VCU College of Engineering

CS25-303-SON-Clinicians

Preliminary Design Report

Prepared for

Dr. Jered Wendte

VCU School of Nursing

By

Tyree Carpenter

Shikriti Ghosh

Ebenezer Hailu

Wyatt Herkamp

Under the supervision of

Dr. John Leonard

December 06, 2024

Executive Summary

This capstone project aims to develop a comprehensive health data analytics system that leverages previous participant data to improve participant outcomes in healthcare settings. The project is driven by the need for efficient data processing and analysis in the medical field, allowing healthcare providers to make informed decisions based on real-time data insights.

The primary objectives of this project include:

- Data Collection: Acquire health-related datasets to serve as a foundation for analysis.
- User Interface: Develop a user-friendly interface for healthcare professionals to access and interact with the data analytics system.

Key design requirements involve adherence to medical codes and standards to ensure the system's safety, reliability, and effectiveness. The project deliverables consist of the following:

- A functional prototype of the health data analytics system.
- Detailed documentation of the algorithms used and their effectiveness.
- User manuals for healthcare professionals.

As of now, significant progress has been made in identifying relevant datasets. The project is currently on schedule, with the timeline outlining key milestones for completion within the designated time frame. By focusing on a budget of $1,000, the project intends to utilize primarily free resources, optimizing expenditure while maximizing output quality. The successful execution of this project has the potential to significantly enhance data-driven decision-making in healthcare, ultimately leading to improved patient care and operational efficiency.

Table of Contents

Section A. Problem Statement

VCU's Mobile Health and Wellness Program (MHWP) aims to provide consistent and personalized care to its participants, but the current process presents challenges for clinicians. With multiple clinicians rotating between appointments, there's often limited time to review participants' past health information, goals, and progress. If the clinician who saw a participant last time is unavailable, the next clinician may lack critical context, leading to inconsistent or delayed care. This issue is especially problematic in mobile settings, where quick, on-the-go access to participant data is essential.

The primary problem is the inefficiency of accessing participant information in real-time, particularly when clinicians rely on tablets or laptops. The current system forces clinicians to spend valuable time reviewing records rather than focusing on participant needs, risking miscommunication and suboptimal care.

To solve this, we are developing a tablet-based application (also compatible with laptops) that allows clinicians to quickly access participant histories, previous goals, and current well-being before an appointment. This solution will improve care continuity, minimize delays, and ensure clinicians are fully prepared to meet participant needs, even if they are meeting them for the first time.

Stakeholders include MHWP clinicians, program participants, and VCU administrators. This project will help the MHWP deliver more efficient, personalized care, improving both participant outcomes and clinician workflow.

(NEEDS TO BE UPDATED TO INCLUDE ALLOWING INSERTION OF PATIENT DATA)

Section B. Engineering Design Requirements

B.1 Project Goals (i.e. Client Needs)

The overall goal of this project is to enhance the efficiency and effectiveness of VCU's Mobile Health and Wellness Program (MHWP) by improving clinicians' access to participant information. The solution will address the need for quick, easy access to health data and goal tracking, enabling clinicians to provide consistent, personalized care, regardless of which clinician meets with a participant. The goals focus on improving workflow, reducing care delays, and ensuring better health outcomes for participants.

The key project goals include:

- Improve access to participant health histories, goals, and progress before appointments.
- Enhance continuity of care by allowing clinicians to seamlessly pick up where the last clinician left off.
- Ensure compatibility of the application on both tablet and laptop devices for flexibility in various work environments.
- Reduce time spent reviewing participant information, allowing clinicians to focus more on direct care.
- Streamline data management to avoid redundancy and prevent gaps in participant care.
- Allow for this interface to allow the clinician to quickly input new data as necessary to improve workflow.

These goals reflect the client's need for a solution that optimizes care delivery while supporting the mobile nature of the MHWP, and including support for the clinicians to update existing data and input new data.

B.2 Design Objectives

The design of the tablet-based application for VCU's Mobile Health and Wellness Program (MHWP) will focus on addressing the specific needs of clinicians for efficient and reliable access to participant information. These objectives outline what the design will accomplish, ensuring that it meets the functional needs of the program in a measurable and achievable way.

The key design objectives are:

- The design will provide instant access to participant health histories, goals, and progress on both tablet and laptop devices.
- The design will allow clinicians to update and review participant data in real time with minimal loading times.

- The design will support seamless transitions between clinicians, allowing them to easily review what was last discussed or accomplished with a participant.
- The design will integrate secure data storage and retrieval, ensuring compliance with health data privacy standards (e.g., HIPAA).
- The design will offer a user-friendly interface that reduces time spent navigating records, optimizing the workflow within a mobile or fast-paced clinical setting.
- The design will be completed and fully operational within the project's set timeline, ensuring that it is deployable within the MHWP's specified schedule.
- These objectives are SMART, ensuring that the application is practical, measurable in terms of performance, achievable with available resources, and realistic for the mobile health setting.

B.3 Design Specifications and Constraints

The design for the tablet-based application for VCU's Mobile Health and Wellness Program (MHWP) will have specific constraints and measurable specifications to ensure the solution meets the necessary objectives. These constraints define the limits within which the design must operate, while the specifications will be used to assess the success of the final product.

Key design specifications and constraints include:

- Compatibility constraint: The design must be fully functional on both tablets and laptops, with screen sizes ranging between 9–15 inches.
- Data security constraint: The application must comply with HIPAA regulations, ensuring all participant data is encrypted and securely stored to meet healthcare privacy standards.
- Performance specification: The application must load participant data within 3 seconds on average, to support quick decision-making in fast-paced clinical settings.
- Data storage specification: The application must handle and store information for at least 1,000 participants, ensuring scalability as the MHWP expands.
- Interoperability constraint: The design must integrate with existing MHWP systems, including current participant databases and health information software, with 100% synchronization to avoid data conflicts.
- User interface constraint: The application must be navigable within 3 clicks to reach key participant information, ensuring usability within a mobile workflow.
- Power consumption specification: On a fully charged tablet, the application must function for at least 8 hours, maintaining usability for a full clinical shift.
- Timeline constraint: The design must be completed and deployed within 6 months, aligning with the MHWP's operational schedule.

B.4 Codes and Standards

The design of the tablet-based application for VCU's Mobile Health and Wellness Program (MHWP) must adhere to various medical and computer science-related codes and standards to ensure legal compliance, safety, data security, and system interoperability. These guidelines set crucial constraints for both the medical and technical aspects of the project.

Key codes and standards include:

- HIPAA (Health Insurance Portability and Accountability Act): This federal law requires the application to protect patient health information (PHI) through encryption, access control, and secure data transmission. Compliance with HIPAA ensures that participant data is handled with confidentiality and privacy safeguards.
- HL7 Standards (Health Level 7): HL7 sets interoperability standards for the exchange, integration, sharing, and retrieval of electronic health information. The application must adhere to HL7 protocols to ensure seamless communication with existing health information systems used by MHWP.
- ISO/IEC 27001 (Information Security Management): This standard provides a framework for managing information security. The application must meet ISO 27001 guidelines for protecting sensitive participant data and ensuring that security risks are systematically evaluated and addressed.
- ISO 9241-210 (Ergonomics of Human-System Interaction): This standard focuses on usability and user experience, ensuring the application's interface is easy to navigate and accessible for clinicians, reducing cognitive load and minimizing user error during fast-paced clinical work.
- IEEE 11073 (Health Informatics – Personal Health Device Communication): The application may need to support communication between medical devices and information systems. Compliance with IEEE 11073 ensures interoperability with personal health devices that may be used by clinicians during participant care.
- WCAG 2.1 (Web Content Accessibility Guidelines): The application must meet WCAG 2.1 standards to ensure accessibility for all users, including clinicians with disabilities. This includes ensuring proper navigation, screen reader compatibility, and color contrast.
- OSHA 1910 (Occupational Safety and Health Standards): If the application requires specific workplace practices for ergonomic or data security equipment, it should align with OSHA standards to ensure that clinicians work in safe and compliant environments.
- NIST SP 800-53 (National Institute of Standards and Technology Security and Privacy Controls): This document provides guidelines on securing information systems, which the application must follow to meet federal-level security requirements, particularly for handling health data in the U.S.

By adhering to these codes and standards, the project will ensure the safety, reliability, security, and interoperability required for a healthcare application that deals with sensitive participant information in a mobile and clinical setting.
The deliverables for this project include all key outputs that will be provided to VCU's Mobile Health and Wellness Program (MHWP) as part of the engineering design process. The

deliverables will ensure the tablet-based application meets clinical needs and supports both tablet and laptop use.

Section C. Scope of Work

The project scope defines the boundaries of the project encompassing the key objectives, timeline, milestones and deliverables. It clearly defines the responsibility of the team and the process by which the proposed work will be verified and approved. A clear scope helps to facilitate understanding of the project, reduce ambiguities and risk, and manage expectations. In addition to stating the responsibilities of the team, it should also explicitly state those tasks which fall *outside* of the team's responsibilities. *Explicit bounds* on the project timeline, available funds, and promised deliverables should be clearly stated. These boundaries help to avoid *scope creep*, or changes to the scope of the project without any control. This section also defines the project approach, the development methodology used in developing the solution, such as waterfall or agile (shall be chosen in concert with the faculty advisor and/or project sponsor). Good communication with the project sponsor and faculty advisor is the most effective way to stay within scope and make sure all objectives and deliverables are met on time and on budget.

C.1 Deliverables

The deliverables for this project include all key outputs that will be provided to VCU's Mobile Health and Wellness Program (MHWP) as part of the engineering design process. The deliverables will ensure the tablet-based application meets clinical needs and supports both tablet and laptop use.
Project Deliverables: A fully functioning tablet-based application for MHWP, accessible on both tablet and laptop Design documentation including:

- User interface mockups and interaction flow diagrams Functional requirements and design specifications
- Data flow diagrams and system architecture Secure login and patient information retrieval features
- Integration with VCU's existing health records system (HL7-compliant) Code repository with all relevant code (frontend, backend, database)
- User manuals and training materials for clinicians
- Testing and evaluation reports demonstrating that the application meets security and usability standards (e.g., HIPAA compliance, user experience testing)

Academic deliverables including: Team contract, project proposal, and preliminary design report Fall semester poster and presentation Final design report and Capstone EXPO poster and presentation

C.2 Milestones

The following table outlines key milestones for the development of the tablet-based application for VCU's Mobile Health and Wellness Program (MHWP). These milestones are designed to ensure smooth progress, timely completion, and alignment with the project's overall goals.

Milestone	Description	Timeframe	Completion Date
Initial Requirements Gathering	Meet with MHWP team to understand clinical needs	2 weeks	Oct 10th, 2024
Prototype	Initial User interface design	2 weeks	Oct 23, 2024
Prototype Revised	User interface is revised	2 weeks	Nov 07, 2024
MVP	Minimum Viable Product	1 Month	January 16, 2025
1st MVP Revision	1st Revision of MVP	2 weeks	February 01, 2025

C.3 Resources

Resource Type	Description	Source	Estimated Cost
Hardware	Basic laptop and iPad for prototype testing	Project Budget	$800
Software	Open-source Integrated Development Environment (IDE) for coding	Free (e.g., VS Code)	$0

Data Analysis Platform	Free tools for statistical analysis and visualization (e.g., Google Sheets)	Free	$0
Version Control System	GitHub for version control and collaboration	Free (open-source)	$0
Cloud Computing Services	The free tier of AWS or Google Cloud for limited processing and storage	Free	$0
Databases	Access to free health data sources for testing and validation	Project Budget	$0
Libraries/APIs	Open-source libraries for predictive analytics and machine learning (e.g., TensorFlow, Scikit-learn)	Free	$0

Total Estimated Cost: $800

This version reflects a focus on utilizing only free resources, and maximizing the budget for any necessary purchases or other project expenses.

Section D. Concept Generation

Inputting Data

Inputting of clinician data. We want to allow the clinicians to input data. Such as adding new participants, adding case notes, updating goals, and other health input taken by Red Cap. This will give them a more modern feel to what they are already doing because Red Cap is …

- **Add New Participants**: Simplify participant onboarding by providing clear forms with dropdowns, auto-fill suggestions, and error-checking to ensure accurate data input.
- **Add Case Notes**: Enable clinicians to enter detailed notes during or after appointments, with options to tag notes for easy reference and categorize them by session date, topic, or goal.
- **Update Goals**: Provide a streamlined way to set, track, and revise participant goals with clear indicators of progress and timestamps for accountability.
- **Input Health Data**: Allow integration with other systems, such as Red Cap, but with a modern, user-friendly design that reduces the manual effort required to input vital signs, lab results, or other metrics.

Key Benefits:

- Streamlines workflows by modernizing a critical aspect of clinician duties.
- Improves data consistency and reduces errors compared to the existing system.
- Enhances clinician satisfaction by making their tools more responsive and aligned with their needs.

Potential Challenges:

- High development costs for building a custom data-input system.
- Initial training is required for clinicians unfamiliar with the new interface.

Medication Input

When inputting participant medications it would be treated as a search. So clinicians do not have to have perfect spelling. It would also be helpful with linking generics with name brands

Search Functionality: Allow clinicians to input medications without perfect spelling, auto-correcting or suggesting similar matches based on incomplete inputs.

• **Linking Generics with Brand Names**: Automatically display equivalent generic and brand-name medications to reduce confusion and ensure accuracy.

• **Integrated Database**: Pull from a comprehensive, up-to-date medication library, providing information such as dosages, interactions, and contraindications directly in the interface.

• **Error Reduction**: Include safeguards, such as alerts for potential duplicates or interactions, to enhance patient safety.

Key Benefits:

• Reduces the time spent entering and verifying medications.

• Minimizes errors associated with manual input and improves accuracy.

• Ensures clinicians have access to comprehensive medication information at their fingertips.

Potential Challenges:

• Requires integration with a reliable medication database that must be regularly updated.

• Could face initial resistance if the system suggests medications that clinicians are unfamiliar with.

Visual Representations of Data

Help visualize and show participants goals by showing progress in a timeline manner. Allowing it to be a visual representation of what is already in the red cap. Allowing the clinician

Timeline Visualization: Show progress over time, linking key events such as appointment dates, updated goals, and completed milestones.

• **Goal Tracking**: Use charts or gauges to represent participant progress toward goals, making it easier for clinicians to discuss progress with participants during sessions.

• **Case Summary Dashboard**: Present a snapshot of a participant's history, including recent updates, upcoming goals, and critical notes, to reduce time spent searching for information.

• **Customizable Views**: Allow clinicians to personalize their dashboard to focus on the data most relevant to their workflow.

Key Benefits:

• Improves data accessibility by organizing information visually rather than textually.

• Reduces time spent reviewing case notes and histories, supporting the goal of streamlining workflows.

• Enhances participant engagement during sessions by providing a clear and understandable picture of their progress.

Potential Challenges:

• Requires thoughtful design to avoid cluttered or overwhelming visuals, especially for participants with extensive histories.

• Development cost for creating dynamic and customizable visualizations.

Section E. Concept Evaluation and Selection

Inputting Data

- Advantages: Modernizes data entry processes, making workflows simpler and more efficient for clinicians. Reduces the frustration associated with using RedCAP. Directly supports project goals of improving workflow and streamlining data management.

- Challenges: Higher development cost due to creating a full data-input system. The potential learning curve for clinicians who are accustomed to RedCAP.
- Potential Success: High, as it directly addresses major pain points and aligns well with design goals.

Medication Input

- Advantages: Improves accuracy and efficiency by allowing clinicians to search for medications, reducing errors associated with manual input. Links generics and brand names, enhancing clarity.
- Challenges: Taking medication details from the FDA. This introduces more time processing and managing that data set
- Potential Success: High, as it resolves a specific pain point, but it may not address broader workflow issues.

Visual Representations of Data

- Advantages: Provides a quick and clear way to visualize participant progress and goals. Greatly enhances data accessibility and reduces time spent reviewing case notes.
- Challenges: Implementation cost and risk of creating cluttered or confusing visuals for participants with extensive histories. Limited improvement to data entry workflows.
- Potential Success: High, as it directly addresses major pain points and aligns well with design goals.

	Inputting Data	Medication Input	Visual Representation of Data
Performance	5	3	3
Ease of Use	5	5	5
Scalability	3	3	5
Adoption Potential	4	5	5
Reliability	5	3	5
Total Score	22	16	23

Section F. Design Methodology

The design methodology outlines the iterative process used to evaluate, improve, and validate the health data analytics system for VCU's MHWP. This methodology ensures the final system meets all functional requirements and design specifications, addressing both clinician and participant needs.

1. Iterative Engineering Design Process

- **Prototype Development**
  A functional prototype will be developed, incorporating the core features: participant history access, the "Add Visit" functionality, and a secure user interface.
- **Testing and Feedback**
  Iterative testing cycles with MHWP clinicians will guide the refinement of features, focusing on ease of use and reliability.
- **Final Validation**
  The final version of the system will undergo rigorous testing to ensure compliance with technical requirements, medical standards, and user expectations.

2. Verification and Validation Process

- **Verification**
  The system will be checked against the following specifications:
    - Accurate data retrieval and display for participant histories.
    - Secure data storage, meeting HIPAA compliance.

    - Functional "Add Visit" feature tested for reliability across devices.
- **Validation**
  Validation ensures the system functions as intended by conducting real-world usability tests with clinicians. Success criteria include:
    - Reduction in time taken to access participant information.
    - Clinician satisfaction scores above 85% during pilot testing.

3. Computer-Aided Modeling and Tools

- **Software Used**
    - **Figma**: For user interface design and prototyping.
    - **Postman**: For API testing and debugging.
    - **Excel/Power BI**: For analyzing test data and visualizing metrics.
- **Boundary Conditions and Assumptions**
    - Participant data is consistently backed up to a cloud database.
    - The system operates within a stable Wi-Fi or cellular environment.

4. Experimental Testing Methods

- **Testing Equipment**
    1. Tablets and laptops preloaded with the prototype application.
    2. Simulated participant profiles for testing.
- **Test Setup**
  Mock appointments will replicate real-world scenarios, with clinicians using the system to perform routine tasks.
- **Testing Procedures**
    1. Measure the time taken to access participant histories.
    2. Test the accuracy and reliability of the "Add Visit" functionality.
    3. Collect feedback via surveys and interviews.

5. Prototype Evaluation

Each prototype iteration will be evaluated based on:

1. **Functionality**: Ensuring all features operate correctly.
2. **Performance**: Testing for low latency and fast response times.
3. **Usability**: Gathering clinician feedback to refine navigation and design.
4. **Compliance**: Verifying adherence to medical codes and standards.

Section G. Results and Design Details

Use this section to highlight the major results of the design methodology described above including important analytical, computational, experimental, modeling, assembly, and testing results. This section should be one of the most substantial sections of the report showcasing all of the hard work and effort that went into the completion of the final design and delivery of the project deliverables. Show how the identified problem was solved.

Highlight the prominent features of the final design through analysis results, modeling, drawings, renderings, circuit schematics, instrumentation diagrams, flow and piping diagrams, etc. to show that the design functions as intended and meets all design objectives and constraints. Overview designs such as dataflow diagrams, process flow, swim lane diagrams, as well as presentation-layer designs (e.g. storyboards for front-ends) should be included here. Detailed designs such as database designs, software designs, procedure flowcharts, or pseudocode should be included here. Support computational and experimental results with key plots and figures. All supporting figures should be clearly labeled and annotated to highlight the most important points of the figure (i.e. explicitly point out what the reader should focus on or understand about the image).

Note that while all results should be used to help inform design decisions, not all results may be necessary to include in the main body of the report. Extraneous supporting results (e.g. graphs, data, design renderings, drawings, etc.) that are not necessary for presenting the fundamental findings can be placed in one or more appendices. Detailed documentation of each program module can be provided as an appendix.

G.1 Modeling Results (example subsection)

G.2 Experimental Results (example subsection)

G.3 Prototyping and Testing Results (example subsection)

G.4. Final Design Details/Specifications (example subsection)

Note that while the design constraints and specifications may have provided minimum or maximum values, or ranges or values, that the design needed to meet, the final design specifications should be listed here showing that the required design values were met. A list of final design details can also be included to demonstrate fulfillment of the design objectives.

Note: Preliminary results should be included in the Preliminary Design Report to show the progress made of the selected design concept to-date. This section should be updated for the Final Design Report to include documentation of all of the work that was completed on the project throughout the entirety of the academic year.

Section H. Societal Impacts of Design

H.1 Public Health, Safety, and Welfare

This project's goal it help the Mobile Health and Wellness program provide welfare and health resources for the public the goal of our project is to help them do that. Provide them with resources and tools to help them do their service to the public

H.2 Societal Impacts

Providing services for the community

The Mobile Health and Wellness program provides a great service for the community of Richmond this project will not have a direct impact on the community but will hope to have an impact on the clinicians who do have an impact on the community around us.

Ease of Use for Clinicians

The design of our project will allow clinicians to have an easier experience with data input and retrieval. This will allow for the clinician to spend more time with participants and be more ready for meetings with the participants

H.3 Political/Regulatory Impacts

H.4. Economic Impacts

H.5 Environmental Impacts

H.6 Global Impacts

H.7. Ethical Considerations

Keeping Data Secure

The primary ethical consideration is keeping participant data secure. Participant data should be kept as secure as possible. Following all regulations regarding HIPPA regulations. We want to keep the same level of confidentiality that they have in Red Cap in our project so the clinicians and participants feel safe in inputting data into it.

Section I. Cost Analysis

For this project, no direct costs are anticipated, as the development and implementation of the software will be carried out entirely by the student team. Since we are leveraging existing resources such as university-provided development tools, software licenses, and equipment, there are no expenditures for hardware, third-party software, or external services. Additionally, as students, we are not incurring labor costs, and our prototype will consist solely of software developed during the course of the project. While a production-ready system might require funding for advanced features, professional testing, or deployment infrastructure, these costs are beyond the scope of this project. Therefore, this cost analysis section will remain cost-free for the duration of the project.

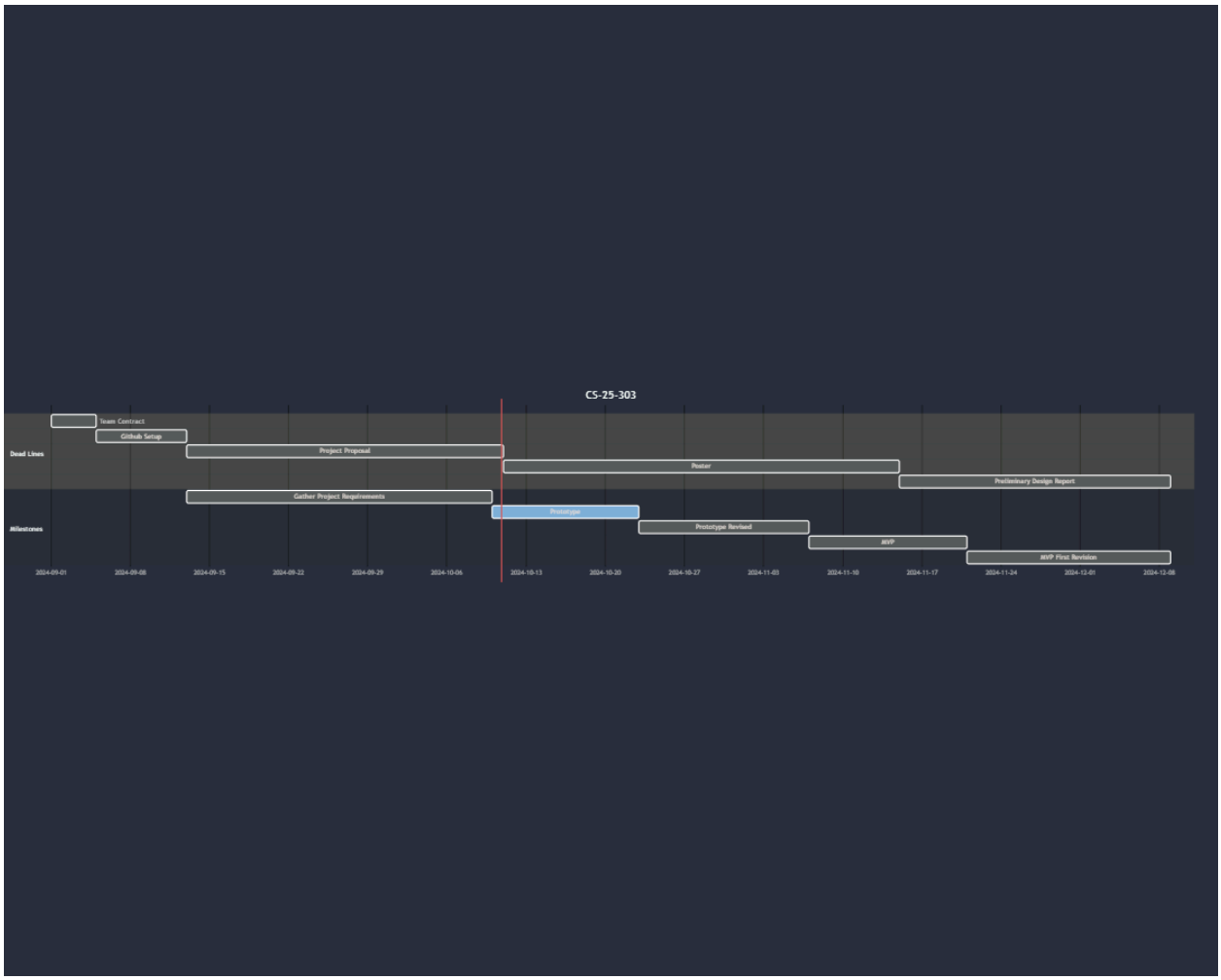
Section J. Conclusions and Recommendations

The journey to the final design of our project is a testament to the dynamic and iterative nature of the engineering design process. As our design team has not yet reached the final design, our story continues to evolve with each step. Throughout this development process, we have focused on creating and refining prototypes, each iteration informed by continuous feedback and rigorous testing.

At the recent CS Capstone Poster session, we had the opportunity to showcase our initial prototypes and engage directly with attendees. The feedback received during this session was invaluable, highlighting both strengths and areas for improvement. This direct engagement allowed us to better understand user needs and expectations, which in turn influenced subsequent design iterations.

Through these iterative processes, we've overcome numerous obstacles and integrated crucial lessons learned into our designs. Challenges such as user feedback incorporation and technical limitations were addressed, leading to significant enhancements in usability and functionality. These adjustments bring us closer to achieving our primary objectives—enhancing user experience, ensuring reliability, and improving system accessibility, paving the way for a final design that meets both functional requirements and user expectations.

Appendix 1: Project Timeline



Appendix 2: Team Contract (i.e. Team Organization)

Step 1: Get to Know One Another. Gather Basic Information.

Task: This initial time together is important to form a strong team dynamic and get to know each other more as people outside of class time. Consider ways to develop positive working relationships with others, while remaining open and personal. Learn each other's strengths and discuss good/bad team experiences. This is also a good opportunity to start to better understand each other's communication and working styles.

Team Member Name	***Strengths each member bring to the group***	***Other Info***	***Contact Info***
Tyree Carpenter	Very communication oriented, good public speaker, versatile.	Proficient in JavaScript-based frameworks and Java, with some experience working with relational databases.	carpentertd@vcu.edu
Shikriti Ghosh	Front-end development, organizational skills,	Proficient in Java, C, and Python; experience with Quarto, Figma prototyping, and working with databases	ghoshs2@vcu.edu
Ebenezer Hailu	Communication, leadership, organization, adaptation	Proficient in Java, C	hailuea@vcu.edu
Wyatt Herkamp	Backend development, quick learner, and database design	Proficient in Rust, Kotlin/Java, and SQL General Experience in Vue, Typescript, C, Python, and CSS	herkampwj@vcu.edu

Other Stakeholders	***Notes***	***Contact Info***
John Leonard	Professor Leonard teaches databases, user interfaces and video game design, with research interests covering modeling, analytics and visualization. Dr. Leonard will provide counsel, as well as act as a liaison between us and our sponsor.	jdleonard@vcu.edu
Lana Sargent	Associate Dean, Office of Practice and Community Engagement and Associate Professor at VCU's School of Nursing. Dr. Sargent will be our primary point of contact surrounding this project.	lsargent@vcu.edu

Step 2: Team Culture. Clarify the Group's Purpose and Culture Goals.

Task: Discuss how each team member wants to be treated to encourage them to make valuable contributions to the group and how each team member would like to feel recognized for their efforts. Discuss how the team will foster an environment where each team member feels they are accountable for their actions and the way they contribute to the project. These are your Culture Goals (left column). How do the students demonstrate these culture goals? These are your Actions (middle column). Finally, how do students deviate from the team's culture goals? What are ways that other team members can notice when that culture goal is no longer being honored in team dynamics? These are your Warning Signs (right column).

Resources: More information and an example Team Culture can be found in the Biodesign Student Guide "Intentional Teamwork" page (webpage | PDF)

Culture Goals	***Actions***	***Warning Signs***
Attend weekly meetings, and if unable to make meetings provide explanation PRIOR to meeting start time.	- Set up meetings in shared calendar - Send reminder in discord/text group chat in day before and of the meeting	- Student misses first meeting without explanation, warning is granted - Student misses meetings afterwards – issue is brought up with faculty advisor - Student consistently does not show up to meetings – issue is brought up with faculty advisor
Constructive Communication	- When feedback is given it is given constructively. - When giving feedback give a proposed solution or alternative	- If consistent negative feedback is given without proposed solutions it will be brought up with the faculty advisor
Collaboration and Teamwork	- If someone is behind on their task and ask for help, help them out if you're finished with yours - Approach collaborations with an open mind	-Start with a private conversation addressing the team's concerns. - If a member is consistently behind, bring it up to the faculty advisor.

	- Engage actively in team discussions and collaborative tasks	

Step 3: Time Commitments, Meeting Structure, and Communication

Task: Discuss the anticipated time commitments for the group project. Consider the following questions (don't answer these questions in the box below):

- What are reasonable time commitments for everyone to invest in this project?
- What other activities and commitments do group members have in their lives?
- How will we communicate with each other?
- When will we meet as a team? Where will we meet? How Often?
- Who will run the meetings? Will there be an assigned team leader or scribe? Does that position rotate or will same person take on that role for the duration of the project?

Required: How often you will meet with your faculty advisor advisor, where you will meet, and how the meetings will be conducted. Who arranges these meetings?
See examples below.

Meeting Participants	***Frequency Dates and Times / Locations***	***Meeting Goals Responsible Party***
Tyree Carpenter Shikriti Ghosh Ebenezer Hailu Wyatt Herkamp	Primary: Room 0101 at Engineering Building West Alternative: Discord Server Time: 6pm, Thursdays	Update group on challenges and accomplishments for the week. Update discord to reflect our team's current status Go through future goals of the project
Tyree Carpenter Shikriti Ghosh Ebenezer Hailu Wyatt Herkamp Faculty advisor John Leonard	Primary: As needed in Room 0101 during our regular weekly meeting Alternative: John Leonard's Office At least Once a month.	Get feedback on current progress. Ask for advice or input from John Leonard.
Tyree Carpenter Shikriti Ghosh Ebenezer Hailu Wyatt Herkamp Project sponsor Lana Sargent	At least Once a month. Location: TBD	Update the project sponsor and make sure we are on the right track. Get Input on the current product.

Step 4: Determine Individual Roles and Responsibilities

Task: As part of the Capstone Team experience, each member will take on a leadership role, ***in addition to*** contributing to the overall weekly action items for the project. Some common leadership roles for Capstone projects are listed below. Other roles may be assigned with approval of your faculty advisor as deemed fit for the project. For the entirety of the project, you should communicate progress to your advisor specifically with regard to your role.

- **Before meeting with your team**, take some time to ask yourself: what is my "natural" role in this group (strengths)? How can I use this experience to help me grow and develop more?
- **As a group,** discuss the various tasks needed for the project and role preferences. Then assign roles in the table on the next page. Try to create a team dynamic that is fair and equitable, while promoting the strengths of each member.

Communication Leaders

Suggested: Assign a team member to be the primary contact for the client/sponsor. This person will schedule meetings, send updates, and ensure deliverables are met.

Suggested: Assign a team member to be the primary contact for faculty advisor. This person will schedule meetings, send updates, and ensure deliverables are met.

Common Leadership Roles for Capstone

1. **Project Manager:** Manages all tasks; develops overall schedule for project; writes agendas and runs meetings; reviews and monitors individual action items; creates an environment where team members are respected, take risks and feel safe expressing their ideas.
   Required: On Edusourced, under the Team tab, make sure that this student is assigned the Project Manager role. This is required so that Capstone program staff can easily identify a single contact person, especially for items like Purchasing and Receiving project supplies.
2. **Logistics Manager:** coordinates all internal and external interactions; lead in establishing contact within and outside of organization, following up on communication of commitments, obtaining information for the team; documents meeting minutes; manages facility and resource usage.
3. **Financial Manager:** researches/benchmarks technical purchases and acquisitions; conducts pricing analysis and budget justifications on proposed purchases; carries out team purchase requests; monitors team budget.
4. **Systems Engineer:** analyzes Client initial design specification and leads establishment of product specifications; monitors, coordinates and manages integration of sub-systems in the prototype; develops and recommends system architecture and manages product interfaces.
5. **Test Engineer:** oversees experimental design, test plan, procedures and data analysis; acquires data acquisition equipment and any necessary software; establishes test protocols and schedules; oversees statistical analysis of results; leads presentation of experimental finding and resulting recommendations.
6. **Manufacturing Engineer:** coordinates all fabrication required to meet final prototype requirements; oversees that all engineering drawings meet the requirements of machine shop or vendor; reviews designs to ensure design for manufacturing; determines realistic timing for fabrication and quality; develops schedule for all manufacturing.

Team Member	*Role(s)*	*Responsibilities*
Tyree Carpenter	Project Manager	Manages all tasks; develops overall schedule for project; writes agendas and runs meetings; reviews and monitors individual action items; creates an environment where team members are respected, take risks and feel safe expressing their ideas.
Shikriti Ghosh	Front-end Developer	Oversee UI/UX, develop and refine Figma prototype, App Layout Design
Ebenezer Hailu	Financial Manager	Researches/benchmarks technical purchases and acquisitions; conducts pricing analysis and budget justifications on proposed purchases; carries out team purchase requests; monitors team budget.
Wyatt Herkamp	Systems Engineer	- Designing Database

Step 5: Agree to the above team contract

Team Member: Tyree Carpenter *Signature: Tyree Carpenter*

Team Member: Shikriti Ghosh *Signature: Shikriti Ghosh*

Team Member: Ebenezer Hailu *Signature: Ebenzer Hailu*

Team Member: Wyatt Herkamp *Signature: Wyatt Jacob Herkamp*

References

Provide a numbered list of all references in order of appearance using APA citation format. The reference page should begin on a new page as shown here.

[1] VCU Writing Center. (2021, September 8). *APA Citation: A guide to formatting in APA style.* Retrieved September 2, 2024. https://writing.vcu.edu/student-resources/apa-citations/
[2] Teach Engineering. *Engineering Design Process*. TeachEngineering.org. Retreived September 2, 2024. https://www.teachengineering.org/populartopics/designprocess