



FAMU-FSU VR Museum VDR2

Sponsored by Dr. Bernadin

11/22/2024, Team 314

Team Members



Jaewan Mcpherson -
Team Leader



Evan Rundlett - AI
Implementor



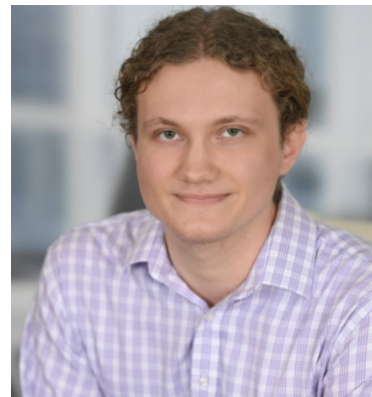
Christian Higgs -
Primary Developer



Devin Nobles -
Secondary Developer



Jason Muse -
Blender Expert



Ethan Myers -
Creative Lead

Sponsor and Advisors

Sponsor:

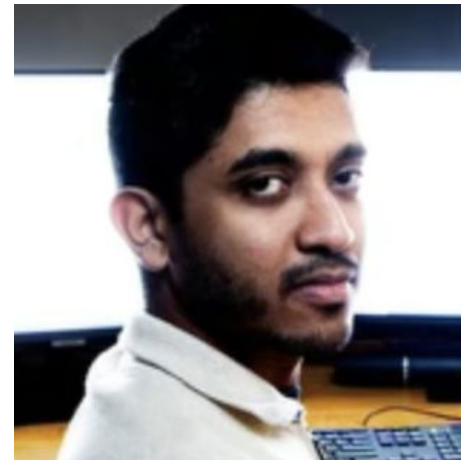


Advisors:

Dr. Shonda Bernadin



Dr. Migara Amarasinghe



Introduction

- Museum of the arts & sciences observable in VR
 - i. Interaction between arts and sciences
 - ii. Utilize AI in generation of exhibits; highlight future of AI in artistic endeavors
- Motivation/Problem
 - i. Designed to educate on a variety of topics
 - ii. Inspire prospective students/engineers



Introduction cont.

- Artistic/creative museum in Virtual Reality
 - Users will be able to explore and interact with numerous exhibits
 - Immersive environment
- Use open source modeling and game engine for development
- Users should be able to interact with the museum via headset controls
 - Microphone included in headset
- Certain aspects should use Artificial Intelligence
 - Some art and images will be AI-generated
 - Sounds and voices can be AI-generated



Introduction cont.

Currently established exhibits:

- Game
- Fashion
- Sculpture
- Star Wars/Marvel
- African Culture
- FAMU-FSU COE History

Improvements:

- Maze Exhibit/First-person Pacman
- Additional exhibit features - more interactivity, more blender objects, playable games
- General features - NPCs, spatial audio, animations, gamification



Needs/Requirements



No.	NEED/ STATEMENT	SOURCE
1	Need to involve Artificial Intelligence.	Customer
2	Needs to be displayed in Virtual Reality.	Customer
3	Needs to be interactive.	Customer
4	Needs to display historical and artistic exhibits.	Customer

	NEED	REQUIREMENT/ INTERPRETATION
1	1	AI shall help create and modify the exhibits.
2	1,3	The exhibits shall be designed for an immersive VR experience.
3	2,3	Shall have exhibits that change or play audio when users interact with them; shall implement voiced characters to interact with.
4	3,4	Visitors shall explore rooms dedicated to classical music, paintings, and sculptures, bringing the museum to life in an interactive 3D space.

Concept Generation

- Methods:
 - Morphological analysis - Take main functions of project and determine possible solutions
 - Crapshoot - Come up with seemingly random ideas and discuss their viability
- Main functions needed to be addressed:
 - VR
 - Which headset?
 - Use of AI
 - Which generative AI tools?
 - 3D Modeling/graphics
 - What model engine?
 - Game engine
 - What game engine is best for VR compatibility?
 - Interactivity
 - Artistic expression

Concept Generation cont.

Morphological Analysis

VR	Metaquest 3	Apple Vision Pro	Metquest Pro	Oculus	Playstation VR
AI	Incorporate multiple AI tools: ChatGPT, Suno, MidJourney	ChatGPT	Suno	MidJourney	Elevenlabs
3D Modeling	Animations/models in Blender	Use Maya for models	Use CAD for models	Use Sketchup for models	Use Cinema4D for renders
Interactivity	Include numerous types of interaction: games, spatial audio, generative exhibits	Add interactive games	Add interactive elements to existing exhibits	Spatial audio	Image generation
Artistic Expression	Add a variety of artistic forms	Focus more on painting/imagery	Focus on historical exhibits	Add musical expression	Add dancing/ expressive art exhibits
Engine	Unreal Engine	Unity	Godot	Lumberyard	CRYENGINE

High Fidelity Concepts

Concept 1:

Game Engine: Unity

3D modeling/animations: Blender

AI tools: ChatGPT, Midjourney, and Suno

Headset: Metaquest 3

Interactivity: Spatial audio, games, generated imagery

New exhibits: Variety such as a sports, history of AI, film, improved game room, classical music.



Concept 2:

Game Engine: Unreal Engine

3D modeling/animations: Blender

AI tools: ChatGPT, Midjourney, and Suno

Headset: Metaquest 3

Interactivity: spatial audio and games

New exhibits: sports room, history of AI room, and film room.



High Fidelity Concepts

Concept 3:

Game Engine: Godot

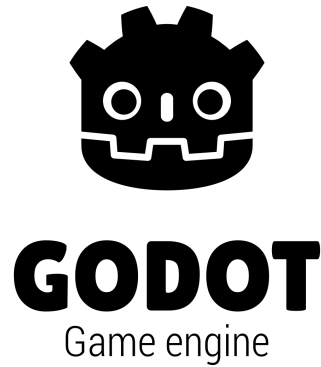
3D modeling/animations: Blender

AI tools: Suno

Headset: Apple Vision Pro

Interactivity: Spatial audio and games

New exhibits: Variety such as a sports, history of AI, film, improved game room



Concept 4:

Game Engine: Unity

3D modeling/animations: Blender

AI tools: ChatGPT, Midjourney, and Suno

Headset: Apple Vision Pro

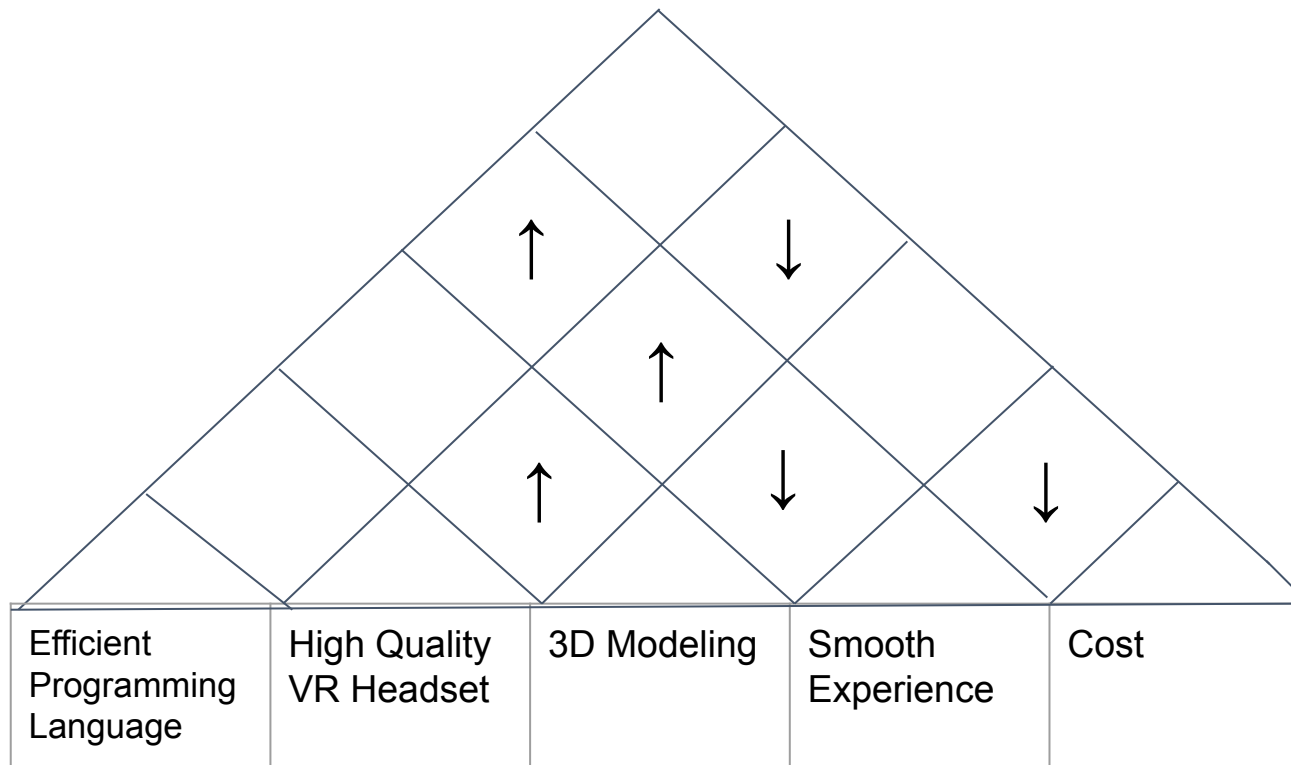
Interactivity: spatial audio and games

New exhibits: sports room, history of AI room, and film room.



Concept Selection

House of Quality Roof:



Concept Selection

House of Quality Base:

		Efficient programming Language	High quality VR headset	3D Modeling	Smooth Experience	Cost
		+	+	+	+	-
Use of AI	+	↑			↓	↓
VR	+		↑↑	↑	↑	↓↓
Interactivity	+	↑↑	↑		↓	
Artistic Expression	+		↑	↑↑	↓	
Targets		Time between interactions and program ≤2 sec	Resolution of 1080x1200	User survey with 80% satisfaction	FPS >72	Budget of \$500

Pugh Chart

Functions	Function Ranking	Concept 1 (reference)	Concept 2	Concept 3	Concept 4
Use of AI	3	-	0	-1	0
VR Headset	5	-	0	-1	-1
Game Engine accessibility	2	-	-1	-1	0
3D modeling	1	-	0	0	0
Artistic Expression	4	-	0	0	0
Score		-	-1	-3	-1
Continue?		Yes	No	No	No

Pugh Chart Discussion

- 3D modeling most important
 - Provides baseline for everything else
 - No models, no museum
- VR headset least important
 - Most mainstream VR headsets have similar specs/controls
- Game engine relatively important
 - Some engines are not very compatible with VR
 - Some engines are easier to design in
- AI also important
 - Some AI tools are better at certain tasks
 - AI is one of our major needs

Pugh Chart Discussion

- Concept 1 was decided to be continued
 - Offers the best combination of solutions
- Unity is more VR compatible and user-accessible than Unreal and Godot
- A variety of AI tools is ideal since AI will be implemented in various ways
 - Suno: audio, Midjourney: images, ChatGPT: Text/misc.
- The Metaquest 3 can provide sufficient resolution and user-controls
 - Metaquest 3 already possessed



Analytical Hierarchy Process

Pairwise comparison matrix for Use of AI

	Concept 1	Concept 2	Concept 3	Concept 4	Column Sum
Concept 1	1	3	5	3	12
Concept 2	1/3	1	4	2	7.33
Concept 3	1/5	1/4	1	1/3	1.783
Concept 4	1/3	1/2	3	1	4.833

Comparisons based on scales 1-9

1= equally important, 3 = moderate, 5= strong,

7= very strong, 9 = extreme

AHP cont.

Normalize Matrix

	Concept 1	Concept 2	Concept 3	Concept 4
Concept 1	$1/12 = \mathbf{0.083}$	$3/7.333 = \mathbf{0.409}$	$5/1.783 = \mathbf{0.28}$	$3/ 4.833 = \mathbf{0.621}$
Concept 2	$0.33/12 = \mathbf{0.028}$	$1/7.33 = \mathbf{0.136}$	$4/1.783 = \mathbf{0.224}$	$2/ 4.833 = \mathbf{0.069}$
Concept 3	$0.2/12 = \mathbf{0.017}$	$0.25/7.33 = \mathbf{0.034}$	$1/1.783 = \mathbf{0.056}$	$0.33 / 4.833 = \mathbf{0.069}$
Concept 4	$0.33/12 = \mathbf{0.028}$	$0.5 / 7.333 = \mathbf{0.068}$	$3/1.783 = \mathbf{0.168}$	$1/ 4.833 = \mathbf{0.207}$

AHP cont.

Calculate Row Averages

	Row Sum	Row Average
Concept 1	1.393	$1.393/4 = 0.52$
Concept 2	0.802	$0.802/4 = 0.201$
Concept 3	0.176	$0.176 / 4 = 0.079$
Concept 4	0.802	$0.802 / 4 = 0.201$

Repeat process for each criterion

Total Score for Concept X = Sum (Weight of Criterion i $\times$ Weight of Concept X under Criterion i)

AHP

Criterion	Weight	Concept 1	Concept 2	Concept 3	Concept 4
Use of AI	0.4	0.52	0.201	0.079	0.201
VR Headset	0.2	0.6	0.2	0.1	0.1
Game Engine Accessibility	0.15	0.7	0.1	0.1	0.1
3D Modeling	0.15	0.5	0.2	0.15	0.15
Artistic Expression	0.05	0.5	0.2	0.15	0.15
Total Score		0.558	0.1854	0.1041	0.1529

Final Concept

Choice 1:

VR
AI
3D Modeling
Interactivity
Artistic/ Historical Expression
Game Engine



Midjourney

SUNO



blender



Bill of Materials

TBD, but we are considering purchasing the following:

- ChatGPT AI API tokens for generation
- Premium AI subscription to access API's
- Budget is only \$500
 - Trying to limit spending
 - If something goes wrong, especially with the headset, we might need our entire budget



ChatGPT

Plus

\$20 / month

For individuals looking to amplify their productivity

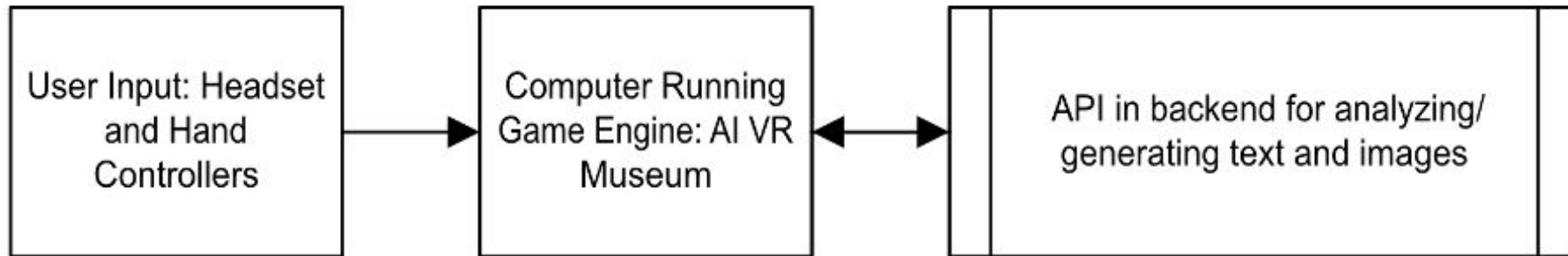
[Start now](#)

[Limits apply >](#)

- ✓ Access to OpenAI o1-preview, OpenAI o1-mini
- ✓ Access to GPT-4, GPT-4o, GPT-4o mini
- ✓ Up to 5x more messages for GPT-4o
- ✓ Access to data analysis, file uploads, vision, and web browsing
- ✓ Access to Advanced Voice Mode
- ✓ DALL-E image generation
- ✓ Create and use custom GPTs
- ✓ Early access to new features



Preliminary Design

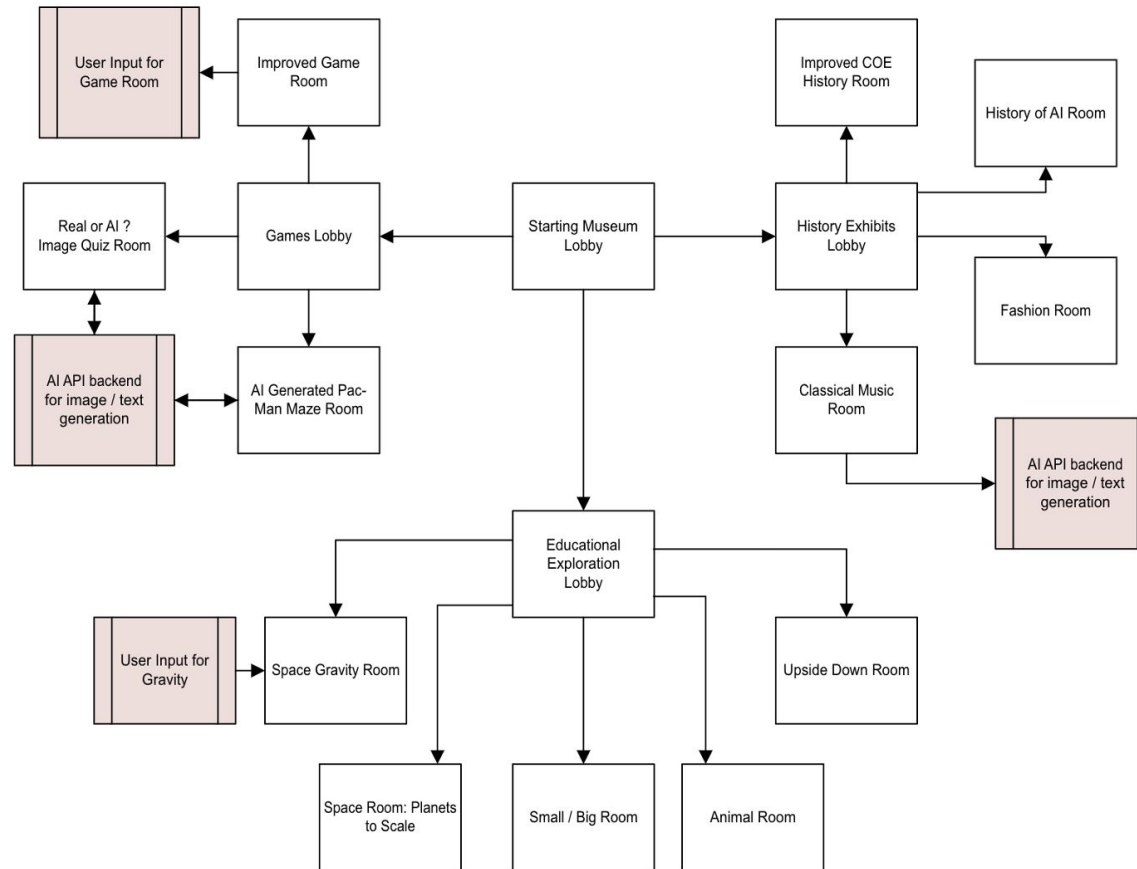


High-Level Block Diagram:

- Our design has 3 components:
 - VR headset
 - Computer running the game
 - AI API backend for generative features

Preliminary Design

We plan to have the Museum begin in the lobby, and then split into 3 different sections:

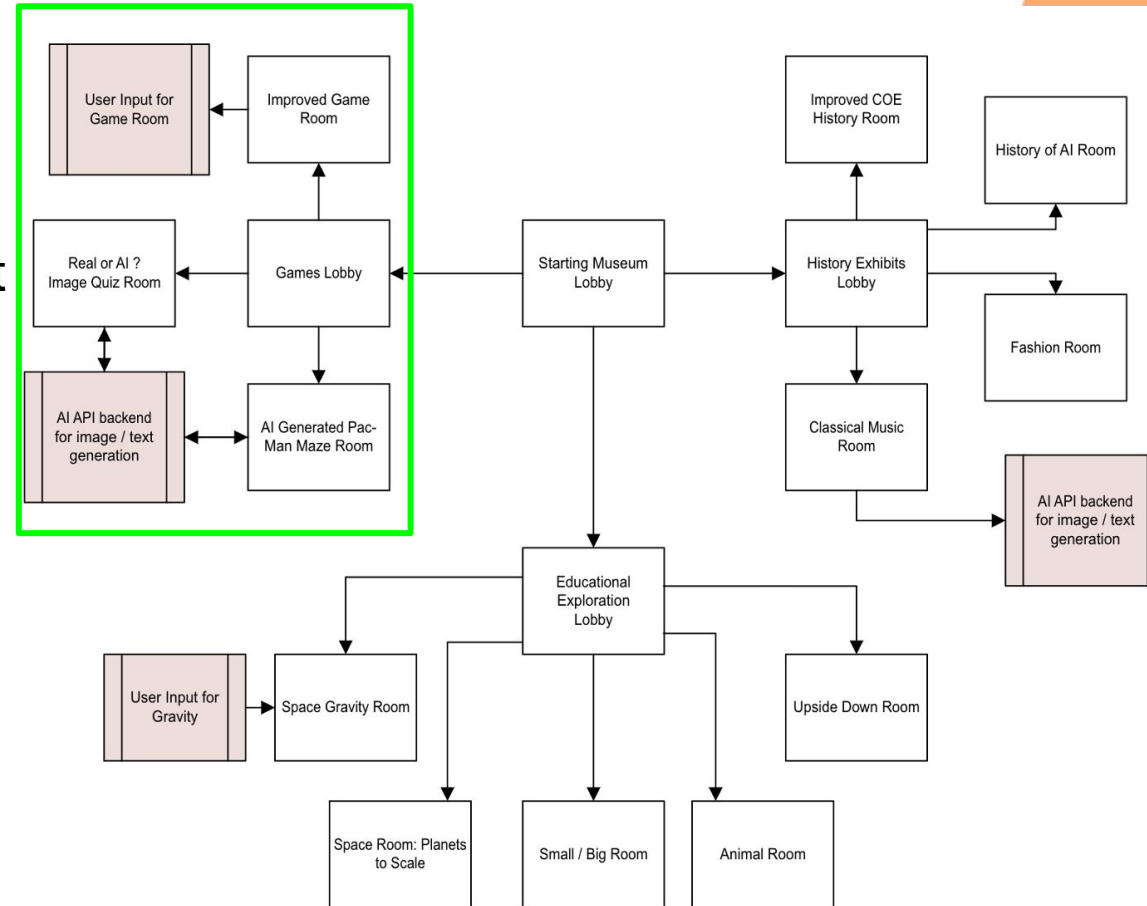


Museum Layout - Red boxes indicate room subprocesses.

Preliminary Design

We plan to have the Museum begin in the lobby, and then split into 3 different sections:

- Games Wing
 - 3 games

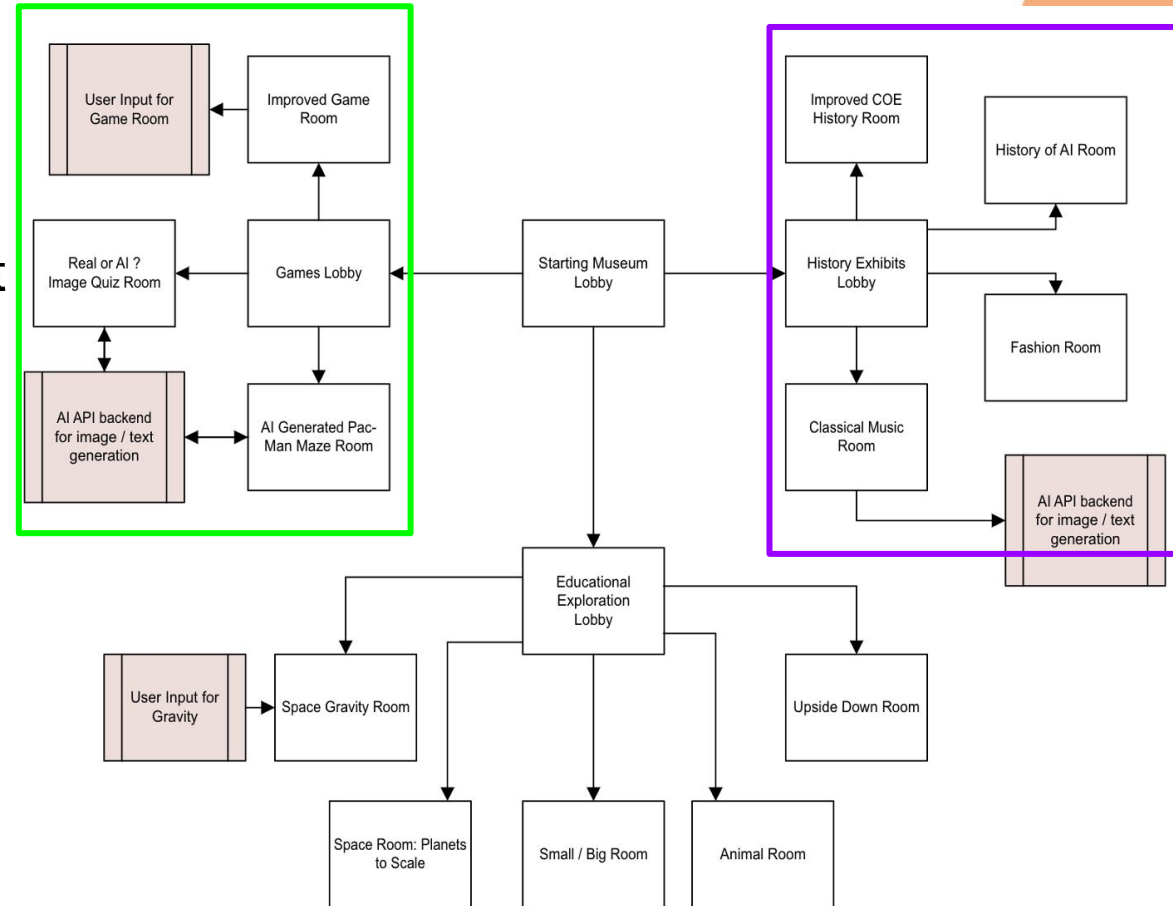


Museum Layout - Red boxes indicate room subprocesses.

Preliminary Design

We plan to have the Museum begin in the lobby, and then split into 3 different sections:

- Games Wing
 - 3 games
- History Wing
 - 4 exhibits

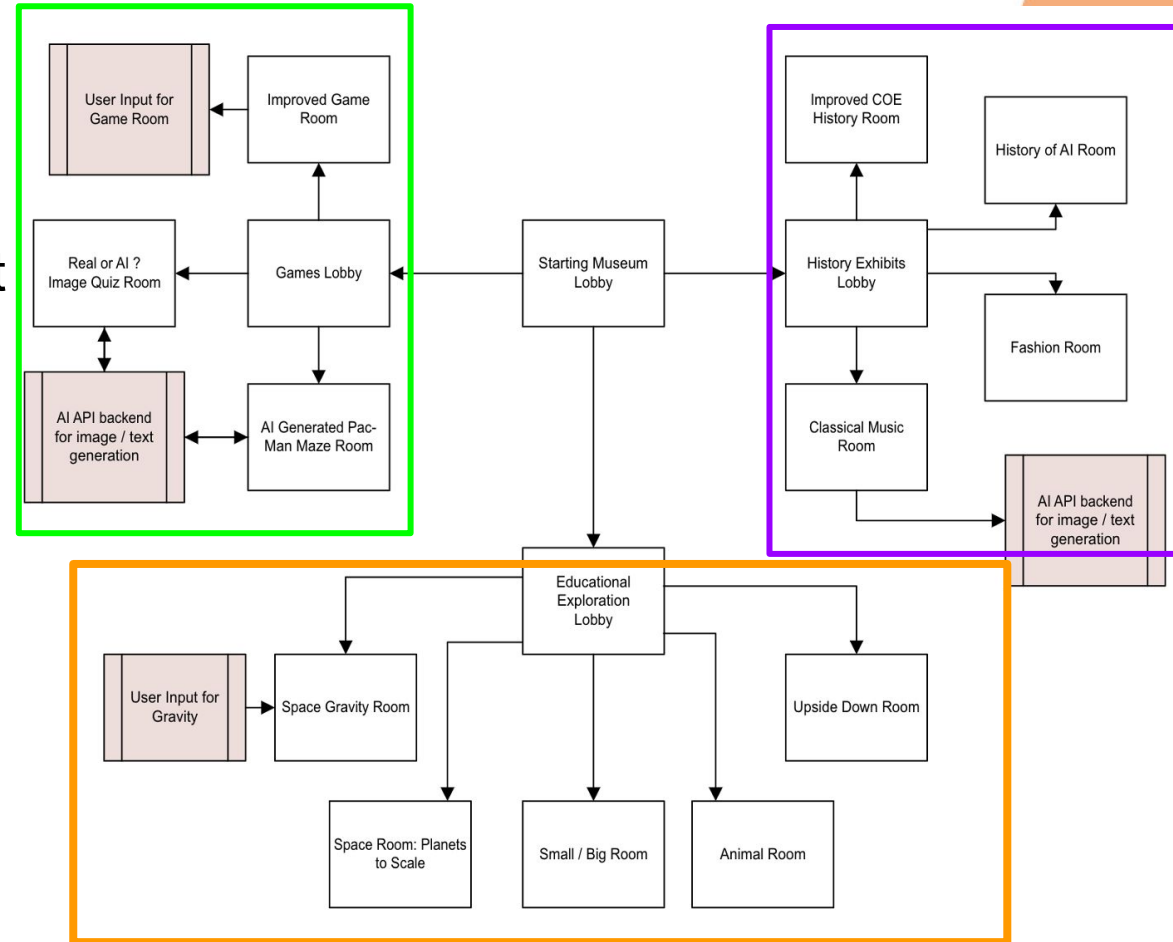


Museum Layout - Red boxes indicate room subprocesses.

Preliminary Design

We plan to have the Museum begin in the lobby, and then split into 3 different sections:

- Games Wing
 - 3 games
- History Wing
 - 4 exhibits
- Educational Exploration Wing
 - 5 exhibits



Museum Layout - Red boxes indicate room subprocesses.

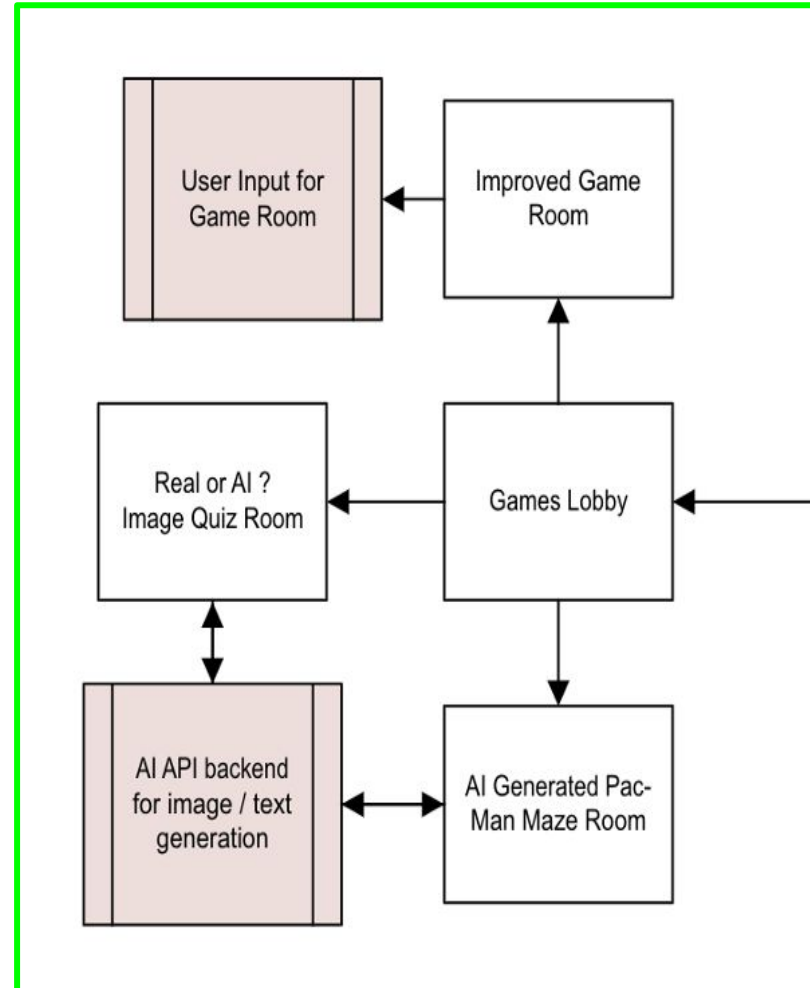
Preliminary Design - Games Wing

Current State

- Game Room

To Be Added

- Improved Game Room
 - User-interactivity Options
- AI-generated Pac-Man Maze Room
 - AI API for text/image generation
- *Real or AI?* Image Quiz Room
 - AI API



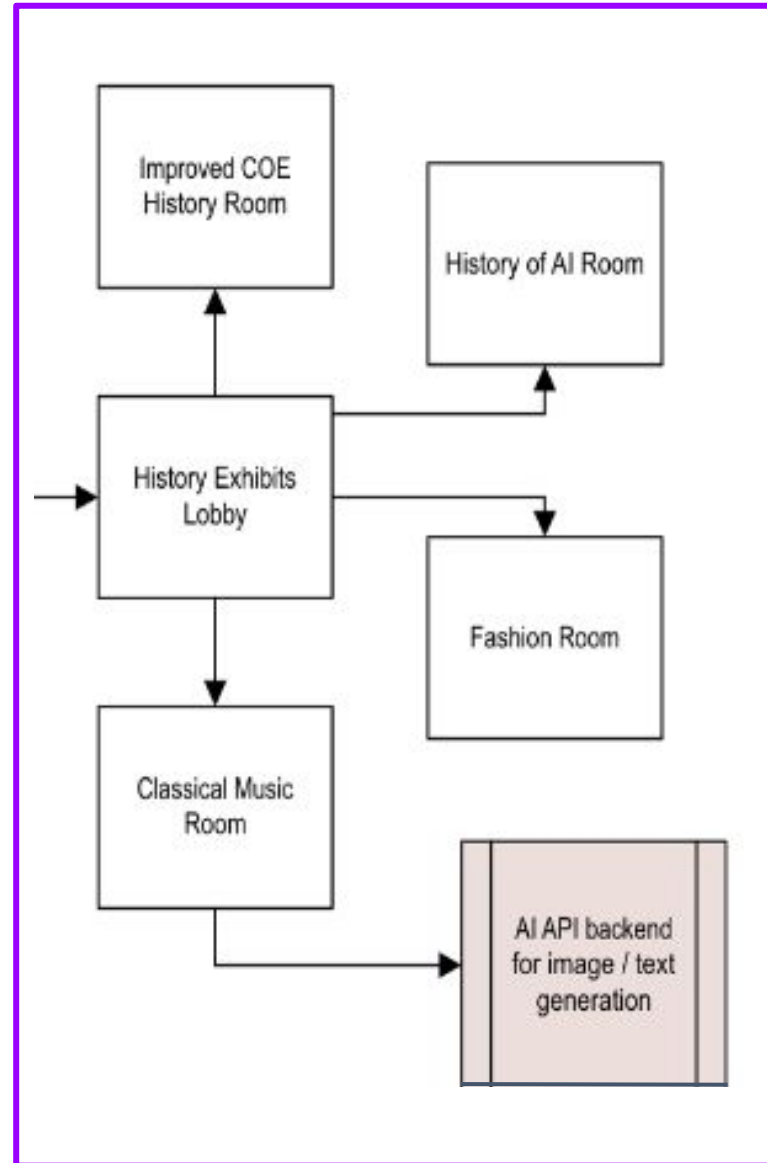
Preliminary Design - History Wing

Current State

- Fashion Room
- COE History Room

To Be Added

- History of AI
- Classical Music
 - AI API Backend
- Improvements for Fashion and COE History rooms

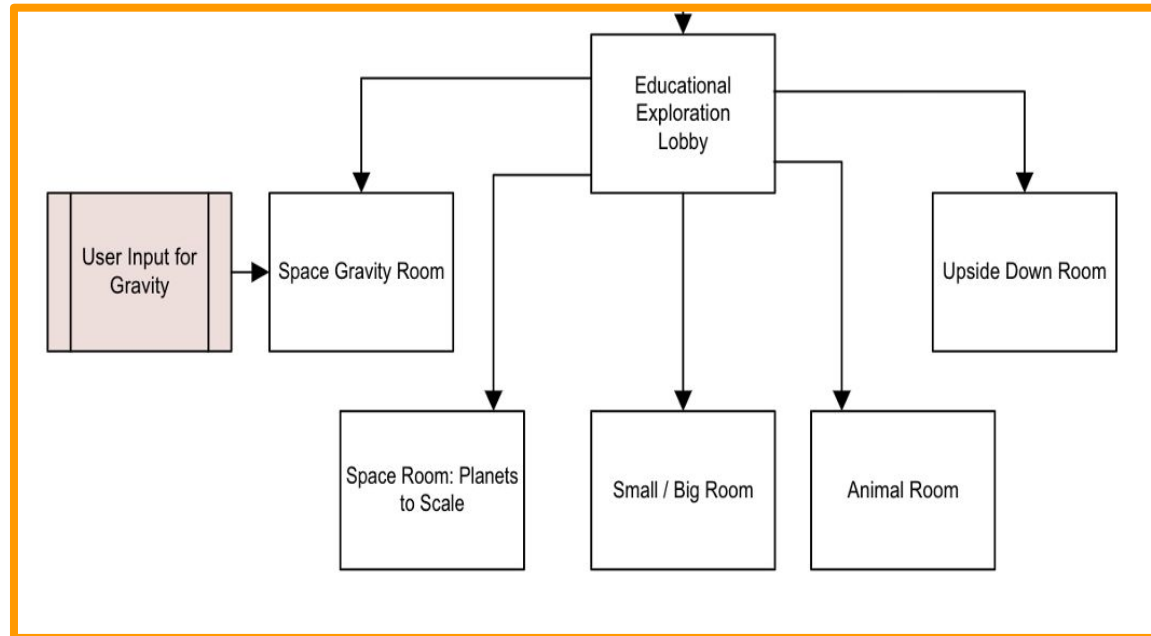


Preliminary Design - NEW Educational Exploration Wing

The Educational Exploration Lobby is planned to be split into 5 exhibits:

- Space Gravity Room
- Space Room: Planets to Scale
- Small/Big Room: Shifting Perspective
- Animal Room
- Upside Down Room: Inverted Gravity

Note: Design is subject to change



Future Works

- Creating and Importing Exhibits into Unity
 - 3D Modeling of new rooms
 - Code implementation of interactive elements
- AI Implementation
 - AI Text-to-Speech Image Generator
 - Speech-to-image generation
 - Tour Guide with AI speech
- Final organization of Museum Layout in Unity

End of Presentation

Any Questions?