

Lifting Stuff Up

Oct. 25, 2019

We know - it's hard.

Thank you to the University of Victoria for hosting the FTC Workshop series!



Types of lifts

- Scissor Lift
- Gear rack
- Continuous linear slides
- Cascading linear slides
- Drawer slides



Scissor Lift

- Easy to build, but need to make sure the two sides are even
- Easy to diagnose problems and fix
- Not always good for heavy loads
- Great for really tall lifts
- Used in industry a lot, so you know it's stable (if you build it to be)
- Must be smooth (screws can't be too tight), as gravity brings it down
- Takes up more space than linear slides

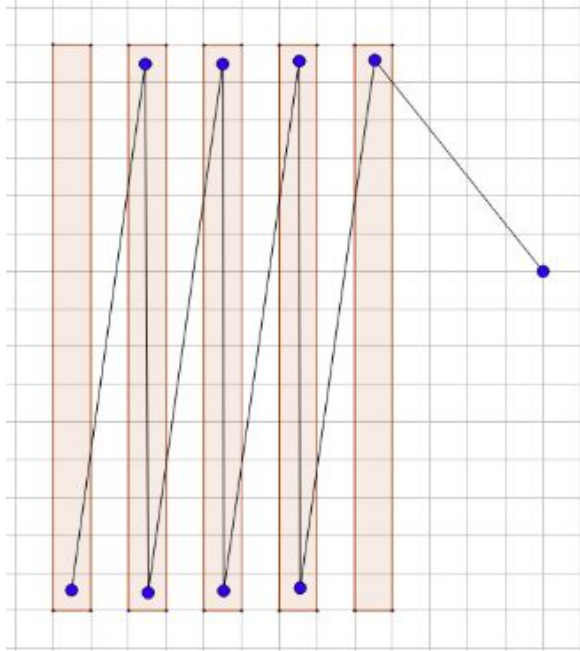


Gear Rack

- Lowered mechanically
- Easy to control
- Great for shorter lifts
- Not good for tall lifts, as you need a motor at every joint
- The load is directly on the motor, be mindful of weight.
- Easy to diagnose problems and fix
- Goes up uniformly
- Needs to be attached to a beam for stability
- Gear slippage

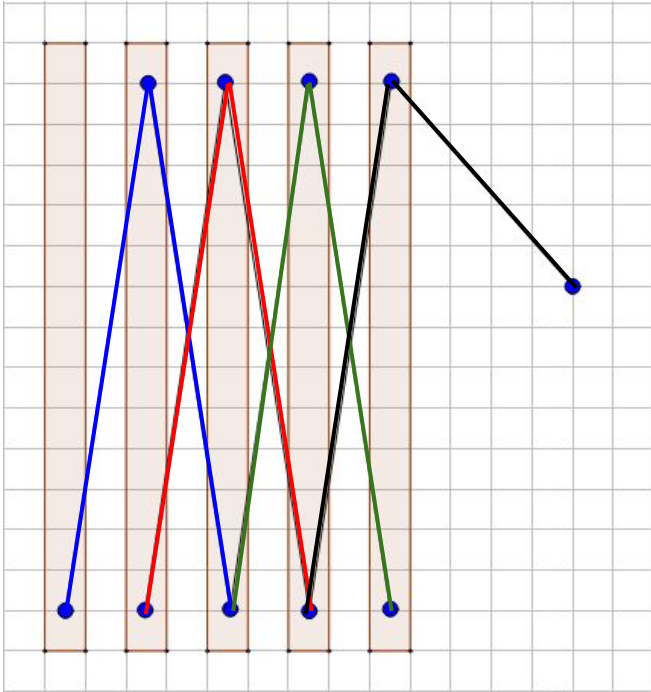


Continuous Linear Slides



- One continuous string is fed through all the pulleys
- Easiest way to lift linear slides - uses one motor and one string.
- Segments will raise one at a time
- Relies on gravity to lower
- Slower than Cascading configuration
- Should be stabilized with second set of slides as it tends to lean

Cascading Linear Slides



- Segments are connected with string in small overlapping sections.
- All segments are raised simultaneously.
- Fastest way to raise linear slides
- Requires more meticulous set-up, all string segments must be the exact same length.
- Relies on gravity to lower.
- Should be stabilized with second set of slides, as it tends to lean

Drawer Slides

- Pre-made assemblies, reduces some of the work
- Require some sort of channel or beam to attach to
- Need to motorize, but requires few motors
- You've already got plenty around the house...
- Very smooth
- Can be bought in various types of materials



A handy chart for comparison

	Scissor Lift	Gear Rack	Continuous Linear Slides	Cascading Linear Slides	Drawer Slides
Speed	Depends on Motor	Slow	Depends on height	Fast	Fast
Hight	As tall as you want	Only good for small lifts	As tall as you want	As tall as you want	Depends on the type of slides purchased
Difficulty to build	Easy	Easy	Medium/Hard	Medium/hard	Medium
Maintenance	Medium	Medium	High	High	Medium
Motors	1-2	One on every joint	1-2	1-2	1-2
Size (in robot)	Requires a wide base to be stable	Can become bulky depending on number of motors	Very compact	Very compact	Very compact, space needed depends on the type of channel used
Stability	Stable	Very stable	Flexes higher up	Flexes higher up	Stable but can flex higher up

Notes for all types of lifts

- Check your bearing sizes
- Find string that doesn't stretch (or pre-stretch it)
- Think about where your wiring will go!
- Watch the strain you put on your motors
- Make sure it's stable!
- Beware of pieces loosening with use.
- If the lift uses two motors, wire them together.
- Be prepared for lots of maintenance!
- **Define criteria for your lift before you build it, please**

Next Week - Engineering Process and Notebooks

Nov 1 at 4:30 - 6:00pm

Engineering Design Process

Engineering Notebooks

Q&A about robots (bring your robot!)