UMassAmherst

X - Bot

Badminton Shuttlecock Collector

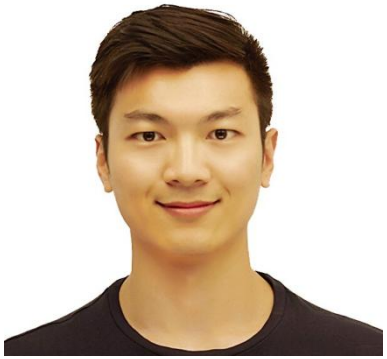
Aug 15, 2018

Department of Electrical and Computer Engineering

Advisor: Professor Tessier

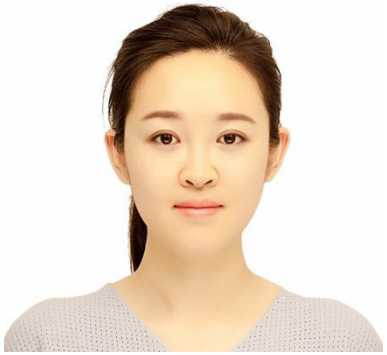
Team Members

Advisor
Prof. Tessier



Daniel Wang

- Team leader
- Software Design



Charlotte Wang

- Hardware Design
- Website Design

Problem Statement

- Many people choose professional gymnasiums to practice badminton with family, friends and coworkers.
- Gymnasiums pay salary to staff to collect shuttlecocks.
- The main ways to collect and sort shuttlecocks are manual or semi-automatic.
- To save human cost and improve sorting efficiency, automatic robots controlled by staff in gyms would be welcome.
- With X Bot, the shuttlecocks on the floor will be sorted with high efficiency and the sorted shuttlecocks will be transported to assigned collection centers.

What can we do with X - Bot?

- **Collect and sort shuttlecocks with high efficiency**
- **Transport shuttlecocks to assigned places via remote control on a Raspberry PI platform**
- **Useful for both professional individuals and gymnasiums**

Requirements Analysis

- **Requirements**

- **Pick up & Transport** shuttlecocks to collection centers (in MDR)

- **Image Identification** of shuttlecocks and courts to pick up the shuttlecocks with the help of a camera (in FPR)

- **Detect** whether the collecting container is full with a sensor

- **Interfaces**
  WI-FI

- **Battery**
  1) Chargeable
  2) Can use 2 hour after charging

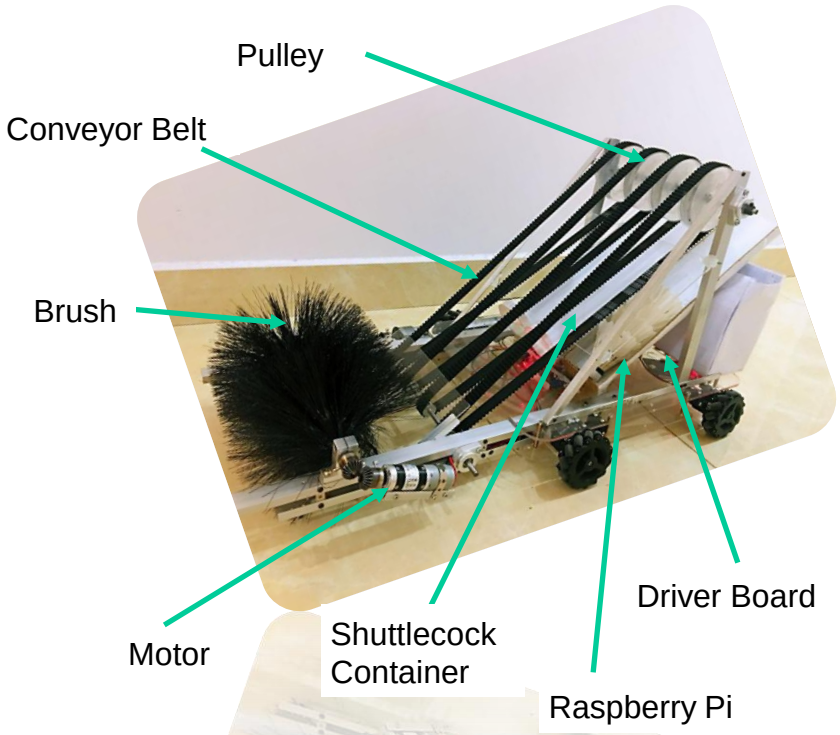
Specifications

Components:

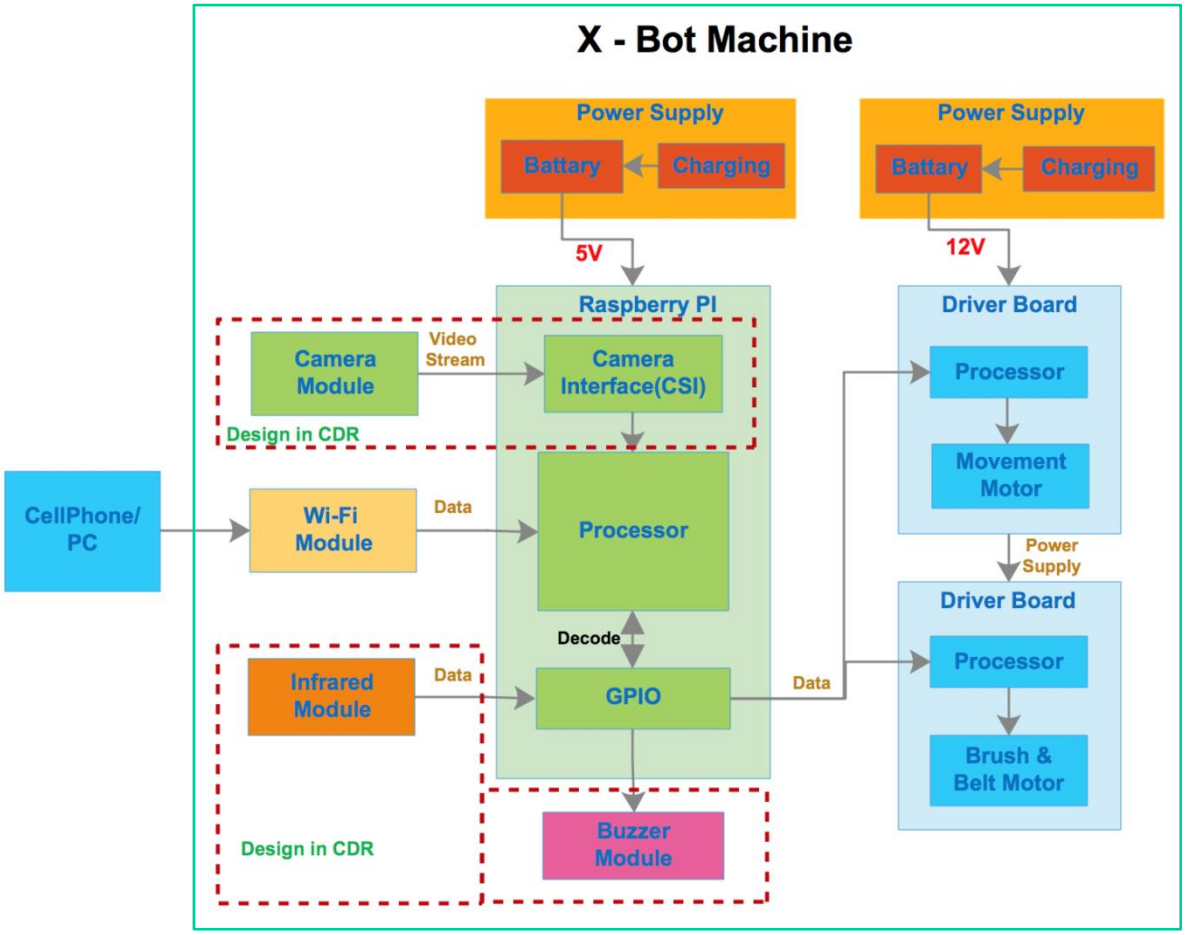
- 1 Main Board (Raspberry PI 3 B+) + 2 Development Boards
- 1 Chassis + 4 Wheels
- 4 Synchronous Pulleys + 4 Conveyor Belts
- 6 Motors
- 1 Mechanical Set + 3 containers
- 1 Brush
- 3 Battery Packs

Dimensions:

720 * 360 * 380 (L*W*H, mm)



Block Diagram



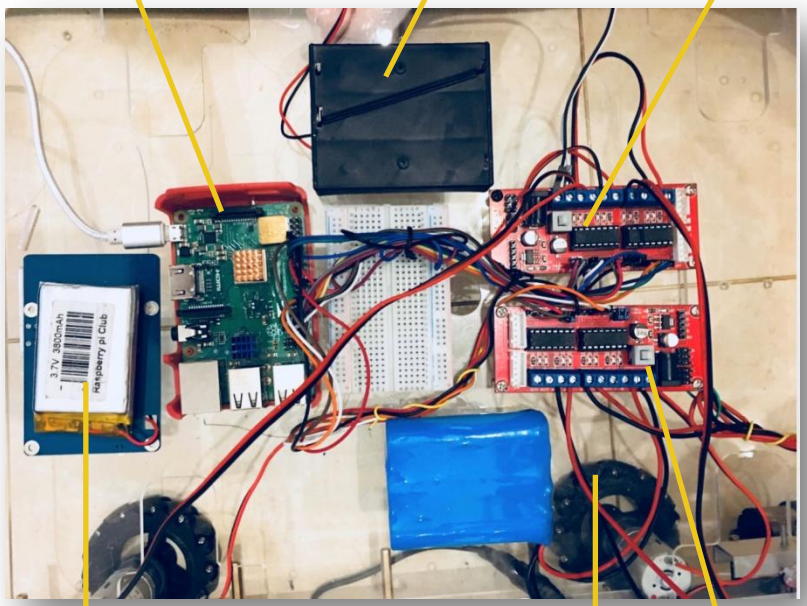
Block Diagram - Physical

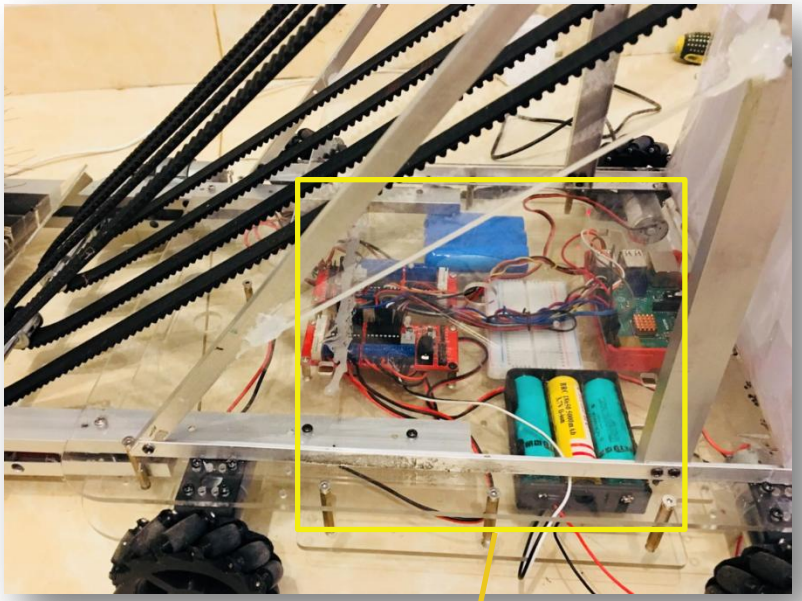
Battery for Driver Board（Vehicle Movement）

12V 4,800mA

Raspberry Pi

Driver Board (Vehicle Movement）





Driver Board（Belt & Brush）

Battery for Raspberry Pi

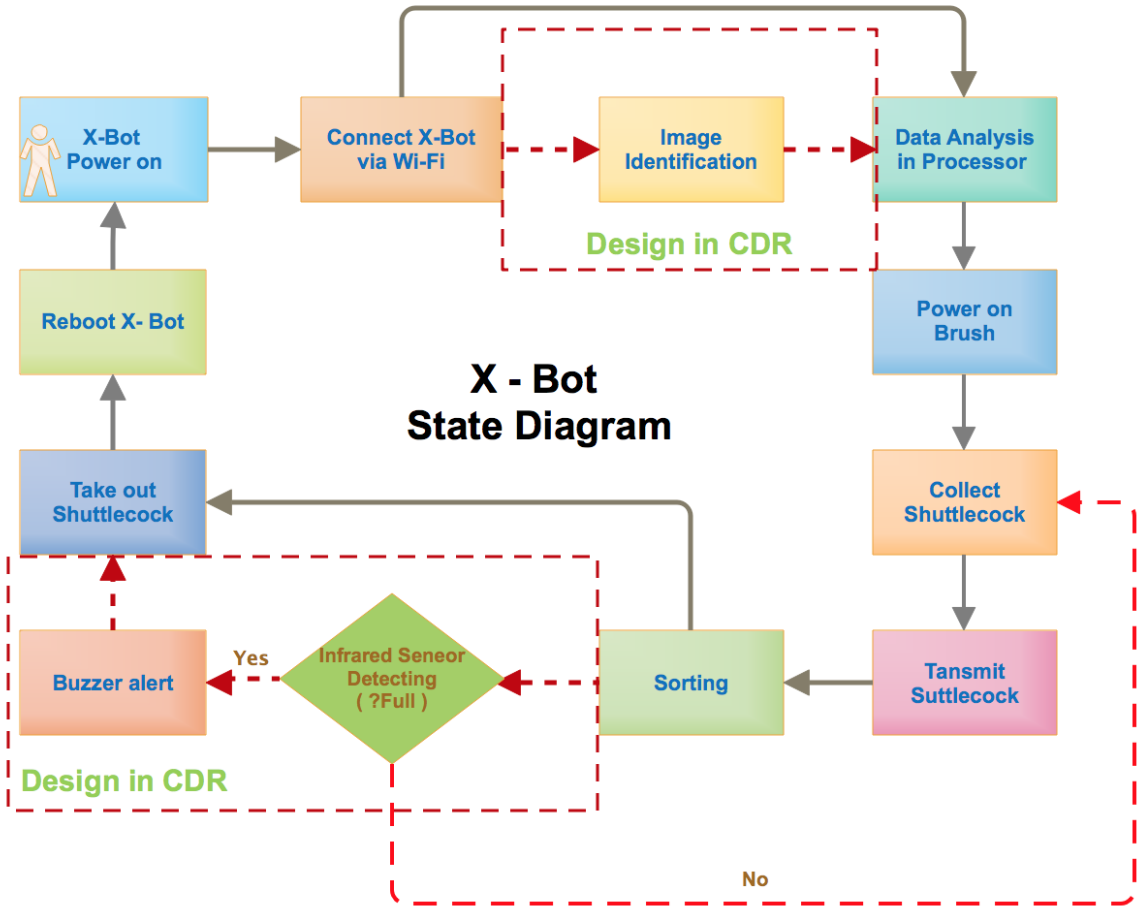
5V 3,700mA

Battery for Driver Board (Belt & Brush)

12V 2,400mA

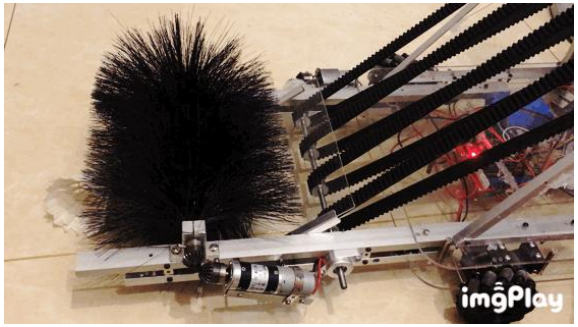
In the lower layer of chassis

State Diagram

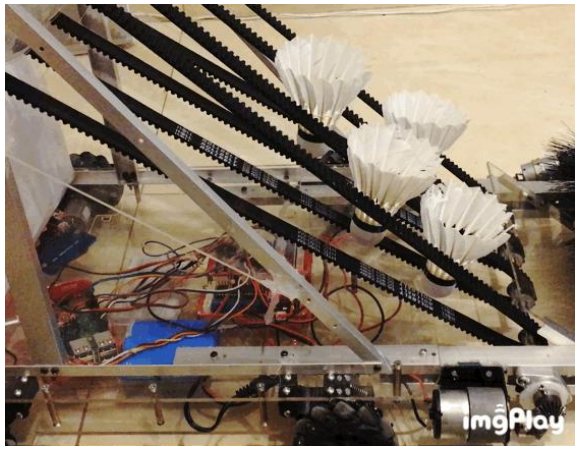


Testing

Can X-Bot Work ?

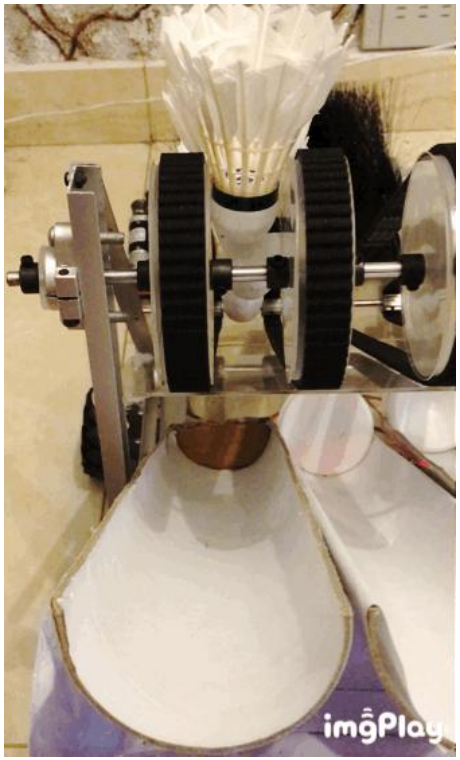


1. Brush



2. Transmit

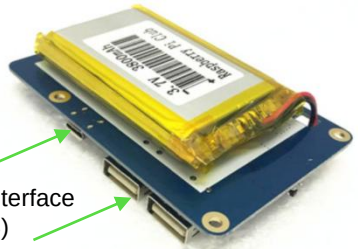
3. Sorting



Parts: Battery

How to select the battery ?

No.	Main Parts	Quantity	MAX electric current per unit	TTL electric current	Power on Time
1	Raspberry pi	1	500 mA	500 mA	7.4H
2	Motor(25GA-370)	4	400 mA	1,600 mA	3H
3	Motor(37-520)	2	600mA	1,200mA	2H
4	TTL requirement			3,300 mA	2H



- **Capacity: 3,700 mA**
- **Output : 5.1V ±0.1V**

- **Capacity: 4,800 mA**
- **Output : 12V ±0.1V**

- **Capacity: 2,400 mA**
- **Output : 12V ±0.1V**

Expenses

Components in X-Bot

No.	Item	Q'ty	Cost(CNY)
1	Raspberry Pi 3	1	269
2	Driver board	2	100
3	Camera + Stand	1	260
4	Wheels	4	200
5	Motor for brushes and pulleys	2	260
6	Motors for Chassis	4	180
7	Chassis	1	300
8	Infrared module	1	19.5
9	WIFI module	1	30
10	Lithium battery + Packs +Charge	3	280
12	Pulleys + Conveyor Belts	4	280
13	Mechanical set	1	300
14	Badminton shuttlecocks set	2	80
15	Brush	1	50
TTL			2608.50

Other Expenses

No.	Item	Q'ty	Cost(CNY)
1	Drill	1	50
2	Glue Gun + Sticks	1	30
3	Testing Belts	1	80
4	Mechanical Set	1	400
5	Testing Brush	4	80
6	Gimlet	1	50
7	Testing Motors	4	20
TTL			710.00

Proposed MDR Deliverables

- **Physical X - Bot**
  - **Function**
    1) Pick up a few shuttlecocks
    2) Deliver them to a container
    3) Transfer shuttlecocks to assigned places
  - **Design**

    As shown in the image on the right

- **Remote control in cell phone**

- **Battery:**
  - Energy calculation
  - Charging method
  - Current: 3300mA

Gantt Chart

No.	Item	1-Jul-18	22-Jul-18	12-Aug-18	4-Sep-18
1	Chassis				
	Wheels + Motors				
	Mechanical Stand				
	Brush + Motor				
	Pulley + Motor				
	Belts				
	Umbrella Gears				
	Sorting Components				
2	Raspberry PI 3 B+				
	Development Board				
	Battery				
	Remote Control Programming				
	Image Identification				
	Infrared Senor Module				
3	Website Design				

CDR Deliverables

- **Image Identification of Shuttlecocks & Programming**

  - Function

  1) Identify images of shuttlecocks

  2) Tell the brush to pick up a few shuttlecocks whenever an object is observed.

  - Design

  Plan to fix it on top of the brush

- **Sensor for alarming**

  When one of the container is full, tell the brush to stop working.

Q & A

Thank you