Augmented Reality
Final Project Guideline

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In the final project, you will work with your peers as a team of three on an AR/VR research or application. You can work on a research project to push the boundaries of AR/VR or build an application that applies state-of-the-art AR/VR technologies to solve a problem in a specific domain. You will need to determine a topic to work on, write a project proposal together, implement the project, and submit the project deliverables as a team.

Suggested topics

The following are the suggested topics. You can choose one of them, but we impose a rule that no more than three teams can work on the same topic. If more than three teams express their interests in the same topic, we will resolve the conflict on a first-come-first-serve basis using the date and time when the project registration is done.

If you are not interested in the suggested topics, you are welcome to propose a new topic of your own. You must discuss the topic with the lecturers and get approval to proceed with your custom project.

A) Research projects

1) Implement a method that reconstructs the 3D environment from an RGB video and produces a 3D triangle mesh of the scene. Use this method to scan at least three scenes, e.g., TCD campus.

2) Implement a method to reconstruct the animated full-body human from an RGB video and produce the animated 3D mesh. Use this method to scan at least three people.

3) Implement a method that automatically creates an animated 3D avatar from an input image or video. (Compared to Project 2, this project focuses on avatars in different styles instead of photorealistic reproduction of the human face/body).

4) Implement a method that detects and tracks everything in the real environment in real time. At least five types of objects must be detected and tracked: ground plane, depth, human face, hand, full-body pose, and generic objects.

5) Implement a method for automatically generating a 3D scene from text prompts. The scene should be composed of objects properly positioned to form a realistic scene.

6) Implement a method that seamlessly integrates virtual objects into a real scene with matching lighting conditions. Text prompts can be used to generate the virtual objects.

B) Application projects

7) Build an AR/MR game with passthrough that shows the interaction between the virtual and the real world. Deploy the game to iOS/Android/VR headsets.

8) Build a head-mounted display using an Arduino/Rasberry Pi board, an LCD panel, and pancake lenses. Deploy some applications, such as stereo rendering, on your platform.

9) Build a 3D painting application in AR/VR/MR. Export your model in OBJ format.

10) Build an AR/VR/MR application for furniture arrangement of your interior space.

11) Build an AR/VR/MR application for virtual tours inspired by Google Street Views or Apple Look Around.

12) Build an AR/VR/MR social platform.

Project registration

Please use this link for project registration. https://forms.gle/kzECxxw2ToC6A5wTA

Note that if you register as a team but do not express your interest in any of the suggested topics or your idea, your team will be assigned to a (random) topic in the suggested list.

If you do not register for a project, you will be assigned to a team by the lecturers together with a (random) topic in the suggested list.

Project proposal

The proposal is limited to 1 page or 500-700 words in the ACM format. You should include the following:

- An abstract (~150 words) to describe your project.
- An introduction section to describe the topic, existing technologies, current challenges, and your idea. Trying to answer the following questions might help building up the introduction section and planning:
  a) What is the topic of interest?

b) Why is the chosen topic a good, meaningful, timely topic that may interest you and others?
c) What are the state-of-the-art technologies? What are their limitations?
d) What is your idea?
e) Does the AR/VR/MR community do any similar work?
f) How do you implement your idea? Do you plan to use any open source or libraries? What resources do you need to complete the project?
g) What is the expected performance? How do you test and evaluate your system?
h) What is the technological and broader impact of your project?
i) How do you plan to distribute the workloads among team members?

The project proposal will be marked and it will set the project scope, so you must work on the proposal with your team to ensure everyone agrees on the topic, the technical contribution, and the workload for each project member. You can repurpose the proposal to write the abstract and introduction of your final report.

Package the PDF and submit your proposal via Blackboard. Remember to include the names of your team and team members in the PDF.

Project Report

Your project report should follow the structure of a technical report or scientific paper, e.g., as follows:

- Abstract
- Introduction
- Related work / Background
- Method / Implementation
- Experimental Results
- Discussion and Conclusion
- References

The report is limited to a maximum of 4 pages.

For the project proposal and report, it is recommended that you use Overleaf and LaTeX and follow the ACM SIGGRAPH template to write your report.

- A template on Overleaf is provided here: https://www.overleaf.com/read/vtbyjvngrzgz#e28726
- Trinity College Dublin provides professional Overleaf subscriptions for staff and students. https://www.overleaf.com/edu/tcd

Deliverables

Package the following: (1) your code, (2) the project final report in PDF, and (3) an illustrative video in mp4 into project-final.zip and submit it to Blackboard.

The video should illustrate the method and main results of your work. By default, we will upload selected videos to a YouTube playlist for reference for future classes. You can opt-out if you do not want your work to be published on YouTube by sending an email to notify the lecturers.

Timeline

- Project registration deadline: Tuesday, Mar 19, 2024, at 12 pm (noon).
  After this date, random allocations will be conducted for unregistered students.
- Project proposal deadline: Wednesday, Mar 27, 2024, at 12 pm (noon).
  The project proposal will be marked with 5% of the total marks.
- Project checkpoint presentation: Apr 08 – Apr 10, 2024.
  The presentation schedule will be announced later.
  The project checkpoint will be marked with 5% of the total marks.
- Project final submission: Wednesday, Apr 24, 2024 at 23:59 (midnight).
  The final submission will be assessed with 30% of the total marks.
- Late submissions are accepted until Tuesday, Apr 30, 2024 at 23:59 (midnight).
  Late submissions will have a **10% penalty** applied to the total marks, i.e., your maximum marks for the project will be 30% for late submissions.
  After Apr 30, 2024, the submission system will be closed. **No further submissions** are allowed after this date.

Evaluation criteria

The project is 40% of the total module marks with the following breakdown:

- Proposal: 5%
- Checkpoint presentation: 5%
- Originality, creativity: 5%
- Technical quality and complexity: 10%
- Usefulness, robustness: 5%
- Report: 10%.
- Bonus: up to 8%

Past projects

Here is the YouTube playlist of the previous class projects for your reference.

https://www.youtube.com/playlist?list=PL6FW1m-qiD7CY7k967XUlkBm-wSClp8td