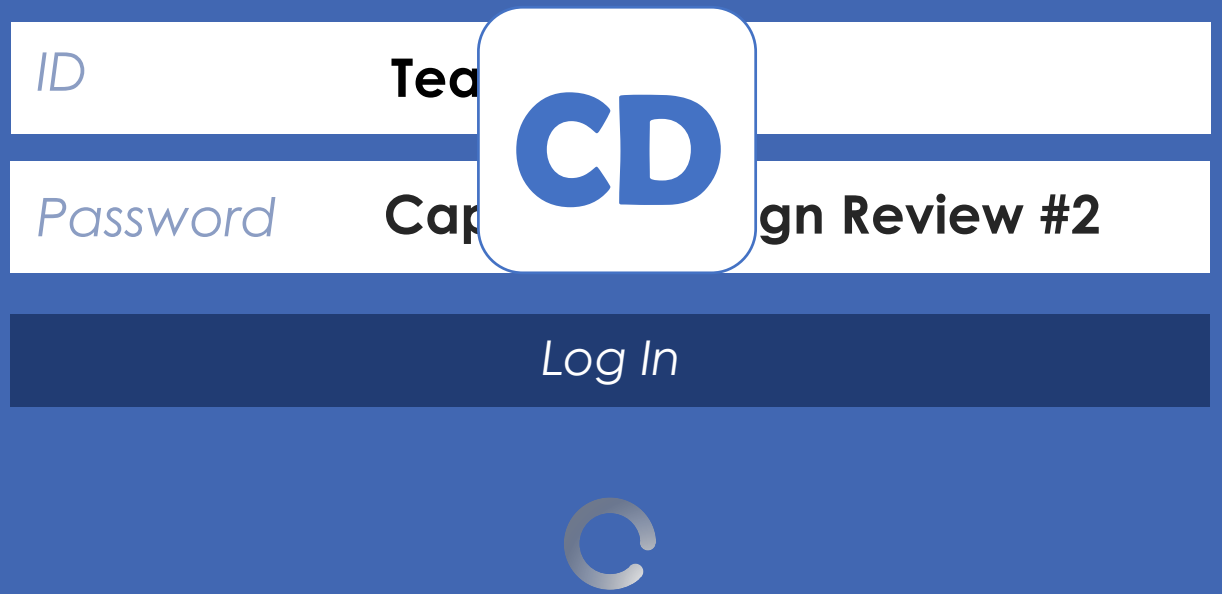
ID
Tea
CD
Password
Cap
gn Review #2
Log In

Members	권영석, 김동현, 김원빈, 김현준, 박태룡, 현규진, Abi, and Fahim

Professor	한순흥	*TA*	한경석

Contents

Team TTB

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- *Hardware part*
- *Software part*
- *Q&A*

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2. **Hardware**

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1 - 2 Frame Fabrication

1 - 3 Collector

1 - 4 Heat Analysis

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1 - 6 Power distribution

Index

2. Software

2 - 1 Overall algorithm

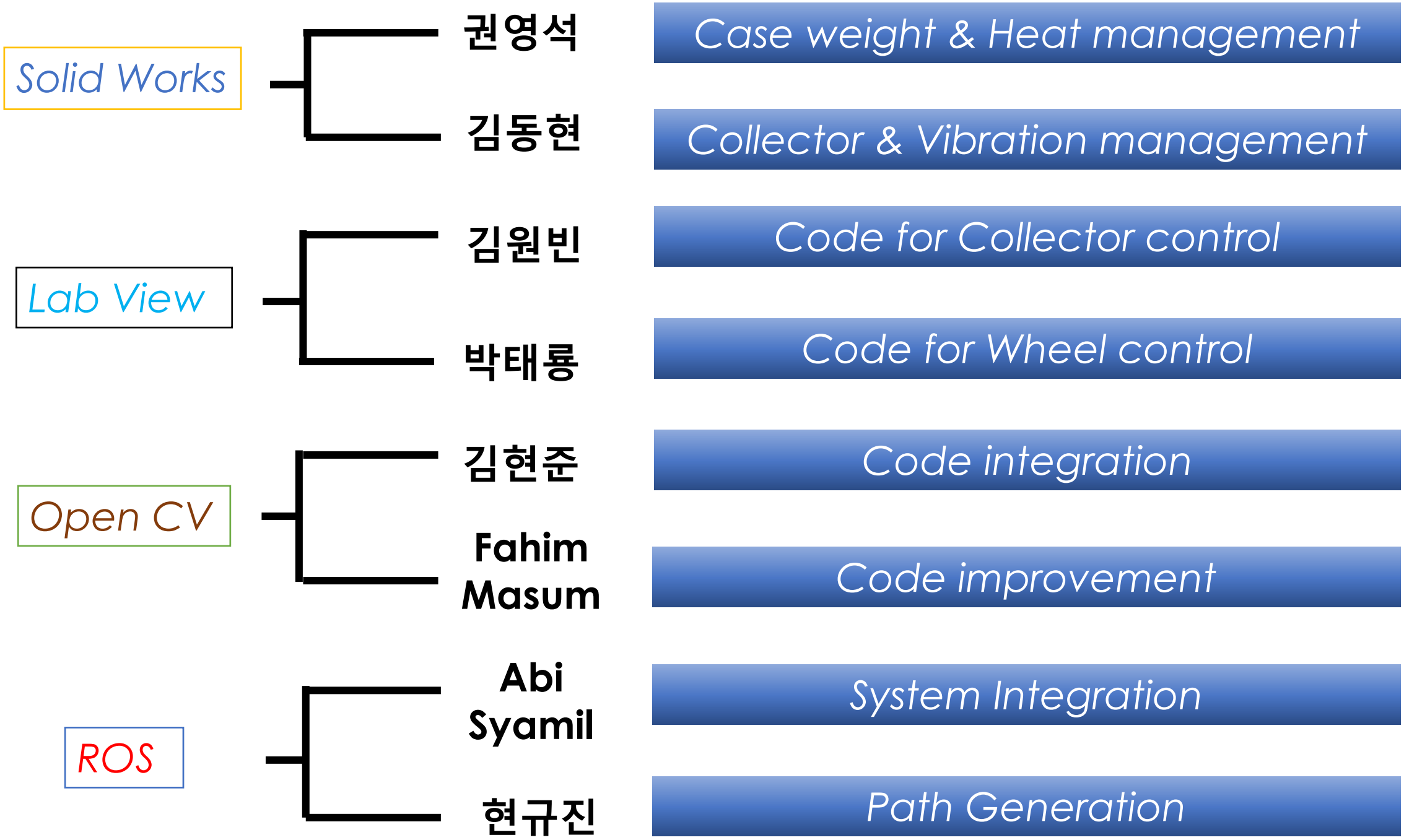
2 - 2 OpenCV

2 - 3 ROS

2 - 4 LabView

3. **Q&A**

4. **Reference**


Solid Works
권영석
Case weight & Heat management
김동현
Collector & Vibration management
Lab View
김원빈
Code for Collector control
박태룡
Code for Wheel control
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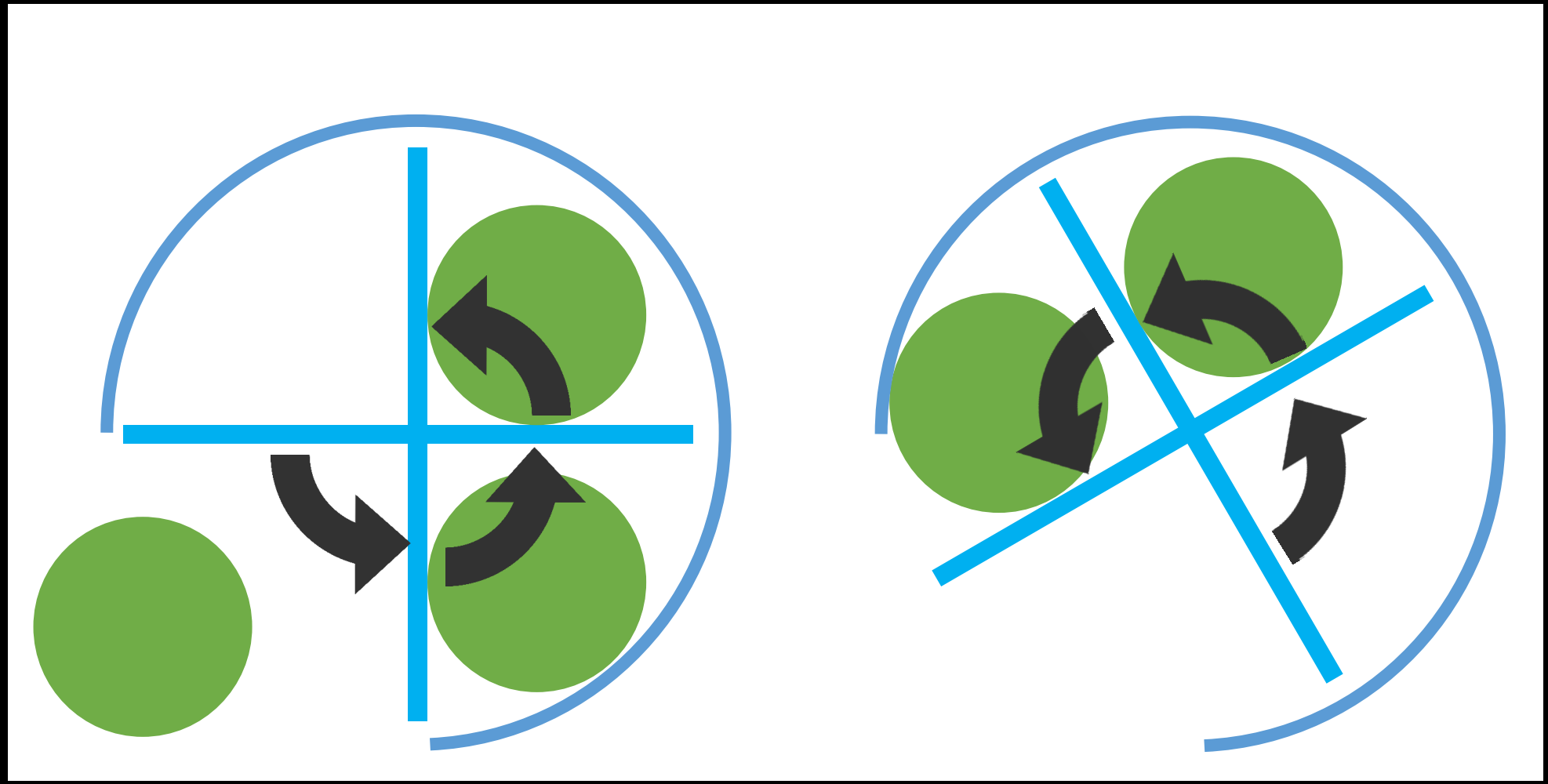
김현준
Code integration
Fahim Masum
Code improvement
ROS
Abi Syamil
System Integration
현규진
Path Generation

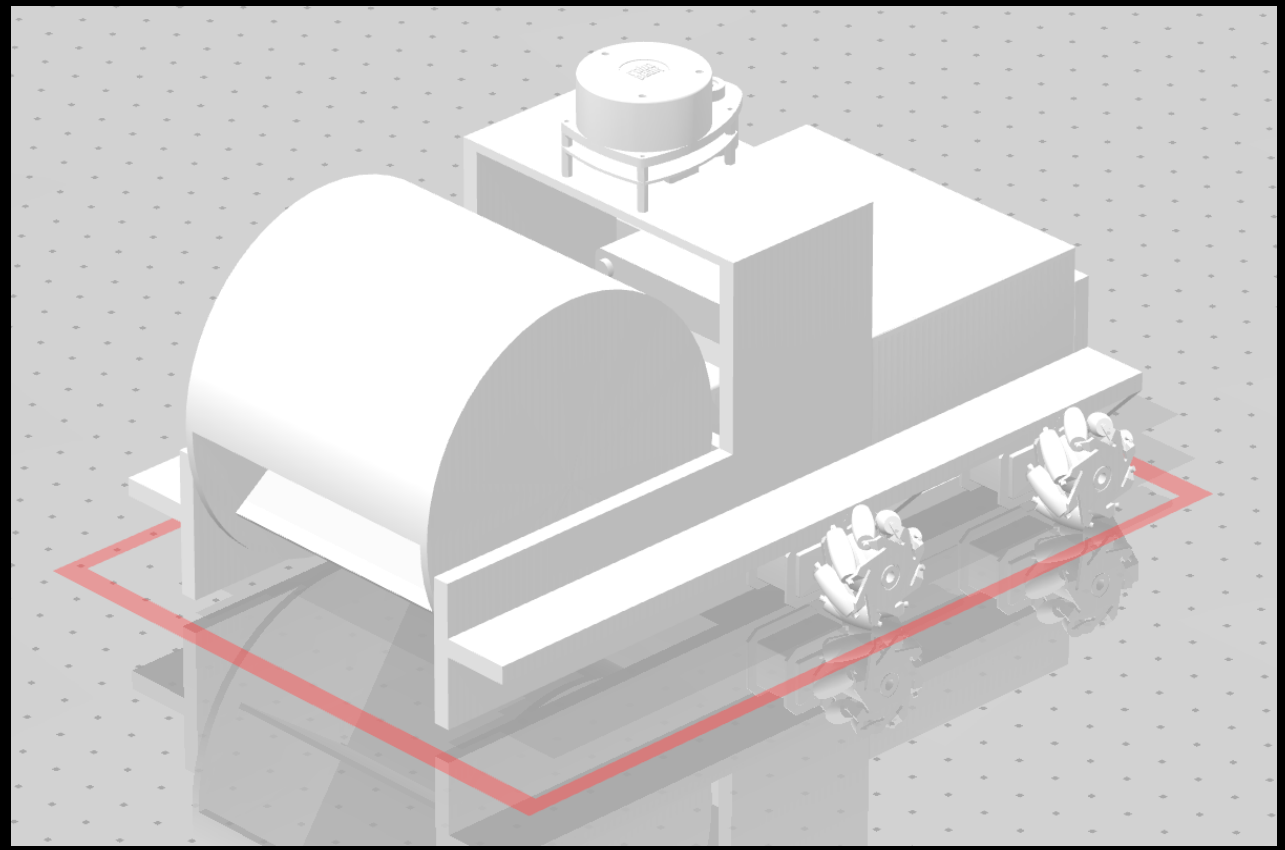
Generated Concept: Collector



좋아요

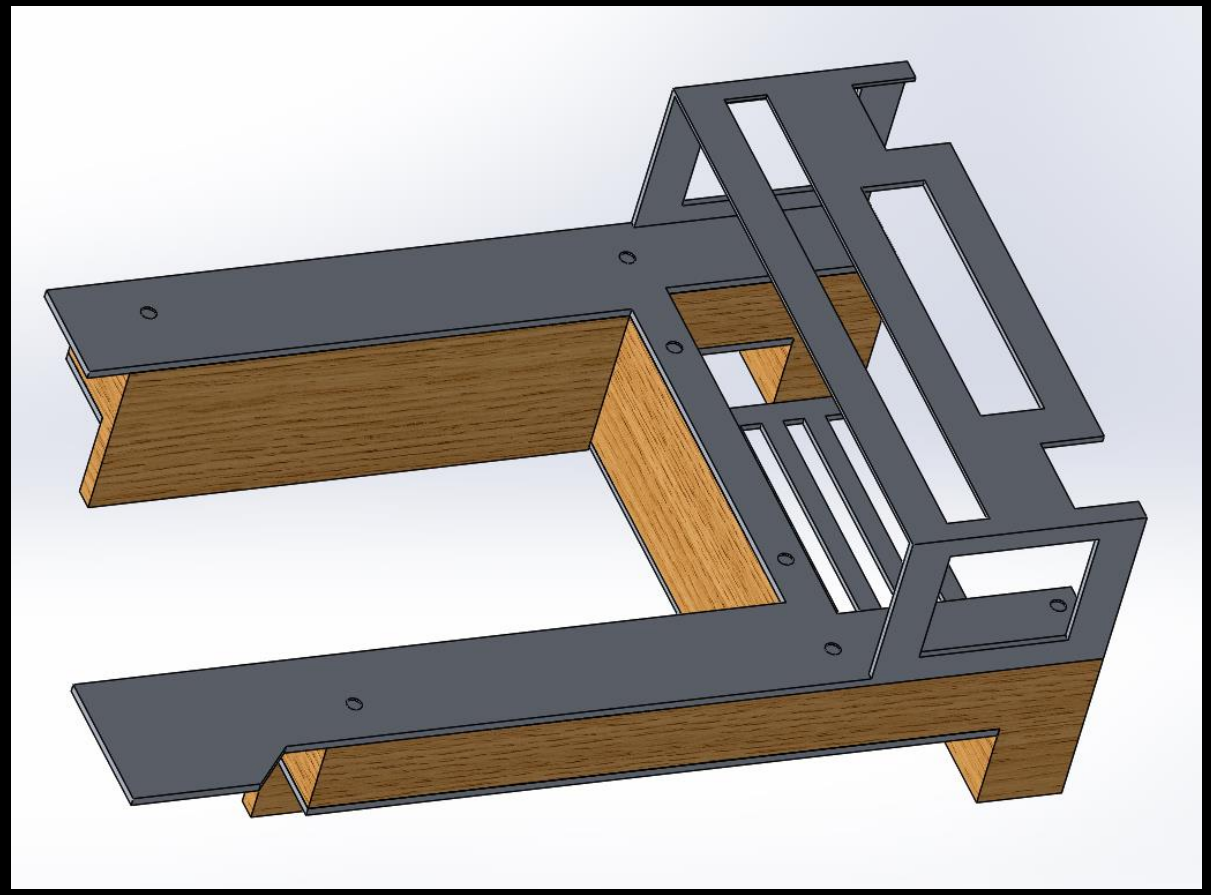
댓글 달기

Generated Concept: Structure



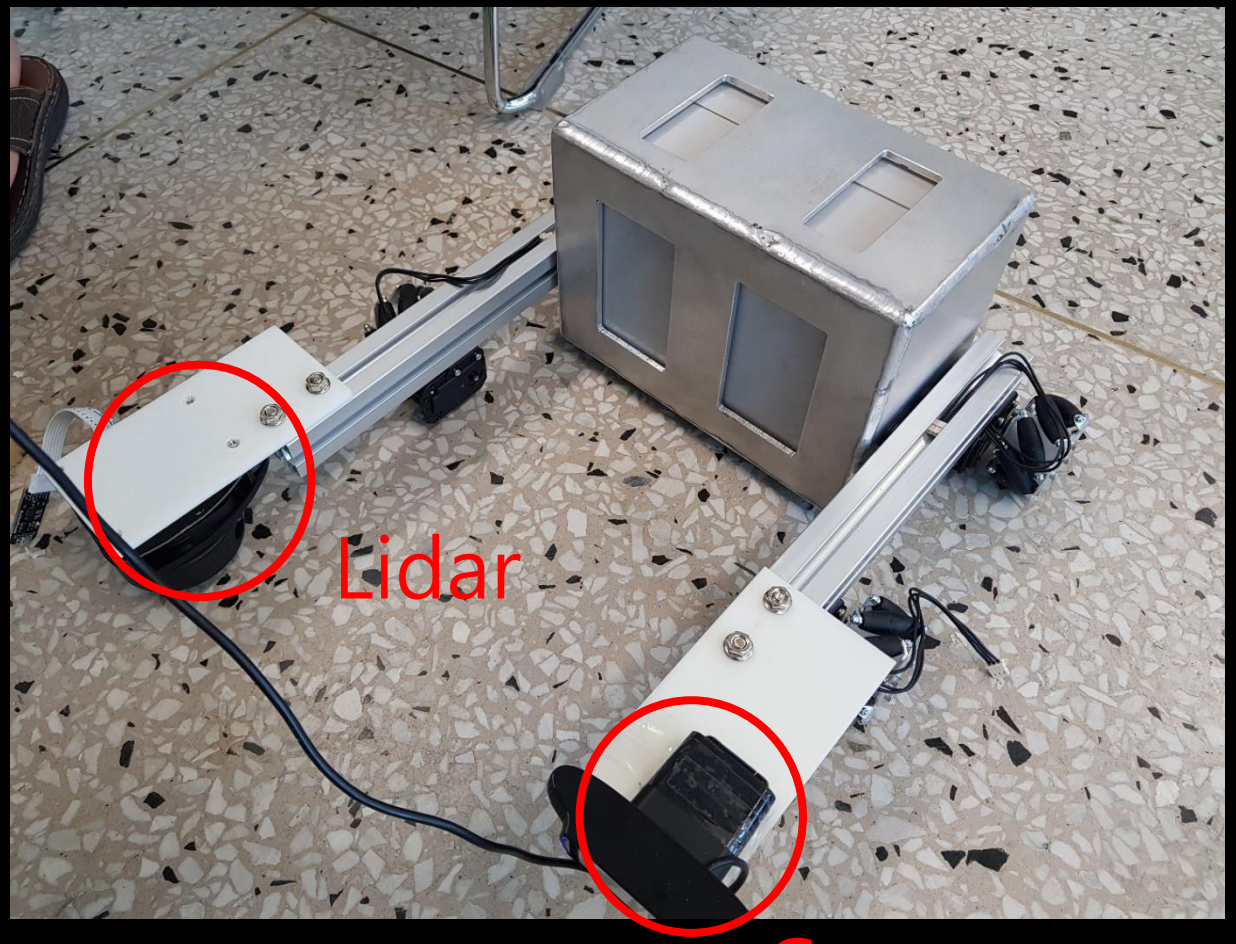
- *Use only one motor to collect balls*
- *Collection & Storing & Disposal integrated into one component*
- *Walls around battery are eliminated for convection & flexibility in heat removal design*

Frame fabrication



- *Tried to use wood for weight reduction*
- *Difficulties in fabrication →*
  Replaced it with Al profiles

Frame fabrication



- *Inefficient cooling*
- *Heavy (5.5~6.0kg expected)*
- *Minor problems*
  (ex: too small tolerances, etc)

좋아요

댓글 달기

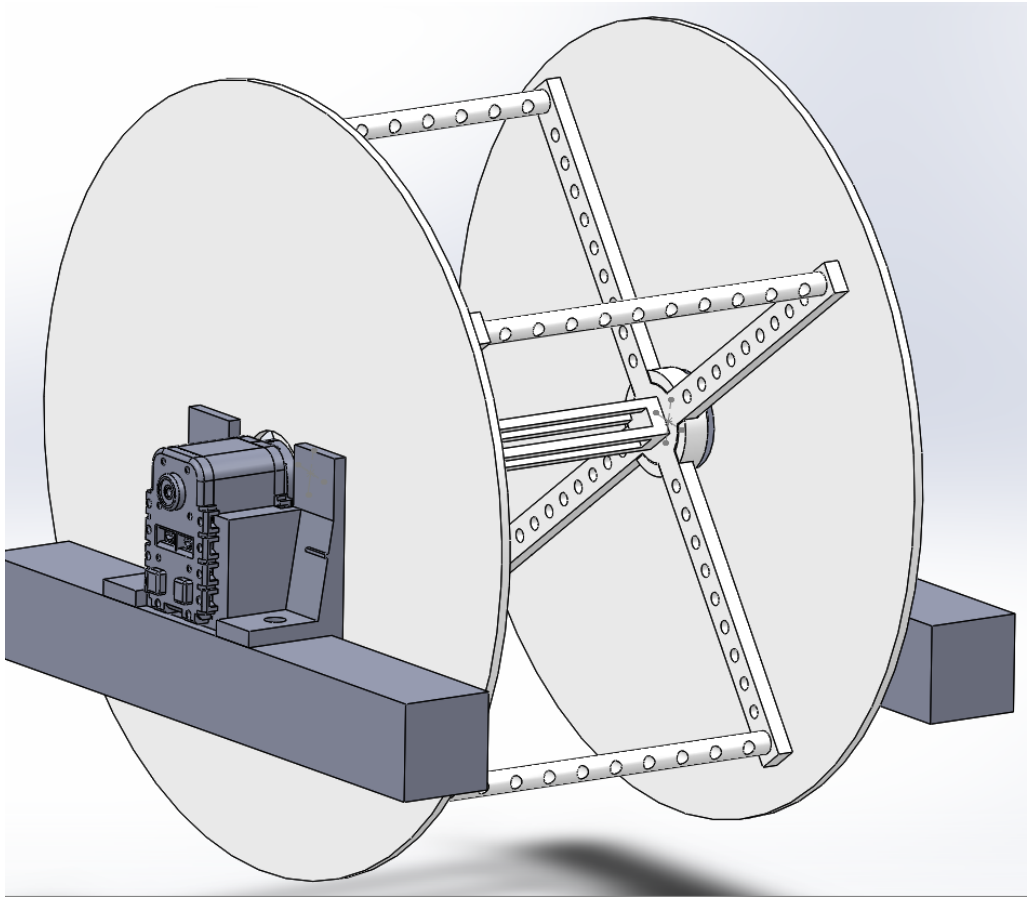
Frame fabrication

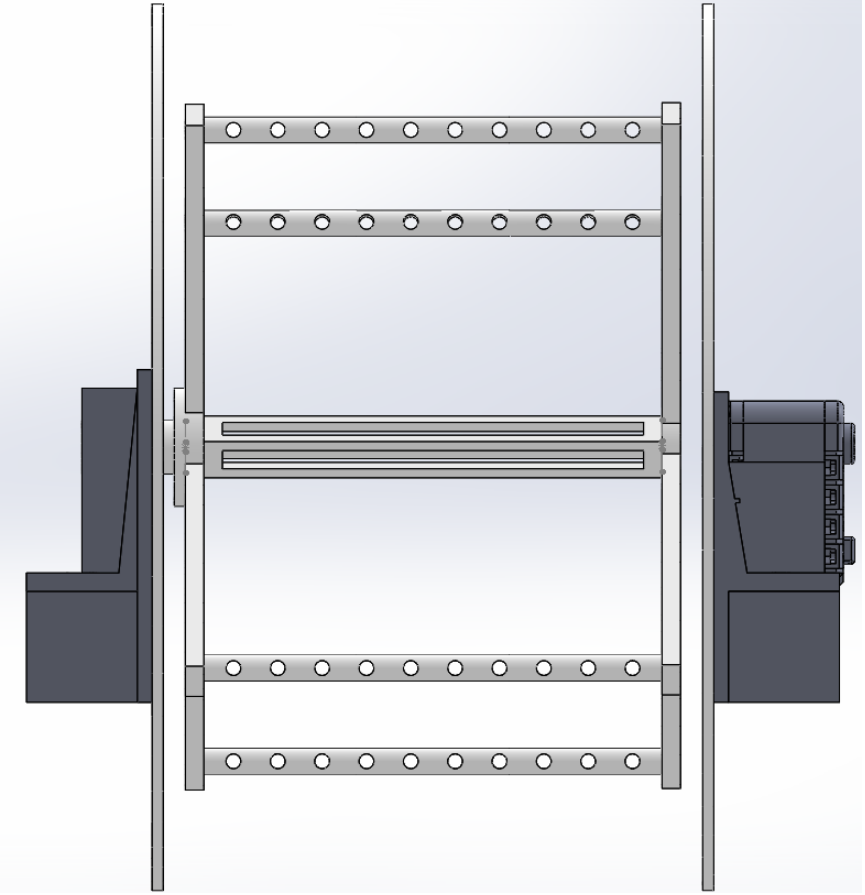
- *Flexibility in cooling method*
- *Less heavier*
  (5.0~5.5kg expected)
- *Problems in wheel – ground contact*
- *Suspension system will be implemented*

좋아요

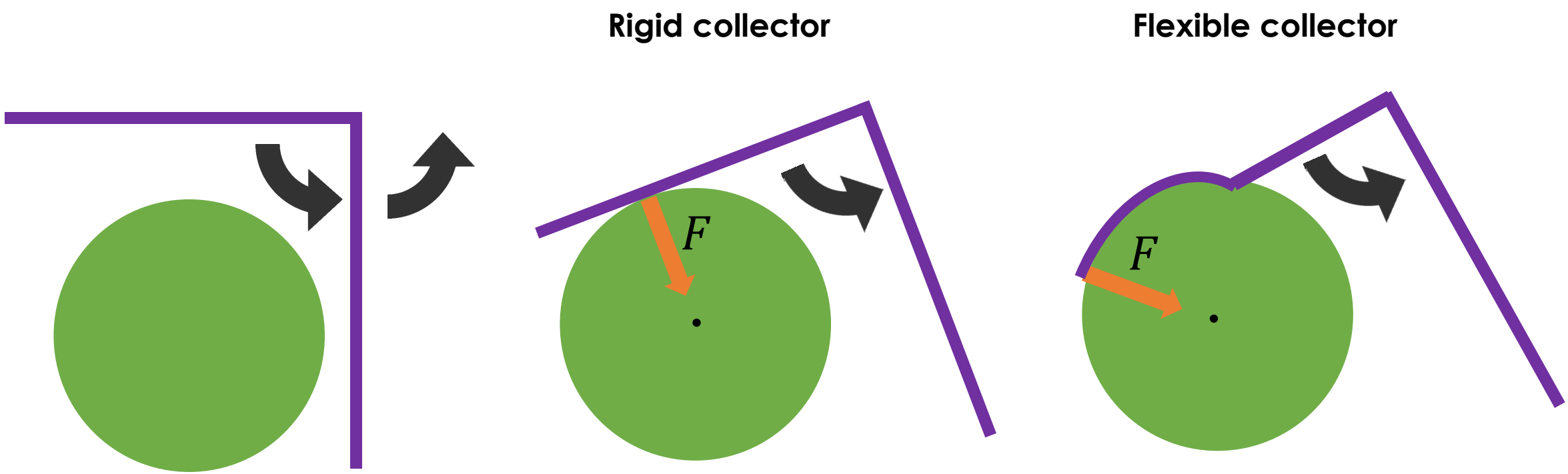
댓글 달기

Collector





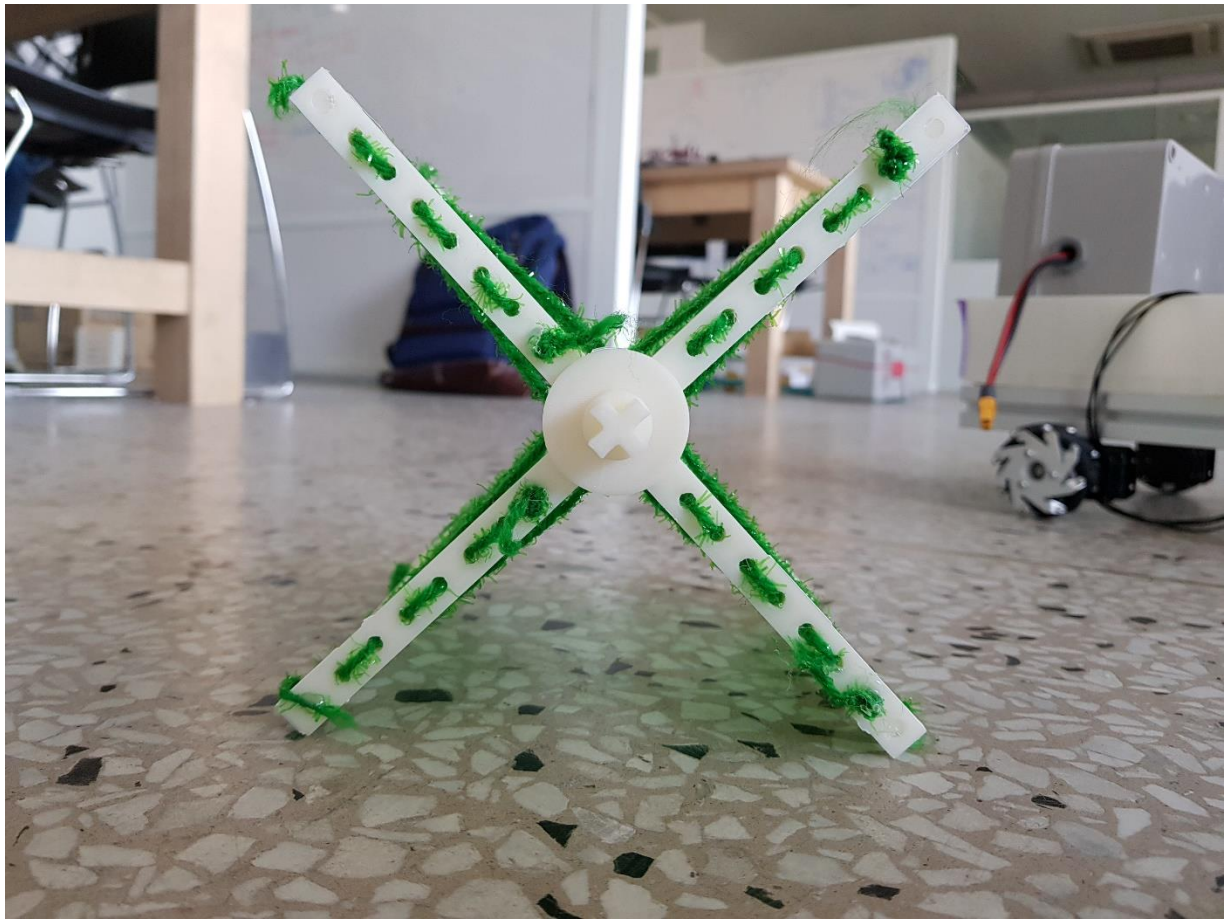
- *Maximize the radius & axis length under geometrical limit*

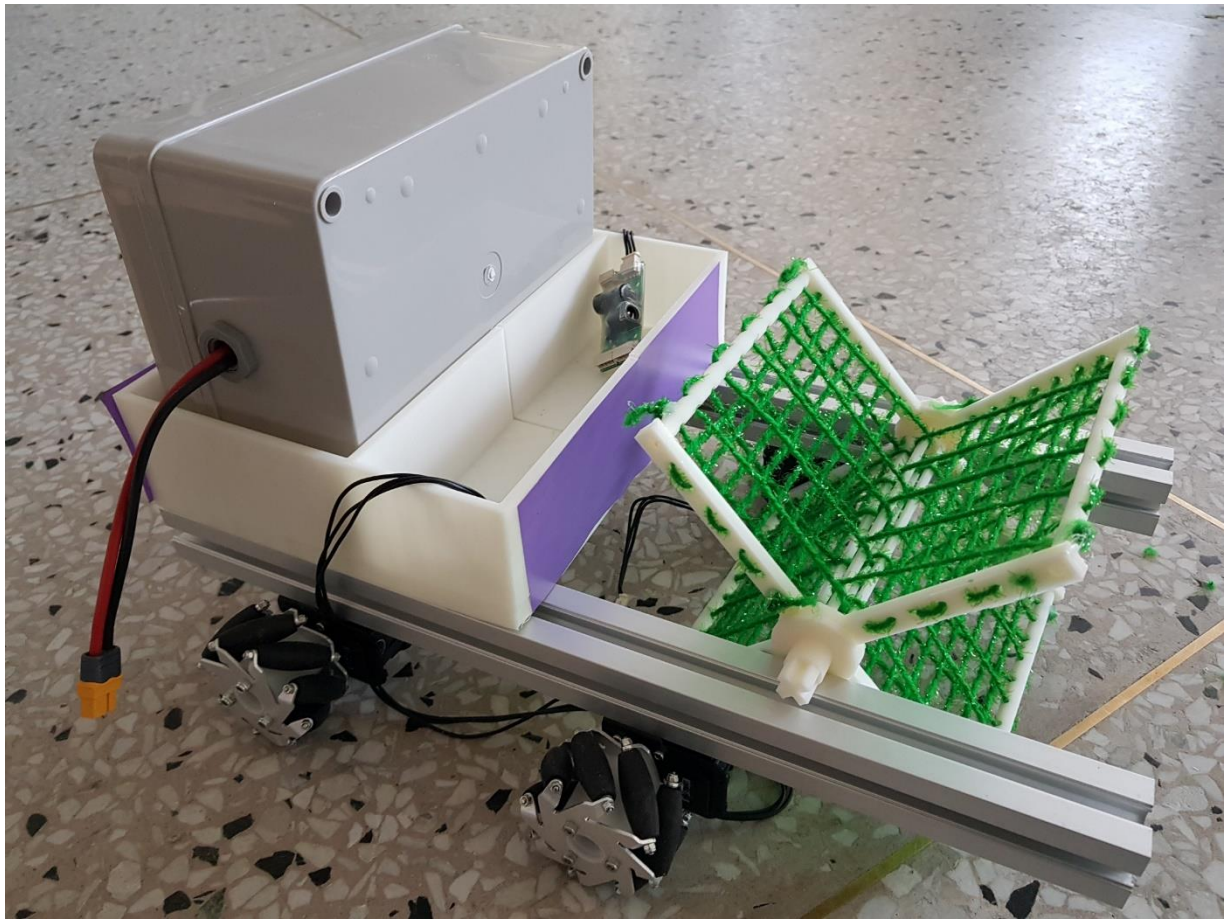


Flexible collector can generate larger x-direction force (desirable), while generating smaller y-direction force (causes friction, and undesirable)

-> Adopted flexible material

Collector





- *Now under construction*

Heat Analysis

Assumptions

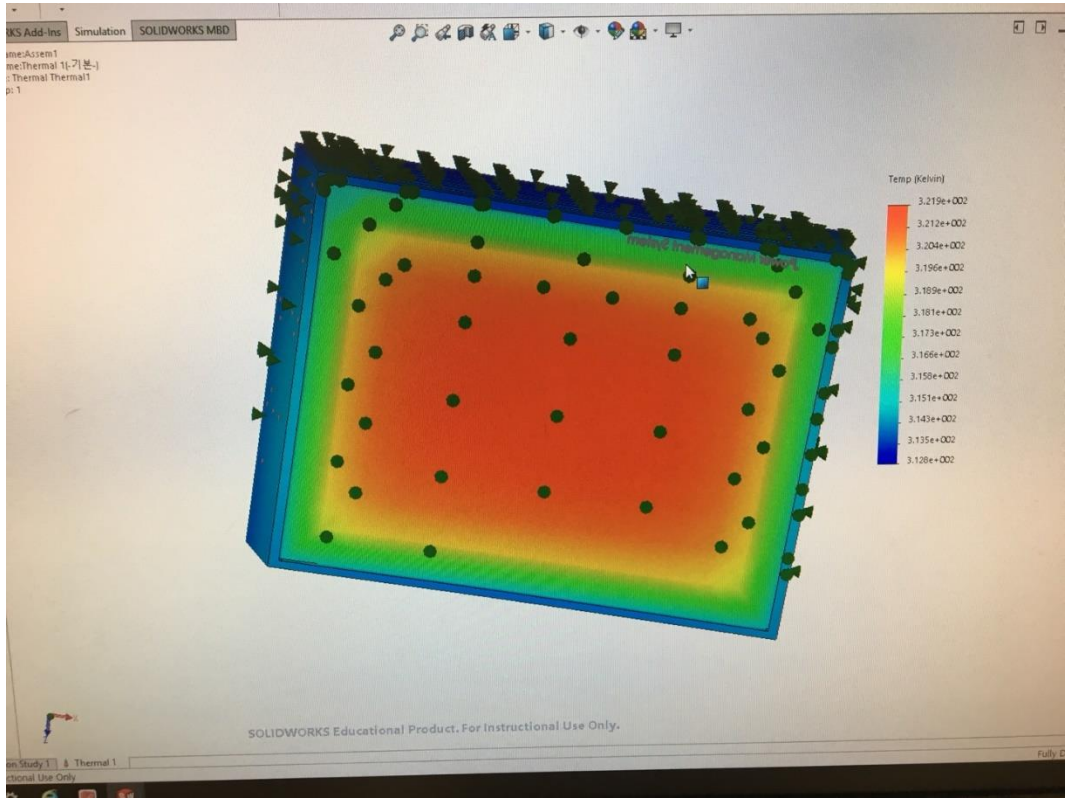
1. Same Heat Power from Battery

2. Heat transfer between Air & battery& Case (Convection&Conduction)

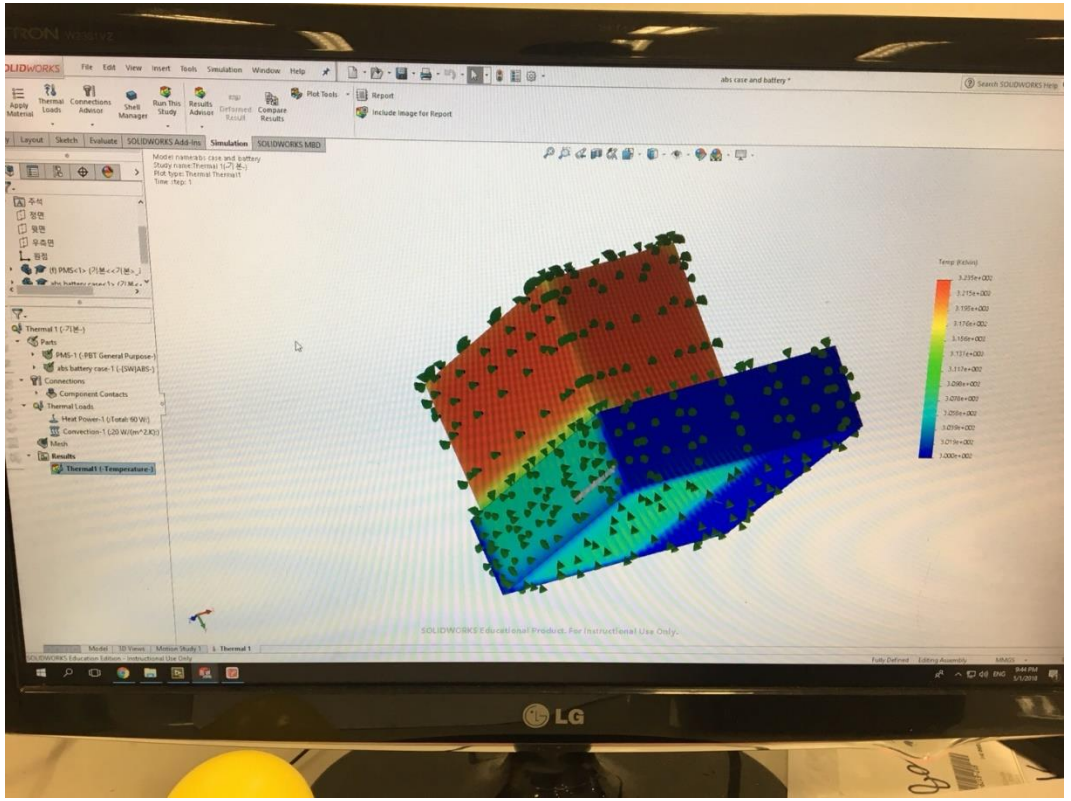
3. Neglect Forced Convection

Heat Analysis

Al Case & battery

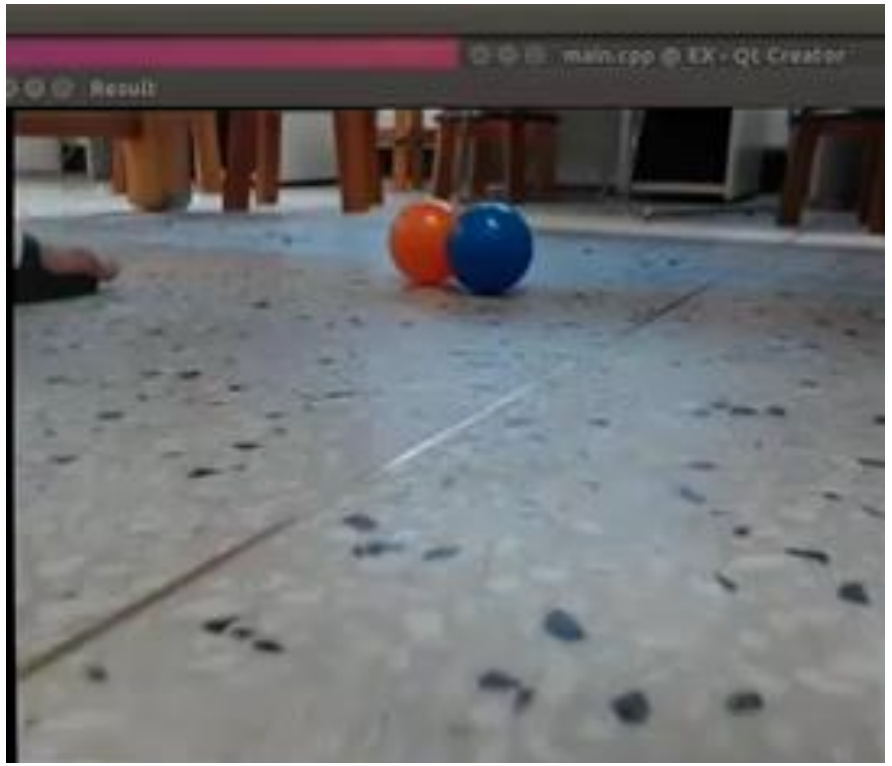


Abs plastic Case & battery

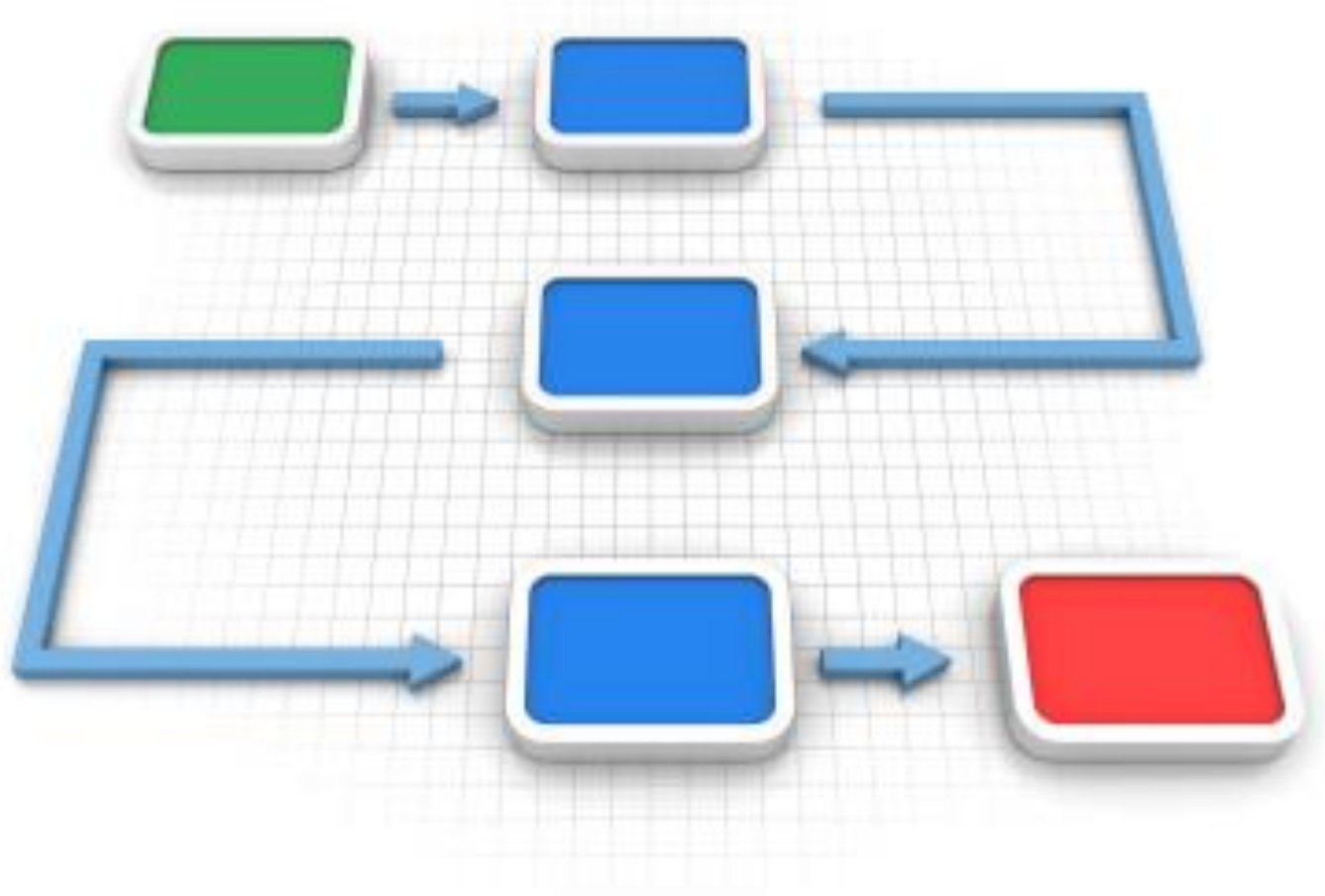


Result : Negligible temperature difference (Almost 1.6 K) -> Use lighter case!

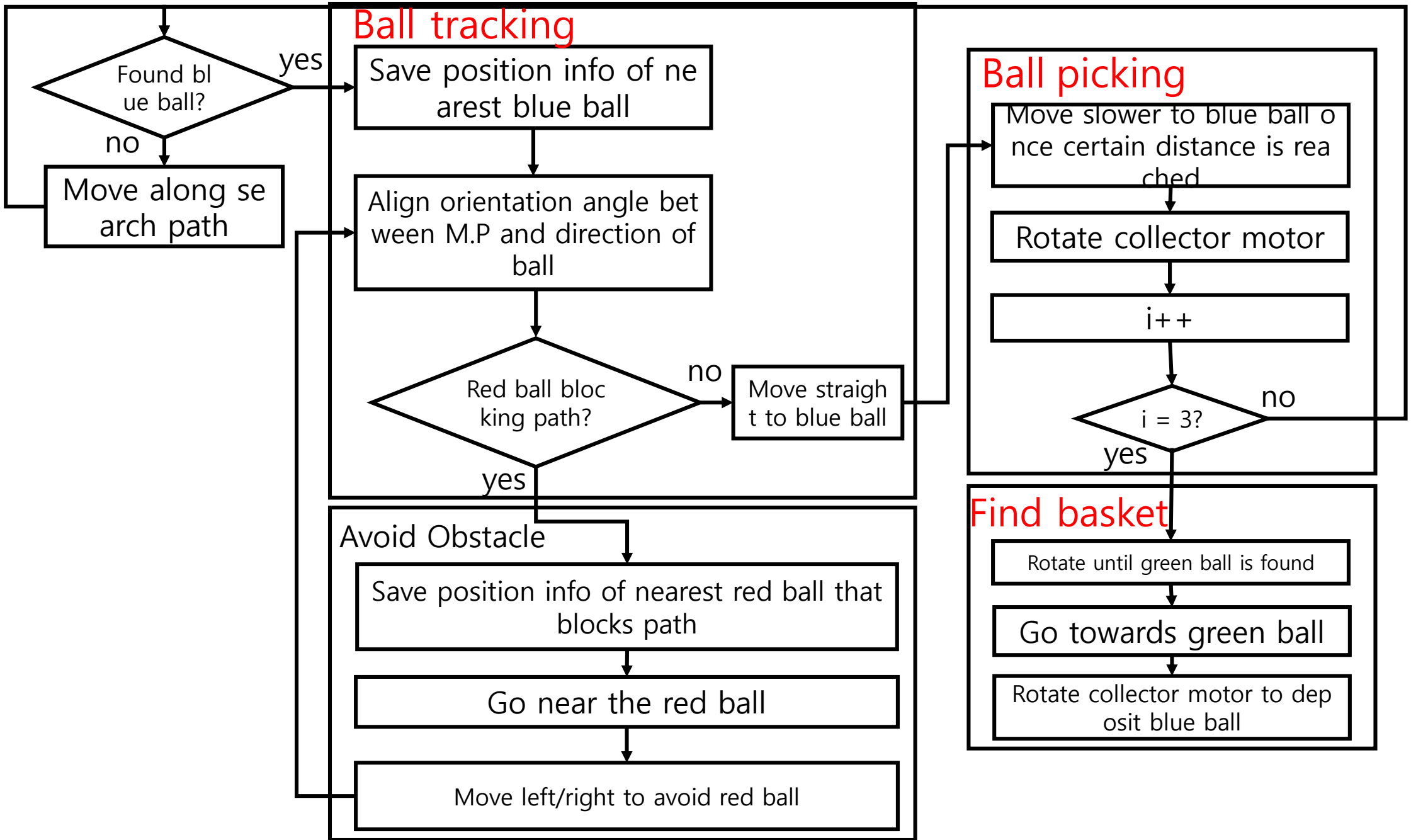
Camera Vibration



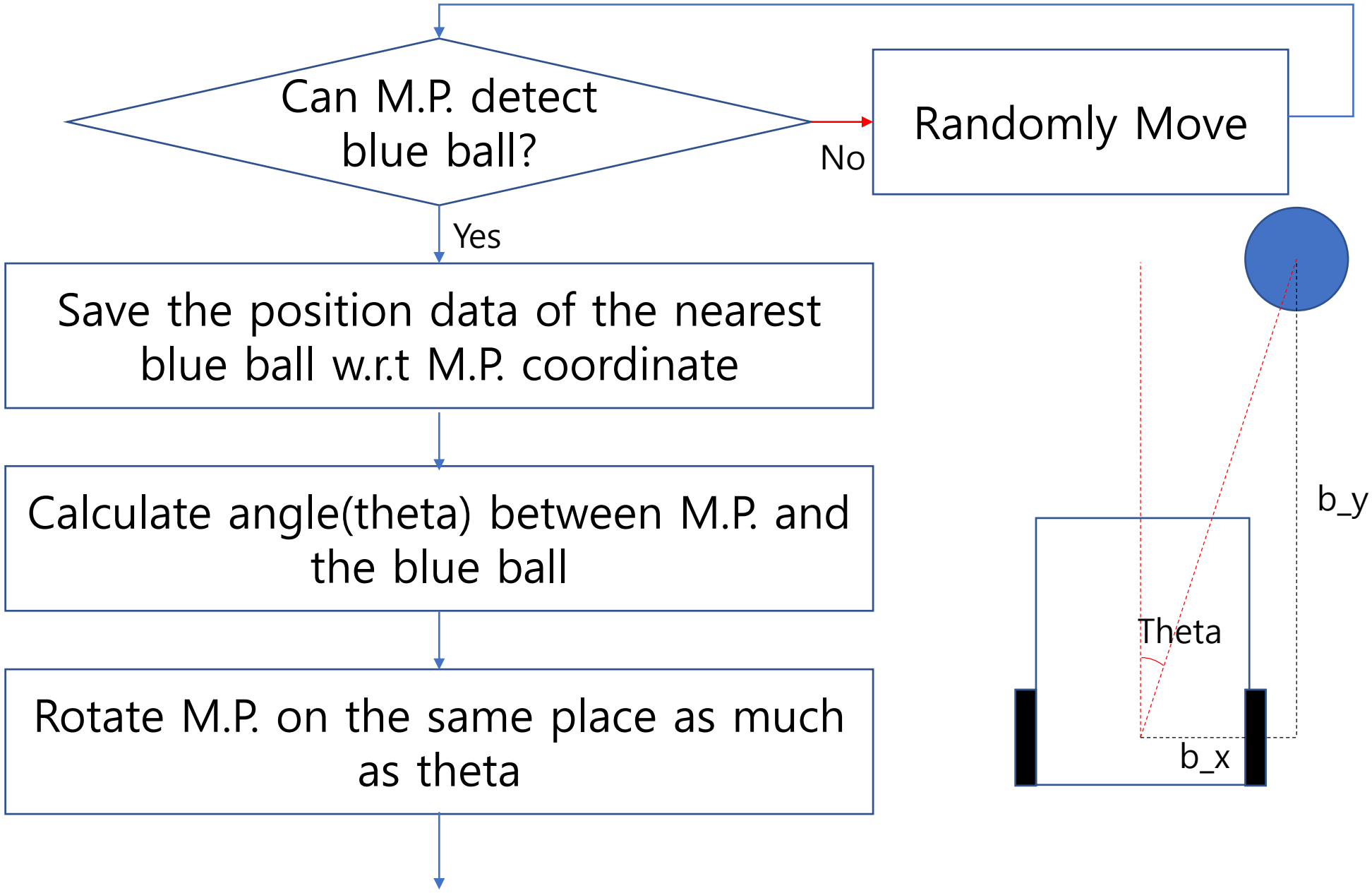
Overall Algorithm



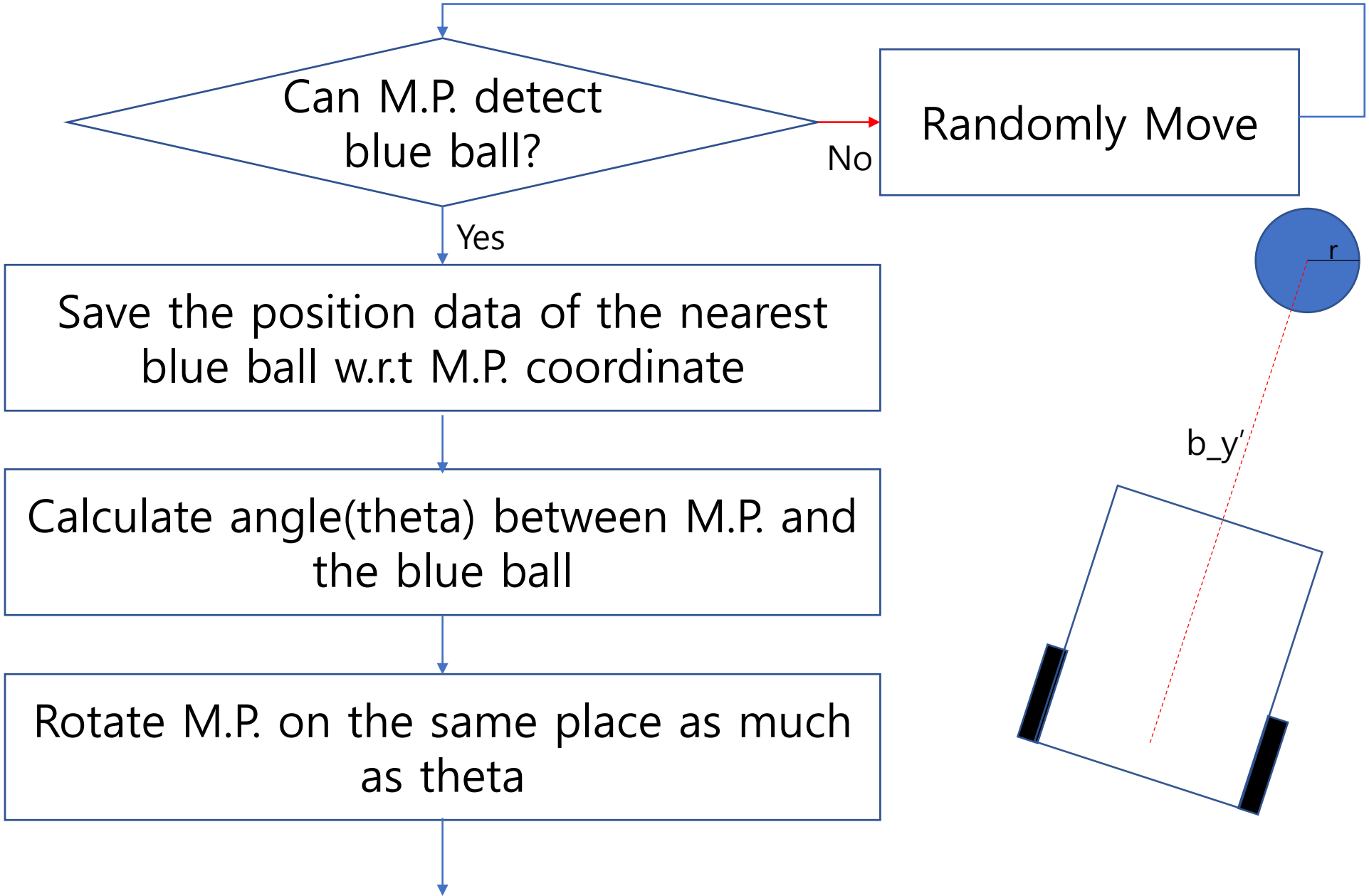
Overall Algorithm



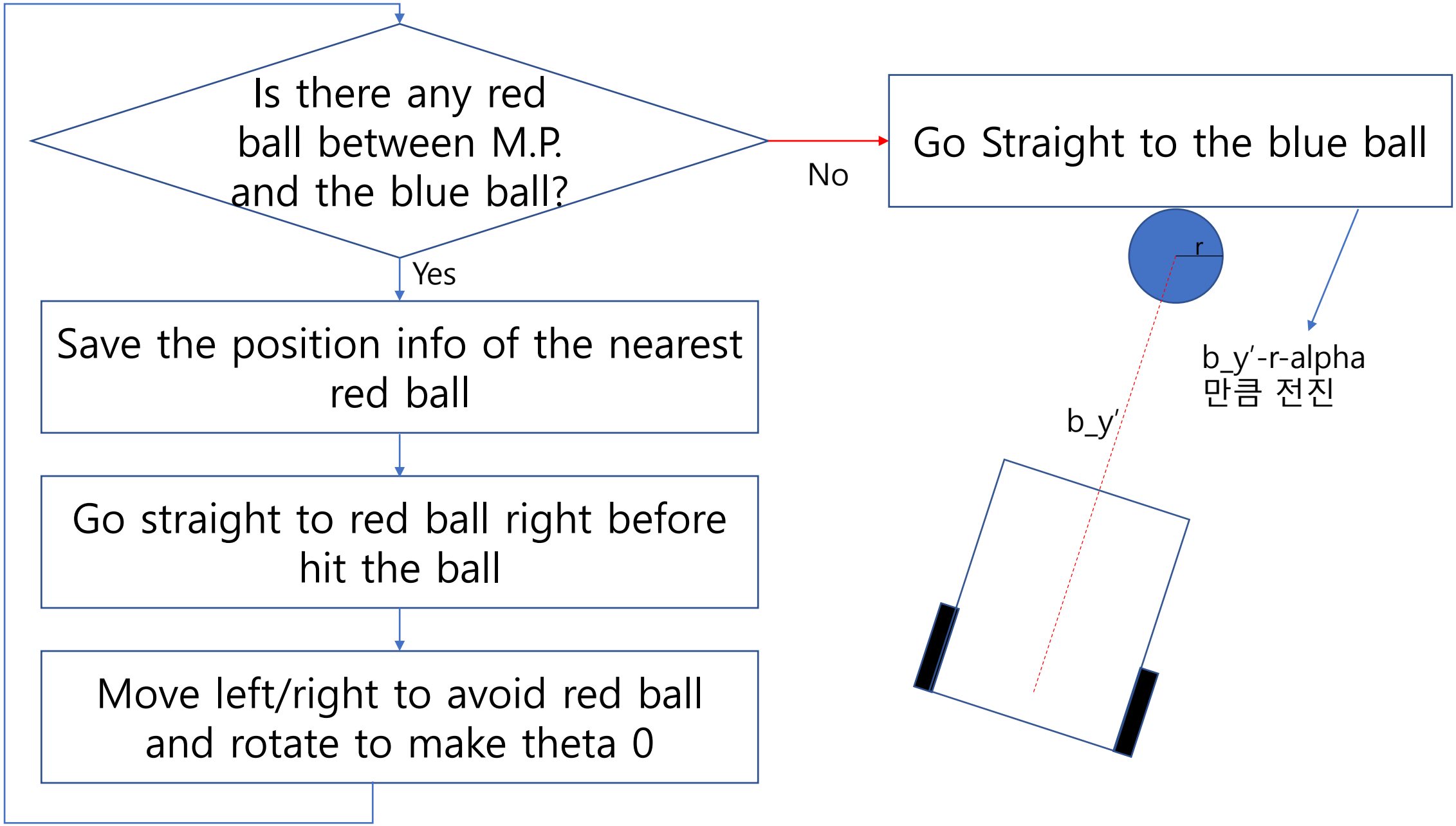
Overall Algorithm (Track)



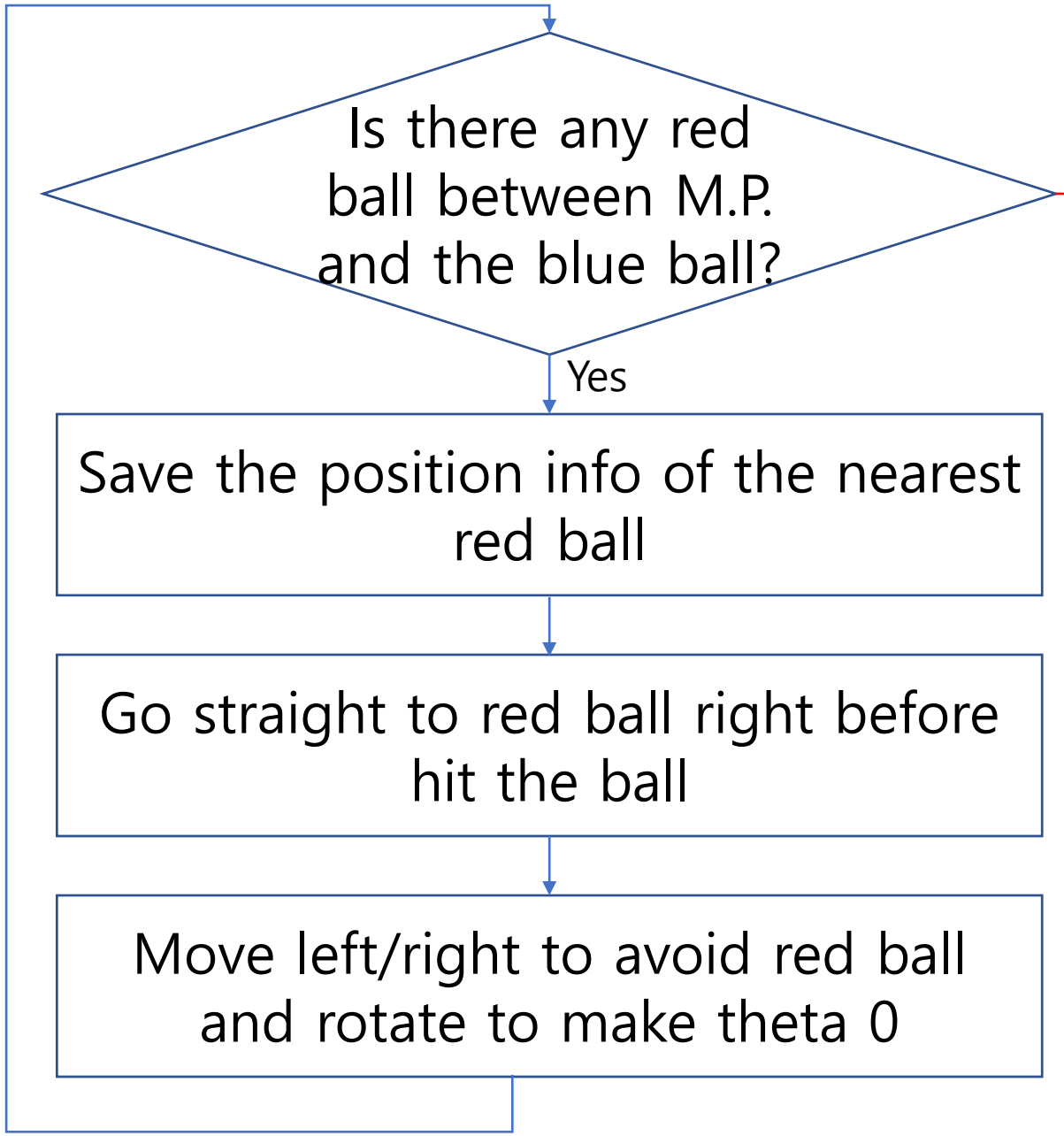
Overall Algorithm (Track)



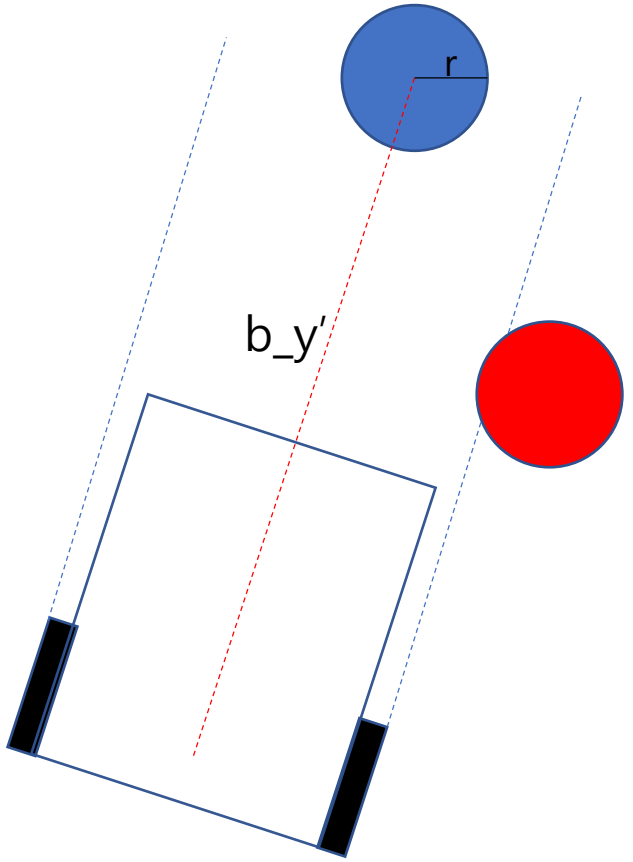
Overall Algorithm (Track – Avoid Obstacle)



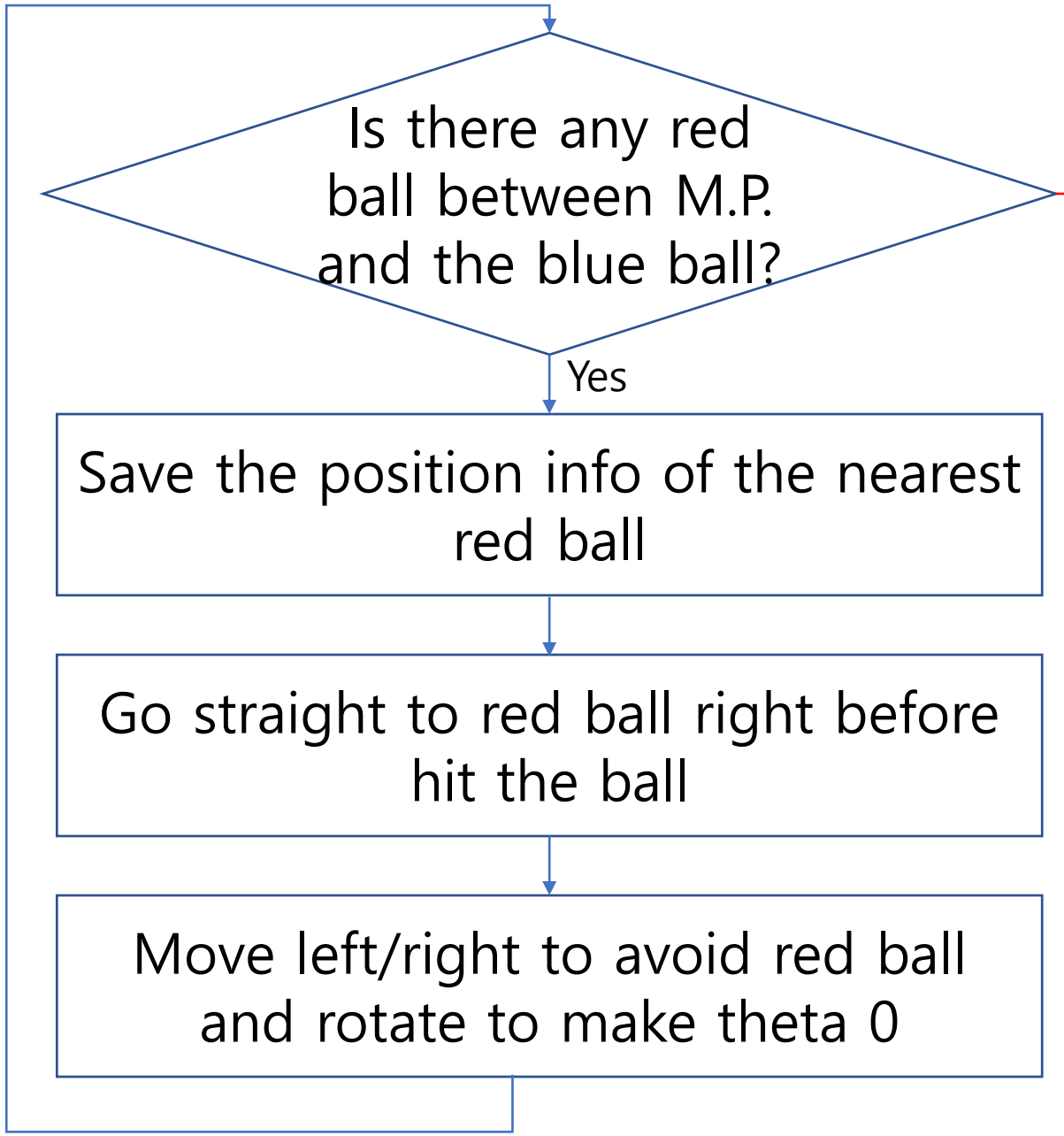
Overall Algorithm (Track – Avoid Obstacle)



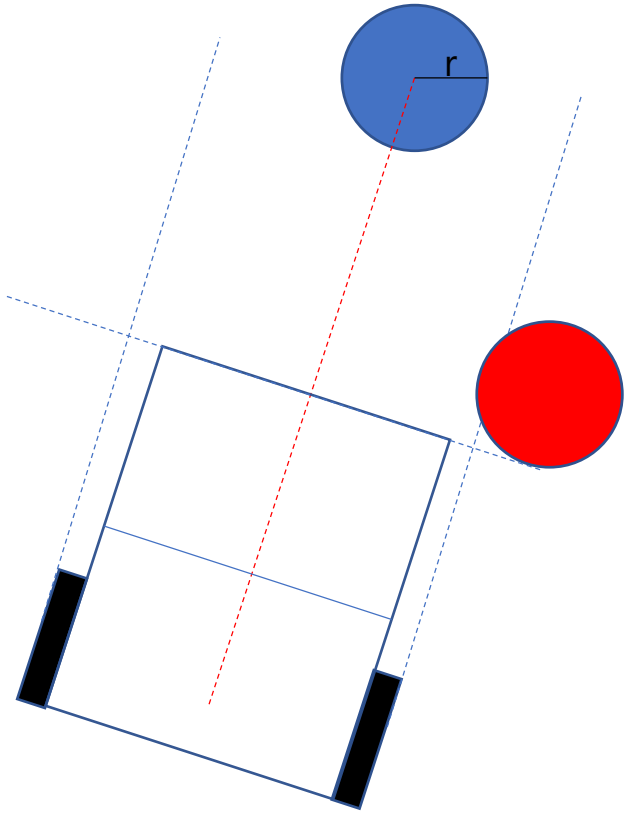
Go Straight to the blue ball



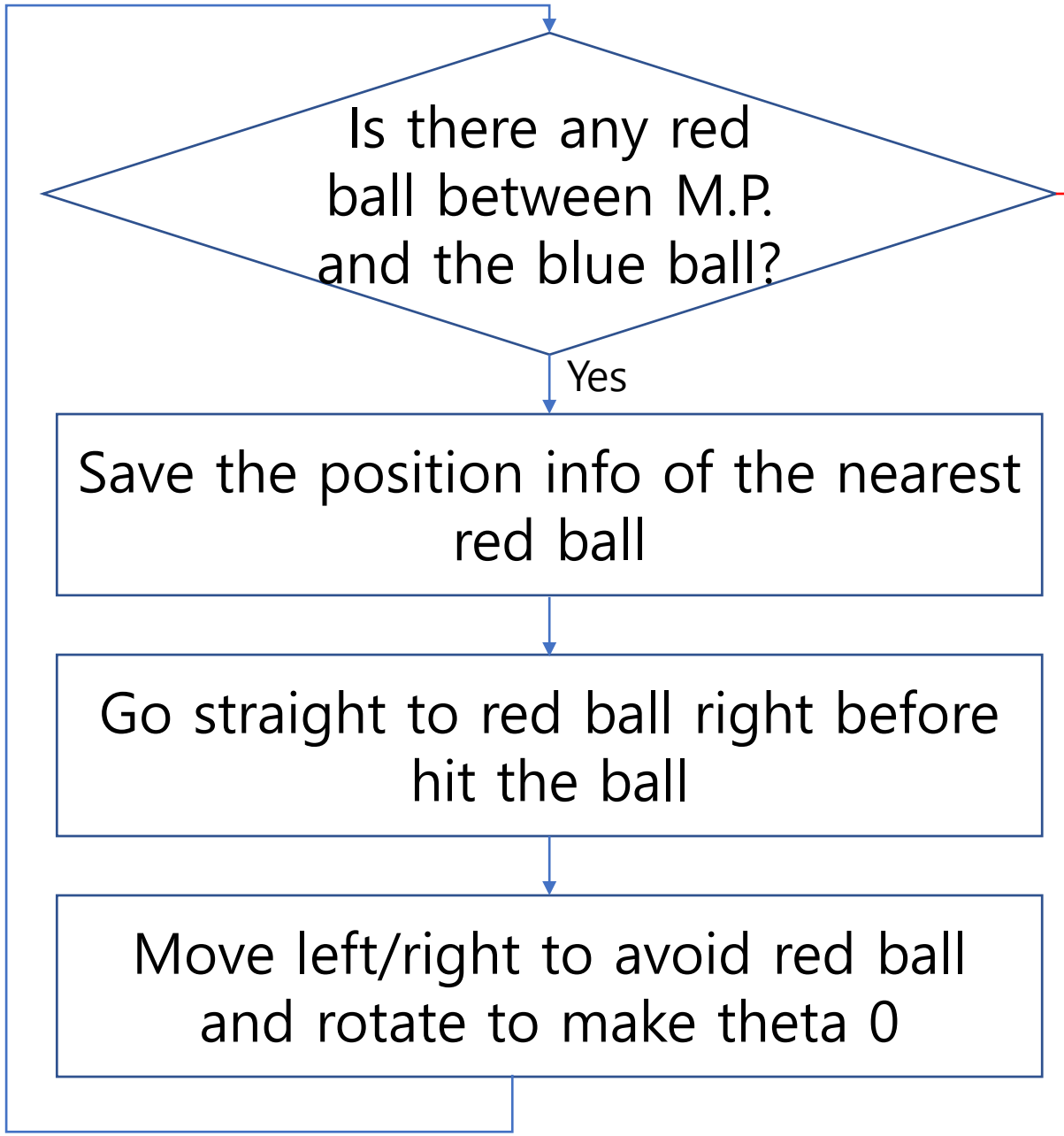
Overall Algorithm (Track – Avoid Obstacle)



Go Straight to the blue ball

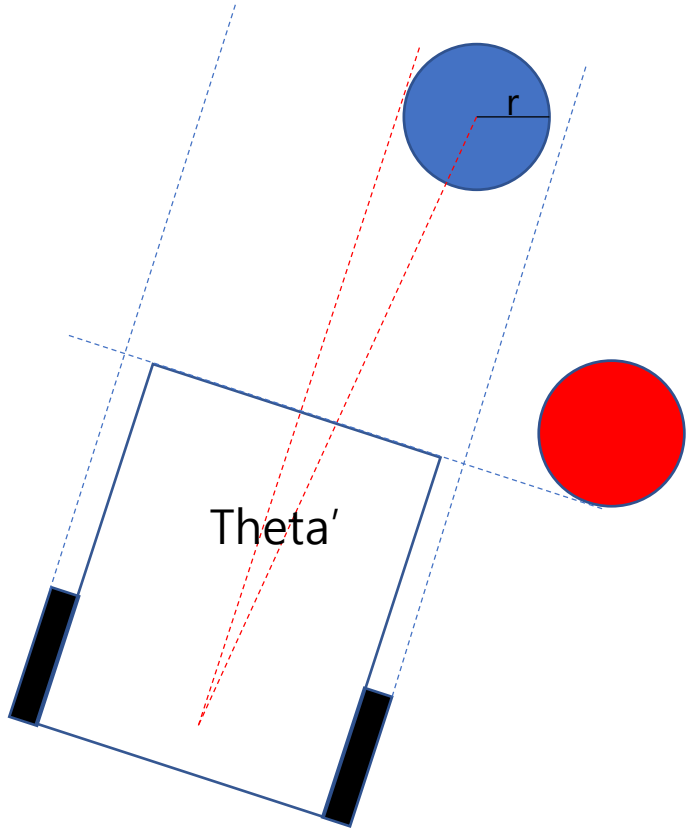


Overall Algorithm (Track – Avoid Obstacle)

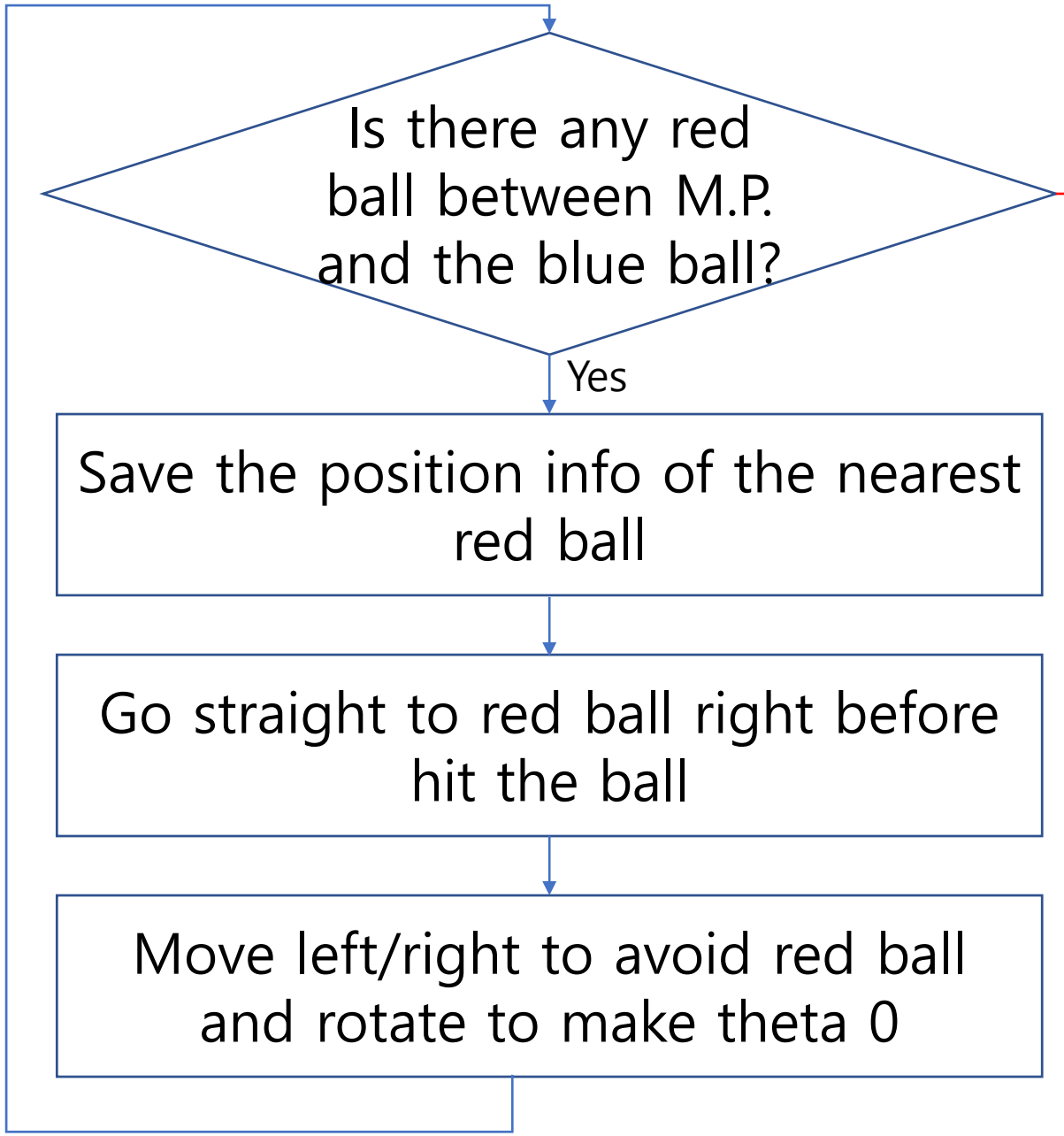


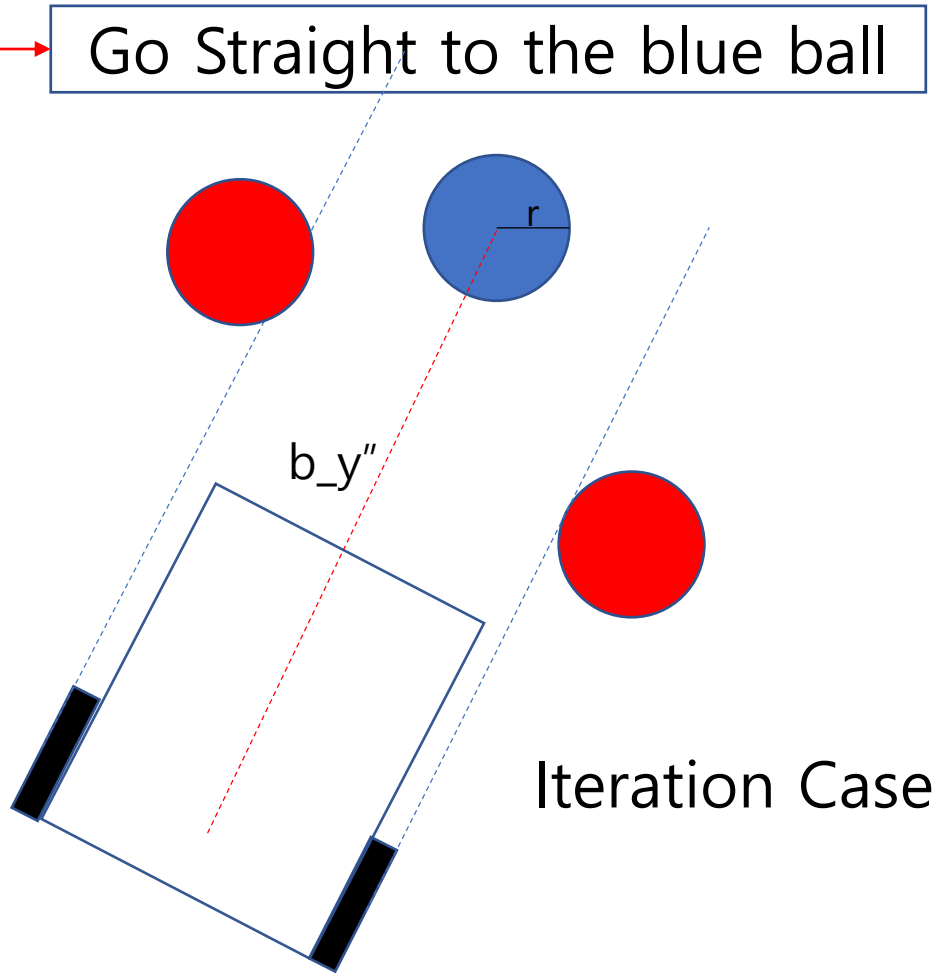
No

Go Straight to the blue ball

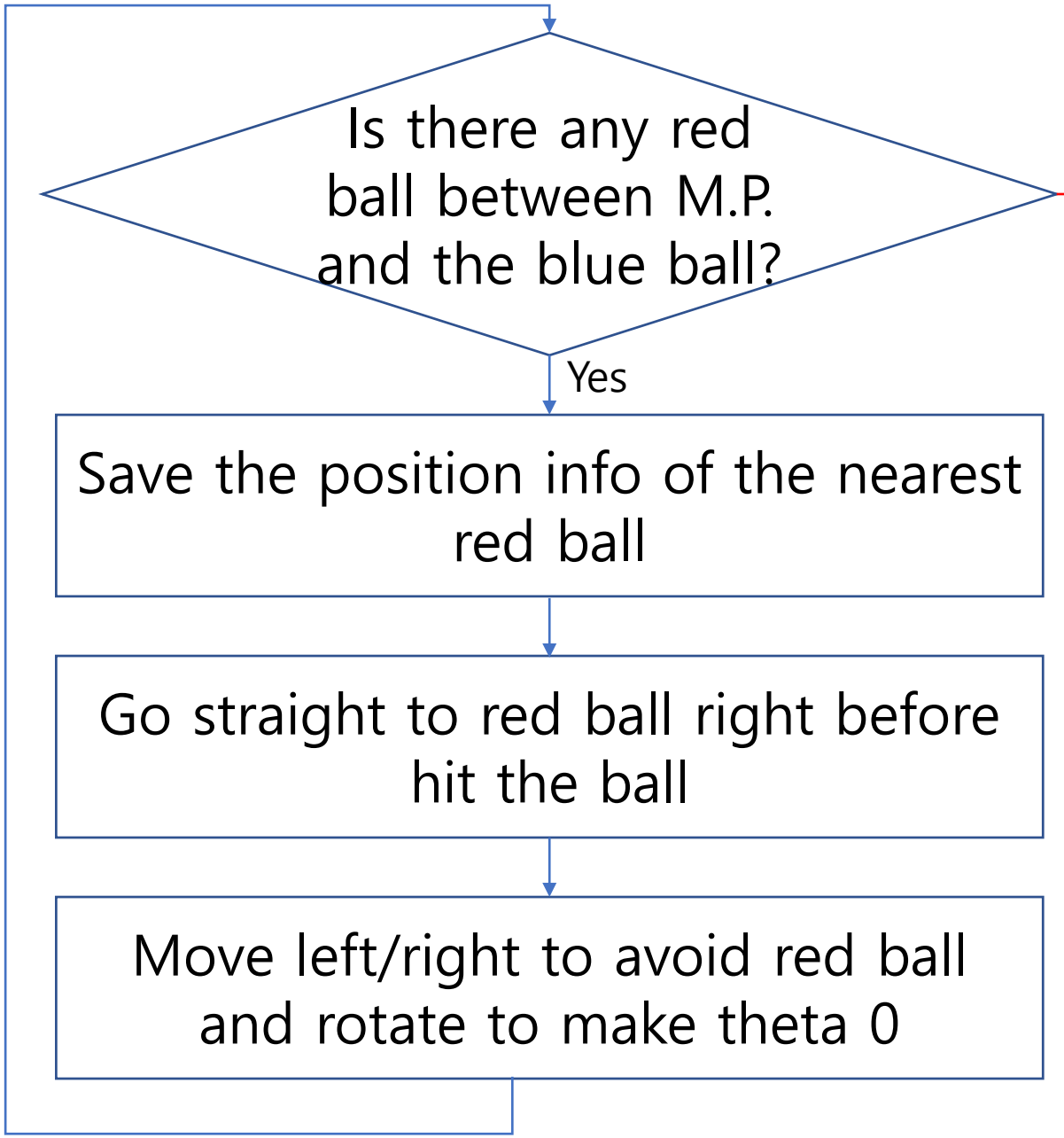


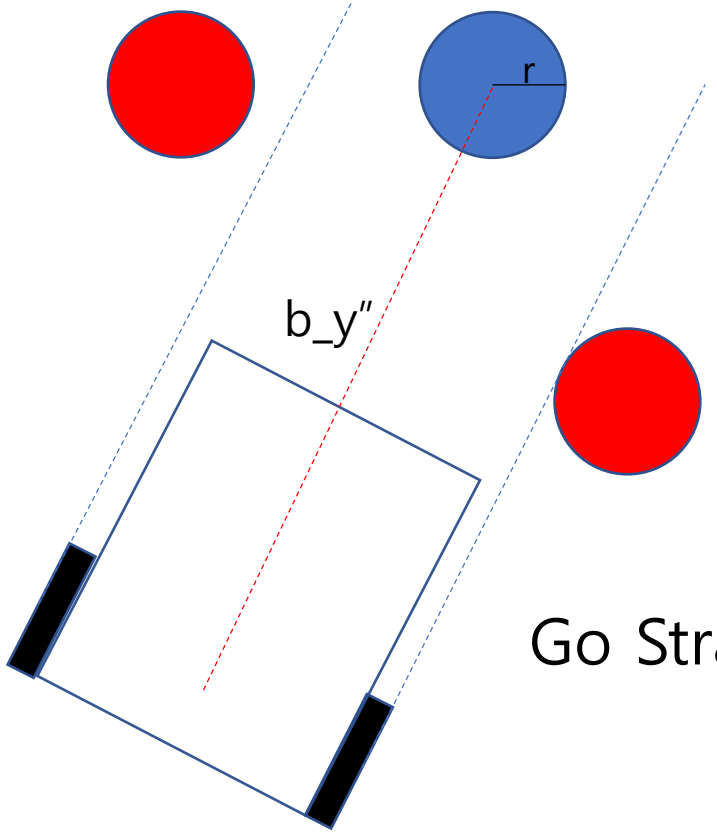
Overall Algorithm (Track – Avoid Obstacle)





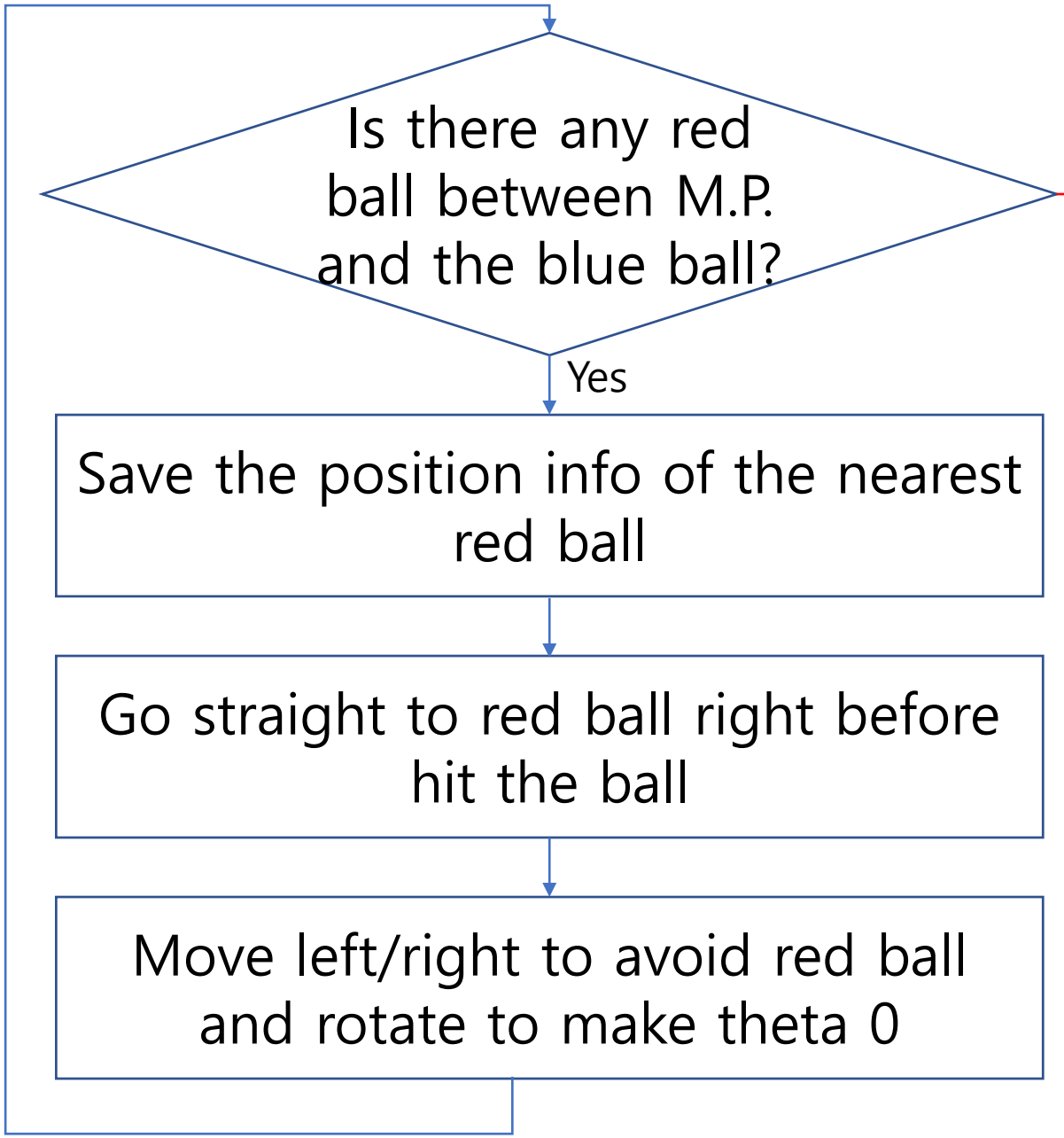
Overall Algorithm (Track – Avoid Obstacle)

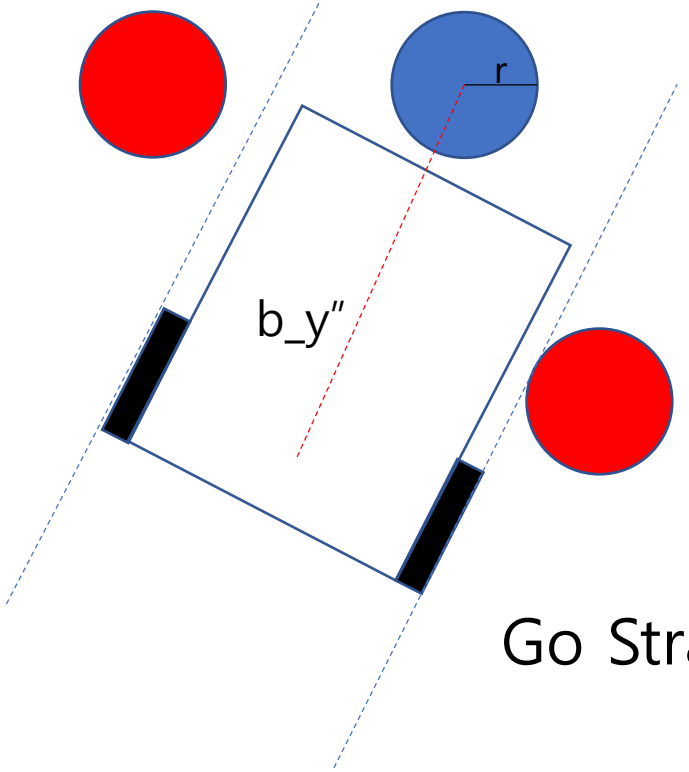




Go Straight Case

Overall Algorithm (Track – Avoid Obstacle)



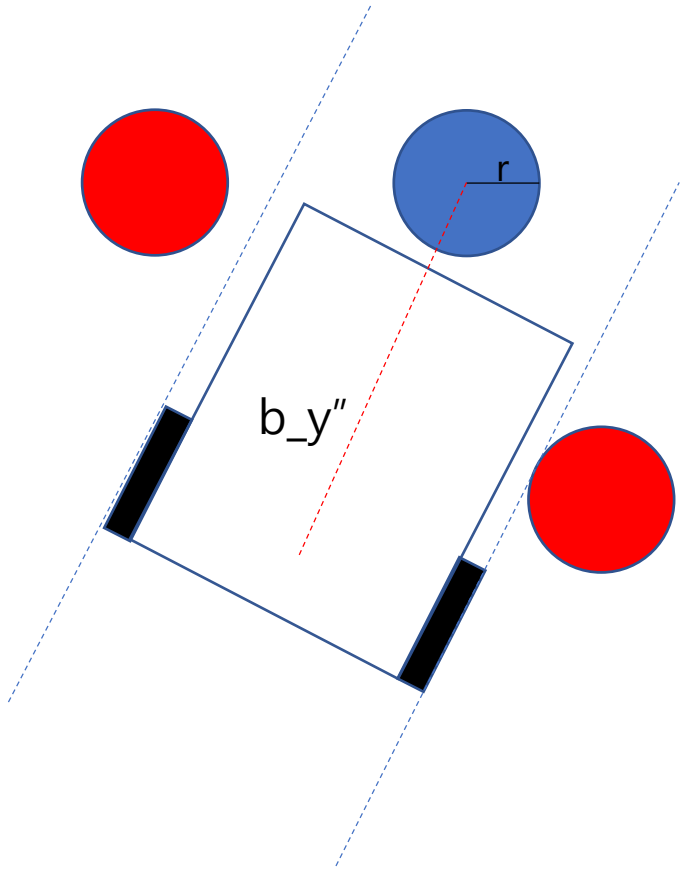


Go Straight Case

Overall Algorithm (Pick)

Move slower to the blue ball

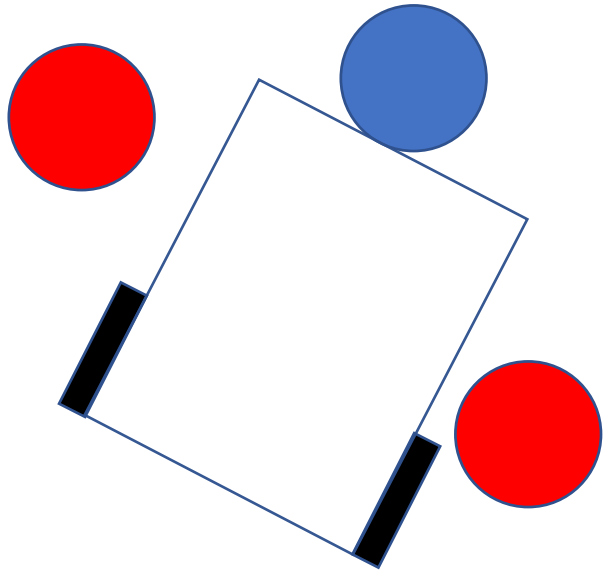
Operate Collector motor



Overall Algorithm (Pick)

Move slower to the blue ball

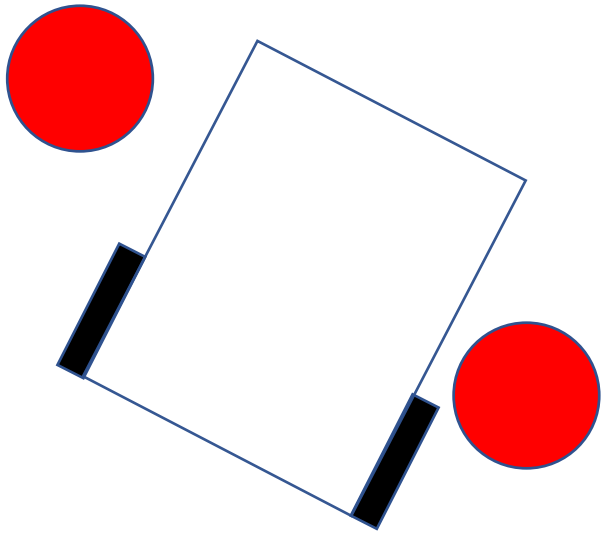
Operate Collector motor



Overall Algorithm (Pick)

Move slower to the blue ball

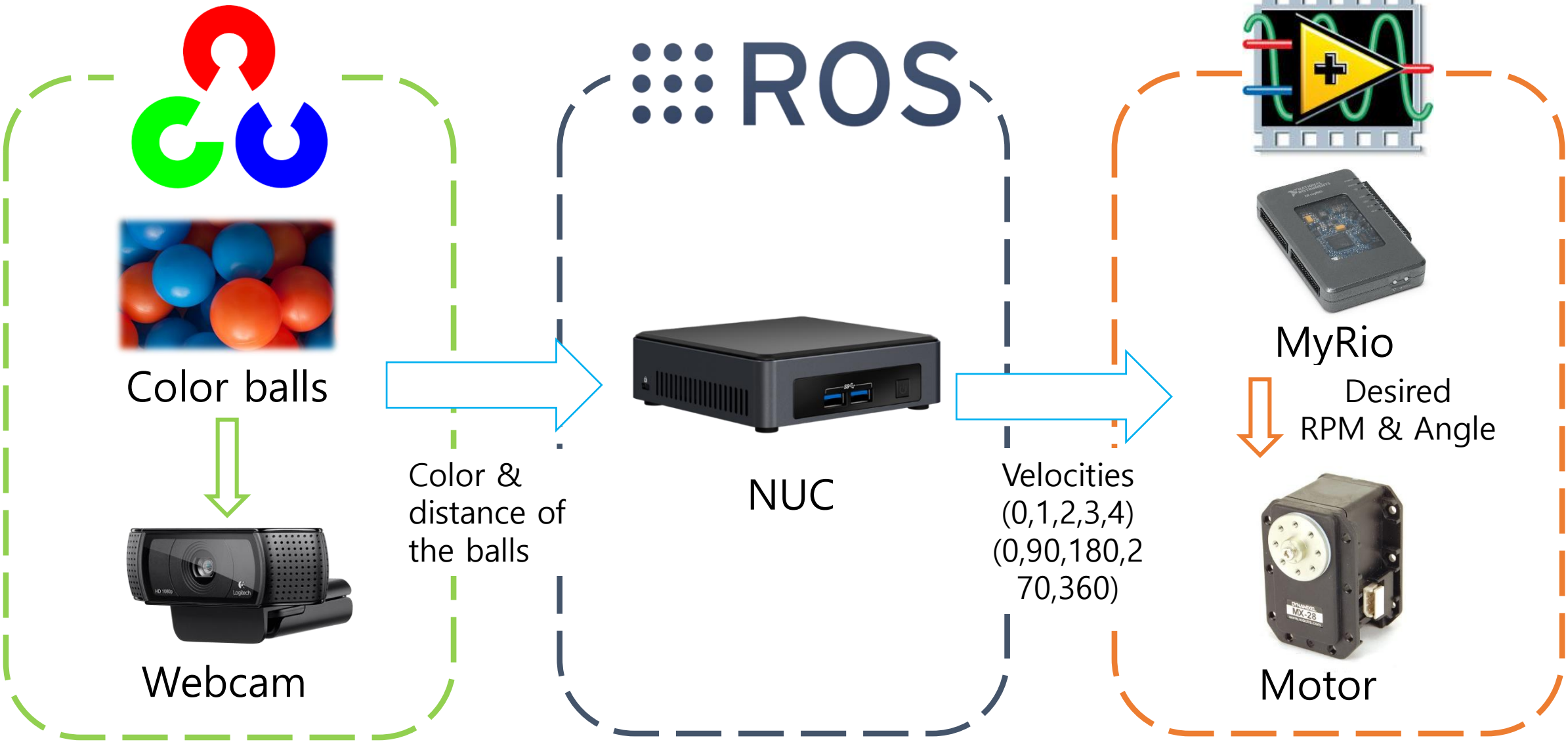
Operate Collector motor



Overall Algorithm (Finding basket)

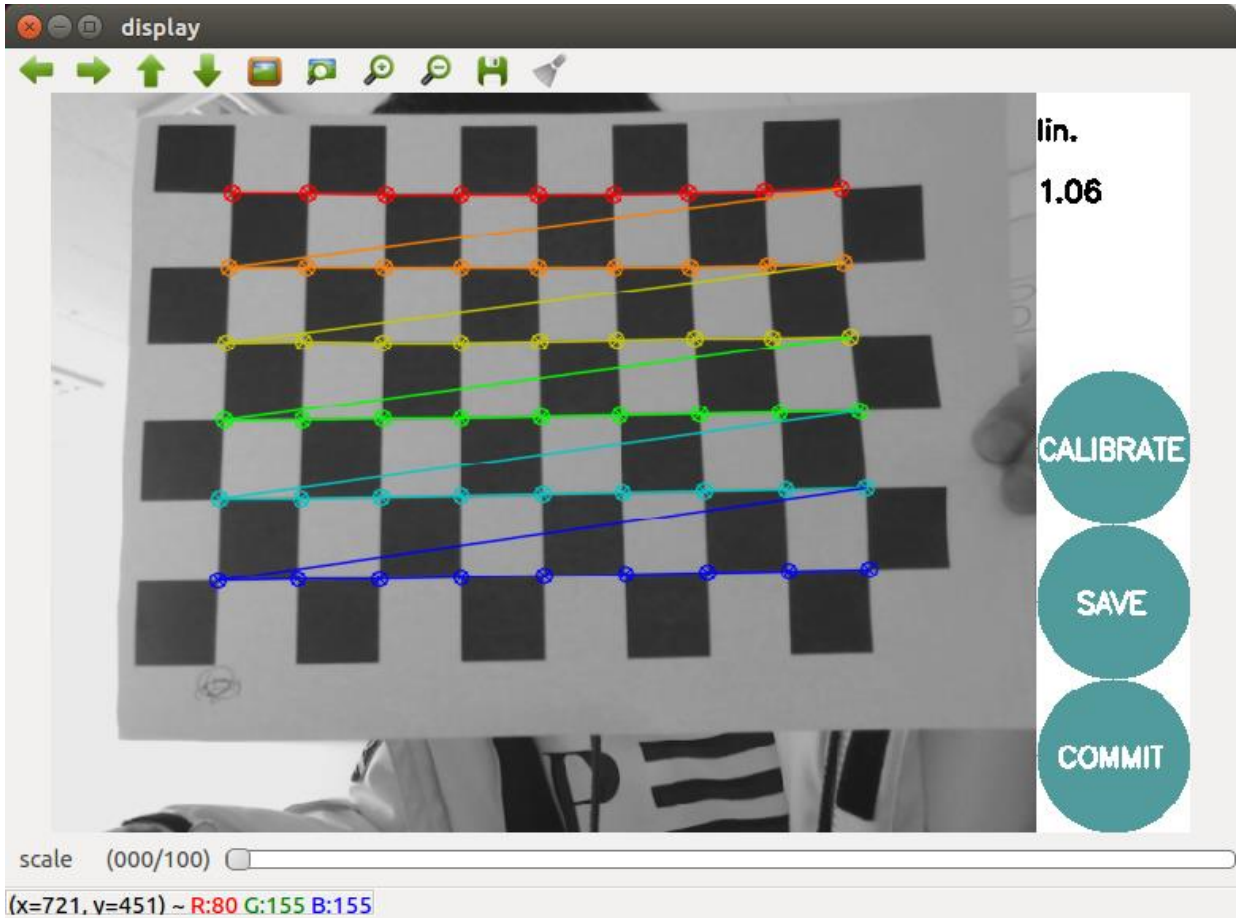
- *Just change blue ball -> green ball in Track code*
- *Rotate Collector motor reversely*
- *It could be changed after notice about green ball announced*

System overview




OpenCV
OpenCV

Camera Calibration



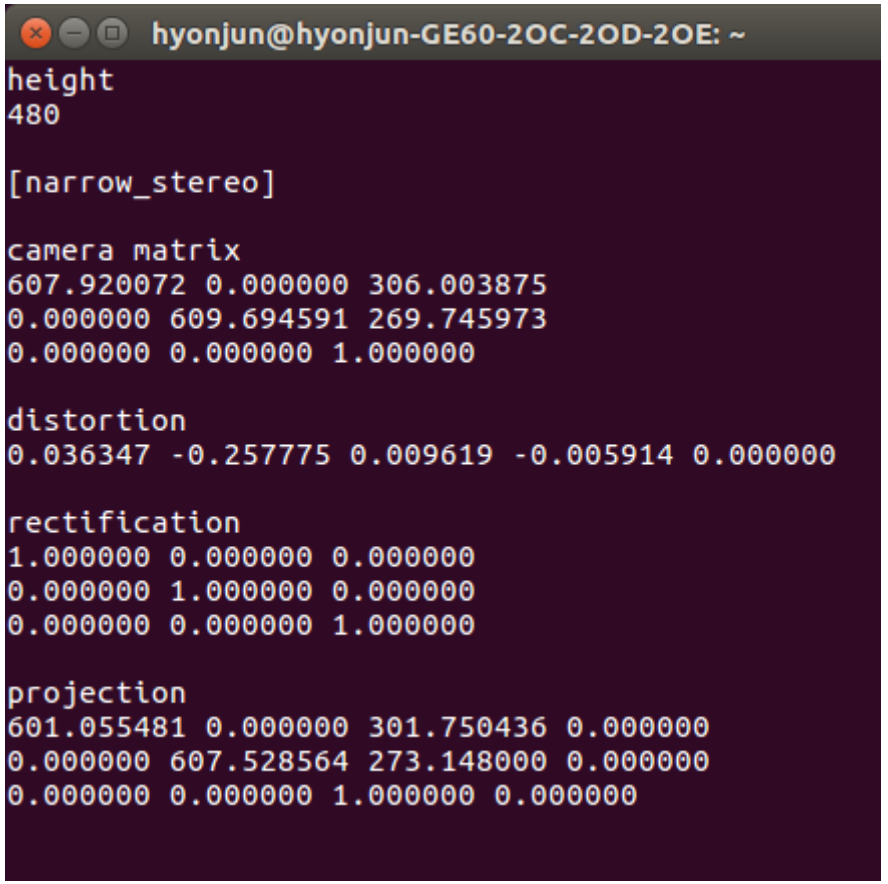
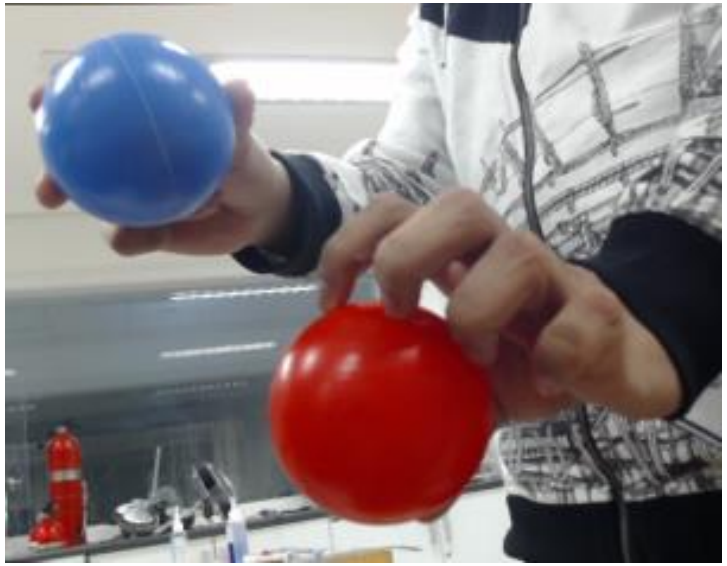
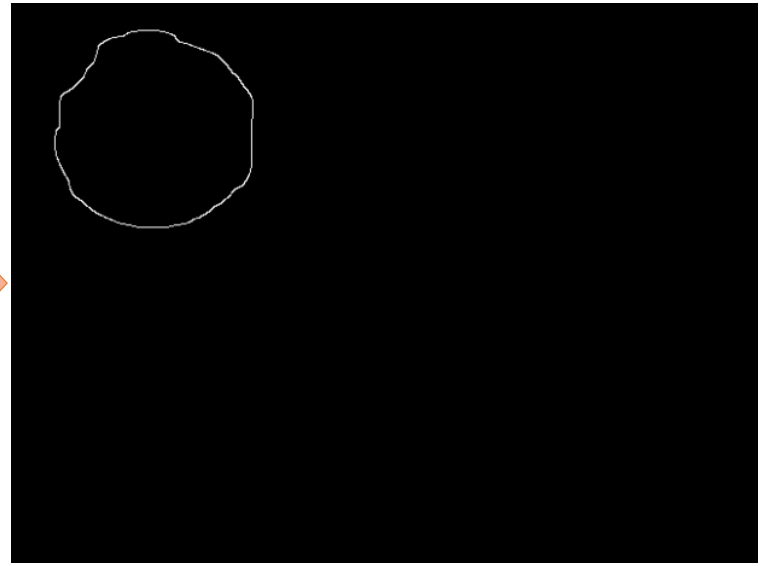


Image Recognition

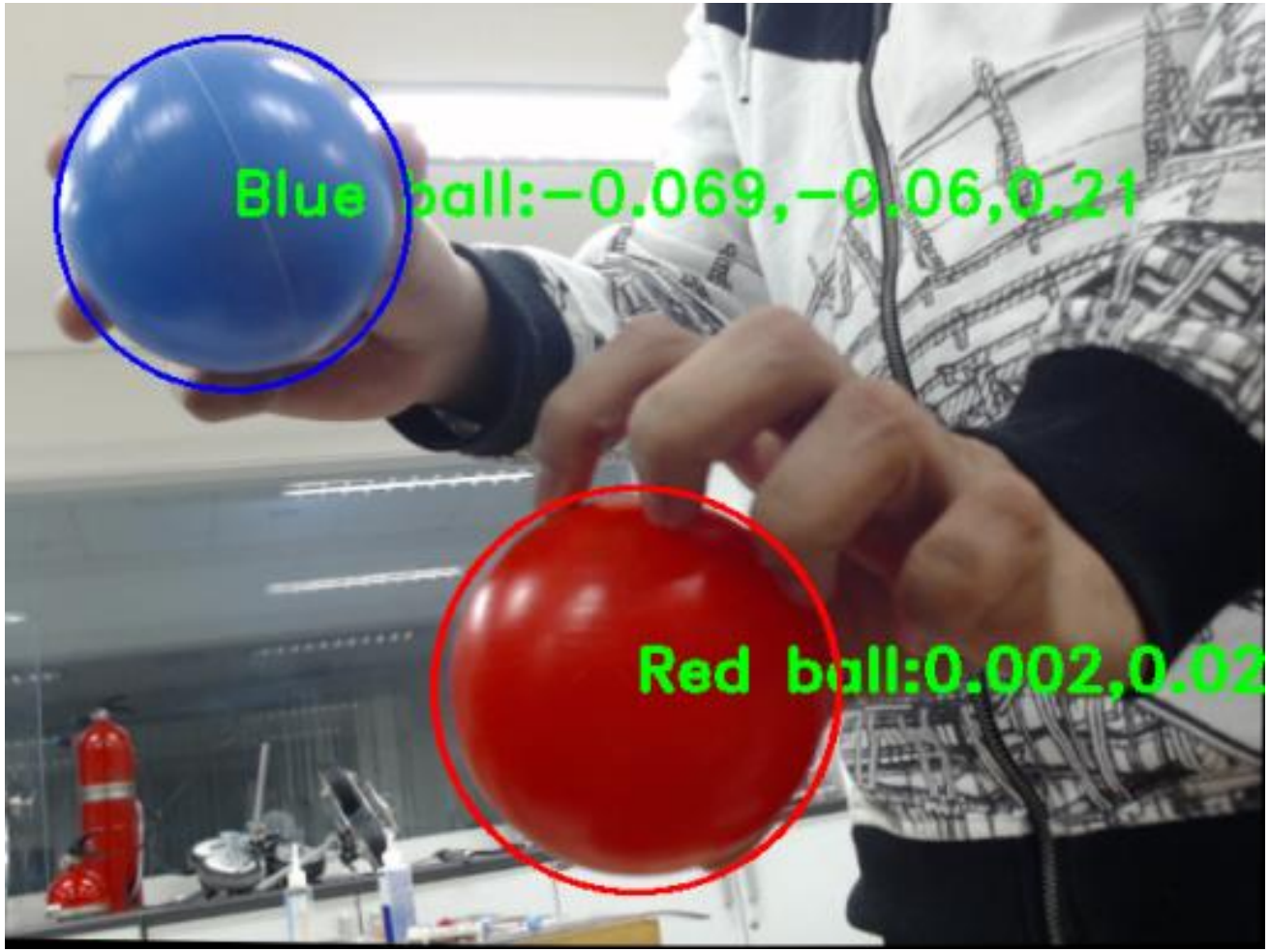


Original image

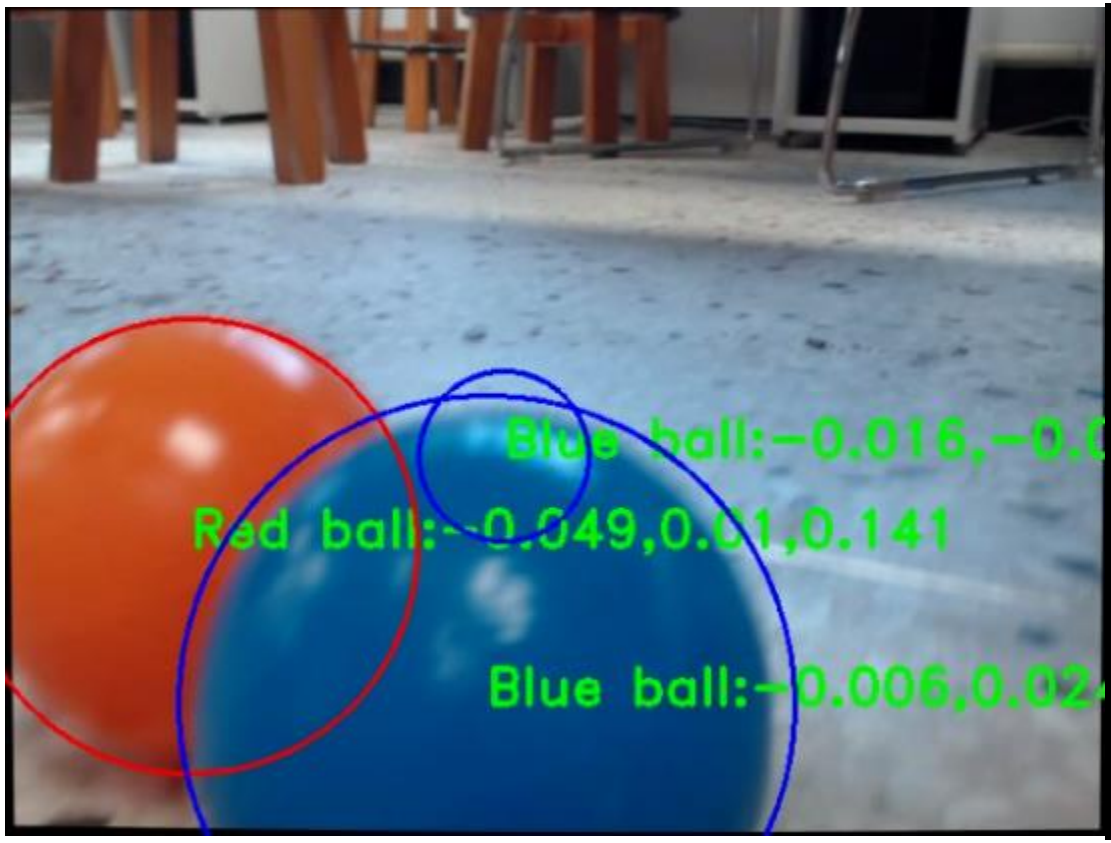
Detected blue object

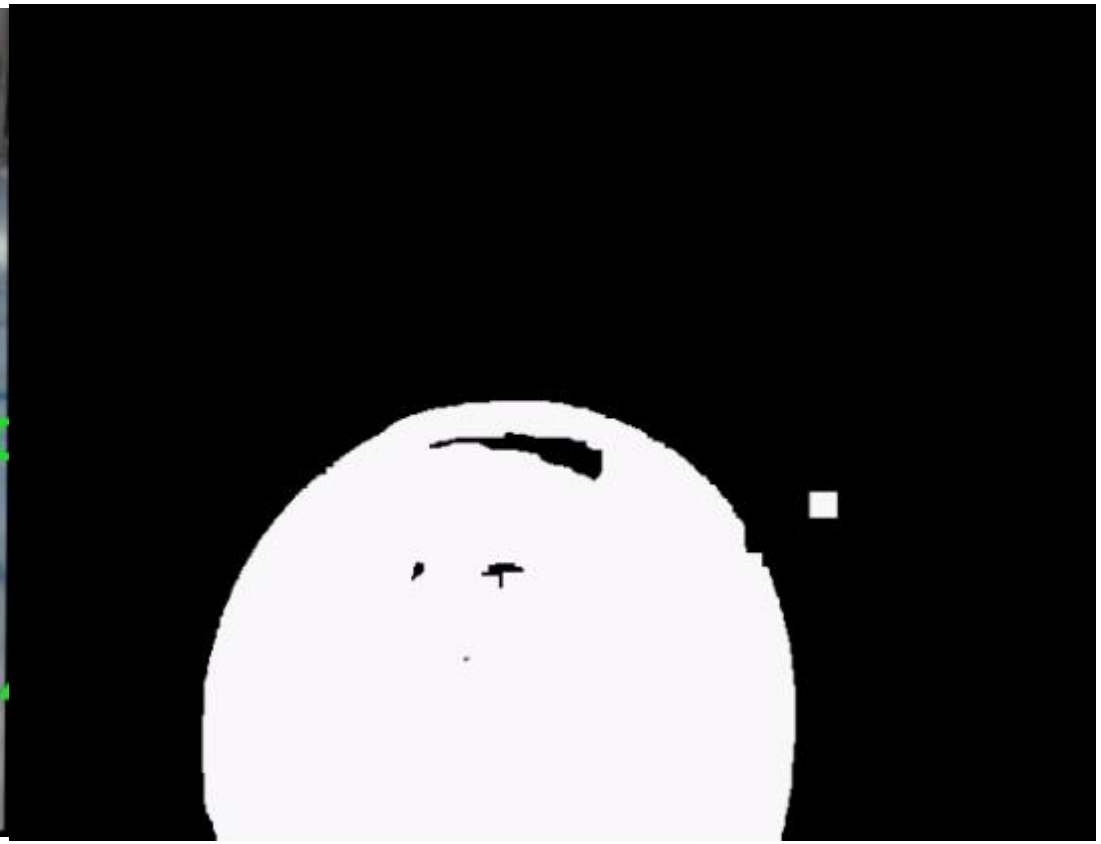


Contour of the object


Blue ball:−0.069,−0.06,0.21
Red ball:0.002,0.02

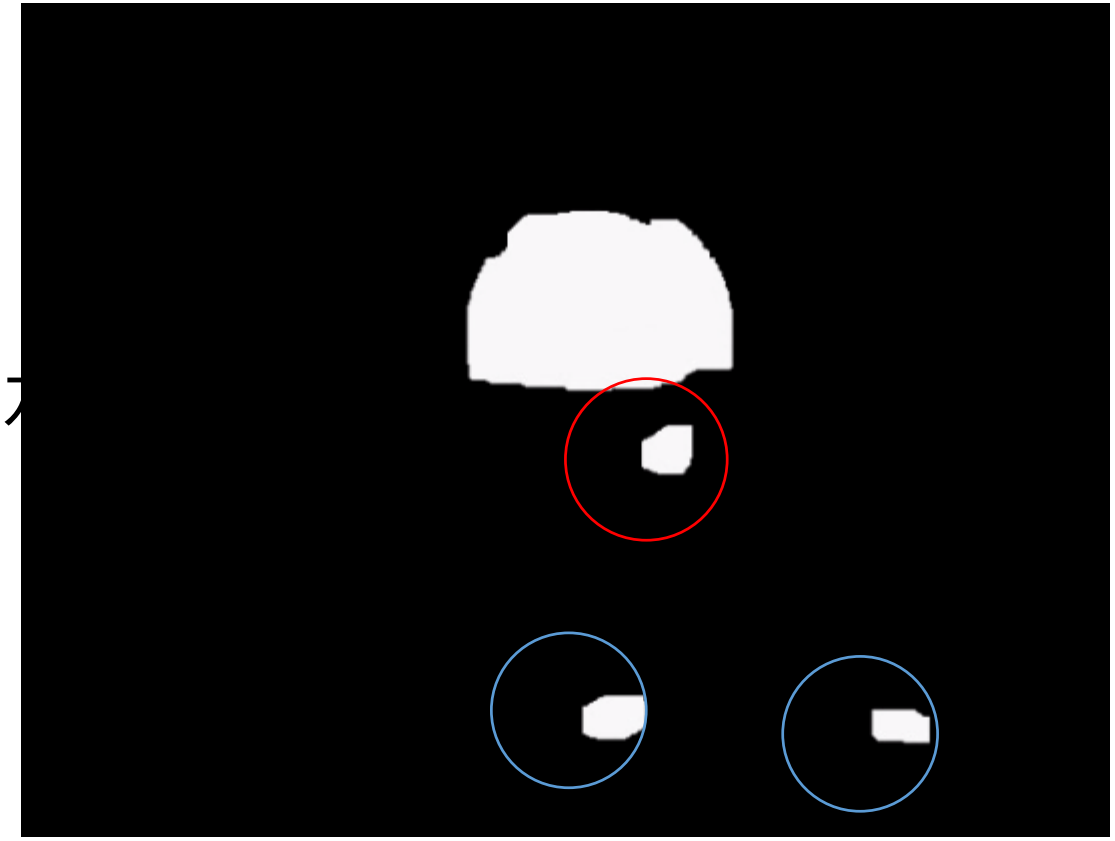
Possible Problem





- The wrong object is detected

Possible Problem

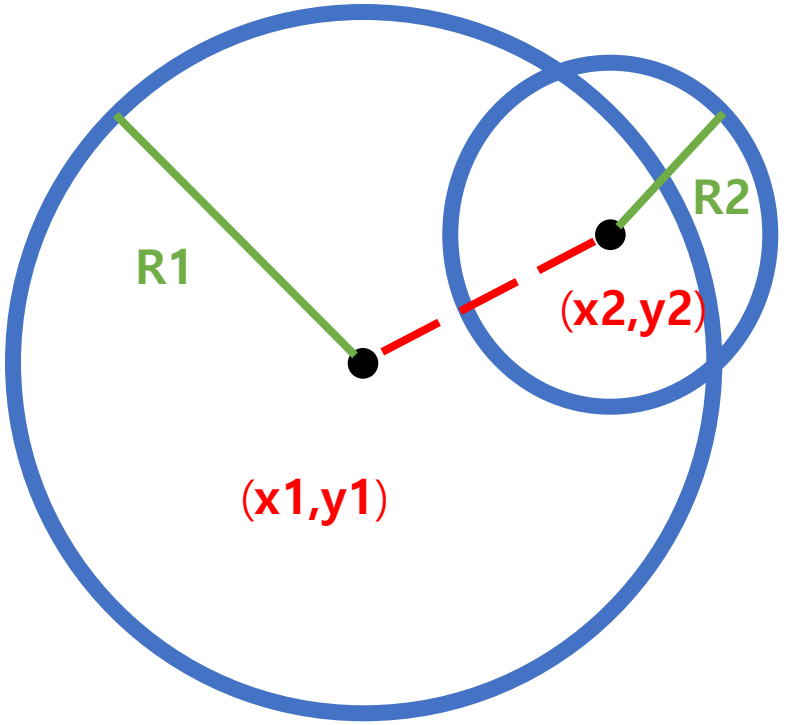


- *Noise is detected*
- *Object is not fully detected*

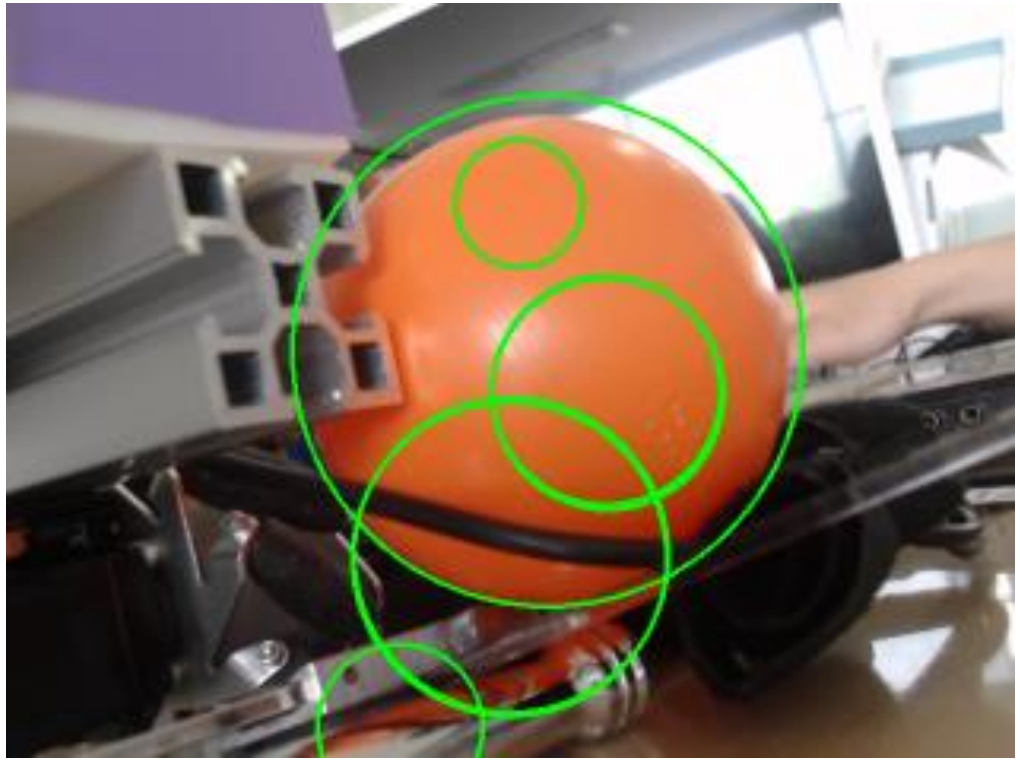
- Delete the data if distance between the data is smaller than maximum radius

Delete if L < max(R1,R2)

$L = \sqrt{x^2 + y^2}$



Fixed code



Old code

fixed code

- *Using the strategy above, we fixed the code*

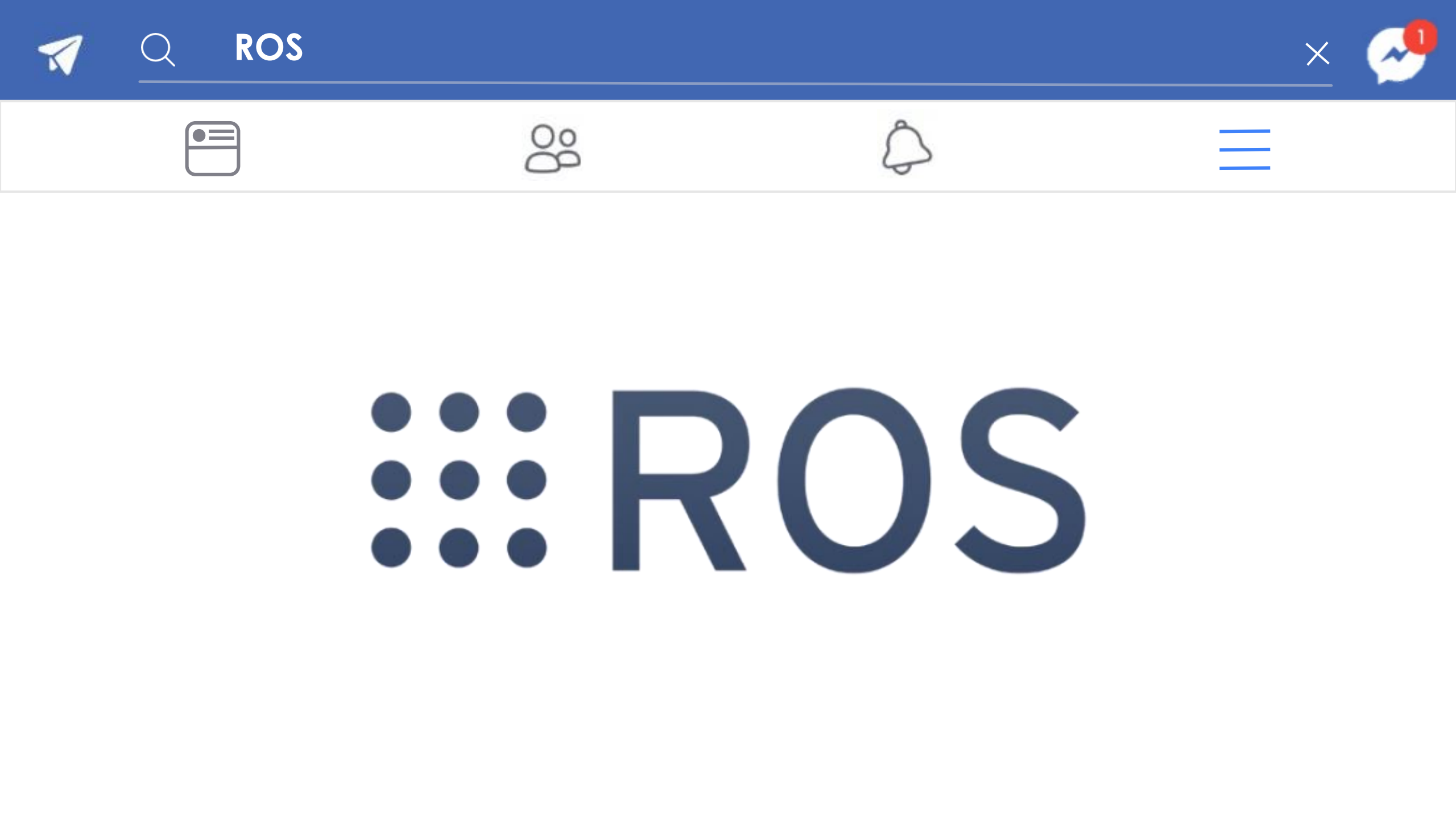
Possible Problem

- *Balls at the edge of camera are not fully detected -> gives wrong distance data (farther than real)*

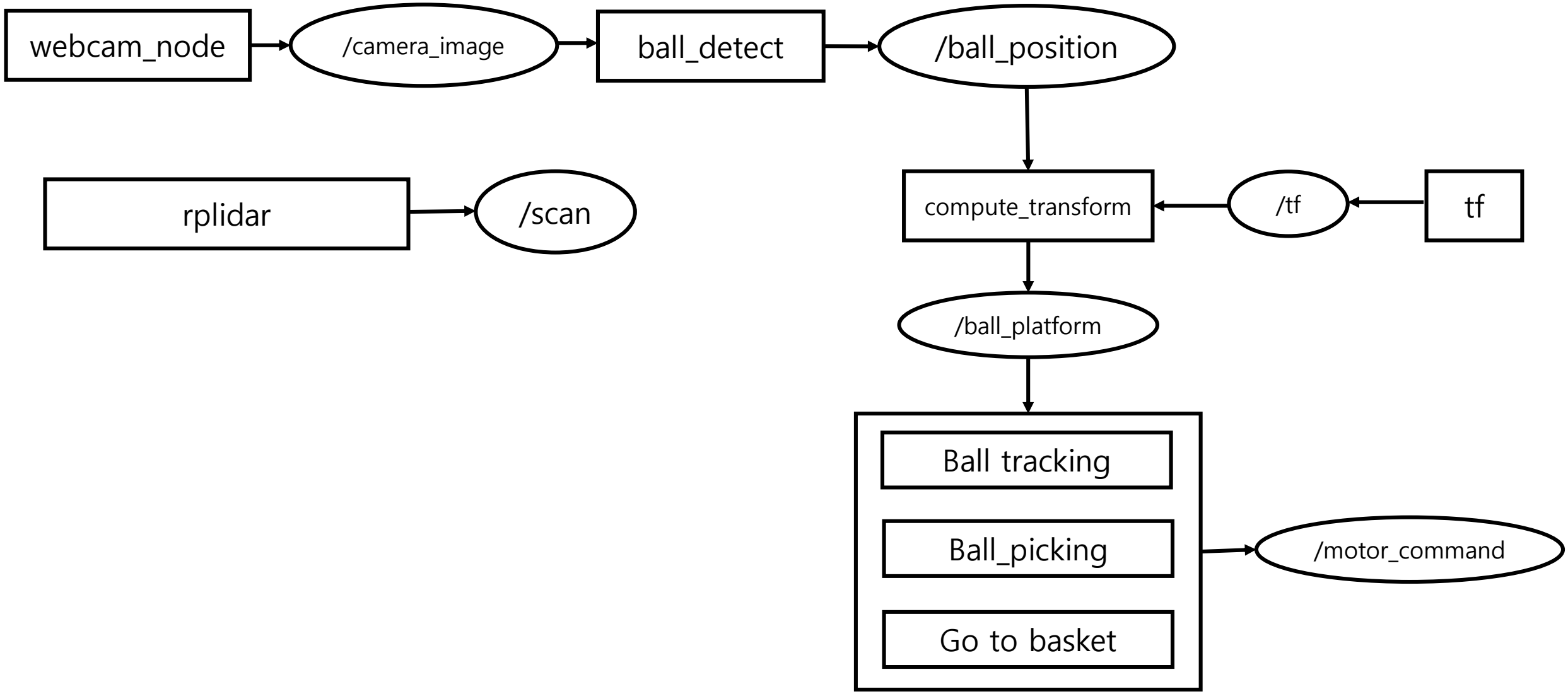
Improvement Strategy

- *Non–detecting zone*

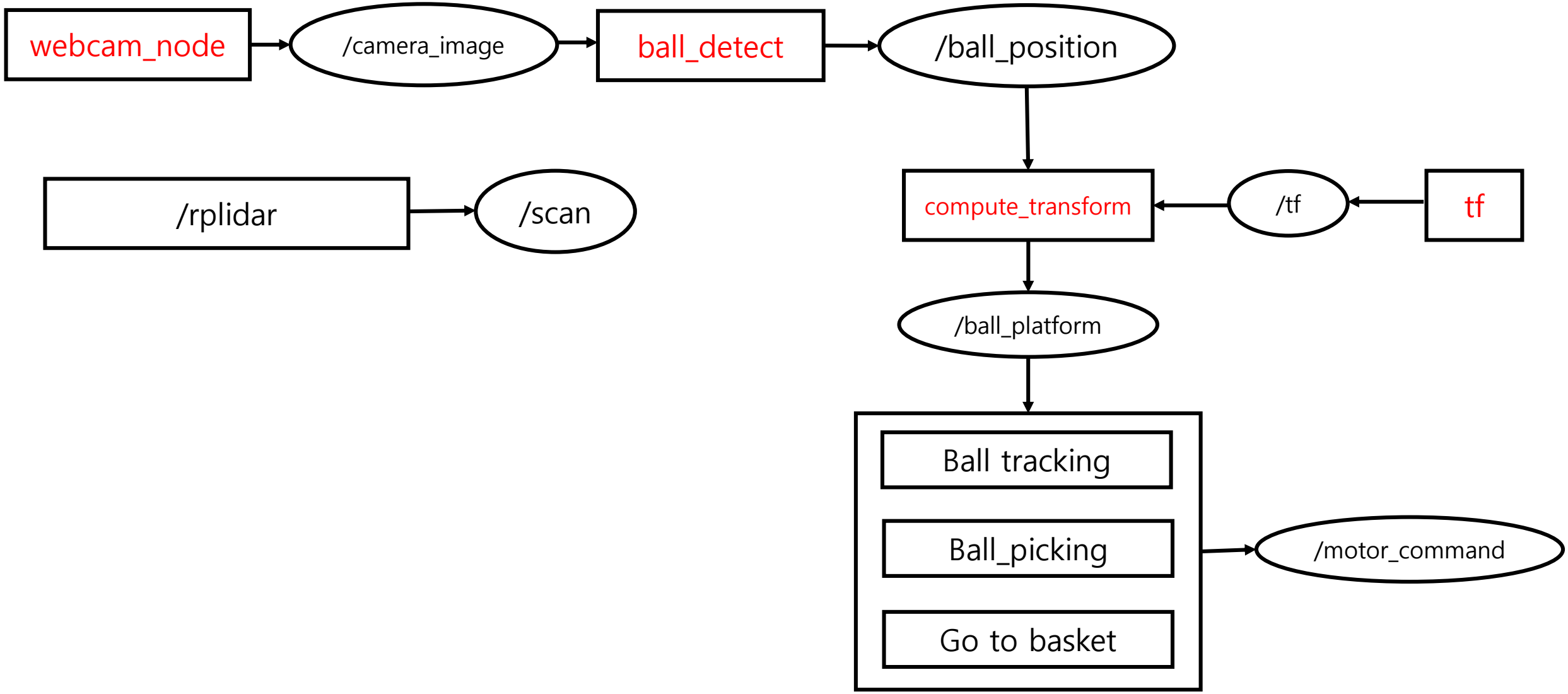
If center of the circles is in the red zone, we do not use the information

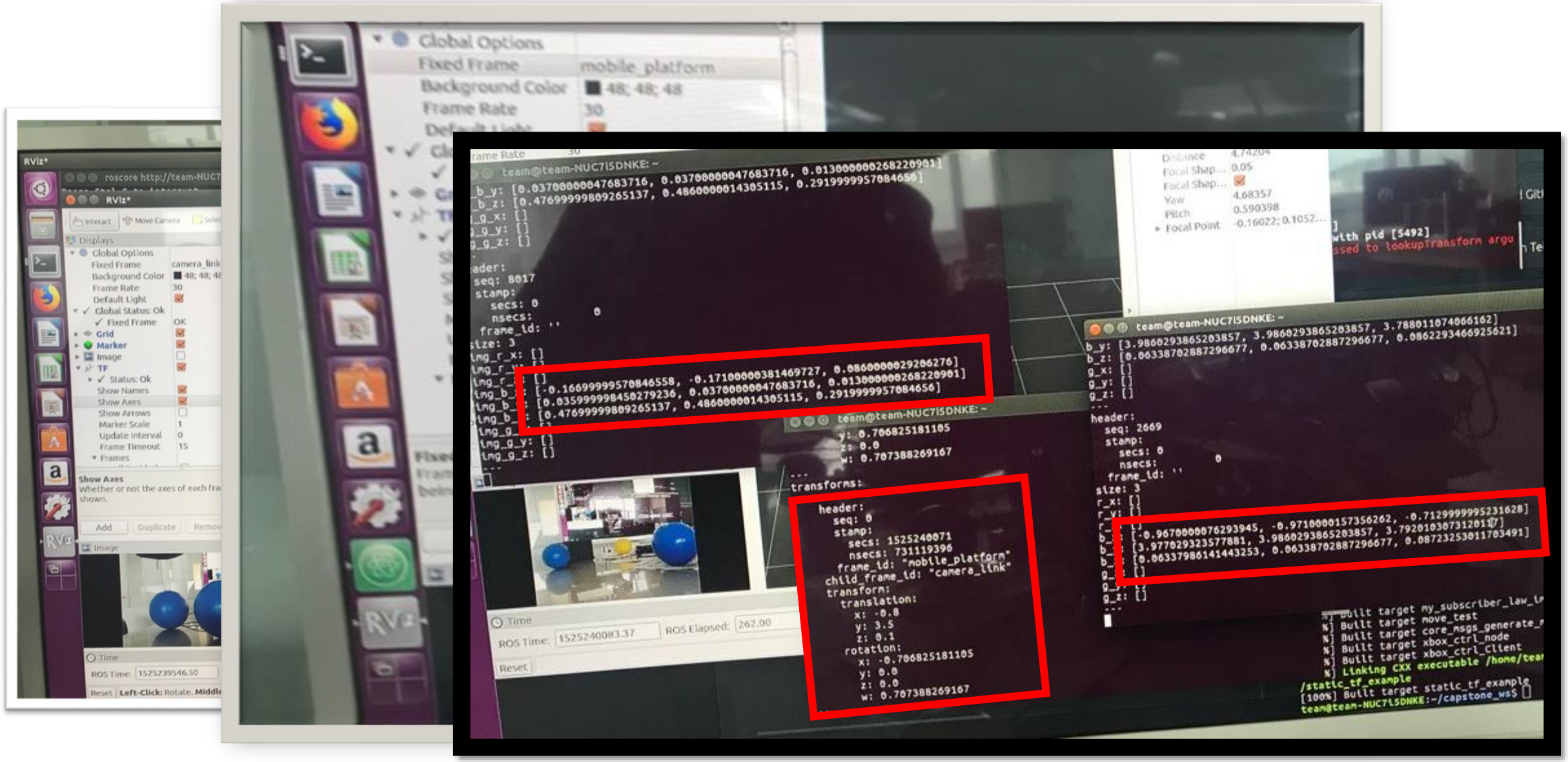

ROS
ROS

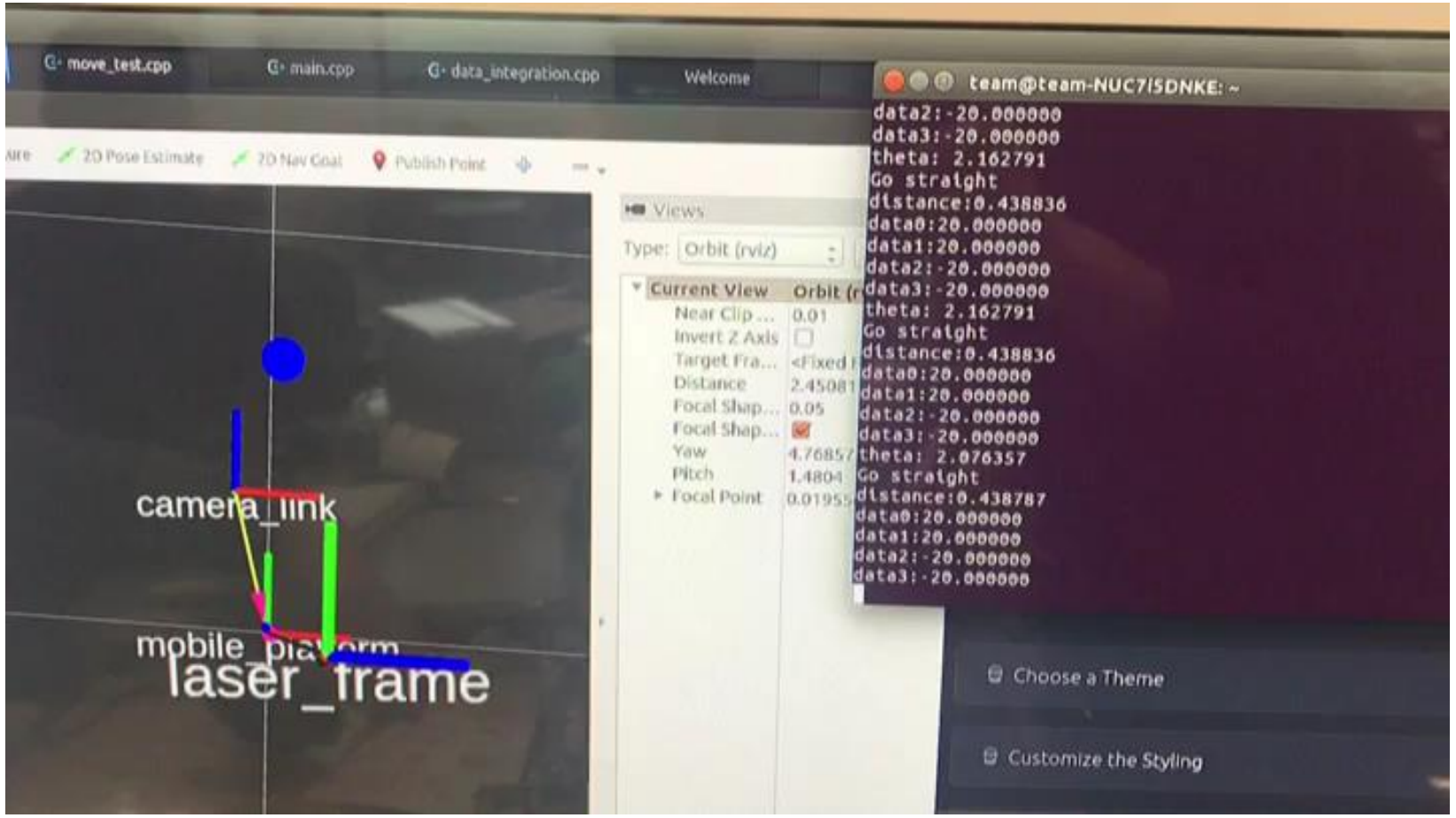
Overall Algorithm to ROS



Overall Algorithm to ROS




RViz*
Global Options
Fixed Frame
mobile_platform
Background Color
Frame Rate
30
team@team-NUC7i5DNKE: ~
transforms:
header:
seq: 0
stamp:
secs: 1525240071
nsecs: 731119396
frame_id: "mobile_platform"
child_frame_id: "camera_link"
transform:
translation:
x: -0.8
y: 3.5
z: 0.1
rotation:
x: -0.706825181105
y: 0.0
z: 0.0
w: 0.707388269167
Time
ROS Time: 1525240083.37
ROS Elapsed: 262.00
Reset
[100%] Built target static_tf_example
team@team-NUC7i5DNKE:~/capstone_ws$


move_test.cpp
main.cpp
data_integration.cpp
Welcome
2D Pose Estimate
2D Nav Goal
Publish Point
Views
Type: Orbit (rviz)
Current View
Near Clip ...
Invert Z Axis
Target Fra...
Distance
Focal Shap...
Focal Shap...
Yaw
Pitch
Focal Point
camera_link
laser_frame
team@team-NUC7i5DNKE: ~
data2:-20.000000
data3:-20.000000
theta: 2.162791
Go straight
distance:0.438836
data0:20.000000
data1:20.000000
data2:-20.000000
data3:-20.000000
theta: 2.162791
Go straight
distance:0.438836
data0:20.000000
data1:20.000000
data2:-20.000000
data3:-20.000000
theta: 2.076357
Go straight
distance:0.438787
data0:20.000000
data1:20.000000
data2:-20.000000
data3:-20.000000
Choose a Theme
Customize the Styling

LabVIEW

Overall Data Flow between NUC & Motors

NUC

Wi-Fi communication
TCP/IP communication

-Velocities
-(0,1,2,3,4)
→
(0,90,180,270,
360)

Data

MYRIO & LabVIEW

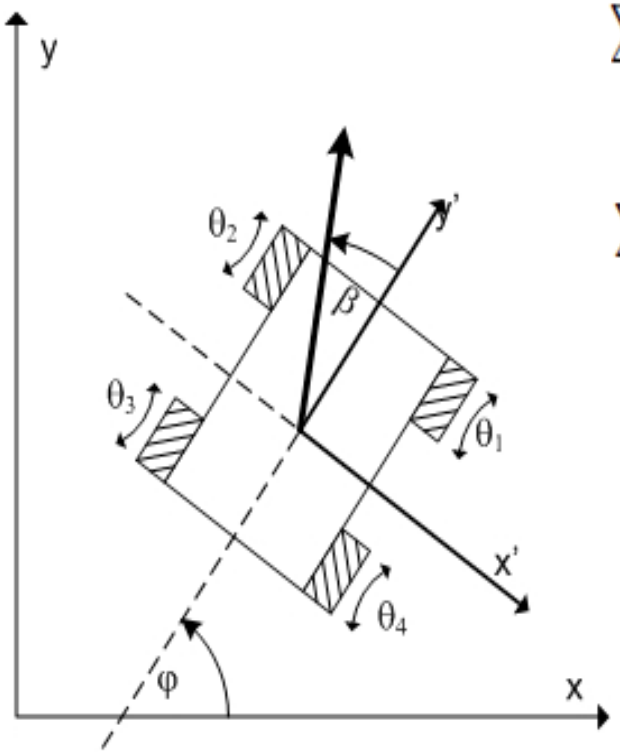
Serial communication

-Desired RPM
-Desired Angle

Command

Motors

Kinematic Modelling



<Coordinate>

$$\sum_{i=1}^{4} \mathbf{v}_{ix'} = \sum_{i=1}^{4} \mathbf{v}_i \cos\alpha = \sum_{i=1}^{4} (-1)^i \mathrm{SIG}(\theta_i) K_i r \dot{\theta}_i \sin\alpha \cos\alpha$$

$$\sum_{i=1}^{4} \mathbf{v}_{iy'} = \sum_{i=1}^{4} \mathbf{v}_i \sin\alpha = \sum_{i-1}^{4} (-1)^i \mathrm{SIG}(\theta_i) K_i r \dot{\theta}_i (\sin\alpha)^2$$

$$\mathbf{v}_x = \sin\varphi \sum_{i=1}^{4} \mathbf{v}_{ix'} + \cos\varphi \sum_{i=1}^{4} \mathbf{v}_{iy'}$$

$$\mathbf{v}_y = \cos\varphi \sum_{i=1}^{4} \mathbf{v}_{ix'} + \sin\varphi \sum_{i=1}^{4} \mathbf{v}_{iy'}$$

$$l_i = \frac{\sqrt{\overline{x_i}^2 + \overline{y_i}^2}}{2} \qquad \dot{\varphi} = \frac{\mathbf{v}_i}{l_i}$$

WITH Velocities of four wheel

Calculate rotational and translational motion!

-Nkgatho Tlale Mark de Villiers, "Kinematics and Dynamics Modelling of a mecanum Wheeled Mobile Platform", Council for Scientific and Industrial Research.

Date type from ROS

<Array[5]>

Double Type

- Velocity 1
- Velocity 2
- Velocity 3
- Velocity 4
- (0, 90, 180, 270, 360)

<TCP/IP>

STRINGS

<MyRio>

STRINGS

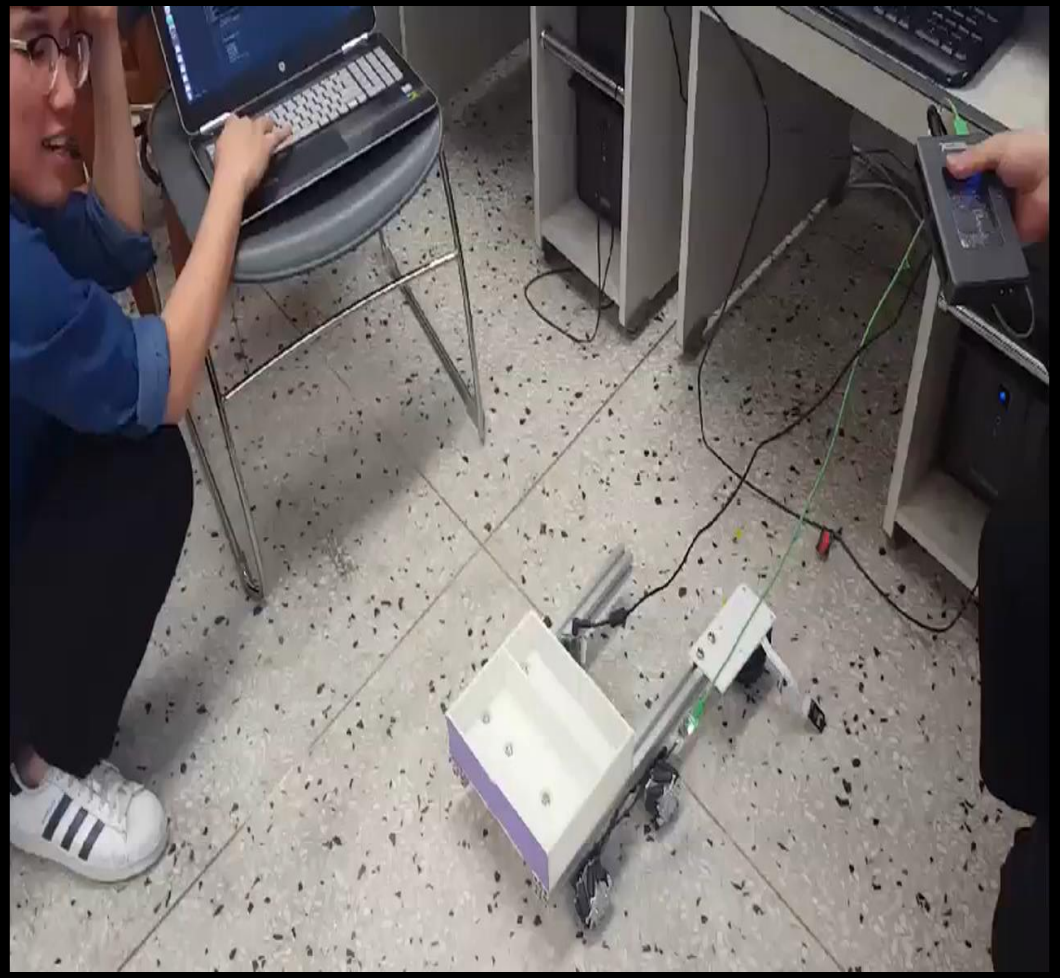
<Array[5]>

- Velocity 1
- Velocity 2
- Velocity 3
- Velocity 4
- (0, 90, 180, 270, 360)

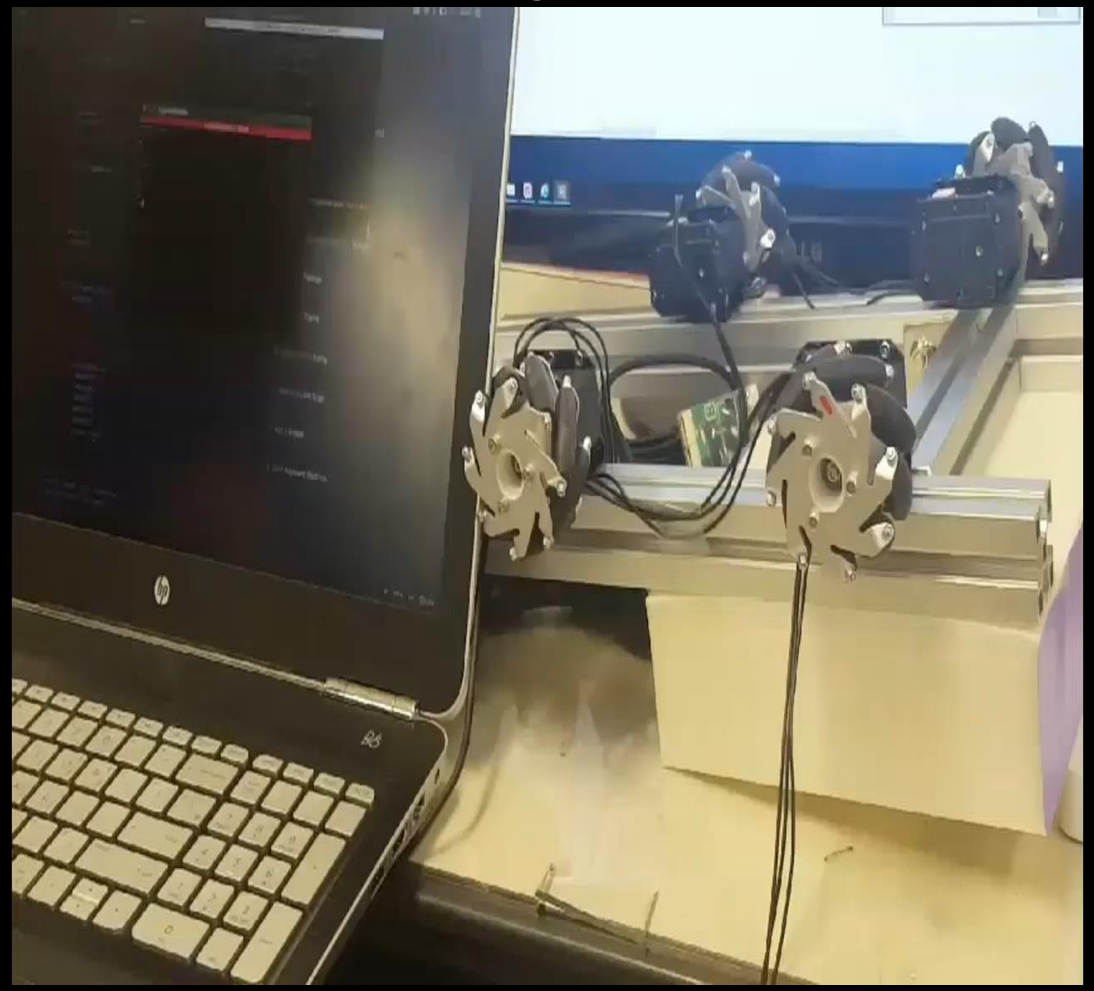
Signal

Watch the motion of the Vehicle

Each wheels by ROS input



Rotation of Picking part by ROS input

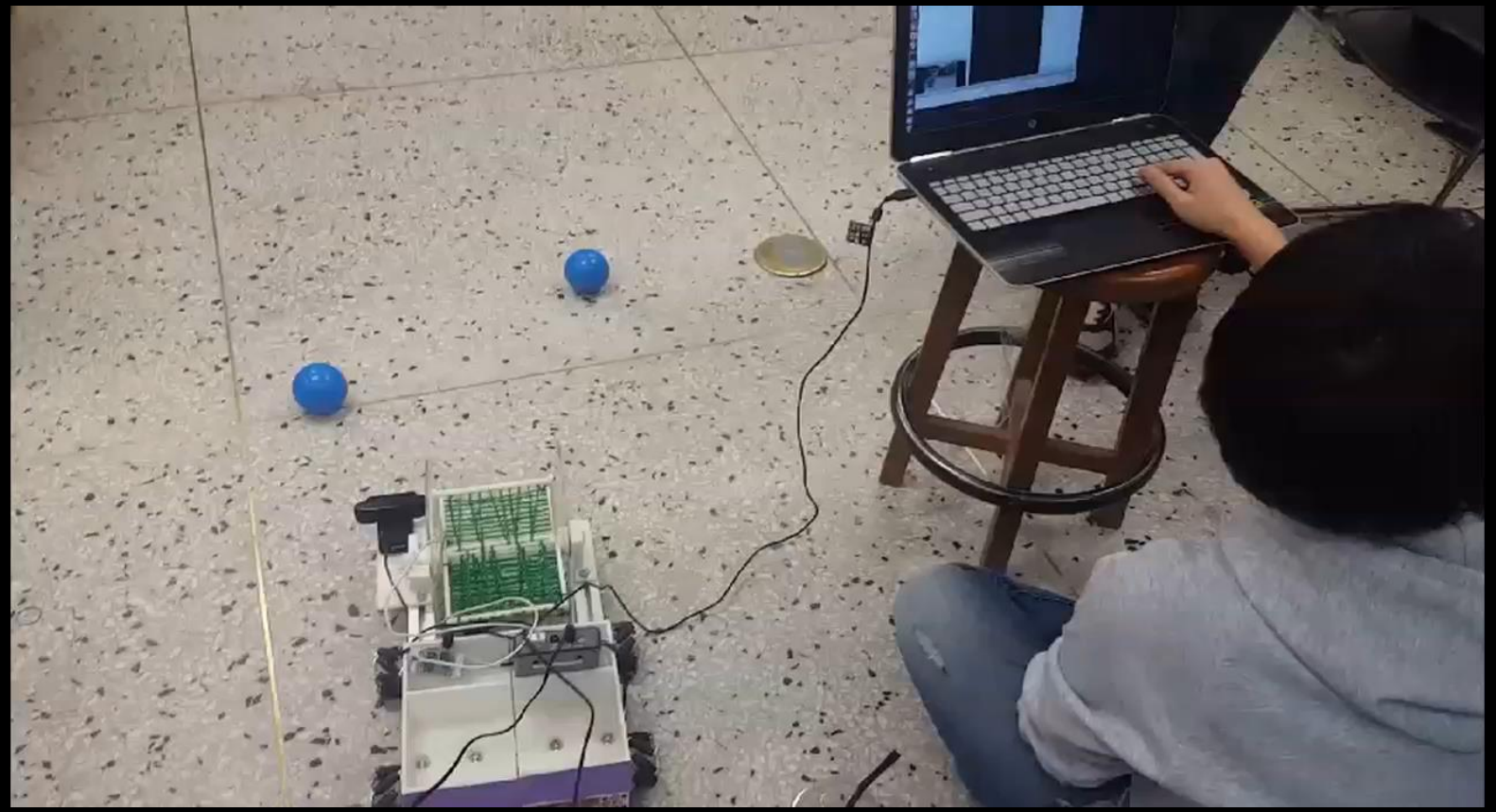


좋아요

댓글 달기

Watch the motion of the Vehicle

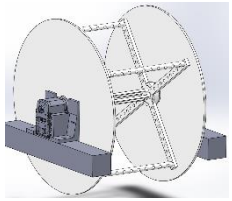
Mobile system detecting and going towards target



좋아요

댓글 달기

Future work



- **Solid works**

Suspension
Heat analysis
Assemble Collector

- **OpenCV**

Code improvement – Delete small circles in the balls
– Delete reflecting light
– Make non detection zone

- **LabVIEW**

Heat management

- **ROS**

Realize the overall algorithm

Logging out. Thank You.


Q
A