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Primary Elements CSCD 350 Quarter Project:

1. Acceleration: the rate of change in velocity, the capacity to gain speed

source: [@khanavademy.com/accelation]

category: noun

data: dynamic because speed is constantly changing based on other controls and outside factors on train

control: conductor adjusts the speed by using acceleration pedal/lever

behavior: speeds/slows vehicle up/down

role: input, being controlled by crew

pattern: behavioral, the acceleration will be a factor in communication between the train and objects around

concern: controller overall as adjusting the acceleration on the model train will adjust view outputs on the trains overall speed

difficulty: easy to manipulate, hard to connect to other things

risk: high

confidence: high confidence in that it might be difficult

presentation: up/down keys for adjusting acceleration up/down, display throttle level on screen with numbers?

2. Cab Signaling:

A safety system that tells the crew information about the condition and status of the track.

source: [@en.wikipedia.org/wiki/Cab_signaling]

category: verb

data: dynamic in that it will change signals to show the crew, static in that it won't have anything else being changed, just holds/displays data

control: shows information to crew

behavior: various lights and descriptions to display information

role: output, displays info

pattern: structural, part of the train

concern: view, displays a view to crew

difficulty: easy, just uses sensors and displays

risk: high, if wrong crew knows very little about train

confidence: high, in that there is high risk, error on caution

presentation: small screen with light indicators and spot for error messages to display

3. Catenary Wire:

Overhead wire system that gives power to certain trains that utilize the wire system, runs above tracks and trains (electrical power that allows trains to move up and down track)

source: [@blog.amtrak.com/2014/01/catenary-wire/]

category: noun

data: power running through might be constantly changing?(Dynamic), but as far as location goes, always the same - static in that regard

control: provide electrical energy to trains

behavior: train runs below wires built above tracks, wire provide connection to train for power so train can move

role: output, outputs power

pattern: structural, big system of wires where tracks are

concern: model, stays the same with tracks giving power to trains

difficulty: the extreme heat and cold wires can face cause them to expand and contract and can be detrimental to usage of the trains, also cutting power to certain areas may be difficult, high

risk: high for reasons stated above, could hinder train(s) even moving

confidence: high in that there is a high risk, low in that im not familiar with how electrical energy is manipulated in these systems at large scale and outside world factors including weather

presentation: some indicator of whether or not the system is experiencing power (voltage?)

4. Coordinates, Absolute:
Absolute coordinates refers to a Cartesian System that uses x-axis, y-axis, and sometimes a z-axis to establish a point some distance from a common origin.

source: [@computerhope.com/jargon/r/relacoor]

category: noun

data: dynamic, coordinates of things constantly changing

control: will be interpreted by position of trains and features on track

behavior: program will interpret position of train with using features like check points and

speed to determine coordinates of train

role: output, displays position of train

pattern: behavioral, will communicate position to other crews

concern: view, to see position on map

difficulty: high, has to read lots of different moving parts hard to code

risk: high, if choices are dependent on position displayed by absolute coordinates

confidence: low, lots of code

presentation: a map/grid displaying coordinates (lat & long) of various trains/track/features

5. Coordinates, Relative:
Relative coordinates are locations defined by their distance from a reference point. An example of a relative coordinate is the distance from your computer monitor to your printer.

source: [@computerhope.com/jargon/r/relacoor]

category: noun

data: dynamic, always changing with moving parts and in reference to certain things

control: relative coordinates are determined by position of two objects in consideration of one

another

behavior: coordinates relative between trains and certain features including each other change

as they move about the track

role: output, constantly reading to measure position of features and trains

pattern: behavioral, works with communication between position and crew

concern: view, meant to observed and then decisions are made by crew after interpretation

difficulty: highly difficult as things are always moving

risk: moderate/high, depending on checks put in place and how dependent collisions are with coordinates

confidence: moderate, decent understanding but hard to code

presentation: lat and long. Coordinates to represent train position and position of different features

6. Coordinates, World:

- By world coordinates, one means coordinates that serve to locate a measurement in some multi-dimensional parameter space.

source: [@fits.gsfc.nasa.gov/firs_wcs]

category: noun

data: static, would have the world/grid of the world and coordinates to indicate different positions on world map, never changes

control: holds coordinates to different spots on map

behavior: defines a certain position on a map of world that is involved

role: output, establishes a base of coordinates.. might give into some input of other things

pattern: structural, ideally to remain the same throughout it's use

concern: model in just storing information, maybe view if like a gui was to represent things on these world coordinates

difficulty: hard to manipulate without messing other things up entirely

risk: high, if the world coordinates are not established

confidence: low, slightly confused between this and absolute coordinates

presentation: every single spot being represented by longitude and latitude at least

7. Crossing Gate:

Most crossing gates are designed to warn against motor traffic in the oncoming lanes, covering half the street, allowing an escape from the tracks for motorists who happen to be on the

crossing when the signal is activated. At some crossings, a "cantilever" extends out above the street with additional flashing lights to warn motorists in multi-lane situations.
Many modern crossing signals have "constant warning" technology which not only allows for the warning time, but adjusts to the speed of the oncoming train to give the same amount of warning, regardless of whether or not the train is moving slowly or very rapidly. The goal is to give adequate warning, but not too much time that would encourage motorists to disregard the signal.

source: [@up.com/aboutup/community/safety/warning_systems/]

category: noun

data: static, generally would just have two positions and can be accessed by status of train coming by

control: should be lowered by approaching of train

behavior: as train is approaching, crossing gate should lower, and crossing gate should raise and remain up when there is no train around

role: output, happens upon train arrival

pattern: structural, doesn't communicate anything

concern: view and control, should be controlled by train presence and visibly lower to keep pedestrians safe

difficulty: moderate, might be a couple different parameters to consider when programming timing of gate lowering/rising

risk: high, if does't work, people could die

confidence: moderate, only two positions it can be in

presentation: will display two positions it is in, one or another

8. Locomotive, diesel:
a type of railway locomotive in which the prime mover is a diesel engine.
source: [@en.wikipedia.org/wiki/Diesel_locomotive]

category: noun

data: structural

control: locomotives run along the track, go, stop, doesn't need catenary wire

behavior: runs along track always and can speed up or come to a stop depending on

acceleration

role: output, physical property being moved

pattern: structural, holds cargo being moved

concern: control, to be controlled by crew

difficulty: high, needs all standard tools

risk: moderate, might not have all standard tools to communicate with rest of track

confidence: moderate, never programmed it before

presentation: string representing position, maybe cargo

9. Locomotive, diesel-electric:
Diesel Locomotives use electricity to drive forward motion despite the name 'diesel'. A large diesel engine turns a shaft that drives a generator which makes electricity. This electrical energy powers large electric motors at the wheels called 'traction motors'.
source: [@edisontechcenter.org/Dieseltrains.html]

category: noun

data: static

control: locomotives run along the track, go, stop, this one uses the electricity to go from diesel

engine

behavior: electricity is generated from diesel engine to power train

role: output, physical property being moved

pattern: structural, holds cargo being moved

concern: control, to be controlled by crew

difficulty: high, needs all standard tools

risk: moderate, might not have all standard tools to communicate with rest of track,

confidence: moderate, never programmed it before

presentation: string representing position, maybe cargo

10. Locomotive, electric:
An electric locomotive is a locomotive powered by electricity from overhead lines, a third rail or on-board energy storage such as a battery or a supercapacitor.
source: [@en.wikipedia.org/wiki/Electric_locomotive]

category: noun

data: static

control: locomotives run along the track, go, stop, this one uses the electricity to go

behavior: electricity runs through the wires and provides power to move train to move along track

role: output, physical property being moved

pattern: structural, holds cargo being moved

concern: control, to be controlled by crew

difficulty: high, needs all standard tools

risk: moderate, might not have all standard tools to communicate with rest of track, needs wire above potentially all of track

confidence: moderate, never programmed it before

presentation: string representing position, maybe cargo

11. Locomotive, multiple unit operation*master/slave):
a method of simultaneously controlling all the traction equipment in a train from a single location—whether it is a multiple unit comprising a number of self-powered passenger cars or a set of locomotives—with only a control signal transmitted to each unit.
source: [@en.wikipedia.org/wiki/Multiple-unit_train_control]

category: adj

data: dynamic, a function on how power is transmitted

control: a signal between each unit that indicates power to passenger cars

behavior: a head car controls the

role: output, power output through cars

pattern: behavioral with its communication

concern: model, control as its to be manipulated like a controller

difficulty: could be difficult w dependencies on what passenger cars are capable of

risk: moderate, not entirely sure how to regulate

confidence: low still confused on concept tbh

presentation: a toggle switch?

12. Pantograph:
an apparatus mounted on the roof of an electric train, tram, trolleybus, trolley truck or electric bus to collect power through contact with an overhead line.
source: [@en.wikipedia.org/wiki/Pantograph_(transport)]

category: noun

data: static, not changing

control: dictated by electricity going through

behavior: receives electrical current through overhead line and applies it to movement of the

train

role: output to train

pattern: behavioral, passing signals from line to train

concern: view, want to know it's receiving electricity

difficulty: low, shouldn't be hard to code like a checkpoint for energy at least

risk: moderate, could be imperative to movement of train, or stopping

confidence: moderate, never seen one of these before

presentation: switch for allowing electricity through/ status, light?

13. Positive Train Control:
Positive Train Control (PTC) systems are technologies designed to automatically stop a train before certain accidents related to human error occur.

Mandated by Congress as part of the Rail Safety Improvement Act of 2008 (RSIA), PTC has been an unprecedented technological undertaking requiring each railroad to develop — from scratch — a system comprised of hundreds of thousands of components that must work across an interconnected network of freight, passenger and commuter railroads.

In order to work safely and be fail-safe, PTC systems must be able to determine the precise location, direction and speed of trains, warn train operators of potential problems and bring the train to a stop if the operator does not act.

source: [@aar.org/campaigns/ptc/]

category: noun

data: dynamic, constantly reading to stop a train, needs to determine location, direction,

speed, and warn

control: constantly reading

behavior: reads trains location, direction, speed and warns in case of collision, will stop train if necessary

role: process, output

pattern: behavioral

concern: view

difficulty: high, deals with a lot of factors

risk: high, lots of factors

confidence: low, decent understanding

presentation: signal to make sure it's activated, showing real time diagnostics of train elements mentioned above

14. Push-pull train:
a configuration for locomotive-hauled trains, allowing them to be driven from either end of the train, whether having a locomotive at each end or not.
A push–pull train has a locomotive at one end of the train, connected via some form of remote control, such as multiple-unit train control, to a vehicle equipped with a control cab at the other end of the train. This second vehicle may be another locomotive, or an unpowered control car.

source: [@en.wikipedia.org/wiki/Push%E2%80%93pull_train]

category: noun

data: static, its a configuration of remotes connected across a train

control: use it to control back and forth movement of train

behavior: described above, uses a remote connected to another train providing power or a dead car

role: output, a physical type of train

pattern: structural, it is type of structure with a special system

concern: model, maybe controlled by crew

difficulty: moderate, should be similar to other trains

risk: moderate, not much different, haven't done before

confidence: moderate, haven't done before

presentation: two directions for train to go controlled by toggle?

15. Rail yard: A complex series of tracks for sorting, storing, loading/unloading rail cars or locomotives

source: [@en.wikipedia.org/wiki/Rail_yard]

category: noun

data: static, rail yard waits to be accessed by a crew, holds tracks

control: store and sort things for railway system

behavior: crew uses rail yard to store items

role: input, takes in input and holds it there, maybe process to sort/organize whatever it holds

pattern: it is a structure that holds things (structural)

concern: model, to be used by crew and manipulated

difficulty: easy, just stores and potentially sorts

risk: low, not many operations or other moving parts drastically dependent on state of rail yard

confidence: high, just a place for storage

presentation: representation of position of various rail yard items

16. Roundhouse:
a building used by railroads for servicing locomotives
source: [@en.wikipedia.org/wiki/Roundhouse]

category: noun

data: static, not moving, hold cargo

control: to hold locomotives

behavior: locomotives are stored and worked on inside this building

role: output, physical property location

pattern: structural, its a structure

concern: model, holds things, locomotives

difficulty: low, maybe some interaction with capacity

risk: low, not dire traffic dependent

confidence: moderate, not fully familiar with term

presentation: numerical representation of capacity

17. Semaphore:
A semaphore works as a moving arm mounted to a mast. A Victorian-era train signal from the mid-19th century, different positions at different angles inform the engineer of when to stop, proceed and travel with caution. Some also work in unison with lights.

source: [@traveltips.usatoday.com/railroad-signal-lights-mean-100407.html]

category: noun

data: dynamic, as it changes position to indicate a signal to engineer

control: has 3 different positions, might work with lights

behavior: moves to one of three positions to indicate stop, go, go slow

role: input if it's dependent on behavior of other trains but generally output to show engineer what to do

pattern: behavioral, constantly changing and behaving for fluidity of train traffic

concern: controller to control movement of trains potentially from a user if not controls traffic of trains, portrays a view too

difficulty: moderate if made dependent on other train behavior which is what I would suspect

risk: high depending on outside factor of other moving trains/people etc.

confidence: mid, first time..

presentation: a number and color (light) indicating the position of the semaphore

18. Sensor:
sensors are available to measure various properties including, but not limited to, speed, position, vibration, pressure, and liquid level.

source: [@te.com/usa-en/industries/sensor-solutions/applications/railway-sensors.html?tab=pgp-story]

category: noun

data: dynamic, always reading (sensing) info in regards of what to display

control:

behavior: sensors take input regarding various things like speed and position and give output on status of train mainly

role: process, has to interpret input and output correct reading

pattern: behavioral, deals with communicating factors of train to crew

concern: view, displays status of train

difficulty: not difficult

risk: high, if sensor is not programmed right, can cause big problems to crews interpretation of the status of the train

confidence: moderate, seems easy but could not be considering all of the things that need to be sensed

presentation: tools in place to read data of train and various other elements to engineer

19. Signal light:
Lights that display trains running in the same direction on the same track; trains running in opposite directions on the same track; and trains running on two tracks that intersect.
More than just go and stop

source: [@trn.trains.com/railroads/abcs-of-railroading/2006/05/railroad-signals]

category: noun

data: dynamic, always changing

control: can display whether or not Train is safe to proceed on route

behavior: should interpret from a source data about other trains on track and display the correct light signal on whether or not a train is to proceed

role: would be its output would be input to crew

pattern: behavioral, not to maintain the same but help communicate between crew and other trains

concern: view, control from crew on what happens next, should display a light though for view

difficulty: moderate in interpreting correct light to display

risk: high if interpretation is wrong

confidence: moderate, seems simple yet never done this before

presentation: three different lights indicating actions to take for crew

20. Speed:
Speed (or rate, r) is a scalar quantity that measures the distance traveled (d) over the change in time (Δt),

source: [@khanacademy.org/science/physics/one-dimensional-motion/dispacement-velocity-time/v/calculatoin-average-velocity-or-speed]

category: noun

data: dynamic, generally changing over the course of time

control: is an indicator of how fast a train would be going in this case, controlled by acceleration

behavior: will show how fast train is moving on average over a duration of seconds

role: process/output, will display speed to crew to know whether or not to speed up or slow down

pattern: behavioral, will be a constant communicator between acceleration and physical movement of train

concern: view, will constantly display view of trains speed

difficulty: easy/moderate, multiple ways to calculate speed

risk: high, if crew can't get reading on speed, can be detrimental

confidence: low in that can be multiple ways to calculate average speed, want most accurate in instance of time

presentation: numerical value to instantaneous speed in mph

21. Stock, rolling:
refers to railway vehicles, including both powered and unpowered vehicles, for example locomotives, railroad cars, coaches, private railroad cars and wagons.

source: [@en.wikipedia.org/wiki/Rolling_stock]
category: noun

data: static, position will be updated, holds data/cargo

control: will be moved along tracks

behavior: rolling stock moves and stays somewhere on the track at all times

role: output, the physical things carrying cargo/data

pattern: structural, for reason above

concern: model, holds cargo

difficulty: low, just has to store data

risk: low, doesn't involve trafficking

confidence: moderate, doesn't seem hard but never programmed before

presentation: string representation of type of vehicle/ cargo on it

22. Switch (track):
a mechanical installation enabling railway trains to be guided from one track to another, such as at a railway junction or where a spur or siding branches off.

source: [@en.wikipedia.org/wiki/Railroad_switch]

category: noun

data: static, switch between two positions to guide the train

control: can switch position for train to go different directions on the track

behavior: train should know desire course and the route switches should be placed in, then switches should move to those positions as train is approaching and guide the train on the correct course

role: output, final guide for direction of train upon junction

pattern: structional, maintains it position until directed otherwise

concern: model, control.. needs to be controlled by crews,

difficulty: high when multiple trains are interacting with same junction, many dependencies

risk: high, if train gets directed wrong way could cause collision

confidence: low, never done this before

presentation: two positions for switch to be in, switch combinations for routes can be created for crew to follow depending on destination

23. Track, main line:
The main line, or mainline in American English, of a railway is a track that is used for through trains or is the principal artery of the system from which branch
lines, yards, sidings and spurs are connected. It generally refers to a route between towns, as opposed to a route providing suburban or metro services.

source: [@en.wikipedia.ord/wiki/Main_line(railway)]

category: noun

data: static, not moving

control: mainlines are built and maintained and support trains moving across them

behavior: support trains moving across them from A to B, other additions to the track are built and added on. Could be shut down to undergo maintenance I suppose. Or added to/removed

role: output, will display it's route

pattern: structural, holds a route/map of grid

concern: model, isn't to do anything else but stay and support trains that move along, maybe view

difficulty: moderate, changing something involving the mainline can potentially have an effect on everything that's built from it

risk: high, in that altering something on mainline will impact entire connections dependent on it's position

confidence: high confidence that there is high risk, low confidence that im thinking of everything

presentation: a map displaying path of main track

24. **Track, siding:**
    a short stretch of railroad track used to store rolling stock or enable trains on the same line to pass

source: [@thefreedictionary.com/railroad+siding]

category: noun

data: static, it is a track laid out that does not move

control: tracks support trains as they drive on them, would not want side stretch length to be shorter than train length, defeats the purpose

behavior: trains move and sit on track siding

role: input as track has to support the mass of train and make sure train isn't too big

pattern: structural, placed down, not moving

concern: model, just sits there, maybe view if you want to know the status of the tracks ability to support and its length

difficulty: moderate, just with train length needing to be same size or shorter in order for other trains to safely pass

risk: moderate, some room for error from reason stated above

confidence: moderate considering last two reasons

presentation: indicator of track support ability check, length check, being available check

25. Track, spur:
a short branch track leading from the main track, and connected with it at one end only

source: [@collinsdictionary.com/us/dictionary/English/spur-track]

category: noun

data: static, just sits there containing data on availability/ maybe capability of support

control: hold trains and other things that need a track

behavior: trains store box cars or park on spurs to remain out of the way of other trains needing to use the circuit of the track to get about

role: input, takes in train

pattern: structural, not moving, just holding data

concern: model hold data, maybe view to indicate it's in use

difficulty: easy, not dependent or has any dependency on many other factors

risk: low, for reason mention above, unless storage order comes into play that could cause an annoying problem of retrieving something stored on at the end of a dead end

confidence: high, not too many moving parts other than what was just previously stated

presentation: indicator of whether or not it is occupied perhaps along with what it is, or that can be indicated through the train ID as well

<u>Track/infrastructure</u>

- track, spur

- Track, siding
- Track, main line
- Switch track
- Signal light
- Crossing gate
- Signal lights
- Semaphore
- Catenary wire
- Rail yard
- Roundhouse

Trains

- locomotive, diesel
- Locomotive, diesel-electric
- Locomotive, electric
- Locomotive, multiple unit operation (master/slave)

Train add-ons

- push-pull train
- Positive Train Control
- Pantograph
- Speed
- Acceleration
- Sensor
- Cab signaling

Location

Coordinates, absolute

Coordinates, relative

Coordinates, world