

MICHIGAN STATE

UNIVERSITY

Project Plan Presentation

Robotic Job Coaching

The Capstone Experience

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Spring 2025



*From Students...
...to Professionals*

Project Sponsor Overview



- Department of Computer Science at Michigan State University
- Dr. Charles Owen, Dr. Ranjan Mukherjee, and Dr. Hung Jen Kuo
- Peckham, Inc., provides job opportunities for those with substantial barriers to employment
 - Headquarters in Lansing, MI
 - Founded in 1976



Project Functional Specifications

- Employee obstacles
 - Anxiety about quotas
 - Forgetting how to perform a certain task or step
- Solution
 - Offer remote-robotic job coaching
 - Audiovisual real-time connection with coach
 - Robotic arm allowing a coach to move and point to areas in the user's space

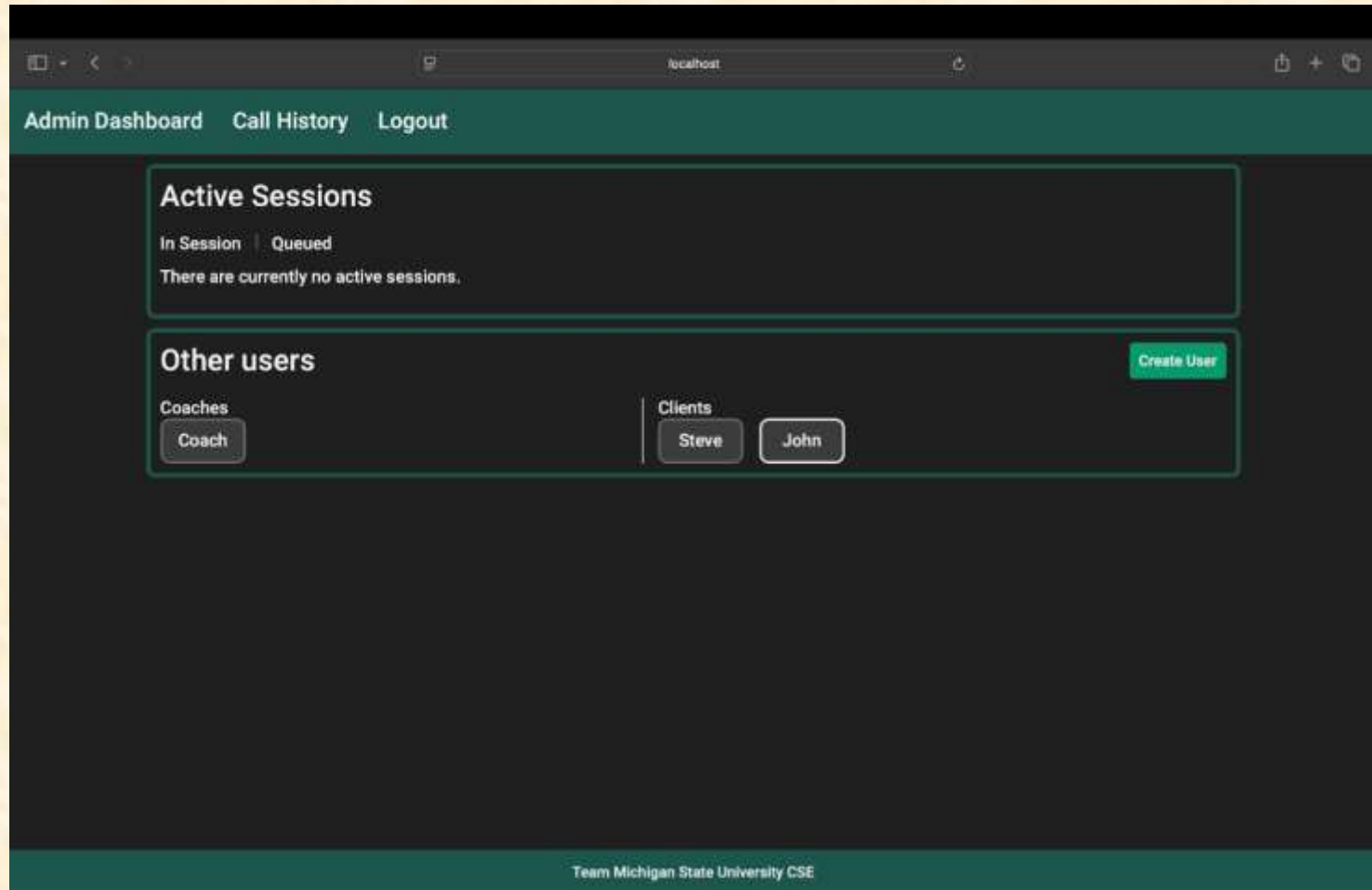


Project Design Specifications

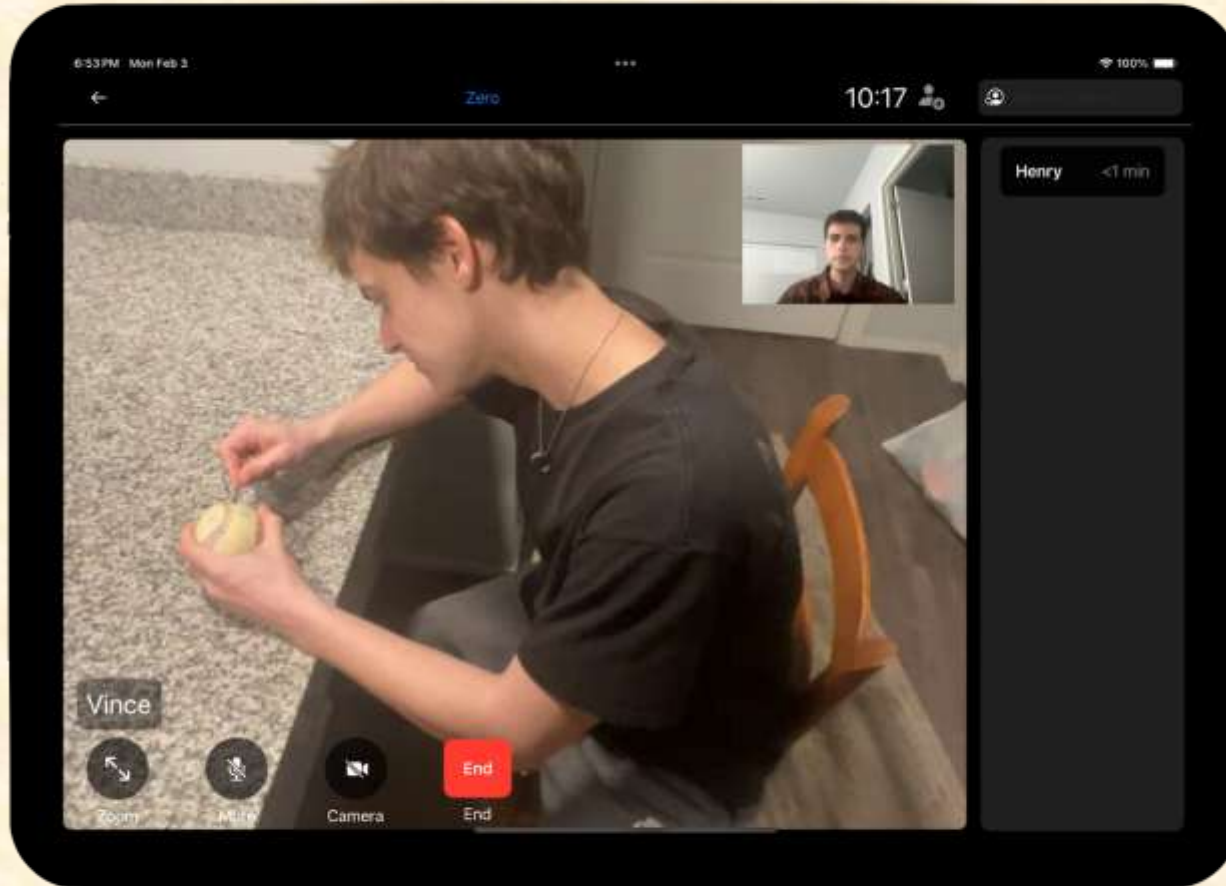
- IOS and Android applications
 - Facilitates communication between employees and job coaches
 - Allows job coach to remotely control the position of the robotic arm
- Admin webpage for server management



Screen Mockup: Admin Home Page



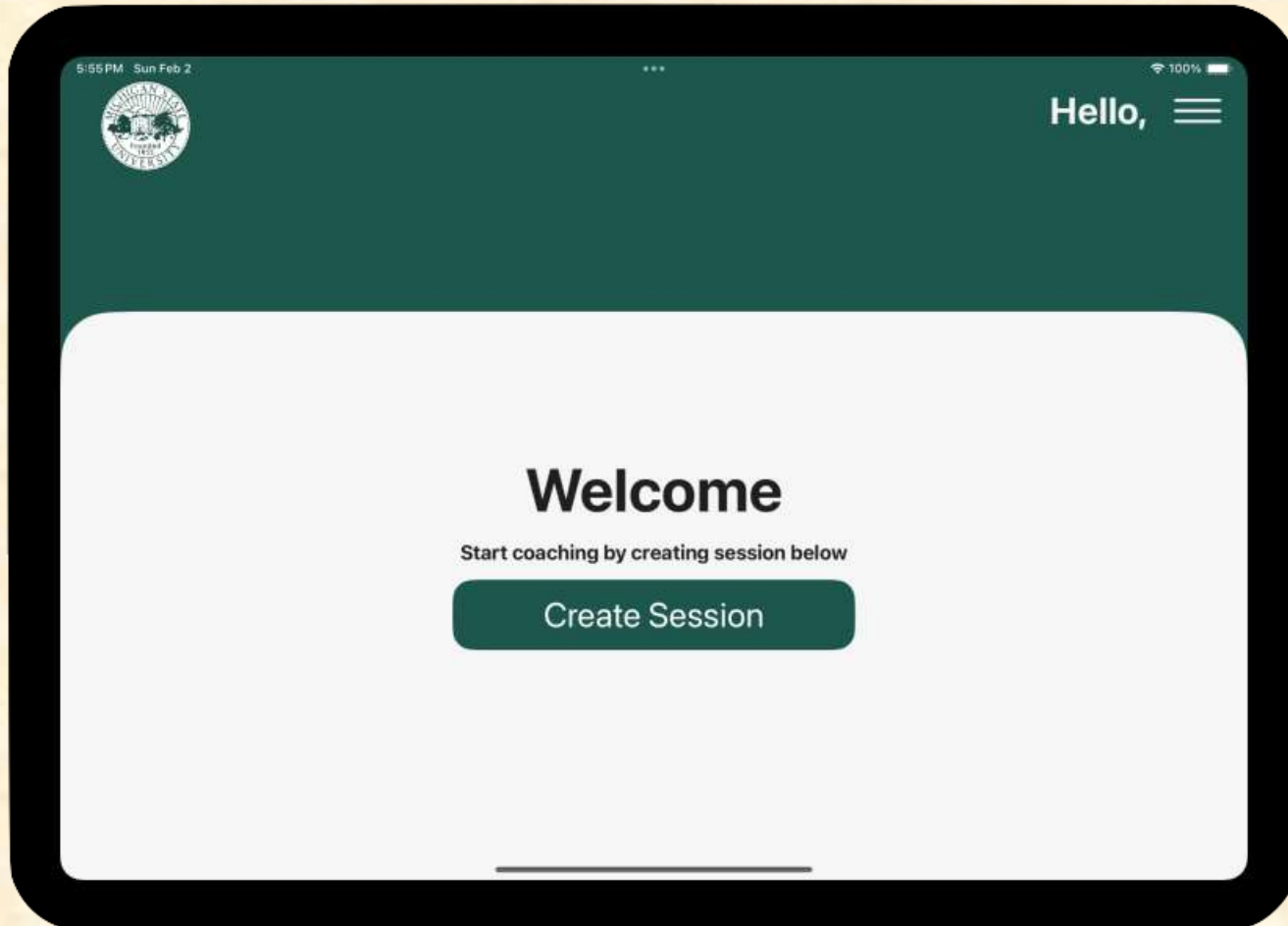
Screen Mockup: Client Coach Connection



Screen Mockup: Client View



Screen Mockup: Coach View

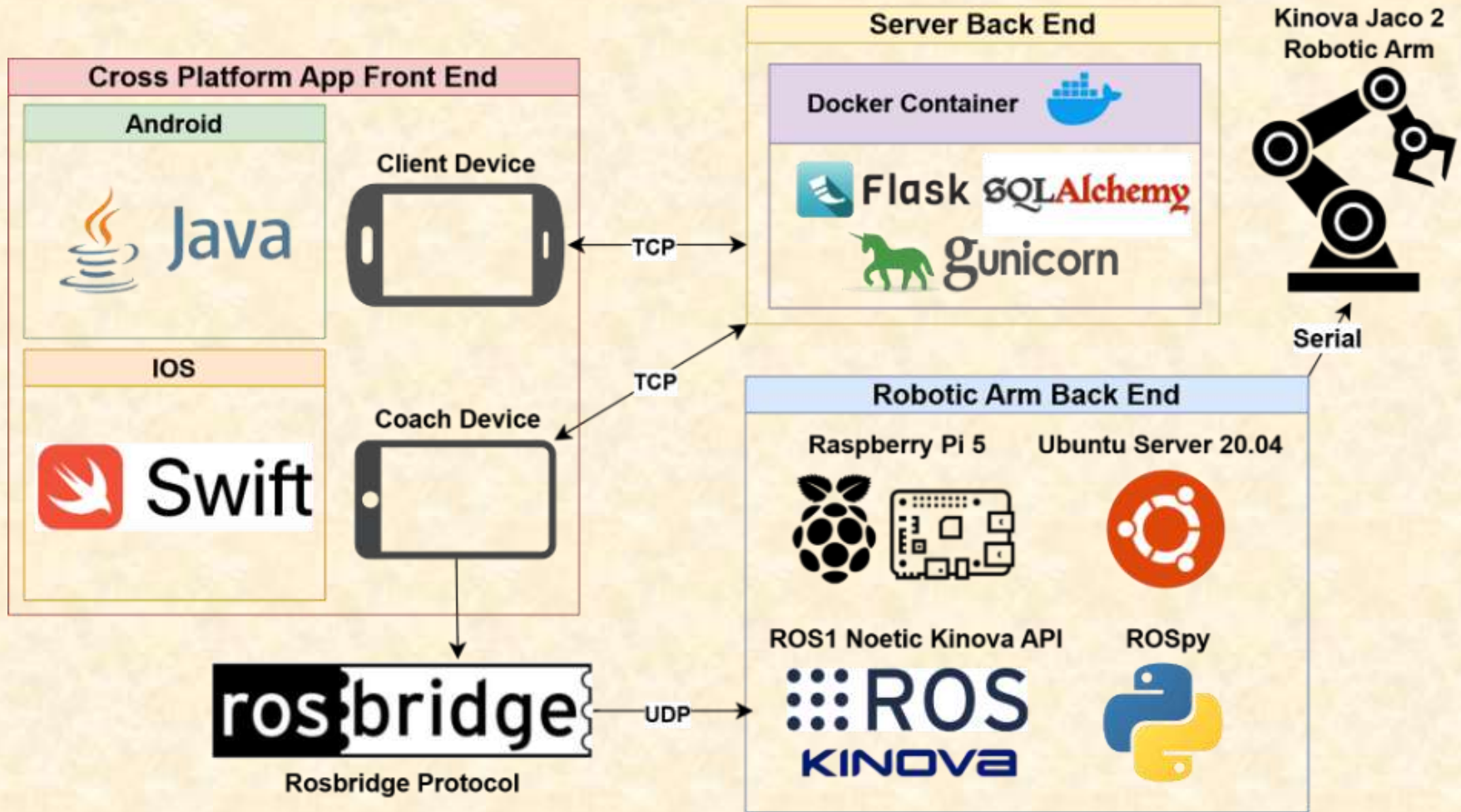


Project Technical Specifications

- **Cross Platform App Front End**
 - Allows users to interact with the software and request service from a coach
 - Developed in Java for Android and Swift for IOS
- **Server Backend**
 - Handles data retrieval requests, log-in authentication, and exchange of video stream between employee and coach
 - Containerized within Docker
 - Front end communicates with HTTP/1.1 over TCP through Flash and Gunicorn
 - Data queries handled by SQLAlchemy
- **Robotic Arm Backend**
 - Enables teleoperation of robotic arm from coaching device
 - Hosted on raspberry Pi running Ubuntu Server 20.04
 - Coach sends movement commands through UDP using ROSbridge



Project System Architecture



Project System Components

- Hardware Platforms
 - Kinova Jaco Robotic Arm
 - Raspberry Pi 5
 - IOS or Android Device
- Software Platforms / Technologies
 - Swift/Java for mobile development
 - Flask, Gunicorn, and SQLAlchemy for server back end
 - ROS, ROSbridge, Kinova-ROS package, and ROSpy for robotic arm server and movement control



Project Risks

- Real Time and Secure Robotic Control
 - Robot must securely keep up with real-time controls; low latency.
 - Secure connection through TCP; transfer data over UDP directly.
- Precise Position Control
 - Robot must move safely with a clear path to its objective.
 - Speed and boundary limits. Setting a default position. Kinova-ROS.
- Safely Implementing Pointing in User Space
 - Laser pointers run the risk of shining into someone's eye.
 - Light diffuser over the beam to maintain precision while lowering brightness.
- Geofencing Robot Arm
 - Virtual boundary around the arm, restricting range of motion for safety.
 - App will provide means to dynamically calibrate geofencing.



Questions?

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