



Halli Galli

Auto-play Robot

Team 9 - 20150780	Chanyang Choi
20180063	Dohyun Kim
20190052	Geon Kim
20210188	Hyeyeon Kim
20224901	Yuanchun HE

What is Halli Galli?



Rules of Halli Galli

1. Each player turns over one card in play order



<https://youtu.be/5yticL06-Nfk>

Rules of Halli Galli

2. When the same fruit appear exactly 5,
the first player who rings the bell gets all the revealed cards

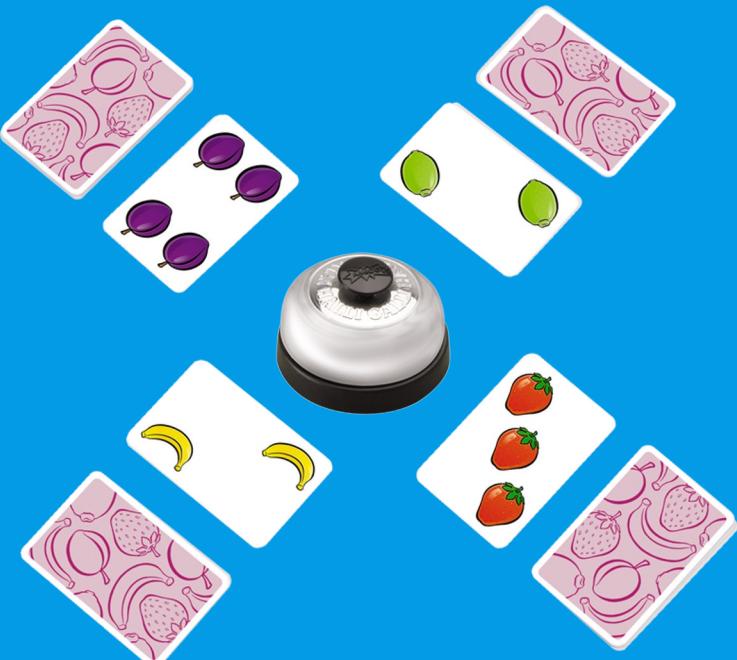


Rules of Halli Galli

3. If you ring the bell when there is no '5',
you should give one card to each person
4. The person who got the most number of cards wins within the time limit

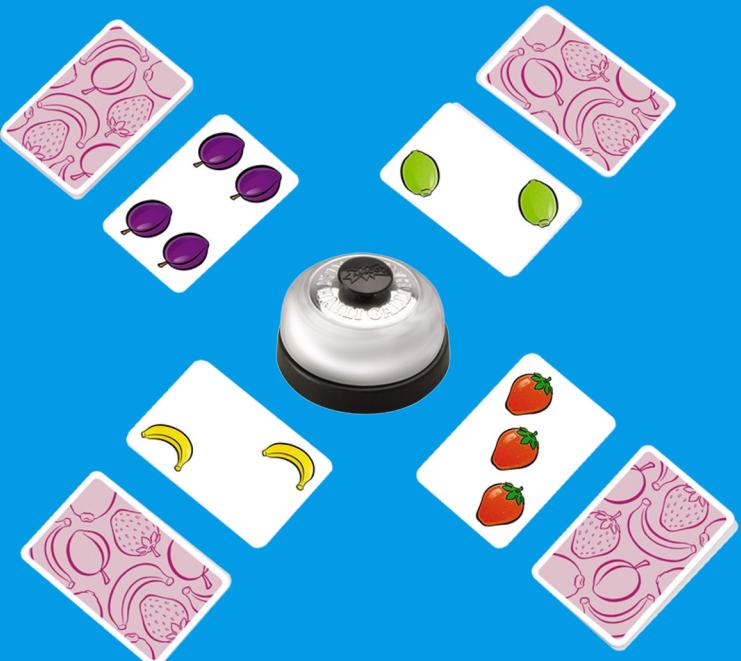
Motivation

- When you don't have someone to play game together
- When you want to practice the Halli Galli



Project Objective

- Develop Halli Galli Auto-play Robot !!



Problems

- Divide the cards
- Collect the revealed cards

Unsolved problems

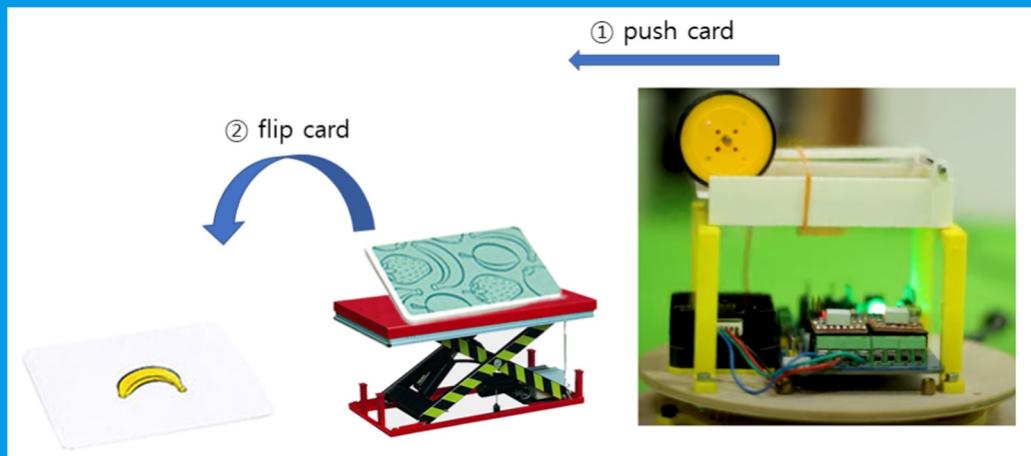
- Recognize card flipped by person
- Flip the card one by one
- Identify the number of each fruit
- After identifying the same five fruits, the robot rings the bell
- Recognize who rings the bell first

Solved problems

Solutions

Flip the card one by one

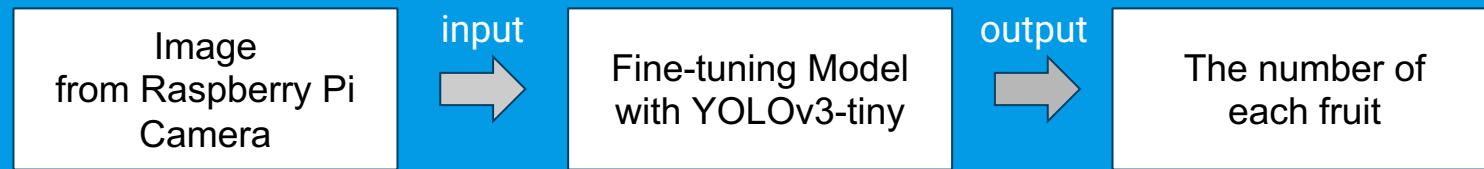
1. Push one card by rolling wheel
2. Flip a card by lifting
3. Repeat!



Solutions

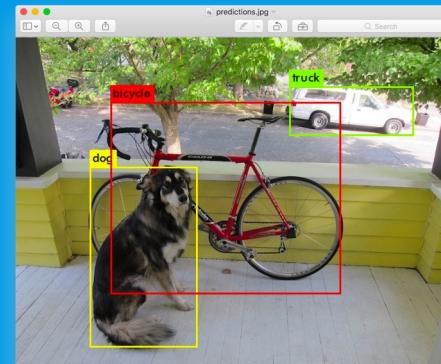
Identify the number of each fruit

Image processing



What is YOLOv3?

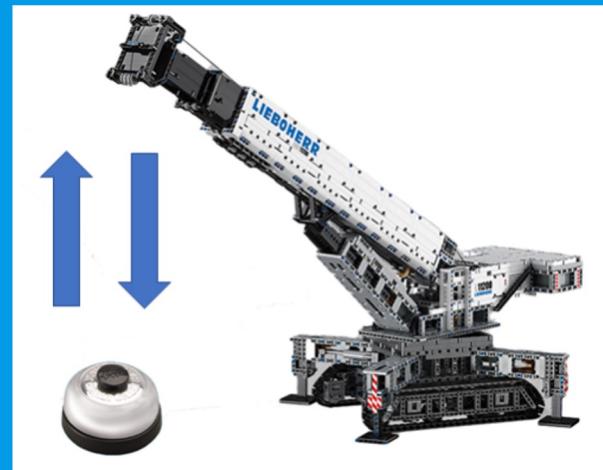
- Real-time object detection system



Solutions

Ring the bell

- We will make something like crane
- If robot recognizes 5 fruits, crane move downside
- After ringing the bell,
crane returns back to original position.



Solutions

Recognize who ring the bell first

Using color sensor, check the palm of the winner

Algorithm 2: playerWhoPushFirst

Result: Return player (robot or human) who push the bell first

```
while true do
    color ← getColor(); // get color from color sensor
    if color is ROBOT_COLOR then
        | return robot;
    end
    if color is HUMAN_COLOR then
        | return human;
    end
end
```



[Robot wins]



[Human wins]

Solutions Entire Process

Algorithm 1: Main

```
Result: Main loop for playing game
robotTurn ← true;
done ← false;
initializeCards();
while done is false do
    if robotTurn is true then
        | flipCard();
    end
    robotTurn ← !robotTurn;
    image ← imread(); // read image from camera
    if areThereFiveFruits(image) is true then
        | pushBell();
        if playerWhoPushFirst() is robot then
            | /* robot takes cards on table */;
            | waitUntilTakingCards(robot, cardsOnTable);
        else
            | /* human takes cards on table */;
            | waitUntilTakingCards(human, cardsOnTable);
        end
    else
        if isHumanPushingBell() is true then
            | /* robot takes one card from human */;
            | waitUntilTakingCards(robot, human.cards.top);
        end
    end
    if robot.cards is empty then
        | result ← human won;
        | done ← true;
    end
    if human.cards is empty then
        | result ← robot won;
        | done ← true;
    end
end
return result;
```

- Pseudo code is designed based on rules of Halli Galli and our solutions described before

Solutions

Entire Process

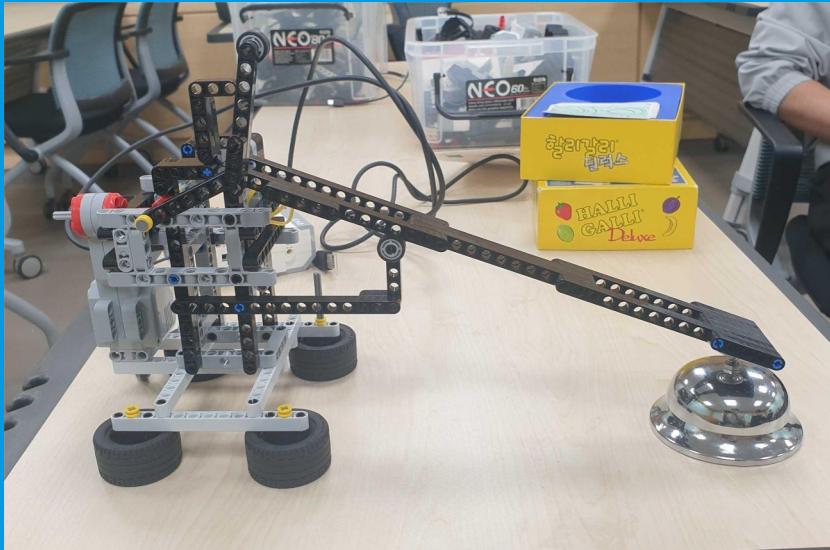
Algorithm 1: Main

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initializeCards();
while done is false do
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    end
    robotTurn ← !robotTurn;
    image ← imread(); // read image from camera
    if areThereFiveFruits(image) is true then
        pushBell();
        if playerWhoPushFirst() is robot then
            /* robot takes cards on table */;
            waitUntilTakingCards(robot, cardsOnTable);
        else
            /* human takes cards on table */;
            waitUntilTakingCards(human, cardsOnTable);
        end
    else
        if isHumanPushingBell() is true then
            /* robot takes one card from human */;
            waitUntilTakingCards(robot, human.cards.top);
        end
    end
end
```

- We assume that robot has image recognition ability with 100% accuracy
- If person pushes the bell when there are not five fruits, it will be considered as person's mistake
- In this case, human should give one card to robot

Have Done

We start robot construction at week 10



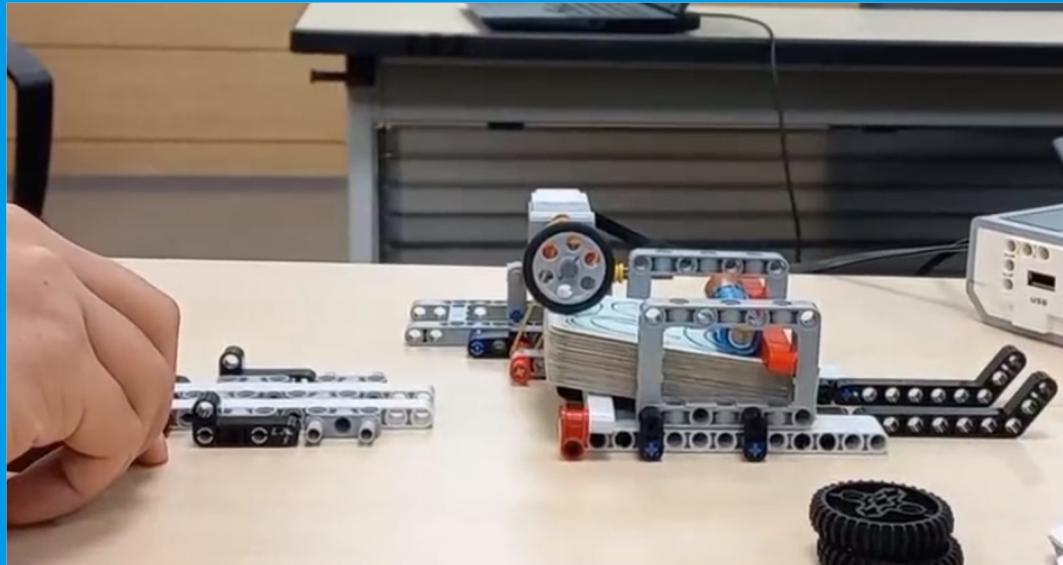
Have Done

Implementation of ring the bell



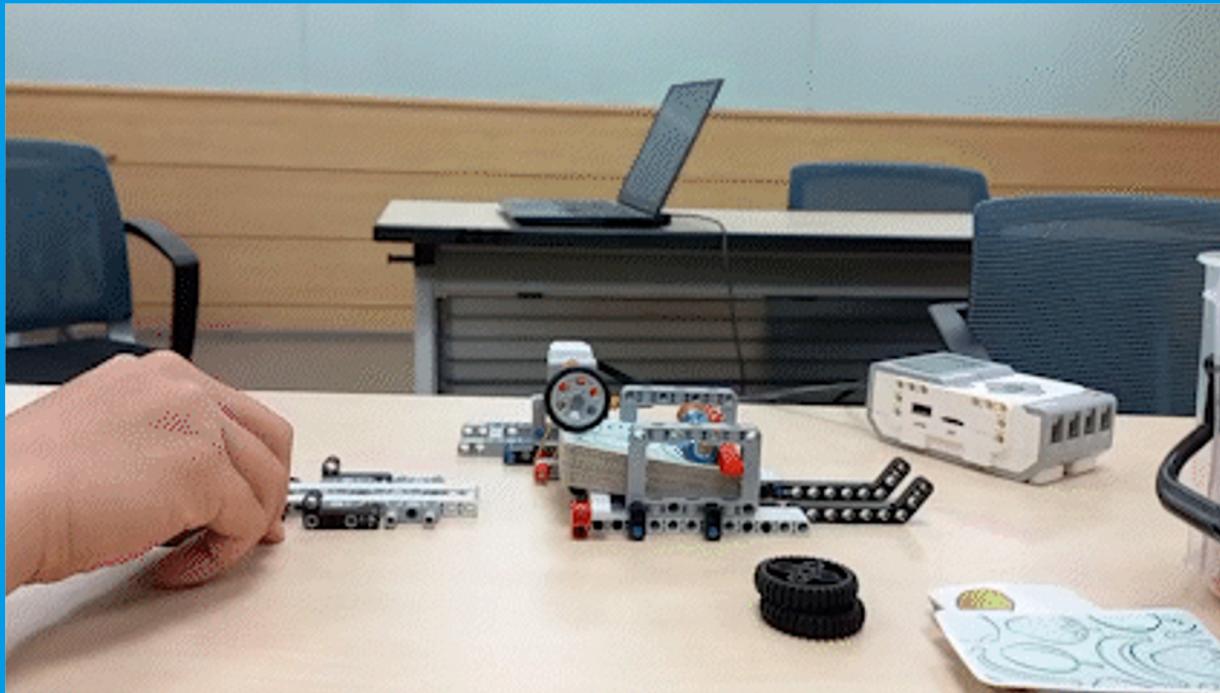
Have Done

Implementation of flip the card



Have Done

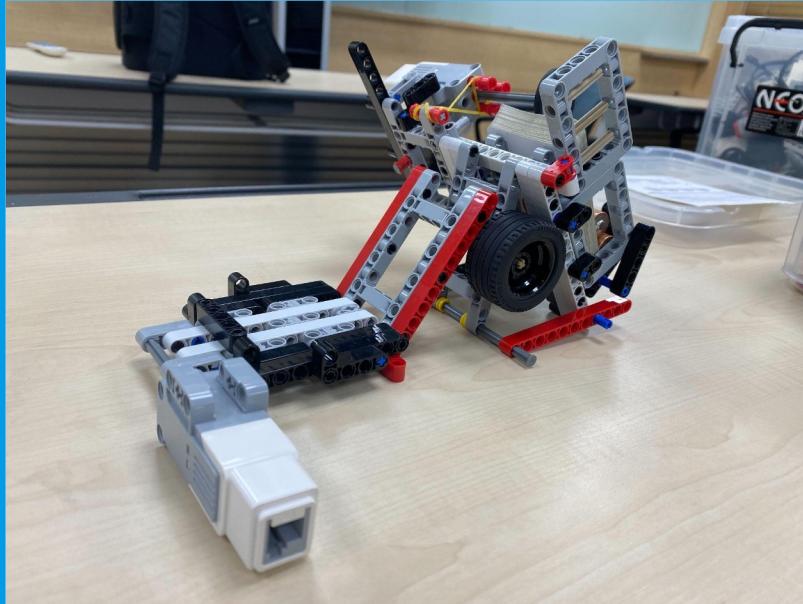
Implementation of flip the card



Have Done

Implementation of flip the card

- Use rubber band for adjusting position of motor



Have Done

Implementation of flip the card

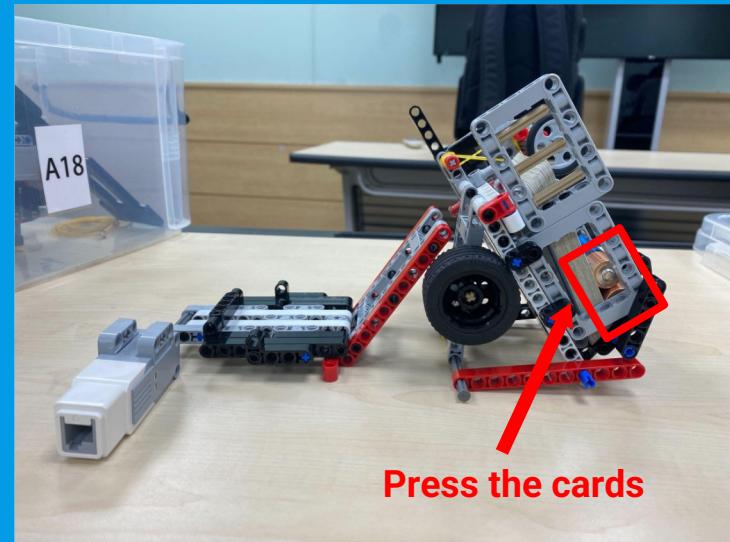
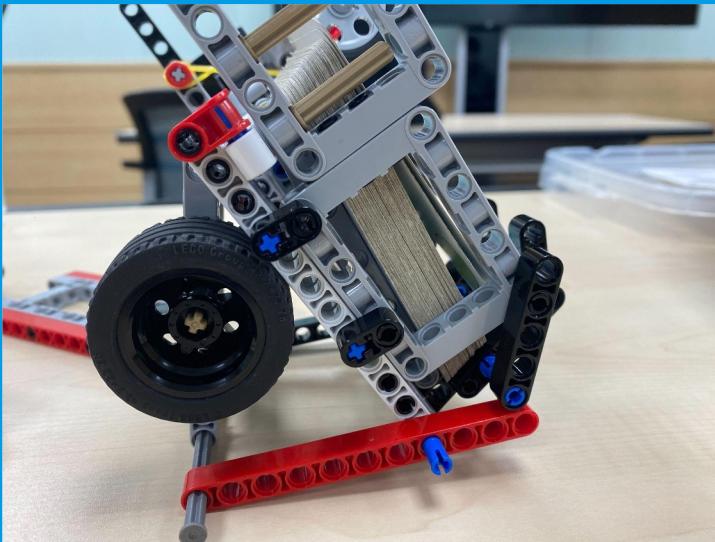
- Make slope to prevent the card on the back from escaping



Have Done

Implementation of flip the card

- Use battery to press the cards



To Do (Work Plan)

	week 11 Midterm Presentation	week 12	week 13	week 14 Final Presentation
Hardware for card flip		Hyeyeon, Yuanchun		
Hardware for ring bell		Chanyang, Dohyun		
Software for card recognition			Geon, Yuanchun	
Software for card flip			Geon, Hyeyeon	
Software for ring bell			Chanyang, Dohyun	
Prepare Final presentation				together



Thank you



Team 9