Project Charter

C18 MDM Team 11: VoltCrafters @ The Centre for Digital Media

Table of Contents

Members

Team: VoltCrafters: Robin Pittman, [redacted]

Supervisor: [redacted]

Client: Vancouver Community College: [redacted]

Executive Summary

The VoltCrafters team @TheCDM are a team of MDM (Master of Digital Media) Students working with Vancouver Community College. This project will provide automotive faculty who need to provide more rapid training on Electric Vehicle Battery repair and replacement procedures for students. The ***VR HVEV Repair Simulator*** is a Virtual Reality Application that simulates the environment in which a student in the automotive program can safely simulate the procedure and safety protocols of EV battery replacement. It includes the required selection of tools and equipment, realistic physics, and vehicle procedures, fail states to indicate when errors of operation occur, and tutorials and guides to make learning easy. Unlike regular hands-on training from instructors, this simulator allows students to practice the procedures in a safe environment without supervision so they can develop the awareness of safety requirement and practice procedures independently – preparing them more rapidly for actual hands on operations. It doesn't replace regular instruction – it supplements it.

Project Overview

Background & Purpose

Vancouver Community College Automotive has tasked us with developing a virtual reality (VR) simulation to enhance the training of automotive students in **safely repairing and replacing electric vehicle (EV) batteries**. Current training methods rely heavily on instructor supervision due to the risks of physical injury, fire, and electrocution, leading to slow learning processes. Traditional resources like service manuals and instructional guides require constant monitoring by instructors, which is challenging given the extensive curriculum and limited instructional time.

Goals and Objectives

The proposed VR simulation aims to allow students to **practice the battery replacement process in a risk-free environment, offering** step-by-step guidance and feedback on their performance. **This tool will enable students to refine their skills outside supervised class time, better preparing them for hands-on training.** The simulation will be interactive, incorporating safety standards and potential fail states to highlight the consequences of incorrect actions.

Additionally, it **will feature gamification elements** to make learning more engaging. Each specific step of EV battery replacement up to our current achievable scope can be practiced by the student and masters, with in game feedback on the completeness and safety of the work done. This is increasingly relevant for the needs of the automotive industry as EVs become more common. The project duration being 12 weeks allows us to complete the project to a level defined in our scope, with potential for expansion.

Successful implementation at Vancouver Community College could lead to the expansion of this simulation for various vehicle types and potential commercialization for use in other institutions. The design of the simulation will be closely aligned with the instructional methodologies of VCC's automotive instructors, ensuring a practical and effective learning experience.

Key Performance Indicators:

1. Completion of Milestones as scheduled.
2. Client Useability – Is the client comfortable with operation of the application?
3. Feature complete Minimum Viable Product on delivery.
4. Defect Rates in Development: Measuring the number of bugs or issues identified per development phase to ensure software quality.
5. Team Velocity: Assess the amount of work completed in each sprint to gauge team efficiency and adjust planning accordingly. Using Burn up or down charts, Kanban progress, Git issue tracking, and sprint review.
6. Regular builds for testing and builds every sprint for client evaluations.

Stakeholders

[redacted], Dean School of Trades, Technology, and Design Vancouver Community College
[redacted] Instructor AST, Vancouver Community College
VCC Automotive Students using this application to train for this procedure.

Deliverables (Due July 25th, 2024)

Project Charter, GitHub Repository, Compiled APK for Quest 2/3, media files (tutorial videos, 3d models, audio assets), project files, Technical Documentation, UX/UI Documentation

These will be all materials for a minimum viable virtual reality product for Meta Quest 2/3 to allow direct operation and expansion of the project for future development. This will be playable up to the level as described in the scope so that students may be able to use this to enhance their learning and retention.

Project Scope

Minimum features completions. Further steps in the project are time dependent and not promised.

Main Features:

- Basic user interface (defined as one with visuals and audio that can guide players to complete the task)
    - Gaming instructions with steps list
    - Game menu.
    - Practice mode (with tutorial)
    - Challenge mode (no tutorial)*
    - In game status (completed tasks and what remains to be completed)
    - Fail states – in game notification of player mistakes.
- A 3D environment of an Auto Maintenance Shop that contains the following Interactive models:
    - Workbench
    - Multimeter functional cables for measuring the voltage, with clamp for ground connection.
    - EV Car (ID4), start engine button, opening hood, and door
    - Functional Lift – with adjustable arms, raising, lowering, safety mechanism
    - Screwdriver
    - EV Battery Connectors with tabs
    - High Voltage Disconnect model.
    - 12 Volt Lead Acid Battery
    - High Voltage Gloves and outer safety gloves
    - 4 orange delineators for attaching safety tape
    - A roll of yellow safety tape
    - Top of car traffic cone
    - Padlock and Key – with
    - Functional scissor lift on wheels
    - Coolant drain pan
    - Functional Tablet for coolant refreshing
    - Bolts for battery removal and reconnections
    - Digital Torque Wrench
    - 1/4” Impact Driver
    - 1/4” Socket Wrench (reversable)
    - 27mm ¼”, 19mm ¼”, 10mm 1/4(sockets)
    - Other non-interactable models to add to the ambience will be added but will not be required.
- In game tutorial on how to complete the task and how to use the controls*
- Haptic controller feedback for interactions
- Controller based play.
- Completion of the procedure with all safety protocols up to the disconnection of the EV battery including (new procedures in bold):
    - Cones and safety taping procedure
    - On/Off engine
    - High Voltage disconnect procedure.

- Lift procedure
- Voltage testing procedure
- Measuring voltage of EV battery with one handed procedure
- Disconnecting tabs on EV battery connectors
- Removing EV battery connectors from battery
- **Draining of Coolant, hoses, into catch tray**
- **Removal of inner battery bolts with impact driver**
- **Removal of battery using scissor lift**
- **Removal of outer battery bolts with impact driver**
- **Reinstallation of battery as before – but using impact driver and torque wrench to measure correct torque.**
- **Refilling coolant with control system through tablet**
- **Reinstallation of 3 battery terminals (2 x high voltage, 1 comms line)**
- **Lowering the car and removing lift arms**
- **Reinstall negative battery terminal, remove padlock, reconnect high voltage cutoff**
- **Restart car**
- **Remove tape and cones**

Scope Changes:

The scope may change with discussion between clients and Product Manager. This may happen because of unexpected challenges, change of needs, or timing. However – it must be agreed in writing by both parties.

For Deliverables:

GitHub Repository

- We will make available all the project code for unity.
- Limitations include any purchased libraries from the CDM that will need license to be used by VCC

APK and other compiled files

- A compiled and playable version of the Application that can be sideloaded to a Meta Quest 2 or 3 using ADB or Sidequest.

Media files

- Any external media files will be included with the project files (incorporated in the project) and separately the original files for future development.

Project assets

- The entire completed Unity folder for windows will be available (as part of the GitHub repo)

Technical Documentation

- All code will include detailed documentation for each script included in the assets.
- Installation instructions for SideQuest
- Hardware and software specs

UX/UI Documentation

- UI Style Guidelines

Virtual Reality Prototype: For Quest 2/3

Out of scope

- This will not be a completed project ready for market.
- High Poly fully realistic and interactive models and simulation – interactions will need to be limited to what is realistic for a vertical slice or minimal viable product up to the end of stage one (disconnection of EV battery, but not removal)
- A fully fleshed out and detailed environment of an Auto Shop.
- Due to hardware limitations this will be designed to run as a low poly environment.
- Development for other hardware platforms (only for Quest 2). Will not be compatible for Quest 1, Quest Pro, or non-Meta hardware. Will work on Quest 3.

Team Organization, Roles, and Responsibilities

- [redacted] (Unity Developer, VR)
  - Working with unity for development and connecting assets with user interface
  - Liaising with UX lead for interactive and UI production and testing

- [redacted] (UI Designer, 3D Modeling)
  - Develop UI and tutorial interfaces
  - Video production assistant
  - Presentation design
  - Assistant UX designer

- [redacted] (UI/UX lead, QA)
  - Accountable for User experience, interface design
  - User Experience Designer

- [redacted] (Project Supervisor)

- **Robin Pittman** (Project Manager, Product Owner, Video Production)
  - Accountable for final project documentation and
  - Compiling sub team documentation
  - Coordinating team member tasks, and scheduling
  - Primary point of contact for client

- [redacted] (3D Modeler Lead)
  - Models' 3D assets that are built local
  - Responsible for passing completed models to dev team.
  - Accountable for approval of 3D modelled assets (build or purchased)

- [redacted] (Development)
  - Unity Developer
  - QA

Changes:

These roles may be reviewed and adjusted as deemed necessary by the Project Manager at any time for the efficiency and quality of the project for best outcome for the client's needs and team's availability. As further training is limited by time within the project, this will only be optional. However any reassignments will be withing current team skillset.

Assumptions (boundaries – don't cross the line) & Justifications.

- Deliverables to Client due on July 25th, 2024
- Deliverable to supervisor at CDM due August 1st 2024
- We will have access to one Quest 2 units, one Quest 3 unit, as well as Robin's Quest 3 for the duration of the project. Other equipment that we will be using are basic computer hardware such as monitors, laptops, cables, etc.
- Approx. Minimum 28-hour work week, increasing as the project progresses or as needed (not to exceed 32 hours)
    - (4x7 hour workdays)
    - 1 hour lunch breaks
    - 2 x 15minute breaks – Not fixed time
- We will be developing for the Meta Quest 2, with compatibility for Quest 3. The choice of VR was made by the client, but we believe it is the best available method for a realistic simulation of the environment and procedures outlined for the project.
- As well the Quest headset is standalone, and though that can create limitations in the detail level of the game, it is not reliant on more expensive hardware. It's low cost, reasonable capabilities, availability, and ease of use for setup make it an excellent choice for the VR Hardware.
- Assumption may be re-evaluated as needed based upon new circumstances.

Project Approach

Communication Plan

Internal

- Discord – Primary mode of internal communication (instant messaging and video/audio)
- Notion – internal short-term or documentation, and links to final documentation
    - Individuals will maintain their own documentation will be synced and reviewed 3 times by the entire team at key points in the project.
- Miro – project brainstorming
- Canva – Meeting Presentations
- Figma – Wireframes (Interactive and direct)

External

- Primary communication channel will be via email and in person meetings.
- For quick and simple matters – texting with Kyle or Brett is permissible.
- Weekly progress reports/minutes with the clients will be provided no more than 48 business hours after client meeting.
- Agenda will be provided no less than 24 business hours before meeting.
- Zoom – Client Meetings for inclement weather situations or as agreed upon.

- May hold hybrid zoom/face to face meetings as well. For group location – external microphone is required.

Other

- VoltCrafters will not be using any official social media, though individuals may post progress on their work if it doesn't violate any private interests for the client or the MDM program.
- Team only file sharing will be via discord for small files, GitHub for development team, draft documents will be created with Notion or the individual's preference, and OneDrive for finalize documents.
- Client may choose their preferred filed sharing method for communications with the team.

Production Methodology

- The project will be done using mixed Agile Methodology
  - Composed of weekly sprints (first 3 sprints), and after that we will be using biweekly sprints.
  - The group is composed of 3 overlapping teams.
    - The design team: Ke (lead), and Hairong
    - Dev team: Cathy, Kenny
    - UX/UI design: Liting (lead), Hairong
    - Project Management: Robin (PM), Liting (assistant), Hairong (assistant)
  - Teams will be primarily responsible for their primary roles, but tasks may overlap to other team members based on skills set or learning goals.
- Progress will be reported to the client weekly (Sprint 0 and Sprint 1) or biweekly (remaining sprints) during meetings and in the minutes.
  - Sprint planning will be done at the beginning of each sprint (Monday Mornings)
  - Regular Client Meetings will be held on Thursday 10am at either VCC, Zoom, or the CDM, weekly and biweekly starting sprint 2 on the following dates:
  - May 9th, 2024, May 16th, 2024, May 30th, June 13th, June 27th, July 11th, and July 15th,
  - Start of workday standups on tasks and blockers will be held either in person or through messaging Discord.
  - Team members are free to consult or work with each other outside of meetings for their own project needs, however they should track their hours.

Quality Assurance Plan

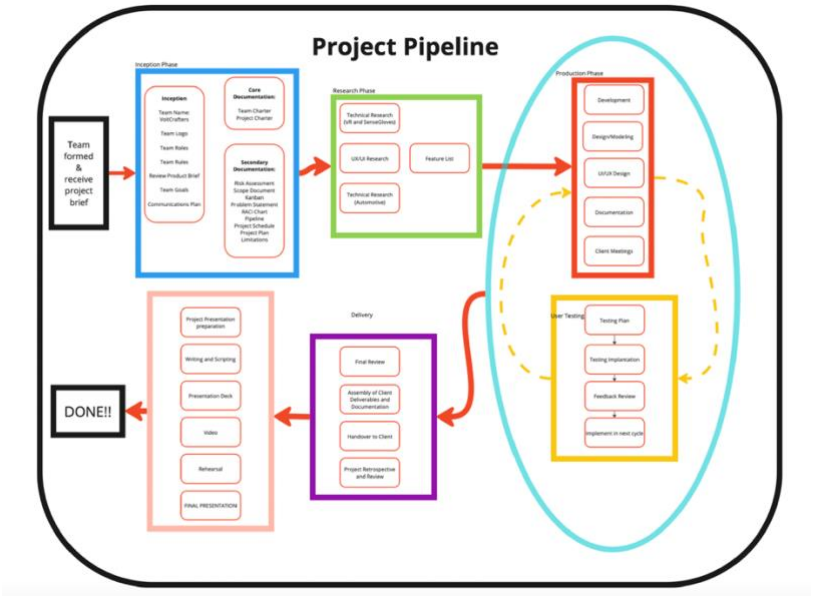
Planning for 3 user tests

Method: User test, with series of objectives and questions, consent forms for tester permissions, and results to be analyzed for necessary changes within scope. We will external submit user test questions to client for review before those tests.

1. Internal Useability test for UX
   a. Responsibility: VoltCrafters
   b. Criteria: are controls and interface clearly operable with minimal supervision (after initial instructions provided)

2. External User test for UX/UI and procedure completeness
    a. Client will provide location and time, and students for testing.
    b. Criteria: Does UI facilitate clear operation of game procedures. Is there understanding clear?
3. Continual ad hoc testing with internal and team members as well as demonstrations with client
    a. Performed by VoltCrafters Team
4. Bug tracking to be reviewed daily using Notion Channel
5. Weekly app builds (about Wednesday) to allow for testing by client and team members.

Project Pipeline



full view available at:

Definition of Done

Using the Kanban board (on Notion) we have arranged our project to encompass:

1. **Backlog**
    a. Known or predicted tasks that aren't started – to be kept up to date by everyone's tasks, regular pruning and addition as needed with project tasks
2. **To Do**
    a. Tasks that are planned to be worked on for the current sprint.
3. **Doing**
    a. tasks being worked on
    b. based on estimated task difficulty
4. **Testing**
    The task has been completed, but not evaluated by the team, or incorporated into the overall project. May be moved back to an earlier column if uncertainty by others or does not meet all criteria including new criteria.
5. **Done**
    b. Task has been completed and person Accountable for that division has "signed off."

c. Ready to be implemented into next stage if it is a dependency.
c. Moved to done panel on Kanban board.

Notes:

1. Object can be moved back at any time if changes are needed due to new constraints in the project.
2. Done column will fill up and all tasks will be removed and filed for potential review.
3. Tasks will be assigned to individuals and or groups, have difficulties levels assigned, priorities and estimated due dates, blocking, and sprint name – all to assist team and PM schedule and track progress.

Risk Assessment and Management

The follow more impactful risks for the project have been identified based on predicted likelihood, impact, and severity, as well as our mitigation plans.

Risk Description	Likelihood	Impact	Severity	Mitigation
Accessibility to the app	5	10	50	Side Quest only for now If VCC wants this publicly accessible to students we can make it accessable on AppLab.
Cannot compile app to Quest	4	10	40	Regular builds for internal testing on different machines, so problems can be detected early. For client will be built for them to install on own machines.
Difficulty with object interaction（Can make operation of the application nearly impossible for new VR users.）	8	8	64	Operational Tutorial and handedness swapping. Change of object interaction as requested by client (Socket wrench from trigger, to cranking)
Unable to complete Stage 2 of project	7	9	63	Build lowfi models that have basic functionality.

				Skip Stretch goals. Identify early through regular team testing and feedback
Unable to complete in game tutorials	7	7	56	Create video training from our in house playing that can be including in the application. Improve UI
Performance problems for build	7	7	49	Early and regular optimization (Lower poly models and assets, prepare simple lighting, testing with Quest APK)
Dev Blockers (Taking too much time)	7	7	49	1. Allow more time to code 2. Simplify needs 3. Better task organization and communication 4. Early flowcharting and planning before coding for clarity
Battery Life	8	6	48	Charging policy documentation External Battery Recommendations

Difficulty tracking bugs and other errors	8	8	70	We have implements an screen shot and logging console to allow for easier bug tracking and recording in our internal testing.

Contingencies

Other Risks will be identified and updated based on a scale from 1-10 for each of severity, likelihood, and impact. Strategies will be created for each to create mitigation solutions and the client will be notified for Risks that will affect the timeline of the project with the suggested solution.

Project Schedule

Sprint 0: May 6 – May 9

Goal: Introductions, rules, roles

Inception – members, roles, meet client, begin team charter and set up rules

Logo - Design

Sprint 1: May 13 – May 16

Goal: Breakdown of tasks

Finish team charter - PM

Begin Project plan - PM

Debugging from previous term

Task Breakdown - UX

Beginning UX Design - UX

Error Console - DEV

Client Meeting #2 - PM

Sprint 2: May 20 – May 30

Goal: Coolant and Project Charter

Implement Timer Function – DEV

Continue Debugging - DEV

Project Charter – PM

Finish Project Plan – PM

Cohort Check in. – ALL

Drain Coolant UX – ALL but PM

Milestone #1

Client Meeting #3

Sprint 3: June 3 – June 13

Goal: Bolts and Battery

Prepare Small and Large bolts and implement game logic

Model Bolts

Drain Coolant – Implementation (Modeler and Devs)

Client Meeting #4

Sprint 4: June 17 – June 27

Goal: Refill and Reinstall

Place scissor lift

Remove/Reinstall battery and refill coolant procedure

User Test – June 18th

Client Meeting #5

Milestone #2

Sprint 5: July 2 – July 11

Goal: Reassembly

Remaining reassembly of car – from power to cones

Continued Bug fixes

Client Meeting #6

Sprint 6: July 15 – July 25

Goals: Final Client Deliverables

Challenge Mode

Tutorial

July 8 – Cohort Checkin

Compile Client Documentation

Project Trailer

Client Handover (July 25th)

Milestone #3

Sprint 7: July 29 – August 1

Goals: CDM Presentation

Compile Client Documentation

Final App build

Compile CDM Documentation

Presentation Trailer

Presentation Slides and rehearsal

CDM Presentation / Documentation Due

Milestone #4

Budget & Resources

Client has agreed to allow team to purchase resources up to $1000 for assets or hardware. Requests for larger amounts may be allowed, but not exceed $5000. Purchasing will be done through sending links to required resources to Brett for approval, and he will acquire them through his department.

Estimated budget for Assets:

- Fluids Asset Package: ~ $15

Project Constraints

1. **Our team consists of:**
    a. a **Project Manager** with broad and diverse technical knowledge who has a strong understanding of all the different skills sets and requirements of the product from the client, but new to project management.
    b. We have two **Developer**s who are familiar with C# and Unity, and the hardware required (Quest 2 and 3)
    c. We have one **3D modeler**
    d. We have a **2D artists** and **UI designer**
    e. We have a **UX designer**

2. **Time Limitations**
    a. With a **12-week turnaround**, the team will use the first week to get our bearings with new team member, then up to 2 weeks to plan tasks and scope before beginning productions. Less research is required as this is continuation of the project from term.
    b. **Productions will be finished before July 25th**. Last two weeks are focusing on deliverables, documentation, and remaining bug fixes.
3. **Graphical Fidelity**
    a. We can use a mixture of custom 3D models and interfaces as well as pre-existing assets.
    b. High polygon count assets will be reduced in detail to work within limitations of the Quest 2
4. **User Testing**

    a. Our initial testing will be in house within the team, and other students in our cohort.
    b. We will present different prototypes to the client for their testing and feedback.
    c. We have request to have some time toward the end of the project to have user testing with the VCC students who would be using the finished product, so we are able to incorporate that feedback into final deliverables.

Approvals & Turnaround

Approved by:

[redacted]: _____ Date:_____

[redacted]:_____ Date:_____

Agreed by:

Name	Primary Role	Signature	Date
[redacted]	Project/Product Manager		
[redacted]	Lead UI/UX		
[redacted]	UI Designer		
[redacted]	Developer		
[redacted]	Lead 3D Modeler		
[redacted]	Developer		
[redacted]	Project Supervisor		