KLAW-4040

INSTRUCTIONS FOR FABRICATION

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POLIFACTORY
POLITECNICO MILANO 1863

Distributed Design

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1. Basic info

Klaw-4040 is an open-source modular transport system that responds to the downsizing of the distance concept due to the health emergency caused by CoVid-19. One of the main consequences of the pandemic is the rediscovery of the neighborhood, a space in which citizens are experiencing new habits and dynamics, thus moving towards the use of an agile, light and flexible means of transport capable of transporting products to meet the needs of both individuals and professionals.

BILL OF MATERIALS

The tables below contain all the materials necessary for the reproduction of the product.

BUY

Name	Link and technical specs	Qty	Price
Structural profile ARTS045A quarry 8mm L.350mm	https://www.algoalluminio.it/contents/download_riservato/it/listino_prezzi.pdf (p. 50)	3	€ 21,00
Structural profile ARTS045A quarry 8mm L.840mm	https://www.algoalluminio.it/contents/download_riservato/it/listino_prezzi.pdf (p. 50)	1	€ 16,40
Triangle ART A0090-000	https://www.algoalluminio.it/contents/download_riservato/it/listino_prezzi.pdf (p. 54 - make sure they are supplied with its screws, washers and nuts)	2	€ 28,00
Cap ART A0051-000	https://www.algoalluminio.it/contents/download_riservato/it/listino_prezzi.pdf (p. 56)	4	€ 6,00
Nut M8 harmonic spring ART V0008-000	https://www.algoalluminio.it/contents/download_riservato/it/listino_prezzi.pdf (p. 57)	6	€ 7,20
Rotatable joint ART A0070-000	https://www.algoalluminio.it/contents/download_riservato/it/listino_prezzi.pdf	2	€ 80,00

	(p. 55 - make sure they are supplied with its screws and nuts)		
Rear wheel Ø 260cm	https://www.leroymerlin.it/catalogo/ruota-antiforatura-in-poliuretano--260-cm-35472920-p	2	€ 31,80
Front Wheel Rotatable with brake Ø 50 cm	https://www.leroymerlin.it/catalogo/rotella-per-mobili-slip2-rotelle-perfette-per-mobili-di-casa-camere-camerette-e-per-cassettiere-di-mobili-di-ufficio.-emuca-in-caucciu-grigio--50-cm-con-freno-4-pezzirotella-per-mobili-emuca-in-caucciu-grigio--50-cm-con-freno-4-pezzi-82441351-p	1	€ 16,99
Bmx handlebar 22.2mm L. 620mm	https://www.decathlon.it/manubrio-bmx-222-620mm-id_8521826.html?LGWCODE=8521826;60585;3601&gclid=CjwKCAjw19z6BRAYEiwAmo64LR3b_DNB2D-gG8EM-GzCBrB344UJL8OxE5FydVnFNPeHXQdDxfFdkxoCBCkQAvD_BwE	1	€ 13,99
Grips City 100	https://www.decathlon.it/manopole-city-100-id_8386790.html	2	€ 8,99
Washer M8		4	
Screw M8x20	socked head screw	8	

Nut M8		2	
Screw M3x15	socked head screw	4	
Nut M3		4	
Screw M8x100	https://www.leroymerlin.it/catalogo/vite-passo-metrico-testa-bombata-l-100-x--m8-mm-34141492-p	2	
Locking pin 8x54	https://www.amazon.it/gp/product/B07D6QS2J2/ref=ox_sc_act_title_1?smid=A1VTAZOJCHR0NC&psc=1	2	€ 10,36
Cotter 8mm	https://www.bricoman.it/it/coppiglia-clips-diam-8mm-10020536/	2	€ 0,80
Carabiner		2 (or more)	
Elastic Rope (max 12 mm Ø)	https://www.amazon.it/dp/B08FBG92CF/ref=cm_sw_em_r_mt_dp_FqRHFb2MB0T4X	1	€ 15,99

The estimated cost of standard components is € 275.

MAKE

Name	Material and Technology	Qty
Rear Wheel Hub	PLA 3D printing	2
Front Wheel Adaptor	PLA 3D printing	1
Handle Clamp 01	PLA 3D printing	1
Handle Clamp 02	PLA 3D printing	1
Hook Element	PLA 3D printing	2 (or more)
Plywood Plate	Laser cut of 5mm plywood	1
Plywood Spar	Laser cut of 5mm plywood	2
Plywood Rib	Laser cut of 5mm plywood	8
Plexiglass Plate	Laser cut of 3mm plexiglass	1

TECHNOLOGY AND TOOLS USED

- Drill to make the connection holes.
- Wasp 2040 (FDM printer) to print all the other components.
- Screwdriver and allen keys.
- Trotec Speedy 400 (laser cutter).

SECURITY TOOLS AND DEVICES

Safety goggles and gloves are suggested for drilling, in addition, also gloves and face mask when laser-cutting the plywood.

2. Step-by-step materialization

DESIGN LOGICS AND ERGONOMICS PRINCIPLES

KLAW-4040, thanks to a democratic approach to remote production, is open-source and self-manufactured: anyone can have a list of the components needed to make it, with references as to where to find them or by whom to have them made. The individual configuration possibilities are almost infinite: the user becomes an integral part of the project, collaborating in the improvement and implementation of the product.

Step 01 - Getting everything ready

First of all, you need to buy all the components and fabricate tailor-made pieces, and also modify a couple you already have.

- Download **Rear_Wheel_Hub.stl** and print 2 of them
- Download **Front_Wheel_Adaptor.stl** and print 1 unit
- Download **Handle_Clamp_01.stl** and **Handle_Clamp_02.stl** and print 1 of each of them
- Download **Hook_Element.stl** and print 2 of them, ore more if you need to hang many things
- Download **Laser_Cut_Plywood_Plate_5mm.ai** and laser-cut the piece
- Download **Laser_Cut_Plexiglass_Plate_3mm.ai** and laser-cut the piece
- Download **Laser_Cut_Plywood_Spar_5mm.ai** and laser-cut the 2 pieces
- Download **Laser_Cut_Plywood_Rib_5mm.ai** and laser-cut the 8 pieces
- Download **45X45_Joint_Reference.pdf** file to guide you through the process of drilling 8mm holes through the A70 pivoting joints, follow the reference and don't freestyle it.

Step 02 - Assembling the Frame

Our most sincere congratulations for getting through the first step, it's now time to get the Frame together.

- Pre-load screws into the 2 A70 Joints (they are included with joints)
- Screw them into the two shorter Profiles
- Slide them one by one in the same cavity of the longer one and tighten the bolts, then proceed to insert the two M8 pins inside the holes previously made to lock joint rotation (90° angle)
- Pre-load 4 M8 nuts inside the structural Profiles, two for the long one and two for the rear short one. Insert 4 M8 screws (and washers) into the 2 A90 supports
- Slide the A90s into the opposing cavities of the long Profile and tighten them just enough so they don't fall, you will tighten them fully in a later step.
- Measure and mark the remaining short Profile right in the middle with a piece of tape
- Proceed to slide the cavity around it the protruding screws of the A90s and tighten them fully, try and keep it aligned with the vertical Profile by using the tape you applied.

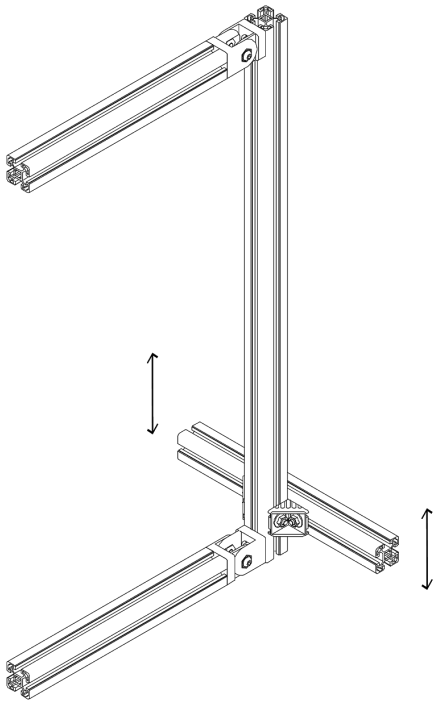

Fig. 1. Assembling of the frame.

Step 03 - Let's roll

So far so good pal, now we mount the wheels.

- Pre-load 4 M3 15mm screws in the front wheel plate and lock it onto the adaptor you 3D printed earlier (4 M3 nuts)
- Slide the front wheel group into the low cavity of the short Profile
- Find something like a shoebox and stick it under the Frame to level it out once it's upright
- Pre-load the bigger Wheels with both their 3D printed hubs and their 2 M8 100mm screws
- Tighten them to the opposing edges of the perpendicular horizontal Profile
- Finally, fully tighten the A90s to the vertical Profile according to the varying heights of all the Wheels.

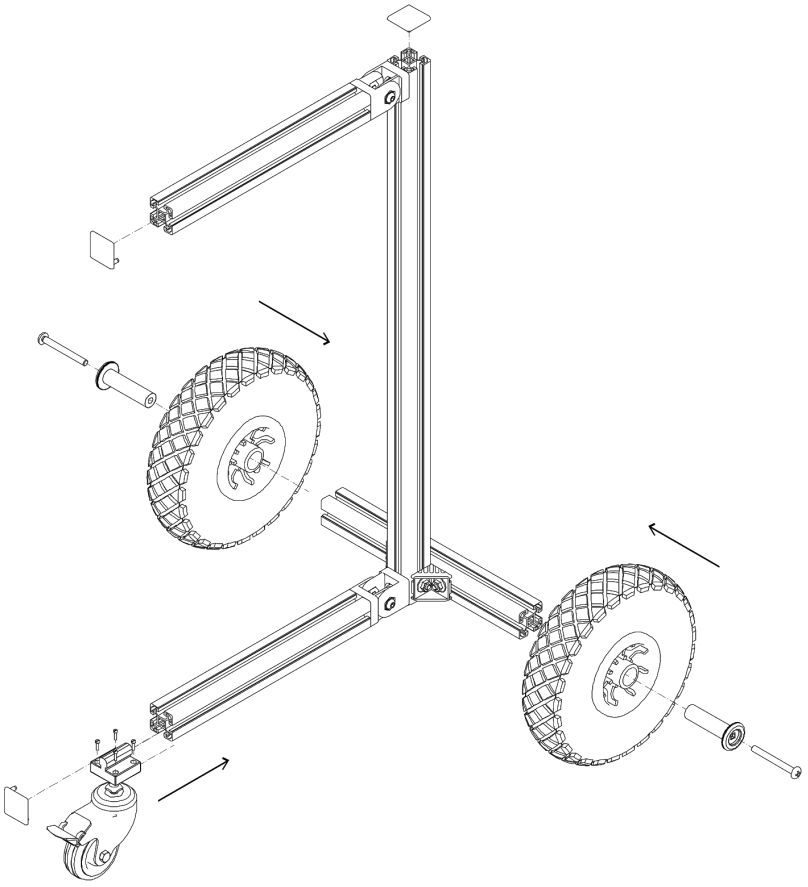

Fig. 2. Assembling the wheels to the frame.

Step 04 - Assembling the Plate (follow the instructions on the pieces)

Hope you like splinters.

- Bring the laser cut plexiglass plate
- Clean all the laser-cut wood pieces. Sanding and waxing would greatly improve how they look, just be careful not to blunt the connecting edges.
- Glue together two by two the ribs (as shown by the instruction on the pieces)
- Joint the ribs to the spar
- Joint the plywood plate with the ribs
- Fix the wood assembly to the frame with the M8 screws, washers and nuts

- Finally, joint the laser cut plexiglass plate over the plywood plate

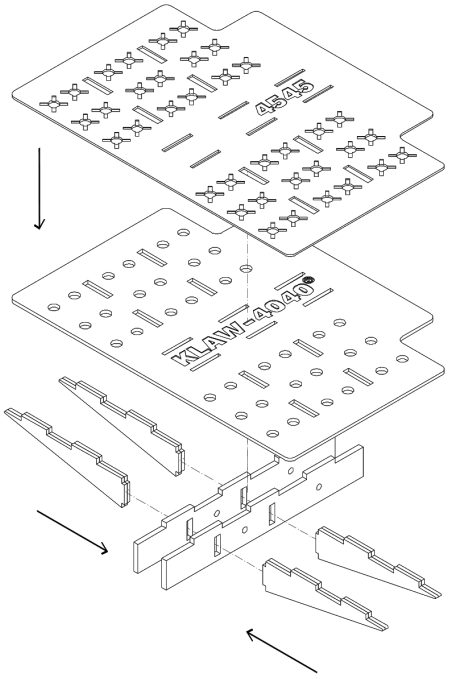

Fig. 3. Assembling the plate..

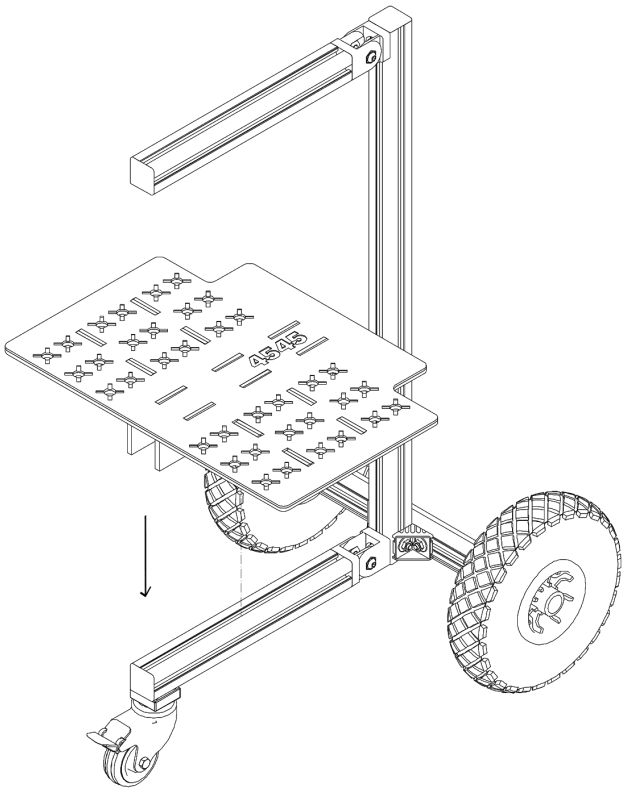

Fig. 4. Assembling the plate to the frame.

Step 05 - Assembling the handlebar

You are almost there, you practically did it, but a few pieces are missing.

- Fix with the M8 screws and the nuts, the 3d printed handle clamp 01 to the vertical structural profile (fix it based on your height)
- Put the handlebar into the handle's clamp cavity
- Use the handle clamp 02 to close together the handlebar with the Handle clamp 01
- To fix them, use the M8 screws and the nuts
- Insert the grips at the ends of the handlebar

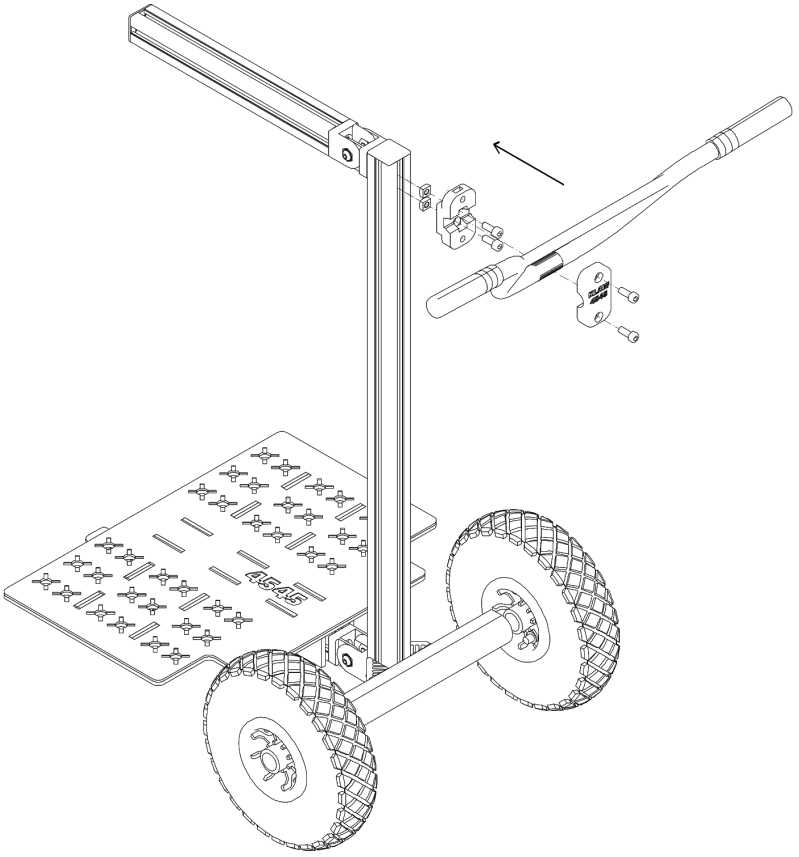

Fig. 5. Assembling the handlebar to the frame.

Step 06 - Customize it

You are very close now, one last effort.

- Slide the 3d printed hook elements into the cavities
- Fix the carabiners to the hook elements
- Customize your Klaw-4040 using the rope and the hook element to fix objects to the frame.

3. Credits

KLAW-4040 is a project publicly released and made available in open source mode according to the **Creative Common License (CC-BY)** and promoted by Distributed Design with the related documentation.

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* POLIFACTORY and DD logos have to be inserted (a .svg file with the two logos is included in the .zip folder named KLAW4040_digitalfiles.zip)

4. Downloadable Files

KLAW-4040 files can be download at:

***www.polifactory.polimi.it/en/polifactory/delice

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