CSE 490V Final Project Proposal Template

RORY SOIFFER and EVERETT CHENG

1 ELEVATOR PITCH

Our project is a game that allows players to fly like a bird through a virtual world by flapping wings in real life. The game uses custom wing-like controllers that players strap onto their arms. The project has two parts: creating the game and creating the wings, with one team member assigned to each part. The demo session will show off these two parts working together.

2 EXTENDED OVERVIEW

Flying like a bird in VR is not a completely new idea, but it hasn't gained significant popularity either. There are a few VR games that have the player fly as a bird, including Eagle Flight (https://store.steampowered.com/app/408250/Eagle_Flight/) and Aquila Bird Flight Simulator (https://www.aquila-bfs.com/). Neither of those games have the player move mainly by flapping their arms like wings. The most notable existing VR bird flight experience is Birdly VR (http://birdlyvr.com/), which relies on the player lying down on a large machine that includes flapping wings and a fan to simulate wind. Our project is somewhat similar to Birdly VR, except it's much smaller in scale: instead of building a full-body machine, we're building wings that strap onto players' arms. While Birdly VR has more potential for immersion, our project requires less specialized equipment, making it more accessible for normal users.

The core of the experience will be exploring a large game world, consisting mostly of natural terrain. We plan to explore techniques for procedural terrain generation (including mountains, trees, rivers, canyons, etc.) in order to create an interesting world players can fly through. Other gameplay elements may be added, such as pre-designed courses to fly through or time trial modes.

The wing controllers will be built from a combination of 3d-printed and purchased parts. The wings will be built by attaching "bones" made of plastic or wood together, then running fabric between the bones to form the body of the wing. Candidate materials for the bones include PVC pipe, small wooden beams, and 3d-printed parts. We will track the wings with Vive trackers, using either one or two trackers per wing, depending on how reliable tracking is with just one.

2.1 Technical Challenges

This project involves addressing the following key technical challenges.

- We will create a game world consisting mostly of procedurally generated terrain. At the simplest, this could just be done using 2D Perlin noise as a heightmap and randomly placing objects such as trees. Depending on the time available, we may explore more sophisticated and realistic generation approaches, and add more features to the terrain.
- We will build a pair of wing controllers that players can strap onto their arms. These controllers will support rapid arm movements, both in physical sturdiness and in accuracy of tracking.
- The wings will be accurately rendered in Unity. The wings' motion will produce realistic air-resistance forces, which will move the player through the virtual environment.
- Optionally, the wings will also have a physical presence in the virtual environment, being able to collide with and push against virtual objects.

Authors' address: Rory Soiffer, rorys4@cs.washington.edu; Everett Cheng, eccheng@cs.washington.edu.

- Optionally, we will build two pairs of wings. This would let us run a small user survey comparing the different models. It would also let us demo on two computers at once.

2.2 Key Risks and Mitigations

We identify the following key risks and potential implementation alternatives.

- Procedurally generating terrain could be too difficult, too computationally intensive, or could not give the desired results. In this case we could switch to a statically constructed game world.
- Everett has little experience with Unity, and will need to learn the basics in addition to implementing the algorithms involved in terrain generation.
- We might not be able to acquire a sufficient number of Vive trackers. In this case, we will instead attach normal VR controllers to the wings.
- In the very unlikely event that we don't have the game in an acceptable state, we will scrap that part of the project. We will demo the wings as part of another VR game that Rory created before this class.
- In the very unlikely event that we don't have the wing controllers in an acceptable state, we will scrap that part of the project. We will demo the game and flying mechanics using normal VR controllers.

3 HARDWARE AND SOFTWARE

This project requires the following hardware.

- [Requested] 2-4 Vive Trackers: Prefer this specific model, but open to suggestions. Two trackers is a minimum, one for each wing. Four trackers is preferred, either to have two trackers per wing (if tracking isn't sufficient quality with only one tracker) or to support two pairs of wings with one tracker per wing.
- [Requested] HTC Vive headset: Prefer this specific model, but open to suggestions.
- [Personal] Desktop PC: This will be provided by the student team.
- [Personal] 3d printing supplies: This will be provided by the student team.

This project requires the following software.

- [Personal] Unity: This will be provided by the student team.

4 TEAM RESPONSIBILITIES

Describe the primary responsibilities for each team member. Remember that the individual responsibilities should be on the order of complexity of two CSE 490V homeworks.

- **Rory Soiffer**: Responsible for: (1) constructing the wing controllers, (2) writing game physics code to let users fly with the wings, (3) helping as needed with the rest of game development, and (4) contributing to the final project report.
- **Everett Cheng**: Responsible for: (1) researching and implementing terrain generation techniques, (2) setting up the basic skeleton of the game in Unity, (3) adding any more structured gameplay elements we might choose to include, and (4) contributing to the final project report.

5 DEVELOPMENT PLAN

We aim to complete this project over three weeks, with the following major milestones.

- **February 25**: Create a basic Unity project and share it among all team members.
- **March 1**: Have a basic terrain generation system working, not including trees, cliffs, water, or other interesting terrain features.

- **March 9**: Have a basic wing controller ready to test. Also have an acceptable terrain generation system working.
- **March 15**: Have a playable prototype of the game ready, including terrain generation, physics, optimization, and wing controllers.
- **March 18**: Complete and submit the final report.
- **March 19**: Prepare final project demo, including (optional) poster.
- **March 20**: Participate in the final project demo session.