BAM!!!!

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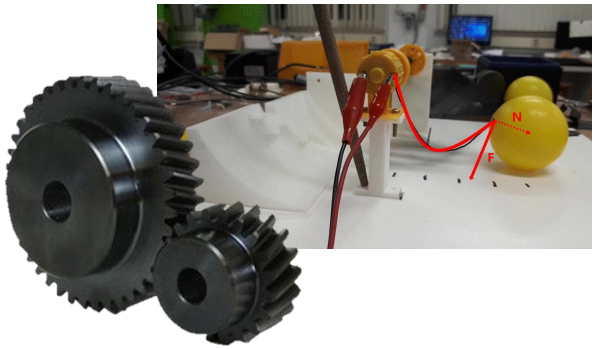
TABLE OF CONTENT

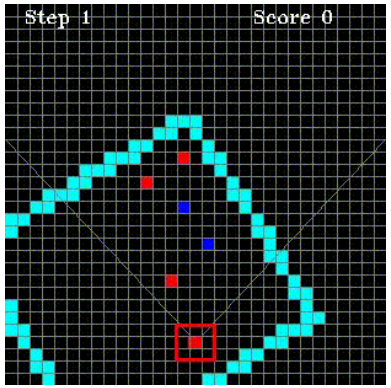
CHIKORITA

KEY FEATURES



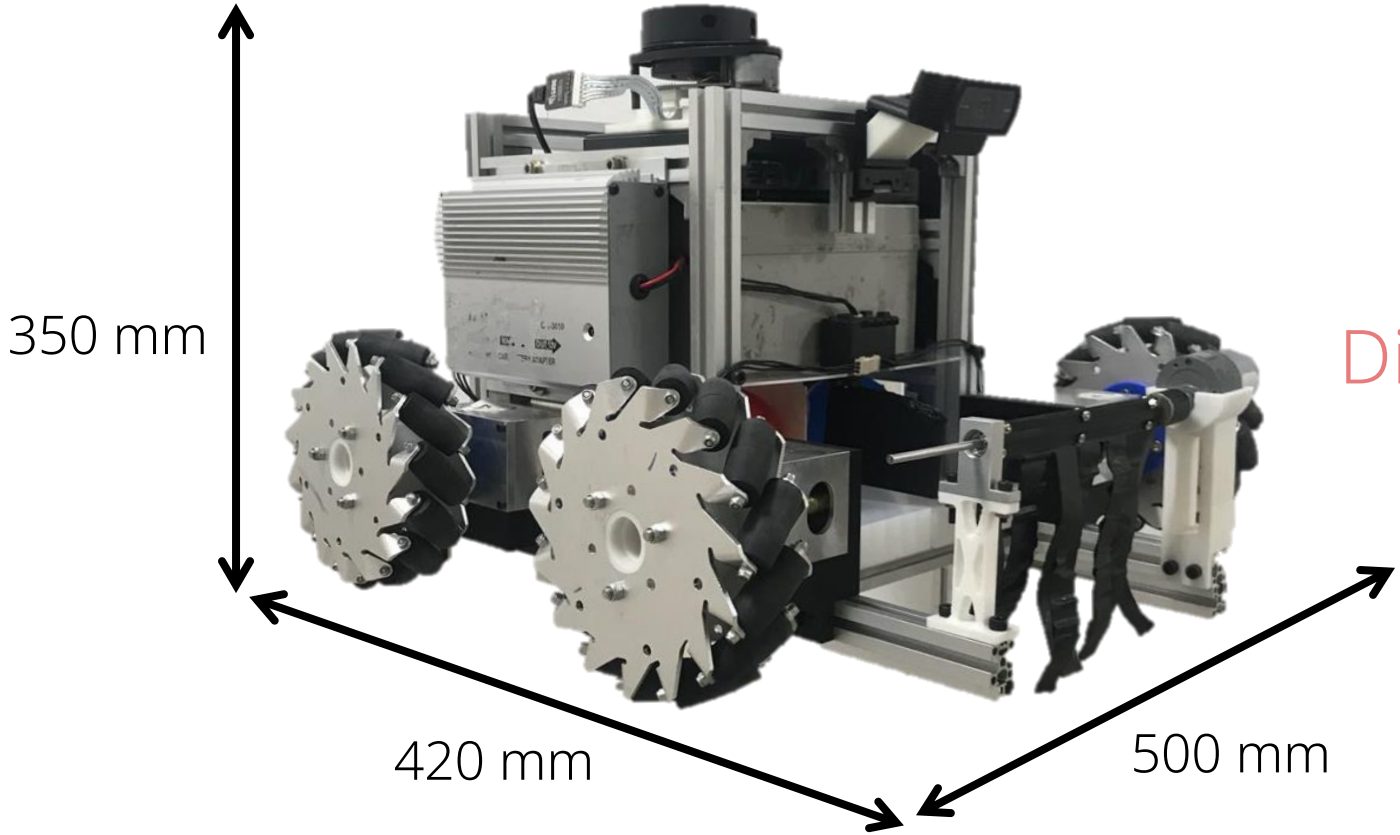
CHALLENGES

SOFTWARE SYSTEM



CHIKORITA

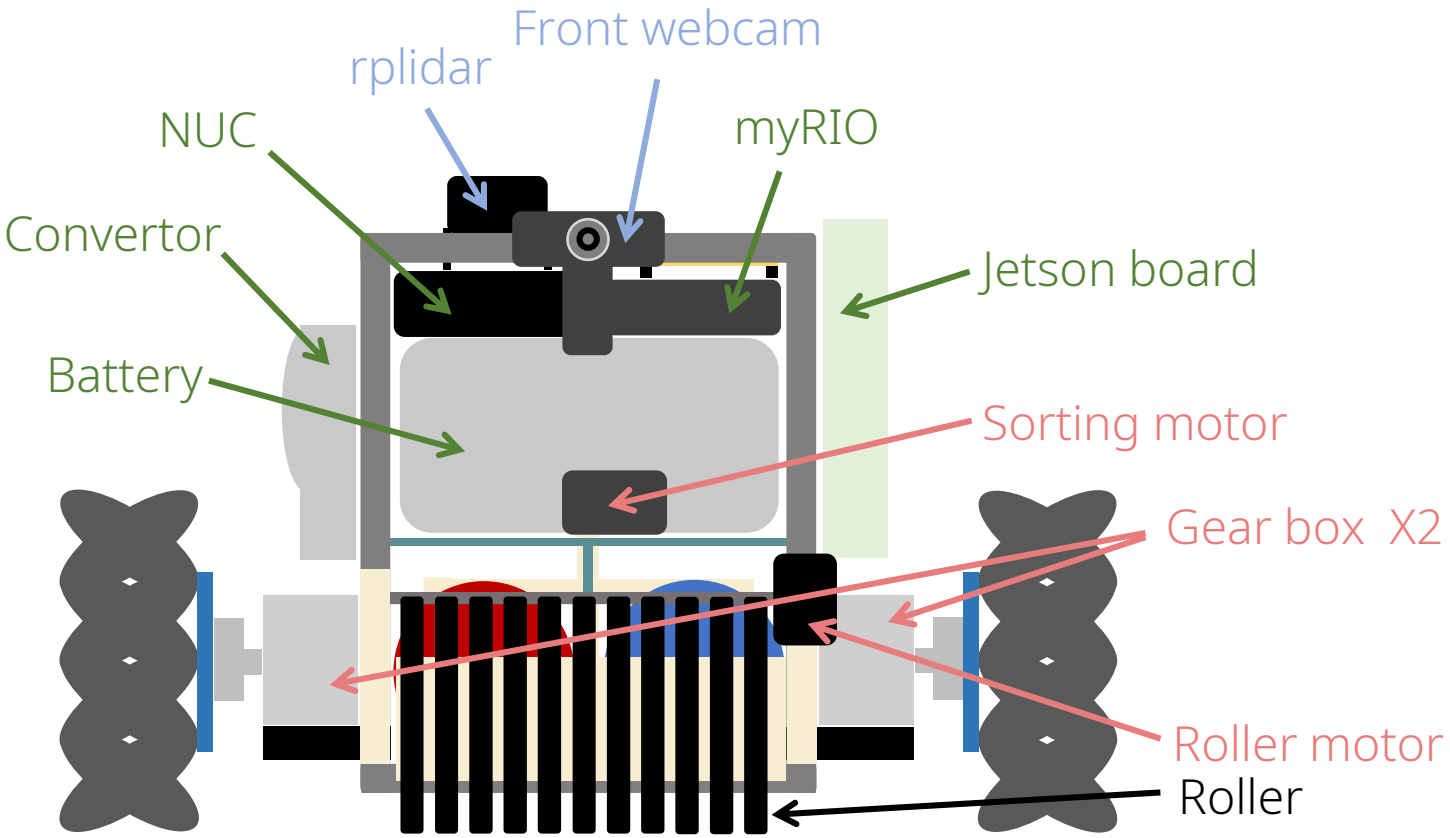
CHIKORITA



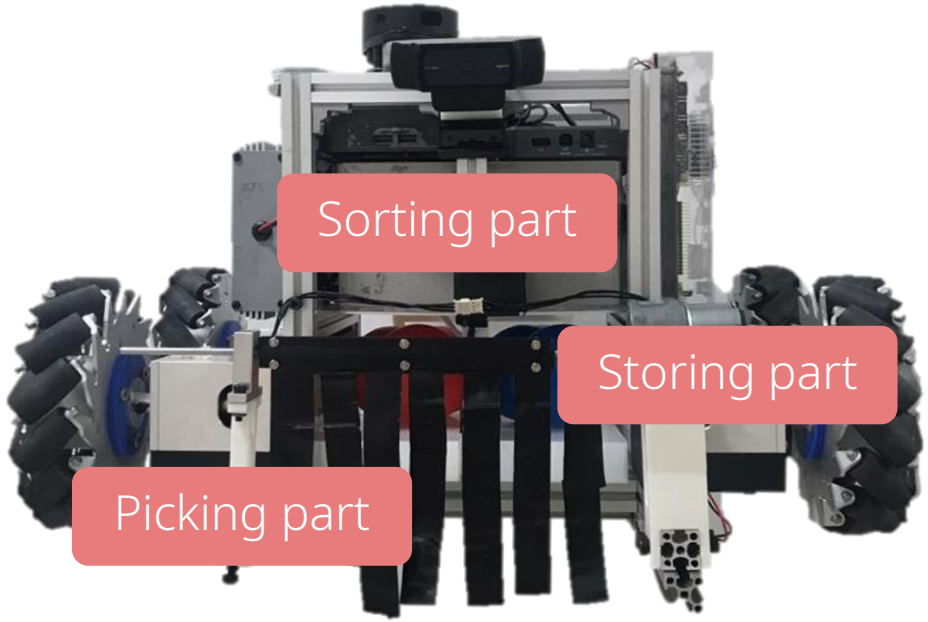
Dimension: 500 x 420 x 350 (mm)
Weight: 12 kg

- Compact size
- Proper height for the rplidar

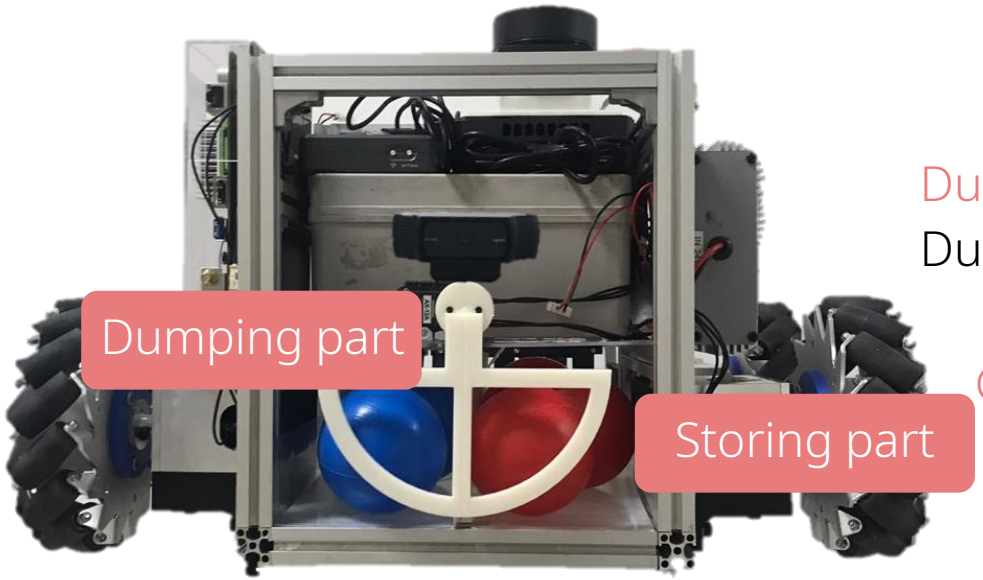
CONFIGURATION

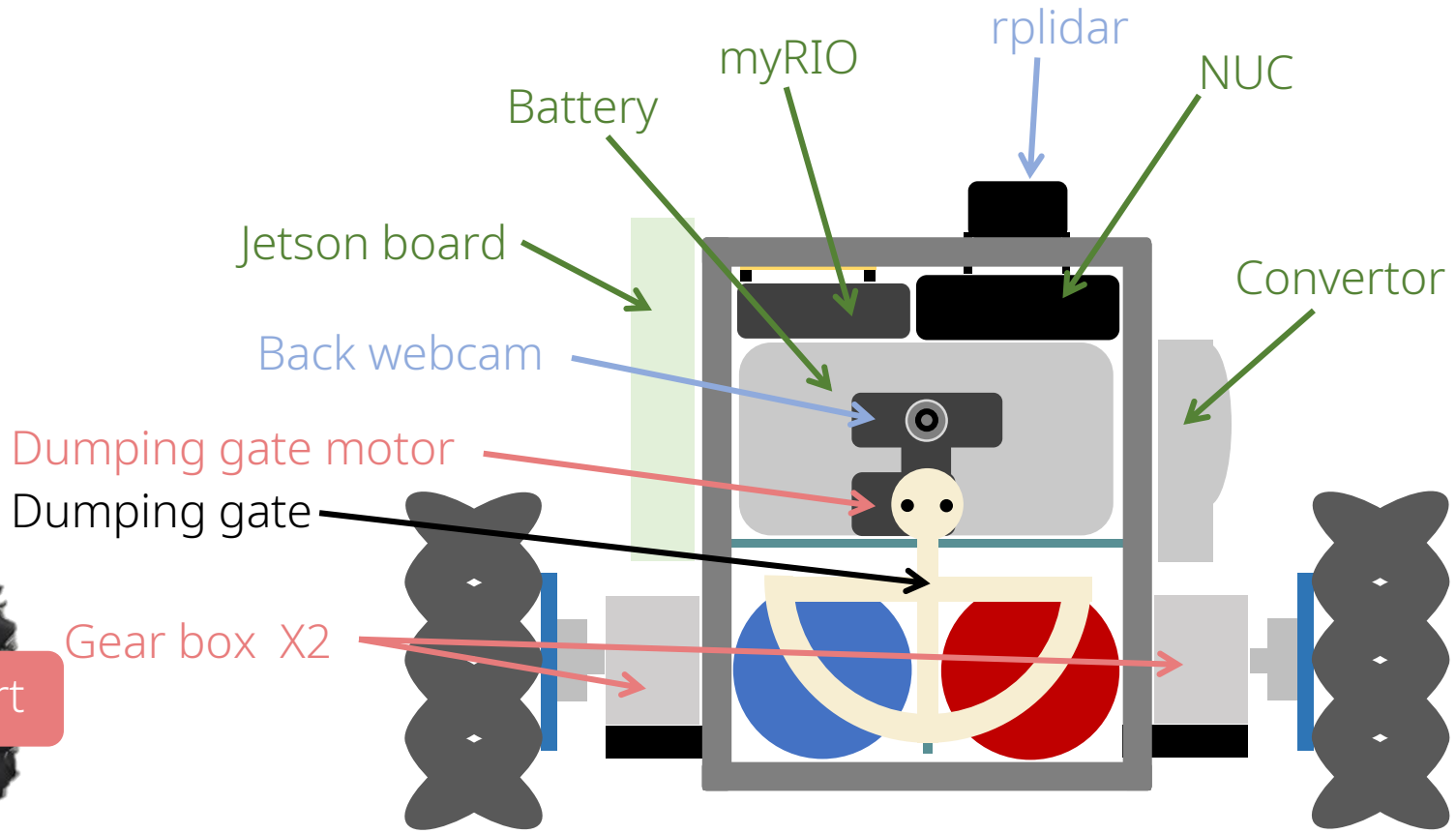


<Front view>



CONFIGURATION

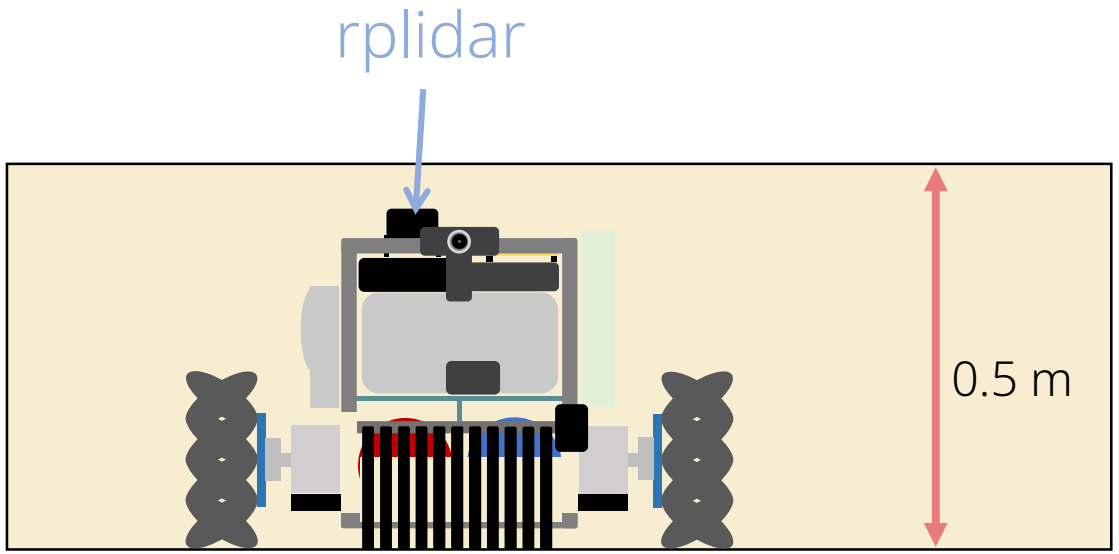


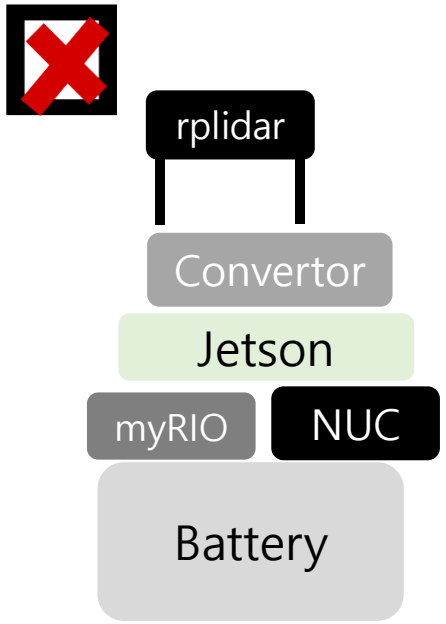


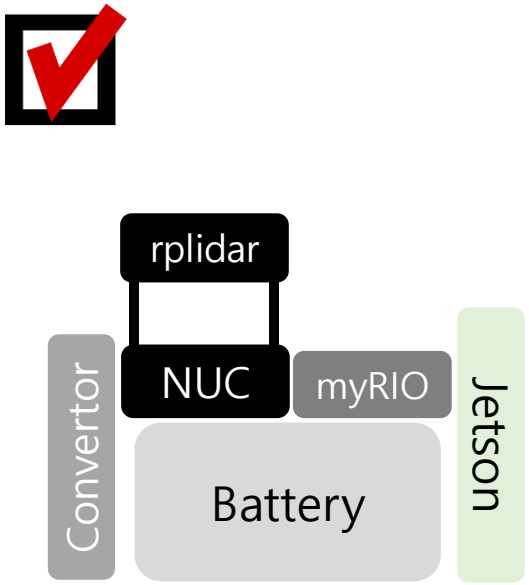
<Rear view>

CONSTRUCTION STRATEGY

Position of the other components < Position of the rplidar < Wall height (= 0.5 m)



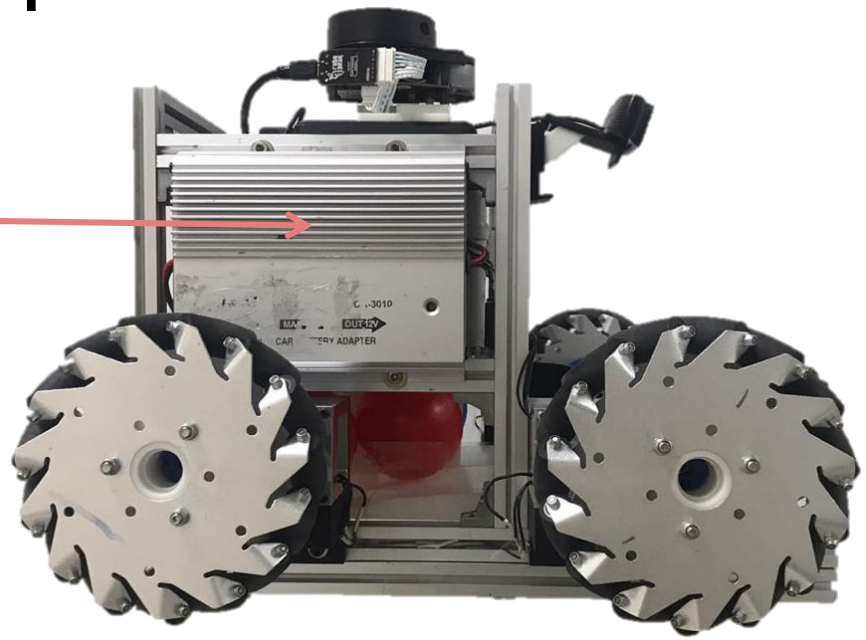


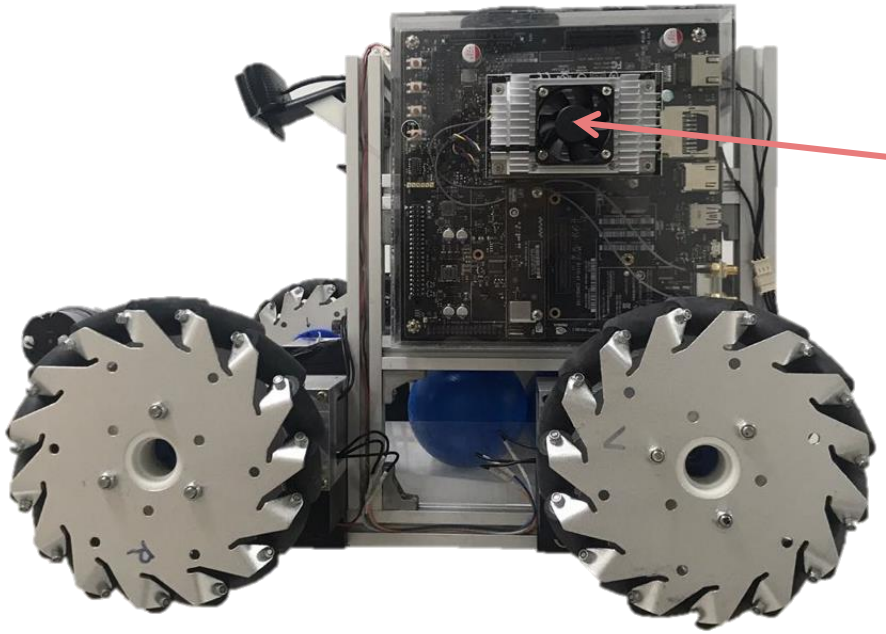


CONSTRUCTION STRATEGY

Heatsink

Give maximum contact area with the air to prevent over-heating



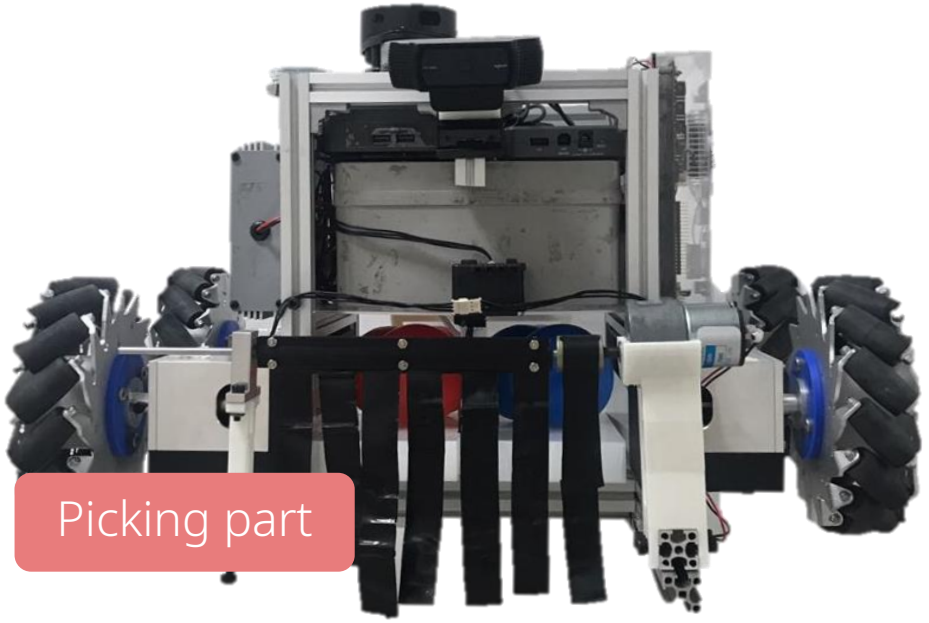


Fan

Give efficient cooling of the Jetson board

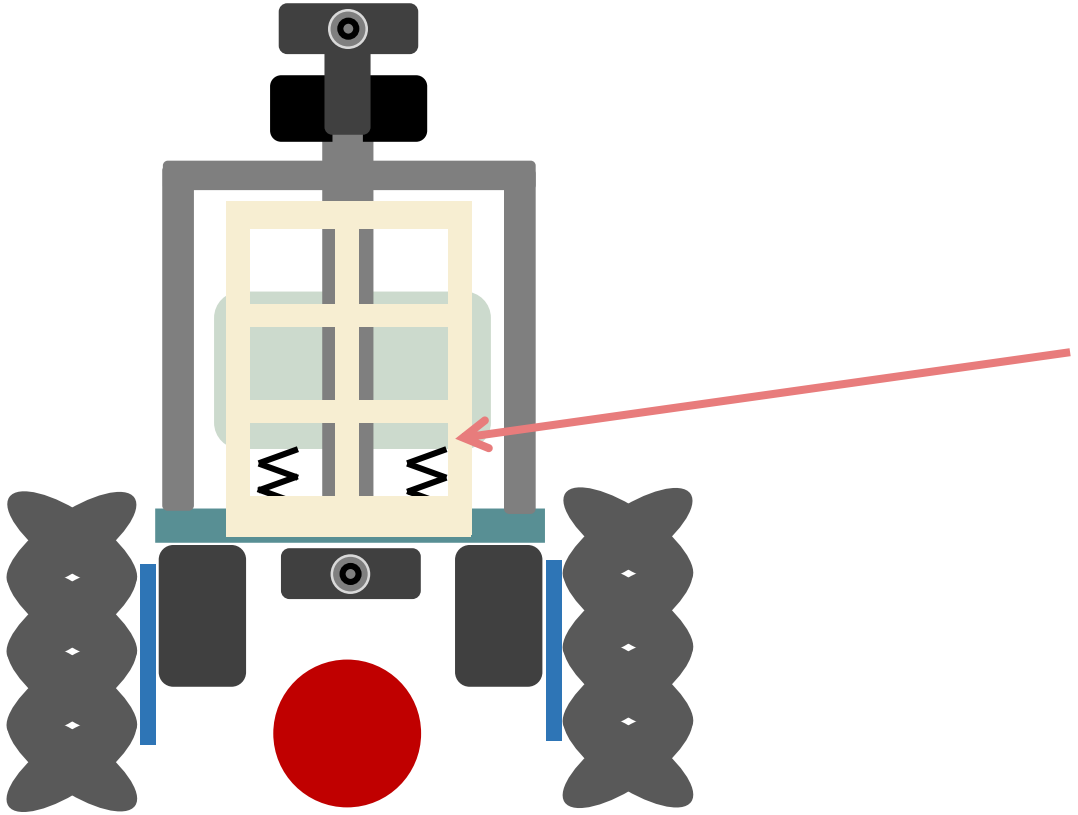
KEY FEATURES

PICKING MECHANISM



Picking part

PROBLEM

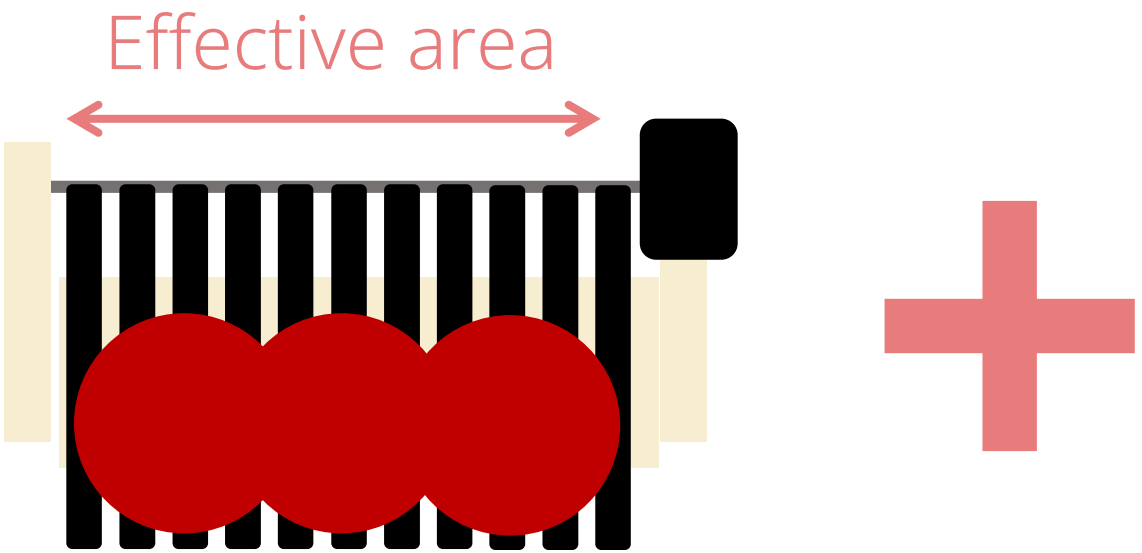


NAMSAENG-2 (CAPSTONE DESIGN 1)

- Need high accuracy in position of the ball
- Pickup box was vulnerable
- Take longer time to pick up

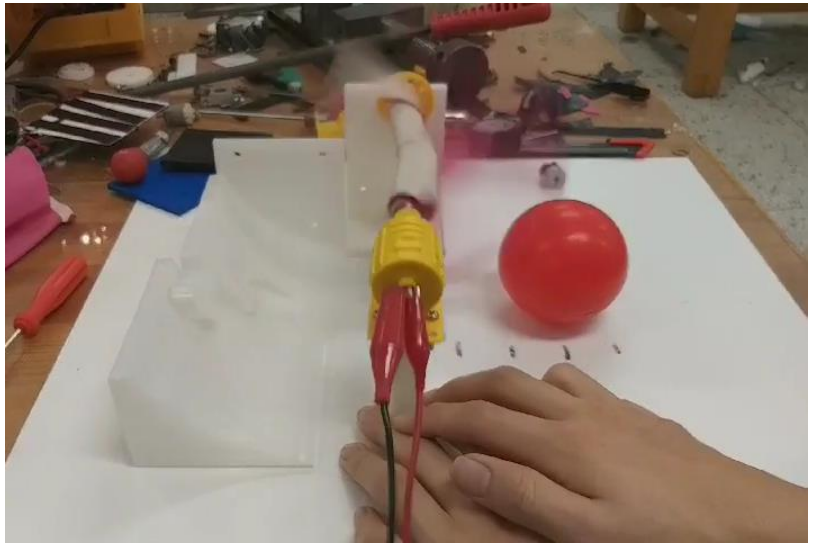
AIM & HYPOTHESIS

AIM: To have wide range of effective area to reduce accuracy problem

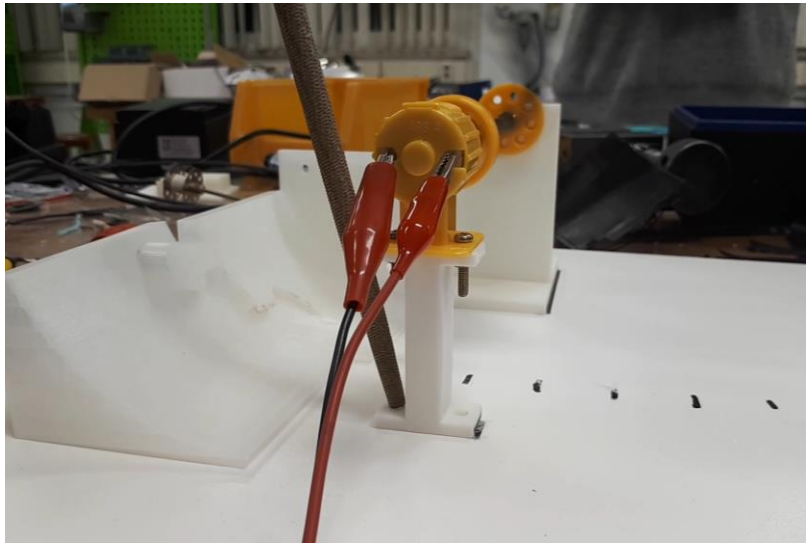


Flexible material

EXPERIMENT



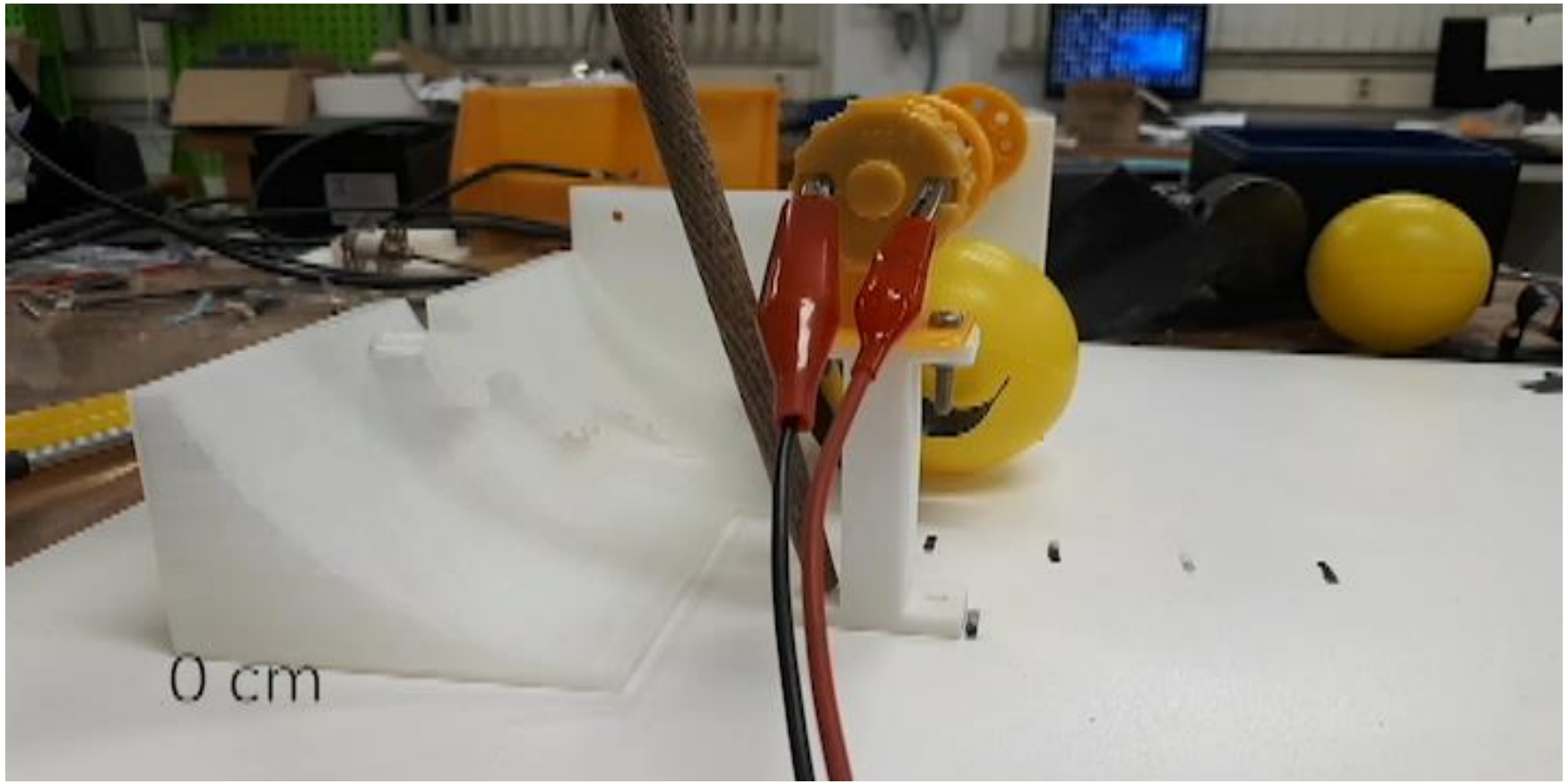
Rubber glove



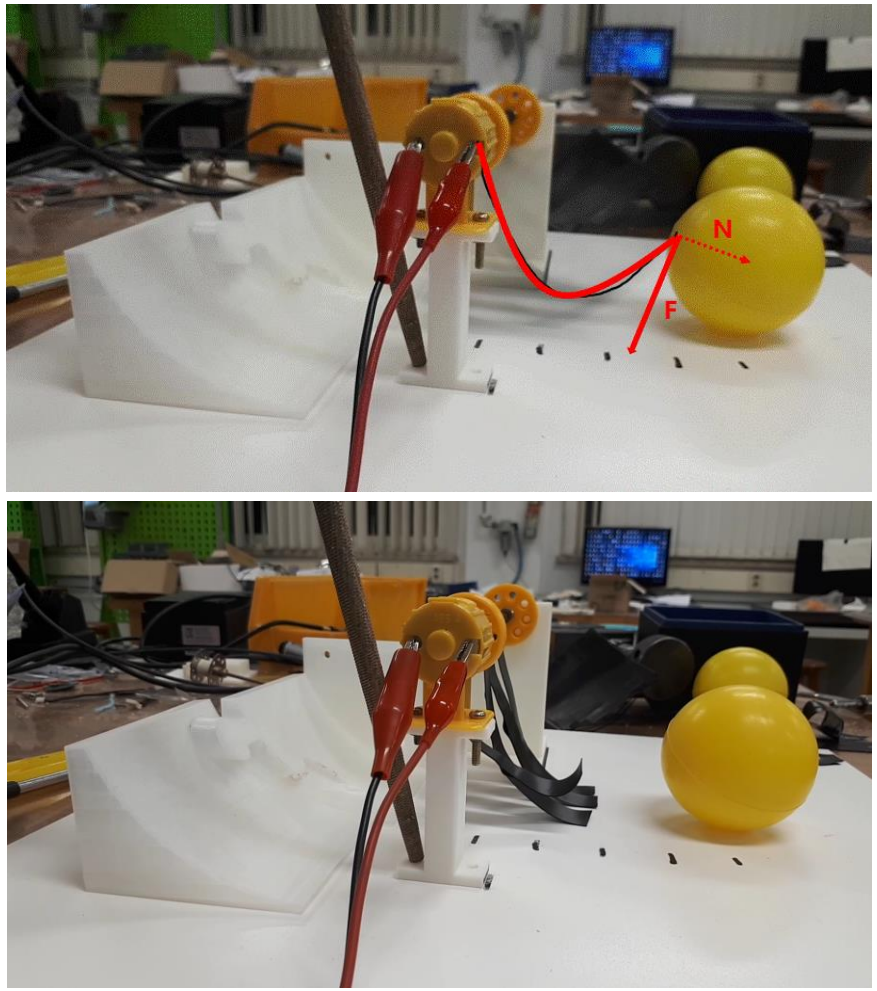
Rubber tape

Foamex

EXPERIMENT

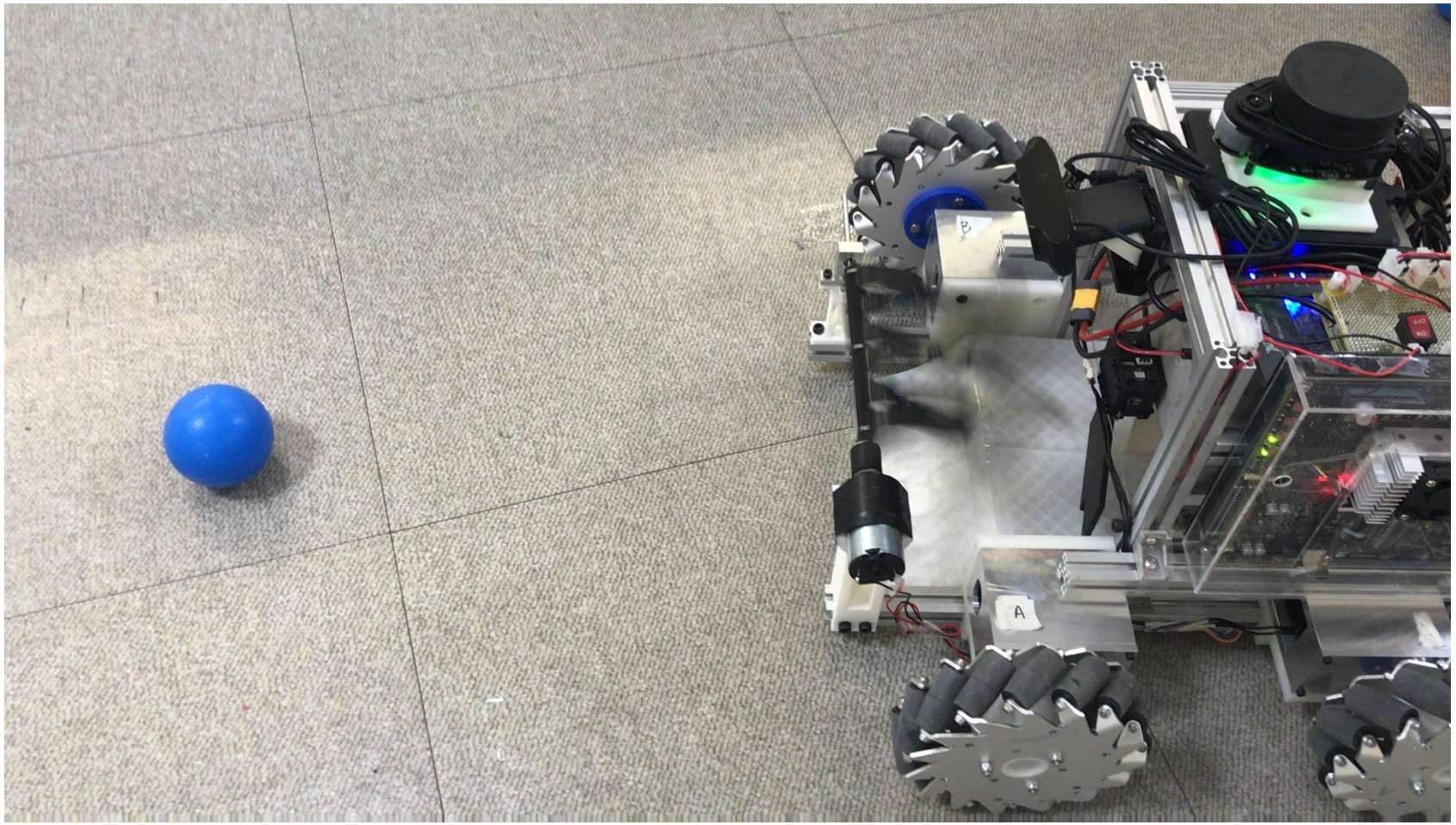


EVALUATION



Can catch a ball near wall

IMPLEMENTATION



GEARBOX

AIM & HYPOTHESIS

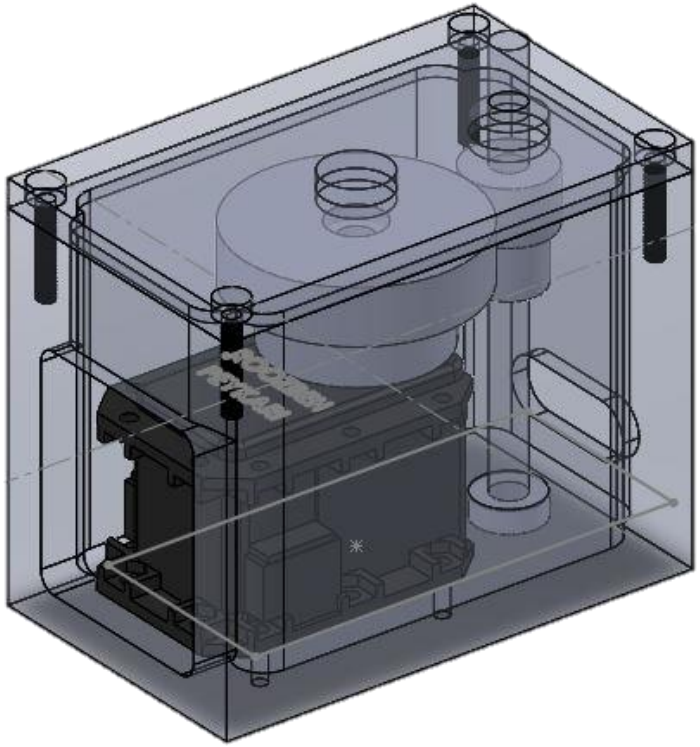
AIM: To increase the speed of the robot

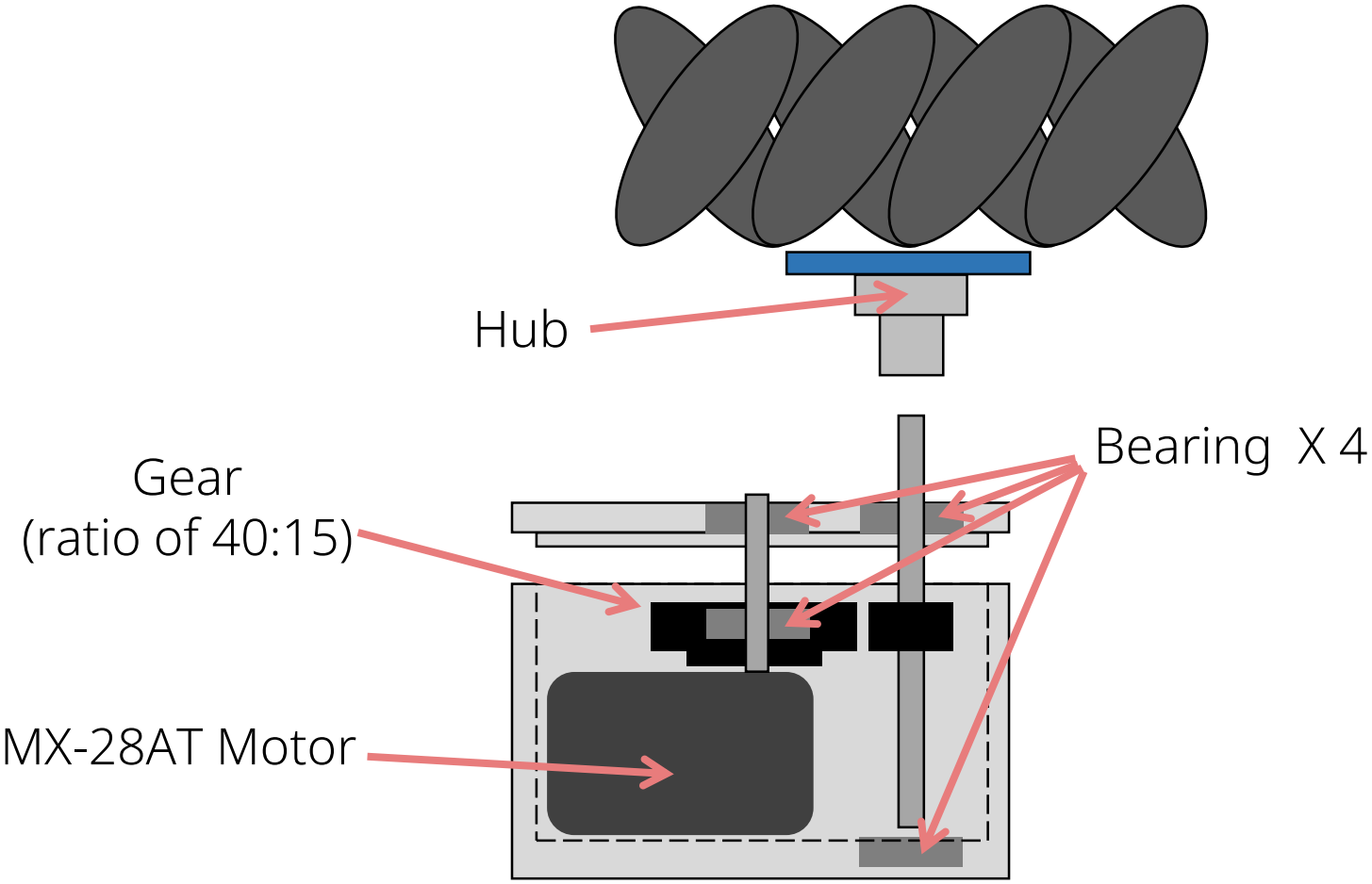
Helical gear

Increase in speed

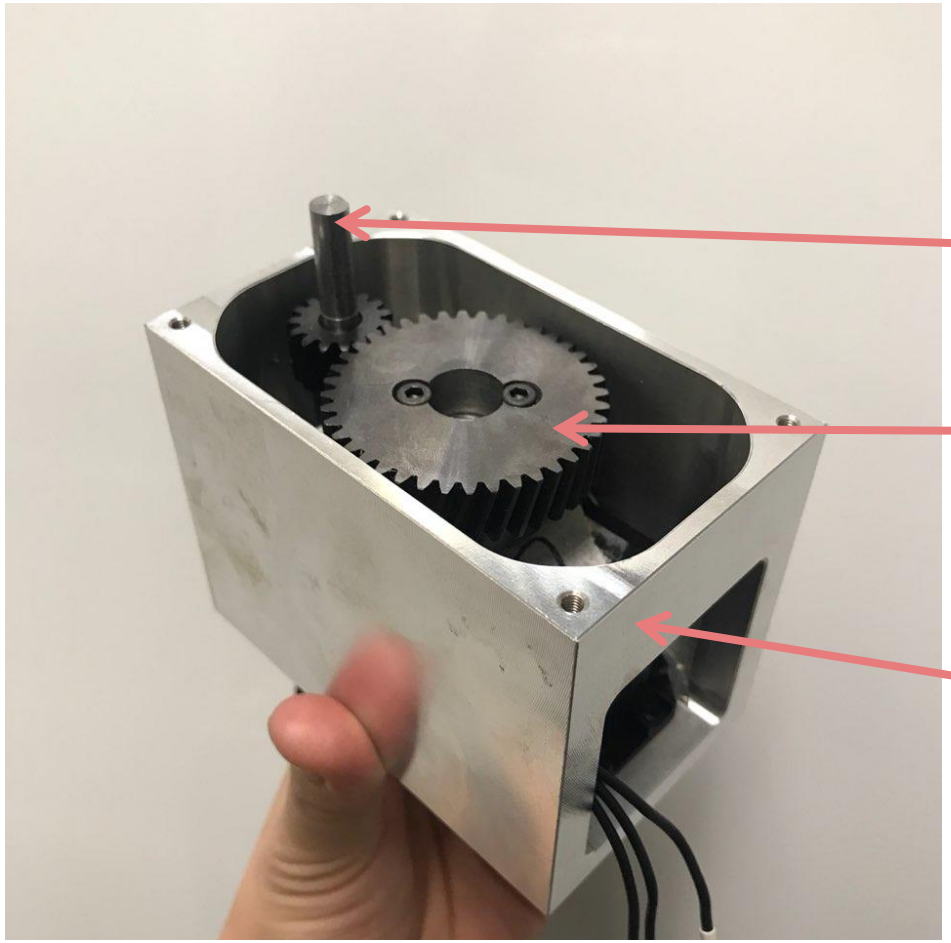
More accurate and smooth control of wheel motor

GEARBOX DESIGN





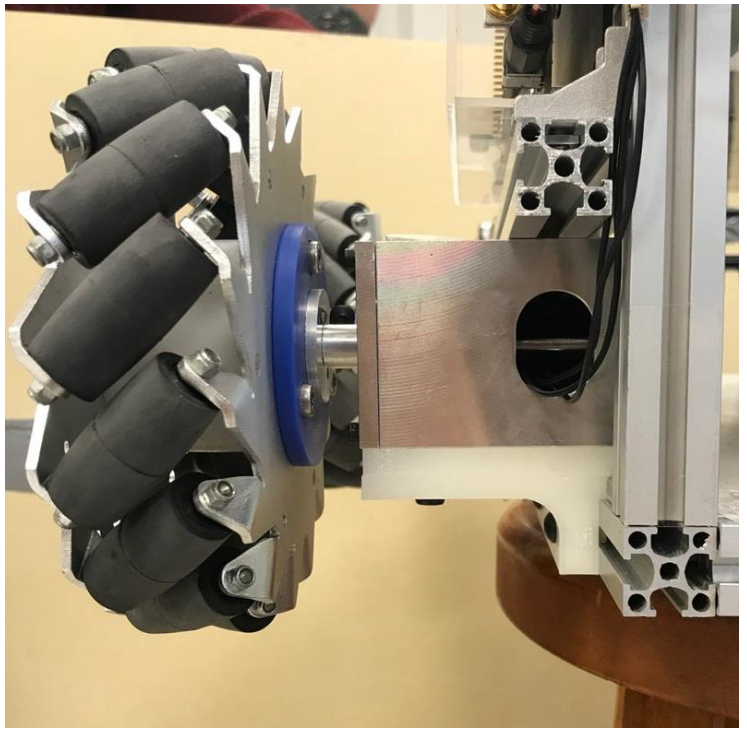
GEARBOX



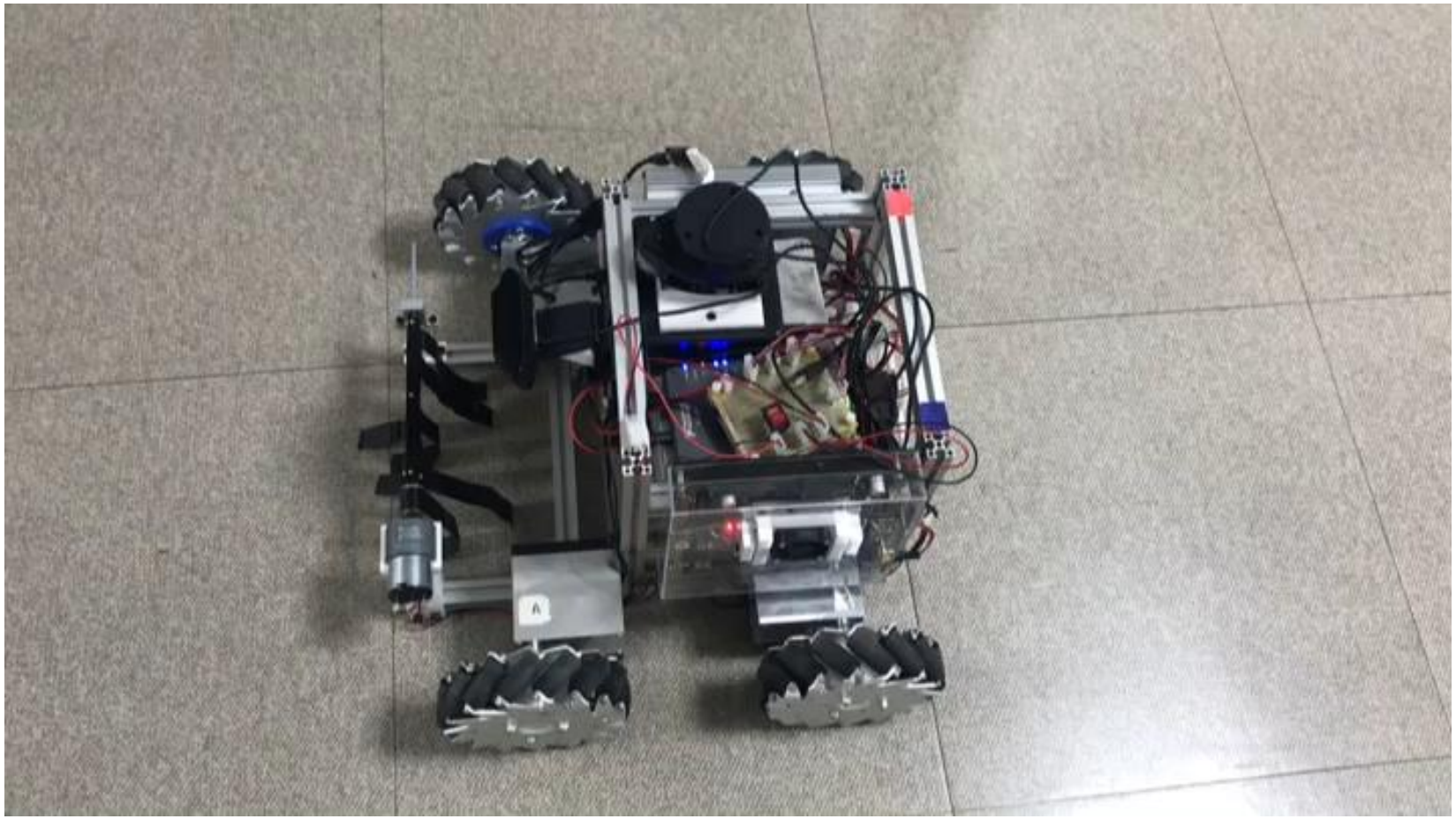
Steel

Steel
(heat-treated)

Aluminum



IMPLEMETATION



CHALLENGE

CONTRADICTION

40

15

BUT....

High speed → Stop

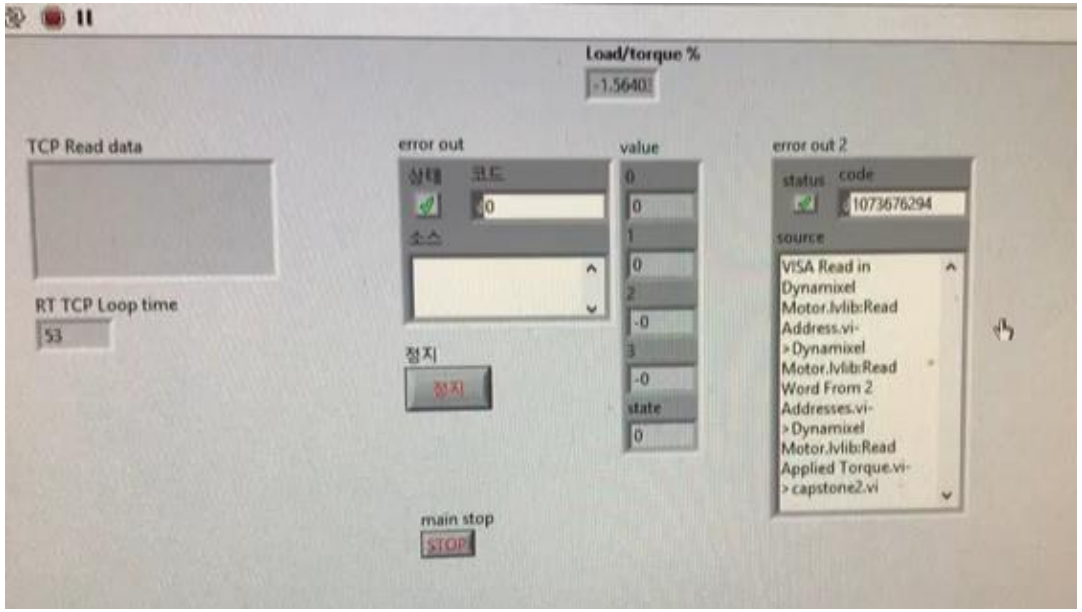
HIGH speed

DAMAGE motor

CONTRADICTION

Sudden stop from high speed requires large torque to be applied from the motor

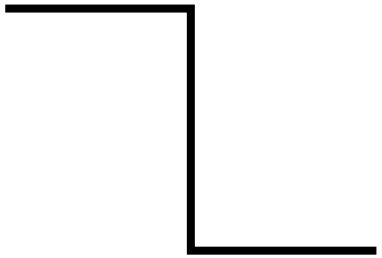
When we checked the torque applied using LabVIEW, it goes over the limit and error occurs



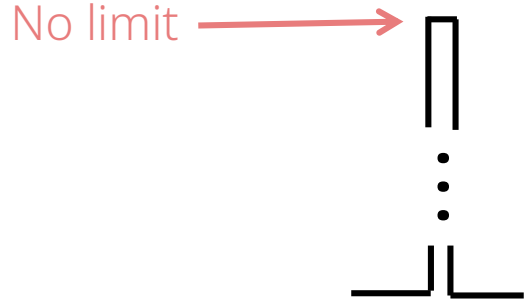
HYPOTHESIS

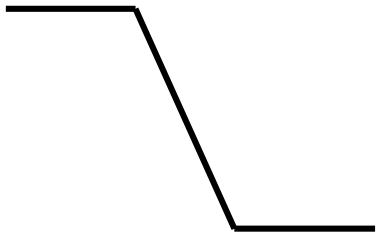
$$T = I \times \alpha$$

Angular velocity

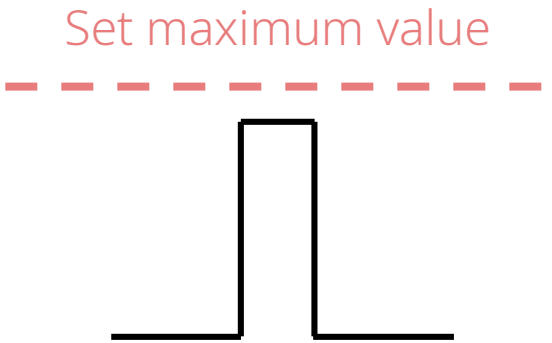


Angular acceleration

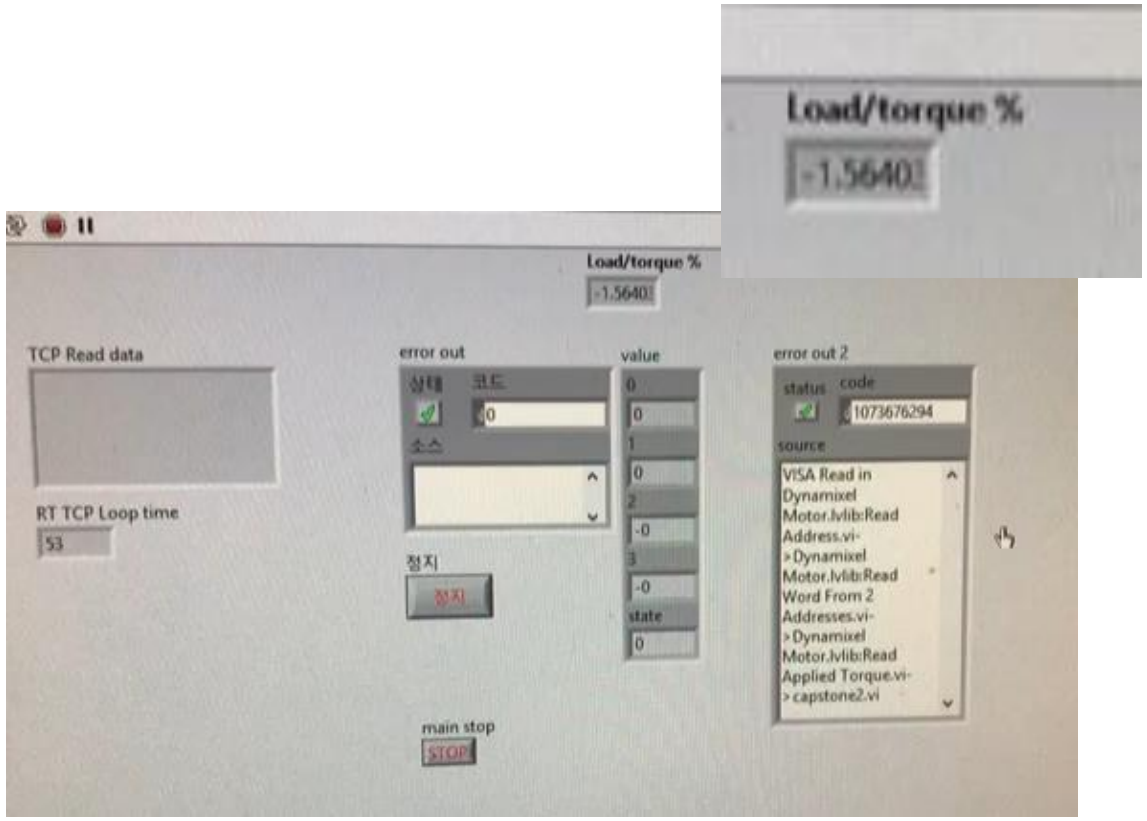




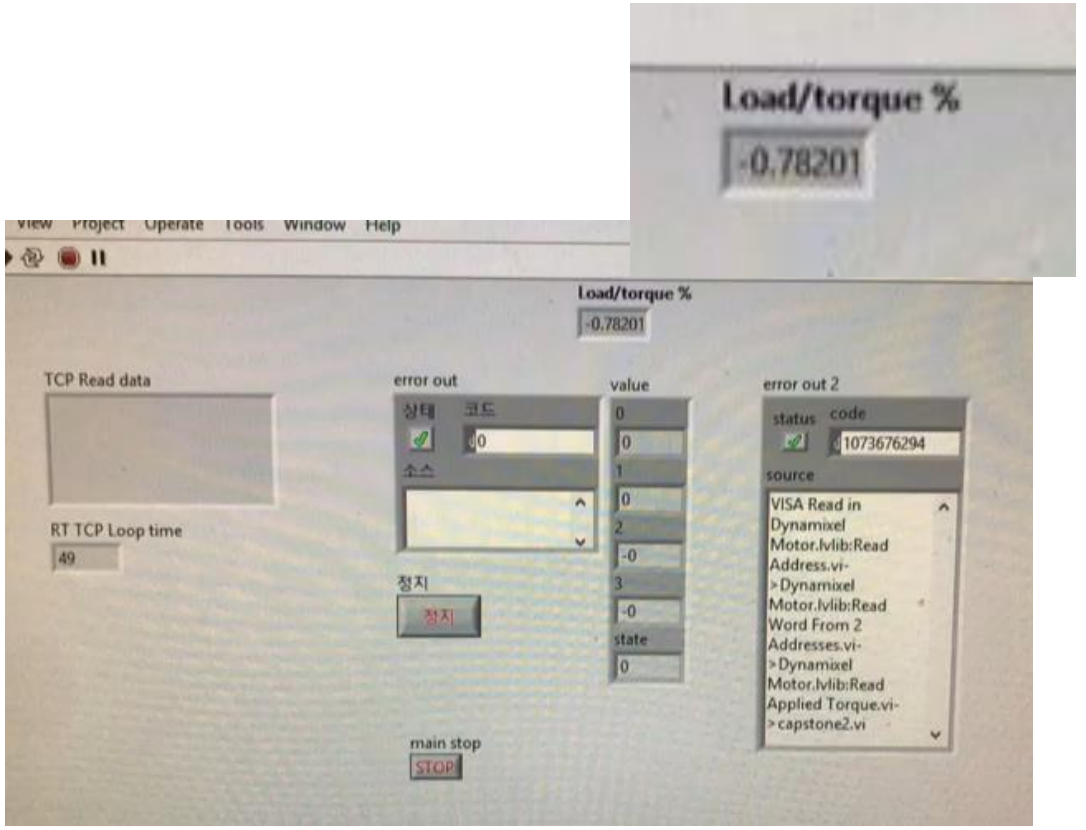
Set maximum value



IMPLEMENTATION

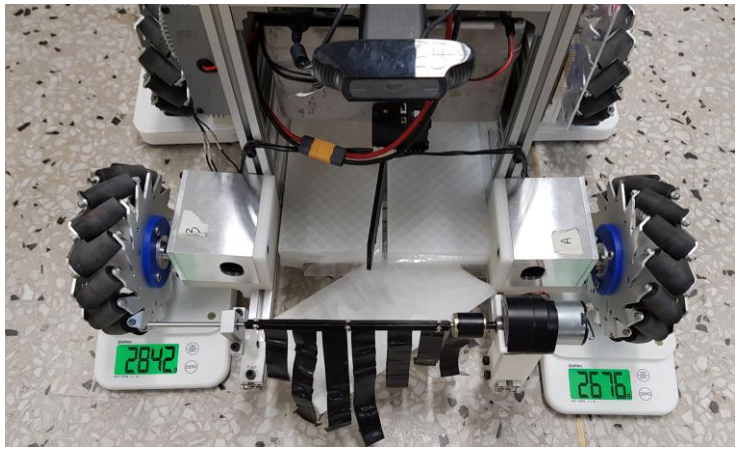


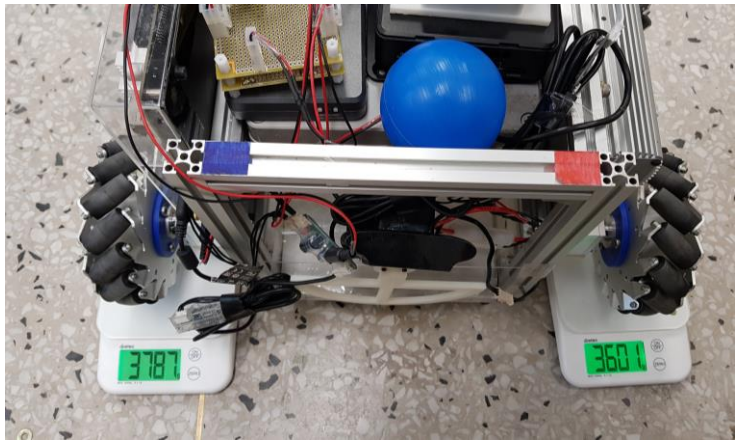
Before control



After control

SUSPENSION





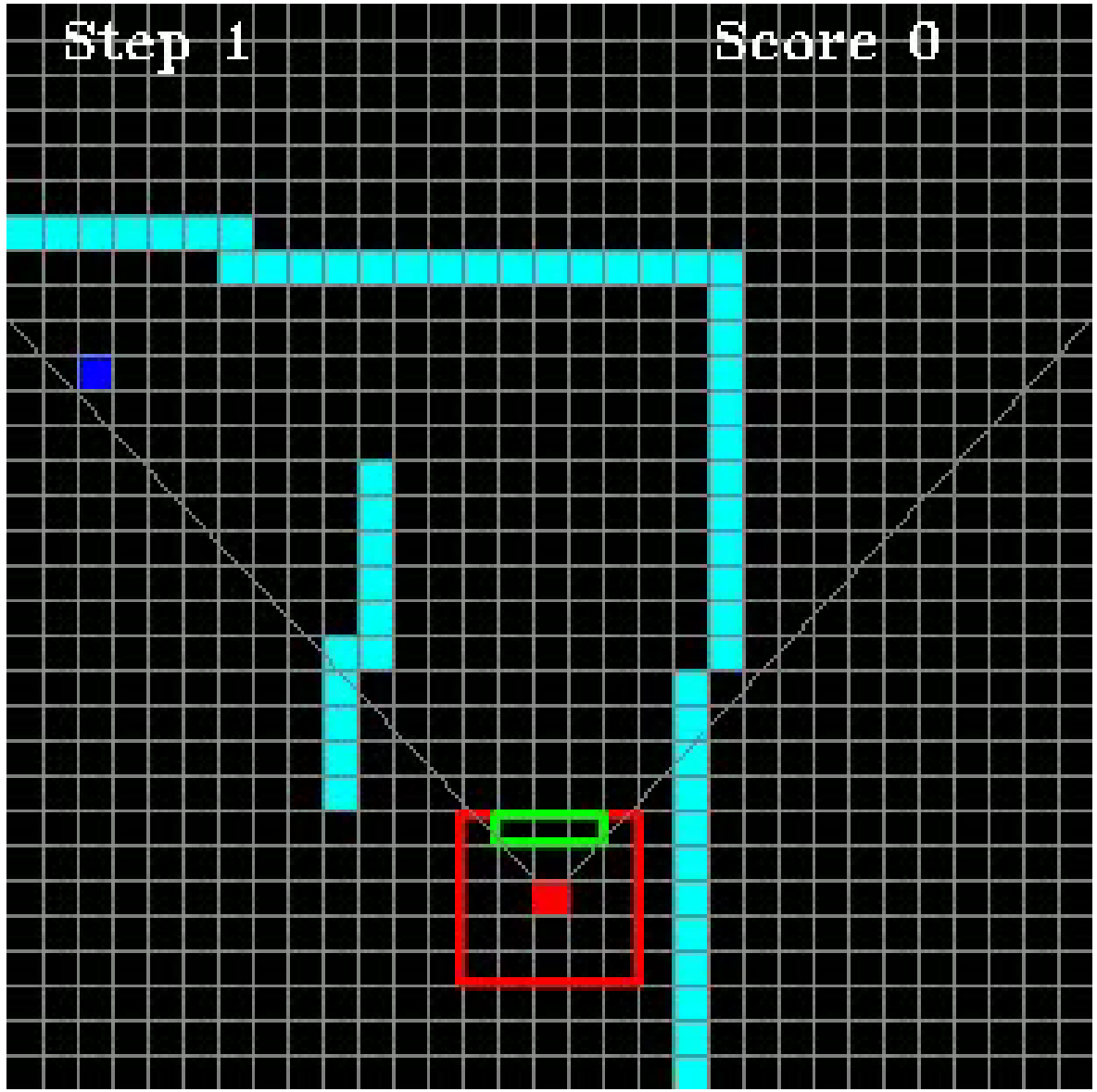
	A	B	C	D
control group	2676	2842	3787	3601
A +3mm	3713	1815	2802	4573
B +3mm	1830	3731	4582	2763
C +3mm	1533	4085	4982	2308
D +3mm	3231	2294	3191	4195
A -3mm	1328	4252	5000<	2321
B -3mm	3177	2394	3278	4140
C -3mm	3005	2558	3404	4017
D -3mm	1384	4121	5000<	2356

SOFTWARE SYSTEM

DQN

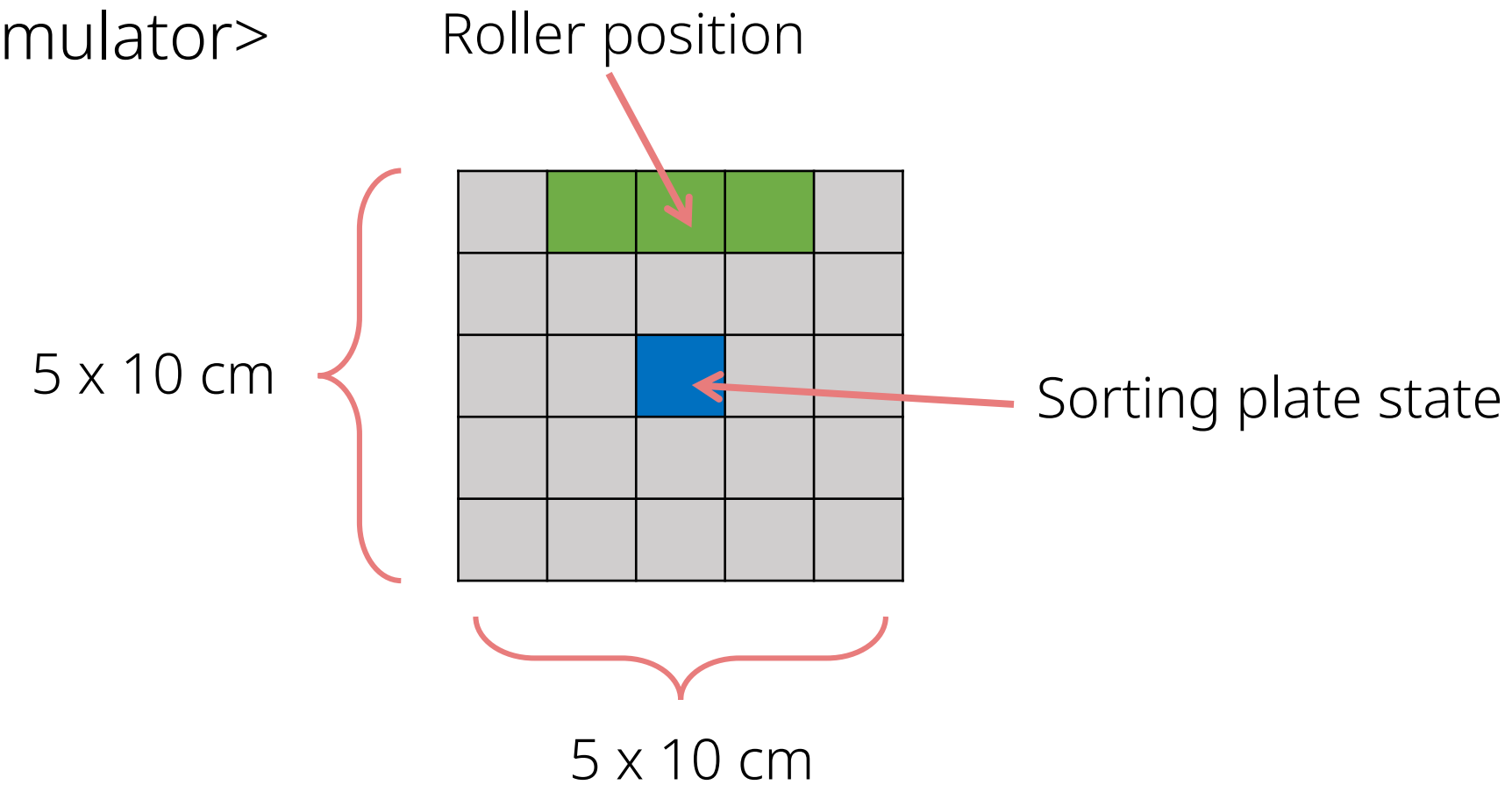
SIMULATION

- Sorting plate position
- Roller



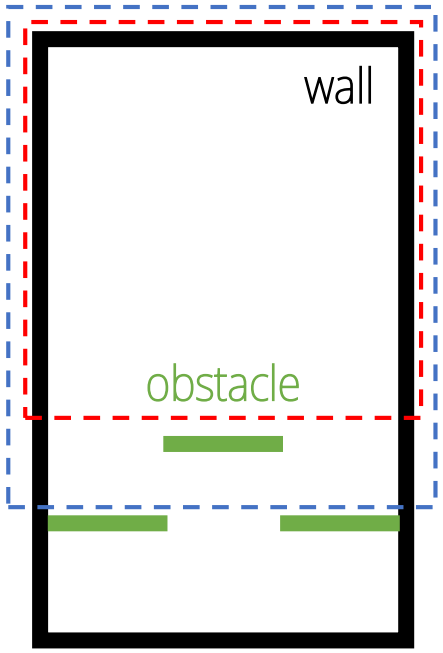
SIMULATION

<Robot simulator>



MAP STRATEGY

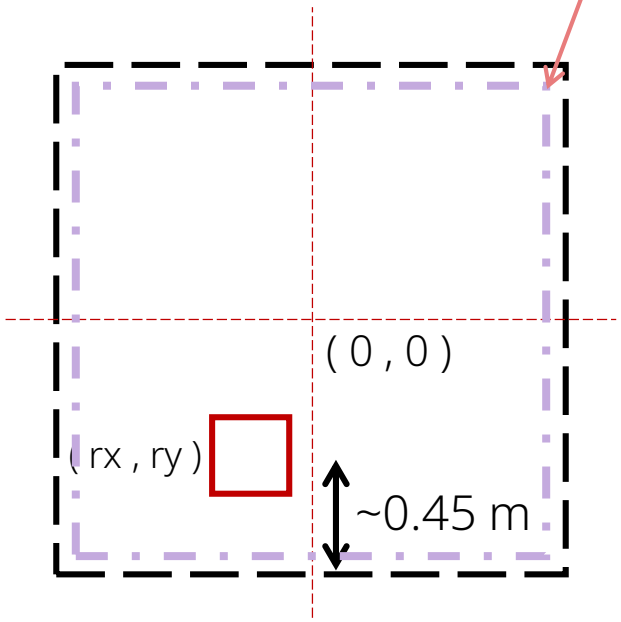
3 types of map will be appear randomly



<Actual structure>

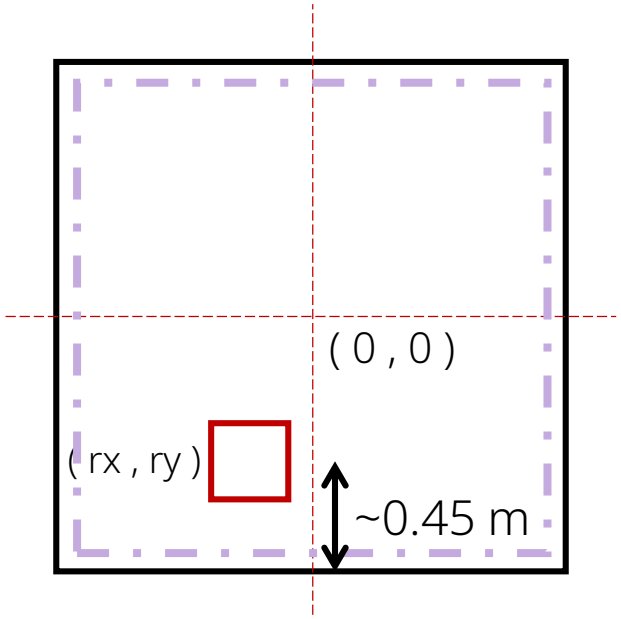
Ball safety margin

i) No walls



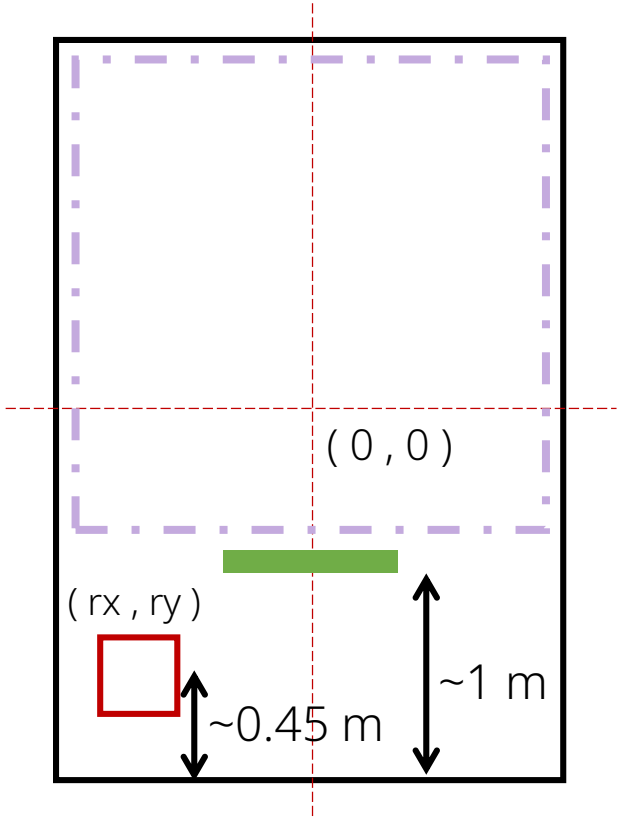
width = 2.5~3.5 m
length = 2.5~3.5 m

ii) Walls without obstacles



width = 2.5~3.5 m
length = 2.5~3.5 m

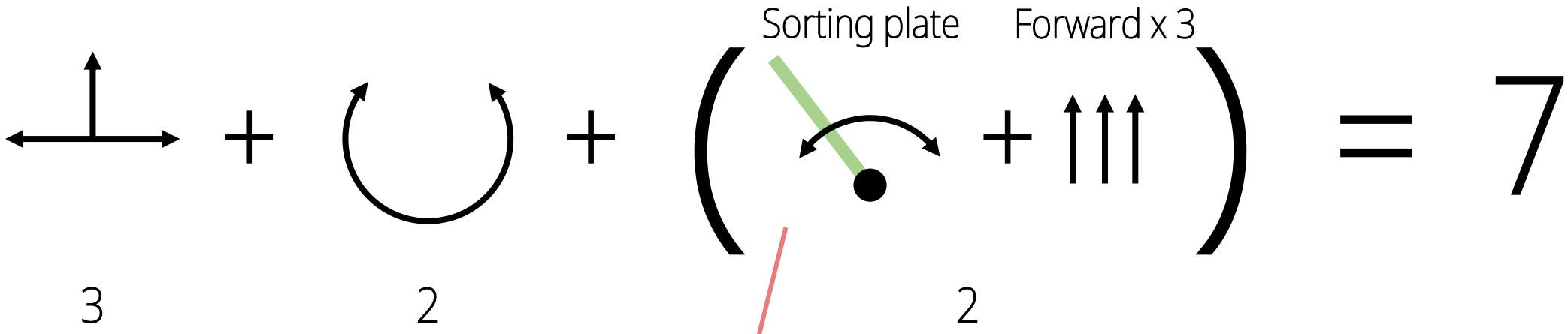
iii) Walls with obstacles



width = 2.5~3.5
length = 3.5~4.5 m

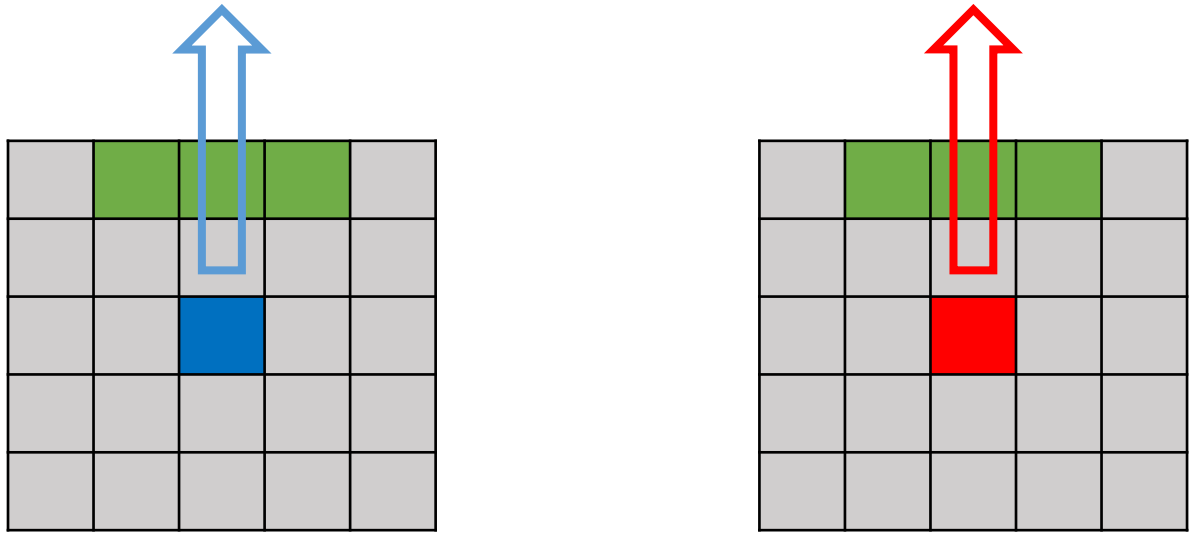
ACTION

SUPER FORWARD MOTION



LEARNING STRATEGY #1

SUPER Forward motion:
Move 3 pixels in forward-direction

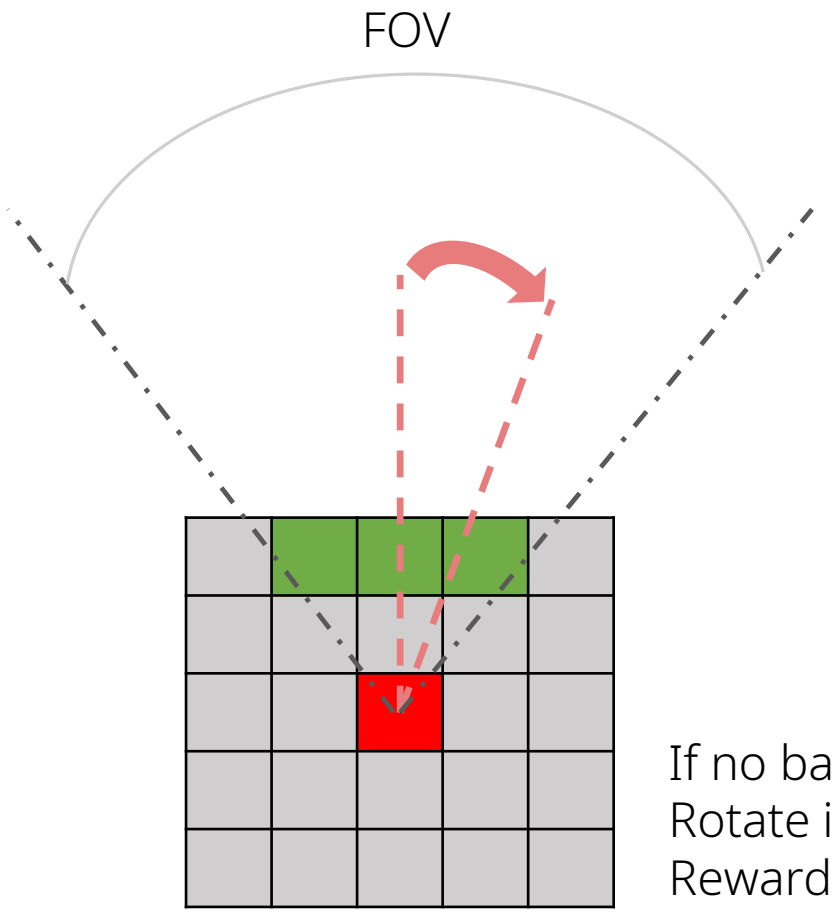


When the robot tries this motion, they got reward -=4 to prevent simulator from abusing super forward motion

If the bots do SUPER Forward motion when picks-up the ball

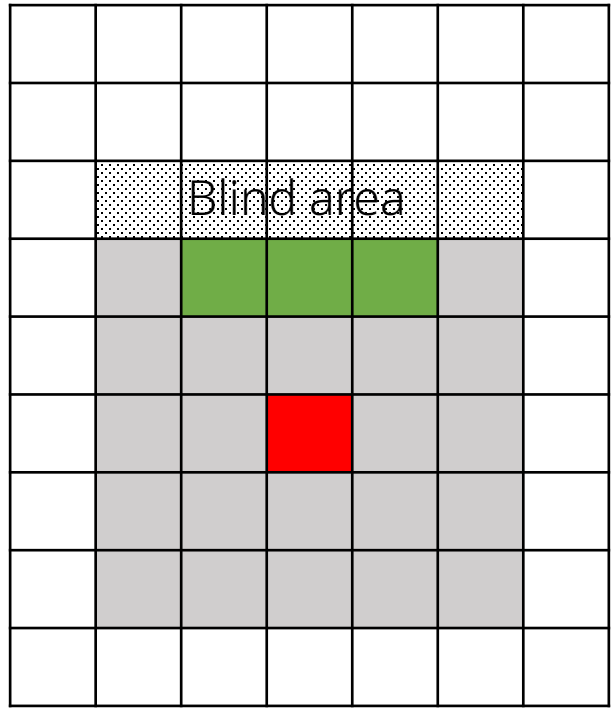
	-5	5	10	5	-5	
	-5	10	20	10	-5	
	-5	5	10	5	-5	
-5						-5
-5						-5
-5						-5
-5						-5
-5						-5
	-5	-5	-5	-5	-5	

LEARNING STRATEGY #2



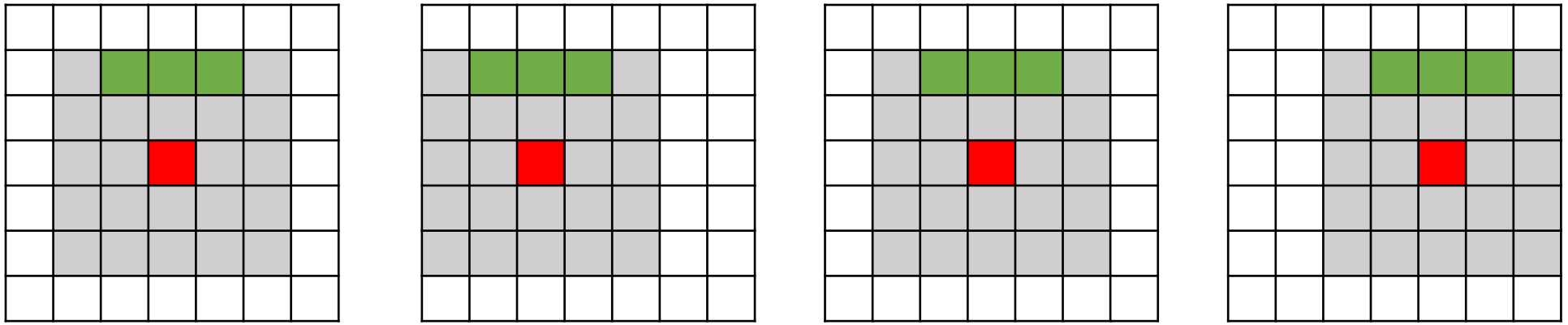
If no balls in screen
Rotate in clockwise direction
Reward +=0.5

Blind Area



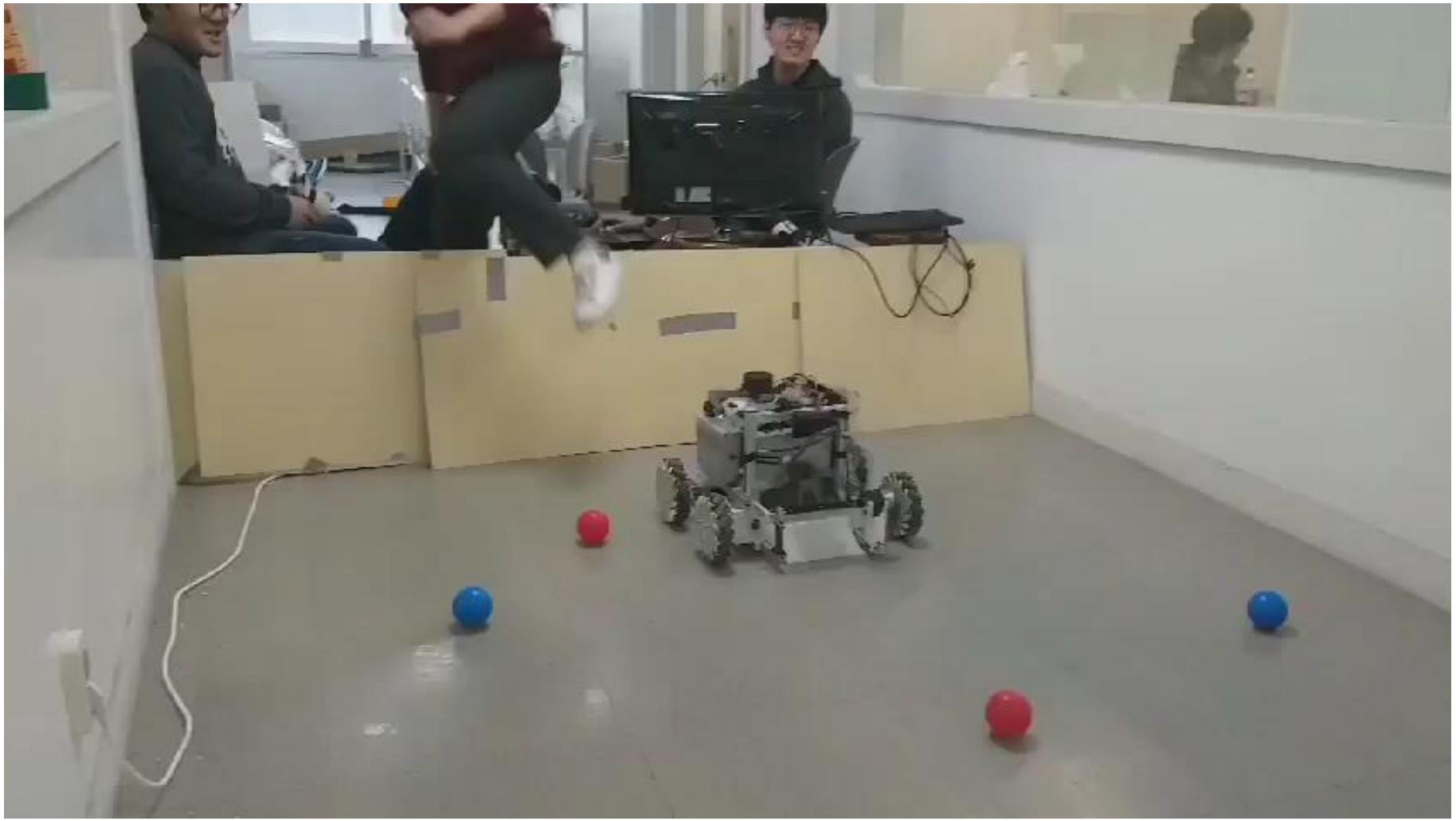
LEARNING STRATEGY #3

Vibrating problem

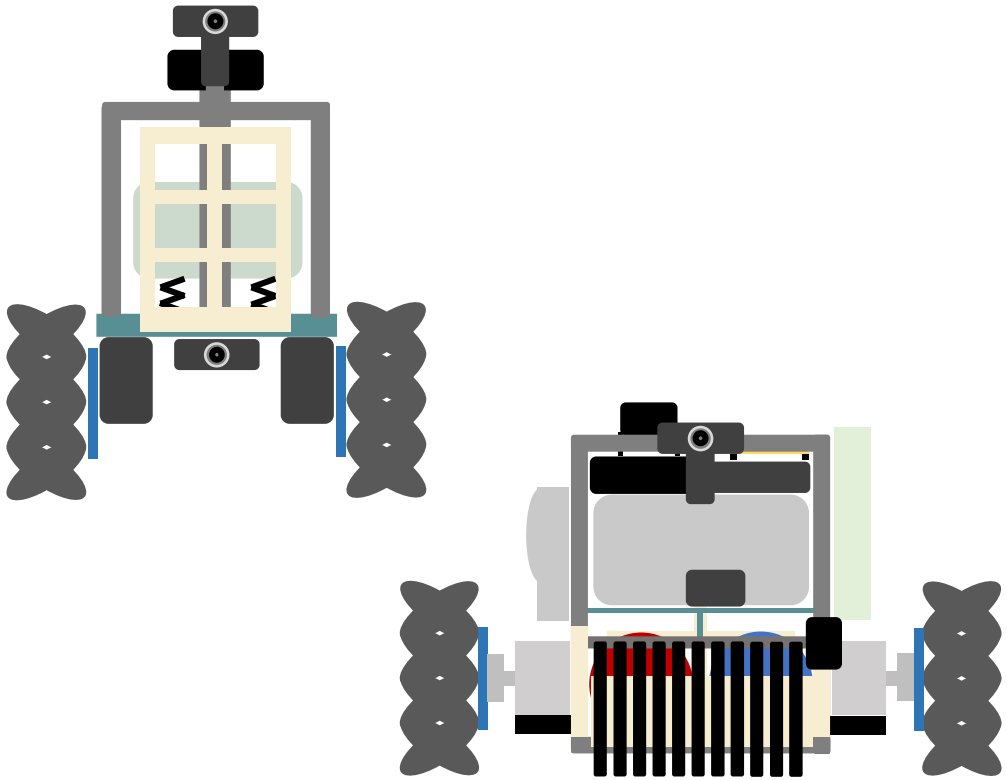


Move only one pixel after 3 steps reward-=0.3

DQN



SENSOR & MOTOR CONTROL VS MACHINE LEARNING



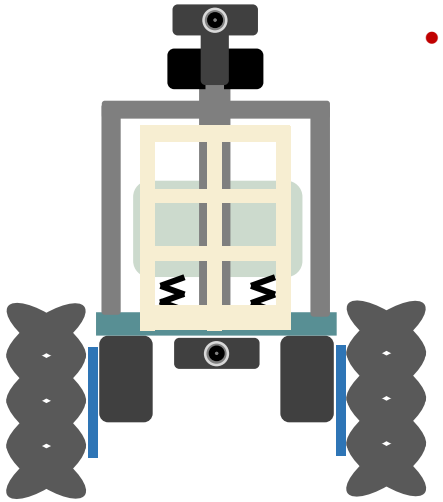
COMPARISON BETWEEN 1&2

Sensor & Motor Control

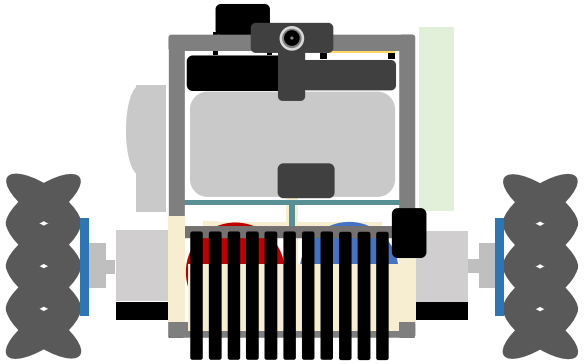
- Control can be continuous and precise
- Take less computing time
- We precisely know our model
- We have to consider all the situation

Machine Learning

- The number of action is finite and limited which can be less precise.
- Take longer time for learning and computing
- It is hard to evaluate as the model created is black box
- It reacts even to the unexpected situation



For simple system, there is no merits using machine learning especially when all the environment and conditions are set clearly



Thank you for listening

Q&A