Course Overview

CAP 6117: Mixed Reality Project

Dr. Ryan P. McMahan

University of Central Florida

Instructor Information

- Instructor:
  Dr. Ryan P. McMahan
- Office Hours:
  TuTh 2:45pm – 4:00pm
- Office Location:
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Course Information

- Course: CAP 6117 Mixed Reality Project
- Credit Hours: 3 credit hours
- Prerequisite(s): CAP 6110 Augmented Reality Engineering
- Term: Fall 2022
- Course Modality: P (In-Person)
- Class Times: TuTh 1:30pm – 2:45pm
- Class Location: HEC 104

Course Description

- Mixed reality, project management, reporting, prototyping, gesture and voice recognition, design walkthroughs, sound design, 3D scanning, character generation, motion capture, UX inspections, tutorials, help, documentation.

Course Purpose

- Students will learn how to rapidly develop mixed reality (MR) projects, including virtual reality (VR) or augmented reality (AR) prototypes, while working in teams and employing agile development and management processes.

Projects Overview

- Projects will be iteratively developed through the following tasks and milestones.

- **Individual Assignments:**
  - Project Pitch: Ideate and present a state-of-the-art mixed reality project, including three key features and required resources.
  - Project Interest Questionnaire: Provide feedback on which course projects and teams you are interested in being assigned to.

Projects Overview

- **Team Assignments:**
  - Cohort Request (Optional): Request which cohort and schedule (A or B) your team is assigned to.
  - Statement of Work: Develop a statement of work that sufficiently details the features and tasks required to implement your mixed reality project.

Projects Overview

- **Team Assignments (continued):**
  - Seed Prototype: Develop and present a seed prototype that explores one key feature of your mixed reality project.
  - Root Prototype: Develop and present a root prototype that implements one key feature of your mixed reality project.
  - Trunk Prototype: Develop and present a trunk prototype that implements and evaluates two key features of your mixed reality project.
  - Branch Prototype: Develop and present a branch prototype that implements and evaluates three key features of your mixed reality project.
  - Crown Prototype: Develop and present a crown prototype that refines and documents your mixed reality project.

Project Pitch

- For the Project Pitch, individual students will ideate and present a state-of-the-art mixed reality project, including three key features and required resources.
- Proposed projects can be **a VR, AR, or MR application that solves a problem or product need.**

Project Pitch

- **Key features can be:**
  - ***Interaction*** features, which are uncommon interaction techniques or input interfaces that must be implemented for a proper solution (e.g., a novel interaction technique for manipulating the arms of a surgical robot through inverse kinematics).
  - ***Scenario*** features, which are complex logic or timelines that must be implemented for a solution to properly handle all possible events (e.g., a novel module manager for teaching users about the quantum mechanics of a hydrogen atom).
  - ***Display*** features, which are uncommon rendering techniques or output interfaces that must be implemented for a proper solution (e.g., a novel shader technique for rendering the electron cloud of a quantum atom model).

Project Pitch

- **Key features can be (continued):**
  - ***User*** features, which are particular tracking techniques or models that must be implemented for a solution to properly understand or predict the user's actions (e.g., a novel machine learning method for predicting whether the user will make an error while virtually troubleshooting a surgical robot).
  - ***Backend*** features, which are particular techniques or methods that must be implemented for a proper solution (e.g., a database for tracking learning errors, a network for implementing multiplayer features).

Project Pitch

- **Required resources can include:**
  - ***Asset*** requirements, which are particular models or assets required for a proper solution (e.g., CAD models of a surgical robot, FinalIK for inverse kinematics).
  - ***Hardware*** requirements, which are particular devices or hardware required for a proper solution (e.g., a Microsoft HoloLens for an AR guidance solution, a Vive Pro Eye for a VR solution requiring eye-tracking capabilities).
  - ***Personnel*** requirements, which are the minimum number of team members required to successfully implement a proper solution (e.g., one to implement interactions, one to implement the scenario, one to implement the novel display feature).
  - ***Skills*** requirements, which are the particular skills required to successfully implement a proper solution (e.g., 3D interaction development, instructional design, shaders).

Project Pitch

- Project pitches will be presented as **5-minute-or-less videos with commentary** that provide sufficient details about the purpose of your MR solution, the three key features to be implemented, and the resources required.
- These videos will be shared with your peers during the Project Pitches I and Project Pitches II class periods.

Project Interest Questionnaire

- For the Project Interest Questionnaire, individual students will provide feedback on which course projects and teams they are interested in being assigned to.
- For each project pitched, you will be able to indicate whether you are **wanting, willing, or reluctant** to be assigned to it.

Project Interest Questionnaire

- Based on everyone's feedback, **the instructor will assign teams of students to the projects that garnered the most interest**.
- Based on prior semesters, approximately one third of the pitched projects will be assigned teams, and team sizes will vary between two and five team members.
- In rare cases, a project may be assigned a single team member, if that student pitched the project, indicated that only a single team member is necessary for its personnel requirements, and will generally be unable to work with other students due to extenuating circumstances (e.g., a full-time job).
- However, such solo projects will still be held to the same standards and expectations as the team projects.

Cohort Request (Optional)

- For the Cohort Request (Optional), **teams can request which cohort and schedule (A or B) they are assigned to**.
- While both cohorts of teams are expected to complete the same prototype assignments with the same standards and expectations, their deadlines differ by one week (see the Course Schedule).
- Prototype assignments are due one week earlier for cohort A and one week later for cohort B.
- It is important to note that while teams can request a cohort assignment, the instructor will assign teams to cohorts based on these requests and other factors.
- **Hence, a team may be assigned to one cohort despite requesting the other cohort.**

Statement of Work

- For the Statement of Work, teams will develop a statement of work that sufficiently details the features and tasks required to implement their mixed reality project.
- The statement of work is expected to provide **sufficient details about the three key features to be implemented** for the various prototypes.
- The statement of work should also include **a Gantt chart with sufficient detail about all tasks** required to satisfy the various prototypes, including the key features, quality improvements, evaluations, demonstrations, and documentation.
- Finally, the statement of work should provide sufficient detail about **which team member will lead and be primarily responsible for each task.**

Prototypes

- Teams will develop and present a series of prototypes that implement the key features of their mixed reality project.
- This series of prototypes is based on the concept of a **Tree of Prototypes**, which involves five stages of increasingly complex prototypes: ***Seed***, ***Root***, ***Trunk***, ***Branch***, and ***Crown***.

Seed Prototype

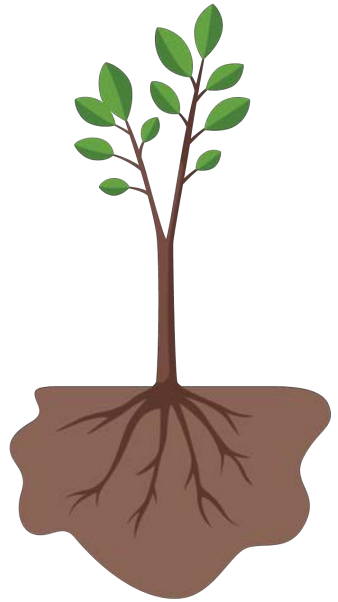
- For the Seed Prototype, teams will develop and present a prototype that explores one key feature of their mixed reality project.
- ***Seed prototypes*** are meant to be *rapid prototypes* for investigating how to implement a key feature.
- If successful, a seed prototype can easily evolve into a root prototype.
- However, if unsuccessful, seed prototypes are intended to serve as *throwaway prototypes*, which can be abandoned for an alternative approach to implementing the key feature.

Root Prototype

- For the Root Prototype, teams will develop and present a prototype that implements one key feature of their mixed reality project.
- ***Root prototypes*** are meant to be *reusable prototypes* for single key features.
- The key feature implemented by a root prototype should be complete and reusable for future prototypes.
- The root prototype is also an opportunity for teams to explore a second key feature for their mixed reality project.

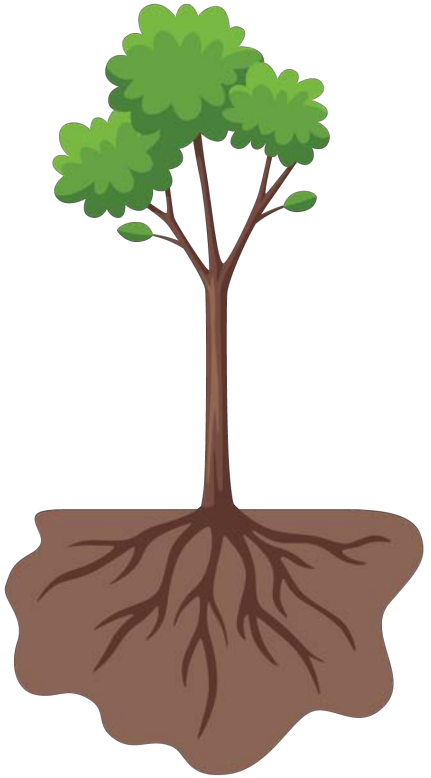
Trunk Prototype

- For the Trunk Prototype, teams will develop and present a prototype that implements and evaluates two key features of their mixed reality project.
- ***Trunk prototypes*** are meant to be *moderate-fidelity prototypes* for two key features.
- Additionally, trunk prototypes should be suitable for user testing and evaluation, outside of the development team.
- The trunk prototype is also an opportunity for teams to explore the third key feature for their mixed reality project.



Branch Prototype

- For the Branch Prototype, teams will develop and present a prototype that implements and evaluates three key features of their mixed reality project.
- ***Branch prototypes*** are meant to be *high-fidelity prototypes* for all three key features.
- Hence, branch prototypes are *minimum viable products (MVPs)*.
- They should also be suitable for user testing and evaluation.



Crown Prototype

- For the Crown Prototype, teams will develop and and present a prototype that refines and documents their mixed reality project.
- ***Crown prototypes*** are meant to closely resemble a *final product*.
- Crown prototypes should be thoroughly user tested and well documented.
- Ideally, crown prototypes can become the basis for actual products.

Evaluations

- In addition to developing the key features for the various prototypes, teams are required to conduct user evaluations of their trunk, branch, and crown prototypes.
- These user evaluations are not intended to be rigorous, but rather rapid, in order to quickly identify any major issues pertaining to the implementation of each prototype.
- Teams will need to **provide evidence of their rapid evaluations** (e.g., video of a person external to the team using the prototype) and to **discuss how the results affected their designs and were addressed within prototypes** (e.g., the team changed text within the user interface to be more clear).

Documentation

- For the Crown Prototype, teams are required to communicate technical information about their final prototypes through **documentation, including commented code, HTML documentation, and a Quick Start guide.**

Summary of Prototype Requirements

- The table below summarizes the high-level requirements of the five types of prototypes.

Prototype Requirements

Prototype	Key Feature #1	Key Feature #2	Key Feature #3	Overall Quality	Evaluation	Documentation
Seed	X					
Root	X					
Trunk	X	X			X	
Branch	X	X	X		X	
Crown	X	X	X	X	X	X

Individual Contributions

- For each team assignment, individual team members are expected to contribute in equitable and fair manners to the outcomes of each assignment.
- For each team assignment, the instructor will evaluate each team member and assess whether that member's individual contribution to the assignment was **at expectations, below expectations, or significantly below expectations**, based on the team's statement of work and weekly reports.

Individual Contributions

- If a team member's contribution to an assignment is at expectations, the team member will receive **100% of the team's score for the assignment as their individual score**.
- If a team member's contribution to an assignment is below expectations, the team member will receive **50% of the team's score as their individual score**.
- If a team member's contribution to an assignment is significantly below expectations, the team member will receive **0% of the team's score as their individual score**.

Weekly Reports

- Individual students are expected to regularly communicate their progress through Webcourses via **weekly reports** (e.g., Weekly Report #1).

Course Schedule

Module	Topics	Weekly Report
Week #1: Introduction	Course Overview Design Requirements	Weekly Report #1
Week #2: Pitch Development	Pitch Development NO CLASS (UCF vs. SCSU)	Weekly Report #2
Project Pitch due Sunday, September 4 by 11:59PM		
Week #3: Project Pitches	Project Pitches I Project Pitches II	Weekly Report #3
Project Interest Questionnaire due Sunday, September 11 by 11:59PM		
Week #4: Project Planning	Project Requirements Prototyping	Weekly Report #4
Cohort Request (Optional) due Sunday, September 18 by 11:59PM		
Week #5: Project Management	Agile Practices Sprint	Weekly Report #5
Statement of Work due Sunday, September 25 by 11:59PM		

Course Schedule

Week #6: Design Guidelines	VR Design Guidelines AR Design Guidelines	Weekly Report #6
Cohort A: Seed Prototype due Sunday, October 2 by 11:59PM		
Week #7: Seed Demonstrations	Seed Demonstrations A Evaluations	Weekly Report #7
Cohort B: Seed Prototype due Sunday, October 9 by 11:59PM		
Week #8: Seed Demonstrations	Seed Demonstrations B NO CLASS (UCF vs. Temple)	Weekly Report #8
Cohort A: Root Prototype due Sunday, October 16 by 11:59PM		
Week #9: Root Demonstrations	Root Demonstrations A Sprint	Weekly Report #9
Cohort B: Root Prototype due Sunday, October 23 by 11:59PM		
Week #10: Root Demonstrations	Root Demonstrations B Documentation	Weekly Report #10

Course Schedule

Week #10: Root Demonstrations	Root Demonstrations B Documentation	Weekly Report #10
Cohort A: Trunk Prototype due Sunday, October 30 by 11:59PM		
Week #11: Trunk Demonstrations	Trunk Demonstrations A Sprint	Weekly Report #11
Cohort B: Trunk Prototype due Sunday, November 6 by 11:59PM		
Week #12: Trunk Demonstrations	Trunk Demonstrations B Sprint	Weekly Report #12
Cohort A: Branch Prototype due Sunday, November 13 by 11:59PM		
Week #13: Branch Demonstrations	Branch Demonstrations A Sprint	Weekly Report #13
Cohort B: Branch Prototype due Sunday, November 20 by 11:59PM		
Week #14: Branch Demonstrations	Branch Demonstrations B NO CLASS (Thanksgiving)	Weekly Report #14
Week #15: Conclusion	Mixed Reality Research Sprint	Weekly Report #15
Crown Prototype due Sunday, December 4 by 11:59PM		
Final Exam Week: Crown Demonstrations	Crown Demonstrations	

Grading Information

- A point-based grading system will be used with 100 total points distributed among individual assignments, team assignments, individual contributions, and the weekly reports, as follows:

Grading Distribution

Project Pitch	5 points
Project Interest Questionnaire	2.5 points
Statement of Work	10 points
Seed Prototype	5 points
Root Prototype	5 points
Trunk Prototype	15 points
Branch Prototype	20 points
Crown Prototype	30 points
Weekly Reports	7.5 points

Grading Information

- The following grading scale will be employed on the final point totals:

Grading Scale	
A	94 - 100 points
A-	90 - 94 points
B+	87 - 90 points
B	84 - 87 points
B-	80 - 84 points
C+	77 - 80 points
C	74 - 77 points
C-	70 - 74 points
D+	67 - 70 points
D	64 - 67 points
D-	61 - 64 points
F	0 - 61 points

MRE Graduate Certificate – Intent to Graduate

- If you are part of the Mixed Reality Engineering graduate certificate program, you need to submit your Intent to Graduate before **Friday, October 14, 2022**.
- Otherwise, UCF will not recognize your completion of the program, and you will not receive your Mixed Reality Engineering certificate.
- **Directions:**
  1. Log on to my.ucf.edu using your NID and password.
  2. Click on "Student Self Service" located under the myUCF Menu.
  3. Once in the myUCF Student Center portal, select "Intent to Graduate: Apply" from the "Other Academics" drop-down menu.

Reminders

Upcoming Classes

- **Thursday:**
  Design Requirements
- **Next Tuesday:**
  Pitch Development
- **Next Thursday:**
  NO CLASS (UCF vs. SCSU)

Questions?