ecobee

Embedded Case Study - Train Signaling System

Design a software program to control a simulation of a train traffic and signaling system. The system should include the following components:

- Several track segments, which consist of a length of track (of arbitrary length), plus two connection points at each end.
- Each of the two connection points in a track segment can:
    - Link with another track connection point directly, such that the next track segment is a continuation of the first
    - Link with another track segment in a junction, providing a fork in the track
    - End in a terminator.
- Junctions can direct train traffic only to one of the forked tracks at any given time
- Signals, which control the flow of traffic along track segments. Signals are optionally placed at the ends of each track segment. Signals can have the following states:
    - Green – train traffic is allowed through
    - Red – train traffic must stop before proceeding to the next track segment
- Trains, which are initially placed in a specific track segment, and given a direction. Trains can either be moving or stopped. Assume trains are one track segment long. Trains stop once they reach a terminator.
- Automatic route planning should be built to ensure trains find optimal routes between their starting point and destination.
- The simulation should automatically set signals in order to avoid collisions.
- The system has the following requirements:
- Provide a facility to build the system by adding track segments, connections between track segments, signals, and a train.
- Provide a facility to start the system and run the simulation. The simulation ends when all trains have stopped.

Optional components

You may choose to implement one or more of the following optional features:

- Provide a facility to display the complete system once built. The format of this display is left to the implementation and could be as simple as a list of segments and signals, or as elaborate as a graphical display.
- Provide a facility to save the layout of the system to file, and to retrieve a layout from file.
- Implement support for multiple trains running concurrently.
- Implement support for trains longer than one track segment.

What we expect from your finished case study

- You will need 5-10ish hours to implement/finish the case study.
- You will be expected to present the finished case study to a panel of ecobee employees (typically two of our embedded developers).
- You should be prepared to discuss all your technical decisions, including choice of platform, programming language, and frameworks. You should be able to explain your design choices, assumptions, and how they support the goals of the system, as well as any significant technical limitations.

- Please submit your completed source code. You can send it to your recruiter by e-mail or share a github repository with us.
- Your design will be evaluated based on how well it meets the requirements stated above, as well as technical criteria such as design choices, code structure, algorithms, and performance.
- You are free to use slides or other support materials to present your case study, in addition to the code itself.
- The presentation will be 1 hour total, with 30 minutes for presentation and 30 minutes for questions.
- Feel free to direct any questions you may have to Emma, we'll be happy to answer them!