FINAL YEAR PROJECT

Consultation and Support System for Students and Legal Case Management System

JANUARY 3, 2025
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1 Introduction

1.1 Project Overview

This project examines the current issues in the education and legal sectors, specifically the issues students have transitioning to higher education as well as the difficulties solicitors experience with managing case workloads and helping clients find the right legal representation. To solve these issues, I am creating a Progressive Web Application that caters to each of these user types. To ease the transition for students, I will develop a mentoring matching algorithm that match's students with mentors based on their profiles to ensure a suitable match. There will be additional features that students can leverage as well. On the legal side, I will develop a case management system that will help solicitors manage their caseloads efficiently and effectively. Additionally, to reduce the worry clients have with finding a suitable solicitor, I am developing a client allocation algorithm that, again, will match clients with solicitors based on their profiles and criteria set by the client.

The backend will be developed using CloudFormation and provide two API's, one for user authentication and the other for interacting with AWS services the progressive web application requires. The hosting will be done through firebase. Lastly, the development process will adhere to Scrum-Agile principles, which is best suited for my project due to the short development timeline.

1.2 Problem Definitions

1.2.1 Student Consultation and Support System

The transition from secondary school to higher education presents numerous challenges for students, significantly affecting both their academic and social well-being. This transition is not only an academic hurdle but a social and emotional adjustment that many students are ill-prepared for. Many reports discuss common themes that students feel secondary school education often leaves students inadequately prepared in key areas such as time management, written assessments, critical thinking, and conducting independent research. One report found that students frequently struggle with the increased academic demands of university due to a lack of these foundational skills, which are not sufficiently emphasised in secondary school. (Denny, 2019)

Additionally, students in their first year of higher education have reported feeling overwhelmed by the lack of information regarding the workload expected in higher education. Many higher education institutions fail to effectively communicate the level of commitment required for coursework, leading students to underestimate the challenges they will face. This lack of transparency results in feelings of anxiety and disengagement. In 2022, a survey was conducted with current and past students with 37% of the 42,852 respondents indicated that they had seriously considered withdrawing from their degrees. The most common reasons for this decision included financial

difficulties, health concerns, and the realisation that the course chosen was not a good fit. (Irish Universities Association, 2022)

1.2.2 Legal Case Management and Client Allocation

To understand the importance of developing a Case Management System (CMS), it is necessary to address the common issues solicitors face. In 2021, the International Bar Association (IBA) published a report highlighting concerns about fatigue and burnout among solicitors. These challenges often stem from heavy caseloads and difficulties in balancing and tracking progress on their cases. This report stated 35% of respondents said their work had a "negative or extremely negative affect on their mental wellbeing" (International Bar Association, 2021). More recently, Realm Recruit published a report stating 62% percent of their respondents had experienced burnout and 21% felt stressed often during 2022 (Realm Recruit, 2023). The pressures faced by solicitors in managing caseloads can lead to missed deadlines, reduced focus on strategic legal tasks, and lower client satisfaction. Without proper tools to streamline workflow, lawyers may find themselves caught in a cycle of reactive rather than proactive case management.

Consumers of legal services often face significant challenges when trying to find a suitable solicitor, including a lack of understanding of legal issues, difficulty assessing lawyer credentials, concerns about costs, limited access to reliable information, and trust issues. Additionally, complicated legal terms discourage many people from seeking professional help, with surveys showing that a large percentage of consumers prefer handling legal matters themselves due to perceived complexity (Law Leaders, 2024).

1.3 Motivation

I have three reasons as to way I am decided to do this project; one being, I wanted to develop a system that helped students through a difficult transitional period in their lives. Moving from secondary school to Higher Education presents many new experiences that can be overwhelming, and I have faced some of these challenges and a system that provides not only guidance/information on fundamental aspects needed to succeed in college, but also provides one-to-one support from mentors and methods to support time management skills, would have been extremely beneficial.

The next reason concerns the technical aspect. I wanted a project that encompasses as many technologies as possible as this allows me to demonstrate the knowledge I have gained throughout my time in college. The legal side of my project requires different services to support it and in turn requires different design implementations which I think help expand the technical side of my project.

Lastly, the decision to build a progressive web application originally stemmed from the idea of not wanting my project to just be functional on specific platform (i.e., IOS or Android). A PWA allows complete flexibility in what devices, regardless of platform, can access and use my project. Additionally, a PWA can also present itself as a mobile application and still retain functionality with no internet connection.

1.5 Objectives

- Develop a consultation system for transitioning students that addresses key areas of difficulty for first year students in higher education institutions.
- Develop a CMS that simplifies the process of case management for solicitors but also improves the process of matching legal consumers to the most suitable solicitors.
- Create a user-friendly, efficient and a secure Progressive Web Application (PWA) that works seamlessly between different types of users.

1.4 Project Outcomes

Upon completing this project, the following outcomes are anticipated:

1. **Cross-Device Compatibility**: A Progressive Web Application (PWA) that operates smoothly across various devices, including desktops, tablets, and smartphones, from a single codebase. Responsive design implementation ensures consistent user experiences regardless device type.
2. **Offline Functionality**: The PWA will provide basic functionality even when users are offline. Service workers and caching will allow users to access key features, ensuring uninterrupted usability and reducing dependency on internet access.
3. **User Role Adaptability**
    - The PWA will efficiently handle the needs of four distinct user groups: Students, mentors, solicitors and clients.
    - Modular and reusable components will allow content delivery to each user type, improving usability and reducing redundancy.
4. **Consultation and Management System**
    - For students, the system will offer resources to help with transitioning to higher education, including course recommendations, time management tools, a mentoring system and support services.
    - For legal users, the system will provide case management tools, streamlining client allocation and improving workload tracking.
5. **Secure System**: The application will be implemented using best practices in secure programming to safeguard user data and use DAST and SAST tools to identify potential threats during and after development.

By the project's end, this PWA will demonstrate how modern web technologies can address real-world challenges faced by students and legal professionals while providing a secure platform.

2. Market Research

2.1 Target Markets

This project aims to provide solutions for problems over two markets, Education and Legal, meaning the project will serve multiple user types. Knowing this, the user types and their use cases can be broken down into the following:

Educational Users:

- Transiting students that require guidance from mentors, and access to foundational resources such as financial supports, skills required for success in college, course suitability assessment, mental welling being resources, and time management features.
- Mentors will need the ability to manage meetings with students, the tasks they set for them, and to communicate with them.

Legal Users:

- Solicitors will need access to manage and view their cases through their personal dashboard detailing their clients, most pressing tasks for each case, and newly allocated clients, documents relating to each case, and billing.
- Legal consumers will need to be quickly allocated a solicitor based on their profile and legal needs. They will also need the ability to communicate with their solicitor through the PWA. Lastly, this type of user will need detailed information about the status of their case.

2.2 Existing Student Consultation and Support Systems

When researching solutions for a student consultation and support systems, I found it difficult to identify web applications that aligned with what my project will be. There are many examples of Learning Management Systems (LMS), but they are designed for educational institutions to provide courses material to students. My implementation will be more focused on students and not on educational institutions. Another aspect of my project that is not covered by the current LMS solutions is they are focused on the students that are already in higher education, where as my solution will cater to not only those type of students, but also to students that are transiting to higher education.

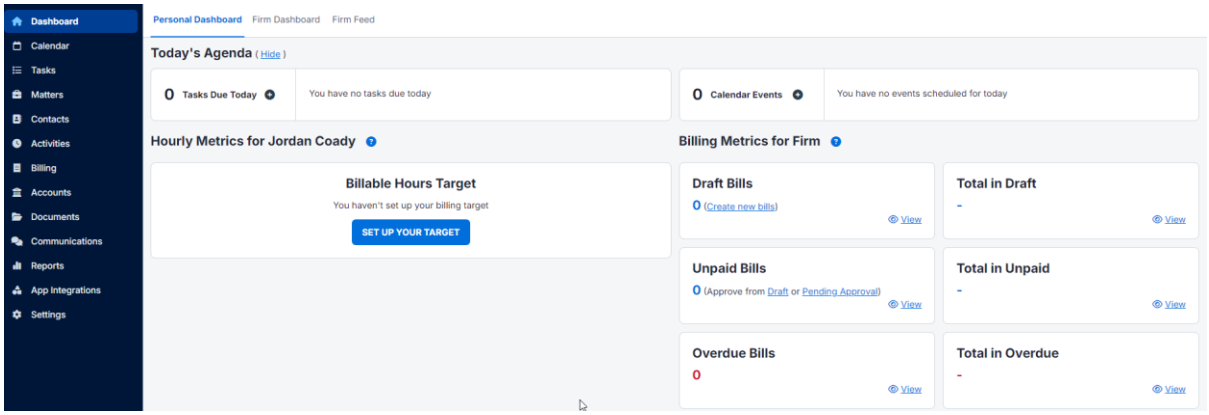
2.3 Existing Case Management Systems

When researching this section, it was hard to find CMS that were available to freely trail. Many websites required you to schedule a demo with the developers before being given access to the case management system.

2.3.1 Clio

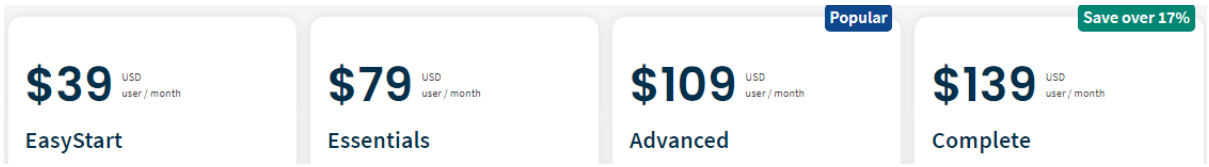
Clio is a cloud-based legal CMS which offers case management, billing, document storage, internal communication and financial tracking. This product is presented very well and offers detailed methods of tracking current legal workloads.

Figure 1: Clio Dashboard



This implementation of a CMS operates by a hierarchical nature, meaning managers are responsible for assigning tasks and deadlines for solicitors. There are no features relating to the client allocation, as in this is strictly meant for legal professionals. It does facilitate solicitor-client communication but only at higher subscription tiers.

Figure 2: Subscription tiers



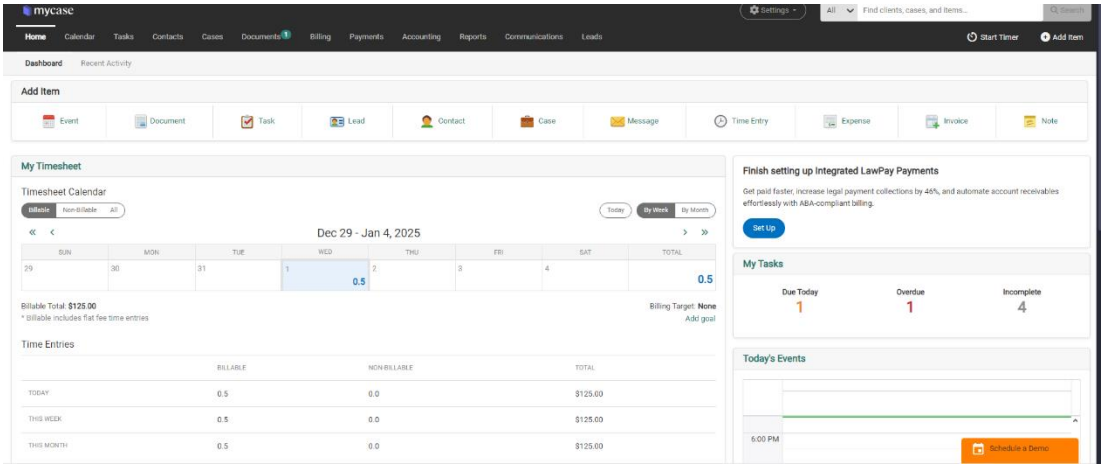
The subscription model is affordable, but the lower tiers are very restrictive on what features are available to law firms. The higher tiers begin to include features such as financial and productivity statistics and advanced methods of task and 'Matter Stages' tracking.

While Clio is presented very well and offers varying features, I think it fails to simplify case management effectively. There is not a centralised dashboard that shows the active cases a solicitor is assigned to. Instead, Clio displays 'tasks' which could relating to any case which I think is a design inaccuracy. Clio also does not offer client allocation nor a client side of the application.

2.3.2 mycase

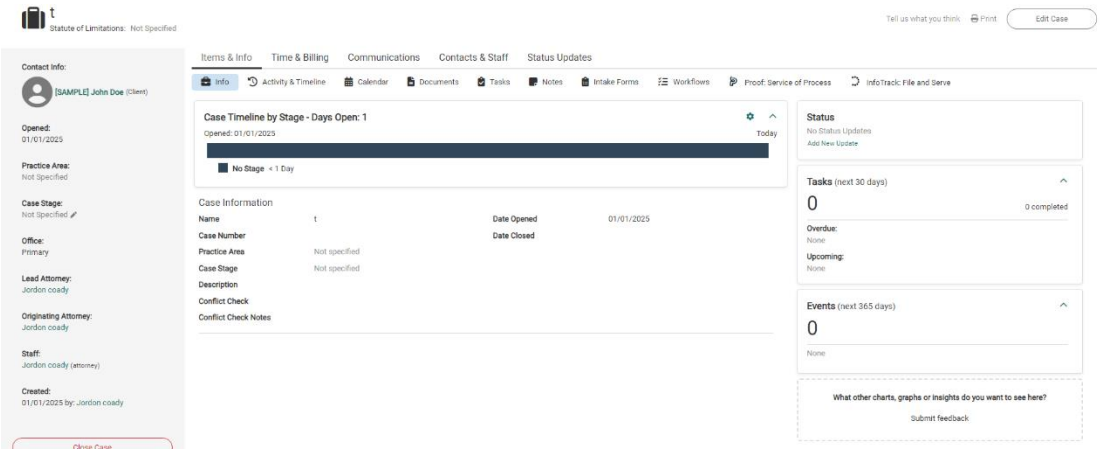
Mycase, much like Clio, offers expected features such as case and task tracking, time and expensive management, billing, calendaring and in application messaging, but mycase offers a more comprehensive CMS that extents to provide features for client intake which is referenced as leads.

Figure 3: Dashboard for mycase



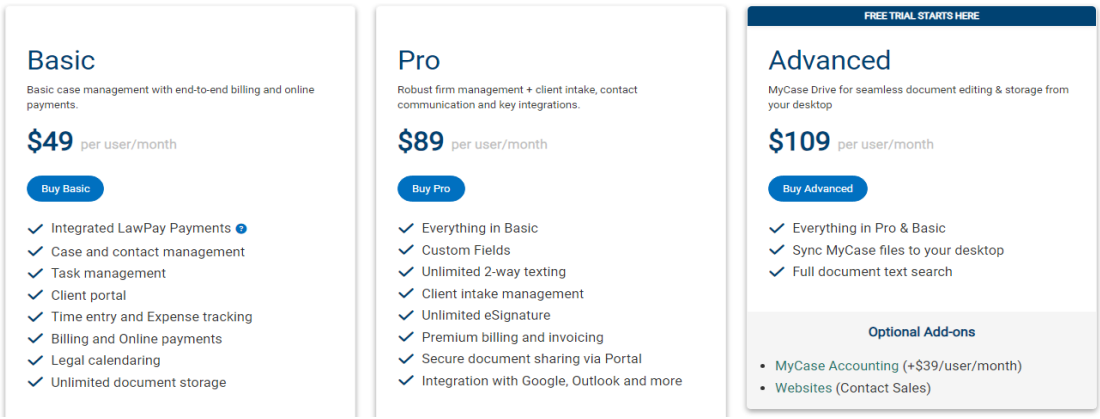
The presentation of the website does make this CMS solution overwhelming to navigate and use. There are a lot of sections and sub sections that are not necessary or could be segmented into their own components. Overall, the presentation is cluttered.

Figure 4: Case Page



This CMS solution does have a case dashboard with detailed information about the case, which I think is a good design choice. Each case has information about the client, total billing and hours worked, past/current tasks, and case documents.

Figure 5: Mycase Subscription Tiers



The lowest subscription tier does provide a lot of functionality required for an effective CMS but does not include the client intake functionality, however, it does allow clients to access a portal to view information about their case. The subscription is also tied to an individual user, meaning if a small firm wants this system implemented, they will have to pay for every solicitor that requires access, increasing the cost of running this CMS dramatically.

2.4 Development Gaps

On the student side of the PWA there is not an existing solution that encompasses all planned features of my progressive web application. Some partial solutions are LMSs, but they do not have supports for students transitioning to higher education, they are focused on students currently in higher education and are not accessible to individual users. This leaves an opportunity to develop a system that is available to users whether they are in higher education or not, it allows me to combine some known features of LMSs, such as assignment calendars and in application messaging, with a consultation system designed to advice students on career paths, potential course suitability, financial and well-being supports.

The legal side has clear existing solutions in place that offer high quality CMSs, but they do not have a system in place for automatic client allocation based on the client's needs. The presentation of the existing solutions also seemed over complicated, which is an area I can simplify and improve during development.

3. Risk Management

3.1 Risk Identification and Assessment

- **Technical Risk:** I will be incorporating many technologies into my project, some of which I am unfamiliar with, which will increase the complexity. This could result in unforeseen delays in development and or degradation in my PWA's performance.
- **Time Risk:** Due to the number of technologies being used, there is a risk that I might miss project milestones. This could result in incomplete features or service implementations.
- **Compliance and Legal Risk:** I intend to test my PWA with my fellow peers and friends during different development phases, to gather feedback. This means that protecting privacy, and user personal information is vital.
- **Operational Risk:** The backend of my project is dependent on AWS services, which can be subject to downtime or failure. This could result in loss of data and or loss of availability.
- **Vulnerability Risk:** I will be using many different libraries and components to serve my PWA, this poses a security risk to my application. When libraries become outdated, they can possibly introduce vulnerabilities.

3.2 Risk Mitigation Strategies

To counteract the mentioned risks, I have planned mitigation strategies:

- **Technical Risk Management**: I have studied the technologies I am unfamiliar with and looked at existing implementations to see how it will fit into my project.
- **Time Risk management:** During the development process I will be monitoring where I am with relation to my project timeline. If I am falling behind due to difficulties with implementing a specific technology, I will evaluate if I can move on without it. I will also ask for guidance if I encounter problems.
- **Compliance and Legal Risk Management:** I am using AWS services to create the API, which will use services like AWS Lambda and AWS API Gateway. Data protection for these services are the responsibility of AWS (Amazon, 2024). These services require the use of TLS 1.2 at minimum, which ensure that the cipher suites being used are strong. User registration and account detail storage will be handled through AWS Cognito. AWS will provide encryption at rest and in transit for this service (Amazon, 2024).
- **Operational Risk Management:** I will be using AWS CloudWatch to monitor logs which will inform me if any services are having issues in availability or performance degradation. I will also utilise backup features of the databases I will be using to prevent data loss.
- **Vulnerability Risk Management:** As I am developing the project, I will be utilising a CI/CD pipeline that will automatically scan new code and the dependencies/libraries using static application security testing (SAST) tools. This will generate reports that detail any issues in my project relating to outdated libraries or insecure programming.

4. System Requirements

4.1 Functional Requirements

Students should be able to:

- Complete an onboarding questionnaire that creates a student profile.
- Have Access to a course assignment tool that recommends suitable courses based on their profiles.
- A Time management tool that creates an assessment calendar based their academic calendars.
- Have access to financial, educational, well-being resources.
- Be allocated to a mentor based on their profiles.
- Select available timeslots for meeting with their mentors.
- Message their allocated mentors through the PWA and view previous conversations.
- Have access to a dashboard that centralises the above information for quick access.

Mentors should be able to:

- Have access to an appointment scheduling system that allows them to allocate their available times for meetings.
- Set tasks and deadlines for specific students.
- Be able to communicate with students through the PWA.

Solicitors should be to:

- View a dashboard that displays their active cases and overall case statistics.
- View an individual case which links to the client, tasks, all relevant documentation, past client communication, and total billables.
- Create tasks for cases and display them in a calendar.
- Communicate with their clients through the application.

Clients should be able to:

- Complete an onboarding process that creates a client profile which informs the allocation system on which solicitor will be best suited to their needs.
- View a dashboard that shows information about their case status.
- Communicate with their solicitor and view communication history.
- Upload documentation that is required by their solicitor.
- View current cost of projected cost of case.

4.2 Non-Functional Requirements

The progressive web application should:

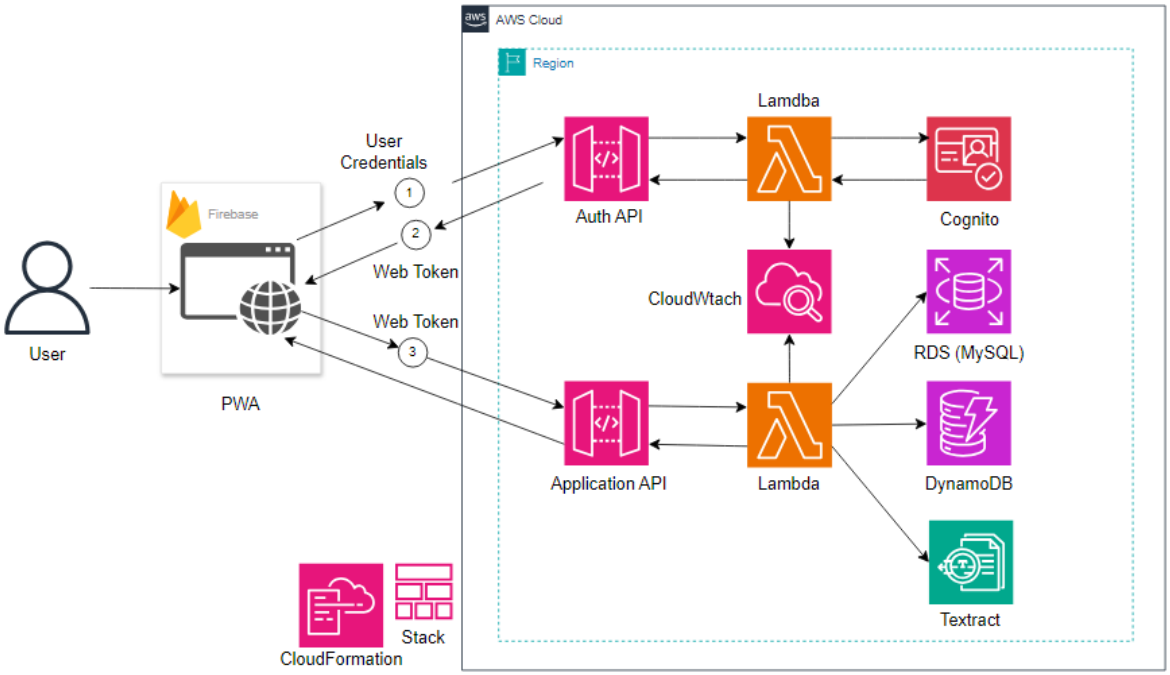
- Function seamlessly between all device types and have the ability to act as a mobile app with offline functionality.
- Have a clean and easy to navigate user interface that is intuitive.
- Be secure and be GDPR compliant.
- Preform data backups to prevent any data loss.
- Have high availability and reliability.
- Render and load pages quickly even if the application is receiving high amounts of traffic.

5 System Design

5.1 Architectural Design

5.1.1 Backend Architecture

Figure 6: AWS Architecture for Backend

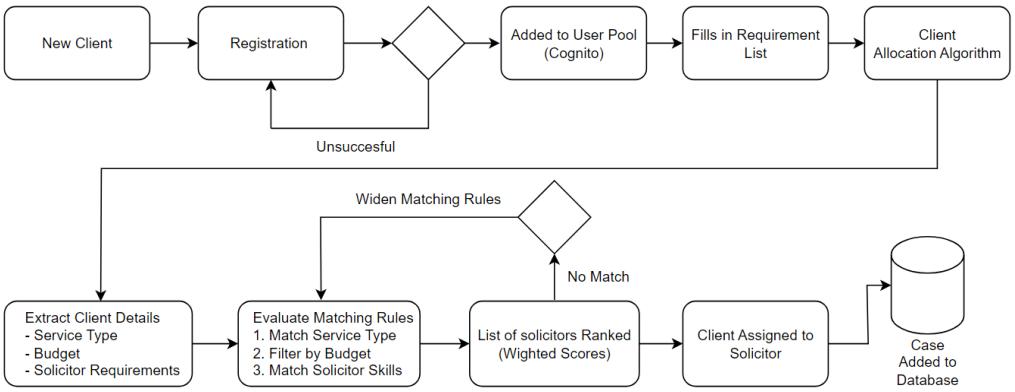


The above diagram defines how the backend architecture will be constructed. I will use CloudFormation to develop two stacks, one for user authentication and one for interacting with the applications API.

- **Auth API:** When a user tries to login/sign up their requests will be sent to the Auth API, the Auth API will then pass the information in the body of the request (Username, Password, Email) to the Lambdas functions. The Diagram only shows a single lambda function, but there will be multiple functions that provide different functionality (login, sign-up, confirm sign-up). Once a user has been verified by Cognito a JSON Web Token (JWT) will be assigned to them.
- **Application API:** The JWT will allow users to access the applications API and interact with services. There will be multiple Lambdas responsible for processing different requests. The legal side of the progressive web application will only need to access RDS. The student side will need to access DynamoDB and Textract.
- **CloudWatch:** Both API's will be logging to CloudWatch. When a Lambda is called the result of that call will be logged. This will allow me to troubleshoot issues, monitor performance and analyse access patterns. I can also set alarms, which will notify me if there is a high failure rate for specific services or request types.

5.1.2 Client Registration Flow

Figure 7: Flow Chart for Client Registration



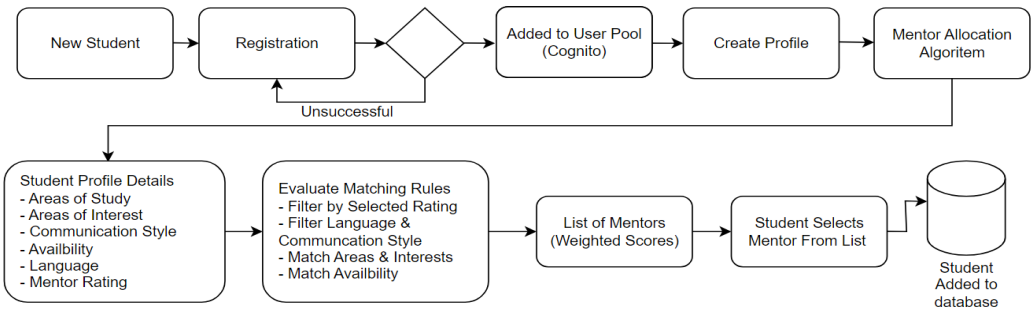
The above figure shows the flow of a new client creating an account. They will be asked to complete a form that builds a client profile. This profile will contain the following information:

- Required legal service type (e.g., family law, business law).
- Budget constraints.
- Solicitor Characteristics:
    - **Experience:** Number of years of practice, areas of expertise.
    - **Case History:** Previous cases handled, success rate.
    - **Languages Spoken**

The client profile will be passed to an algorithm which will utilise rule-based matching. The algorithm will apply matching rules and calculate a ranking for solicitors. The remining solicitors will be ranked using weighted scoring. There will be three categories that will be assigned weights which will be decided by the client. The categories are skill match, budget match, and Availability. Once the scores have been calculated for each category, an overall weighted score will be assigned to each solicitor. The highest ranked solicitor will be assigned to the client, and the case will be added to the database.

5.1.3 Student Registration Flow

Figure 8: Flow Chart for Student Registration



The above system will function the same as discussed in the client registration flow section. The same algorithm will be used for mentor allocation, but using different matching criteria, which can be seen in Figure 8.

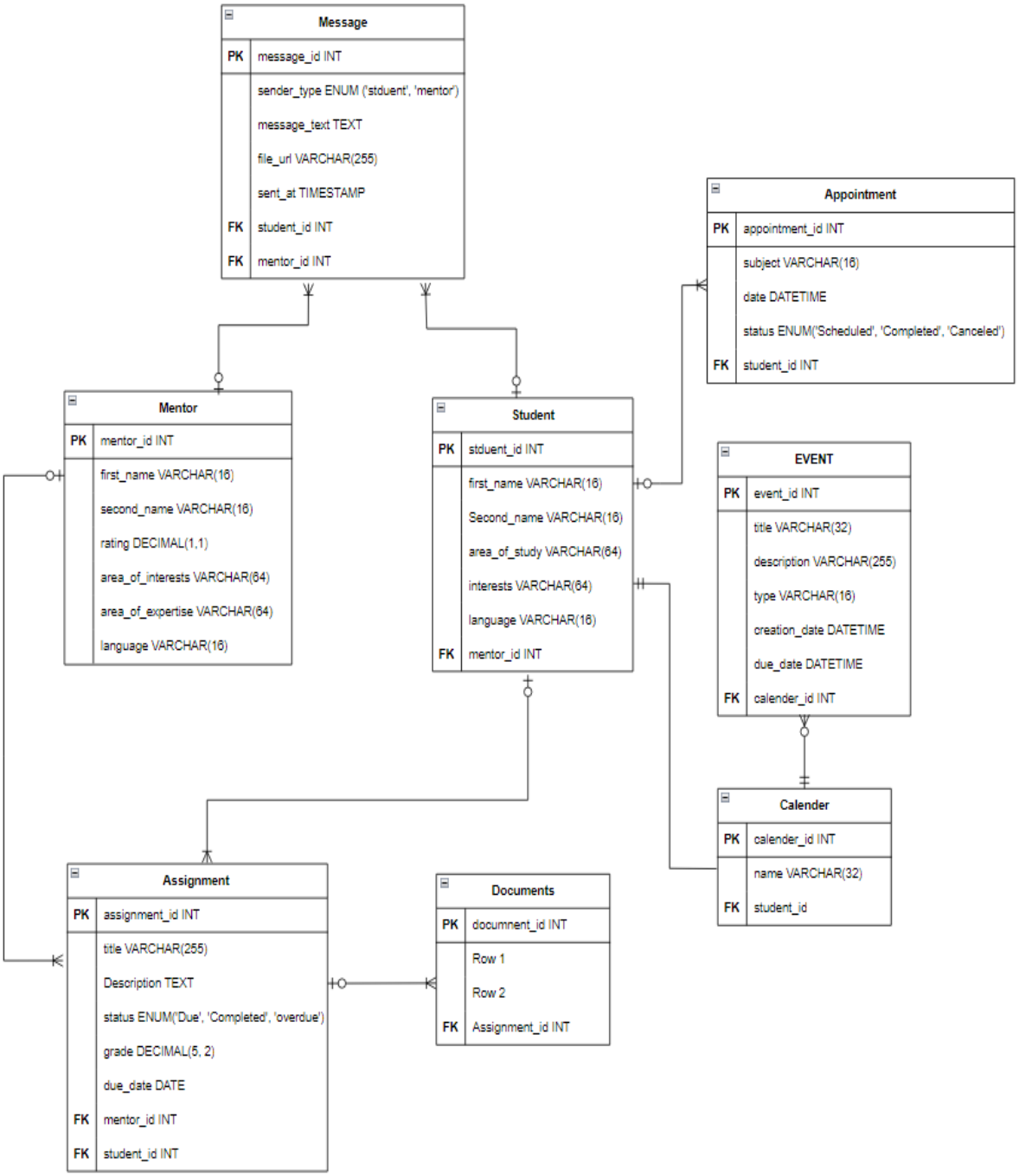
5.2 Database Design

5.2.1 CMS Entity-Relationship Diagram (ERD)

Figure 9: ER Diagram for Case Management System

5.2.1 Student Counselling Entity-Relationship Diagram (ERD)

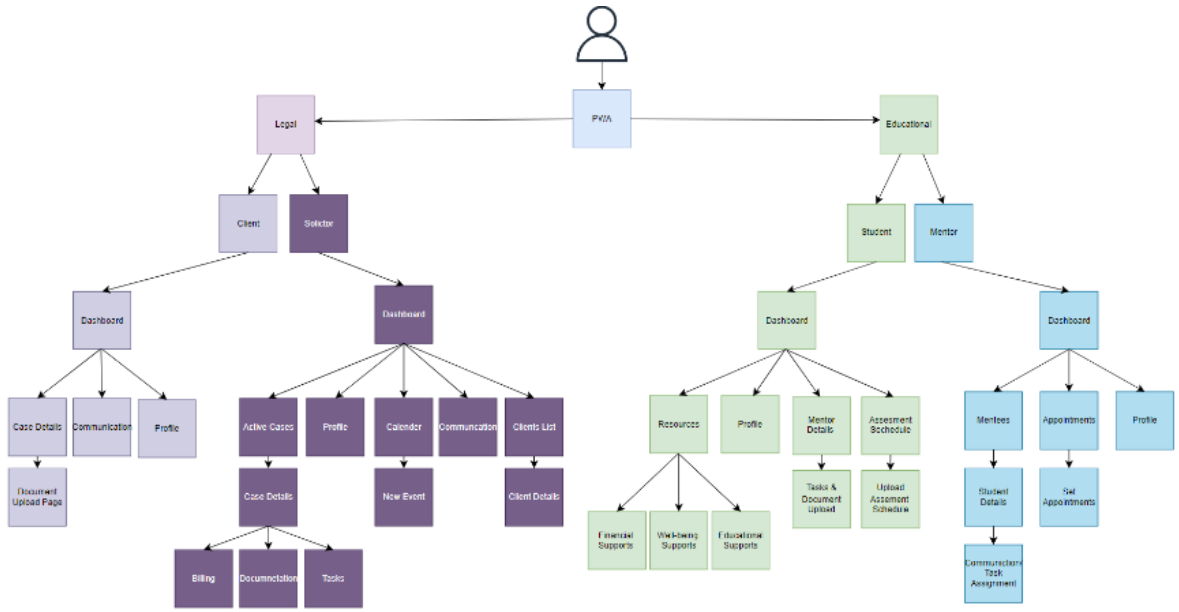
Figure 10: ER for Student Counselling System



5.3 User Interface Design

5.3.1 Site Map

Figure 11: Site Map Diagram

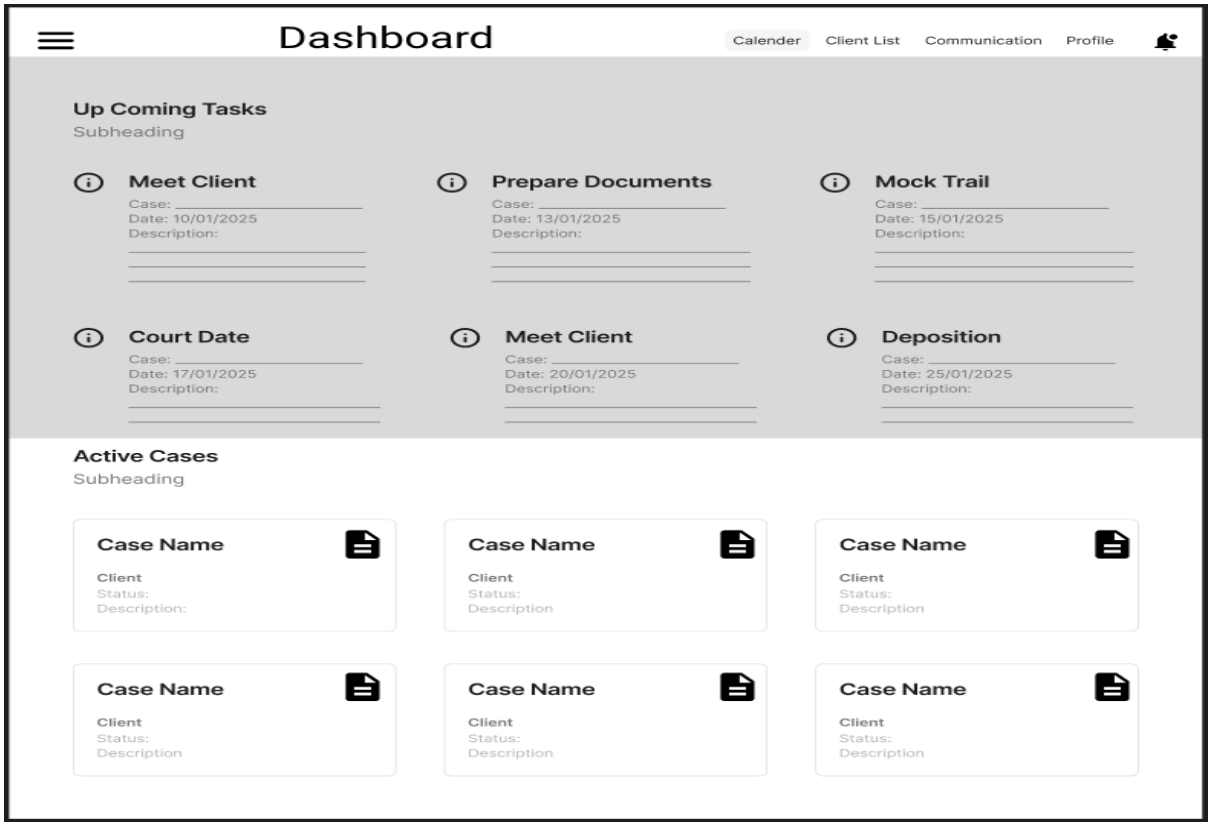


5.3.2 Login/Registration Page

Figure 12: Sign-in/Sign-up Page

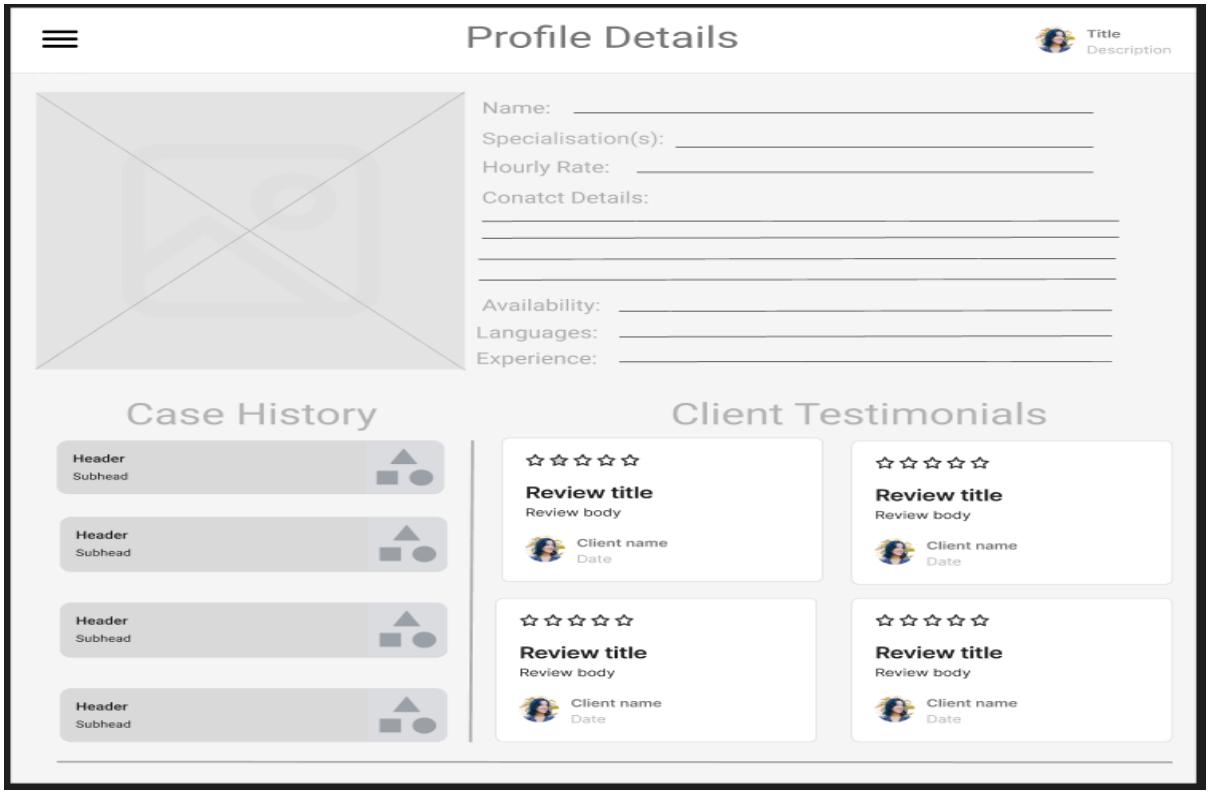
5.3.2 Solicitor Dashboard

Figure 13: Solicitor Dashboard Design



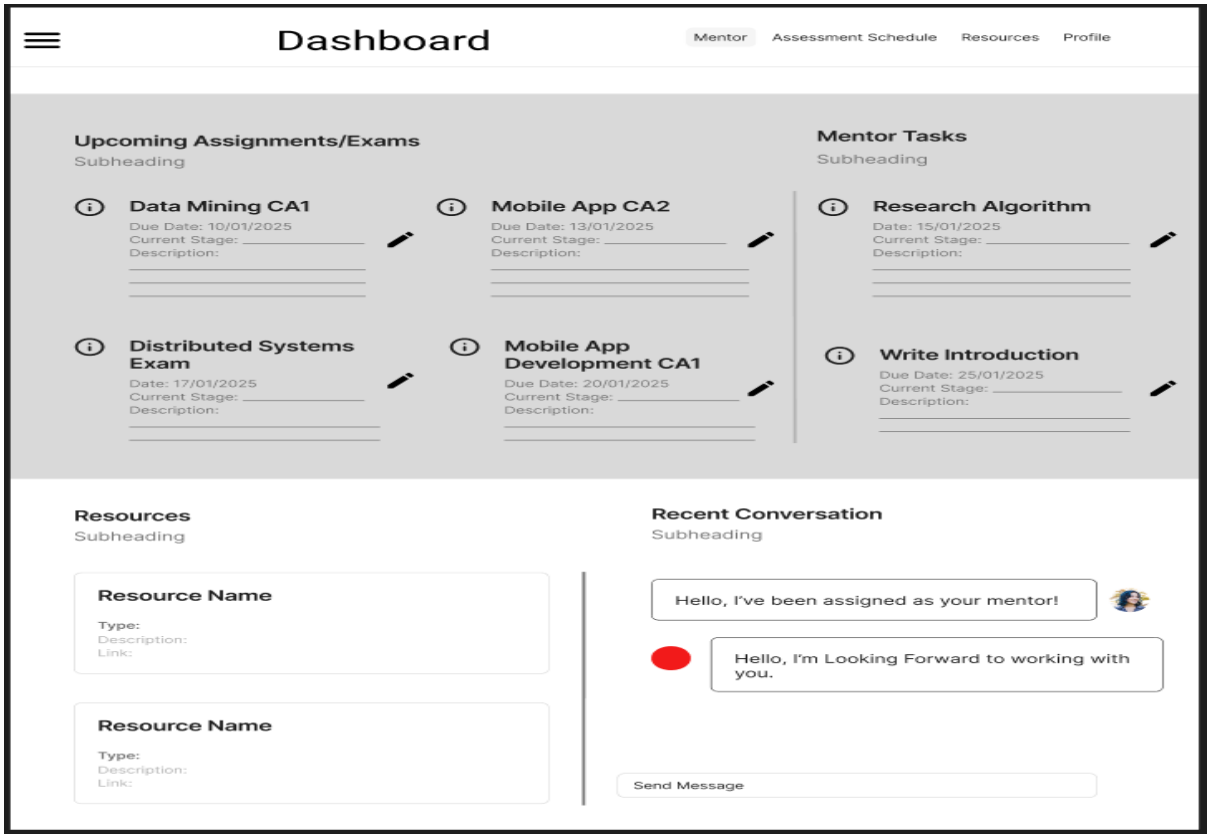
5.3.3 Solicitor Profile Page

Figure 14: Solicitor Profile Design



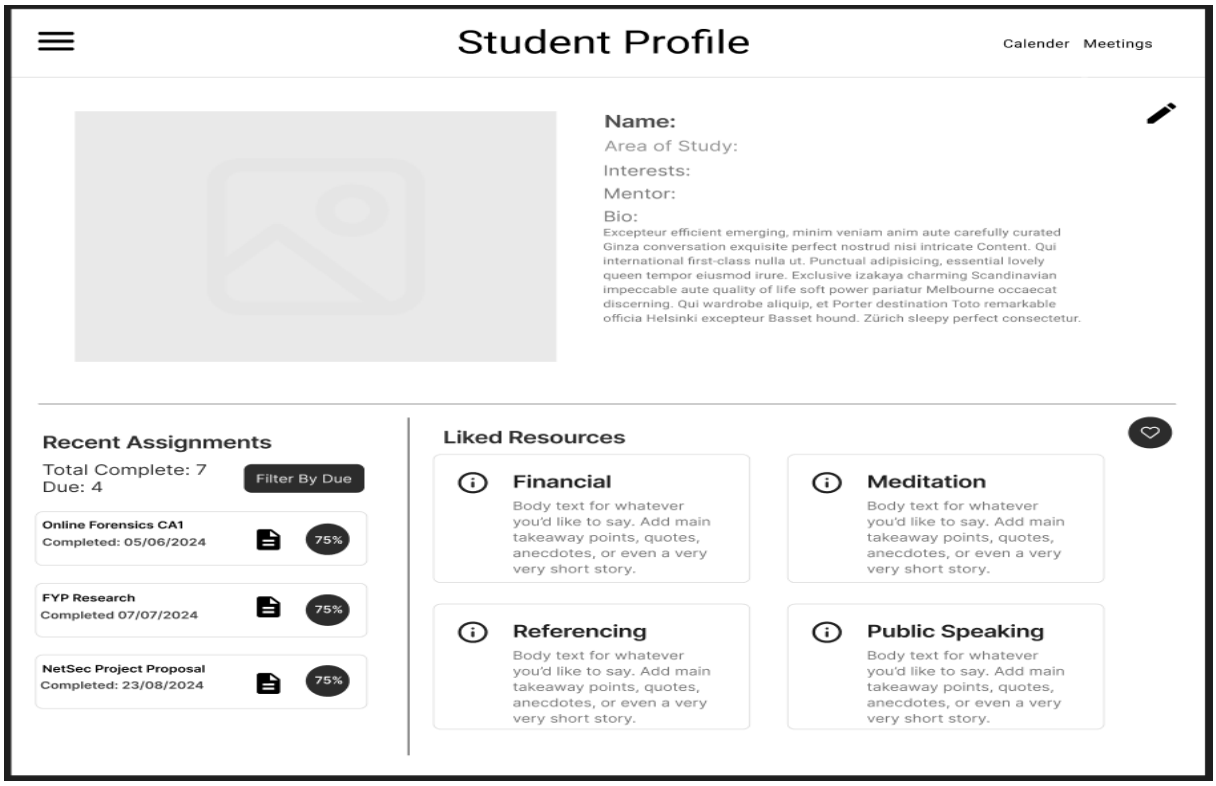
5.3.4 Student Dashboard Page

Figure 15: Student Dashboard Design



5.3.5 Student Profile Page

Figure 16: Student Profile Design



6 Technology Stack and Tools

6.1 Technology Stack

Frontend (JavaScript):

- **React:** Framework for creating a modular, responsive user interface. React has a strong ecosystem of prebuilt components that will also me to build the frontend quickly but will also allow me to repurpose them for separate parts of the PWA.
- **Bootstrap:** CSS framework that has pre-designed classes that will simplify styling the PWA.
- **Workbox** (Service Workers): For caching resources and enabling offline functionality and to handle features like background sync and push notifications.

Middleware:

- **React Query:** Library for managing server-state, handling data fetching, caching, and synchronization within the React application.
- **WebSocket API**: Provides a full-duplex communication channel, meaning it allows the client and server to communicate simultaneously which makes it perfect to facilitate the in-app messaging system (mozilla, 2024).

Backend (TypeScript):

- **AWS CloudFormation:** Allows me to manage and develop the below services as code. It will be used to build a serverless REST API and deploy it as a stack.
- **AWS Lambda:** Serverless compute for executing backend logic.
- **AWS API Gateway:** For managing and exposing secure and scalable endpoints.
- **AWS Cognito**: Will be used for user authentication and authorisation.
- **AWS Textract:** Used to extract users assessment schedules into customable for format.
- **AWS S3:** Used to store documents and images provide by the users.

Database System:

- **Amazon RDS (MySQL):** The case management system and student consultation will have complex relations and data structures that are unlikely to change, so SQL is best suited for this type of system.

6.2 Tools

1. **GitHub:** Source control management.
2. **GitHub Actions:** For creating a CI/CD Pipeline for automating code builds, testing, and deployment processes.
3. **SonarQube (via CI/CD):** SAST tool that will analyse my codebase for vulnerabilities and ensure secure coding practices.
4. **Zed Attack Proxy (ZAP):** DAST tool that will dynamically analyse the application during runtime for vulnerabilities.

5. **D3.js:** Will allow me to visualise data belonging to students, clients, solicitors and mentors.
6. **AWS CloudWatch:** Used to monitor the backend logs.
7. **Postman:** For testing API functionality.
8. **Visual Studio Code:** For developing the web application and AWS infrastructure.

7 Development Methodology

7.1 Research Methodologies

For a comprehensive report, I wanted to utilise two different methods of research, the first being **quantitative**. This mythology relies on using numeric data to support an underlying argument or thought. During the problem definition phase, I used different statistics to support the problems I was presenting. For example, I stated students find difficulty when transiting to higher education and supported that argument with statistical data, I also used the same process in the legal problem definitions. In addition, I also used **qualitative** to support my arguments. Qualitative research involves using data that describes, characterises or categorises information. The use of this can be seen, again, in the problem definition section.

The use of both research methodologies strengthens my understanding, but also, supports the information being stated throughout the report. Currently, all data referenced hasn't been collected by me, but this brings me to the next section, Agile Development.

7.2 Agile Development

Agile software development priorities that developers have the ability to be flexible in planning/implementation, that they should be more collaborative and focus on iterative progress. Below are the main values Agile promotes in their manifesto (Agile Allicance, 2024):

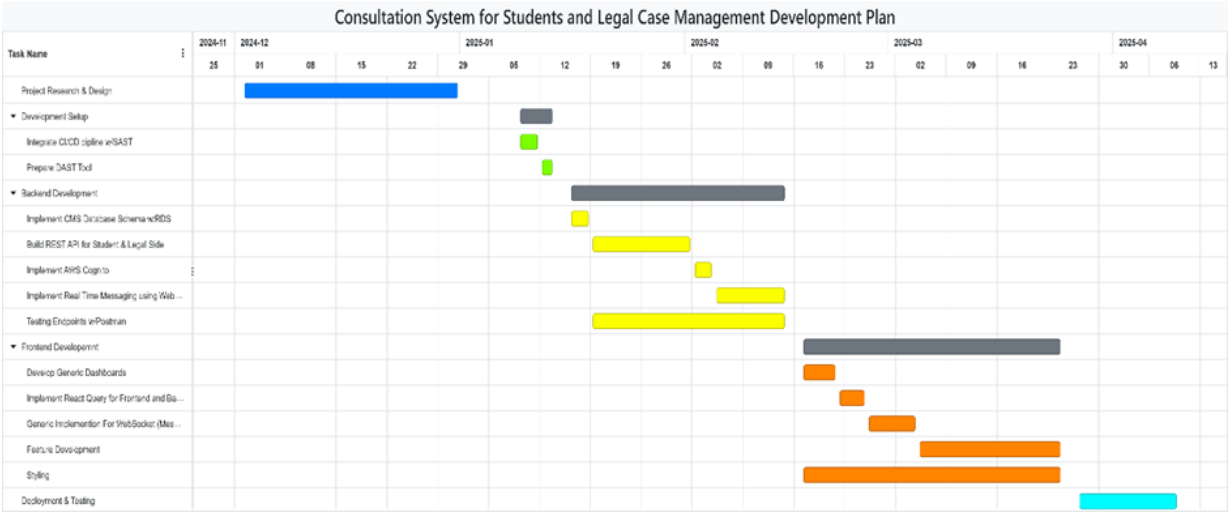
- "Individuals and interactions over processes and tools"
- "Working software over comprehensive documentation"
- "Customer collaboration over contract negotiation"
- "Responding to change over following a plan"

This development methodology is suitable for my project, as I will be continuously making development iterations, and it will allow me to reassess features or planned implementations and decide if it still suitable. It's important to state that Agile is an umbrella term for many development frameworks, this means I plan to adopt the Scrum-Agile approach to software development. Scrum uses defined sets of time for development called sprints. Scrum also focuses on re-evaluating and incorporating feedback, which ties back with qualitative research. I will be testing the functionality of my web application by allowing my peers to use and provide feedback. This feedback will be used to inform my development decisions. If I fall to implement some features or fully

implement them when a sprint is over, I will enter it into a backlog and leave it for another sprint, if possible. I will be using GitHub Issues to track uncompleted tasks.

In addition to adopting Scrum-Agile principles, I plan to integrate a CI/CD pipeline into my development process. This pipeline will automate testing and deployment, ensuring that as code changes occur, they are automatically tested for bad coding practices and potential vulnerabilities using Static Application Security Testing (SAST) tools. When the web application is running, I will perform penetration testing using Dynamic Application Security Testing tools (DAST). The combination of these security tools development methodology supports iterative and continuous delivery but also maintains the security and quality of the codebase.

8 Project Timeline



Following the Scrum-Agile methodology, there is one planning and research phase and four distinct sprints that focus on developing different components of my project. The current stage I'm in is research and design. This stage includes defining the architecture, technologies, features my project will need, but also, it involves background research on the problem definitions. This phase will last until the 30th of December.

The first sprint is when development will begin and it will be focused on setting up my development environments, by creating repositories on GitHub and using GitHub Actions to implement a CI/CD pipeline with a SAST tool. This sprint will last from January 9th to the 13th. I don't anticipate any problems during this sprint.

The second sprint focuses on developing the backend of my PWA. I anticipate this sprint to be the most difficult, which is the reason I'm tackling this early. After implementing my CMS schemas in RDS (MySQL), I'll start creating the REST API, during this process I will be testing as I'm developing using postman. Implementing WebSocket may be challenge as this is a new technology to me. This sprint will last from January 16th to February 14th.

The Third sprint consists of developing the frontend. The initial focus will be creating reusable components for both sides of the PWA (Legal & Student). Then moving onto

connecting the backend with the frontend. Then moving onto creating the features I specified in the solution section. I will be styling each component as I'm developing.

The last sprint will be about moving away from production to deploying the PWA and testing it. Important to note during every sprint a certain level of testing is being done automatically through the integration of the CI/CD pipeline w/SAST and additionally using DAST tools to test for vulnerabilities.

9 Conclusion

In conclusion, the transition from secondary school to higher education and the challenges faced by legal professionals highlight significant gaps in both sectors that can be addressed through technology. For students, the lack of preparation for higher education demands a solution that provides the necessary tools for time management, academic support, and career guidance. Similarly, the legal profession faces challenges in managing caseloads and matching clients with suitable solicitors, which can be alleviated through an efficient case management system. The development of a Progressive Web Application (PWA) that integrates these solutions will offer a seamless experience across devices, improve accessibility, and provide key functionalities to both students and legal professionals. By using modern web technologies, implementing Agile principles, and ensuring robust security measures, this project aims to deliver a valuable platform that enhances user engagement, supports academic success, and streamlines legal case management. Ultimately, the PWA will help users in both educational and legal domains to manage their responsibilities effectively while mitigating the stress associated with their respective transitions.

10 Declaration

I, Jordon Coady (20096529), hereby declare that all the work submitted by me in this project is entirely my own, and any external sources of information have been properly and fully acknowledged through citation. I have not engaged in any form of plagiarism, and I am aware of the consequences it may entail, including the possibility of receiving a failing grade for the assignment, academic disciplinary actions, and damage to my academic and professional reputation. By submitting this work, I take full responsibility for the content and integrity of this work, and it adheres to Southeast Technological University's plagiarism policies.

Signed: Jordon Coady 03/01/2025

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