KF6018 - Computer Graphics & Animation

**3D Models**

* Overall scene graph uses classes to add complex models such as station and train to the scene and control them independently. This also helps improve code quality.
* Train (animated)
  + Uses scene graph to rotate pistons at an offset to the wheels
  + Sub-models:
    - Carriages (generated using custom parameter-based algorithm)
    - Presents (generated using custom parameter-based algorithm)
      * Uses scene graph to position correctly within the carriage.
* Station
  + Uses scene graph for easy updates/changes – the walls rooted to the floor, the clock rooted to the wall, etc.
  + Consists of various Sub-models:
    - Seating (generated using custom parameter-based algorithm)
    - Clock (animated)
      * Uses scene graph to hook each hand to a respective gear and correctly animate the clock (not time-sensitive, for demonstration purposes, but the hands do move at different speeds, relative to each other)
* Tunnel
* Terrain generation (modified public source code)
  + Uses geometry deformation to create a hilly landscape

**User Interaction**

* User can look around using their head movement
* User can tap screen when looking at carriages to start/stop train
  + Changes camera viewpoint between on-board train and station-side
  + Train slows down/speeds up for a few seconds before switching to avoid snapping between scenes
* If on desktop, user can still use tap function by going to Sensors->Force Enabled Touch

**Graphical Rendering**

* Textures are used to give context & feel to environment. Public textures referenced below
  + Asphalt floor of station to give gritty feel
  + Coloured asphalt floor near edge of platform to maintain feel, but make the lines seem painted on
  + Tactile paving near edge of platform
  + Non-bumpy wood to make the train seem varnished
  + Bricked walls, material selected to recreate the look of a traditional UK train station
  + Dark wood pillar beams, again to recreate the look of a traditional UK train station
  + Gridded metal chairs – custom modified texture to recreate the style of chairs found in modern metro/train stations
  + Deliberately separated tunnel from outside area to give contrast on lighting styles
  + Landscape has snowy texture
* Tunnel deliberately low lit to demonstrate differing lighting for inside & outside, creating feel of dark & dingy underground station

**Special Effects**

* Smokestack at front of train
  + Uses Math.random to fuzz the position of the particles, slowly pushing them up, to give feel of heavy smoke clouds.
* Snow falling around world
  + Uses Math.random to fuzz the position of the particles, but this time the particles fall lightly to the ground, as expected from snow particles

**Proposed extra features**

* W16019711
  + Terrain generation
  + Instead of static environment, have the user travel along rails, with camera positioned inside of train to improve the immersion of the animation.
* W16007006
  + Sounds:
    - Train loop
      * Plays only while train is animating
    - Conductor’s whistle when changing from inside to outside
    - Train horn when changing outside to inside
  + Wheel animation relative to current velocity
  + Delayed transitions between the two cameras (inside/outside) to give context and avoid sharp camera changes

**Resource References**

The following objects, sounds and textures were used in the project. Sounds and textures may have been resized or otherwise modified to fit the needs of the project. Where public source code was used, this is mentioned and explained within the relevant areas of the project source code.

Textures

* Asphalt
  + <https://www.sketchuptextureclub.com/textures/architecture/roads/asphalt/asphalt-road-texture-seamless-07308>
* Brick
  + <http://www.mb3d.co.uk/mb3d/Brick_Seamless_and_Tileable_High_Res_Textures_files/Red_Brick_01_1.jpg>
* Gravel
  + <https://www.sharecg.com/v/15485/related/6/Texture/tileable-gravel>
* Paper
  + <https://www.freepik.com/free-vector/wrinkled-paper-texture_851248.htm#term=paper%20texture&page=1&position=0>
* Snow
  + <https://pixabay.com/en/snow-texture-winter-background-1186174/>
* Tactile Paving
  + <https://www.boral.com.au/sites/default/files/media/field_image/products-pavers-tactile-cautional-red-boral.jpg>
* Wood (light)
  + <http://gdj.graphicdesignjunction.com/wp-content/uploads/2013/03/wood-textures-high-quality-1.jpg>
* Wood (dark)
  + <https://www.sketchuptextureclub.com/textures/architecture/wood/fine-wood/dark-wood/dark-old-raw-wood-texture-seamless-04259>

Objects

* Medieval Horn lantern
  + <https://www.turbosquid.com/FullPreview/Index.cfm/ID/485023>

Sounds

* Train Horn
  + <https://www.audioblocks.com/stock-audio/train-horn-2-sound-effect.html>
* Train loop
  + <https://freesound.org/people/debsound/sounds/354062/>
* Station Whistle
  + <https://freesound.org/people/tommon/sounds/40754/>