MICHIGAN STATE UNIVERSITY

Project Plan Presentation

Virtual Reality Inspection Training

The Capstone Experience

Team Union Pacific

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From Students…
…to Professionals

Project Sponsor Overview

- The largest railroad company in North America by freight volume.
- Sell their tech to other railroad companies.
- Headquarters in Omaha, Nebraska.
- Founded by U.S. Congress in 1862.

Project Functional Specifications

- Traditional training at Union Pacific is limited by real-world defects for effective inspection training.
- Re-platform inspection training into an immersive VR application.
- Uses Meta Quest 3 for defect identification, integrated with LMS via SCORM.
- Scalable, realistic training without needing physical equipment.

Project Design Specifications

- Users log into the LMS to access VR modules, entering a PIN to launch specific training scenarios.
- Built in Unity with OpenXR, for device-agnostic VR compatibility, includes three immersive training modules and an AR component.
- Real-time user progress is tracked via REST services, with data stored in a PostgreSQL database and synced with the LMS using SCORM standards.

Screen Mockup: VR Scenario

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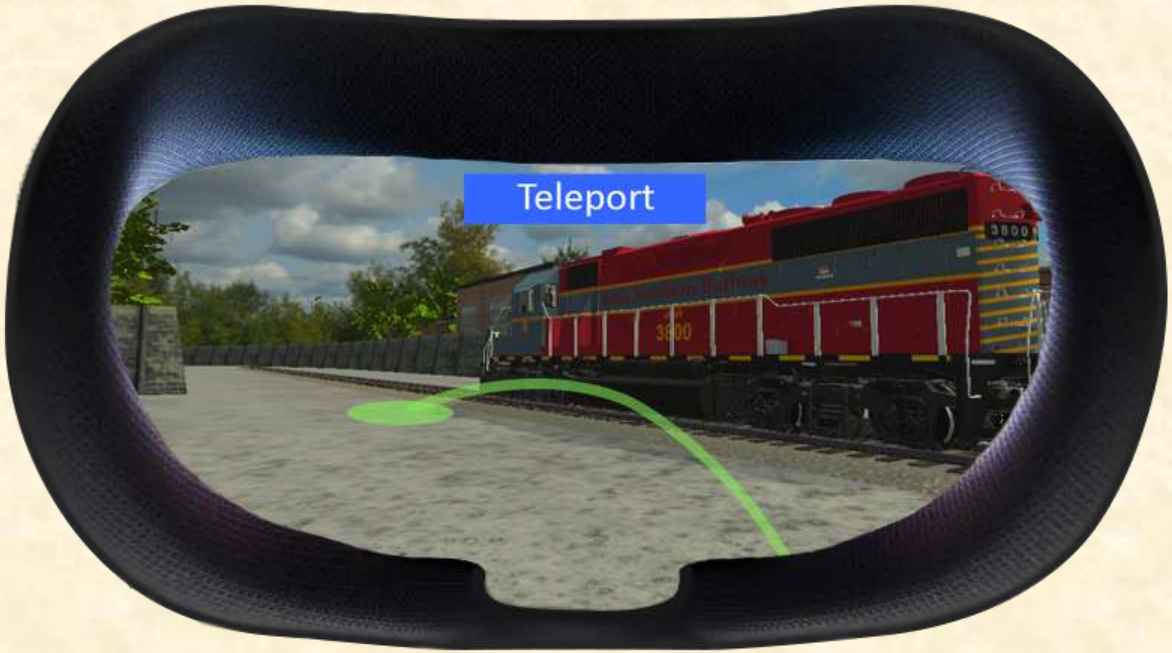
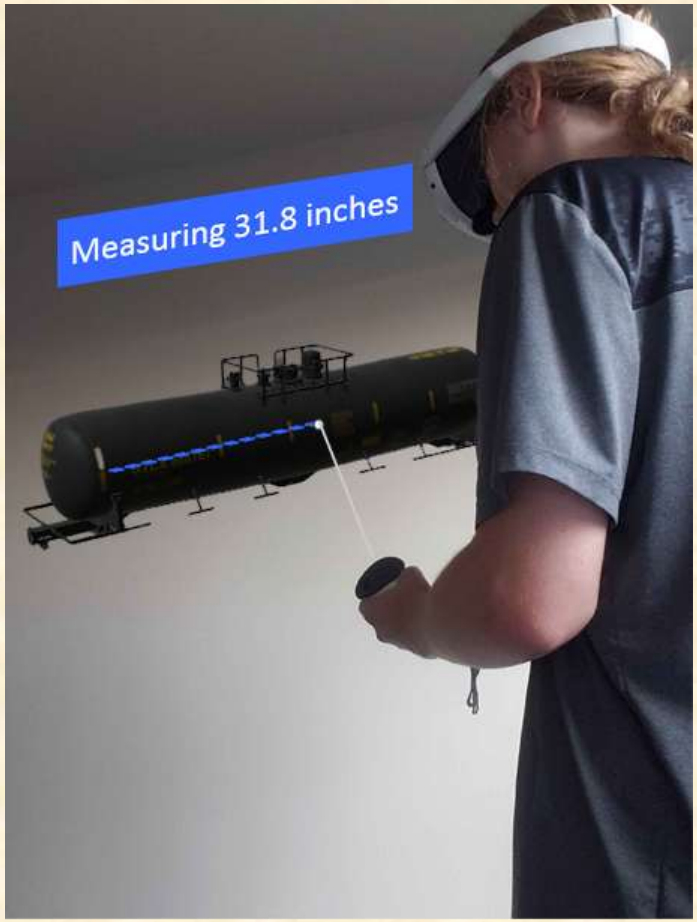
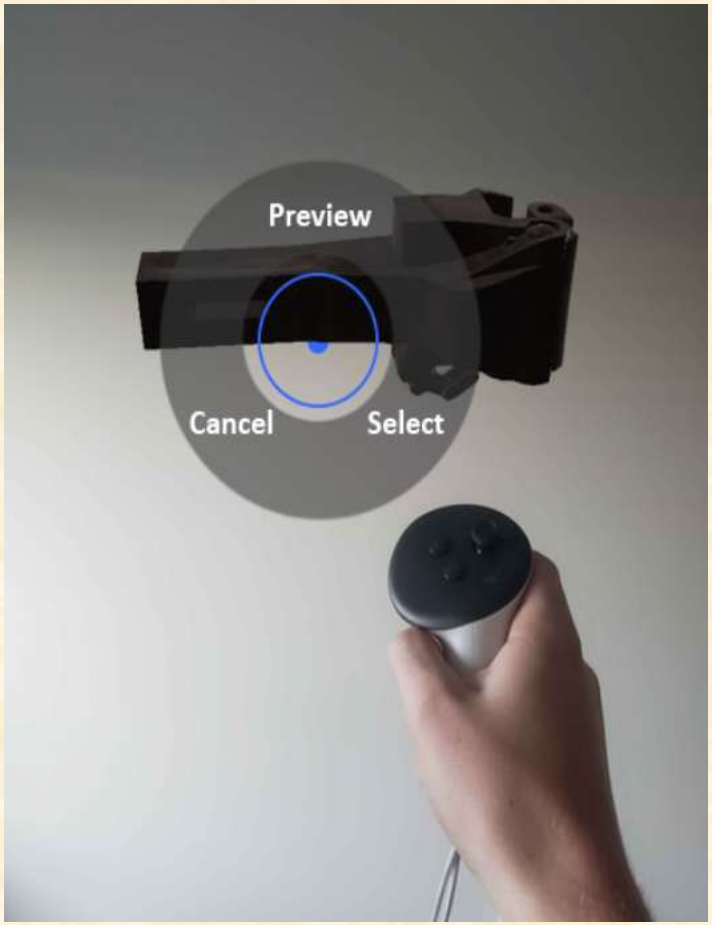


Screen Mockup: PIN Screen

Screen Mockup: AR Scenario

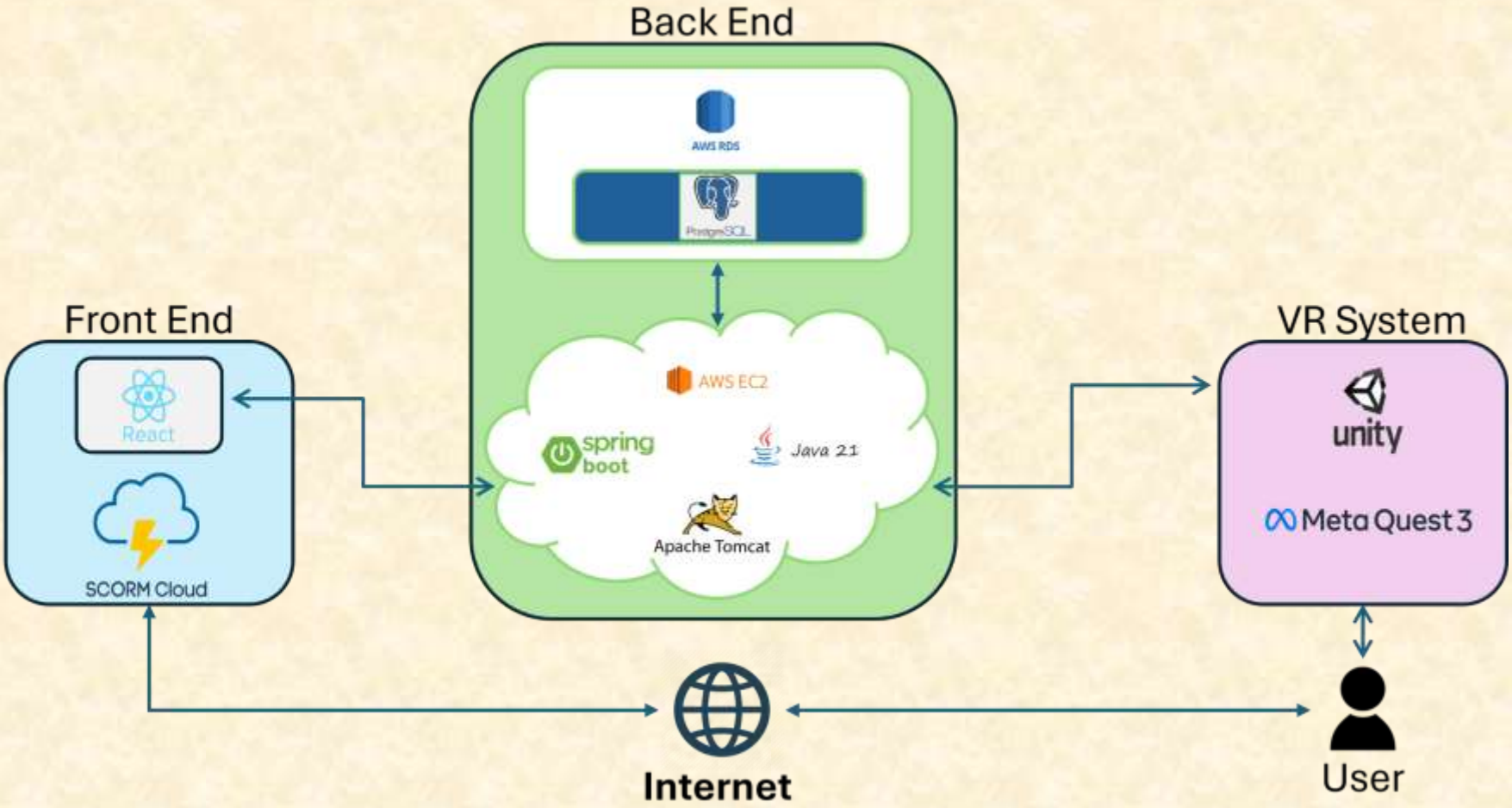




Project Technical Specifications

- The Virtual Reality Inspection Training will use a series of front end and back end technologies to provide users with a functional and smooth experience.
- The LMS front end and the VR headset will communicate with the back end database through a webserver using HTML web commands.
- During the LMS front end communication, through a React interface window to the back end, the web app will generate a 4-digit PIN that ties to the user's current session and will store it in the database.
- When the user sends the PIN via the VR headset, the PIN is verified, and the associated course configuration files are then sent to the VR headset to begin their selected course.
- When a course is completed, the React interface window will retrieve the score from the back end database and submit the score to SCORM Cloud. Upon a successful submission, the PIN, along with its contents, will be deleted from the back end database.

Project System Architecture



Project System Components

- **Software Platforms**
- SCORM – Technical standard for eLearning software, its packages are uploaded to an LMS for users.
- REST – Software architecture imposing conditions on how an API should work.
- Tomcat – Open-source web server and Servlet container for Java code.
- PostgreSQL – Open-source database management system using SQL to manage and query data.
- Amazon EC2 – Scalable cloud computing service allowing the use of virtual servers to run/manage servers.
- Amazon RDS – Managed database service simplifying the setup, scaling and operation of relational databases in the cloud.

Project System Components

- **Developmental Environments/Languages**
- React – Open-source JavaScript library used for creating user interfaces in front end environments.
- Spring Boot – Open-source back end tool using Java that helps in creating web applications.
- Unity – Cross-platform game engine designed to create 2D, 3D, VR and AR applications using C#.
- **DevOps**
- Azure – Cloud computing platform for developers to deploy software and create web applications.
- GitLab – Version control system used as a code repository and CI/CD pipeline.

Project Risks

- Risk 1
  - Difficulty optimizing VR performance.
  - Mitigation: using Unity's profiler and texture compression.
- Risk 2
  - Misconfigured security groups in AWS EC2 instance could expose sensitive data or allow unauthorized access.
  - Mitigation: apply least privilege principles for AWS security groups, only opening necessary ports like SSH or HTTP.
- Risk 3
  - Making sure that our VR application doesn't cause motion sickness.
  - Mitigation: testing our application with multiple students outside of our team who are prone to motion sickness.
- Risk 4
  - Platform specific issues between different VR systems.
  - Mitigation: researching device-agnostic libraries, and testing on available headsets.

Questions?