2019 FLYSET FTC Workshop

7172 - telescoping linear extension, elevator, omniwheel encoder

(8/24/2019)

Presented by 7172

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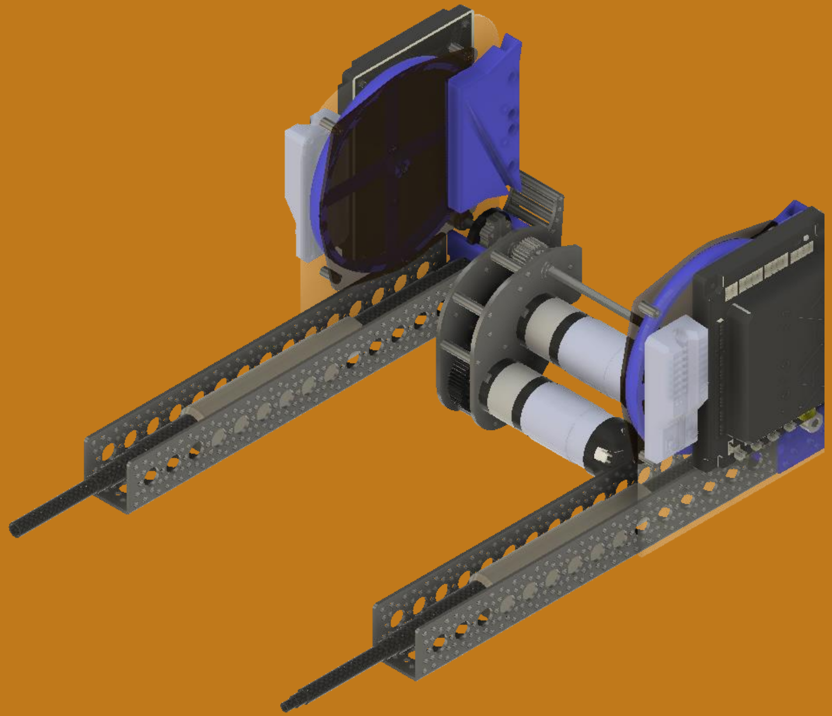
Telescoping extension



Goals for linear extensions

Length - sufficient reach to score points

Fast - extend fully in less than 1 second

Strong / reliable

Background

Used in Rover Ruckus season

Based on concept used by i2c Robotics in Res-Q season

Telescoping components

- Telescoping fishing pole
  - Carbon fiber - light and strong
  - Excellent reach
- Flexible rack gear (KHKGears.us)
- Driving gear
- 3D-printed gear guide
- Gear storage system

Challenges

- Fit inside of 18"
  - Tight bend required at insertion point
- Gear rack storage
  - Avoid kinking or breaking rack gears
- Motor synchronization when using two poles
  - Stinger: unsynchronized, sometimes binds
  - Chariot: 2 motors drive common axle

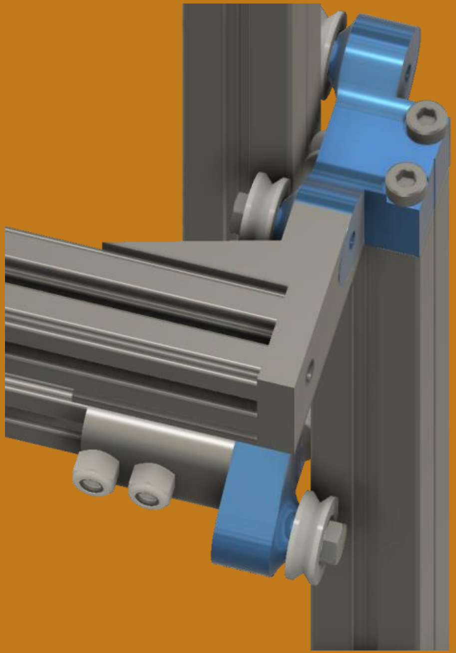
Video demonstration

https://youtu.be/fF23CUXN4XI

Results

- Length: Excellent
  - Extend 48+ inches
  - Limited primarily by length of rack gear (2M)
- Speed: Excellent
  - Unloaded - full extension in 0.5 seconds
  - Loaded - good extension in ~1 second
- Reliability: Fair
  - Pro: Cord / pulleys not needed, less entanglement
  - Con: Rack gears can break easily if not managed
  - Telescoping poles increase friction with use
- Cost: high ($35 per rack gear, $30 per pole)

Elevator Lift



Goals for elevator lift

- Strong / reliable
  - Able to lift robot weight if needed
  - Won't bind, kink, break, snap
- Length
  - Achieve at least 40 inches of extension
  - As far as possible with 2 stages
- Fast
  - Full extension in under 1 second
  - Ideally around 0.5 second

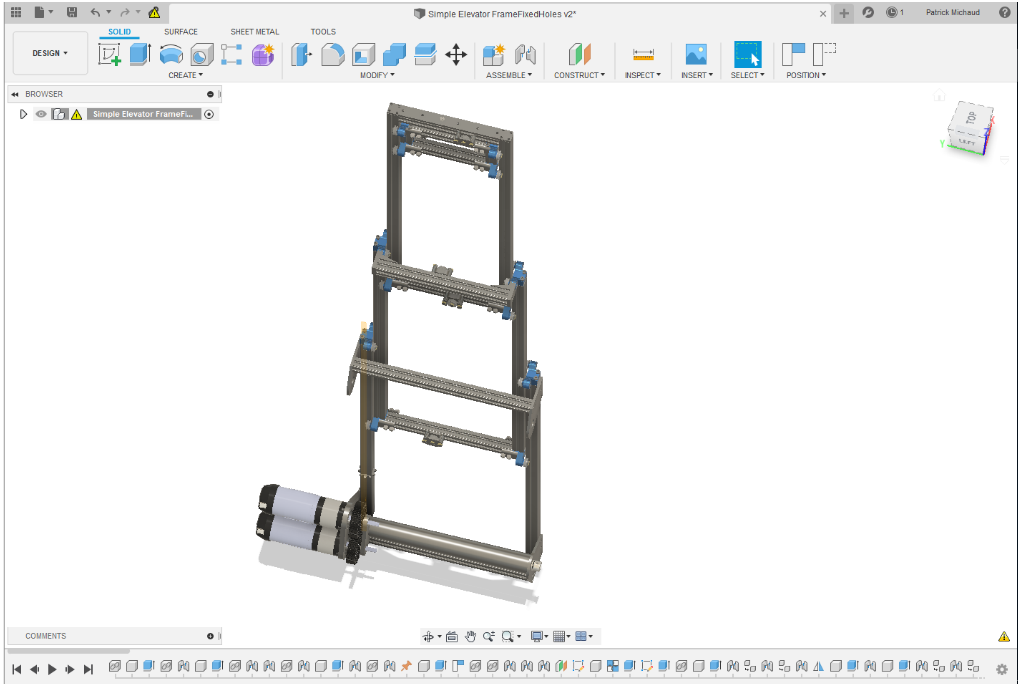
Background

Based on frame-based elevators used by top FRC teams

Telescoping components

- REV punch tubes and extrusion
- Pulley bearings
    - Lots of pulley bearings
- 3D printed parts
- Motors, gears, axles, etc.
- Spring assist
    - May not be FTC legal as purchased

CAD Model



Simple Elevator FrameFixedHoles v2*
Patrick Michaud
DESIGN
SOLID
SURFACE
SHEET METAL
TOOLS
CREATE
MODIFY
ASSEMBLE
CONSTRUCT
INSPECT
INSERT
SELECT
POSITION
BROWSER
Simple Elevator FrameFi...
COMMENTS

Video demonstration

https://youtu.be/5oV5_snbVPo

Results

- Length: Good
  - Extend 40+ inches, more with articulated arm
  - Limited primarily by 18" size constraint
- Speed: Excellent
  - Unloaded - full extension in 0.5 seconds
  - Loaded - good extension in ~1 second with 4 pound payload
  - Spring balancer makes a big difference
- Reliability: Good so far
  - Needs testing on field and on robot
- Cost: average

Encoder navigation

Goals for encoder navigation

- Enable robot to know its position on the field to within 1"
- Program autonomous modes using waypoints
- Repeatedly return to the same spot

Background

Based on encoder-based navigation

used by Gluten Free in Relic Recovery and Rover Ruckus seasons

Components for study

- VEX shaft encoders
  - Inexpensive, easy to wire to REV hubs
- VEX omniwheels
  - Easy to connect to VEX shaft encoders
- 7172 standard drive chassis
- 3D printed mounting components

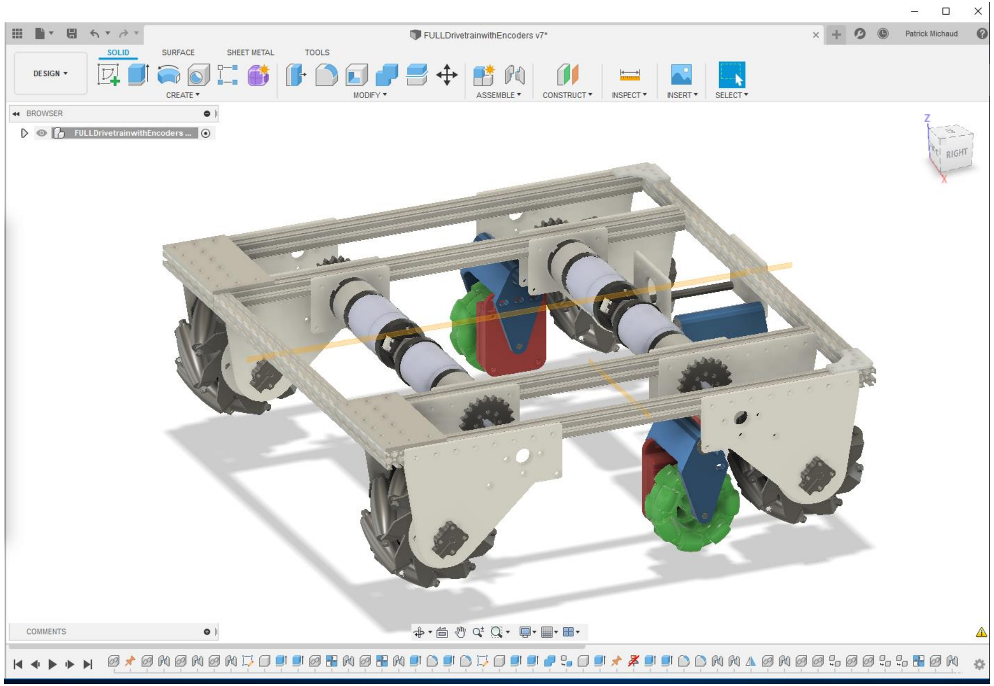
Key observations

- VEX encoders have varying levels of quality
  - Some reliably give 360 ticks/rotation
  - Others seem to "miss" ticks

- Omni wheels need to be tensioned to surface

- Three wheels needed to keep track of orientation and distance

CAD Model


FULLDrivetrainwithEncoders v7*
Patrick Michaud
SOLID
SURFACE
SHEET METAL
TOOLS
DESIGN
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FULLDrivetrainwithEncoders ...
RIGHT
COMMENTS

Video demonstration

https://youtu.be/Ozm6f5Uy-X8

Results

- Still early in development
- Implementation only does positioning in one orientation; rotation being worked on next
- Some VEX encoders are inconsistent
  - Still determining why
  - Will likely switch to other encoders
- Very reasonable results
  - Can generally navigate to within 2 inches of target point, even with flaky encoders

Questions?