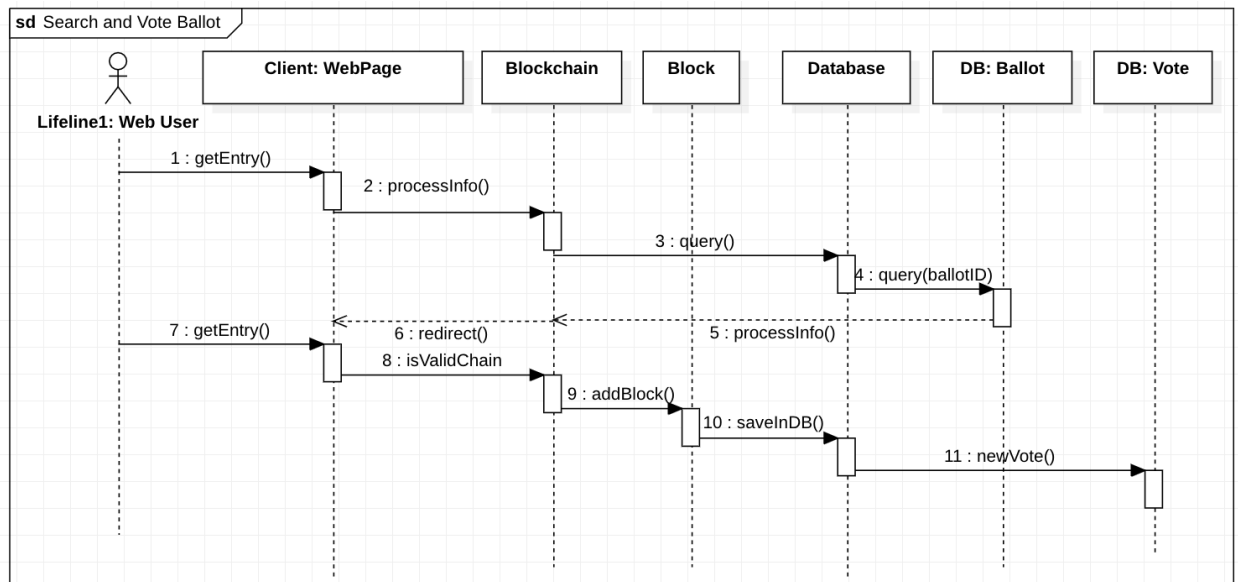
2. Entity-Relationship Diagram



3. Sequence Diagram - Create a Ballot



4. Sequence Diagram - Search and Vote on a Ballot



Appendix B - User Interface Design

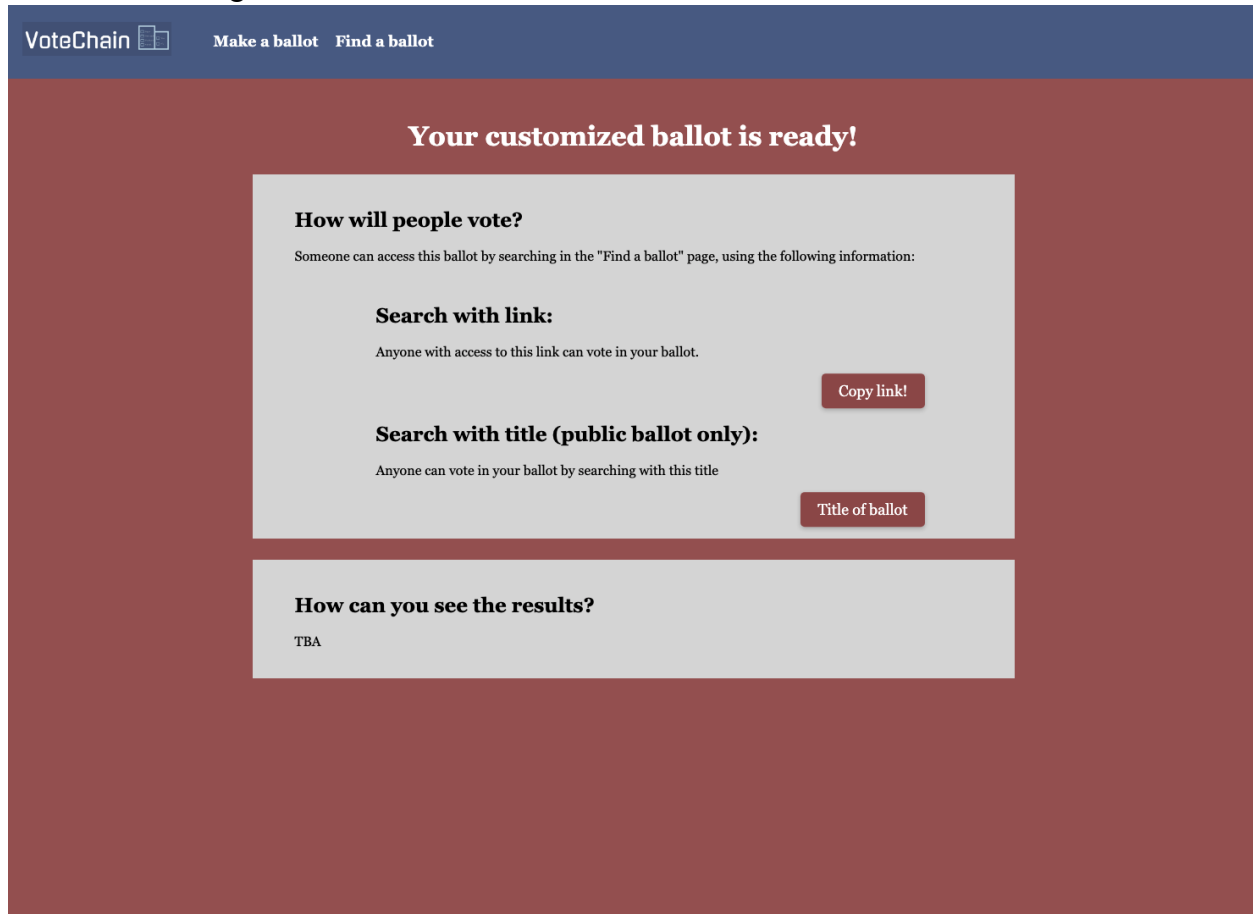
Create a Ballot Page

The screenshot shows the 'Create your own ballot' page in the VoteChain application. The page has a dark blue header with the 'VoteChain' logo and navigation links 'Make a ballot' and 'Find a ballot'. The main content area has a dark red background with the title 'Create your own ballot' and a subtitle 'Fill out the following information to customize your ballot. Click "Create" and copy the link to share!'. A light gray form box contains the following fields:

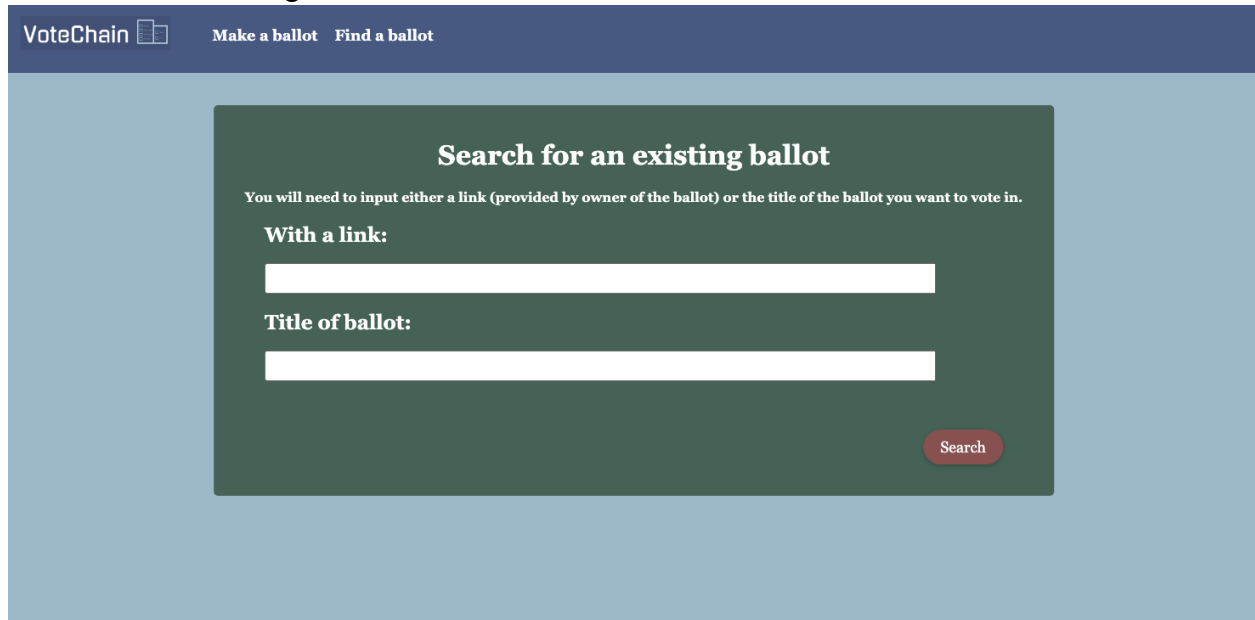
- First, authenticate your identity.**
 - Username:
 - Password:
- Customize your ballot bellow.**
 - Title:
 - Question:
 - Answer 1:
 - Answer 2:
 - [+ Add Answer](#)
 - Add any additional information here:
- Check one:**
 - (private ballots can only be accessed with a unique link)
 - ☐ Public
 - ☐ Private

A **Submit** button is located at the bottom right of the form box.

Ballot Created Page



Search for a Ballot Page



The screenshot shows a web interface for searching for an existing ballot. At the top, there is a dark blue header bar with the 'VoteChain' logo on the left and two links, 'Make a ballot' and 'Find a ballot', on the right. Below the header, the main content area has a light blue background. In the center, there is a dark green rectangular box with rounded corners. Inside this box, the title 'Search for an existing ballot' is displayed in white. Below the title, a line of text states: 'You will need to input either a link (provided by owner of the ballot) or the title of the ballot you want to vote in.' There are two input fields: the first is labeled 'With a link:' and the second is labeled 'Title of ballot:'. Both fields are white with a thin grey border. A red 'Search' button is located at the bottom right of the green box.

VoteChain  [Make a ballot](#) [Find a ballot](#)

Search for an existing ballot

You will need to input either a link (provided by owner of the ballot) or the title of the ballot you want to vote in.

With a link:

Title of ballot:

Search

Appendix C - Sprint Review Reports

Sprint 1 Review Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 11:30 PM

End time: 12:00 PM

User Stories Accepted by Product Owner (After a show and tell presentation, the implementation of the following user stories were accepted by the product owners)

- User Story 1 - As a developer, I want to conduct research that is vital for the development of this project.
- User Story 2 - As a developer, I want to develop a comprehensive list of the steps and timeline for creating a website with blockchain technology.
- User Story 3 - As a user, I want the design of the website to be visually pleasing, efficient, and easy to use.

User Stories Moved to the Product Backlog for Future Sprint Planning (The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting)

- N/A

Sprint 1 Retrospective Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 11:30 AM

End time: 12:00 PM

What went wrong?

- Did we do a good job estimating our team's velocity?
 - Yes, we went at a pace that everyone was comfortable with. This is the start of a new project so we are being flexible with the velocity since there are a lot of things that each individual team member has to learn.
- Did we do a good job estimating the points (time required) for each user story?
 - We did a good job estimating points for the user stories. However, user story 1 (research/learn web development) will need more time as there are many things we need to learn.
- Did each team member work as scheduled?
 - Yes, each team member worked on their part, making everything fair between everyone.

What went right?

- Did we communicate with each other effectively?
 - Yes, there was effective communication between team members this sprint.
- Did we Achieve our goals?

- Some yes. There is still some work to be done in the user stories of this sprint that will be continued in sprint 2.

How to address the issues in the next sprint?

- How to improve the process?
 - With the Discord server finally done, we can better provide information to each other. We also need to have each teammate working on separate parts of the website so that we are able to get more work done.
- How to improve the product?
 - Keeping up to date with the user stories will ensure we do not fall behind. Make sure to document the steps taken to build it.

The project will begin in the next phase of the sprint so we'll be getting those webpages setup soon for the project. Finally, we hope to finish this project quite early for the presentation.

Sprint 2 Review Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 3:00 PM

End time: 3:30 PM

User Stories Accepted by Product Owner(After a show and tell presentation, the implementation of the following user stories were accepted by the product owners)

- User Story 1 - As a developer, I want to start creating features for the application which will make it useful and will be restrictive to different ledgers within communities.
- User Story 2 - As a developer, I want to develop a list of features and begin implementing them into applications.
- User Story 3 - As a user, I want the design of the website to be visually pleasing, efficient, and easy to use.
- User Story 4 - As a developer, I want to have access to the base code and be able to upload my changes of the code.
- User Story 5 - As a developer, I want our project to be hosted online by github pages or GoDaddy .

Sprint 2 Retrospective Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 3:00 PM

End time: 3:30 PM

What went wrong?

We're moving at a pace gracefully and need to start development. I'll say this sprint wasn't that bad, we just need to start doing the projects and getting this completed by Sprint 3 . It's going to be a rough process but development will be fun and we already got a project that we can actually work on now. Another big issue was for us to line up our busy schedules.

What went right?

We got a project up and running or should I say react application. We just need to make some adjustments for the content which will not take that much time. We're on the verge of finally having a set plan in motion to get this project in a cohesive format. Thus, this sprint will be us putting ideas into the projects and hopefully getting it to work in an efficient manner. We should have a basic outline of our idea ready by the beginning of sprint 4.

How to address the issues in the next sprint?

We just need to keep going at a similar pace and dedicate more time at this point. This semester is about to start getting rough and we're about to start developing this project because we need to make the push for development in react and merge with the javascript. Thus, let's finally start making these products and launch it on April 12th.

Sprint 3 Review Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 12:30 PM

End time: 1:00 PM

User Stories Accepted by Product Owner(After a show and tell presentation, the implementation of the following user stories were accepted by the product owners)

- **User Story 1** - As a developer, I want to conduct research that is vital for the development of this project.
- **User Story 2** - As a developer, I want to develop a comprehensive list of the steps and timeline for creating a website with blockchain technology.

- **User Story 3** - As a user, I want the design of the website to be visually pleasing, efficient, and easy to use.
- **User Story 4** - As a developer, I want to have access to the base code and be able to upload my changes of the code.
- **User Story 5** - As a developer, I want the front-end of the website to be up and running.

Sprint 3 Retrospective Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 12:30 PM

End time: 1:00 PM

What went wrong?

- Did we do a good job estimating our team's velocity?
 - The team's velocity has been a bit slower than anticipated. However, the team needs to learn a lot of new things (React, blockchain technology...), so the learning curve is what is impacting our speed.
- Did we do a good job estimating the points (time required) for each user story?
 - Yes, some user stories needed more time required than we thought, but generally, the time estimated has been accurate.

- Did each team member work as scheduled?
 - Yes, each team member worked on their part, making everything fair between everyone

What went right?

- Did we communicate with each other effectively?
 - Yes, there was effective communication between team members this sprint.
- Did we Achieve our goals?
 - Some yes. There is still some work to be done in the user stories of this sprint that will be continued in sprint 4.

How to address the issues in the next sprint?

- How to improve the process?
 - To improve the process we need to focus more on programming the front end with React and connecting the frontend with the server (blockchain technology)
- How to improve the product?
 - Creating a new process to streamline the project while engaging in new ways to communicate with consumers.

Sprint 4 Review Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 4:00 PM

End time: 4:30 PM

User Stories Accepted by Product Owner(After a show and tell presentation, the implementation of the following user stories were accepted by the product owners)

- User Story 1 - As a developer, I want to conduct research that is vital for the development of this project.
- User Story 2 - As a developer, I want to develop a comprehensive list of the steps and timeline for creating a website with blockchain technology.
- User Story 3 - As a user, I want the design of the website to be visually pleasing, efficient, and easy to use.
- User Story 4 - As a developer, I want to have access to the base code and be able to upload my changes of the code.

User Stories Moved to the Product Backlog for Future Sprint Planning (The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting)

- User Story 5 - As a developer, I want the front-end of the website to be up and running.
- User Story 6 - As a service maintainer, I want to be able to maintain a reproducible build for my service.
- User Story 7 - As a designer, I want to implement blockchain technology into the website.
- User Story 8 - As a developer, I want to have a database up and running.

Sprint 4 Retrospective Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 12:30 PM

End time: 1:00 PM

What went wrong?

- Did we do a good job estimating our team's velocity?
 - The team's velocity has been a bit slower than anticipated due to exams and life in general, however the project is starting to come together.
- Did we do a good job estimating the points (time required) for each user story?
 - Yes, some user stories needed more time than we thought, but generally, the time estimated has been accurate. Figuring out how to implement the blockchain technology has been more time consuming, as anticipated.
- Did each team member work as scheduled?
 - Yes, each team member worked on their part, making everything fair between everyone.

What went right?

- Did we communicate with each other effectively?
 - Yes, there was effective communication between Team Members this sprint.
- Did we Achieve our goals?

- Some goals were achieved. However, there is still some work to be done and user stories to complete that will be moved to the following sprint.

How to address the issues in the next sprint?

- How to improve the process?
 - To improve the process we need to focus on completing the front end while at the same time continuing to design and develop the server (blockchain technology)
- How to improve the product?
 - Creating a new process to streamline the project while engaging in new ways to communicate with consumers.

Sprint 5 Review Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 4:00 PM

End time: 4:30 PM

User Stories Accepted by Product Owner(After a show and tell presentation, the implementation of the following user stories were accepted by the product owners)

- User Story 1 - As a developer, I want to conduct research that is vital for the development of this project.

- User Story 2 - As a developer, I want to develop a comprehensive list of the steps and timeline for creating a website with blockchain technology.
- User Story 3 - As a user, I want the design of the website to be visually pleasing, efficient, and easy to use.
- User Story 4 - As a developer, I want to have access to the base code and be able to upload my changes of the code.

User Stories Moved to the Product Backlog for Future Sprint Planning (The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting)

- User Story 5 - As a developer, I want the front-end of the website to be up and running.
- User Story 6 - As a service maintainer, I want to be able to maintain a reproducible build for my service.
- User Story 7 - As a designer, I want to implement blockchain technology into the website.
- User Story 8 - As a developer, I want to have a database up and running.

Sprint 5 Retrospective Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 3:00 PM

End time: 3:30 PM

What went wrong?

- Did we do a good job estimating our team's velocity?
 - The team's velocity has been a bit slower than anticipated due to exams and life in general, however the project is starting to come together.
- Did we do a good job estimating the points (time required) for each user story?
 - Yes, some user stories needed more time than we thought, but generally, the time estimated has been accurate. Figuring out how to implement the blockchain technology has been more time consuming, as anticipated.
- Did each team member work as scheduled?
 - Yes, each team member worked on their part, making everything fair between everyone.

What went right?

- Did we communicate with each other effectively?
 - Yes, there was effective communication between team members this sprint.
- Did we Achieve our goals?
 - Some goals were achieved. However, there is still some work to be done and user stories to complete that will be moved to the following sprint.

How to address the issues in the next sprint?

- How to improve the process?

- To improve the process we need to focus on completing the front end while at the same time continuing to design and develop the server (blockchain technology)
- How to improve the product?
 - Creating a new process to streamline the project while engaging in new ways to communicate with consumers.

Sprint 6 Review Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 6:00 PM

End time: 6:30 PM

User Stories Accepted by Product Owner(After a show and tell presentation, the implementation of the following user stories were accepted by the product owners)

- User Story 1 - As a developer, I want to conduct research that is vital for the development of this project.
- User Story 2 - As a developer, I want to develop a comprehensive list of the steps and timeline for creating a website with blockchain technology.
- User Story 3 - As a user, I want the design of the website to be visually pleasing, efficient, and easy to use.

- User Story 4 - As a developer, I want to have access to the base code and be able to upload my changes of the code.
- User Story 5 - As a developer, I want the front-end of the website to be up and running.
- User Story 7 - As a designer, I want to implement blockchain technology into the website.

User Stories Moved to the Product Backlog for Future Sprint Planning (The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting)

- User Story 6 - As a service maintainer, I want to be able to maintain a reproducible build for my service.
- User Story 8 - As a developer, I want to have a database up and running.

Sprint 6 Retrospective Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 6:00 PM

End time: 6:30 PM

What went wrong?

- Did we do a good job estimating our team's velocity?
 - The team's velocity this sprint was okay. We finished up the code for most of the front end and continued developing the backend of the website.
- Did we do a good job estimating the points (time required) for each user story?
 - Some user stories were difficult to complete but we're going to try to present this project to the audience on friday and showcase some of its abilities or features.
- Did each team member work as scheduled?
 - Yes, each team member worked on their part.

What went right?

- Did we communicate with each other effectively?
 - Communication this sprint was decent. We were a bit busy with other classes and projects but overall we talked and continued collaborating on the project
- Did we Achieve our goals?
 - We've achieved most of our goals but some of the functionalities of the website are not complete and will be left to be developed by future capstone students.

How to address the issues in the next sprint?

- How to improve the process?
 - Communication must be more streamlined and programming knowledge of javascript, react and rust should be required before entering this project.
- How to improve the product?
 - To improve the product, future capstone students will need to work on developing the backend and creating a connection with the frontend.

Sprint 7 Review Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 6:00 PM

End time: 6:30 PM

User Stories Accepted by Product Owner(After a show and tell presentation, the implementation of the following user stories were accepted by the product owners)

- User Story 1 - As a developer, I want to conduct research that is vital for the development of this project.
- User Story 2 - As a developer, I want to develop a comprehensive list of the steps and timeline for creating a website with blockchain technology.
- User Story 3 - As a user, I want the design of the website to be visually pleasing, efficient, and easy to use.
- User Story 4 - As a developer, I want to have access to the base code and be able to upload my changes of the code.
- User Story 5 - As a developer, I want the front-end of the website to be up and running.
- User Story 7 - As a designer, I want to implement blockchain technology into the website.
- User Story 8 - As a developer, I want to have a database up and running.

User Stories Moved to the Product Backlog for Future Sprint Planning (The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting)

- User Story 6 - As a service maintainer, I want to be able to maintain a reproducible build for my service.

Sprint 7 Retrospective Meeting:

Attendees: Alec Jean-Herald Joseph, Michael Anthony Ferrer, Ximena Puig, Adriel Molerio, Felix Rodriguez Jr

Start time: 6:00 PM

End time: 6:30 PM

What went wrong?

- Did we do a good job estimating our team's velocity?
 - The team's velocity this sprint was very well. We finished up all the documents that needed to be turned in for the showcase and finishing up the final deliverable.
- Did we do a good job estimating the points (time required) for each user story?
 - We did a good job estimating the time required.
- Did each team member work as scheduled?
 - Yes, each team member worked on their part of the final assignments.

What went right?

- Did we communicate with each other effectively?
 - Communication this sprint was much better than the previous.
- Did we Achieve our goals?
 - We've achieved all our goals of finishing up the documents.

How to address the issues in the next sprint?

- How to improve the process?
 - Starting putting together documents earlier in the project would be more productive.
- How to improve the product?
 - To improve the product, future capstone students will need to work on developing the backend and creating a connection with the frontend.

Appendix D - User Manuals, Installation/Maintenance Document, Shortcomings/Wishlist Document and other documents

User Manual

Background

The blockchain implementation for the WebChain project is backed by the block.js library. It has a backend and a frontend. The backend is built with Node.js and a frontend built with javascript, css, html, and React. We use the block.js library to create a blockchain implementation to ensure the integrity of the WebChain.

Getting Started

Since the application does not fully work, the following are the steps to interact with the html files:

- The first step to running this program requires a computer, preferable a computer with Windows 11 or Mac OS 12/3.
- First you open a browser like FireFox or Chrome and open the createaballot.html.
- The page loads and then you get to have a few options to fill out: The title, question, answers, details, and a private/public toggle.
- The title is given to show the item of the vote, then the question for the vote, then the various answers for the question is added, and finally an option to select whether to keep the question private or public.
- After the question is posted, users can choose to vote on each question of their desire.
- The users can then search for topics to vote on via link or title for public votes only.
- After the votes are casted, the users should be able to see the results of the votes on the screen.

- The users are not able to manipulate the results as the votes are registered to the blockchain.

Installation/Maintenance Document

- The first step is to ensure you have a proper computer to run this with. It is recommended to run this software with Mac OS 12/13 or Windows 10/11.
- You need to install JavaScript, React, and node.js via “<https://nodejs.org/en/download>” under the LTS tab. The other tab is experimental.
 - For Windows, you need to click on the 64-bit installer version and follow the prompts to install the program.
 - For Mac OS, you need to click on the 64-bit/ARM64 tab and follow the prompts.
- Once you have node.js installed, use `npm -v` and `node -v` in the terminal to ensure that it is installed.
- Since React requires a version of npm above 5.2.0 to ensure that we have access to npx, we need to use `npm install -g npm` in the terminal.
- Install SQL and a Chromium or Firefox browser. The SQL will serve as the database.
- Then we need the library to ensure that the code base is working.

Shortcomings/Wishlist Document

Front-end

- Client development is still missing a lot due to time constraints.
- The Front End still needs to be properly merged with the Blockchain and the Database.
- CSS and HTML are written for page elements, but the actual functionality has yet to be implemented properly.

- Polls can be made, but they aren't saved anywhere in the Blockchain or Database.

Blockchain

- Basic idea behind Blockchain is complete, but more functionality could be added as you see fit.
- Be sure the Database actually is linked to Block addition after the Chain has been verified and the Block has been added.
- Be sure Blockchain isn't only being stored in Memory, as well. That might use up too much Memory during Runtime.

Database

- Database isn't integrated with the Blockchain, but exists for whatever team takes this project up in the future.
- Will need to be implemented on a per Block basis, so each Row of the Database will contain pieces of info from each Block.
- Option for future database implementation:
 - Potential grounds to use CovenantSQL using MySQL script, giving an easy way to store and track votes and polls in the Database.

Test Cases

- Another shortcoming we had was developing and testing more test cases.
- Future developments will need to properly test the system once the three components (front-end, database and blockchain) are properly implemented and connected.

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