Midterm Prep

CSE165 - Discussion 7

Agenda

- Midterm Introduction
- Last Year’s Exam
- Review
  - 3D UI Overview
  - Selection and Manipulation
  - Input Devices
  - Wayfinding & Travel
  - System Control
- Tips and Advice

Midterm Introduction

- Worth 25% of your grade!
- Many questions come directly from lecture, so study slides carefully!
- Question types include multiple choice, short answer, and long answer
- Some questions will require you to just list info from lecture
- Some questions will require you to think/design a system
- **There will be no programming/Unity questions on the test**

Last Year's Exam Review

- Link: http://ivl.calit2.net/wiki/images/b/b7/CSE165W17Midterm.pdf
- 8 questions total (80 points)
- Includes short response, multiple choice, long-answer
- Some questions are directly from lecture, so study the slides!
- Other questions require you to think/design a system
- Actually DO last year's exam! Will help prepare you for this year's

Last Year's Exam Review

- Question 1: Input Devices
- Know the pros/cons of all the types of devices mentioned in class
  - Questions may be fairly specific or refer to a specific device, so review well!
  - You should understand ALL the devices mentioned, including the examples
- Have a general idea of each one works so you can explain their differences
  - Ex. Electromagnetic vs. optical tracking

Last Year's Exam Review

- Question 2: Selection and Manipulation
- Know all of the different selection/manipulation methods **well**
  - You'll need to be able to distinguish between each and all of them
- Ones from last year:
  - Ray-Casting
  - Go-Go
  - World-in-miniature
  - Image plane
  - Two-Handed pointing
  - Flashlight
  - Virtual Hand

Last Year's Exam Review

- Question 3: Wayfinding
- Identify the different types of wayfinding/travel in a question
- Goal is to actively recognize wayfinding techniques in different applications
- Practice ideas:
  - Look at VR videos or applications. Identify methods of wayfinding/travel in them
  - Also identify how that wayfinding/travel works and why it works well
- Understand reference frames (egocentric and exocentric)
  - And which is meant for newer vs. old users!

Last Year's Exam Review

- Question 4: Pokemon VR
- Another situational question where you must identify travel techniques
- Be familiar with the pros/cons of the various travel techniques
  - More importantly, which applications/situations call for certain techniques
- Very subjective, just make sure your argument makes sense
  - Be sure to provide good justification for your reason!
  - Justification based on reasons from the slides pretty much guarantees a right answer
- Again, for situational questions best would be to practice with existing apps
  - Try to find any game online and just name/write down what the travel is and why it's good
  - Maybe even identify why a travel technique that game uses is BAD!

Last Year’s Exam Review

- Question 5: System Control
- Primarily focused on justification and knowing different system control types
  - Review the slides to know what’s possible, and the reasons for each different one!
  - If you can justify your answer well, you’re in a good place
- Examples required for some questions, so know these in practice
  - Review examples from slide and recall those for best luck
  - Otherwise, review system control techniques in real VR apps and use those

Last Year’s Exam Review

- Question 6: Symbolic Input
- (Not covered yet in class)

Last Year’s Exam Review

- Question 7: 3D UI Design
- Not covered yet in class, but you should be able to solve part b & c
- Part b, just use your creativity
  - Make an example where 2 handed interaction is clearly better than 1 handed
- Part c, think outside the app. Think about the customer using the app

Last Year’s Exam Review

- Question 8: Virtual Reality
- Need to understand the pro/cons and use cases of 3D input device
- Relate the capability/restriction of input device to their uses in 3D applications
  - Think about the user scenarios of the application
  - And why 3D manipulation can be necessary/better in this application
- Open ended
  - Either the Oculus Touch or the Leap Motion can make sense.
  - But You need to give a good justification to your answer.
  - Try to find some existing 3D / VR / AR applications with practical use and see how people are interacting in the application

Review: 3D UI Intro

- Goals of 3D UI's:
  - Performance (Efficiency, Accuracy, Productivity)
  - Usability (Ease of use, ease of learning, user comfort)
  - Usefulness (System goals, transparency)
- Difficulties of 3D Interaction
  - Spatial input, lack of constraints/standards/tools/precision, fatigue, scene layout
- Universal Tasks
  - Navigation, Selection, Manipulation, System Control, Symbolic Input
- Approaches/Philosophies
  - Artistic approach: Decisions based on aesthetics/heuristics/common sense
  - Scientific approach: Quantitative evaluation, performance requirements
- Interaction workflow
  - User (actions) -> Input Device (signals) -> System (display) -> Output Device (perceptual info)

Review: Selection and Manipulation

- Selection: Specifying one or more objects from a set
  - Goals: Indicate action, query object, make object active, travel to object, prep manipulation
- Manipulation: Modifying object properties
- Parameters for selection
  - Object distance, object size, object density, presence of occluding objects
  - Number of control dimensions (DOFS), simultaneously?
  - Form factor and impact on accuracy
- Parameters for manipulation
  - Position, rotation, distance
- Isomorphic (real) vs. Non-Isomorphic (magic)
- Selection methods
  - Raycasting, Two-Handed Pointing, Flashlight, Image Plane, Virtual Hand, Gogo, WIM, voodoo
- Technique Classification: Egocentric vs. exocentric vs. hybrid

Review: Input Devices

- Degrees of Freedom: 2-DOF, 3-DOF, 6-DOF
  - Know their meanings, examples, differences, pros/cons, and use cases.
- Ways of tracking: the information collected to understand user's physical input.
  - Inertial, optical, ultrasonic, electromagnetic, infrared, etc.
  - Advantages and restrictions of different tracking methods.
- Modern 3D User Input Device:
  - Wii Remote, Kinect, Leap Motion, Oculus Touch, Gear VR Remote, PlayStation Move, HiBall, etc.
  - What's the DOF? Types of Tracking? Their best use case?
- Special purpose and application specific input device:
  - Cubic mouse, virtual canoe, etc.
- Haptic Feedback:
  - Different types: controller vibration, finger pinch, force feedback, etc.
  - Use cases: grab stuff, play piano, user notification, etc.

Review: Wayfinding

- Wayfinding: Cognitive component of navigation
  - Cognitive process of defining a path through an environment
  - Often unconscious activity
- Information: Landmarks, signs, maps, direction, etc.
- Issues with virtual worlds
  - Less constrained movement (only 6DOF max), physical constraints, no motion cues
- Advantages of virtual worlds
  - Potential for more information, distractions aren’t a huge deal
- Wayfinding goals
  - Exploration (browse environment and build cognitive map)
  - Search (spatial knowledge acquired and used
  - Naive search: Not enough info for cognitive map. Primed search: Use of cognitive map

Review: Wayfinding

- Useful spatial knowledge
  - Landmark knowledge: Environment, shape/size/texture, relative positioning
  - Procedural knowledge: Sequence of actions to follow a path
  - Survey knowledge: Maps/topographical info
- Reference frames: Egocentric (first person) vs. Exocentric (third person)
  - Egocentric happens the first time, creates landmarks/etc
  - Exocentric happens later, when we already have an internal representation of the world
- User-centered wayfinding
  - Large FOV allows for more info. Motion cues enable depth/direction
  - Presence/immersion helps as well.
- Environment-centered wayfinding support
  - Environment design: Create distinct parts of the environment that are recognizable
  - Artificial aids: Maps/compasses/trails/etc (HW3!). Can be local or global
  - Reference objects (well-known objects for reference)

Review: Travel

- Travel: Motor component of navigation (may integrate wayfinding)
  - Movement between two locations
  - Most common virtual interaction technique
- Tasks
  - Exploration: travel with no specified target
  - Search: Naive - travel to find target with no position. Primed - travel to known target
- Maneuvering: Traveling to a position viewpoint for a task. Short & precise
- Characteristics/aspects of travel
  - Distance, turns
  - Target visibility
  - DOFs available and accuracy required
  - Active v. Passive
  - Physical v. virtual

Review: Travel

- Physical locomotion (i.e. “real-world”)
  - Walking, treadmills, bicycles, other physical motion. Ex: Roomscale VR, Virtuix Omni
- Steering techniques: Continuous motion
  - Eye gaze, head direction, hand pointing, torso direction, or physical hardware
  - Often involves going in direction of a certain device. Know advantages of each method!
- Route-planning: Specification of a path
  - Draw entire paths, move points along the path. Specify entire route in advance
- Target-based techniques: Teleportation
  - Directly move to a specified location, usually be selecting that location on the ground
  - Visualize via a line or arc or WIM
- Map-based techniques: Select new position on a map and move there
- Manual manipulation: Hand gesture travel (ex. Rope pulling)

Review: System Control

- Commands are issued to accomplish some task or change some state
- Graphical menus: 2D and 3D
  - Placement matters! What reference point? Head? World? Controller?
  - Selection: DOFs and constraints
  - Form, size, space, and hierarchy of the menu
- Voice commands
  - Speech recognition/voice dialogue Requires a good microphone and speech engine
- Gestures
  - Posture - static hand, and Dynamic - specific movement
- Tools
  - Possible actual physical object to manipulate
  - Virtual tools as well, such as a virtual toolbelt
- Multimodal input: Allow for different types of inputs. Makes it easier for users

Tips and Advice

- Majority of questions come from knowing lecture/reviewing the slides
  - Know the slides REALLY well… especially when there are lists of things to know!
  - Input devices and travel/wayfinding are especially critical
- Assignments and projects should’ve prepared you for design questions
  - Always just think about what’s easiest for the user to do. Advantages? Disadvantages?
  - Know all the different options and other ways you could’ve implemented something
  - Maybe even review your projects and question what you could’ve done better!

Questions?

Feel free to ask on Piazza!

(Making your questions public is helpful to everyone!)