VCU College of Engineering

CS25-303-SON-Clinicians

Final Design Report

Prepared for

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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.

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Section A. Problem Statement

VCU's Mobile Health and Wellness Program (MHWP) is dedicated to delivering consistent, personalized care to its participants. However, clinicians currently face significant challenges due to the fragmented nature of patient data access. With rotating clinical staff, limited appointment time, and a mobile care environment, clinicians often have difficulty reviewing a participant's past health information, goals, and progress. When the previous clinician is unavailable, incoming clinicians may lack essential context, leading to inconsistent or delayed care.

These challenges are further amplified by inefficiencies in the current system, especially when accessed on mobile devices like tablets or laptops. Clinicians are forced to navigate disjointed records and multiple systems, reducing time spent with participants and increasing the risk of miscommunication or oversight.

To address this, we are developing a streamlined, tablet-first application using React Native, optimized for iPad use but also compatible with laptops and the web. This application will provide quick access to participant histories, previous goals, and well-being data—empowering clinicians to be fully informed before each appointment, regardless of prior interactions.

Crucially, the app will also allow clinicians to input new patient data directly during or after appointments. This feature ensures that up-to-date information is captured in real-time, supporting continuity of care across rotating clinicians and visits.

Stakeholders include MHWP clinicians, program participants, and VCU administrators. By reducing friction in both reviewing and recording participant data, this project enhances clinical workflows and contributes to more responsive, effective, and personalized care delivery.

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 prior to appointments.
- Enhance continuity of care by enabling clinicians to seamlessly pick up where the previous clinician left off.
- Ensure application compatibility on both tablets and laptops for flexible use in various clinical environments.
- Reduce time spent reviewing participant information, allowing more focus on direct care.
- Streamline data management to avoid redundancy and prevent gaps in participant records.
- Enable clinicians to quickly input new data during or after appointments to improve workflow.

These goals reflect the client's need for a solution that optimizes care delivery, supports the mobile nature of the MHWP, and enables clinicians to both update existing data and enter new data efficiently.

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:

- Provide instant access to participant health histories, goals, and progress on both tablet and laptop devices.
- Enable clinicians to update and review participant data in real time with minimal loading delays.

- Support seamless transitions between clinicians by allowing easy review of prior discussions and actions.
- Integrate secure data storage and retrieval to ensure compliance with health data privacy standards (e.g., HIPAA)
- Deliver a user-friendly interface that minimizes navigation effort and optimizes workflow in mobile or fast-paced clinical settings.
- Ensure the application is completed and fully operational within the project's set timeline, aligning with the MHWP's deployment schedule.

These objectives are **SMART**—specific, measurable, achievable, realistic, and time-bound—ensuring the application is practical and effective within a mobile healthcare environment.

B.3 Design Specifications and Constraints

The design for the tablet-based application for VCU's Mobile Health and Wellness Program (MHWP) will include specific constraints and measurable specifications to ensure the solution meets its intended objectives. **Constraints** define the operational boundaries of the system, while **specifications** serve as benchmarks for evaluating its success.

Key design specifications and constraints include:

- **Compatibility constraint:** Must be fully functional on both tablets and laptops, with screen sizes ranging from 9 to 15 inches.
- **Data security constraint:** Must comply with HIPAA regulations, ensuring all participant data is encrypted and securely stored to meet healthcare privacy standards.
- **Performance specification:** Must load participant data within an average of 3 seconds to support quick decision-making in fast-paced clinical environments.
- **Data storage specification:** Must support the storage and management of records for at least 1,000 participants, allowing for MHWP program growth.
- **Interoperability constraint:** Must fully integrate with existing MHWP systems, including current databases and health information software, with 100% synchronization to prevent data conflicts.
- **User interface constraint:** Must enable users to access key participant information within three clicks to support a streamlined mobile workflow.
- **Power consumption specification:** Must operate for a minimum of 8 hours on a fully charged tablet, ensuring full usability throughout a clinical shift.
- **Timeline constraint:** Must be designed, developed, and deployed within six months, in alignment with MHWP's operational rollout 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 established medical and computer science-related codes and standards to ensure legal compliance, data security, system interoperability, and overall user safety. These guidelines establish critical constraints that inform both the medical and technical aspects of the project.

Key codes and standards include:

- **HIPAA (Health Insurance Portability and Accountability Act):** A federal law requiring the protection of patient health information (PHI) through encryption, access controls, and secure data transmission. Compliance ensures confidentiality and privacy of participant data.
- **HL7 Standards (Health Level 7):** Defines interoperability standards for the exchange, integration, sharing, and retrieval of electronic health data. The application must follow HL7 protocols to ensure compatibility with existing MHWP systems.
- **ISO/IEC 27001 (Information Security Management):** Provides a framework for managing information security risks. The application must align with these guidelines to safeguard sensitive participant data.
- **ISO 9241-210 (Ergonomics of Human-System Interaction):** Ensures the application offers a user-friendly interface by emphasizing usability and reducing clinician cognitive load in fast-paced environments.
- **IEEE 11073 (Health Informatics – Personal Health Device Communication):** Supports communication between personal health devices and clinical systems. Compliance ensures interoperability with any connected health devices used during care.
- **WCAG 2.1 (Web Content Accessibility Guidelines):** Ensures accessibility for all users, including clinicians with disabilities. The application must provide screen reader support, sufficient color contrast, and navigable interfaces.
- **OSHA 1910 (Occupational Safety and Health Standards):** If the application influences ergonomic or data security practices in the clinical workspace, it must align with OSHA standards to promote safe working conditions.
- **NIST SP 800-53 (National Institute of Standards and Technology Security and Privacy Controls):** Provides comprehensive guidelines for securing federal information systems. The application must meet these controls to ensure robust protection of health data.

By adhering to these codes and standards, the application will meet the necessary safety, reliability, security, and interoperability requirements for delivering healthcare in mobile clinical settings.

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 work, encompassing key objectives, timeline, milestones, and deliverables. It clearly outlines the responsibilities of the team and the process by which the proposed work will be verified and approved. A well-defined scope helps facilitate understanding, reduce ambiguity and risk, and manage stakeholder expectations.

In addition to stating the team's responsibilities, the scope should also explicitly define tasks that fall **outside** the team's responsibilities. Clear boundaries around the timeline, available funds, and promised deliverables help prevent scope creep—uncontrolled changes to the project scope.

This section also outlines the **project approach** and **development methodology** (e.g., waterfall or agile), to be selected in consultation with the faculty advisor and/or project sponsor. Ongoing communication with the sponsor and advisor is essential to staying within scope and ensuring that all objectives and deliverables are completed on time and within budget.

C.1 Deliverables

The following deliverables will be provided to VCU's Mobile Health and Wellness Program (MHWP) as part of the engineering design process. These outputs will ensure that the tablet-based application meets clinical needs and functions effectively on both tablet and laptop devices.

Project Deliverables:

- A fully functioning tablet-based application for MHWP, compatible with tablets and laptops
- 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 systems (HL7-compliant)
- Code repository containing frontend, backend, and database code
- User manuals and training materials for clinicians
- Testing and evaluation reports demonstrating compliance with:
    - HIPAA standards
    - Usability and performance benchmarks

Academic Deliverables:

- 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	Free	$0

	and visualization (e.g., Google Sheets)		
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

The application will provide clinicians with a streamlined, modern interface for inputting data—enhancing tasks they already perform using RedCap. This includes adding new participants, case notes, updating goals, and entering health-related information. By improving usability and reducing manual steps, the system will serve as an intuitive extension of their existing workflow.

- **Add New Participants**: Simplify onboarding with structured forms that include dropdowns, auto-fill suggestions, and input validation for accuracy.
- **Add Case Notes**: Enable clinicians to enter detailed session notes with tagging capabilities (e.g., by date, goal, or topic) for easier retrieval.
- **Update Goals**: Offer a guided interface to create, track, and revise participant goals with visual progress indicators and timestamped edits.
- **Input Health Data**: Reduce manual entry effort by offering RedCap integration while providing a more modern, user-friendly interface for inputting vital signs, lab results, and other health metrics.

Key Benefits:

- Streamlines workflows by modernizing a critical part of clinician duties.
- Improves data consistency and reduces user input errors.
- Enhances clinician satisfaction by offering a more responsive and intuitive tool.

Potential Challenges:

- Higher development costs due to the custom 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**
    - Tablets and laptops preloaded with the prototype application.
    - 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**
    - Measure the time taken to access participant histories.
    - Test the accuracy and reliability of the "Add Visit" functionality.
    - Collect feedback via surveys and interviews.

5. Prototype Evaluation

Each prototype iteration will be evaluated based on:

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

Section G. Results and Design Details

The result of our project is a functional prototype of a clinician-facing mobile application designed specifically for the Mobile Health and Wellness Program (MHWP). Built using React Native with a tablet-first approach, the prototype is optimized for iPads but also supports use on laptops and the web. The design prioritizes clarity and efficiency, allowing clinicians to quickly understand participant health trends and update records on the go.

The interface features a clean and minimal layout with screens dedicated to key participant information. For each visit, clinicians can view:

- Vital statistics such as **weight**, **blood pressure**, and **glucose levels**

- A summary of **past and current health goals**
- Historical data trends across multiple visits
- A user-friendly display of the participant's overall wellness progression

In addition to reviewing data, clinicians can seamlessly **enter new patient information** using fields that mirror the existing MHWP survey format. This ensures that the app integrates smoothly into the current clinical workflow without requiring process changes or retraining.

The simplicity of the design helps reduce cognitive load and maximizes usability in fast-paced mobile care settings. The prototype has demonstrated the potential to streamline data access and entry, supporting more personalized, informed, and continuous care—even when clinician rotations occur.

Section H. Societal Impacts of Design

H.1 Public Health, Safety, and Welfare

This project's goal is to 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. 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 development of our prototype demonstrates that a clinician-facing mobile application for the Mobile Health and Wellness Program (MHWP) is both feasible and impactful. The application successfully consolidates participant health data into a simple, accessible format, allowing clinicians to view vital signs, track health goals, and enter new data directly from the field. This validates our core goal: enabling more efficient, personalized, and consistent care across rotating clinicians in mobile healthcare settings.

While the prototype proves that the concept works, several improvements are necessary before the application is fully production-ready. The current user interface, while functional, requires further refinement to enhance usability and visual appeal. A more polished and intuitive UI will reduce training time and improve clinician adoption, especially in high-pressure mobile environments.

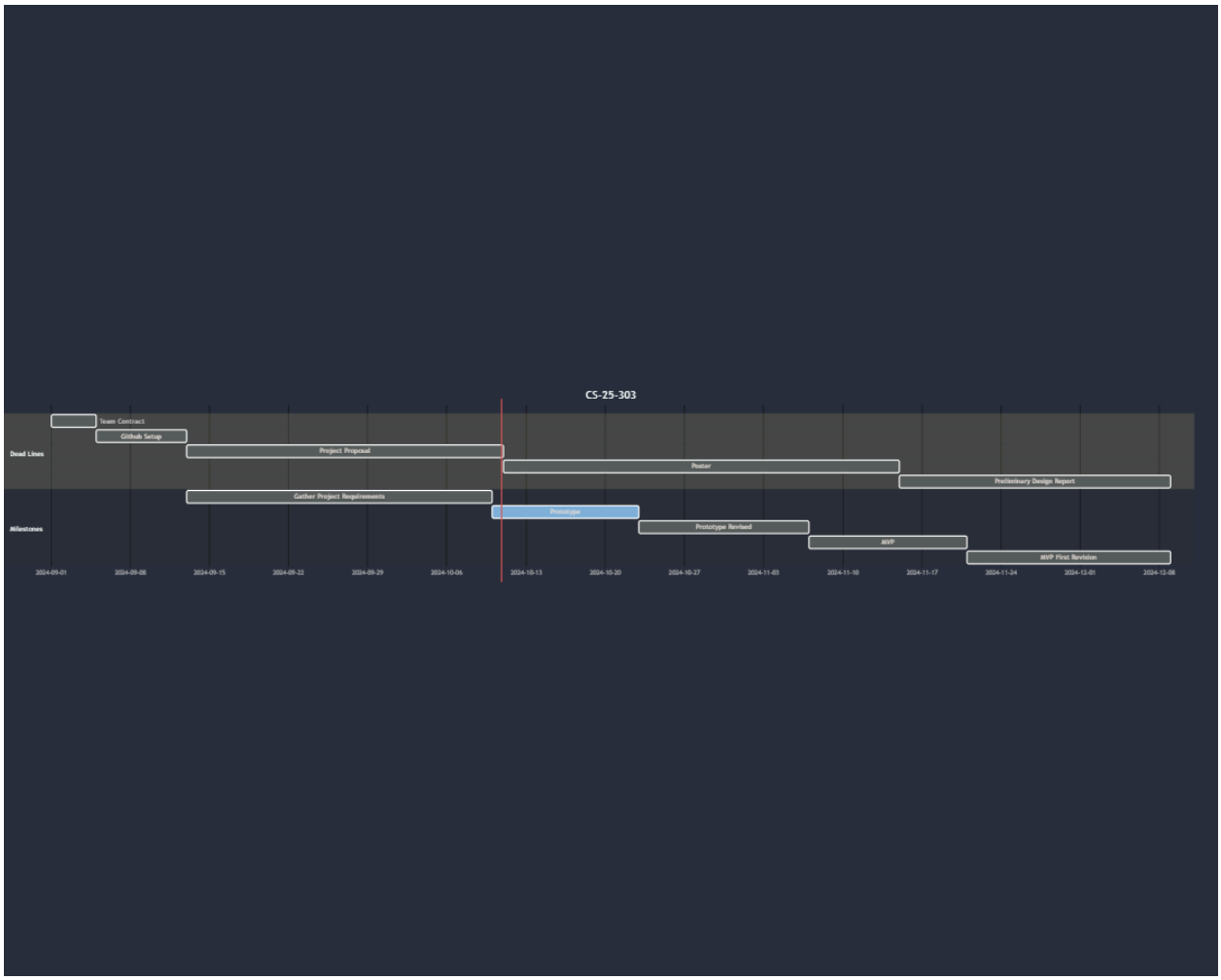
Additionally, integration with MHWP's existing systems will require careful backend development to ensure **HIPAA compliance**. This includes implementing secure authentication, encrypted data storage and transmission, user access controls, and audit logging. These safeguards are critical for protecting participant privacy and complying with federal healthcare regulations.

Further recommendations include:

- **User Testing with Clinicians**: Conduct usability testing with MHWP staff to gather feedback, identify pain points, and refine the interface based on real-world workflows.
- **Offline Support**: Ensure the app functions in areas with poor connectivity by allowing temporary offline data capture with secure syncing once reconnected.
- **Scalable Data Models**: Design the backend to accommodate future data types (e.g., lab results and notes) as the program evolves.
- **Audit Trail Features**: Enable a log of all data changes for clinical accountability and quality assurance.

With improved design and robust security infrastructure, this application has the potential to become a cornerstone of MHWP's digital toolkit—empowering clinicians to deliver faster, more informed, and higher-quality care across their mobile health initiatives.

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	Front-end development, communication, leadership, organization, adaptation	Proficient in Java, C; experience with Quarto, SQL, Python, HTML	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 explain before meeting start time.	- Set up meetings in a shared calendar - Send reminders in discord/text group chat in day before and of the meeting	● Student misses first meeting without explanation, warning is granted ● Student misses meetings afterward – the 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 asks for help, help them out if you're finished with yours ● Approach collaborations with an open mind ● Engage actively in team discussions and collaborative tasks	● Start with a private conversation addressing the team's concerns. ● If a member is consistently behind, bring it up to the faculty advisor.

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 the 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	Actively work on the project (Alex will document these meetings by taking photos of whiteboards, physical prototypes, etc, then post on Discord and update the Capstone Report)
Tyree Carpenter Shikriti Ghosh Ebenezer Hailu Wyatt Herkamp	Primary: As needed in Room 0101 during our regular weekly meeting Alternative: John Leonard's Office At least Once a month.	Update faculty advisor and get answers to our questions 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