KAIST ME & NAVER Labs

Capstone Design 2018

Team 必勝

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Advisor:
Professor Philseung Lee | TA Sooyong Kim

Team Name: 必勝

必 Pronunciation: 필, Phill
Meaning: 반드시, Must

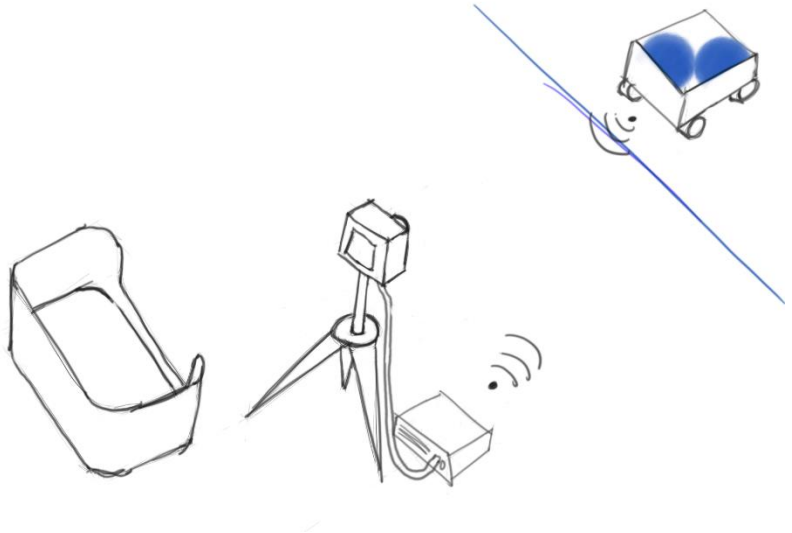
勝 Pronunciation: 승, Seung
Meaning: 이기다, Win, Victory

必勝 in Chinese letter means must, or will, win. This represents our team's strong will to win the first prize with professor Philseung Lee in Capstone Design 2018.

Also it could be re-interpreted as 'feel-seung', which means 'feel victory'.

Contents

Original Idea

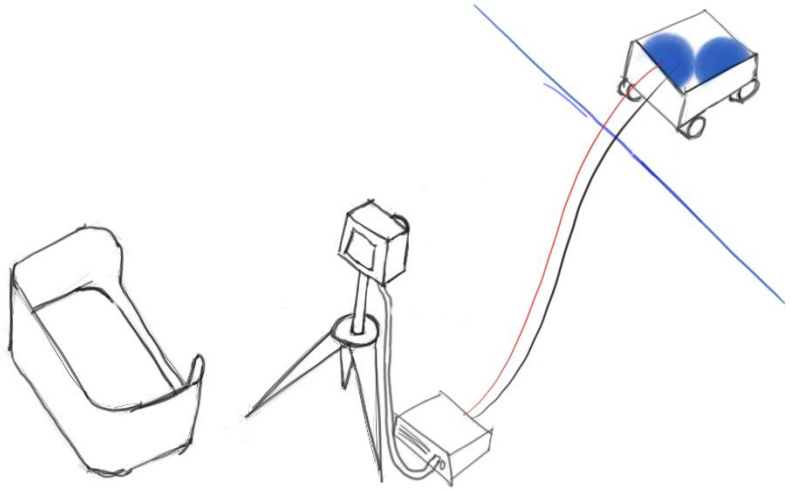


Wireless communication

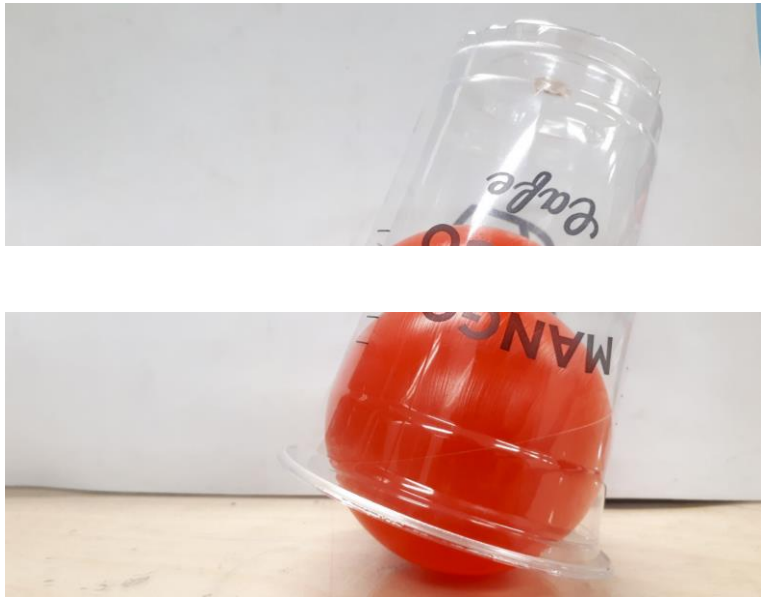
Simple gripping

01.
Ideation
About
System

Feedback



Contraint: One power source

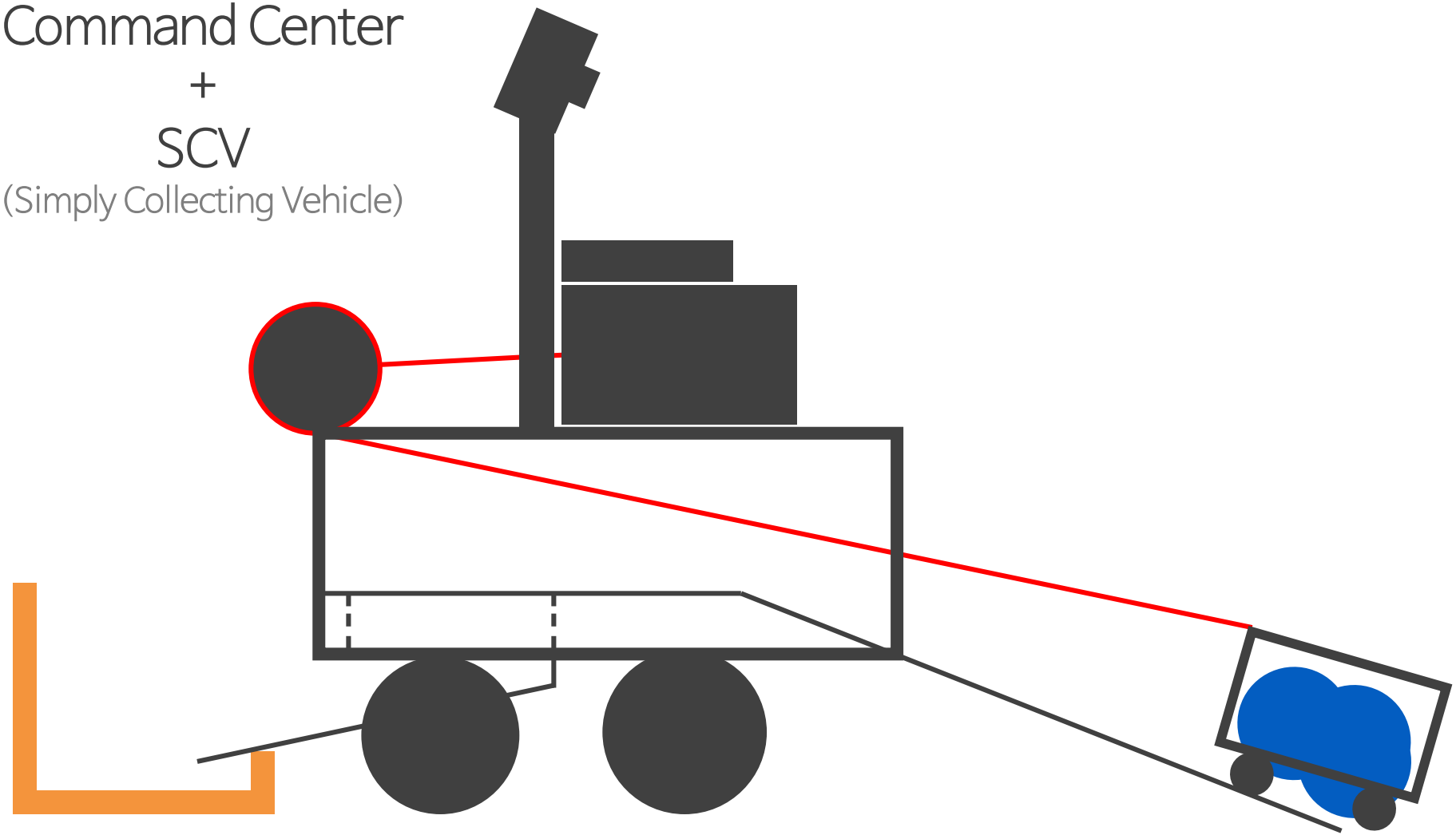


Final output: only balls inside basket

01.
Ideation
About
System

01. Ideation About System

Command Center + SCV
(Simply Collecting Vehicle)



02. Prototyping

Hardware_entire system

SCV collects the ball and bring them to the command canter

PMS_powering vehicle

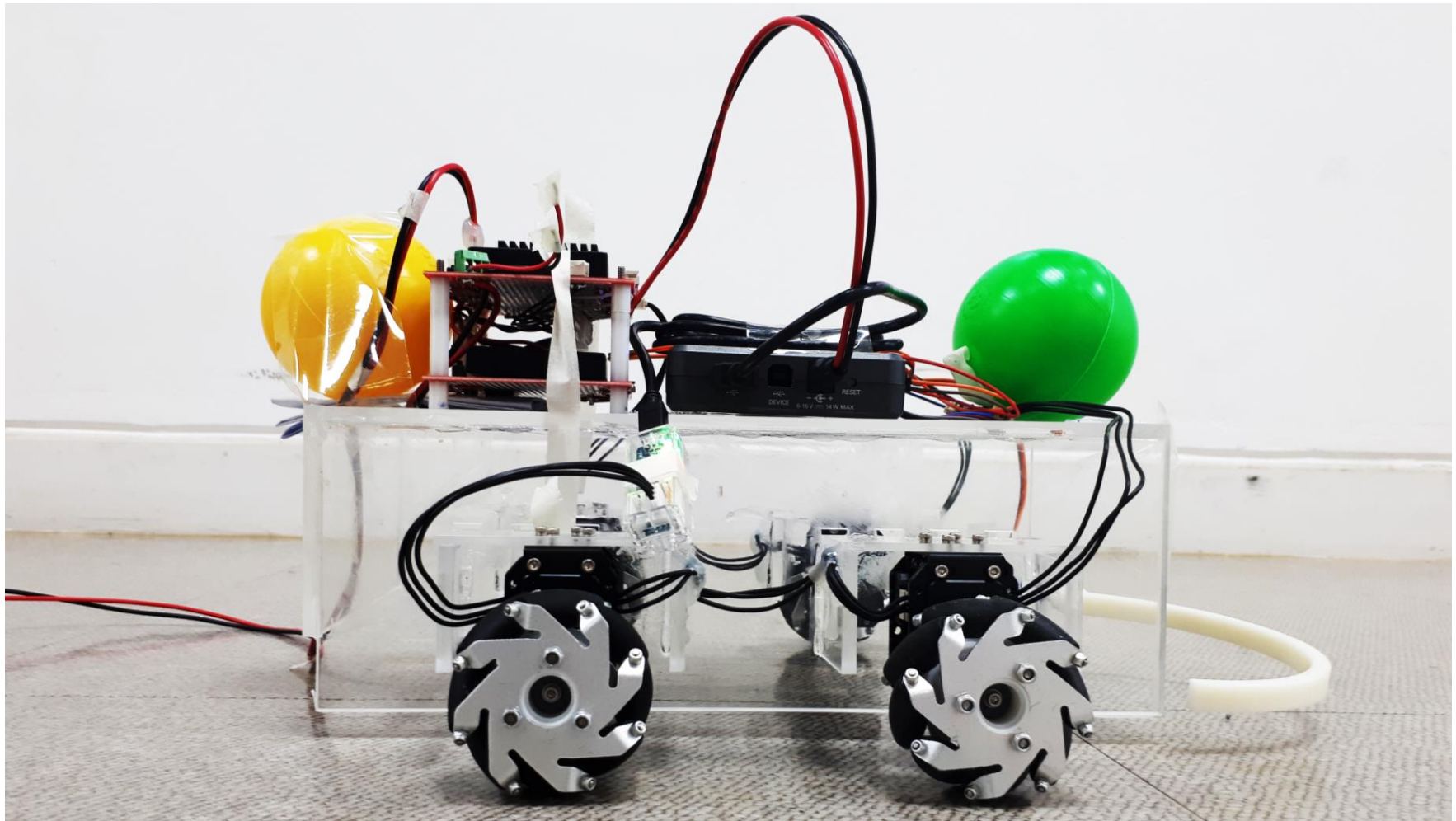
Give appropriate voltage and current

Heat, pickup, vibration_evaluated criteria

For safety and efficiency

02 Hardware

SCV (Simply Collecting Vehicle)

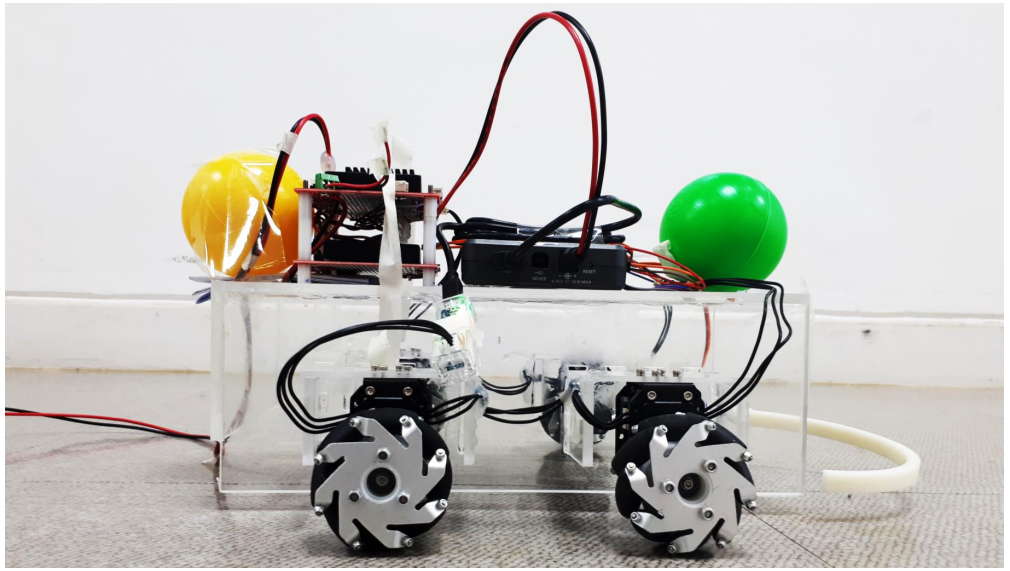


02 Hardware

Command Center

02 Hardware

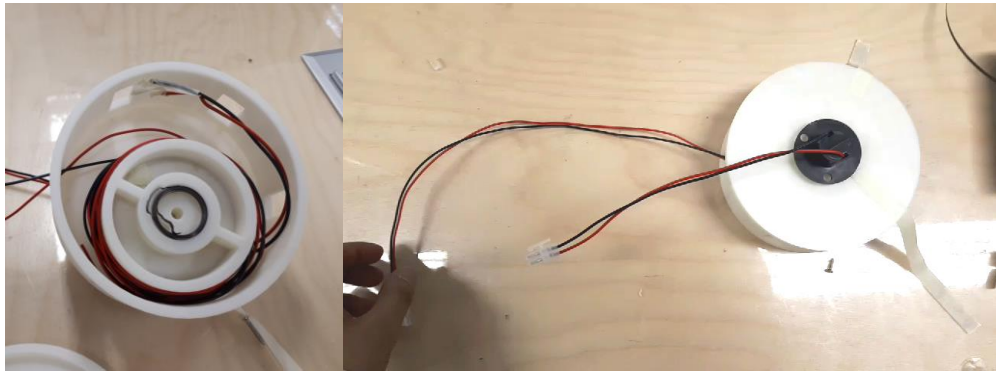
Entire system



Material	Acryl 5T
Processing	Laser Cutting & 3D printing
Dimension	SCV: 300 * 300 * 200 C.C: 500*300*1000
Key Features	Light weight Connected by wire Transparency (to monitor inside) - will be changed for final system

Existing Challenge

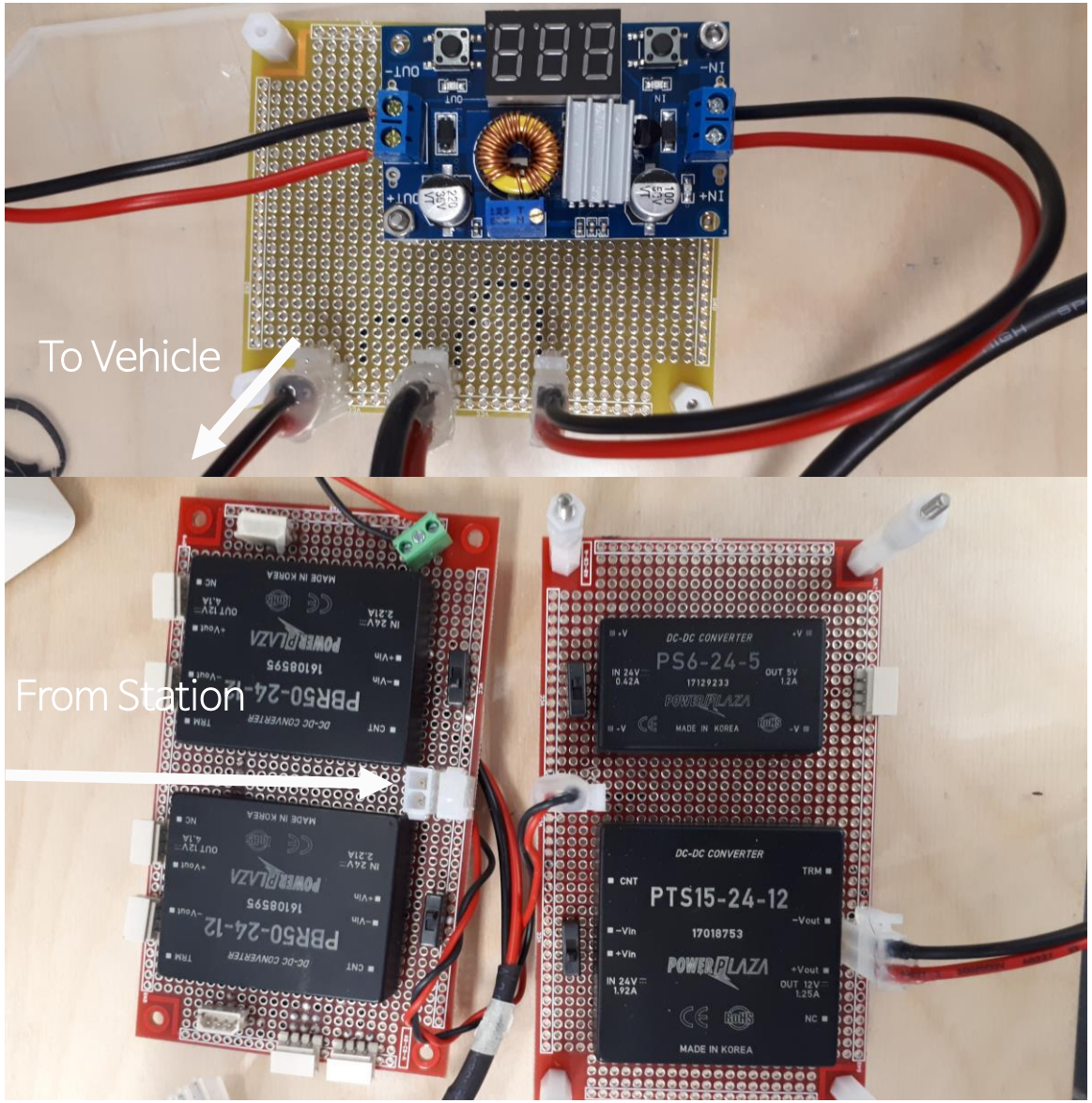
Managing Cable



02 PMS

Powering Vehicle

Material	DC-DC converter, board, wires, switches
Processing	Soldering
Input	21.6V DC(from battery)
Output	12V DC, 5V DC(optional) 19V DC
Key Features	Separately turned on/off Modularize



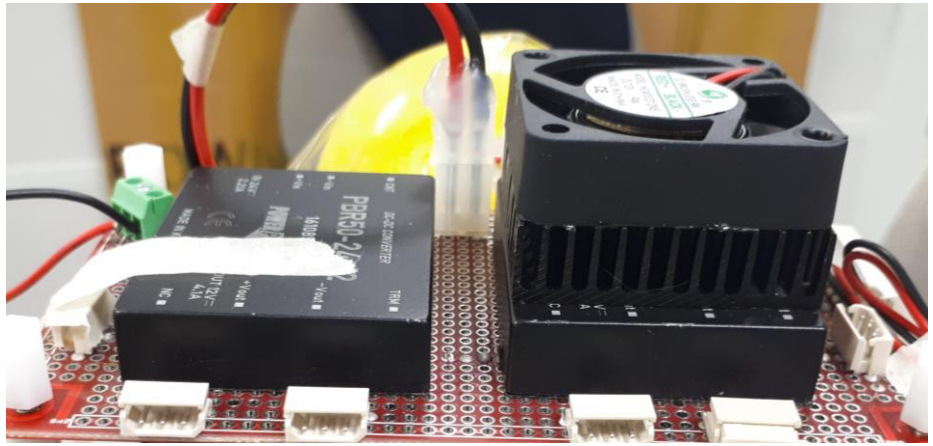
02 Heat, pickup, and vibration

Evaluated Criteria

Heat

Most temperature rise: converter

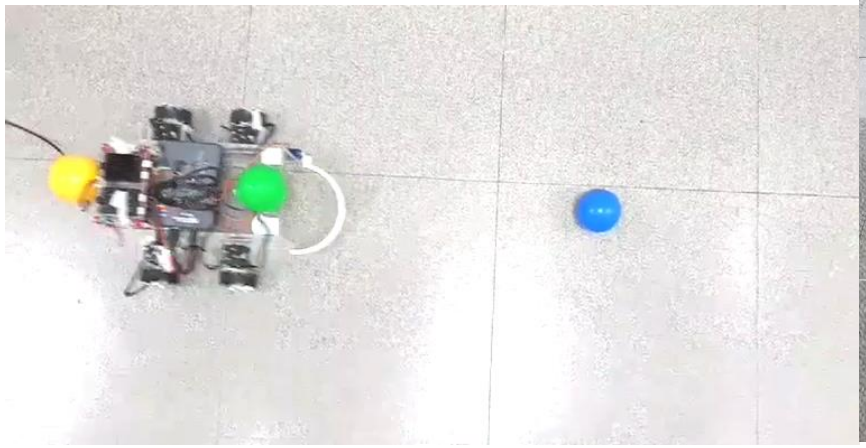
Fin and fan system



Pickup

No picking up process

Use C.C. to release the ball



02 Heat, pickup, and vibration

Evaluated Criteria

Vibration

Vibration source: mecanum wheel (SCV)

Does it affect detection of SCV?

03. Vision And Control

Vision_Camera and vision processing

Recognizing balls and SCV

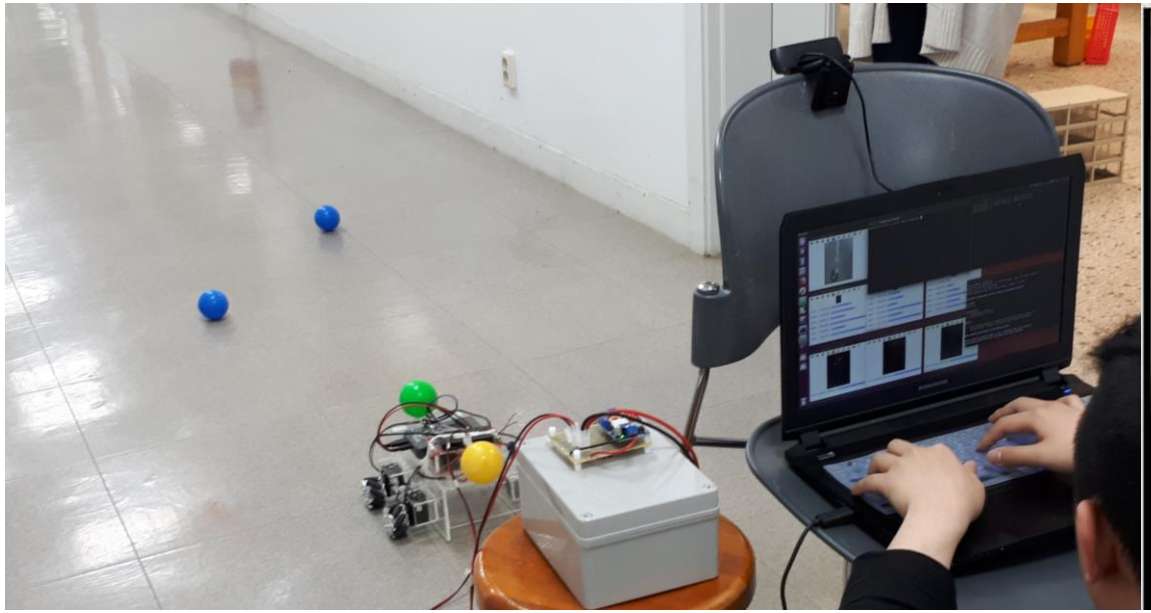
Motor Control_Communication and control

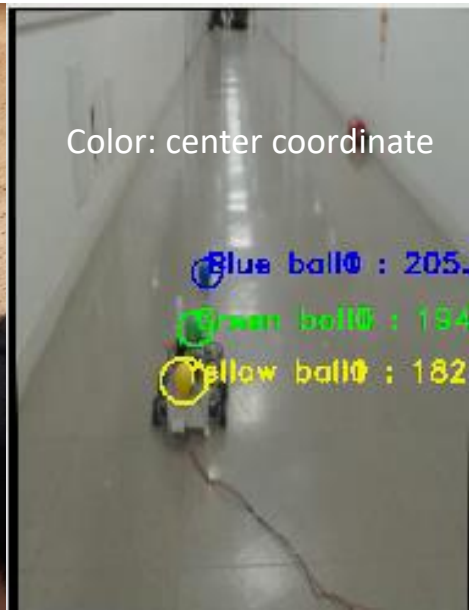
Control motor and Communicate with ROS to get input

03 Vision

Camera and vision processing

Identify **balls** Recognize **SCV** (x, y, θ) Print **command**





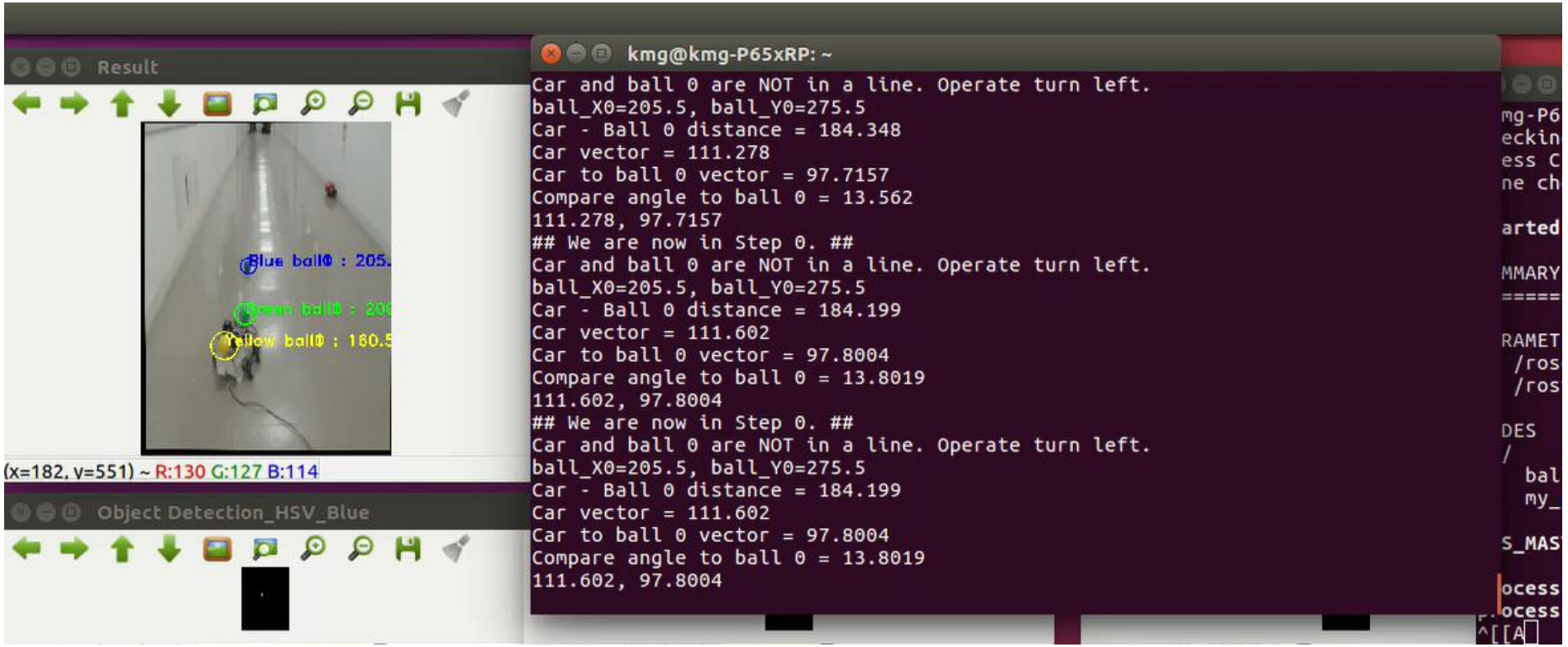

```
Car to ball 0 vector = 96.7721
Compare angle to ball 0 = 0.835045
## We are now in Step 0. ##
Car and ball 0 are in a line. Go straight to ball 0.
ball_X0=205.5, ball_Y0=276
Car - Ball 0 distance = 144.875
Car vector = 97.6511
Car to ball 0 vector = 96.6392
Compare angle to ball 0 = 1.01193
## We are now in Step 0. ##
Car and ball 0 are in a line. Go straight to ball 0.
ball_X0=205.5, ball_Y0=276
Car - Ball 0 distance = 143.824
Car vector = 97.9533
Car to ball 0 vector = 96.7883
Compare angle to ball 0 = 1.16508
## We are now in Step 0. ##
Car and ball 0 are in a line. Go straight to ball 0.
ball_X0=205.5, ball_Y0=276
Car - Ball 0 distance = 142.917
Car vector = 97.5108
Car to ball 0 vector = 96.8655
Compare angle to ball 0 = 0.64537
```

Key Features Fixed camera (origin) | center detection | no mapping | markers on SCV

03 Vision

Camera and vision processing

Does vibration affect detection of SCV?



03 Motor Control

Control motor and Communicate with ROS

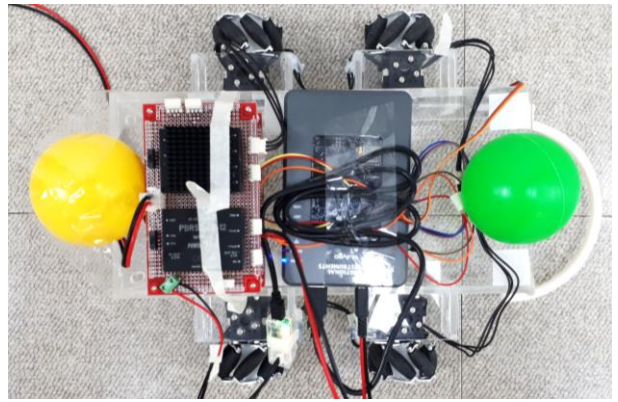
★★★★★

ROS→LabView

(50Hz) (100Hz)

Data Communication

Mapping



04. Algorithm Development

04 Algorithm

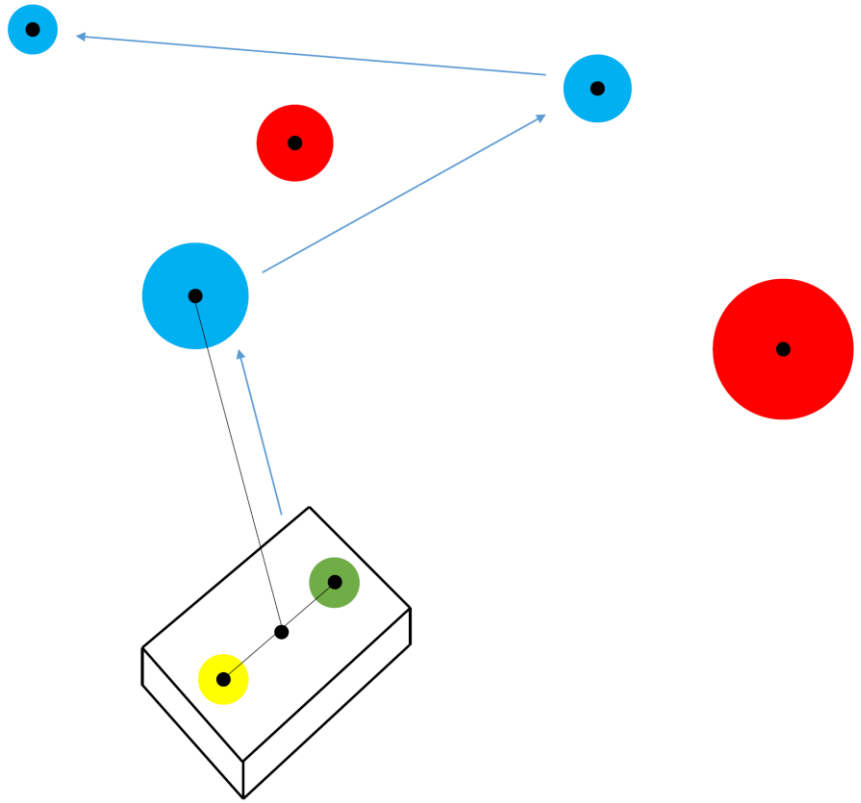
Key features

Easy

- Point mass system
- Minimized calculation
- Inertial frame of reference

Fast

- Shortest path: straight line
- No gripping motion

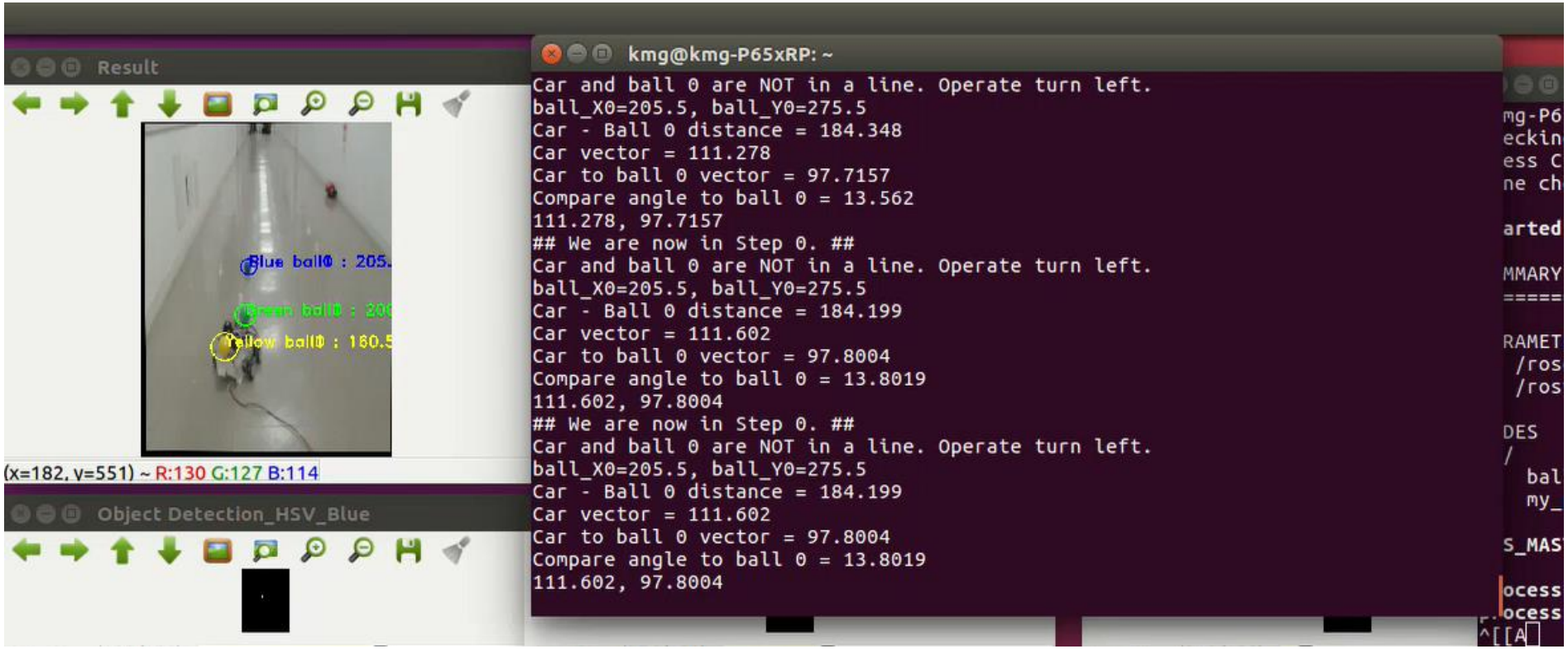


05.
Future
Plan

01.

Command Center

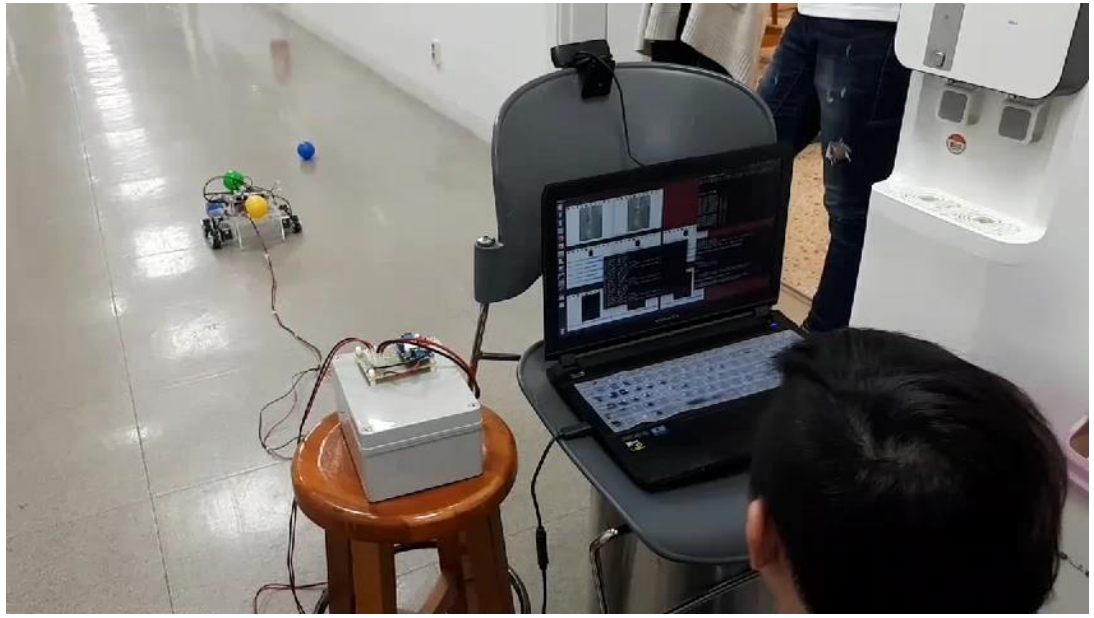
- Additional Control
- Wire Reel: slip ring + tension control (passive vs active)



02.

Algorithm

- Safer: fail safe, plan B
- Faster: eliminating delay
- Automation



03.

Make Final System

05.

Future Plan

Thank you!

Q&A