# DEPARTMENT OF COMPUTER SCIENCE
# NORTH CAROLINA A&T STATE UNIVERSITY

## PROJECT CHARTER

**COMP 496: SENIOR DESIGN II Spring** 2025


# Stack Underflow
# Lumi

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## REVISION HISTORY

| Revision | Date | Author(s) | Description |
|---|---|---|---|
| 0.1 | 03.18.2025 | JF | document creation |
| 0.2 | 03.19.2025 | NH,MS,DB | Sections 3-8 completed |
| 0.3 | 03.20.2025 | DB, MS,JF | Complete draft |
| 1.0 | 03.24.2025 | JF, MS, LD | Updating table of contents |
| 1.1 | 03.25.2025 | JF,NH,MS,DB,LD | Finished document |

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## 1 Vision

**Mental health challenges are a growing concern in today's society. While there are various resources available, many individuals still struggle to find accessible, personalized, and consistent tools to manage their mental well-being. Social stigma, busy lifestyles, and a lack of tailored support often prevent people from seeking the help they need.**

**Our project, Lumi, aims to offer individuals an outlet to practice mindfulness, emotional self-care, and consistent engagement to improve their mental well-being in a way that is tailored to their unique needs and supports long-term positive change. Lumi bridges the gap between mental health awareness and actionable daily practices by combining innovative technologies like artificial intelligence and augmented reality with proven wellness techniques.**

**By addressing these needs, Lumi hopes to reduce the emotional burden many face and empower individuals with tools that promote lasting mental well-being. Through personalization, accessibility, and interactivity, Lumi envisions a future where emotional care is as routine and approachable as physical wellness.**

## 2 Mission

**The mission of Lumi is to offer individuals a platform to practice mindfulness in a manner that helps people improve their mental well-being through consistent, personalized engagement. Our solution is to create a web-based application that promotes emotional self-awareness, encourages reflection, and supports the development of long-term self-care habits.**

**The platform is designed to allow users to create daily logs for their emotions and thoughts through a personalized check-in system, giving them the opportunity to reflect on their mental state over time. With built-in mood tracking and a self-care streak system, Lumi motivates users to maintain consistent mental health practices. The platform also includes journaling capabilities, offering a secure space for self-reflection, emotional processing, and mental clarity.**

**To enhance personalization, Lumi integrates AI-powered sentiment analysis to offer compassionate, real-time insights based on journaling entries. These insights aim to guide users toward healthier coping strategies and greater self-understanding. For moments of high stress or anxiety, users will have access to AR-based relaxation exercises, offering immersive experiences like guided breathing or calming visual aids.**

**Beyond daily use, Lumi serves as a bridge to real-world support by offering a centralized resource hub that connects users with trusted links to mental health professionals, self-help guides, and emergency helplines. Through this holistic combination of features, Lumi strives to create an accessible, engaging, and empowering experience that meets users where they are and supports them on their journey toward better mental health.**

## 3 Success Criteria

**Upon completion of our prototype, we expect the following success indicators to be observed:**

- **Zero technical issues with core features, such as the mood tracker, journaling, and AR relaxation**

- **exercises.**
- **App load time under 3 seconds, with smooth transitions during journaling and AR exercises.**
- **70% of users log their emotions and thoughts at least once in the first week.**
- **50% of users engage with the AI-powered insights based on their journaling entries.**

**Within 6 months after the prototype delivery date, we expect the following success indicators to be observed:**

- **30% of users have completed 10 or more check-ins and used the mood-tracking feature at least**
- **once per week.**
- **40% of users establish a self-care streak.**
- **25% of users interact with the AI-powered insights on a weekly basis.**

**Within 12 months after the prototype delivery date, we expect the following success indicators to be observed:**

- **50% of users log emotions and thoughts at least 3 times per week.**
- **40% of users achieve a self-care streak of 30 days or more.**
- **80% user retention rate.**

## 4 BACKGROUND

**According to the National Institute of Mental Health, approximately one in five adults in the U.S. experience mental health challenges. While awareness of mental health has increased, many individuals still struggle to find accessible, engaging, and personalized tools to manage their well-being effectively. Despite the wide range of mental health apps available, they often fall short in key areas, preventing long-term user engagement and meaningful impact.**

**A major issue in current mental health applications is low user retention. Many individuals start using these apps but quickly abandon them due to a lack of motivation, engagement, or a structured system that encourages consistency. Studies have shown that long-term engagement is crucial for behavioral change, yet many existing apps fail to implement features that promote habit formation and sustained usage. Another significant gap is the lack of meaningful personalization. Many mental health apps provide general mood tracking or journaling tools, but they fail to adapt to individual users. Without contextualized feedback or AI-driven insights, users are often left feeling like they are inputting data without receiving any real, actionable support in return.**

**Additionally, mental health apps tend to be fragmented, with each one focusing on a specific aspect of self-care. Some specialize in mood tracking, others in journaling, and some strictly provide mindfulness exercises. As a result, individuals are forced to use multiple apps rather than having a single, unified platform that integrates these different elements into a cohesive experience. This disjointed approach makes mental health management feel overwhelming rather than seamless.**

**Lumi is designed to bridge these gaps by creating an all-in-one, AI-powered mental health companion that combines personalization, engagement, and accessibility into a single platform. Unlike other apps that focus on one specific aspect of mental well-being, Lumi offers a comprehensive experience, integrating multiple self-care tools to support users in a more meaningful way. By addressing the engagement, personalization, and fragmentation challenges that currently exist in digital mental health solutions, Lumi provides a more effective, accessible, and user-friendly way for individuals to take control of their mental well-being.**

## 5 Related Work

**Currently, there are over 10,000 mental health and wellness applications available, each taking different approaches to supporting users' well-being. Many focus on mood tracking, mindfulness, or cognitive behavioral therapy (CBT)-based techniques, but few provide a comprehensive, interactive, and adaptive experience that combines AI-driven insights, AR-based coping mechanisms, and habit-building features. One example is MindShift, an app designed to help individuals manage anxiety through journaling, guided breathing, and mood tracking [5]. While MindShift aligns with Lumi's goal of integrating multiple mental wellness features, it lacks advanced personalization and immersive coping mechanisms like AR-based exercises. Moodfit offers tools for tracking emotions, engaging in CBT-based exercises, and setting mental health goals, but it relies heavily on self-reported data, which limits its ability to offer dynamic AI-driven feedback and real-time insights [4]. Sanvello combines journaling, mood tracking, and meditation with peer support, but much of its core functionality is hidden behind a paywall, making it inaccessible for many users seeking affordable options [4]. Apps like Calm and Headspace focus primarily on guided meditation and mindfulness exercises, yet they lack features like journaling and interactive feedback, which could help users engage more consistently [5], [4]. Lumi addresses these gaps by promoting long-term engagement through features like streak tracking and personalized self-care recommendations.**

**On the academic side, there's growing interest in the use of natural language processing (NLP) and sentiment analysis for mental health monitoring. A study published in npj Digital Medicine explores how AI-driven technologies can enhance mental health interventions by offering personalized insights and therapeutic recommendations [3]. Building on this foundation, Mishra et al. (2023) propose an NLP-based mood classification system designed to monitor emotional states and deliver tailored feedback, an approach closely aligned with Lumi's use of AI to provide actionable insights [2]. However, many of these studies remain in the early stages, with limited implementation in user-facing applications. Lumi addresses this gap by integrating sentiment analysis into a fully developed, user-friendly platform that delivers real-time feedback based on journaling and self-reflection, making these advanced technologies accessible and practical for everyday use.**

**Expanding on that, a recent review highlights the effectiveness of AI-powered interventions and digital CBT in treating conditions such as anxiety, depression, and PTSD [1]. While these approaches demonstrate promise, the review also identifies key challenges, including sustaining user retention, ensuring data security, and overcoming barriers to equitable access. Lumi's integration of AI-driven insights and personalized feedback directly responds to these concerns, offering a comprehensive, web-based platform that enhances**

**engagement and prioritizes accessibility.**

**While existing solutions contribute valuable tools to the mental health space, most fall short in terms of personalization, engagement, and accessibility collectively. Lumi overcomes these shortcomings by combining AI-powered insights, habit-building features, and immersive AR exercises into a unified, interactive platform designed to support long-term mental wellness.**

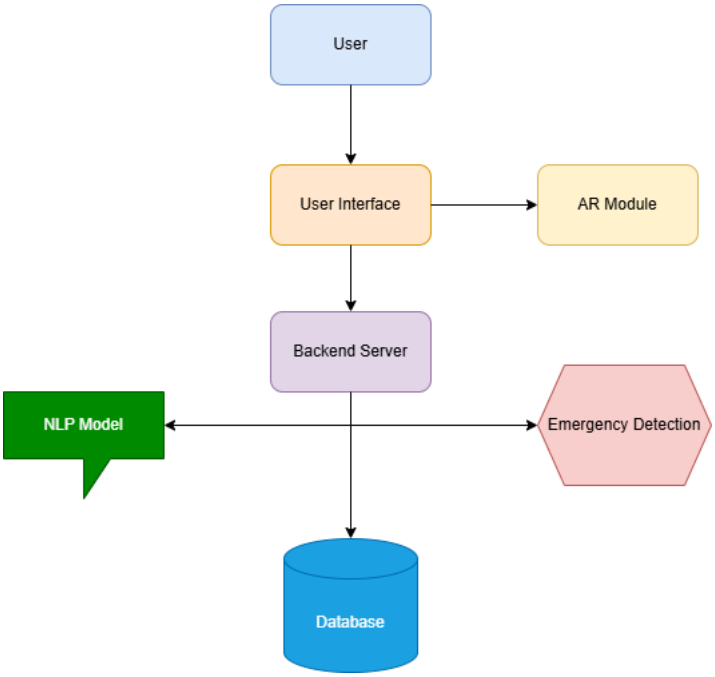
## 6 System Overview

**Explain, at a high level, how you will implement a solution to the problem. Include a diagram of major components to the system (not a full architectural design, but a high level overview of the major system components and how a user or external system might interface). Avoid specific implementation details (operating system, programming languages, etc.). This section should occupy at least 1 full page.**

**Our solution will be implemented using a web application designed to provide users with an interactive and intuitive platform for mental health support. The application will incorporate several core functionalities, including personalized daily check-ins, mood tracking, journaling, sentiment analysis via natural language processing (NLP), emergency detection for crisis intervention, and access to mindfulness exercises and mental health resources.**

**The major components of our system are the User Interface, Back-end Server, Database, NLP Model, Emergency Detection, and Augmented Reality.**

Major System Components Diagram:




The User Interface is where the users will interact with the app and provide any input such as logging in, journal entries, and interactions with the augmented reality. The application will be available to the user using a website link, and inner functionalities will be accessed once the user logs in to their pre-existing account using their credentials.

The back-end server is where the user's interactions and inputs are processed. The database is where the user's information is stored: login information, journal entries, streaks, and moods from their entries.

The NLP is integrated for text analysis to detect the user's moods, and if there is any concerning entries, the emergency detection is activated to respond appropriately.

The Augmented Reality component will be integrated directly into the application and provide the user with options for mindfulness exercises.

## 7 ROLES &RESPONSIBILITIES

**The key stakeholders of this project include the end users of the Lumi application, the development team, and the project advisor. The end users—primarily students and young adults—will benefit from the platform's features that promote emotional well-being and self-care through daily check-ins, journaling, mood tracking, and AR-based coping exercises. The development team is responsible for designing, building, and testing the system to ensure it meets the needs of those users. The project advisor acts as a mentor and quality overseer, guiding the team to ensure deliverables align with academic standards and project goals.**

**The primary point of contact from the sponsor or customer side is the team's faculty advisor, Professor Tony Gwyn, who oversees the project's direction and provides feedback throughout the semester.**

**Our team has been organized into two main focus areas: Frontend and Backend development.**

**All five team members share equal ownership and responsibility for the creation, editing, and submission of all project documentation and reports.**

**The Frontend Team is responsible for building the user interface using React.js, ensuring that the application is responsive, accessible, and user-friendly across devices.**

**The Backend Team is in charge of implementing the core application logic using HTML and JavaScript, integrating MongoDB for data management, and ensuring features like mood logging, journaling, AI-driven insights, and emergency detection function correctly and securely.**

**In addition, the team has one member assigned to developing the AR features using WebXR, which will be integrated into the later stages of the project to provide an immersive self-care experience.**

**The role of Product Owner will remain consistent throughout the development lifecycle. This individual is responsible for maintaining the overall vision of the application, prioritizing features, managing the product backlog, and integrating both frontend and backend components into a cohesive system.**

**The team's Scrum Master role will be maintained for the duration of the project by a designated member who ensures that Agile principles are followed, sprint goals are clear, challenges are addressed, and the team remains on track. The Scrum Master will facilitate sprint planning, retrospectives, and weekly meetings (when applicable) to keep development aligned and efficient.**

**This structure ensures that roles and responsibilities are clearly defined while maintaining flexibility and accountability throughout the Agile development cycle.**

# 8 COST PROPOSAL

There is currently no expected cost for the product's development.

## 9 Facilities & Equipment

**To support the successful development of Lumi, our team plans to utilize available facilities and resources within the College of Engineering. The New Engineering Building will serve as the primary lab space for development and testing, particularly for the Augmented Reality (AR) portion of the project. This space provides the necessary environment, equipment access, and connectivity for collaborative coding, user interface testing, and AR development.**

**For the AR feature integration, we plan to borrow VR/AR headsets from the university lab, which will enable us to test WebXR-based coping exercises in a simulated environment. These goggles will be used to test our AR functionality and ensure an engaging user experience that aligns with our project objectives. Coordination with lab supervisors will be made to secure access to the equipment for development and testing windows.**

**In addition to the AR-related tools, we will continue using personal laptops and university-provided development environments for general web application work (frontend and backend), including use of GitHub, MongoDB, and Visual Studio Code. The current toolset for developing our web application consists of technologies such as React, JavaScript, and MongoDB. The user interface is built using React to create a responsive experience that enhances usability. For backend development and additional frontend interactivity, we are using JavaScript, allowing efficient communication between the client and server components. MongoDB is used as our database of choice due to its flexibility for storing user data such as mood logs, journaling entries, and account information**

**No major purchases are anticipated, as most tools required for software development are open-source or already provided by the university. Any additional equipment or software needs will be met through borrowing from university labs or using free academic licenses.**

## 10 ASSUMPTIONS

**The following list contains critical assumptions related to the development, implementation, and testing of the Lumi application:**

1. **VR/AR equipment (e.g., headsets or goggles) will be available to borrow from the university lab during the time scheduled for AR development and testing.**

2. **The New Engineering Building will remain accessible to the team for in-person development sessions and AR testing throughout the project timeline.**

3. **All team members will have continued uninterrupted access to development tools and platforms, including GitHub and MongoDB, with no major compatibility or licensing issues.**

4. **It is assumed that the final deployed version of the web application will be functionally complete, with minimal to no bugs, crashes, or performance issues at launch.**

5. **The WebXR AR scenes and Three.js-based test environments are compatible with modern web browsers and can be accessed on both lab systems and personal laptops for seamless integration and testing of AR exercises.**

6. **It is assumed that the data entered by users will be clear, honest, and accurate enough for the system's sentiment analysis and tracking features to operate effectively.**

7. **It is assumed that users will be willing to provide personal input (e.g., mood logs, journal entries) and allow the platform to collect and analyze this data to generate meaningful insights.**

## 11 CONSTRAINTS

**The following list contains key constraints related to the development, implementation, and testing of the Lumi mental health web application:**

- **The final prototype demonstration must be completed by May 1, 2025, in alignment with the COMP 496 class schedule within the syllabus.**

- **No external funding is provided for this project, meaning all development must be completed using free tools, personal devices, and university-provided resources.**

- **The team has limited access to AR/VR hardware, such as goggles or headsets, which must be borrowed from the university lab and shared with other students on a reservation basis.**

- **All development work must be conducted outside of normal class hours, since students are balancing this project with full course loads and additional responsibilities.**

- **Any data collected from users (even test users) must comply with university policies regarding ethical data use, privacy, and security, restricting how data can be stored, shared, or analyzed.**

## 12 RISKS

The following high-level risk census contains identified project risks with the highest exposure. Mitigation strategies will be discussed in future planning sessions.

| Risk description | Probability | Loss (days) | Exposure (days) |
|---|---|---|---|
| Limited availability of VR/AR headsets for AR testing | 0.60 | 10 | 6.0 |
| Bugs or instability in the final web app preventing successful prototype demonstration | 0.40 | 12 | 4.8 |
| Scheduling conflicts due to team member coursework and limited working hours | 0.50 | 8 | 4.0 |
| Incompatibility or errors in WebXR build when integrating AR features | 0.30 | 10 | 3.0 |
| Network access issues during app hosting or AR testing sessions | 0.25 | 6 | 1.5 |

Table 1: Overview of highest exposure project risks

# 13 Documentation &Reporting

## 13.1 Major Documentation Deliverables

### 13.1.1 System Requirements Specification

**It will be updated as needed throughout the development process when requirements evolve or new features are added.**

**Initial Version Delivery: February 25, 2025 (submitted on Blackboard)**

**Final Version Delivery: May 8, 2025 (included in Final Project Record ZIP)**

### 13.1.2 Project Charter

**It will be updated if there are any major changes to the project's structure, objectives, or constraints.**

**Initial Version Delivery: Between March 25 and April 1, 2025 (submitted on Blackboard)**

**Final Version Delivery: May 8, 2025 (included in Final Project Record ZIP)**

### 13.1.3 Architectural Design Specification

**It will be revised as necessary when architectural changes are made, especially after major implementation sprints.**

**Initial Version Delivery: April 8, 2025 (submitted on Blackboard)**

**Final Version Delivery: May 8, 2025 (included in Final Project Record ZIP)**

### 13.1.4 Detailed Design Specification

**It will be updated alongside the ADS as system modules are completed and integrated.**

**Initial Version Delivery: April 24, 2025 (submitted as ADS+DDS)**

**Final Version Delivery: May 8, 2025 (included in Final Project Record ZIP)**

### 13.1.5 System Test Plan

**It will be revised after each sprint and finalized once all features are implemented and verified.**

**Initial Version Delivery: May 1, 2025 (submitted on Blackboard)**

**Final Version Delivery: May 8, 2025 (included in Final Project Record ZIP)**

## 13.2 Recurring Sprint Items

### 13.2.1 Product Backlog

Adding Items: Items will be derived from the Software Requirements Specification (SRS) document and added to the product backlog by the product owner after consultation with the development team.

Prioritization: Items will be prioritized using MoSCoW (Must-have, Should-have, Could-have, Wont-have) or based on user impact and technical feasibility.

Decision Maker: The product owner makes the final decision, with input from the team.

Backlog Management Software: We will use Jira or Trello to maintain and share the backlog with stakeholders.

### 13.2.2 Sprint Planning

Planning Process: Sprint planning will occur at the beginning of each sprint, where the team discusses tasks, estimates workload, and defines sprint objectives.

Number of Sprints: Estimated 6 sprints, of two weeks each.

### 13.2.3 Sprint Goal

**Decision Maker: The product owner, in collaboration with the development team and stakeholders.**

**Customer Involvement: Customers/users will provide feedback through surveys, usability testing, and direct consultation before setting the sprint goal.**

### 13.2.4 Sprint Backlog

**Selection Process: The development team, guided by the product owner, selects product backlog items for the sprint backlog.**

**Backlog Maintenance: Managed via a Scrum board (Trello/Jira) to track progress and status of tasks.**

### 13.2.5 Task Breakdown

**Task Assignment: Team members will voluntarily claim tasks based on skills and workload capacity.**

**Time Documentation: Developers will log time spent on tasks in Jira/Trello's time-tracking feature or a shared Google Sheet for transparency.**

### 13.2.6 Sprint Retrospective

**The sprint retrospective will take place at the end of each 2-week sprint during a 30–45-minute team meeting led by the team leader. The meeting will occur every Wednesday after a sprint completion. During the retrospective, the team will reflect on:**

- **What went well during the sprint**
- **What challenges were faced**
- **Suggestions for improving future sprints**
- **Team collaboration and communication**

**As a group, we will document a shared Sprint Retrospective Summary in our Google Docs, including key takeaways and action items for the next sprint which will be due within two days after the group meeting.**

**Individual reflections can be informally submitted in the team group chat following the meeting, allowing everyone to share thoughts or feedback that may not have come up during the discussion.**

#### 13.2.7 Individual Status Reports

**Individual status updates are given verbally during weekly team meetings every Thursday. Each team member shares their progress, current tasks, and any challenges.**

**In addition to verbal updates, all code, documentation, and relevant contributions are consistently uploaded to the team's shared GitHub repository. This serves as the primary record of individual work and progress throughout the project.**

**Each status update includes:**

- **Tasks completed since the last meeting**
- **Work currently in progress**
- **Any challenges**
- **Plans for the next steps**

### 13.3 Closeout Materials

#### 13.3.1 System Prototype

**The final system prototype will include a fully functional web-based AI Mental Health Companion with:**

- **A secure user login system**
- **Personalized daily check-ins**
- **Mood tracking with visual trends and streaks**
- **Journaling feature with text analysis for support**
- **Emergency detection and resource hub**
- **An interactive AR-based coping exercise demo**

**The system will be demonstrated to the class during the final presentation on May 1st, showcasing all major features and walking through a live user demo. A pre-recorded demo video may also be prepared as a backup.**

#### 13.3.2 Project Poster

**The final project poster will follow the standard Senior Design Expo template provided by the College of Engineering. The poster will showcase Lumi's concept, development process, and final prototype using engaging visuals and summaries.**

**Included Sections on the Poster:**

- **Project Title: Lumi: An Augmented Reality Mental Health Companion**
- **Team Members**
- **Instructor Name**
- **Problem Statement**
- **Design Objective**

- **Design Criteria**
- **Design Architecture**
- **Design Implementation**
- **Testing Methodology**
- **Results & Conclusions**
- **Prototype Display**
- **Team Logo**
- **Poster Number: Assigned by the Expo**

**Final Dimensions:**

**The final printed size will be 36" x 48" in landscape orientation, according to the Senior Design Expo requirements.**

**Delivery Date:**

**The poster will be finalized and submitted by April 18, 2025, ahead of the Senior Design Expo on April 22–23, 2025.**

### 13.3.3 WEB PAGE

**The project web page will serve as the landing site for the AI Mental Health Companion. It will include:**

- **Overview of the project and mission**
- **Feature highlights (Daily Check-Ins, Journaling, Mood Tracking, etc.)**
- **Screenshots and UI mockups**
- **AR feature preview**
- **Team member names and roles**
- **Link to a demo video and GitHub repository**

**The web page will be accessible to the public and hosted via GitHub Pages. It will be updated at the end of the project once everything is finished. The final version will be delivered at project closeout.**

### 13.3.4 DEMO VIDEO

**The demo video will showcase the core functionality of Lumi, including:**

- **User login and authentication**
- **Daily check-ins and mood tracking**
- **Journaling feature and text analysis**
- **Emergency detection with helpline integration**
- **AR-based coping exercise preview**
- **The video will include footage of the user interface and interactions.**

**The demo video will be approximately 3–7 minutes long and narrated to guide viewers through key features.**

### 13.3.5 SOURCE CODE

**All source code for Lumi, including frontend, backend, and AR components, will be stored and maintained in a GitHub repository for version control. The repository will be organized into clearly defined folders:**

- **frontend/ – React.js components and interface logic**
- **backend/ – JavaScript (Node.js or Express-style) server-side logic and HTML code**
- **database/ – MongoDB, schema definitions, and files**
- ar-module/ – **Folder containing JavaScript files, Three.js scenes, and AR-related assets for browser-based AR experiences using WebXR**

**Key Details:**

- **Full source code will be delivered to the customer via GitHub.**
- **A complete setup guide will be included in the root README.md.**

**The project will be open-sourced under the MIT License, with license terms included:**

- **In the root LICENSE and README.md**
- **In the header comments of major source files (JavaScript, C#, etc.)**

### 13.3.6 SOURCE CODE DOCUMENTATION

**Lumi's source code will be documented using standard conventions for JavaScript, React, MongoDB. The goal is to ensure that any developer reviewing the code can easily understand and modify it in the future.**

**Frontend (React.js)**

- **Follow JSDoc commenting for all React components and functions.**
- **Component usage and prop definitions will be described in inline comments.**

**Backend (HTML + JavaScript)**

- **Inline documentation using JSDoc style comments.**
- **API endpoints will be documented in a separate file (API_DOCS.md) explaining routes, expected inputs/outputs, and example usage.**

**Database (MongoDB)**

- **Mongoose schema definitions will be commented.**
- **Data structure overview will be provided in a DATABASE_SCHEMA.md file.**

**Web-Based AR Module:**

- **Script logic and Three.js/WebXR interactions will be commented inline to explain scene construction, animation flow, and user interaction handling.**
- **AR content is designed for browser compatibility and does not require any external installations, ensuring quick access for users.**

**Final Documentation:**

- **All documentation will be compiled into a single PDF file.**

- **The PDF will include:**
- **Table of contents**
- **API documentation**
- **Frontend + backend structure overview**
- **Database overview**
- **AR structure & guide**
- **Screenshots where appropriate for clarity**

**This PDF will be submitted as part of the project closeout package and uploaded to the GitHub repository under /docs.**

### 13.3.7 Installation Scripts

**While the main Lumi platform is fully web-based and requires no installation, the AR module may utilize WebXR and WebGL features that depend on compatible browsers and devices. If applicable:**

- **A README.md file will describe how to launch and test the AR experiences using WebXR in supported browsers (e.g., Chrome, Firefox).**
- **No mobile builds or external apps are required; AR experiences are embedded directly into the web application.**
- **All WebXR/Three.js dependencies (e.g., modules, loaders, asset links) will be documented in the setup guide for developers.**

### 13.3.8 User Manual

**The customer will receive a digital user manual (PDF and web-based) covering:**

- **Step-by-step guides for using key features**
- **Screenshots and example flows**
- **How to access support**
- **A short setup video (about 2 minutes) showing how to create an account and use the dashboard**

**Both the manual and video will be accessible via the project's web page and GitHub repo.**

## REFERENCES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