1. **Acceleration**

   Source: [@]
   Category: noun
   Data: final velocity (dynamic because it changes depending on when you stop measuring), initial velocity(static because you only start your measurement once), elapsed time (dynamic because it changes depending on when you stop measuring)
   Control: final velocity can be higher or lower than initial; time can only increase
   Behavior: Acceleration of the train can be increased or decreased
   Role: output, because it is a product of intrinsic properties of what we are observing. We don't use it as an input or processing for other things.
   Pattern: creational. Building block for train.
   Concern: model. Intrinsic property of train.
   Difficulty: moderate. I think due to the sheer weight of the train, having acceleration spike is relatively hard. Thus programming mistakes could be "absorbed" by the weight.
   Risk: low, due to weight and real world consequences.
   Confidence: moderate. Have never coded something that affects real life.
   Presentation: screen with acceleration constantly refreshing, wish indicators for too high or too low(?) of an acceleration.

2. **Cab signaling:**

   Source: [@en.wikipedia.org/wiki/Cab_signalling]
   Category: verb
   Data: various lights (dynamic because they turn on and off) and indicators(dynamic because they turn on and off)
   Control: the various lights and indicators are used to convey information regarding the track and sometimes even nearby trains.
   Behavior: The lights to indicate turn on when the train approaches a portion of the track that is deemed lower speeds.
   Role: output because it shows the user what status
   Pattern: behavioral. We manipulate it.
   Concern: view. because we see the state
   Difficulty: easy because technology is used often
   Risk: high risk because a failure or bug could cause death or destruction
   Confidence: low because I know nothing of what messages need to be conveyed and received as a train operator
   Presentation: Screen with lights for slow down, speed up, auto-brake, track condition and status, nearby trains. Similar to car dashboard.

3. **Catenary Wire**:

   Source: [@iseptaphilly.com/blog/catenary]

Category: noun
Data: wire (static because its always a wire, stays in same place), carries current (dynamic because current changes)
Control: current within the wire can increase or decrease
Behavior: The current going through the catenary cable increases to allow for a higher train speed, or the current is lowered to limit train speeds.
Role: Output, pushes power to train.
Pattern: structural. It links the power to the train.
Concern: model. It defines what something is.
Difficulty: easy, because there's not much to be concerned here. As long as the data goes through fine, we are good!
Risk: moderate, because it's fine if we under supply our current as the speeds will just lower, but giving it too much could blow motors or get trains up to unsafe speeds
Confidence: high, because I think this is mostly a hardware problem with minimal software involvement.
Presentation: a wire with "voltage" lines on it.

4. **Coordinates, absolute:**

Source: [@brighthubengineering.com/geotechnical-engineering]
Category: noun
Data: Set of values to describe position (dynamic, because they change according to the object)
Control: Values are either increased or decreased according to the position of the object
Behavior: A train automatically updates its' coordinates with the system through cab signaling
Role: input as we just store coordinates.
Pattern: creational. It's a building block.
Concern: view, it displays information.
Difficulty: Easy, only need to store numbers. Number won't overflow either.
Risk: low. Given that trains are on a track, on the off chance that the system introduces error to the coordinates due to IEEE conversion, it is realistic to assume that the trains wont fall off the track due to the differences.
Confidence: High, due to having low risk.
Presentation: Grid that expands or contracts depending on how far away the object is from the origin of the system

5. **Coordinates, relative:**

Source: [@brighthubengineering.com/geotechnical-engineering]
Category: noun
Data: Set of values to describe position of object, and the reference object
Control: Values of both sets of coordinates are increased or decreased according to the position of the object and the reference object
Behavior: As object A leaves object B, the coordinates of object A are updated.
Role: Input as we just store coordinates

Pattern: creational. It's a building block.
Concern: view, it displays information.
Difficulty: Low, same reason as absolute coordinates
Risk: Low, same reason as absolute coordinates
Confidence: High, same reason as absolute coordinates
Presentation: Grid with two dots that scale dynamically to always encompass two dots

6. **Coordinates, world:**

Source: [@brighthubengineering.com/geotechnical-engineering]
Category: noun
Data: coordinates of an object with respect to the earth (dynamic because the data changes)
Control: coordinates are manipulated numerically
Behavior: As train A moves around the earth, its coordinates is updated accordingly.
Role: Input as we just store coordinates
Pattern: creational. It's a building block.
Concern: view, it displays information.
Difficulty: Low, same as absolute coordinates
Risk: Low, same as absolute coordinates
Confidence: High, same reason as absolute coordinates
Presentation: Grid, with a single dot representing the object on the earth.

7. **Crossing gate:**

Source: [@whippanyrailwaymuseum.net/exhibits/structures/railroad-crossing-gates-a-signals]
Category: Noun
Data: arm (dynamic, moves up and down); lights (dynamic, turns on and off); mounting (static, does not move)
Control: Arm moves up and down
Behavior: As train approaches, the crossing gate automatically closes to prevent cars from crossing the track
Role: Output, we it's only there to signal the driver.
Pattern: creational. It's part of the train track.
Concern: model. It defines what something is.
Difficulty: Low, not much to worry about here
Risk: High, not closing when it should could end in deaths
Confidence: Low, not sure what I can do here
Presentation: A road that is blocked by a striped gate

8. **Locomotive, diesel:**

Source: [@en.wikipedia.org/wiki/Diesel_locomotive]
Category: Adjective

Data: wheels (dynamic because they rotate); engine (static because it doesn't move); train (static because it doesn't move)
Control: Speed up or slow down train
Behavior: Train can be sped up or slowed down by the operator
Role:
Pattern: behavioral. It's complete and you can do something
Concern: model. It defines what something is.
Difficulty: Moderate
Risk: Low
Confidence: Low
Presentation:

9. **Locomotive, diesel-electric:**

Source: [@en.wikipedia.org/wiki/Diesel_locomotive]
Category: Adjective
Data: wheels (dynamic because they rotate); engine (static because it doesn't move); train (static because it doesn't move)
Control: Speed up or slow down train
Behavior: Train can be sped up or slowed down by the operator
Role: Processing. It takes our input and gives output (speed)
Pattern: behavioral. It's complete and you can do something
Concern: model. It defines what something is.
Difficulty: Moderate
Risk: Low
Confidence: Moderate
Presentation: Side view of train, but engine, but has diesel powering an alternator that connects to wheels.

10. **Locomotive, electric:**

Source: [@american-rails.com/electric.html]
Category: Adjective
Data: cab (static*), wheels (dynamic, they rotate), engine (static*)
*static with respect to itself
Control: Same as normal locomotive.
Behavior: Same as normal locomotive.
Role: Processing. It takes our input and gives output (speed)
Pattern: behavioral. It's complete and you can do something
Concern: model. It defines what something is.
Difficulty: Moderate. Not sure what changes electrical engines cause trains.
Risk: Low, not much to go wrong.
Confidence: High, seems simple enough.
Presentation: Side view of train, but engine has thunder to indicate electric.

11. **Locomotive, multiple unit operation(master/slave):**

    Source: [@quora.com/What-is-a-slave-engine-on-on-a-locomotive]
    Category: Adjective
    Data: master engine (static*), slave engine (static*), cabs (static*), wheels (dynamic, they rotate)
    Control: slave engine is paired with master
    Behavior: Same as a train, but provides more traction in certain cases.
    Role: Processing. It takes our input and gives output (speed)
    Pattern: behavioral. It's complete and you can do something
    Concern: model. It defines what something is.
    Difficulty: Easy. Should be simple to implement a slave engine.
    Risk: Low. Even if slave doesn't work, shouldn't cause any damage.
    Confidence: High, given the difficulty and risks.
    Presentation: Train with two engines up front, but only one has a cab for operator. Line between engines to indicate they are linked.

12. **pantograph:**

    Source: [@railsystem.net/pantograph/]
    Category: Noun
    Data: plunger (dynamic, moves in and out), upper link (static*), upper arm (static*), lower arm (static*), lower link (dynamic, moves in and out)
    *static with respect to itself
    Control: None.
    Behavior: It mounts on top of the train to collect energy.
    Role: Input, it takes in energy.
    Pattern: Structural. It links the power to the train.
    Concern: Model. It is intrinsic to the train.
    Difficulty: Easy, little moving parts.
    Risk: Low, either the train gets power or it doesn't.
    Confidence: Moderate, have experience in power but no high voltage experience.
    Presentation: Side view of train with electrical lines on top, with pantograph arms connecting to train.

13. **Positive Train Control:**

    Source: [@railroads.dot.gov/train-control/ptc/positive-train-control-ptc]
    Category: Noun
    Data: positive zones (dynamic, changes according to use)
    Control: Zones increased to indicate possible routes of travel
    Behavior: Positive zones are given to a particular train to allow the train to move in that particular zone.

Role: Processing. It takes our input and gives the train an output of where it can go.
Pattern: Behavioral, we can use it.
Concern: Controller, because we use it.
Difficulty: Hard, complicated system to implement correctly. High interconnectivity.
Risk: High, wrong behavior might cause crashes.
Confidence: Low, have never attempted anything like this. New to the concept as well.
Presentation: Top down view, train is only in green tracks with green headroom ahead, while surrounding tracks are greyed out.

14. **Push-pull train:**

Source: [@www.britannica.com/technology/locomotive-vehicle/Types-of-diesel-motive-power]
Category: Adjective
Data: wheel (dynamic, they need to rotate), train (static, they do not move with respect to itself)
Control: Can be operated on either ends to move towards either directions.
Behavior: Train can be operated on its tail to move in the direction of the tail, or vice versa.
Role: Processing. It takes our input and gives output (speed)
Pattern: behavioral. It's complete and you can do something
Concern: model. It defines what something is.
Difficulty: Easy, simple checks should suffice.
Risk: Low, if they move in opposite directions it would be obvious.
Confidence: High, given difficulty and risk.
Presentation: Train with arrows on both ends pointing in same direction.

15. **Rail yard:**

Source: [@]
Category: Noun
Data: Tracks (static, stays in place),
Control: None.
Behavior: None.
Role: Input, takes in trains.
Pattern: structural. It creates structure for train tracks.
Concern: model. It defines what something is.
Difficulty: Easy. Not much to do implement.
Risk: Low. Either it works or it doesn't.
Confidence: High, due to difficulty and risk.
Presentation: top down view, few tracks branching into exponentially more tracks.

16. **Roundhouse:**

Source: [@en.wikipedia.org/wiki/Railway_roundhouse]
Category: noun
Data: Building (static), turntable (dynamic, it turns)

Control: Building can be open or closed, turntable can rotate
Behavior: The turntable rotates in place inside the building
Role: Input, takes in trains.
Pattern: structural. It creates structure for train tracks.
Concern: model. It defines what something is.
Difficulty: Easy. Simple to implement.
Risk: Low. If rotation is wrong, train won't align to the tracks.
Confidence: High. Seems simple to implement.
Presentation: Horizontal track with disconnected track inside a rotated disc in the middle

17. **semaphore:**

Source: [@american-rails.com/signals.html]
Category: noun
Data: blades (dynamic, they move), lenses (static, only to aid in vision)
Control: the blades move to display desired signal
Behavior: The operator moves the blade 45 degrees to signify caution.
Role: Output, it takes our wanted signal and gives an output to the train
Pattern: structural. It creates structure for railway signals.
Concern: view. We see it.
Difficulty: Easy. Minimal moving parts.
Risk: Moderate. Wrong signal might cause collisions.
Confidence: High. Simple implementations and easy to test.
Presentation: Pole with blade on the end, with all possible positions laid over each other in transparency.

18. **sensor:**

Source: [@amphenol-sensors.com/en/transportation-sensors/railway-sensors/cabin-control]
Category: noun
Data: sensor itself (static, sensors are generally mounted statically)
Control: None.
Behavior: The track sensor senses the speed of the train that just passed.
Role: Input, takes in measurements.
Pattern: creational. It's a "building block" to the track and/or train.
Concern: model. It defines what something is.
Difficulty: Moderate. Different sensors put out different types of data and consolidating different protocols might be hard.
Risk: Moderate. Due to difficulty. However sensors normally have backups, or secondary systems.
Confidence: Moderate. Given the difficulty and risks, this seems though. But I have background in microprocessors and sensors.
Presentation: Graphical drawing of the sensor itself.

19. **Signal light:**

    Source: [@american-rails.com/signals.html]
    Category: Noun
    Data: Light (dynamic, on or off)
    Control: Signal turns on or off
    Behavior: The red signal is turned on by the track to indicate the train must stop.
    Role: Output, shows desired signal.
    Pattern: behavioral. You manipulate it on or off.
    Concern: view. User sees it.
    Difficulty: Easy, There exists a set of all required signals, and implementing them as Boolean is easy.
    Risk: High. Wrong signal could cause crashes.
    Confidence: High. Boolean logic is simple.
    Presentation: Light with silhouette of the respective signal, in words. Eg: red light with STOP silhouette

20. **Speed:**

    Source: [@www.thoughtco.com/speed-2699009]
    Category: verb
    Data: distance (dynamic, always changes) time (dynamic, always changes)
    Control: Speed can be increased or decreased
    Behavior: By applying less power, the speed of the train is decreased
    Role: Output, shows information given other data.
    Pattern: creational. Building block for train.
    Concern: model. Intrinsic property of train.
    Difficulty: Easy. Simple to calculate if sensors are present.
    Risk: Moderate. Might mess up speed indication, but physical sensation of speed would be warning to the driver and passengers that something is wrong. Could also have track monitors.
    Confidence: High. Have interest and knowledge in physics and race cars.
    Presentation: Speedometer gauge

21. **Stock, rolling:**

    Source: [@en.wikipedia.org/wiki/Rolling_stock]
    Category: adjective
    Data: railway vehicle
    Control: None
    Behavior: None
    Role: Output. This is a label put on railway vehicles
    Pattern: Structural. It links together various information (train) to give context.
    Concern: View. It's how we see our locomotive.
    Difficulty: Easy. Simple to implement.

Risk: Low. I can't see any possible risk.
Confidence: High. Only "status" of vehicle.
Presentation: Side view, locomotive on tracks

22. **Switch (track):**

Source: [@en.wikipedia.org/wiki/Railroad_switch]
Category: Noun
Data: points (dynamic because they move)
Control: points move to facilitate diversion of trains direction
Behavior: Switch is used to join two tracks into one, while introducing the capability to switch between two tracks.
Role: Output, switches the train direction because of our input
Pattern: creational. It is building block for train tracks.
Concern: model. It defines what something is.
Difficulty: Low. Seems fairly simple to implement. Testing might be hard.
Risk: High. Wrong implementation might cause train accidents or wrong path.
Confidence: Moderate. Risk is high but difficulty seems low.
Presentation: Top down view, one track going straight, another goes from the one track, but tangents off the side.

23. **Track, main line:**

Source: [@en.wikipedia.org/wiki/Main_line_(railway)]
Category: Adjective
Data: Tracks (static, they don't move)
Control: None. Static.
Behavior: The train rolls along on it's track.
Role: Processing, allows train to go to move on it
Pattern: creational. It is building block for train tracks.
Concern: model. It defines what something is.
Difficulty: Easy. Either they work or they crash.
Risk: High. Could cause crashes if not done properly.
Confidence: High. Fairly straight forward
Presentation: Top down view, two thick parallel lines with thin horizontals across

24. **Track, siding:**

Source: [@cs.trains.com/mrr/f/11/t/261192.aspx
Category: Adjective
Data: Track (static, they don't move)
Control: None. Static.
Behavior: Sidings are used for low speed and low traffic lines.
Role: Processing, allows train to go to move on it

Pattern: Structural. It is not creational (not required), but links other concepts (low speed traffic)
Concern: model. It defines what something is.
Difficulty: Easy. Seems simple to implement.
Risk: Low. Train should have low speed here anyways.
Confidence: Moderate. Have not considered all the use cases of a track siding.
Presentation: Top down view, track going across with another track connected to the main, but thinner lines to represent low speed and low traffic.

25. **Track, spur:**

Source: [@cs.trains.com/mrr/f/11/t/261192.aspx]
Category: Adjective
Data: track (static because they never move)
Control: track that is connected to the main only on one end
Behavior: lets the track be connected to static objects like a building. Allows for trains to be "disconnected" from the larger track.
Role: Processing, allows train to go to move on it
Pattern: Structural. It is not creational (not required), but links other concepts (other buildings)
Concern: model. It defines what something is.
Difficulty: Easy. Seems fairly simple to implement.
Risk: Low. Train will have to slow down to approach a spur, so no big risks.
Confidence: Moderate. Have not considered all the possible use cases of a spur.
Presentation: Top down view, track going from bottom to up, but it ends at a building.

1) **Train**

- Acceleration
- Locomotive, diesel
- Locomotive, diesel-electric
- locomotive, electric
- locomotive, multiple unit operation (master/slave)
- speed
- stock (rolling)
- catenary wire
- pantograph
- push-pull train

2) **Track**

- track, spur
- track, siding
- track, main line
- coordinates, absolute
- coordinates, whole
- coordinates, world
- switch (track)
- crossing gate
- rail yard
- sensor
- roundhouse

3) **Signalling**

- Positive train control
- Semaphore
- Signal light
- Cab signalling

2807 words