MICHIGAN STATE
U N I V E R S I T Y

Project Plan Presentation
Mobile Train Handling Simulator

The Capstone Experience

Team Union Pacific

Adam Kasumovic
Darien Ford
Kevin Shin
Nhat Vong
Nicholas Tyler Shari
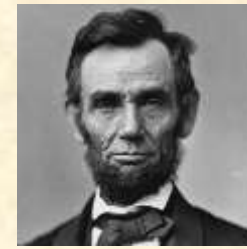Reid Harry

Department of Computer Science and Engineering
Michigan State University

Fall 2022

From Students…
…to Professionals

Project Sponsor Overview

- Union Pacific Railroad company first founded in 1862 under direct approval of Abraham Lincoln.

- Oversees 8,300 locomotives over 32,200 miles.

- Union Pacific employs subsidiary called PS Technology for software-based solutions which are mainly sold to other large railroad companies.

- PS Technology created the physics API for the train simulator we will be using.

- Contact, named Jeff Girbach, is an MSU and Capstone alum from 2013. Specializes in simulation software at PS Technology.

Project Functional Specifications

- Project is a mobile train simulation app with simplified physics and throttle controls.

- Main objective of the simulation is to balance the buff and draft forces and drive the train without failure in order to teach the basics of distributed power.

- Simulation creates mobile solution for swiftly training locomotive engineers inexpensively.

- Numerous combinations with weight of cars, number of cars, terrain, and locomotives to provide best experience.

Project Design Specifications

- Features a track (terrain) selector and train selector, as will be supporting any combination of fixed sets of tracks and trains.

- Every train car will be represented a thin, colored rectangle to allow for many trains to fit on the screen. The train cars will change color depending on the buff and drag forces acting on them.

- There will throttle controls for each locomotive, which is all the user has control of.

- The train itself will be a continuous, small snake-like rectangle, fixed on the left side of the screen to allow users to see much of the terrain ahead.
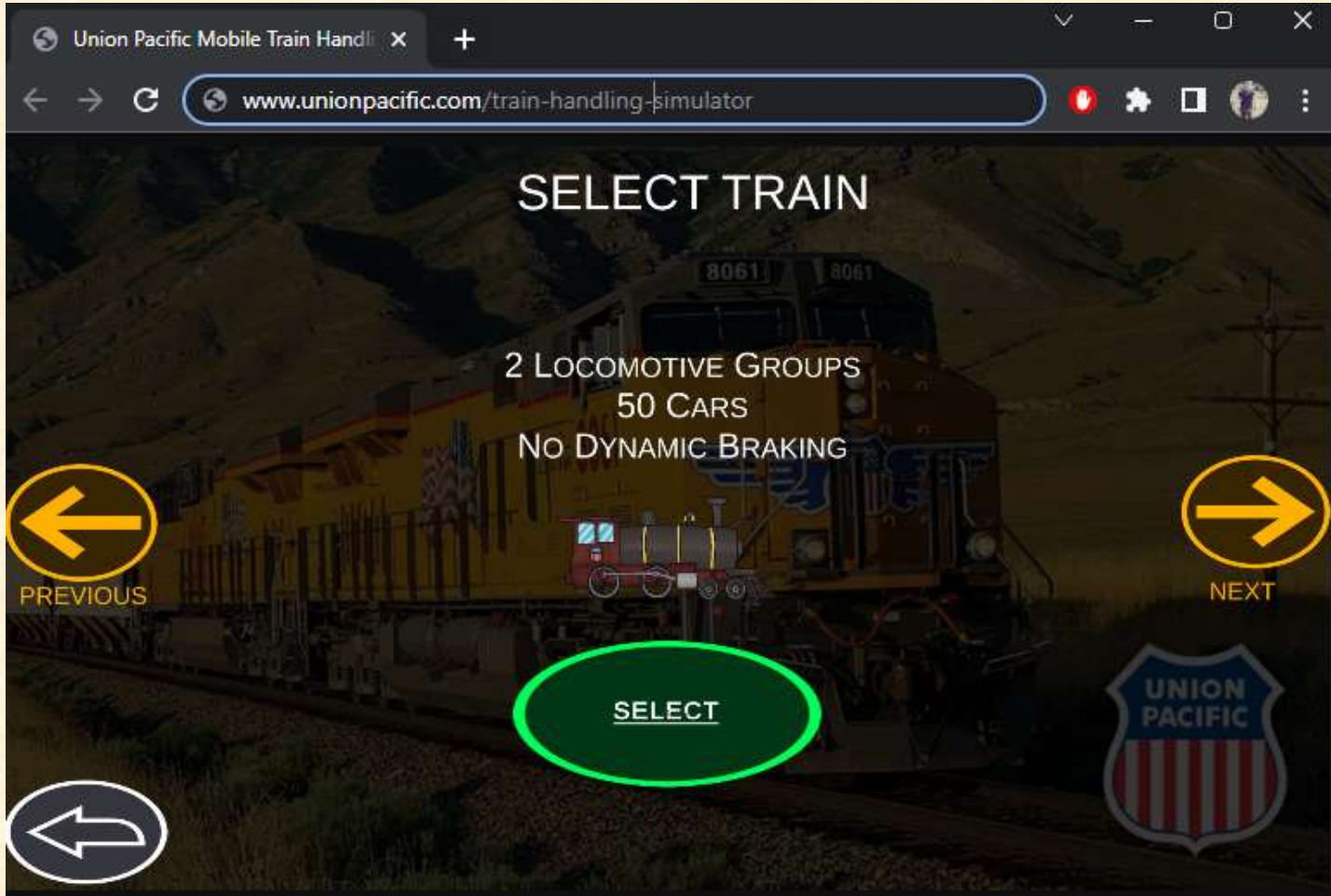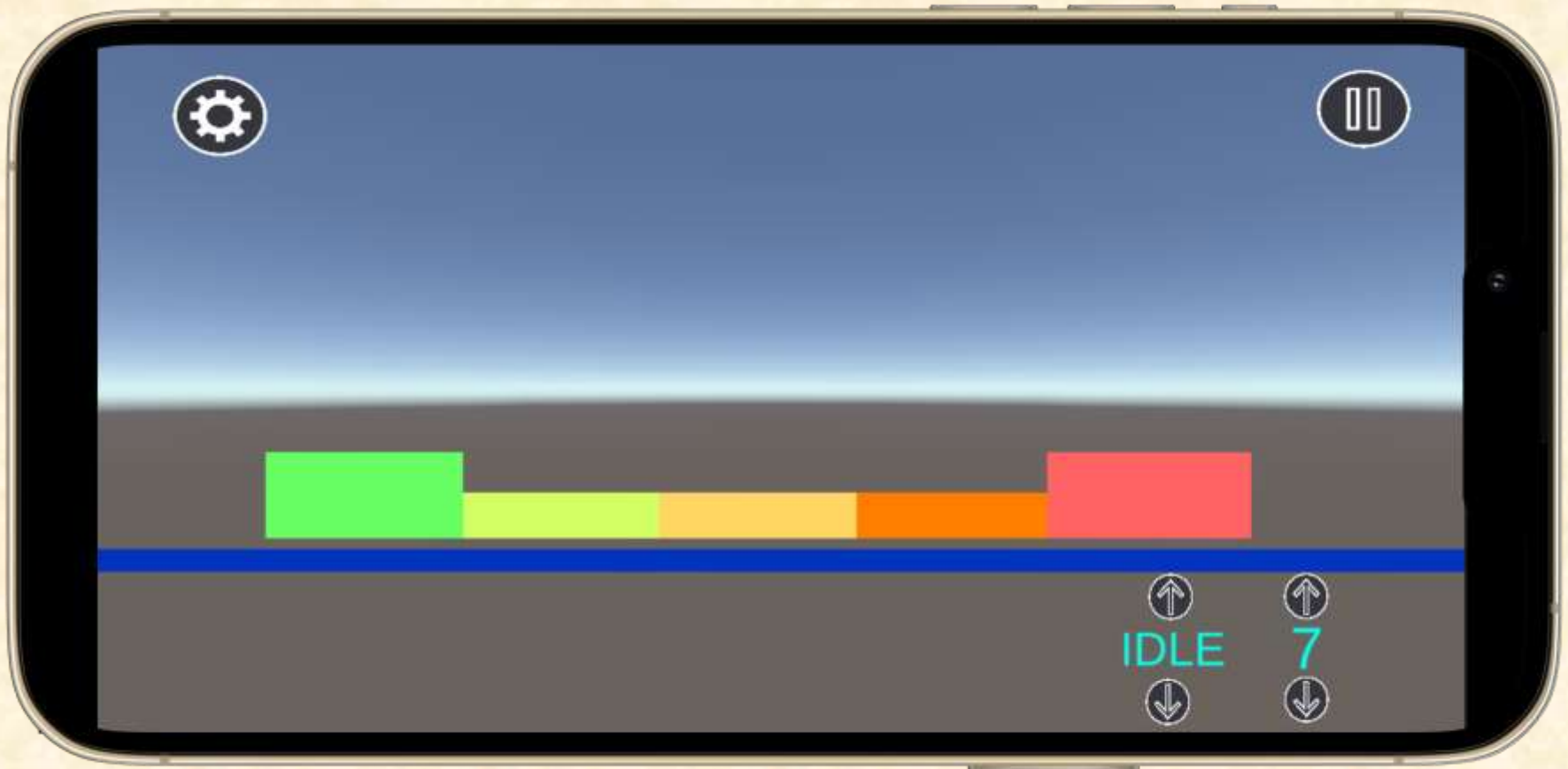
Screen Mockup: Main Menu

Screen Mockup: Track Selector

Screen Mockup: Train Selector

Screen Mockup: Simulation Scene

Project Technical Specifications

- Use Unity and C# to develop and build the simulation game.

- Integrate PS Technology's provided physics API C# library into the Unity project.

- Target platforms are Android, iOS, and WebGL, all of which are supported by Unity.

- Use Xcode to build to iOS devices.

- Use Python to write any necessary automation scripts (such as level and train creation) along with create local HTTP servers for running WebGL builds.

Project System Architecture
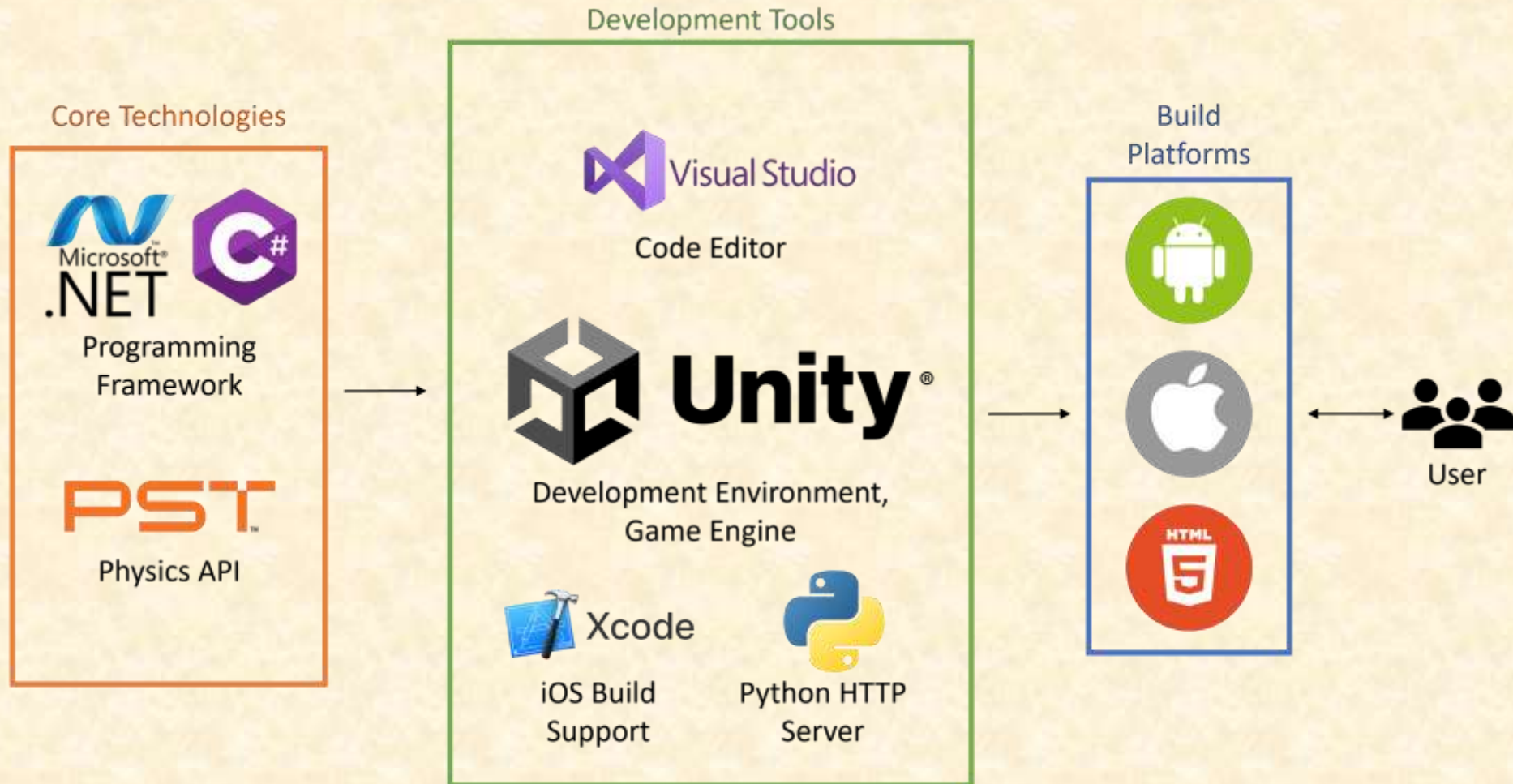
Project System Components

- Hardware Platforms
  - iPad and iPhone for iOS testing.
  - Samsung Galaxy phones for Android testing.
  - MacBook with Xcode for iOS builds.
- Software Platforms / Technologies
  - Unity for development, testing, and building.
  - Windows and Visual Studio Community 2019 for .NET and C# development.
  - PS Technology's .NET 4.6 Physics API

Project Risks

- Create the tracks and trains for the levels
    - All the physics is simulated internally provided a combination of train and track files; however, we need to accurately represent the internal simulation in Unity.
    - Since train files are just .CSVs, develop an automatic train to Unity prefab file converter. Similarly, track files are just .XMLs so we can parse them for information we can use to create the levels. This way, we can drop a train prefab into a desired track Unity scene based on the user selection.
- Build to target platforms
    - The provided physics API was built for a much older version of Unity and only for Windows, and so there is no compatibility with the target platforms.
    - We are working with the client and have been receiving the source code to adapt it ourselves to the target platforms. A Windows-only build is also a last-resort option to demonstrate the proof of concept.

Questions?

? ? ? ?
? ?
? ? ?