

Jordan Williams - Smart Drawbridge

Purpose

Simulate and visualize the operation of Company X's smart drawbridge.

Requirements

Show one ship traveling towards the bridge at a speed between 10 and 30 m/s. When the ship is 10 seconds away from the bridge, open the bridge to let the ship through. 10 seconds after the ship passes, close the bridge.

Design

Ship class

- Stores position and velocity of ship, as well as references to OpenSceneGraph elements. These include the ship's transform and a Box shape representing the ship.
- Also stores the state of the ship relative to the bridge in an enum, ShipState. ShipState can be either "approaching" or "leaving."
- An update method that changes the ship's position each step based on its velocity and time elapsed since the previous step. This method also updates the ship's OpenSceneGraph transform.

Bridge class

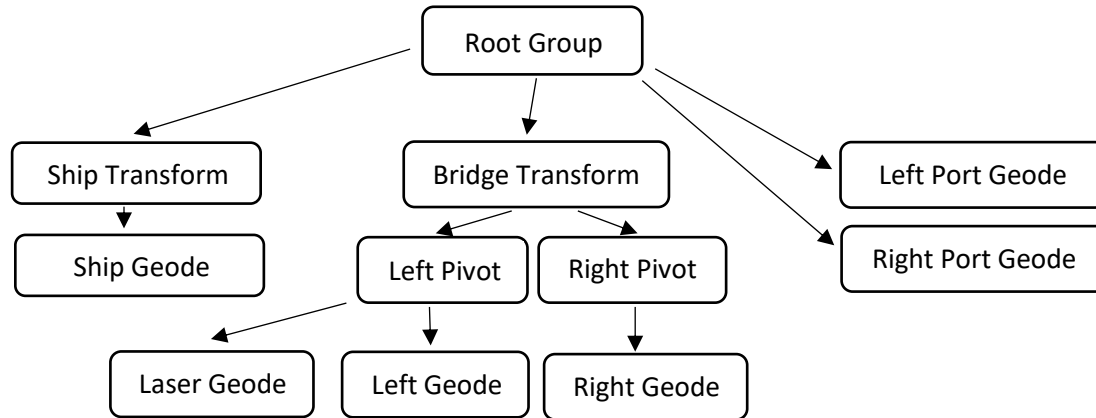
- Stores position of bridge, OpenSceneGraph element references, and variables concerning the opening and closing of the bridge. These include maximum and current angle, time to open, and time to wait before closing.
- OpenSceneGraph elements include the main bridge transform, transforms on the left and right to allow each half of the bridge to pivot, geodes containing box shapes on each pivot transform, and a laser geode mounted on one half of the bridge.
- Also stores the state of the bridge in the enum BridgeState. This enum can be "open," "closed," "opening," or "closing."
- An update method that updates the bridge state and opening angle, and checks the distance from the ship.

Main "Driver" file

- Creates bridge and ship instances.
- Sets up OpenSceneGraph root group, adding transforms from the ship and bridge.
- Creates OpenSceneGraph camera and viewer. Positions camera above scene facing down.
- Main loop
 - Calculates time since last iteration.
 - Updates ship and bridge positions and states.

- Prints debug information: current ship position and velocity, bridge opening angle, and time until ship reaches bridge.

OpenSceneGraph Tree Structure



Operation

At the start of the program, the bridge is closed and the ship state is set to “approaching.” The ship approaches from the top of the screen at a random speed between 10 and 30 units per second (units treated as meters in this case). On each iteration of the main loop, the bridge update method checks for the time until the front edge of the boat reaches the origin of the scene, where the bridge is positioned. For this design, the bridge must be fully open 10 seconds before the ship reaches the bridge. Since the time to open the bridge is set at 5 seconds, the bridge state starts opening 15 seconds before the ship reaches the bridge. When the boat is 10 seconds away, the bridge is fully open. When the ship reaches the bridge, the ship state switches to “leaving” and the bridge’s closing timer starts. When 10 seconds have passed, the bridge automatically starts to close, fully closing 5 seconds later.