

LMECA2840

Technical

Presentation II

Group A5

Brevi Matteo
Creelle Robbe
Diriken Axel

Ibrahim Muhammad
Marchal Youri
Peres Hugo

Philipin Aurélien

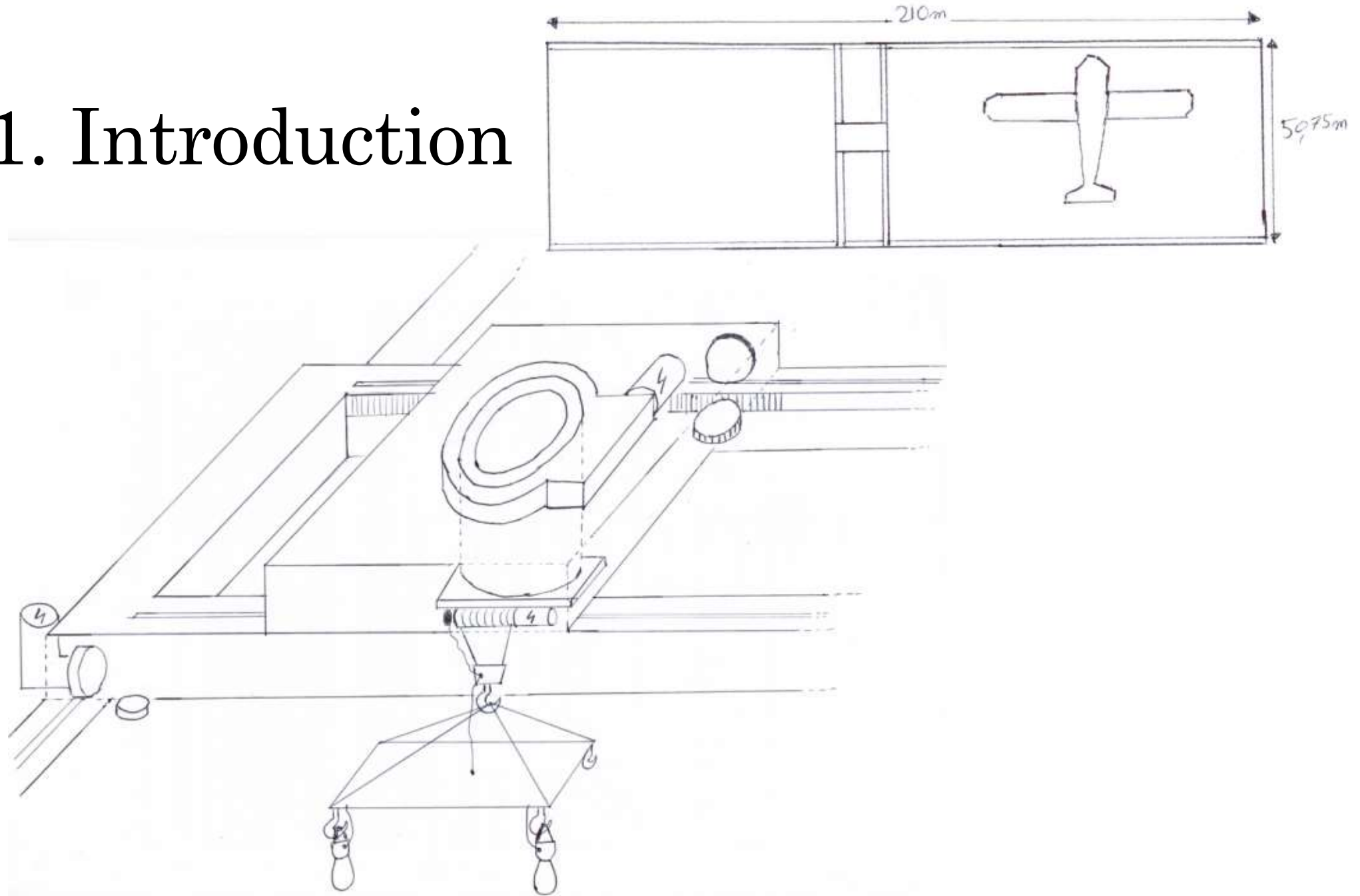
Summary

1. Introduction
2. Functional graph
3. Morphological Matrix
4. Concept Variants
5. Evaluation Chart
6. Preliminary Layout
7. Discussion

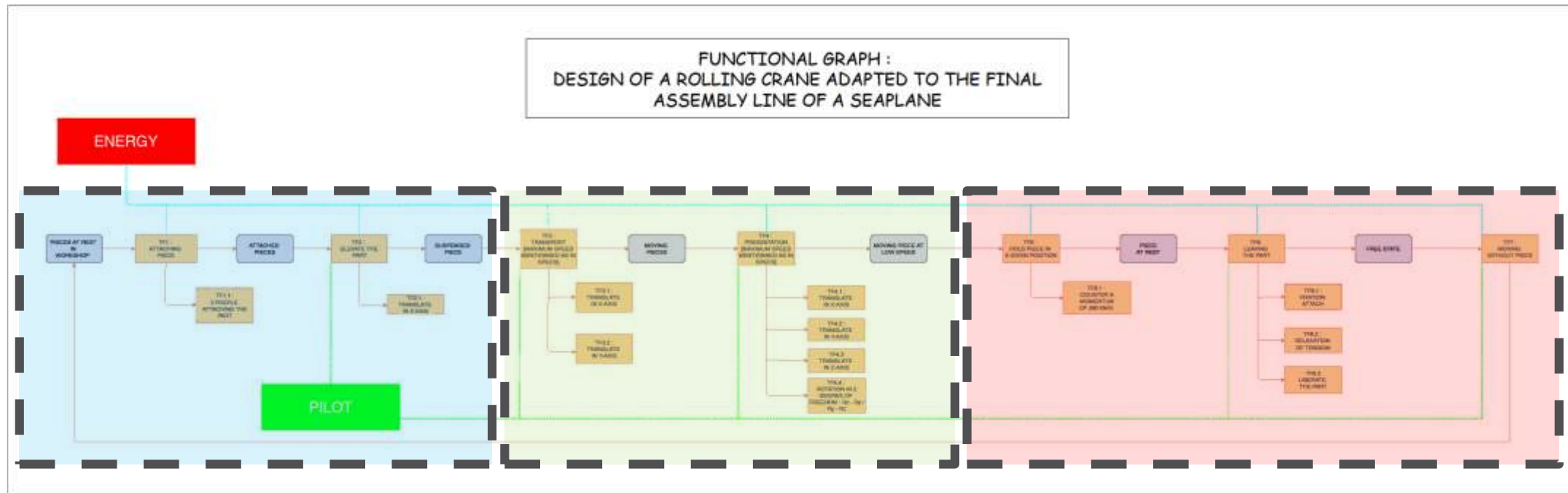
1. Introduction



1. Introduction



2. Functional graph

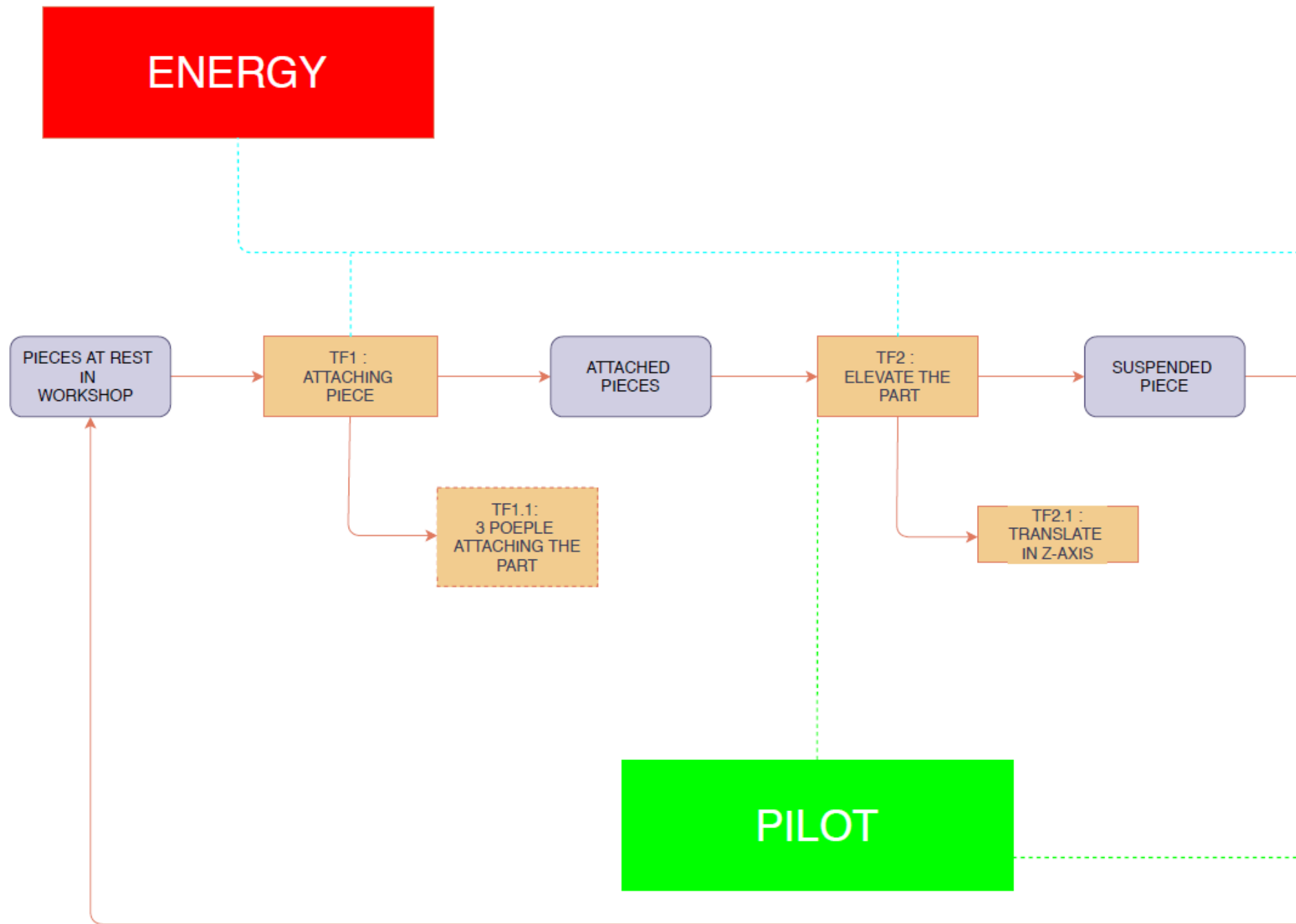


1

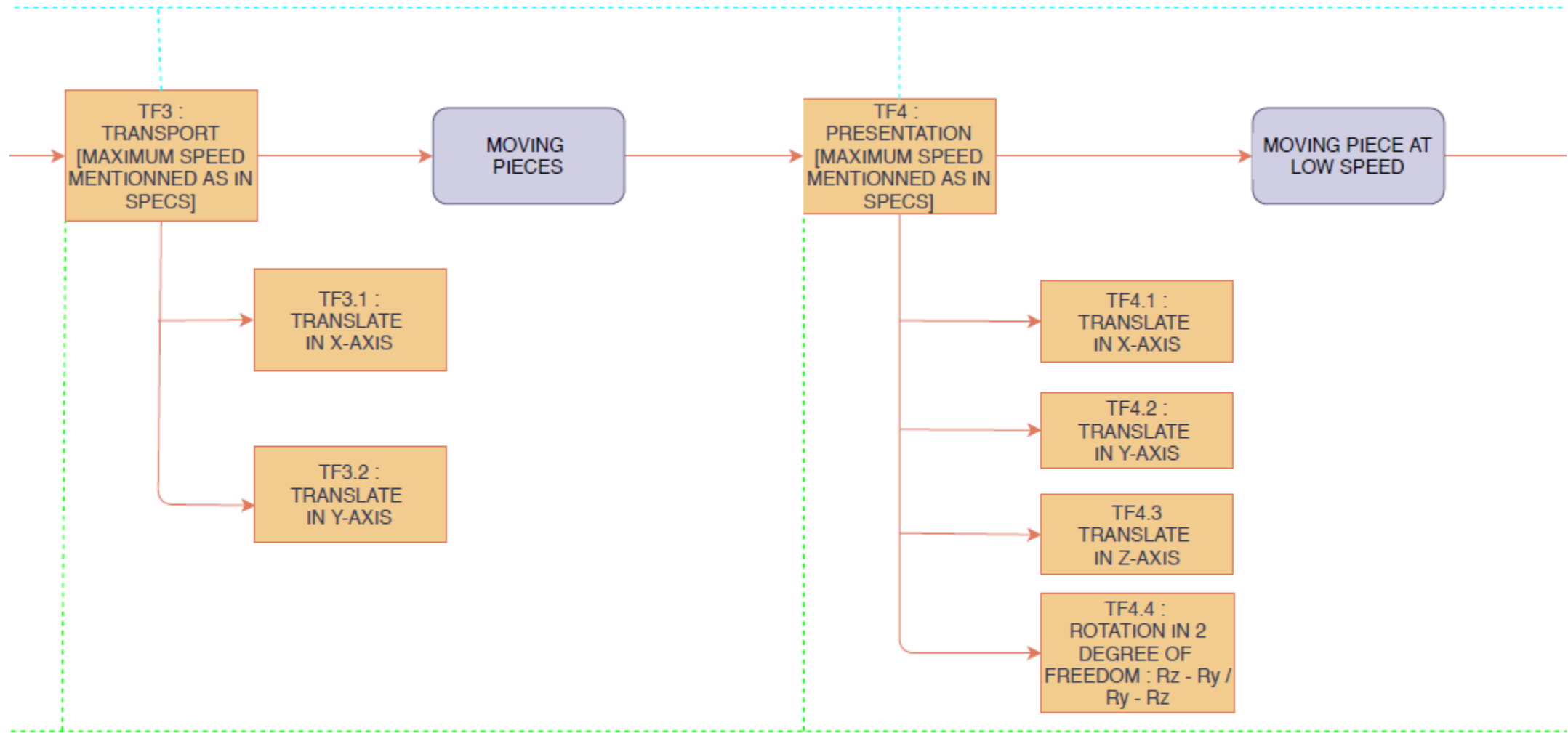
2

3

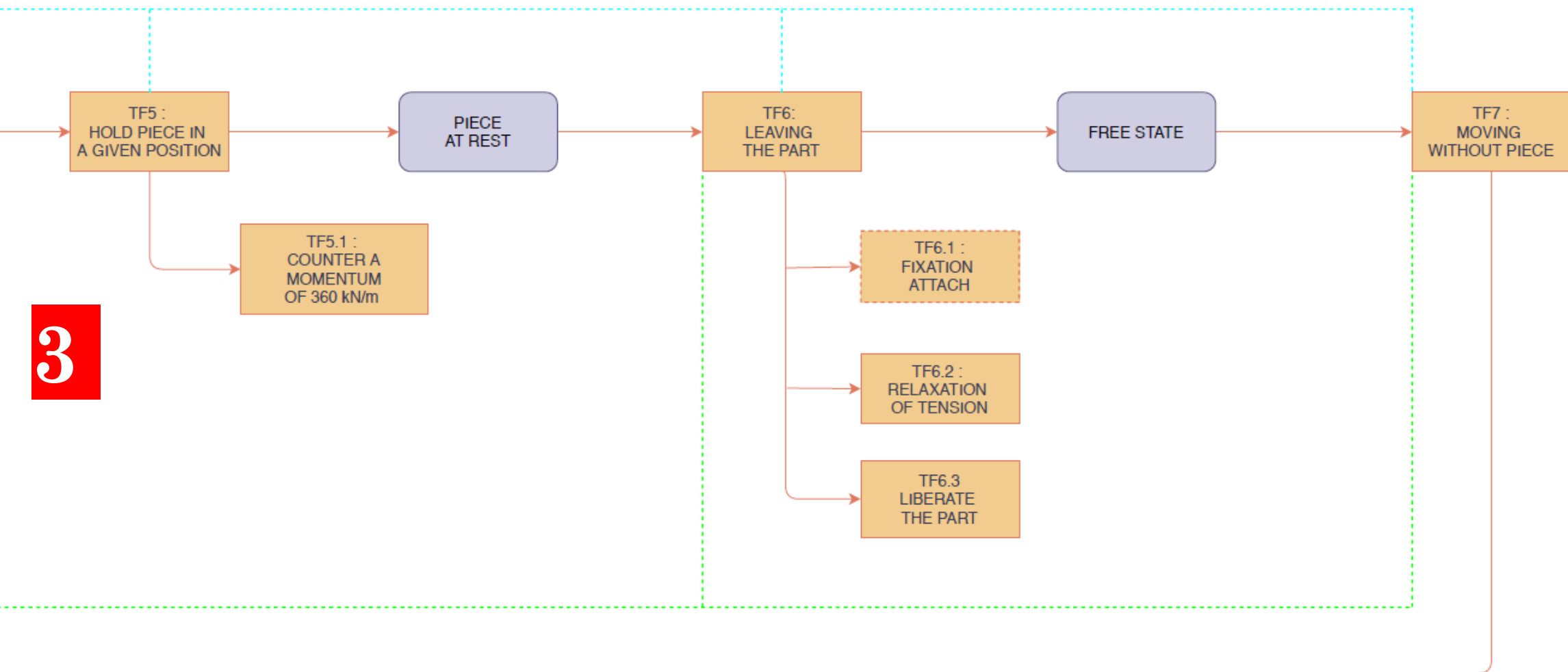
1





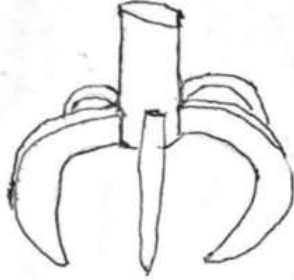



2



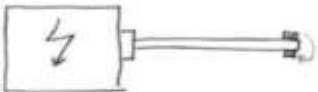
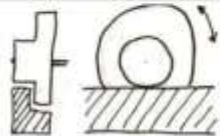
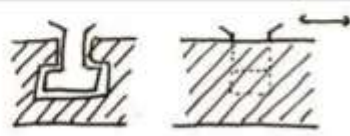
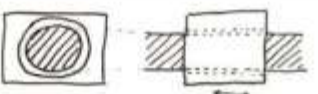





3



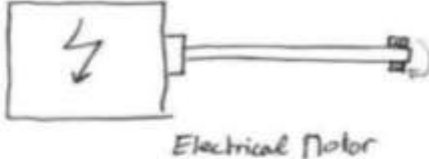
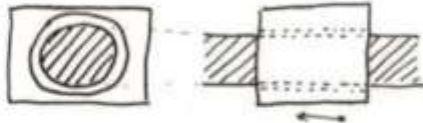
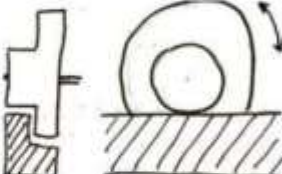
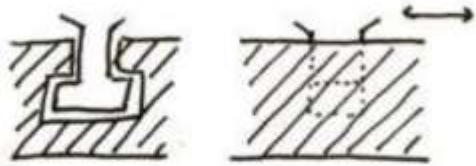
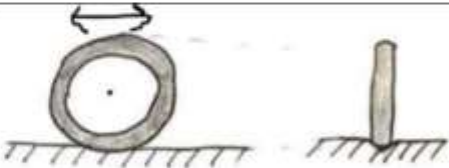
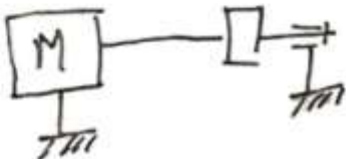

3. Morphological Matrix

TF1 : Attach			
Principle	 <p>A hand-drawn diagram showing a small hook-like shape with a curved end, positioned above a rectangular block. The word "HOOK" is written to the right of the block.</p>	 <p>A hand-drawn diagram of a bolt, showing a cylindrical threaded body and a hexagonal head with a cross symbol on its face.</p>	 <p>A hand-drawn diagram of a fastener with a central vertical shaft and four curved, prong-like arms extending outwards from the base.</p>
	 <p>A hand-drawn diagram showing a hook-like shape passing through a material represented by diagonal hatching lines.</p>	 <p>A hand-drawn diagram showing two stages of a fastener being inserted into a hole. The first stage shows the fastener just entering the hole, and the second stage shows it fully inserted with some motion lines indicating the action.</p>	 <p>A hand-drawn diagram of a curved fastener with two small rectangular attachment points at its ends, each labeled with the letter "N".</p>

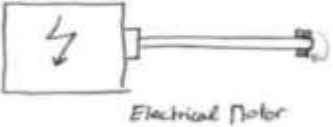
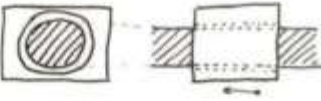
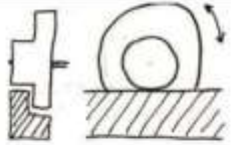
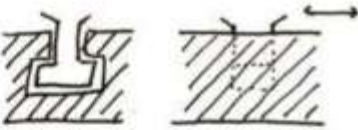

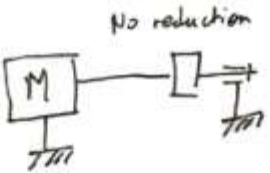
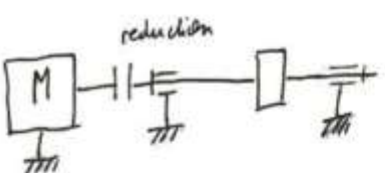
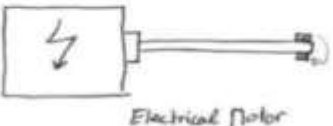
3. Morphological Matrix

TF2 : Lift up/down			
Actuation	 <p>Electrical Motor</p>	Hydraulics	Pneumatics
Guidance	No guidance		
			
Transmission			
			


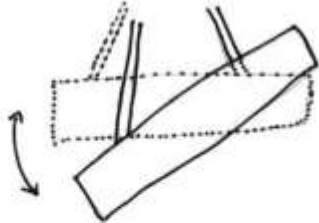

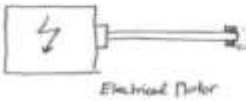

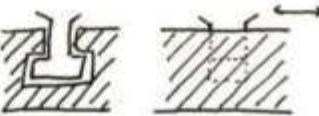
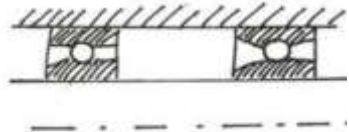




3. Morphological Matrix

TF3 : Horizontal movement			
Actuation	 <p>Electrical Motor</p>	Hydraulics	Pneumatics
Guidance			
			
Transmission	<p>No reduction</p> 	<p>reduction</p> 	

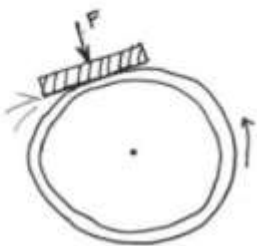
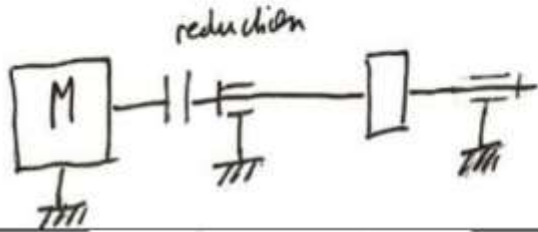
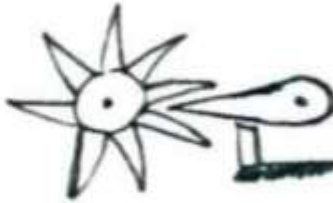
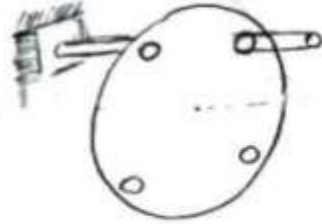
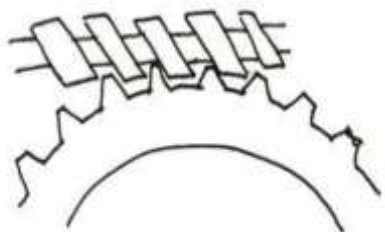
3. Morphological Matrix

TF4 : Presentation			
Actuation Translation (x-y)	 <i>Electrical Motor</i>	Hydraulics	Pneumatics
Guidance Translation (x-y)			
		No guidance	
Transmis- sion Translatio n (x-y)	 <i>No reduction</i>	 <i>reduction</i>	
Actuation Rotation (y)	 <i>Electrical Motor</i>	Hydraulics	Pneumatics


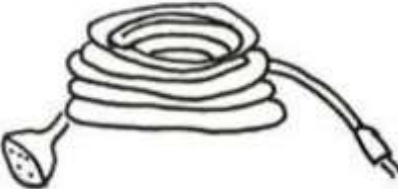



3. Morphological Matrix

Principle rotation (y)			
Actuation Rotation (z)	 Electrical Motor	Hydraulics	Pneumatics
Guidance Rotation (z)			
	No guidance		
Transmission Rotation (z)			

3. Morphological Matrix

TF5 : Blocking system			
Active		 <p>reduction</p>	
Passive			

3. Morphological Matrix

TF6 : pilot			
Connection type	Wireless 	Wire 	
Hardware	Remote 	Laptop 	Panel control 

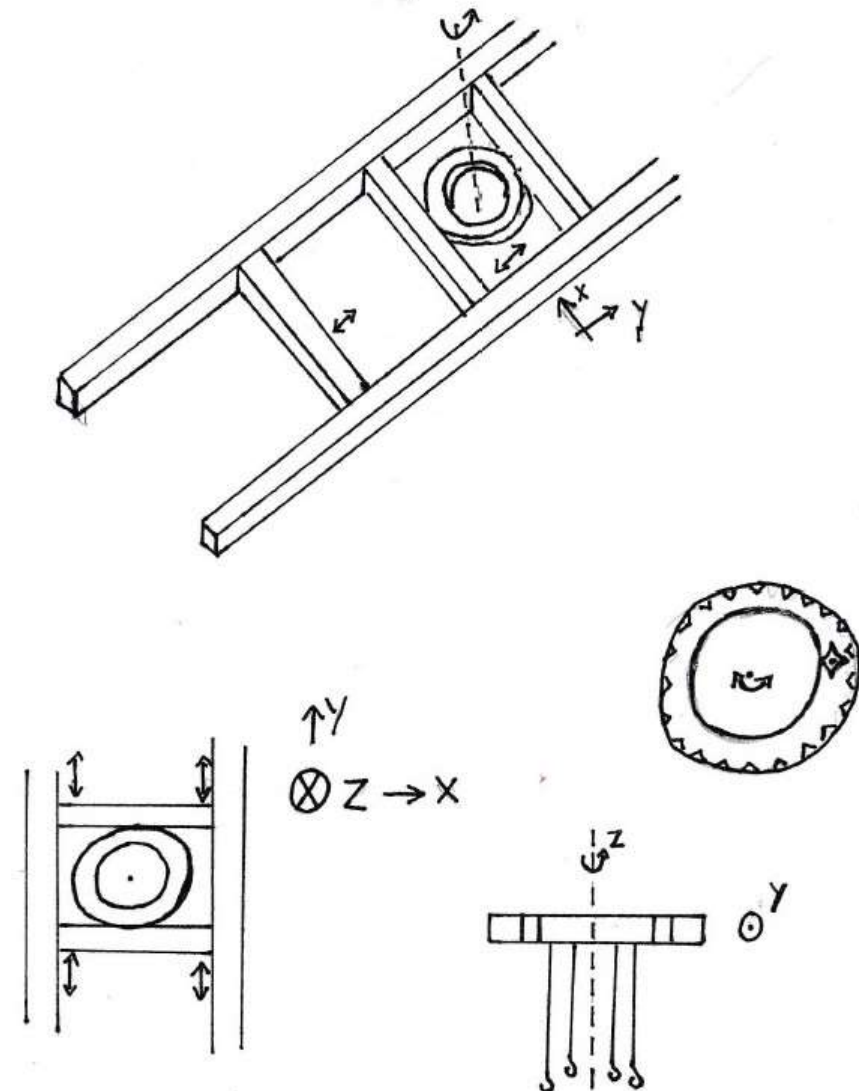
4. Concept variants

- Concept variant 1: Lift up + Attach + Presentation
- Concept variant 2: X-Translation + Y-Translation
- Concept variant 3: Pilot

Concept variant 1

Solution 1 :

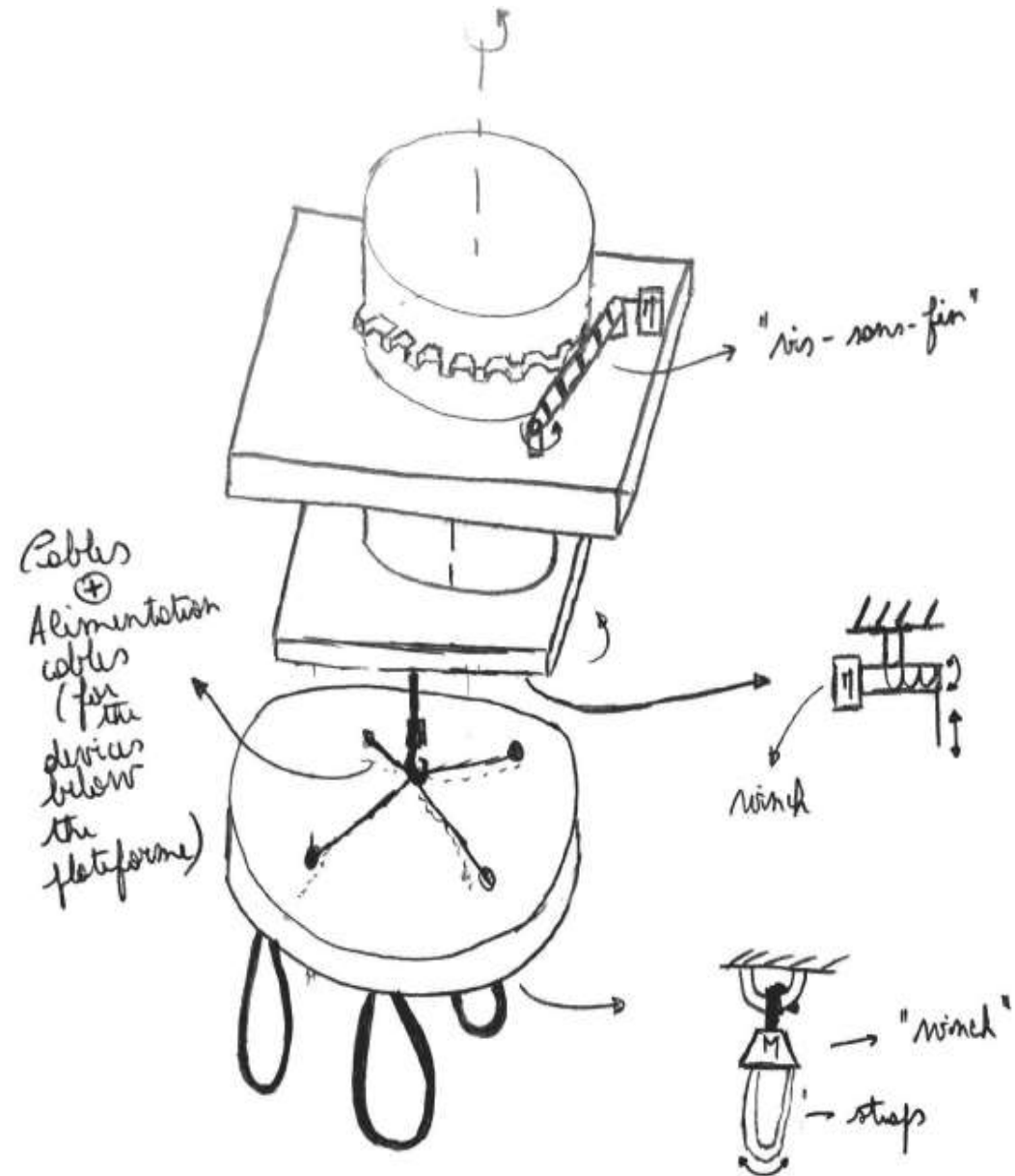
- Z-axis rotation :
Slewing ring with external teeth (couronne d'orientation)
Rollers with electrical motor
- Lifting up :
Winch/drum (treuil)
4 cables
Additional 2 cables trolley for more versatility
- X/Y- rotation :
4 cables moving independently



Concept variant 1

Solution 2 :

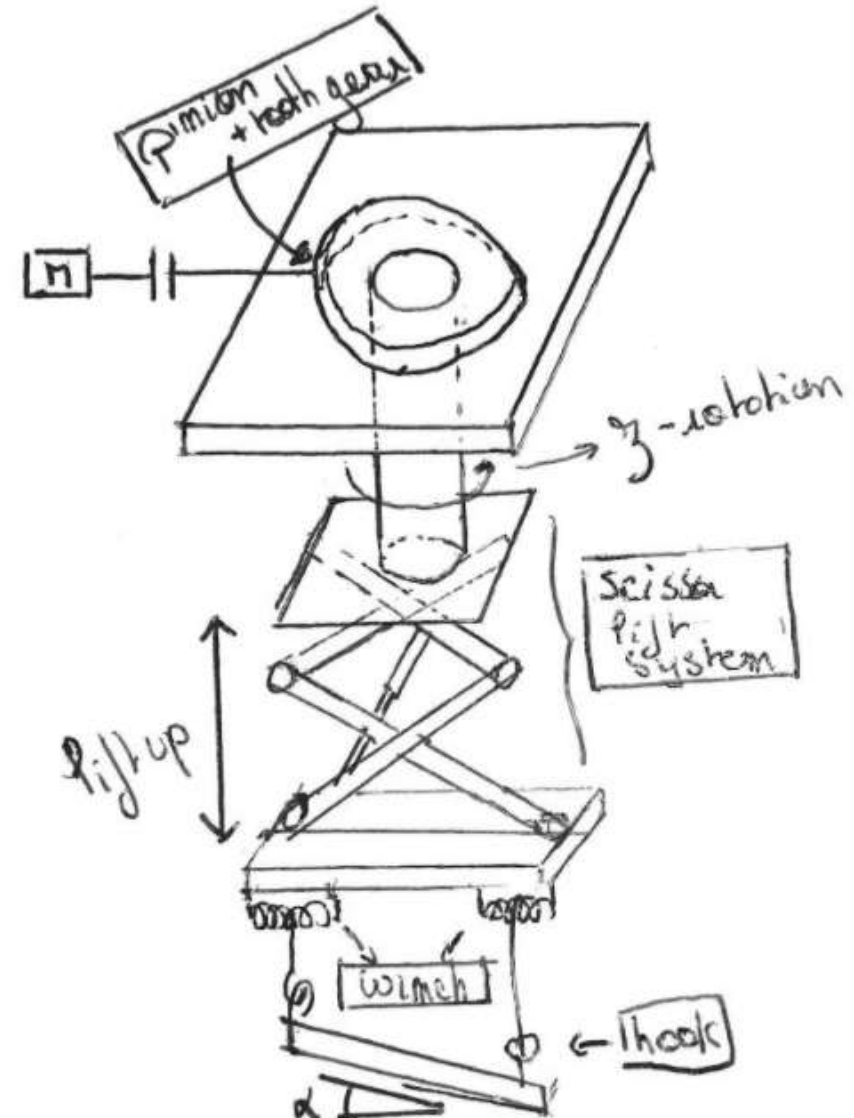
- Z-axis rotation :
Slewing ring with external teeth (couronne d'orientation)
Worm screw (vis-sans-fin)
- Lifting up :
Winch/drum (treuil)
Electromechanical braking device
4 cables
Lifting frame (palonnier) with several locations for the rotating device
- X/Y- rotation :
« Palonniers retourneurs à sangles »
Electromechanical braking device



Concept variant 1

Solution 3 :

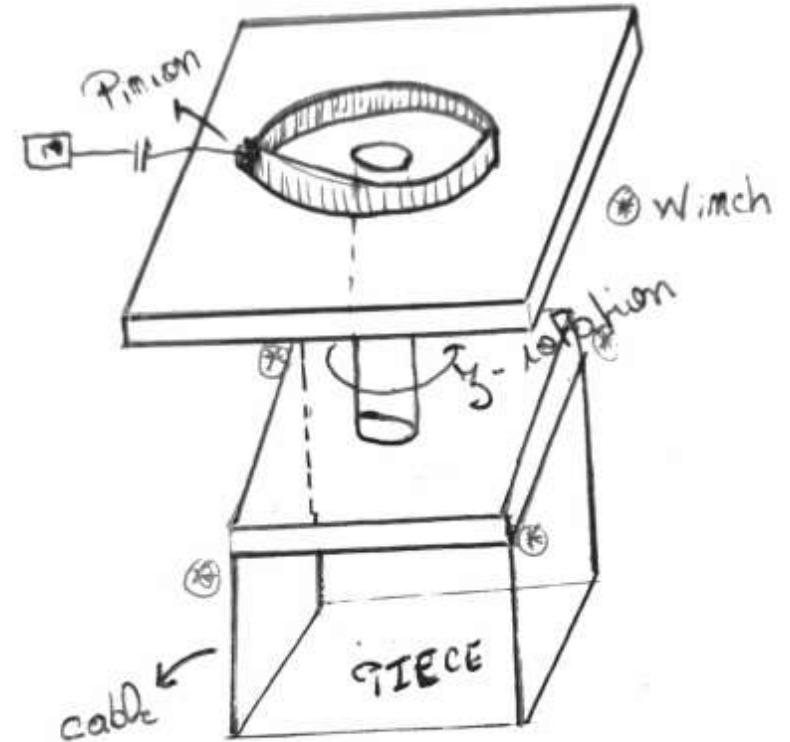
- Z-axis rotation :
Slewing ring with external teeth
Pinion
- Lift-up system :
Scissor lifting system (with jack)
- Y-axis rotation :
2 winches – Cables with different
lengths make the rotation (α)



Concept variant 1

Solution 4 :

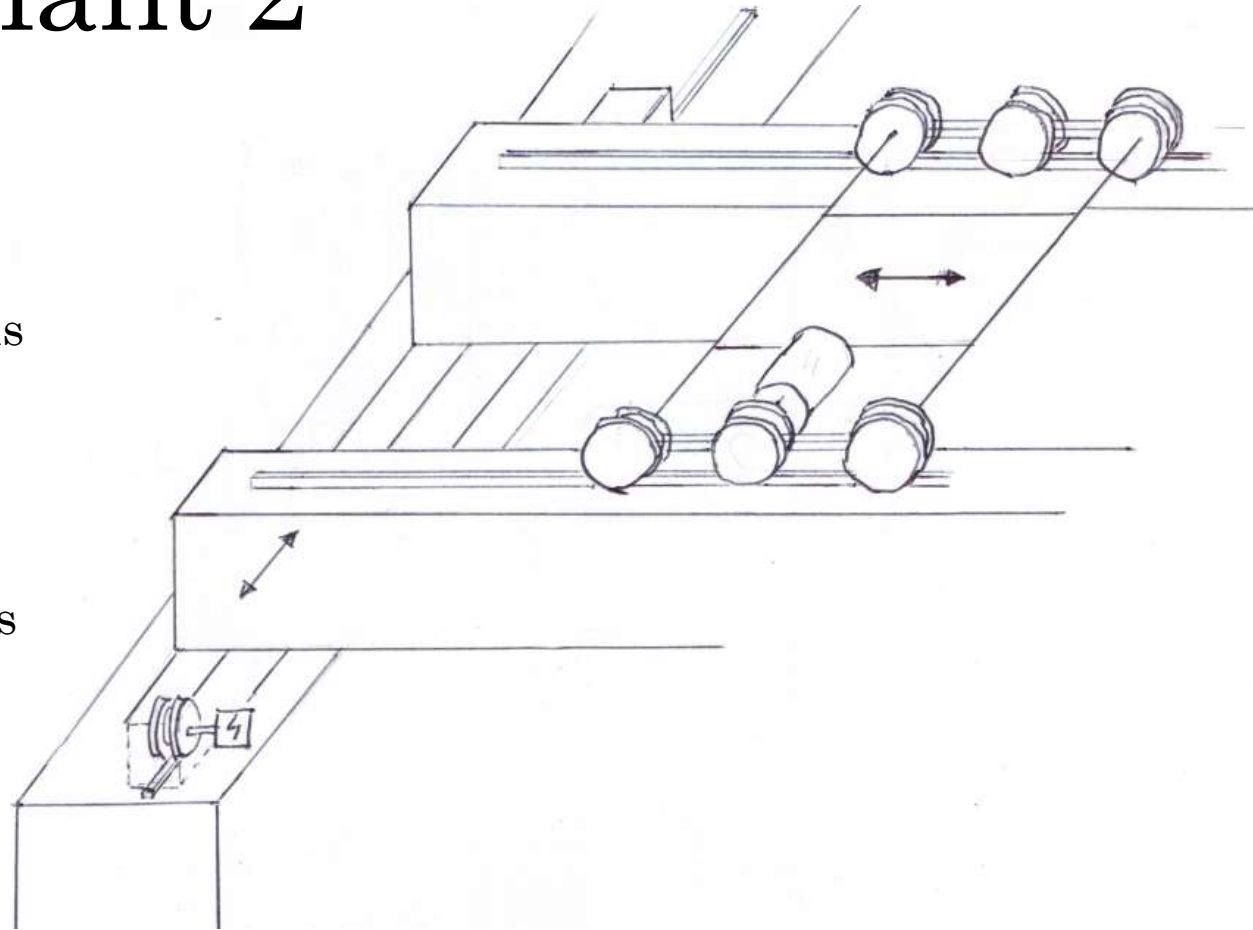
- Z-axis rotation :
Slewing ring with external teeth
Pinion
- Lift-up system :
4 winches
- Y-axis rotation :
Cable with different length



Concept variant 2

Solution 1 :

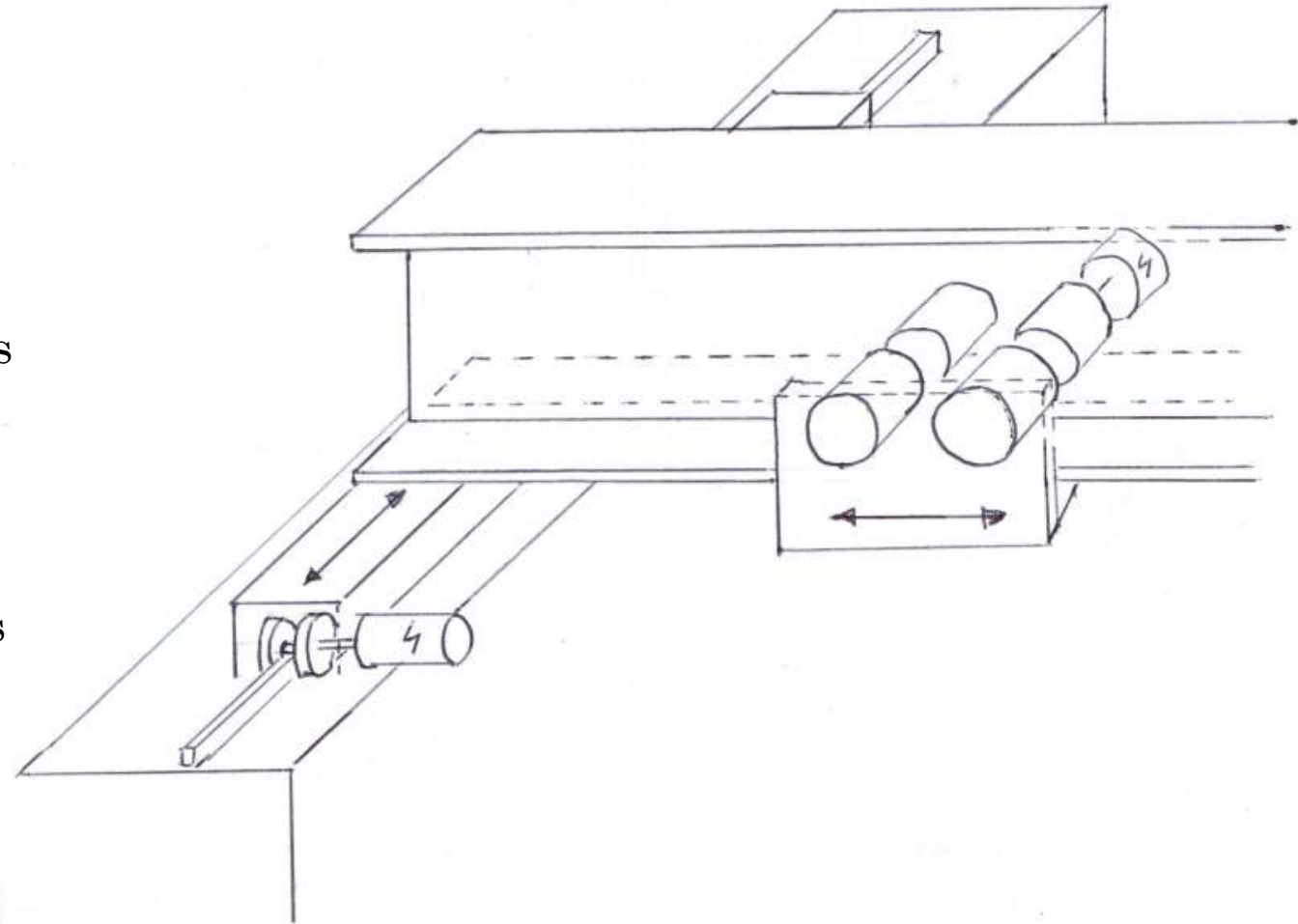
- X-direction :
 - Actuated wheels (2)
 - Guided by profiled wheels
- Y-direction :
 - 2 transversal beams
 - Actuated wheels (2)
 - Guided by profiled wheels



Concept variant 2

Solution 2 :

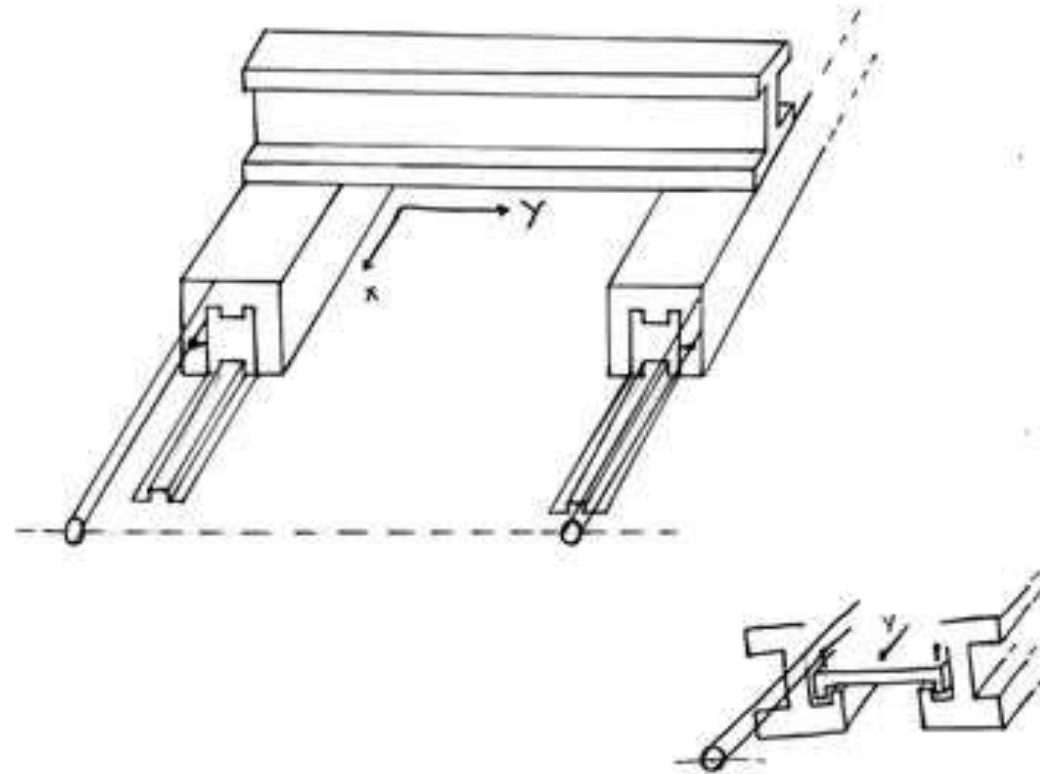
- X-direction :
Actuated wheels (2)
Guided by profiled wheels
- Y-direction :
1 transversal beam
Actuated wheels (2)
Guided by profiled wheels



Concept variant 2

Solution 3 :

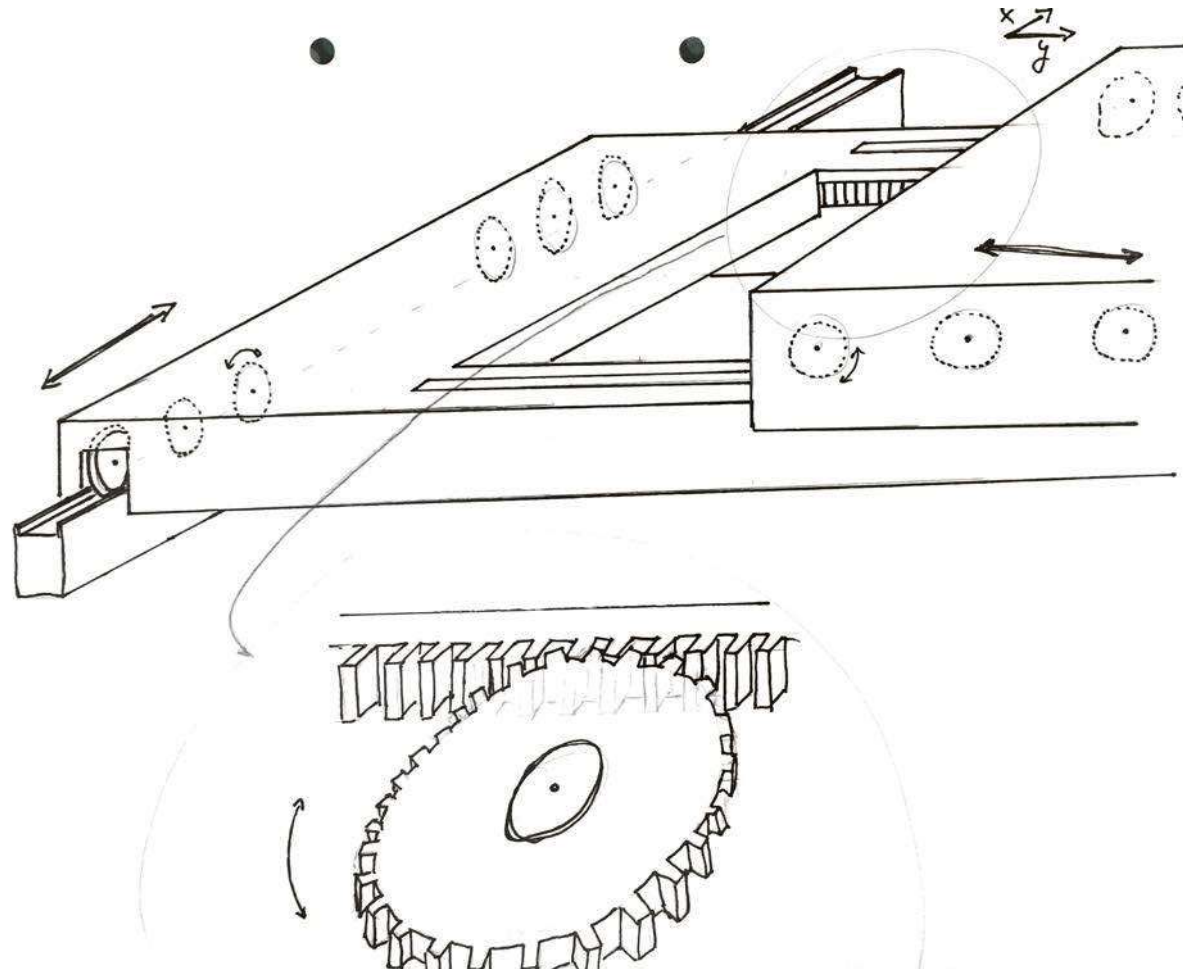
- X direction:
Actuated by a pulley and
transmission with cables
Wheels + rail
- Y direction
Actuated with cables
2 pinions
Sliders



Concept variant 2

Solution 4 :

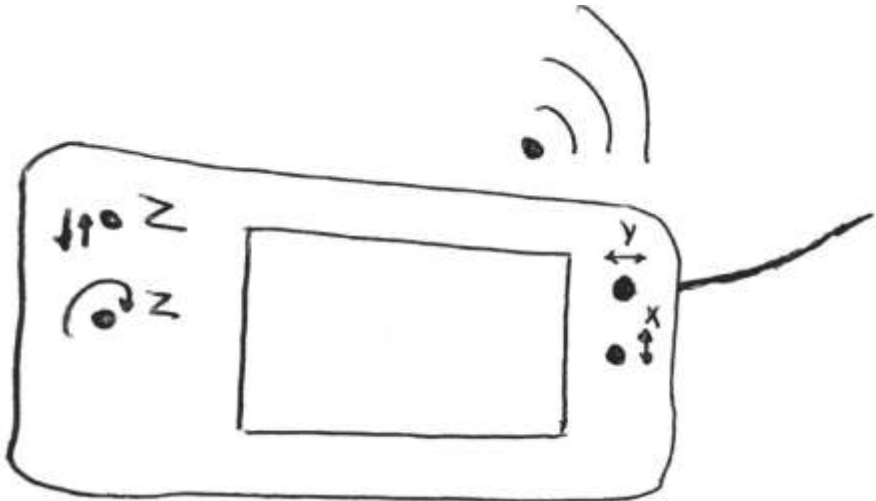
- X-direction :
Actuated wheels
Guided by profiled wheels
- Y-direction :
Actuated pinion on a rack
Guided by profiled wheels



Concept variant 3

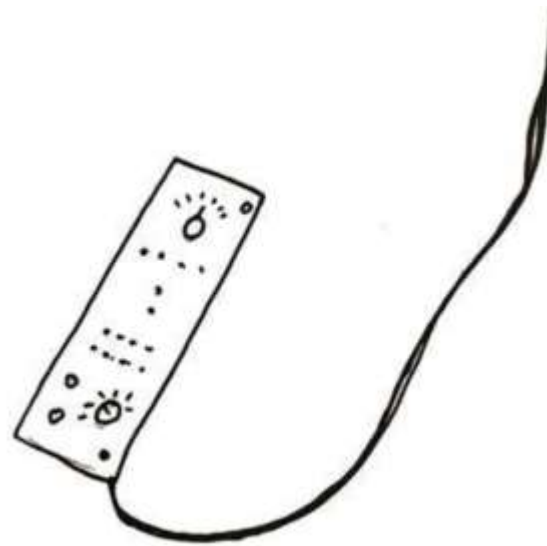
Solution 1 :

- Wireless or wired remote control
- Screen with security cameras



Solution 2 :

- Wired remote control



Concept variant 3

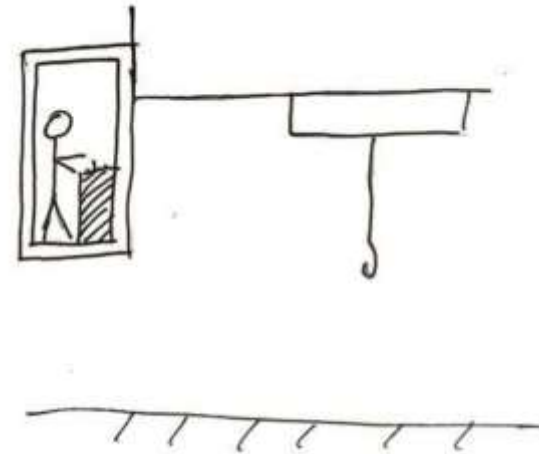
Solution 3 :

- Wireless Laptop piloting



Solution 4 :

- Piloting in a cabin
- Control Panel
- Cabin is fixed on the trolley



5. Evaluation Chart

Global idea

- Define criterias
- Put different weights
- Choose a reference solution
- Compare each criteria with the reference (-1/0/+1)

CV 1 : Attach + Lift up + 2 rotations		Solutions							
Criteria	Weight	Solution 1		Solution 2		Solution 3		Solution 4 (REF)	
Cost (installation, complexity,etc)	4	-1	-4	0	0	-1	-4	0	0
Safety/reliability	5	0	0	0	0	0	0	0	0
Weight	2	0	0	0	0	-1	-2	0	0
Maintenance	4	1	4	1	4	-1	-4	0	0
Versatility	4	0	0	1	4	1	4	0	0
Precision	5	0	0	-1	-5	1	5		
TOTAL		0		3		-1		0	

5. Evaluation Chart

1) Attaching, lifting up and rotations

CRITERIAS

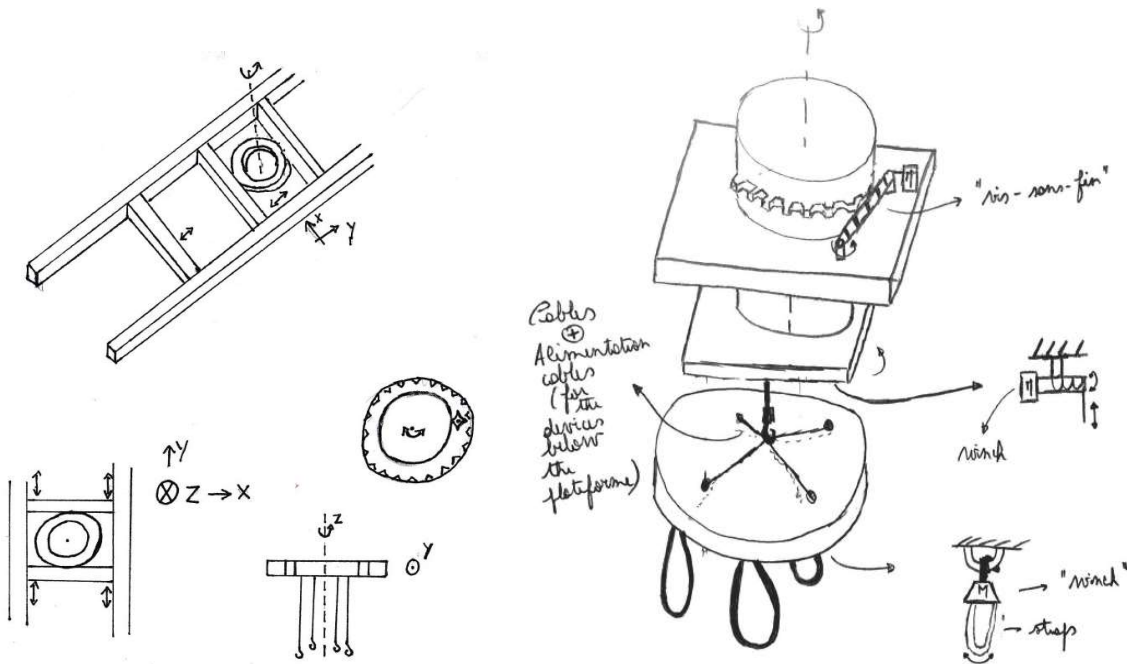
- Cost
- Safety and reliability
- Weight
- Maintenance
- Versatility
- Precision

DISCRETIZATION

- +/- 10% cost
- Number of DOF blocked
- +/- 20% weight
- Number of maintenances over lifespan (+/- 10%)
- Can rotate and translate all pieces
- +/- 10% price/accuracy

5. Evaluation Chart

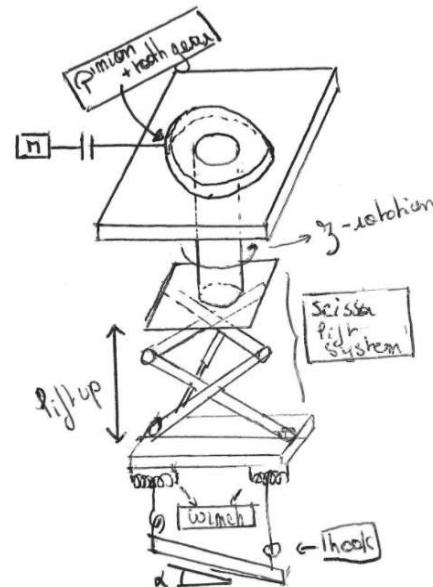
1) Attaching, lifting and rotations



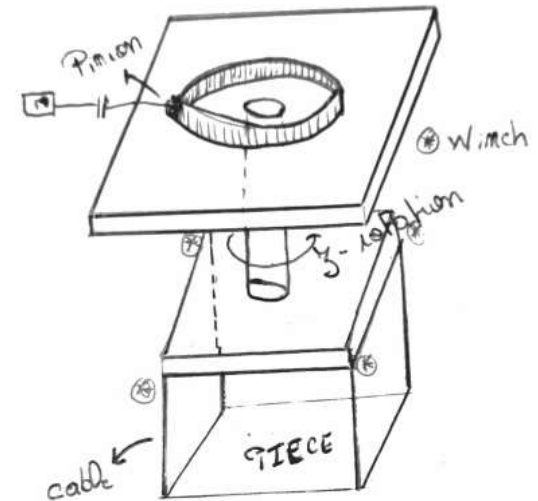
Cables
Alimentation
cables
(for the
device
below
the
plateforme)



versatile



Reference solution



5.Evaluation Chart

2) X and Y translation

CRITERIAS

- Cost
- Weight
- Safety
- Maintenance
- Precision

- Power required

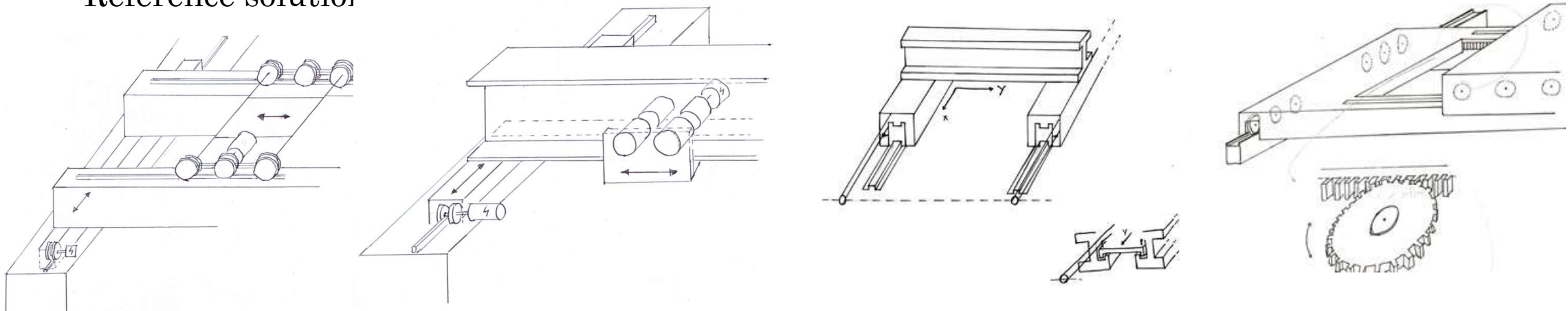
DISCRETIZATION

- +/- 10% cost
- +/- 20% weight
- Number of degree of freedoms blocked
- Number of maintenances over lifespan (+/- 10%)
- +/- 10% price/accuracy
- +/- 10% more power

5. Evaluation Chart

2) X and Y translation

Reference solution



5.Evaluation Chart

3) Pilot

CRITERIAS

- Cost
- Safety and reliability
- Weight
- Size
- Maintenance
- User friendly

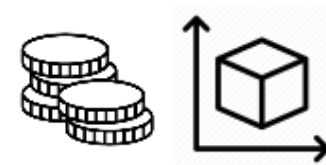
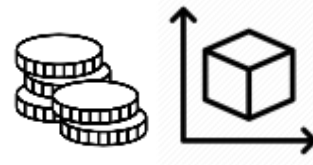
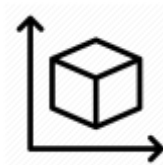
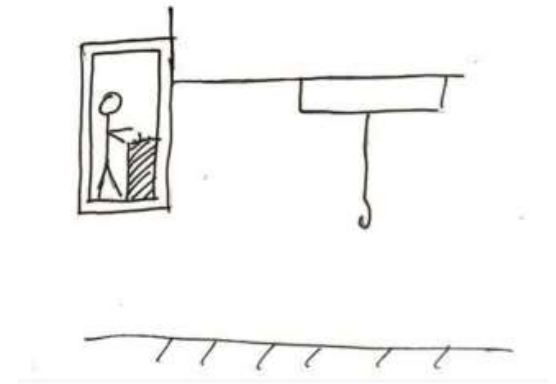
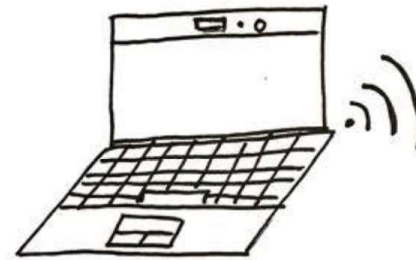
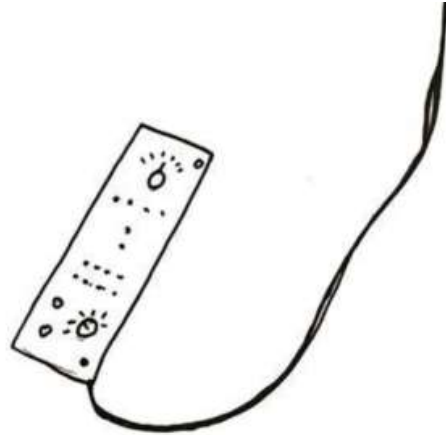
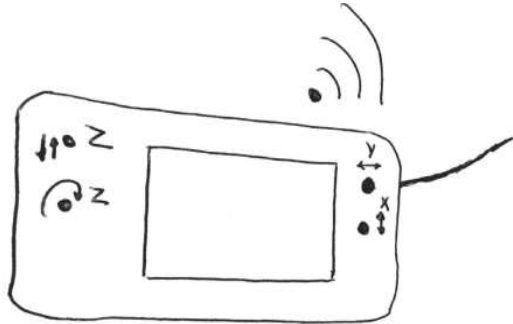
DISCRETIZATION

- +/- 10% cost
- Independant of the bridge ? Yes or no
- +/- 20% weight
- +/- 10% size
- Number of maintenances over lifespan (+/- 10%)
- Yes or no

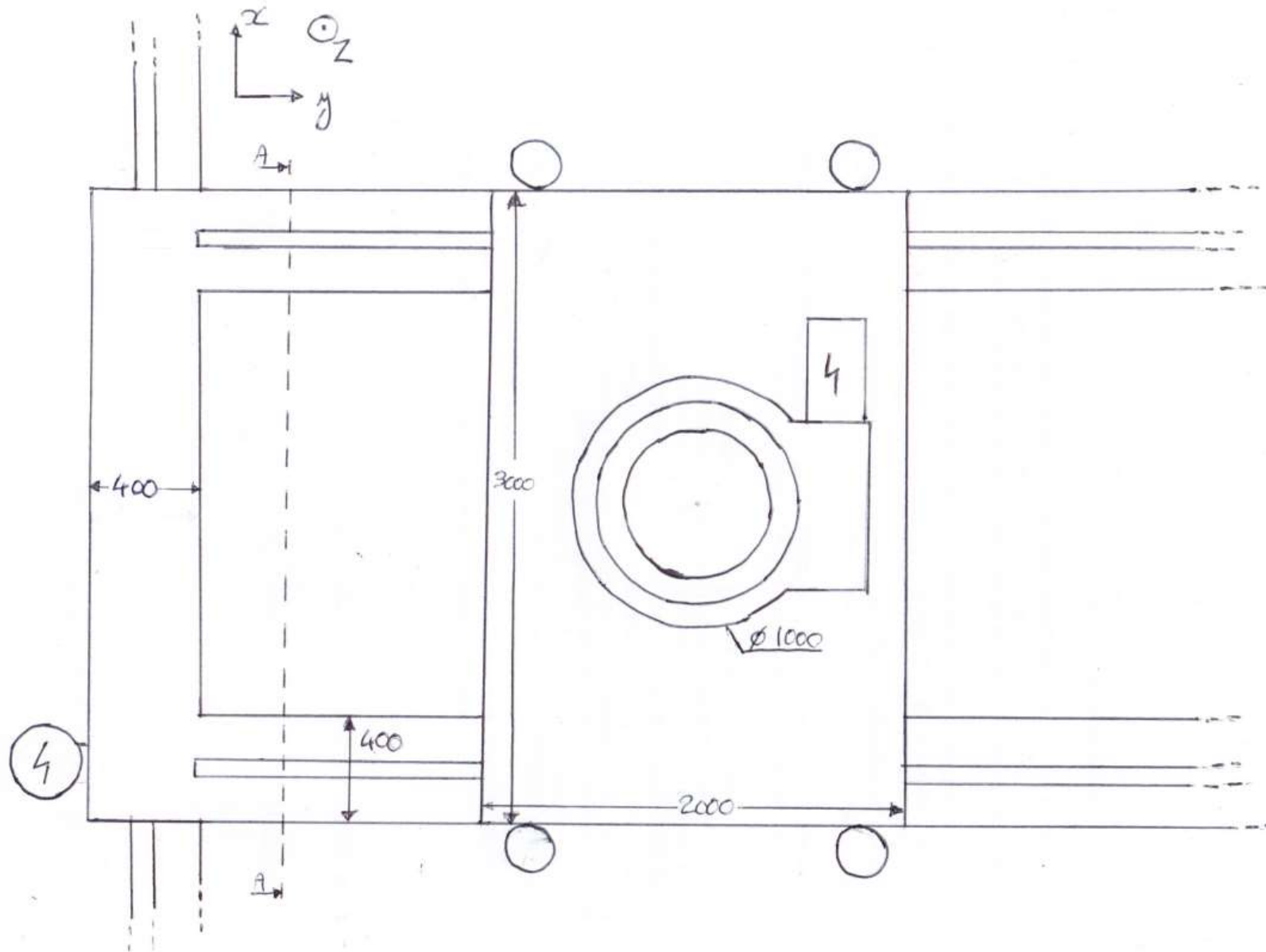
5. Evaluation Chart

3) Pilot

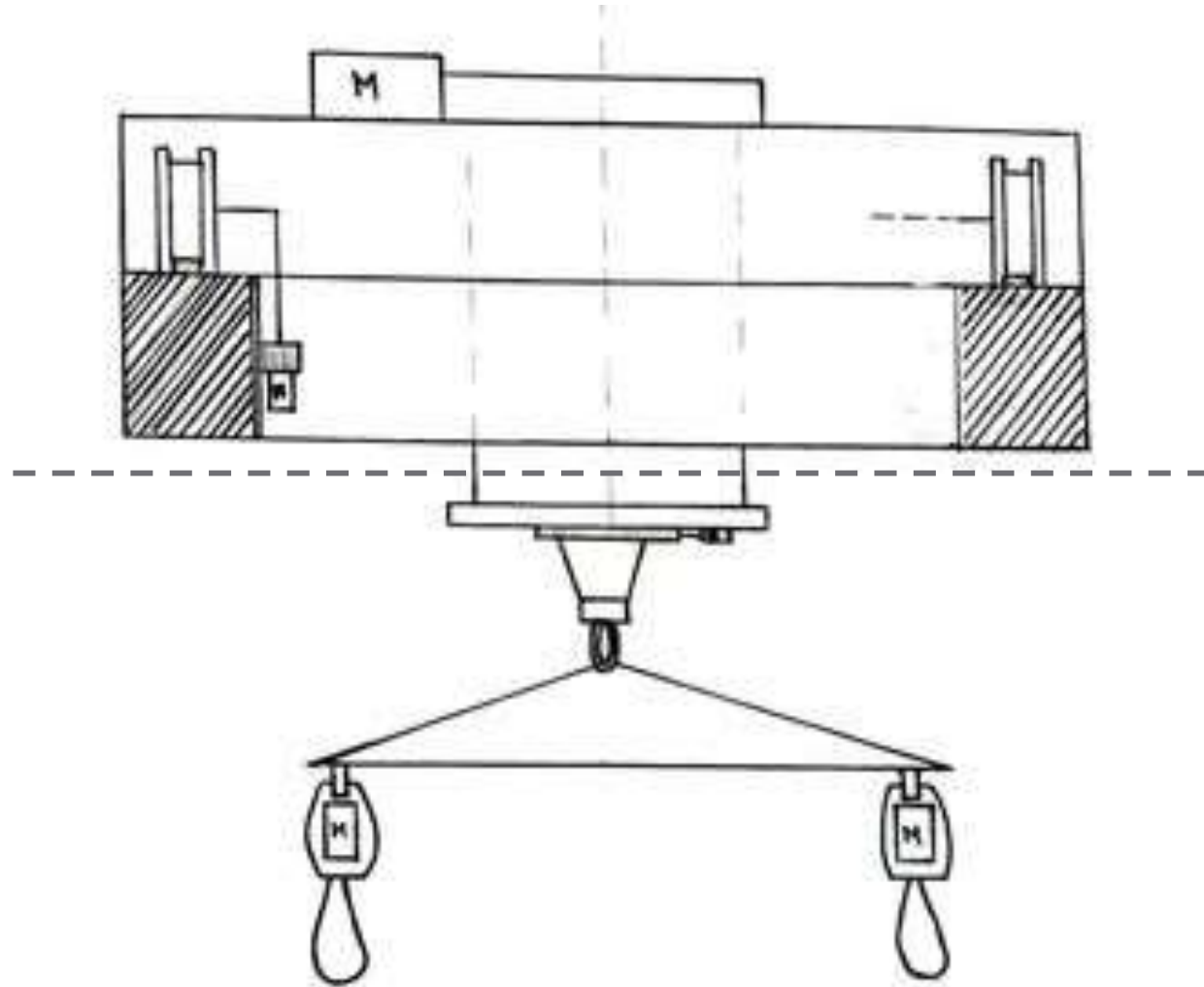
Reference solution



Top view

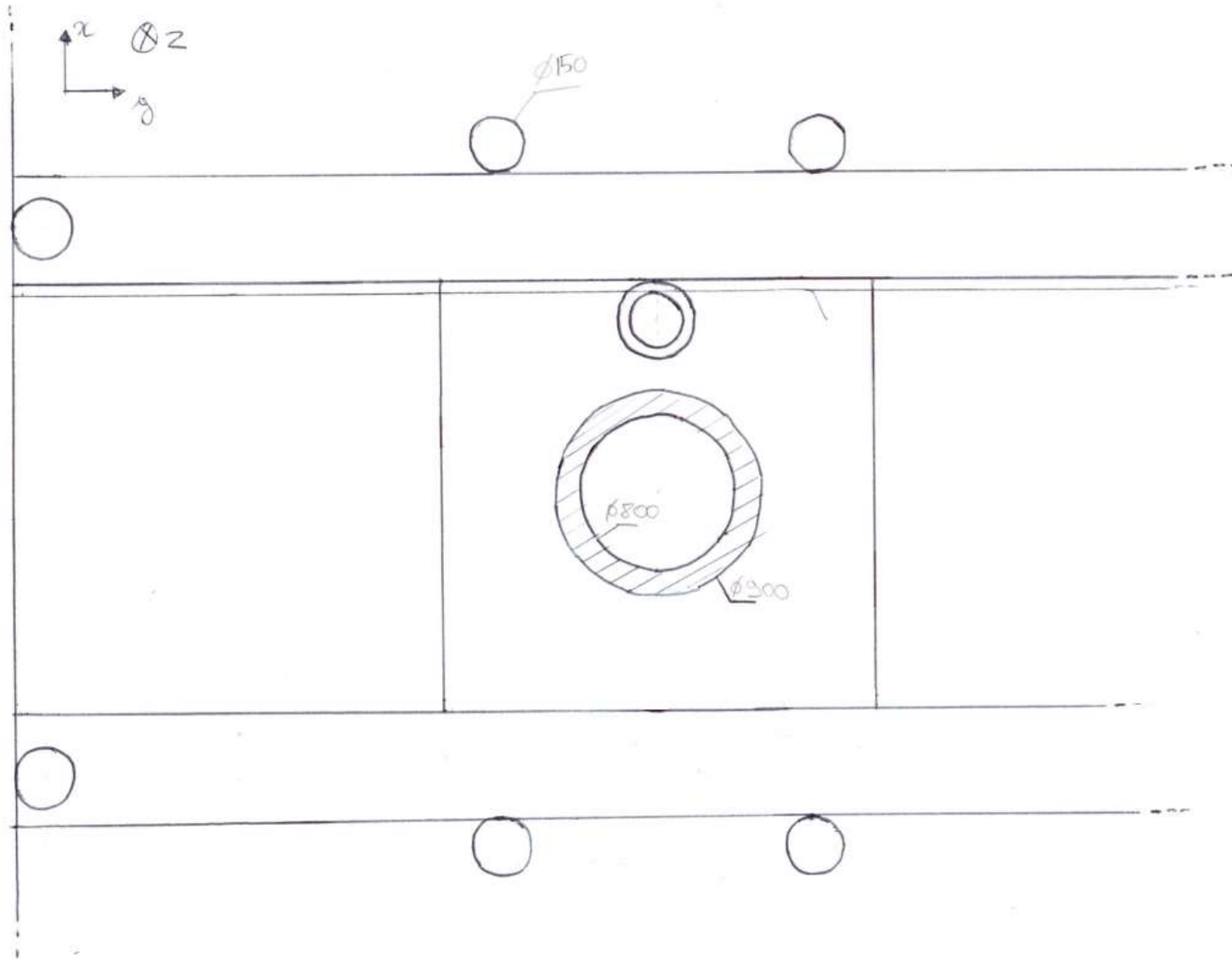


Section view

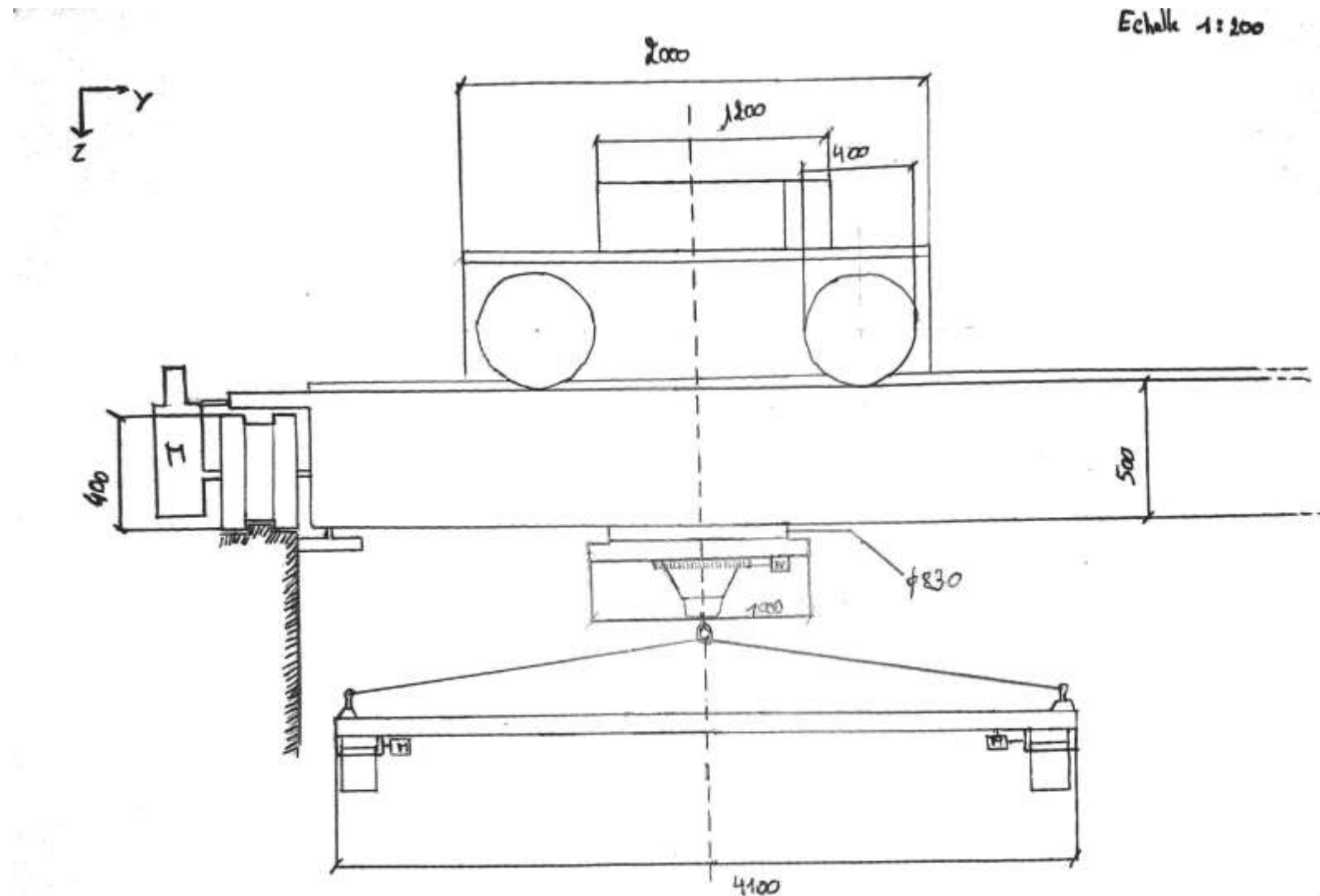


A-A

Section view B-B



Front view



6. Preliminary layout - dimensionning

A : Trolley

- Cables : 20 meters long + diameter 4 cm + weight of 100 kg
- Drum : diameter 0.4 m and mass of 200 kg
- Trolley dimension 3m x 2m
- Mass: 20t (mass of charge + mass of trolley (drum + slewing ring + motors))
- Slewing ring diameter : 1 m

B : Bridge

- Span : 50.75 [m]
- Mass : 40 t
- Total Mass : 60 t



6. Preliminary layout - dimensionning

RACK AND PINION

RACK:

High precision rack : module = 5

Max force : 76 kN

PINON:

Module = 5

Max force : 47 kN

20 teeth

Pitch diameter : 100 [mm]



http://atlantagmbh.com/wp-content/uploads/2016/03/Servo_Deutsch.pdf

6. Preliminary layout - dimensionning

POWER ESTIMATION :

Lift-up :

- Efficiency = 0.85
- Speed : 0.2 m/s
- Load: 158 kN
- Power : $158 \text{ [kN]} * 0.2 \text{ [m/s]} / 0.85 = 38 \text{ kW}$

Y-direction:

- friction (rack and pinon)
- Power : 488 W

X-direction :

- Negligible friction (like a rail wheel)
- Power : 1318 W



Thank you for your attention !
Any questions ?

