Functionality pathways

1. Simulating front, rear, all-wheel drive
   1. Front wheel drive
      1. Click on button that says start/stop front wheel simulation
      2. Start engine
      3. Keep updating the fuel level in the tank as long as the engine is running(should update every 5 seconds) – simulates the consumption of fuel
      4. Send power to the front drive shaft from the engine
      5. Front driveshaft send turning action to the front wheels
      6. Front wheels turn
   2. Rear wheel drive
      1. Click on button that says start/stop rear wheel simulation
      2. Start engine
      3. Keep updating the fuel level in the tank as long as the engine is running(should update every 5 seconds) – simulates the consumption of fuel
      4. Send power to the middle drive shaft from the engine (runs from engine to the back of the car)
      5. Middle driveshaft sends power to the rear driveshaft
      6. Rear driveshaft send turning action to the rear wheels
      7. Rear wheels turn
   3. All wheel drive
      1. Click on button that says start/stop all wheel simulation
      2. Start engine
      3. Keep updating the fuel level in the tank as long as the engine is running(should update every 5 seconds) – simulates the consumption of fuel
      4. Send power to the front drive shaft and middle driveshaft from the engine
      5. Front driveshaft send turning action to the front wheels
      6. Middle driveshaft sends power to the rear driveshaft
      7. Rear driveshaft sends turning action to rear wheels
      8. Front and rear wheels turn
2. Simulating fuel system in different situations (already provided)
   1. Low fuel
   2. Incorrect fuel
   3. Normal mode
   4. Changing incline
3. Simulate cooling system in the car
   1. High temperature (overheat)
      1. Turn on engine
      2. Auto set engine temperature to be about 120 celcius
      3. Let engine run, as engine runs, keep increasing temperature about 2 degrees a second
      4. Show coolant entering to engine from coolant tank and out of engine at slow rate
      5. Show coolant moving from engine to radiator and out of radiator to coolant tank at a slow rate
      6. Once engine temperature reaches 140 celcius light up the high engine temperature warning on the instrument cluster
      7. Within 5 seconds, display “engine overheat! Engine will shut down” message in the message center
      8. Shut down engine automatically after 5 seconds. Display check engine light and high temperature light.
   2. OK temperature
      1. Turn on engine
      2. Auto set engine temperature to be about 70 celcius
      3. Let engine run, as engine runs, keep increasing temperature about 2 degrees a second, up to about 90 degrees
      4. Show coolant entering to engine from coolant tank and out of engine at fast rate
      5. Show coolant moving from engine to radiator and out of radiator to coolant tank at a fast rate
4. Simulate electrical system in the car
   1. Lights
      1. Headlights
         1. Click on button to turn on headlights
         2. Display headlights on icon in instrument cluster
         3. Show power going from battery to headlights
         4. To turn off, click the same button again. It will turn off the headlights on icon as well
         5. If front foglight, high beam, rear foglight are on, turn it off as well automatically, disable the front foglight, high beam and rear foglight on symbol.
      2. Front fog lights
         1. Click on button to turn on front foglights
         2. If headlights are not on, display a warning in the message center that the headlight has to be on first
         3. If headlights are on, display the front fog light on symbol in the instrument cluster
         4. Show power going from battery to front fog light
         5. To turn off, click the button again. Disable the front fog lights on symbol.
      3. High beam
         1. Click on button to turn on high beam
         2. If headlights are not on, display a warning in the message center that the headlight has to be on first
         3. If headlights are on, display the high beam on symbol in the instrument cluster
         4. Show power going from battery to high beam light
         5. To turn off, click the button again. Disable the high beam on symbol.
      4. Rear fog light
         1. Click on button to turn on rear foglights
         2. If headlights are not on, display a warning in the message center that the headlight has to be on first
         3. If headlights are on, display the rear fog light on symbol in the instrument cluster
         4. Show power going from battery to rear fog light
         5. To turn off, click the button again. Disable the rear fog lights on symbol.
      5. Hazard lights
         1. Click on the turn on hazard lights button
         2. Show power going from battery to front and rear indicator lights via a switch than engages and disengages
         3. Repeatedly turn on and turn off the left and right indicator symbol.
         4. Click the same button to turn off.
   2. Wipers
      1. Click the button to turn on wipers
      2. Display in message center “Wipers active!”
      3. Send power from battery to wipers. As speed increases, increase the rate of power going to wipers
      4. Can change the wiper speed from 1 – 3 using +/- buttons (like speed)
      5. If speed changed, display message in message center “Wiper speed changed to x” where x is the new wiper speed.
      6. Click the same button to turn off.
   3. Audio system
      1. Click the button to start the audio system
      2. Can change the volume using the +/- like the speed max is 20, minimum is 0
      3. Can change the channels through perhaps 6 numbered buttons representing each a channel
      4. Every time we change the channel/volume, display in message center “Now playing: Channel x” or “Volume: x”
      5. Show power going from battery to car radio
      6. Show car radio sending power to the speakers in the car (4 speakers, one on each door). As volume increases, rate of power moving increases
   4. Cruise control
      1. Click on simulate cruise control button
      2. Display +/- for cruise speed, make sure speed is not 0
      3. Click on set cruise, cruise control module gets power from battery, sends signal to engine, engine gets a stable rate of fuel sent to it.
      4. Click on cancel cruise, no more power sent to cruise control module, slow down car at a rate of 1kmh per 2 seconds, until 0 (if user didn’t quit) – don’t care the speed they set.
      5. If cruise speed is lower than current speed, slow down until reached cruise speed at a rate of 1 kmh per 2 second.
      6. If cruise speed more than current speed, increase speed at a rate of 1 kmh per 0.1 second until reached cruise speed
   5. Defrost rear
      1. Click on button to activate the rear heater
      2. Light up the rear defrost icon on instrument cluster
      3. Send power from battery to rear window defrost
      4. To turn off, click on button again, disable the rear defrost icon
5. Simulate steering system
   1. Click on turn steering to the left
   2. Turn steering to the left
   3. Turn steering pinion (rod)
   4. Move steering rack to the right (causing wheels to turn left)
   5. Move tyres by 15 degress to the left (change image)
   6. Can repeat until tyres are at 75 degrees left. At which point cannot anymore.
   7. Do the same for the right way.
   8. (Essentially range of angles is from 75 degrees left to 75 degrees right)
6. Simulate braking system
   1. Hand brake
      1. Click engage/disengage handbrake
      2. If disengaged already, engage it. Light up hand brake icon on instrument cluster. Send signal to parking brake mounted in rear wheels and power from battery. Parking brake locks
      3. If engaged already, disengage it. Disable hand brake icon on instrument cluster. Send signal to parking brake mounted in rear wheels and power from battery. Parking brake unlocks
   2. Foot brake
      1. Let car be moving at 60kmh
      2. Click and hold apply brake button
      3. As long as the button is applied keep sending signal to the brake pump
      4. Brake pump pumps brake fluid to the brakes on 4 wheels
      5. As long as brake fluid is pumped, apply the brakes
      6. Reduce the speed at a rate of 15kmh per second
7. Simulate adding attachment
   1. Click add trailer
      1. Trailer mounted to rear of the car
   2. Click add tow box
      1. Tow box mounted to car
   3. Unmount accessory
      1. Remove mounted attachment
   4. When attempting to add, check first if there is any accessory there. If yes, prompt to remove first. Same thing when removing if nothing to remove inform the user
8. Simulate alternative fuel powered drivetrains
   1. Hybrid
      1. Petrol engine gets fuel from fuel tank (similar to the earlier one with the fuel tank etc)
      2. Battery supply power to the motor in the front also, if got enough power
      3. Motor + petrol engine drive the front wheels with the front drive shaft.
      4. All this is done when the car speed is increased.
      5. When doing nothing(constant speed), rotation of rear wheels will send power to the battery. Engine is off.
      6. When slowing down, braking will send power to the battery from wheels – when user reduces the speed (while the battery is not full, every 1kmh drop = 0.05% power stored);
   2. Hydrogen
      1. Hydrogen pumped from tank to fuel stack (in the middle of the car)
      2. Fuel stack produces electricity and sends electricity to motor on front wheel
      3. Motor will turn the front driveshaft so now the front wheels will move.
      4. Slow down like normal(no regenerative charging)
   3. Electric
      1. Similar like hydrogen, just that no fuel stack. Battery send electricity to the front motor and front motor will drive front wheels
      2. When cruising, rotation of rear wheels send power to the battery
      3. When user reduces the speed, braking will send power to the battery from wheels – when user reduces the speed (while battery is not full, every 1 kmh drop = 0.05% power stored)
9. Simulate different driving conditions at high altitude
   1. Similar to the #2, only have normal mode
   2. User increases altitude, more fuel is used.
   3. Altitude decrease, less fuel is used (provided speed is the same)
   4. User changes altitude the same way they change incline like in #2