

Forklift Accessory

Start lifting and moving with this forklift attachment for Root! With this 3D printed accessory, leverage the marker actuator to lift and shift lightweight items with Root!



Purpose and Application

Root can push things around with the 3D printed "bulldozer" but now it can pick things up and carry them around, too! Root's marker actuator only moves up and down 10mm, so it doesn't pick things up very far, just enough to hold them up off the table.

Getting Started

The Root Forklift can be 3D printed with an affordable FDM/FFF extrusion 3D printer, using whatever color(s) of filament you'd like. There are 6 parts: the "marker peg" is made up of 2 parts that need to be super-glued together after printing both.

A raft is recommended while printing each part, unless you know that your build plate is particularly good at keeping parts stuck to it during printing.

Subject(s):

- 3D Modeling
- Mechanical Engineering

Experience Level:

Intermediate

Print Time:

8-10 hours

Supplies:

- 3D printer with a 175 x 75mm build area (7" x 3") or larger
- 1 or 2 spools of different color filament
- Craft glue or superglue
- Tape OR magnets (5mm diameter by 2.5mm thick) ([Suggested magnets](#))
- [iRobot Coding platform](#)

Disclaimer:

3D printed items are not toys and should be kept away from small children, due to the danger of cracking or breakage of thin parts and the resulting sharp edges.

Root's bumpers are mostly blocked while using the forklift, but you should still be able to activate the touch sensors on top.

The forklift attachment is designed to lift lightweight items like pens or popsicle sticks.

The largest part, the "fork," is about 7" long and should take about 4 ½ hours to print. It needs supports under the entire area of the model. (Be careful removing the supports after printing since most of the fork is thin.)

The "top plate" should print in about 90 minutes. It may need supports under the two short pegs at the front that the "lever" part snaps onto. A couple of rows of supports under part of the hollow main body may also be helpful if your printer doesn't do a great job of "bridging" over open air.

The "lever" should take about 30 minutes, and can be printed on its side, with supports underneath and also between the "rungs" that connect the two sides. Pliers may make removing the supports easier after printing.

"Marker peg top" and "marker peg bottom" may be printed together, next to each other. These should take about an hour to print without any supports needed. As mentioned above, they should be super-glued together after printing to make a single finished part.

The recommended settings for PLA material are:

- 0.4mm to 0.6mm extruder
- 0.25mm layer height
- 10% infill
- 2 shells (two-layer-thick outer walls)
- 3 top & bottom layers (three-layer-thick floors & ceilings)
- 215°C extruder temperature
- 60°C platform temperature
- 50mm/sec printing speed, 25mm/sec outer shell
- Rafts extending 4mm around the part (for parts that require a raft)

Assembly

After printing each part, peel off all rafts & supports, and scrape off any extra bits of filament. Glue the marker peg top & bottom together and let them dry.

Now it's time to put everything together.

- 1) After gluing the "marker peg" top & bottom together, insert the "marker peg" into Root's marker holder. It should be oriented so the holes that the "lever" will attach to are at the sides.

- 2) To attach the "top plate" to Root, you can tape it down across the top of the robot from side to side, or you can press-fit or glue in four small magnets (5mm diameter by 2.5mm thick) underneath the top plate. If you use magnets, let them snap in place on the top of the robot first, to be sure that their north poles are all facing up away from the top of the robot.
- 3) Bend the long arms of the "lever" outward and snap them into the holes on top of the "marker peg." Bend the middle of the lever just enough to squeeze it between the posts at the front of the top plate, so that the posts fit through the lever's two middle holes.
- 4) Bend the short front arms of the "lever" inward enough to fit them through the holes on the "fork." Insert the pegs on the "fork's" long arms into the holes at the back of the "top plate."

Once everything is connected on top of Root, **make a program like this one** to lower Root's marker when you tap the bumper to tell it to stop and pick something up.



Have fun coding Root to pick up lightweight items! What will you pick up first?