Marshmallow Roasting Robot Design Review

Design Considerations

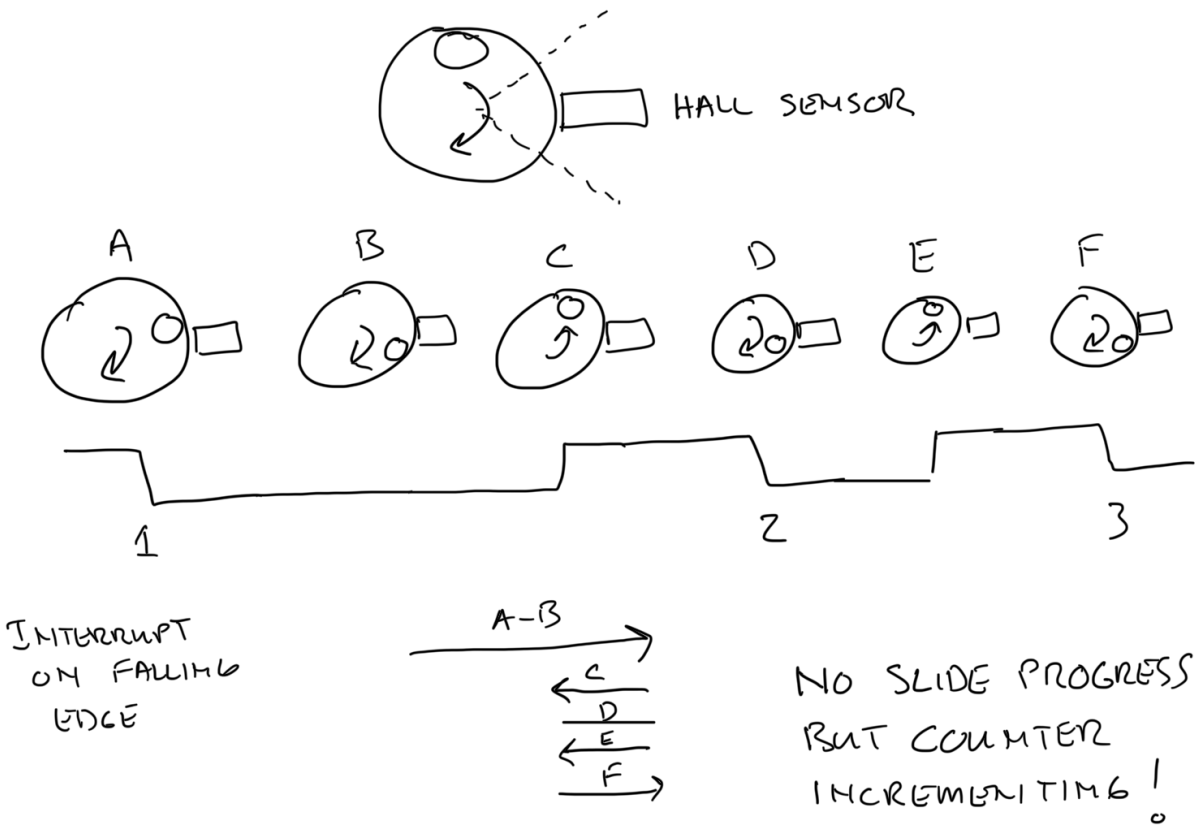
- Has to work over open flame! (Campfire ~200-400c)
- No limit switch could be used at the far end of the slide
- No 3d printed parts on the slide
- Needed high temp cable for slide (used wire)
- Needed heat shield around rotisserie motor
- Used high temp silicone wire 200c capable (might need teflon - 300c)
- Remove all petroleum grease from slides (using silicon grease - 200c)

Slide Control

- Transmitter commands asynchronous to robot controller
- Transmitter sends command packets when joysticks move position
- Slide cable drum has magnet that is sensed by hall-effect sensor
- What is the problem with this?

Slide Creep

- Slide “stop” command might be between hall-sense points!



Solution

- Synchronize transmitter command with hall-sensor
- Transmitter “stop” command just requests stop
- Controller moves slide to the next sensor tick then stops
- Controller homes the slide on boot-up and keeps sensor tick count to enforce max extension

Slide Elevation Control

- Very small lever arm due to short throw linear actuator and space constraints (20:1 reverse leverage)
- Actuator rated at 9lb (20N) force so only capable of lifting ~0.5lb of slide weight
- Used spring assist as counter force to unload linear actuator

Robot CG

- Had to add heavy items (battery) up front to keep from tipping
- Used long wheelbase chassis

Design Tradeoffs/Lessons

- Test the boundary conditions! Slide creep
- Slide elevation assist spring helps and hurts actuator depending on slide extension position
- Limited ports on Arduino nano - Had to cut some options (servo control on ESP32-CAM)
- Limited PWM channels. Had to forgo speed control on slides and elevation control
- Lesson: Read I/O specs carefully! Some Arduino ports don’t have full functionality (in/out/pull-up)
- Cheap drawer slides have some binding but didn’t want to “roast” nice ones…
- Binding causes some movement oscillation amplified by slide-cable springs