VIRA
Virtual Insight into Real Athletics

Katie Perkins, Nate Irmiter, Bailey Righi, Willem Paul, Caroline Rankin
Advisor: Dr. Diane Rover
Client: Self-Proposed
Team: sdmay20-33

Problem

There is nothing as good as hands-on, in-person experience for an athletic trainer. When students in Iowa State's Athletic Training program work in the training room, their time is very valuable. However, a full-time athletic trainer must watch and guide them, which can be difficult when the training room is busy. On top of that, there are many traumatic injuries a student may never experience firsthand until they are working in the field.

Solution

A virtual reality (VR) training program allows athletic training students to get the extra experience and feedback they need without interrupting or wait for a full-time trainer. VIRA is a VR application consisting of a set of training modules that walk an athletic training student through injury evaluation and diagnosis scenarios.

Design Requirements

Functional
The user must be able to:
- log in and navigate to the modules,
- choose a guided module,
- view and move the virtual athlete's limb, and
- review their progress and performance on guided modules.

Non-Functional
The system must:
- respond to user input in real time,
- not negatively impact the user's health or safety,
- operate for at least an hour on a single charge, and
- contain reasonably realistic instructions and medically accurate graphics.

Operating Environment
The system is to be used:
- indoors,
- while the user is stationary, and
- in obstacle-free surroundings.

Intended Users and Uses
The intended users are student athletic trainers in Iowa State's Department of Sports Medicine.

VIRA is not intended to replace in-person training, but to provide supplementary experience.

Engineering Standards and Design Practices

Standards
- IEEE P2048.5 – Standard for Virtual Reality and Augmented Reality: Environmental Safety
- IEEE P2048.6 – Standard for Virtual Reality and Augmented Reality: Immersive User Interface
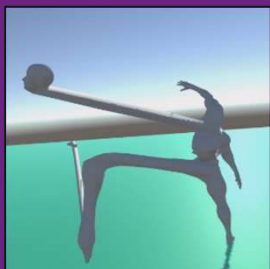
Design Practices
- Comfortable VR experience (No flashing lights, fast movements, etc.)
- Modular application and code design
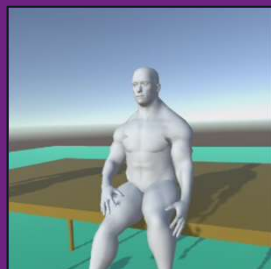- Consistent, intuitive UI

Testing

We tested VIRA continuously in the Unity development environment so that we could see the effects of our changes in real time. We also tested VIRA on the Oculus Quest to ensure that our changes were having the desired effect and that they were VR-compatible.

We intended to perform user acceptance testing with students and trainers from the Athletic Training Program, but due to circumstances caused by the COVID-19 pandemic, we were unable to allow others to test VIRA. Instead, we tested VIRA on the Oculus Quest ourselves and spent time comparing our special test module to various video examples of the same medical test.

Design Approach and Technical Details
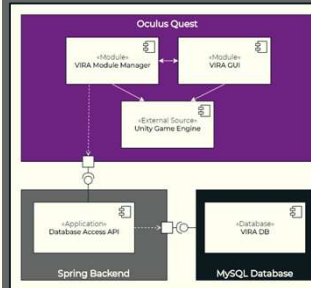
Application Component Diagram

VIRA Module Manager
Contains the behind-the-scenes logic of the client-side system and interacts with the server. Logic includes:
- population of the user profile selection and guided special test selection screens;
- executing guided special test modules; and
- sending user performance data to the server.

VIRA GUI
Consists of 7 Unity scenes which allow the user to interact with VIRA through the Oculus Quest headset.

Server Component Diagram

Spring Boot Backend
Server dedicated to accepting and handling requests for data from the database from the VIRA application.

MySQL Database
A MySQL database to store all data relevant to the application, such as special test information, user performance data, etc.

Database Schema

Software Used
Languages:
- C#
- Java (Spring Boot/Hibernate Frameworks)

Development Tools:
- Unity Game Engine
- MySQL Server

Other Tools:
- Blender
- MB-Lab

Hardware Used
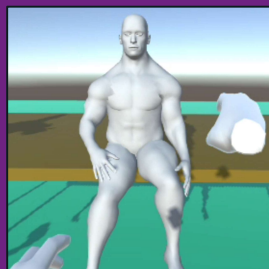- Oculus Quest VR Headset

Model Development

Probably Not What We Want

A Decent-Looking Model

Interacting with an Old Model

Figuring out Clothes and Details

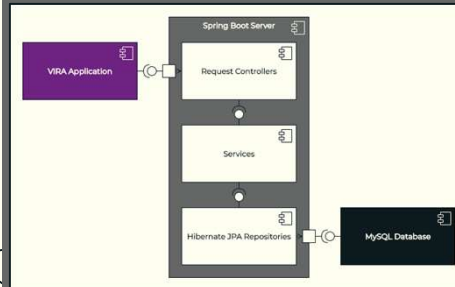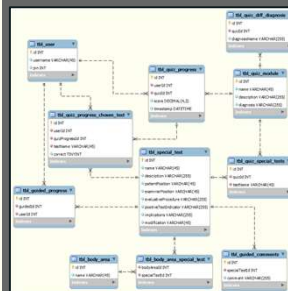A Finished Model