Announcements and Administrative Stuff

- Project 9 is due Thursday Oct. 29\textsuperscript{st} by 10pm.

- Hand in ALL the files needed to run your tests.
Project 9

◆ Pick up where you left off on Project 8

◆ Finish designing fast speed drive and smart dispatcher
  • Statecharts
  • Unit tests
  • Implementation
  • Traceability
  • Peer reviews:
    – Dispatcher & DriveControl statechart
    – Dispatcher & DriveControl implementation
    – Revised unit tests
New Requirements

- R-T6: The Car shall only stop at Floors for which there are pending calls.
- R-T7: The Car shall only open Doors at Hallways for which there are pending calls.
- R-T8: The Car Lanterns shall be use in a way that does not confuse passengers.
  - R-T8.1: If any door is open at a hallway and there are any pending calls at any other floor(s), a Car Lantern shall turn on.
  - R-T8.2: If one of the car lanterns is lit, the direction indicated shall not change while the doors are open.
  - R-T8.3: If one of the car lanterns is lit, the car shall service any calls in that direction first.
- R-T9: The Drive shall be commanded to fast speed to the maximum degree practicable.
- R-T10: For each stop at a floor, at least one door reversal shall have occurred before the doors are commanded to nudge.
Fast Drive Speed

- Simulator assumes that car can instantly stop from slow speed

- Need to ramp down speed from fast in time to stop at desired floor
  - Cannot instantly stop from fast speed (engages emergency brake)

- **Commit Point:**
  The elevator position at which you must decide whether to stop at particular floor
  - Occurs when elevator reaches the stopping distance from that floor location
  - Think of it as a “point of no return”
Fast Speed Drive - Commit Point

- Stop speed $= 0.00 \text{ m/s}$
- Slow speed $= 0.25 \text{ m/s}$
- Fast speed $= 1.00 \text{ m/s}$
- Constant acceleration/deceleration $= 1.00 \text{ m/s}^2$

- Calculate the maximum stopping distance of the elevator
  - $x(t) = x_0 + v_0 t + \frac{1}{2} a t^2$
  - $v_f^2 - v_0^2 = 2 a \Delta x$

- Include slack for:
  - Sensor granularity (CarLevelPosition is in 10 cm increments)
  - Delay of DriveControl control loop
  - Delay for message to be sent periodically
  - Be conservative!!
    - Leveling behavior may save you, but better not to overshoot in a real elevator
Fast Speed Drive – Verification Example

- Commit point computation:
  - Ideal case: kinematics equations
  - Real-world: kinematics + delays

- Suggestion: use the monitoring infrastructure to verify commit point calculations

- What conditions would you check?

- What sensor inputs would you need?
Only Service Landings with Pending Calls

◆ Elevator must only stop at floors/hallways that need to be serviced

◆ DesiredFloor
  • Floor – the floor we intend to go to next
  • Direction – the direction we intend to go after we reach the desired Floor
  • Hallway – which doors should open
Only Service Landings with Pending Calls

◆ Update desired floor/direction based on current state of hall/car calls
  • When is it OK to update these?

◆ For example:
  • If the elevator is stopped and opening its doors
    AND there is no pending call at the current floor
    AND there is a pending call at another floor
    THEN:
      – DesiredFloor.Floor must NOT BE current floor by the time the doors are fully open
      – DesiredFloor.Direction must correspond to illuminated lantern direction

◆ What about between floors?

◆ When should you NOT update these values?

◆ Above example is not a hard requirement
◆ Follow the requirements and do what makes sense for your design
Example

- Suppose car is initially at floor 1 and stopped
  - No calls
  - Desired Floor = (1, stop)
Example

- Get a hall call for (8, down)
  - Car begins moving up
    - Current direction = Up
  - DesiredFloor.floor = 8
  - DesiredFloor.direction = Down
    - Where we’re going after servicing floor 8
Example

- Get a hall call for (8, down)
- Then receive a hall call for (5, up)
  - Dispatcher decides to service floor 5 first
    - Depends on your algorithm
  - Current direction remains Up
  - DesiredFloor.floor = 5
  - DesiredFloor.direction = Up
    - Where we’re going after we service floor 5

- How do you decide where to go next?
  - Based on current set of car/hall calls
  - Anything that meets the requirements is OK
    - Example: Sweeping up and down servicing calls in the current direction first
Questions?