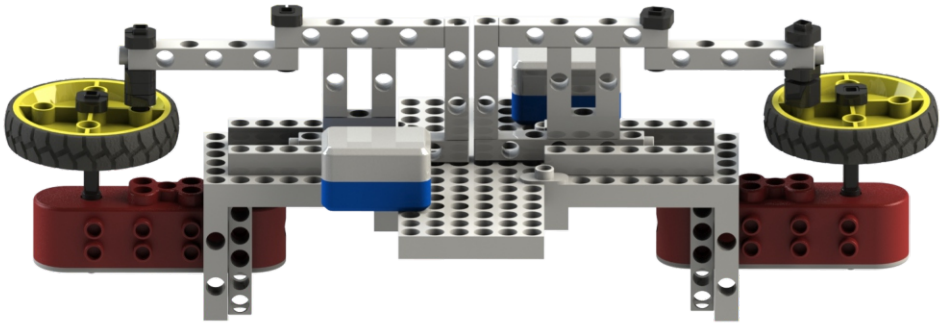
robo X

An Experiential Learning Package



Automatic Door Sliding Mechanism

WORKSHOP # Automatic Door Sliding Mechanism

Introduction:

The automatic door mechanism is widely used in the shopping malls, airports etc, which automatically open and close the door when a person passes by it. We can add additional level of security by adding a password or fingerprint lock to this mechanism.

Today's Agenda

To build a basic door sliding mechanism which slides open automatically when a person enters or exits a room/building.

Session Plan

- Introduce today's agenda to the class
- Make students answer the pre-activity questions listed below
- Show the video of automatic door mechanism. The video gives students a rough idea on the usefulness of the mechanism
  (Link: https://www.youtube.com/watch?v=D6OBSQ6nTLM)
  Youtube Robox Learning Channel Activity Introduction Videos
- How and where will we use this Mechanism?

Session Guide

Note: Teacher will act as facilitator to guide the students to accomplish the task given in the agenda:

- Students need to be divided into groups and a leader should be chosen
- Each of the students will be asked to pick up one of the three activities, to assemble the mechanism, to configure the Robot & to write the Code
- Students need to assemble the mechanism as per the step by step guidelines
- Students need to configure and place the sensors at the right position such that it can detect an obstacle according to the mechanism
- The code logic is to be explained to the students and accordingly the relevant program code is to be written by the students using ROBOGURU Software

Game-1:

The students are asked to check the response time of gates made by other groups. The students are expected to wave their hands in front of the door as quickly as possible to find faults in the mechanism. Also the students can to try experiment and play around with the mechanism by trying to open it without actually standing in the front.

This will test the sensor placement of the mechanism. The team with minimum number of flaws can be considered as the winner.

Key features of the game: The student will understand the requirements to build a robust mechanism when he/she finds the flaws in the existing system. This improves to quality of the mechanism built.

Fun Element

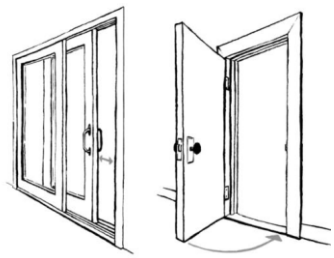
The students will have fun in testing the mechanisms made by others teams and thereby put more efforts in finding faults and issues.

Life Skills Developed

- Logic building
- Task division and management
- Creativity and Innovation

Pre-Activity Questions

Q1.What is the difference between a sliding door and a hinge door?



Write your answer in this box.

Q2. Why do we need remotely controlled robots?

Write your answer in this box.

Q3.How is a sliding door better than a general purpose hinge door?

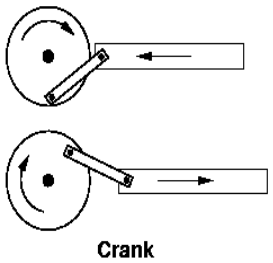
Write your answer in this box.

Q4. Draw the flowchart for the logic to implement the door sliding mechanism.

Write your answer in this box.

Students Note:

Concepts covered:



How motor rotation is modified to slide a door?

We will use the concept of crank shaft mechanism which is converts rotational motion of the motors to linear motion, this can be used to slide the doors open.

Exercise:

Let us build the door sliding mechanism using ROBOX building blocks and tools.

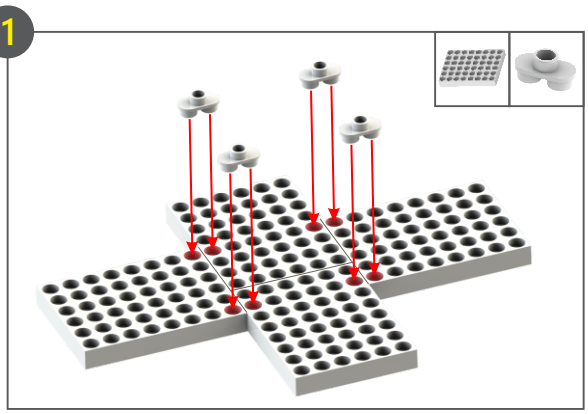
Divide the project into steps of smaller tasks and write them down with the name of the person who is going to implement it.

Task	Name

Do make sure that you strike off the tasks once they are finished.

Step by step mechanism assembling:

1



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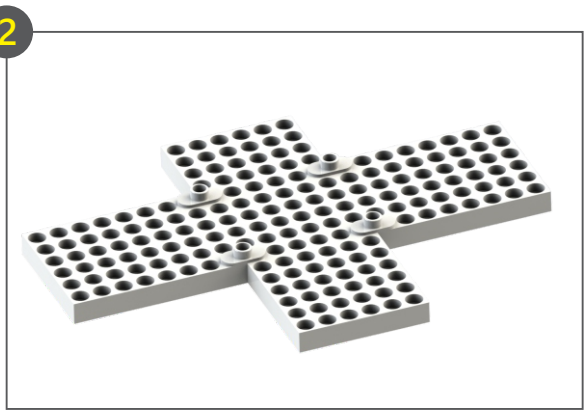

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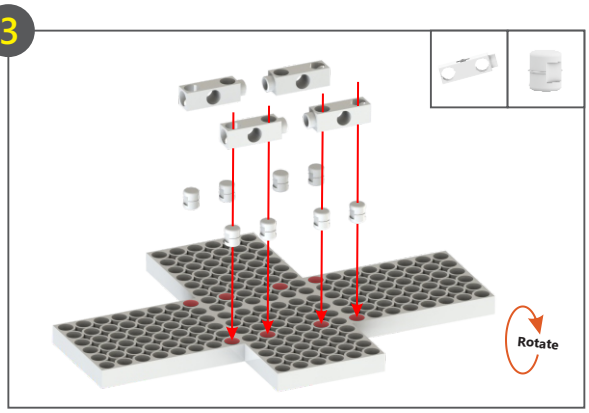

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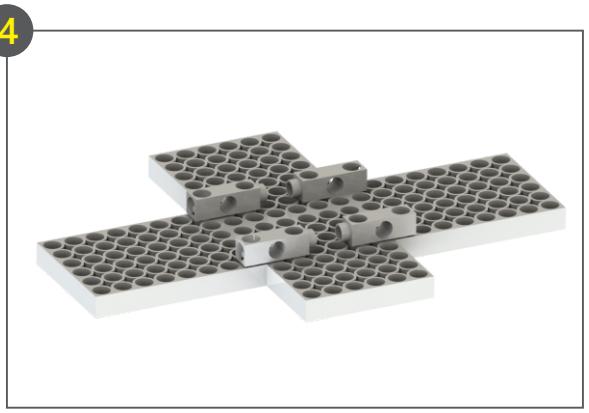

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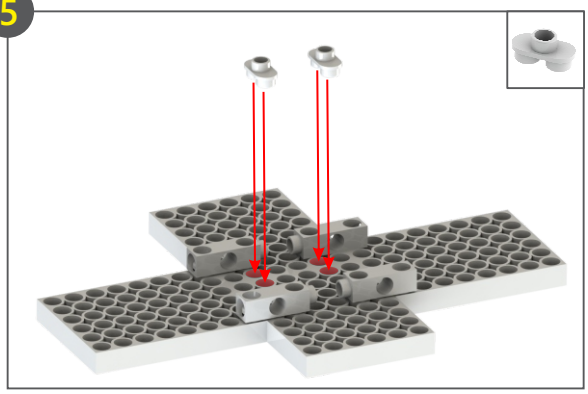

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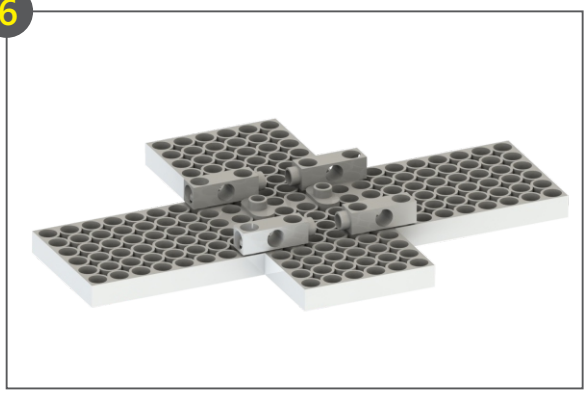

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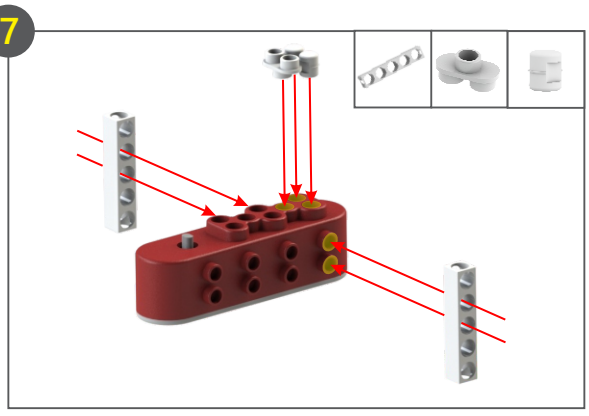

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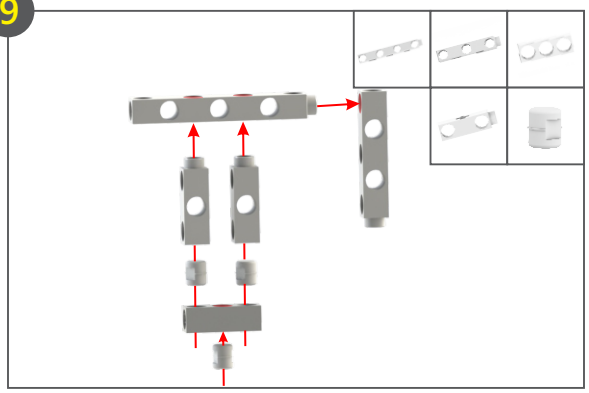

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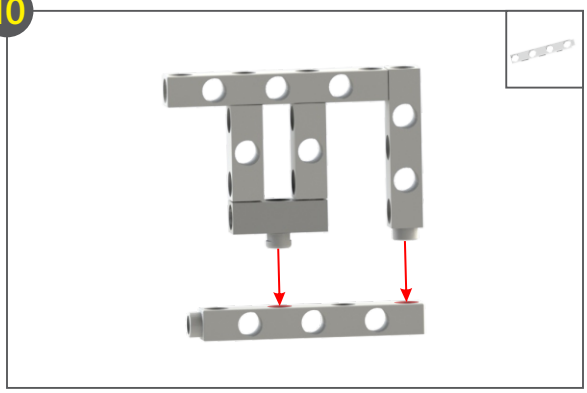

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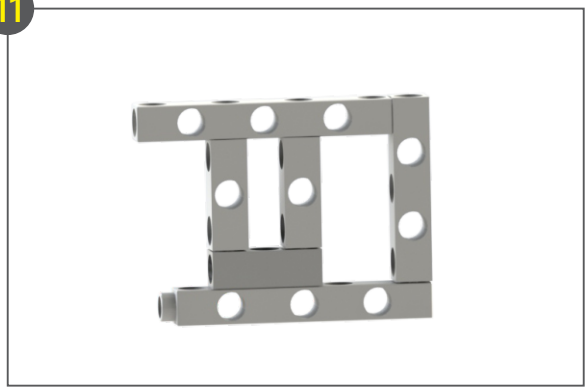

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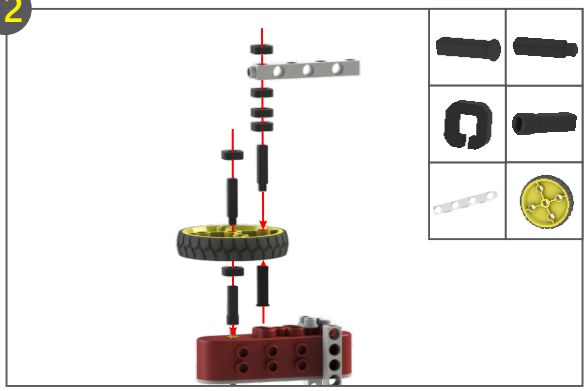

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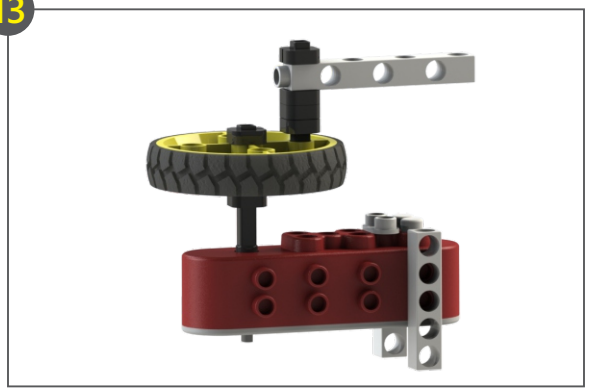

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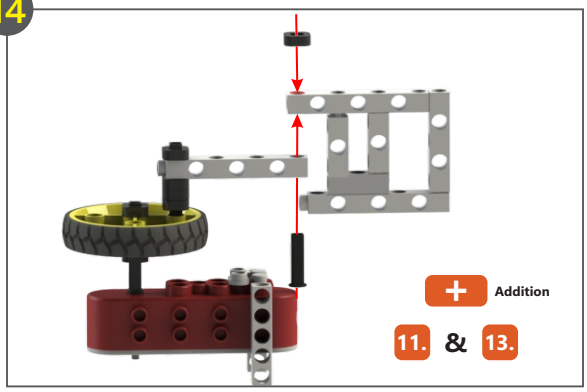

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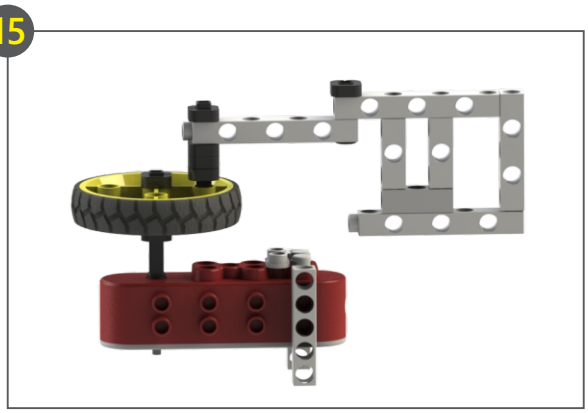

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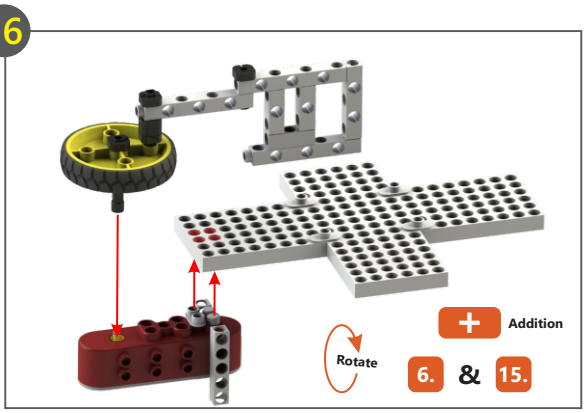

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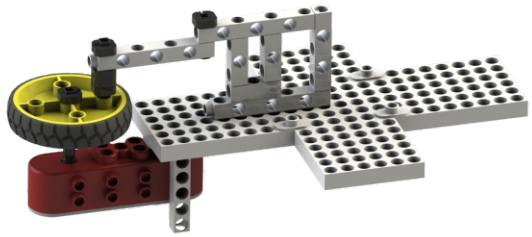

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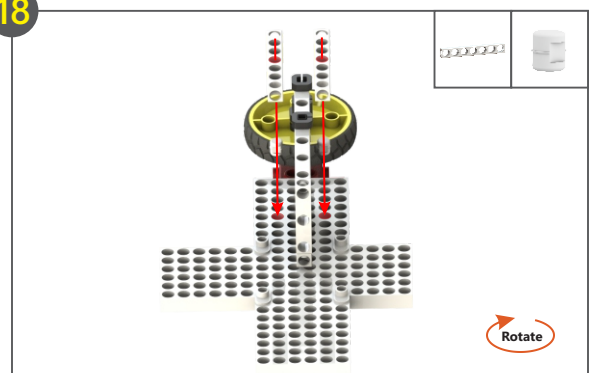

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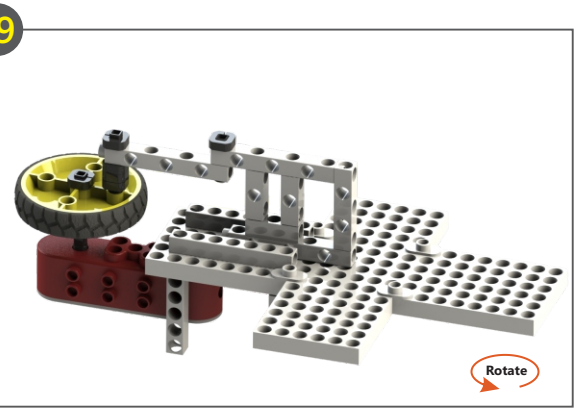

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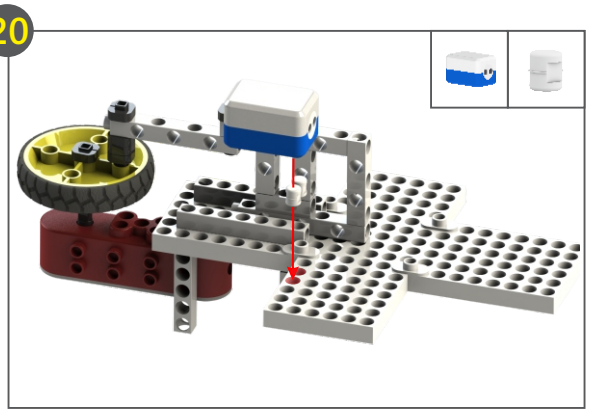

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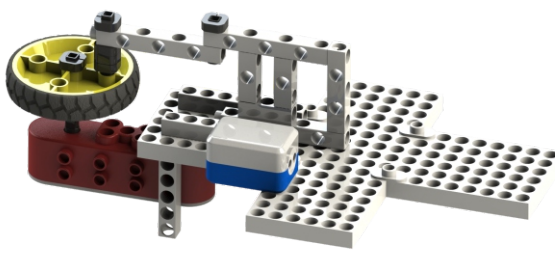

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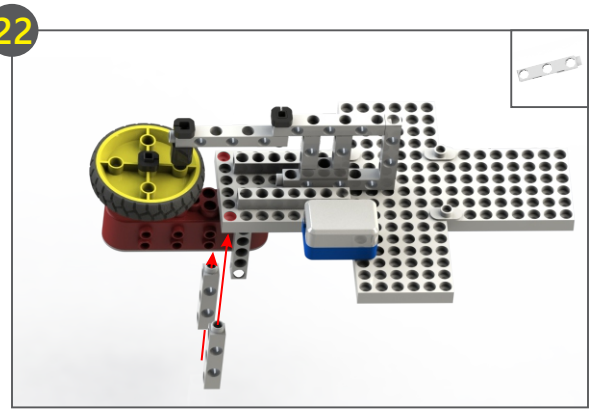

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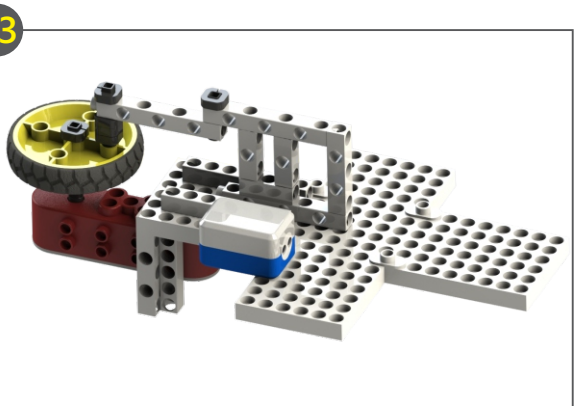

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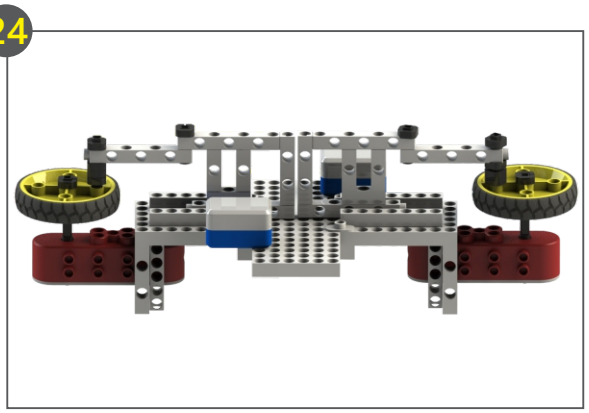


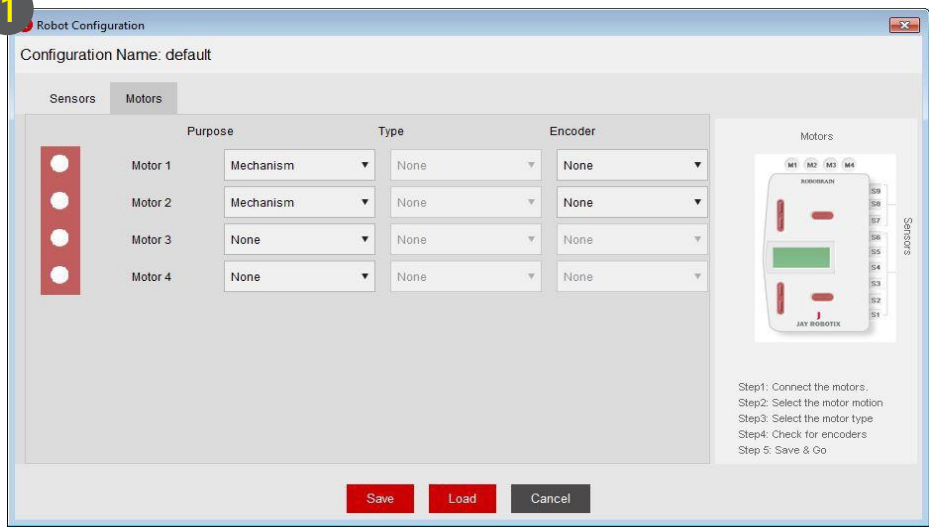
Configuring your Robot:

Hardware:

1. Power up the RoboBrain by connecting a power cable between the battery block and the RoboBrain
2. Connect the motor blocks to the motor ports M1 & M2 on RoboBrain using the motor cables
3. Connect the IR sensors to the sensor ports P1 and P2 on RoboBrain using the sensor cables
4. To program the RoboBrain, connect it to the laptop/computer using a USB cable

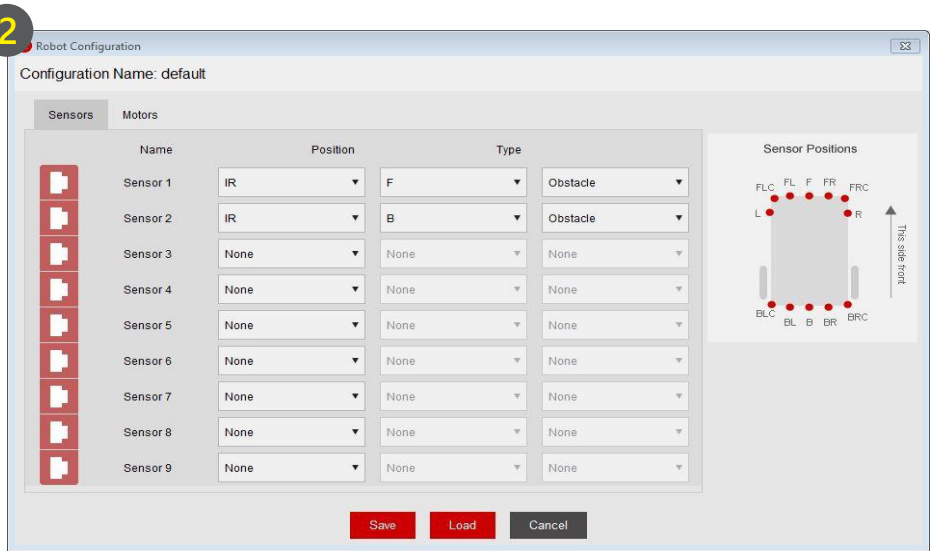
Software:

1



In the Main Menu, go to 'Robot' → 'Configure' → 'Motors' and configure it

2



Sensor's configuration

3 *Write a program in code editor (Refer to next page for programming code)*

Programming:

Let's start programming the mechanism, by following the below given algorithms using ROBOGURU.

Step-1:

Program your mechanism to open and close the door repeatedly without using the sensors.

- Start the repeat loop
- Turn motors clockwise and anticlockwise till the door completely opens
- Wait for a while
- Turn the motors anti-clockwise and clockwise till the door completely closes
- Wait for a while
- End the Repeat loop

Code:

```
MainStart
repeat()
        {
        Motor1_CW(); /*motor1 is moving clockwise to open the door*/
        Motor2_CCW();          /*motor2 is moving counter clockwise to open the door*/
        Delay(200); /* delay can be adjusted as per the requirement*/
        Motor1_Stop(); /*Stop motor1 and motor2*/
        Motor2_Stop();
        Delay(500); /*delay between opening and closing the door*/
        Motor1_CCW(); /* motor is moving counter clockwise to close the door*/
        Motor2_CW(); /*motor2 is moving clockwise to close the door*/
        Delay(200); /*delay can be adjusted as per the requirement*/
        Motor1_Stop(); /* Stop motor1 and motor2*/
        Motor2_Stop();
        }
MainEnd
```

Step-2:

Program your mechanism to open the door as long as a button is pressed and close the door when a button is released.

- Start the repeat loop
- If button is pressed
- Turn motors clockwise and anticlockwise till the door completely opens
- Wait till button is pressed
- If button is pressed
- Turn motors anti-clockwise and clockwise till the door completely closes
- End the Repeat loop

Code:

```
MainStart
repeat()
        {
        if(Switch1ON()) /*Switch1 is used to open the door*/
        {
        Motor1_CW(); /*motor1 is moving clockwise to open the door*/
        Motor2_CCW();          /*motor2 is moving counter clockwise to open the door*/
        Delay(200); /*delay can be adjusted as per the requirement*/
        Motor1_Stop();/*Stop motor1 and motor2*/
        Motor2_Stop();
        }
        if(Switch2ON()) /* Switch2 is used to close the Door*/
        {
        Motor1_CCW(); /*motor is moving counter clockwise to close the door*/
        Motor2_CW(); /*motor2 is moving clockwise to close the door*/
        Delay(200); /*delay can be adjusted as per the requirement*/
        Motor1_Stop(); /*Stop motor1 and motor2*/
        Motor2_Stop();
        }
        }
MainEnd
```

Step-3:

Check the alignment of the sensor and connect it to the brain while programming your mechanism to open the door when the sensor detects a human and close the door when the path is clear.

- Start the repeat loop
- Wait till sensor not active
- If sensor is active
- Turn motors clockwise and counter clockwise till the door completely opens
- Wait till sensor is active
- Turn motors anti-clockwise till the door completely closes
- End the Repeat loop

Code:

```
MainStart
repeat()
        {
        while(!F_is_Obstacle()) /*Do nothing when no person is detected*/
        {
        }
        if(F_is_Obstacle()) /*Open the door is a person is detected*/
        {
        Motor1_CW(); /*motor1 is moving clockwise to open the door*/
        Motor2_CCW();          /*motor2 is moving counter clockwise to open the door*/
        Delay(200); /*delay can be adjusted as per the requirement*/
        Motor1_Stop();/*Stop motor1 and motor2*/
        Motor2_Stop();
        while(F_is_Obstacle()) /*keep the door open till the person pass through the door*/
        {
        }
        }
        Motor1_CCW(); /*motor is moving counter clockwise to close the door one the person cross the door*/
        Motor2_CW(); /* motor2 is moving clockwise to close the door*/
        Delay(200); /*delay can be adjusted as per the requirement*/
        Motor1_Stop(); /* Stop motor1 and motor2*/
        Motor2_Stop();
        }
MainEnd
```

Step-4:

Add one more sensor on the other direction of the door and program the RoboBrain to open the door when any one of the sensor detects a person. Start the repeat loop

- Start the repeat loop
- If Sensor1 is active or Sensor2 is active
- Turn motors clockwise till the door completely opens
- Wait till Sensor1 or Sensor2 is active
- Turn motors anti-clockwise till the door completely closes
- End the Repeat loop

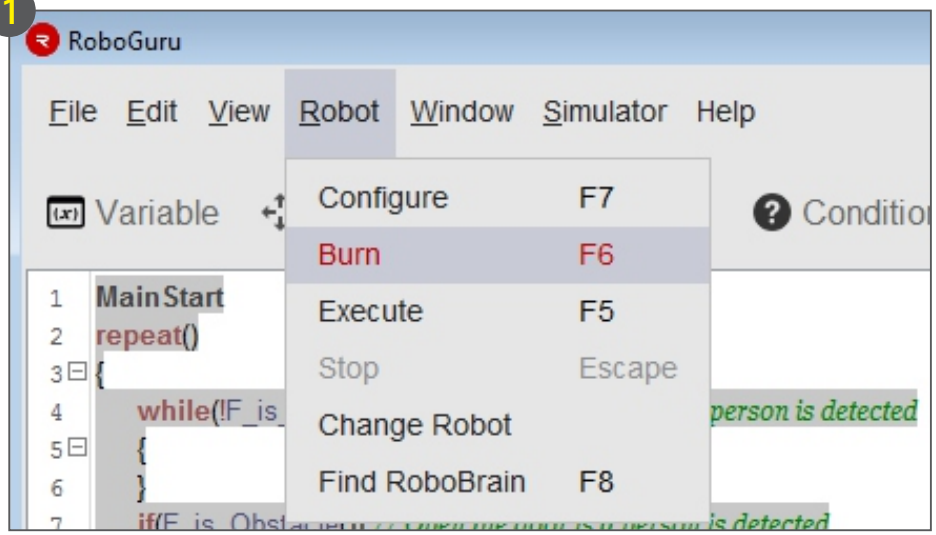
Code:

```
MainStart
DIM i=0;
repeat()
        {
        while((!B_is_Obstacle())&&(!F_is_Obstacle())) /*Do nothing when there is no
         obstacle infront of the sensors.*/
        {
        }
        while(((F_is_Obstacle())||(B_is_Obstacle()))&&(i==0)) /*When the sensors detect the
         obstacle for the first time.*/
        {
        open(); /*calling function open  to open the door*/
        while(((F_is_Obstacle())||(B_is_Obstacle()))&&(i==0)) /*Do nothing until the
         condition is true.*/
        {
        }
        i=1;
        }
        while(((B_is_Obstacle())||(F_is_Obstacle()))&&(i==1)) /*when the person is detected by
         the sensors for the second time.*/
        {
        close(); /*calling function close  to close the door*/
        while(((B_is_Obstacle())||(F_is_Obstacle()))&&(i==1)) /* Do nothing until this
         condition if true.*/
        {
        }
        i=0;
        }
        }
MainEnd
void open() /*Declaration of function open to open the door*/
        {
        LCD_CLR();
        LCD_MSG("OPEN");
        Motor1_CW();
        Motor2_CCW();
        Delay(200);
        Motor1_Stop();
        Motor2_Stop();
```

```
}
void close() /* Declaration of function close to close the door*/
{
LCD_CLR();
LCD_MSG("CLOSE");
Motor1_CCW();
Motor2_CW();
Delay(200);
Motor1_Stop();
Motor2_Stop();
}
```

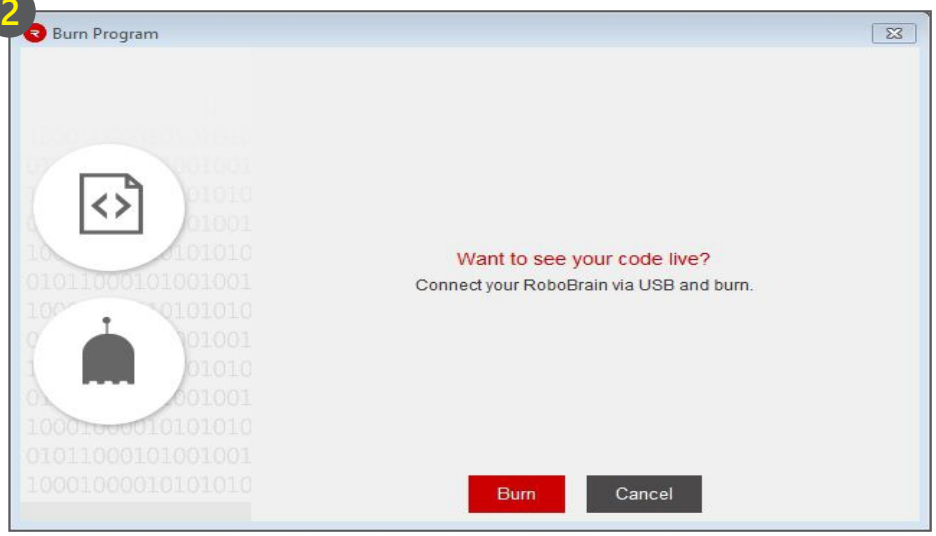
Burning procedure:

1



go to 'Main menu' → 'Robot' → 'Burn'

2



And then you can see that your code is burning into the RoboBrain

3 *Once it is burnt successfully, your robot is ready to navigate*

Assessment Questions:

(These questions are based on the knowledge acquired by the student during the session. There are no right answers to the questions but each question is targeted to test specific life skills like Observation, Creativity & Innovation, Application oriented, Critical Thinking, Analytical Thinking, Problem Solving Math, Science, Programming, Communication, Leadership & Team skills.)

Q1. Why is the siding type of door used? (Logical and reasoning)

a. To save electricity
b. To save time
c. For convenience
d. For luxury

Q2. Why is a manual sliding door better than the traditional hinge joint door (manual)? (Application Oriented)

a. Saves power
b. Saves space
c. It is easy to build
d. It is not easy to build but it looks good

Q3. Which sensor is being used to trigger the door? (Creativity and Innovation)

a. Proximity sensor
b. Sound sensor
c. IR sensor
d. Touch sensor

Q4. Where would you implement this mechanism so that it could make many people's daily life easier? (Application Oriented)

Write your answer in this box.

Q5. Which of the following skills will be needed to implement this project? (Critical thinking)

a. Programming
b. Mechanical design and building
c. Sensor placement
d. All the above

Q6. Which conversion mechanism is used to make the doors slide, using motors? (Physics)

a. Potential to kinetic conversion
b. Linear to rotational conversion
c. Rotational to linear conversion
d. Kinetic to potential conversion

Q7. How many sensors are required to automatically open the door, if people are entering from both directions? (Application Oriented)

a. 1
b. 2
c. 3
d. 4

Q8. Which of the following can be called as response time of the door? (Critical thinking)

a. The time taken to open the door after the person is detected
b. The time taken for a person to walk through the door
c. The actual time at which the person is entering the door
d. The time for which the system can work

Q9. What operator did you use to check for the condition where any of the two sensors would be active? (Programming)

a. AND
b. OR
c. NOT
d. Equal to

Q10. What does the distance of the sliding door's linear movement depend on? (Logical and Reasoning)

a. Speed of the motor
b. Length of the linear shaft
c. Distance of the rotational joint from the center of the wheel
d. Length of the door

If you were not a team leader answer the following questions based on your experience in this project.

Q11. Was your leader good at discussing problems faced while executing this project? (Communication and Collaboration)

a. Yes, he/she was very active
b. Yes, but we had to talk to him/her first
c. No, he/she was stubborn
d. No, he/she was shy

Q12. Did your leader treat all the team members equally? (Leadership)

a. Yes
b. He/she was talking more to his friends
c. He/she was not talking to me
d. He/she was not talking to anyone

Q13. Did your leader complain regarding lack of resources? How did you try to solve it? (Leadership, Critical thinking)

a. No, the leader was very satisfied with the skill set of the team
b. Yes, the leader compared the skill set of our team with others and made us feel incapable
c. Yes, the leader found weak points in the team and we worked together to improve the teams weakness
d. Yes, we requested for a change of leader

The person leading the team should answer the following questions

Q14. Was your team happy with all the decisions you made? (Team Work)

a. Yes, they were happy for all the decisions I made
b. Yes, but I had to convince the team members to believe in my decision
c. No, I had to impose my decisions on them
d. No, they did not accept my decisions and worked as per their own plan

Q15. Was any team member more interested in doing other members task? How did you handle this situation? (Communication and Collaboration, Critical Thinking)

a. No, all were happy and satisfied with the tasks assigned to them
b. Yes, I allowed him to help in finishing the task of his interest after the task assigned to him is finished
c. Yes, I convinced him by promising that he will be assigned the task of his interest in the next project
d. Yes, I made him do the task assigned to him and he was not very happy

Answers to Pre-Activity Questions:

Q1. What is the difference between a sliding door and a hinge door?

A. ***Sliding Door:*** *A sliding door is a type of door which opens horizontally by sliding, usually parallel to a wall.*

Hinged Door:

A movable structure used to close off an entrance, typically consisting of a panel that swings on hinges. A hinge is a mechanical bearing that contents two solid objects, typically allowing only a limited angle of rotation between them.

Q2. Where did you see the sliding door mechanism?

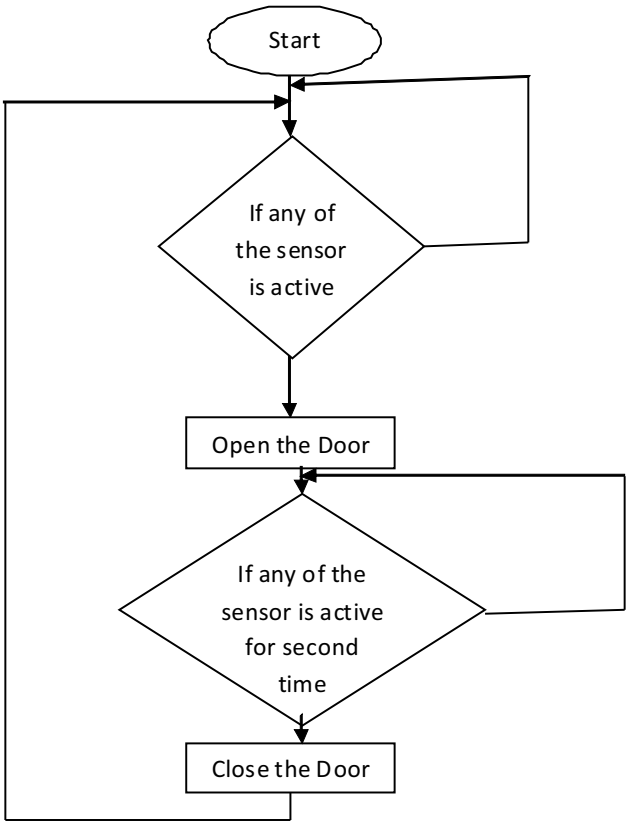
A. Shopping Malls, corporate offices etc.

Q3. How is a sliding door better than a general purpose hinge door?

A. Hinged stall doors need room to swing out into the barn aisle, but since the door doesn't swing outward into the barn aisle in the sliding door they save room.

Q4. Draw the flowchart for the logic to implement the door sliding mechanism.

A.



Answers for Assessment questions:

(Please note that answers only to the affirmative and definitive questions are provided, and as mentioned the observational and analytical questions do not have any right or wrong answers)

Q1. Why is the siding type of door used? (Logical and reasoning)
A. *For convenience.*

Q2. Why is a manual sliding door better than the traditional hinge joint door (manual)?
A. *Saves space.*

Q3. Which sensor is used to trigger the door? (Creativity and Innovation)
A. *IR Sensor.*

Q4. Where would you implement this mechanism so that it could make many people's daily life easier? (Application Oriented)
A. Shopping Malls, corporate offices etc.

Q5. Which of the following skills will be needed to implement this project? (Critical thinking)
A. *All the above.*

Q6. Which conversion mechanism is used to make the doors slide, using motors? (Physics)
A. *Rotational to linear conversion.*

Q7. How many sensors are required to automatically open the door, if people are entering from both directions? (Application Oriented)
A. *"2".*

Q8. Which of the following can be called as response time of the door? (Critical thinking)
A. The time taken to open the door after the person is detected.

Q9. What operator did you use to check for the condition where any of the two sensors would be active?
A. OR.

Q10. What does the distance of the sliding door's linear movement depend on? (Logical and Reasoning)
A. Length of the Door.

Notes:

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