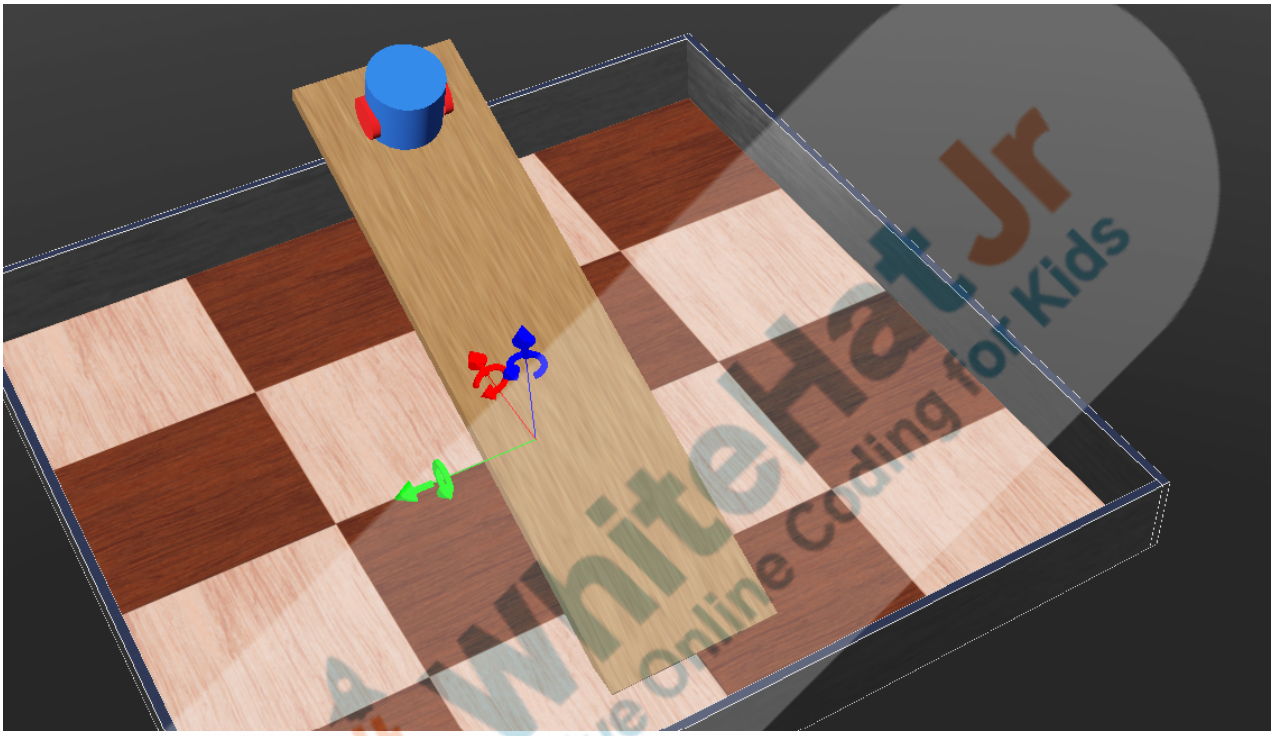
Topic	Ramp Follower Robot- III	
Class Description	**Students will learn about differential drive wheel Robots. Students will design the face of the Robot and mount distance sensors in Robot eye's to calculate the length.**	
Class	**PRO C282**	
Class time	**45 mins**	
Goal	• Introduction to Distance Sensor • Design of Robo Eye and Face	

Resources Required	• Teacher Resources:
	  ○ Laptop with internet connectivity
	  ○ Earphones with mic
	  ○ Notebook and pen
	  ○ Smartphone
	• Student Resources:
	  ○ Laptop with internet connectivity
	  ○ Earphones with mic
	  ○ Notebook and pen	

Class structure	**Warm-Up** **Student-Led Activity 1** **Student-Led Activity 2** **Wrap-Up**	**05 mins** **15 mins** **15 mins** **10 mins**
Credit & Permissions:	**This project uses Webots, an open-source mobile robot simulation software developed by Cyberbotics Ltd.** **License**	
WARM-UP SESSION - 05 mins		
Teacher Action		**Student Action**

Hey <student's name>. How are you? It's great to see you! Are you excited to learn something new today? **Following are the WARM-UP session deliverables:** • Greet the student. • Revision of previous class activities. • Quizzes.	**ESR**: Hi, thanks! Yes I am excited about it! Click on the slide show tab and present the slides
WARM-UP QUIZ Click on In-Class Quiz	
Activity Details **Following are the session deliverables:** • Appreciate the student. • Narrate the story by using hand gestures and voice modulation methods to bring in more interest in students.	
STUDENT-LED ACTIVITY-1 - 15 mins	
Student Initiates Screen Share	
• **Introduction to Wheel Design** • **Installation of Rotational Motors**	
Teacher Action	**Student Action**
Any doubts from the last class! *The teacher will clarify if there are any doubts!* So in the last class we designed wheels for our Robot Can you tell me what components we used to process the complete working of Wheels?	**ESR:** Varied! **ESR:** Rotational Motor, HingeJoint and Position Sensor.

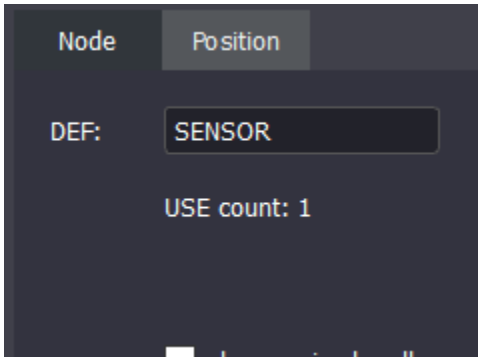
Perfect! So now we have almost covered important parts of our Ramp Follower Robot. Next thing is to use distance sensors and make a Face of the Robot. Are you ready? *Note: This activity will be student driven.Teacher will guide the student to follow the same.But teacher should practice all the activity beforehand.*	**ESR:** Yes!
Teacher will click on Teacher Activity 1 Download the previous code file or the student can open his/her file too. If there is any error then use last class Boiler plate code and open the same in Webots using **Open World**	Student will click on **Student Activity 1**
So we covered in last class: 1. Ramp/Slope: For Ascent and Descent 2. Robot Design Body 3. Two Wheel: To drive Robot Let's focus on another parts: Distance Sensors to follow the ramp/Slope size *So let's start with the design part: Robot's design usually takes patience and time.Please follow instructions to get exact designs.*	
If you see a small rectangle arena, No need to increase the size for the rectangle arena, we will change the view option to make it large.	

1. Go to **view** 2. Select **Orthographic Projection or press F10**	
Output will look like this:	
	
So today we will focus on Distance Sensors and Face What is the use of Distance Sensor? Distance sensors sense distance from the object.	**ESR: Varied!**
Let's design Distance Sensor We will install a Distance Sensor in the Robot's eyes to keep track of distance from any upcoming project.	

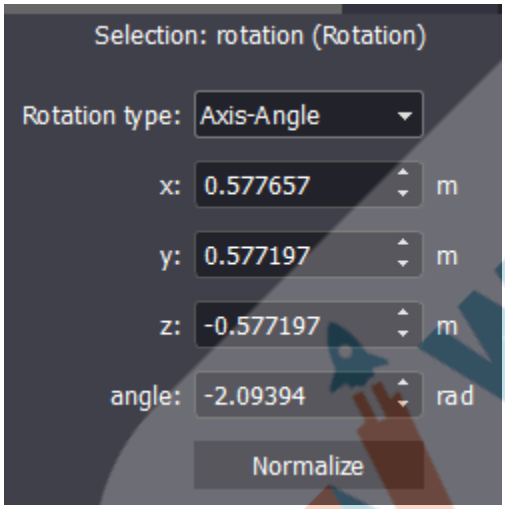
Procedure for Distance Sensor/Eyes

1. Click on **HingeJoint**(Last Hingejoint from the Bottom)
2. Click on **+**
3. Select **Base nodes**
4. Click **Base nodes drop down** 
    a. Select **DistanceSensor**
    b. Click **Add**
    c. **Parameters**
        i. Set **translation 0.042, 0.02, 0.063**
        ii. Set **rotation 0, 0, -1, -0.499**
        iii. **Set name " ds0"**

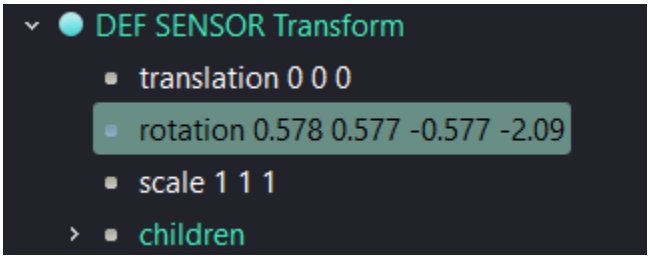
    d. Double Click **on children**
        i. Select **Transform** under Base nodes
        ii. Click **Add**
        iii. Write the name of DEF function **"SENSOR"**



iv. Set **rotation** as per below values



v. Double Click on **children under DEF SENSOR TRANSFORM**



vi. **Select** Shape **under** Base nodes

vii. Click **Add**

viii. Double click on drop down of **Shape**

1. Double Click on **Appearance**
2. **Select PBR Appearance**
3. **Click Add**
4. **Set base color 0.97 , 0.98, 0.025(Yellow color)**

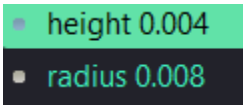
Note : Color can be selected from ColourBox too as per student wish.If not then use the mentioned one.

5. **Set Roughness 1**
6. **Set metalness 0**
7. Under **Appearance** there is **Geometry Null.** Double Click on **geometry Null**
8. Select **Cylinder under Base nodes**
9. Click **Add**
    a. Set **Height**

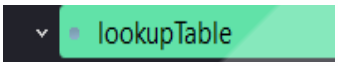
0.004

b. Set **Radius**

0.008



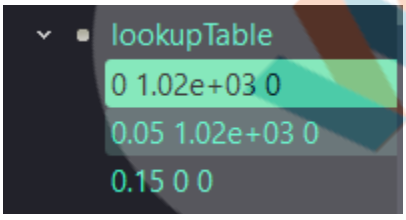
10. **Go to lookup Table**



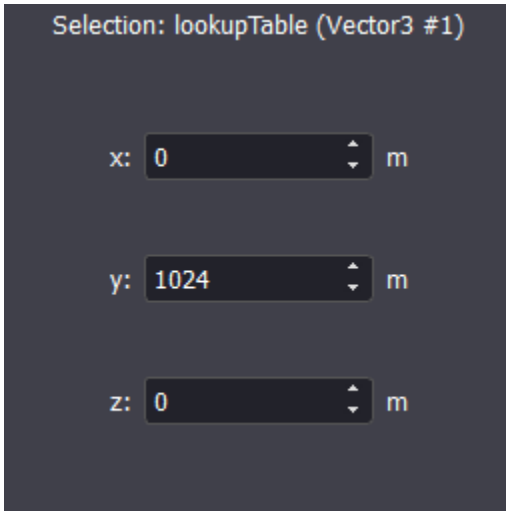
Now we want to shows rays from distance sensor while moving for that we need to fix positional values

You will see two options under look up table but we need three different x,y,z values for three positions

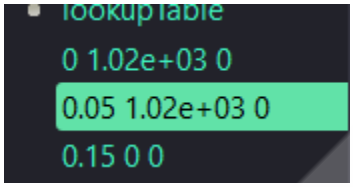
Click on Ist and enter the following values.

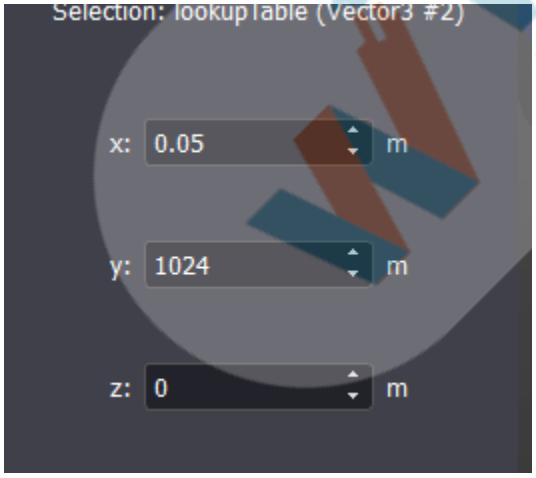


Ist Value:



2nd Value:

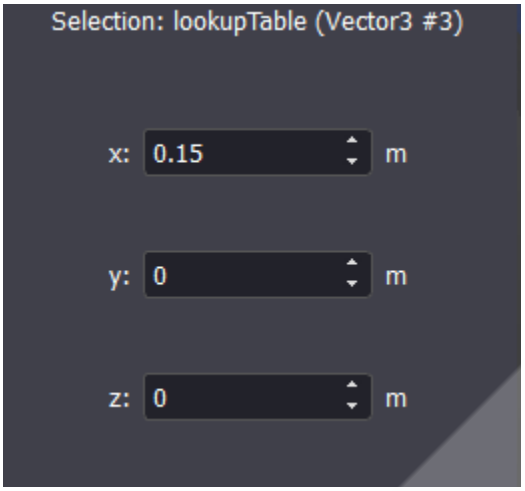




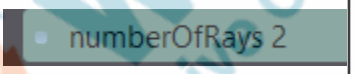
3rd Value:

If the third value is not there you can copy the

second row and just click on paste.



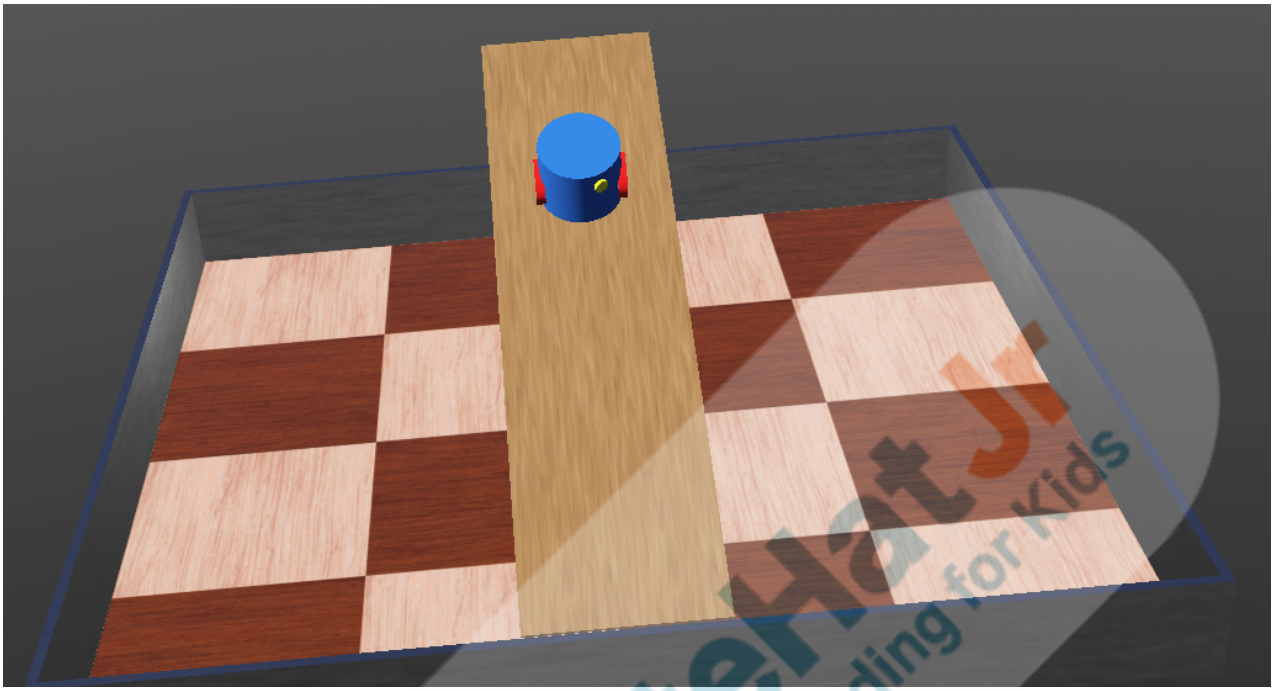
11. Set **number of rays** : 2



12. Set **Aperture**

13. Save the simulation.

You will see a yellow eye on the right side.
Distance sensor is used in Robot Eye's.



So our one eye is set. Next task is to set the another eye So are you enjoying it?	

STUDENT-LED ACTIVITY -2 15 mins

- **Ask the student to press the ESC key to come back to the panel.**
- **Guide the student to start Screen Share.**
- **The teacher gets into Full Screen.**

Student Initiates Screen Share

ACTIVITY

- **Design another eye of robot using Distance Sensor**

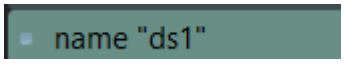
Teacher Action	Student Action

Let's change some translational and Rotational settings to set the eye and distance sensor

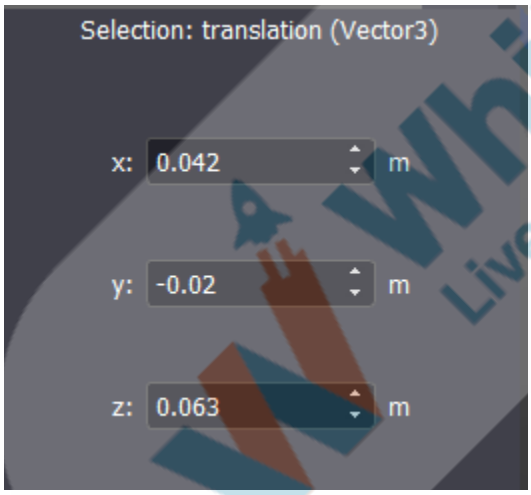
1. Go to the Distance sensor ds1
2. Click on Drop Down Distance Sensor ds1

Note: You will see right eye, but as this is left eye we need to change the name.

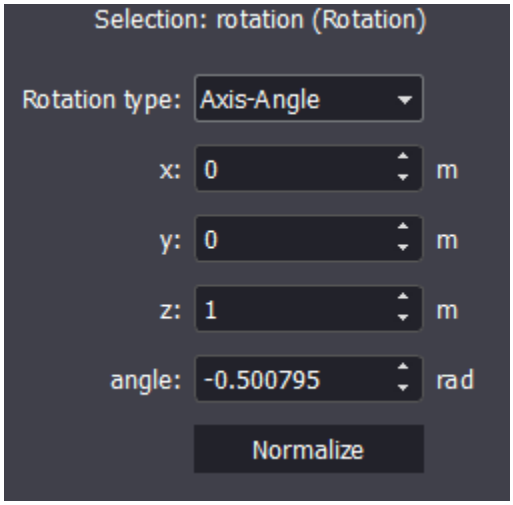
3. Go to the name option and write "ds1



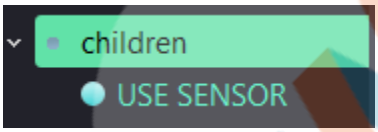
4. Set translation settings:



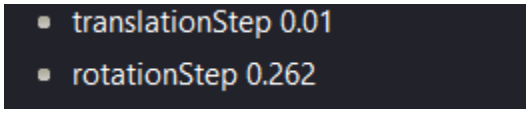
5. Set Rotation

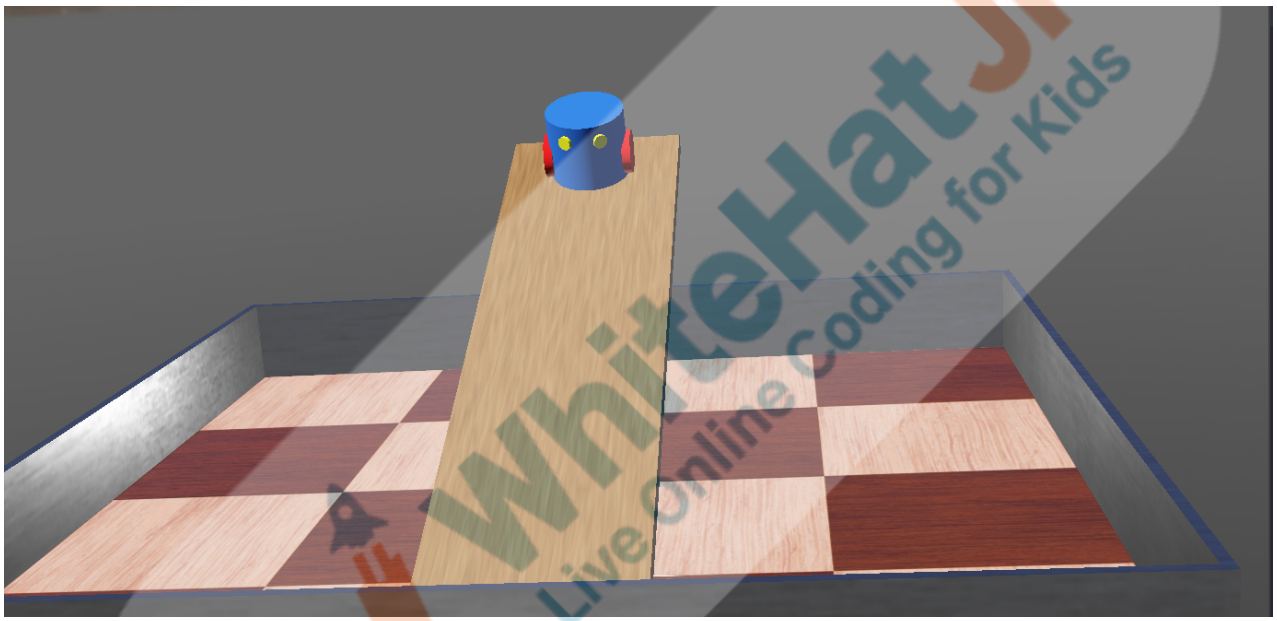


6. Double click on **children** under **DistanceSensor ds1**
7. Instead of Base nodes we will use pre-defined function which we made while right eye .Select **on Use and click on drop down and** Select **SENSOR (Transform)**



8. Click on **Add**
9. Translational and Rotational Step setting will remain same



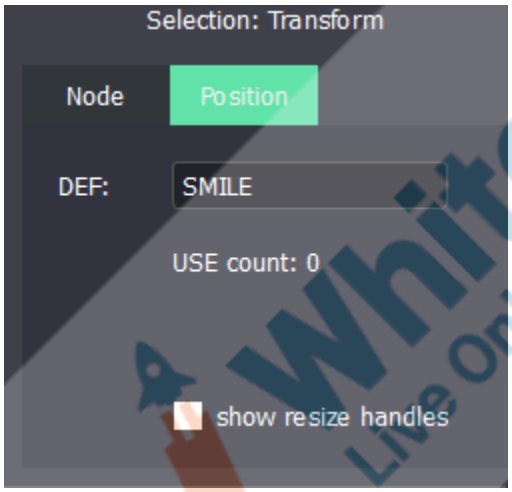
Save the simulation. 	
So Output will look like this: We can see two eyes on Robot with distance sensors.	
	
Still Happy Face is pending! Let's make a smiling face of Robot. Procedure will be remain same:	
Procedure for Smile 5. Click on **DistanceSensor ds1**(Last **DistanceSensor ds1** from the Bottom)	

6. Click on **+**
7. Select **Base nodes**
8. Click **Base nodes drop down**

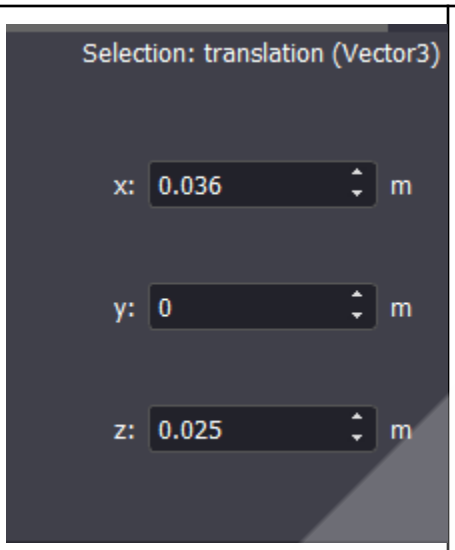
    a. Select **Transform**

    b. Click **Add**

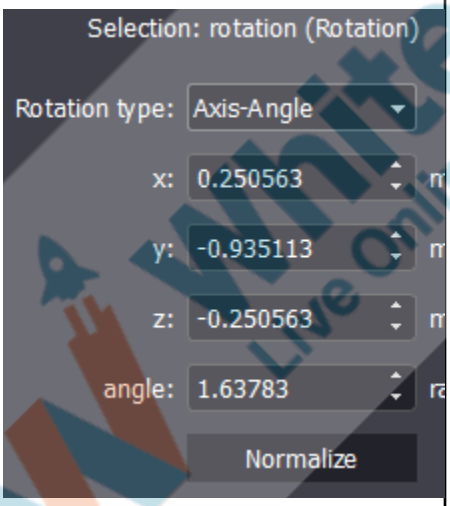
    c. Write the name of DEF function SMILE



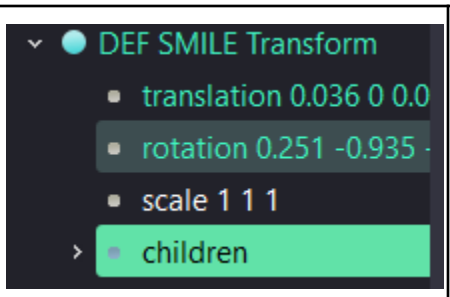
    i. Set **translation** as per below values



ii. Select rotation



iii. Double Click on **children** **under DEF SMILE** **TRANSFORM**

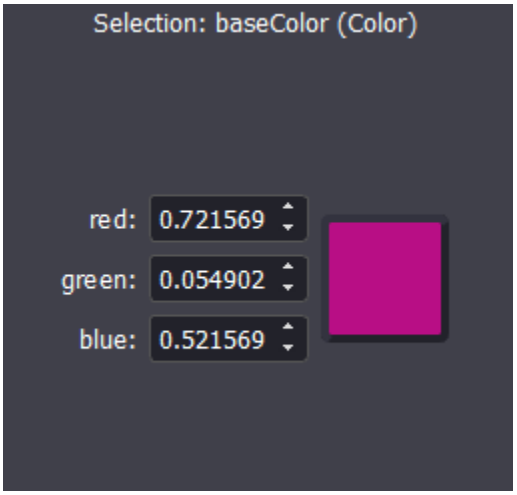


iv. **Select** Shape **under** Base nodes

v. Click **Add**

vi. Double click on drop down of **Shape**

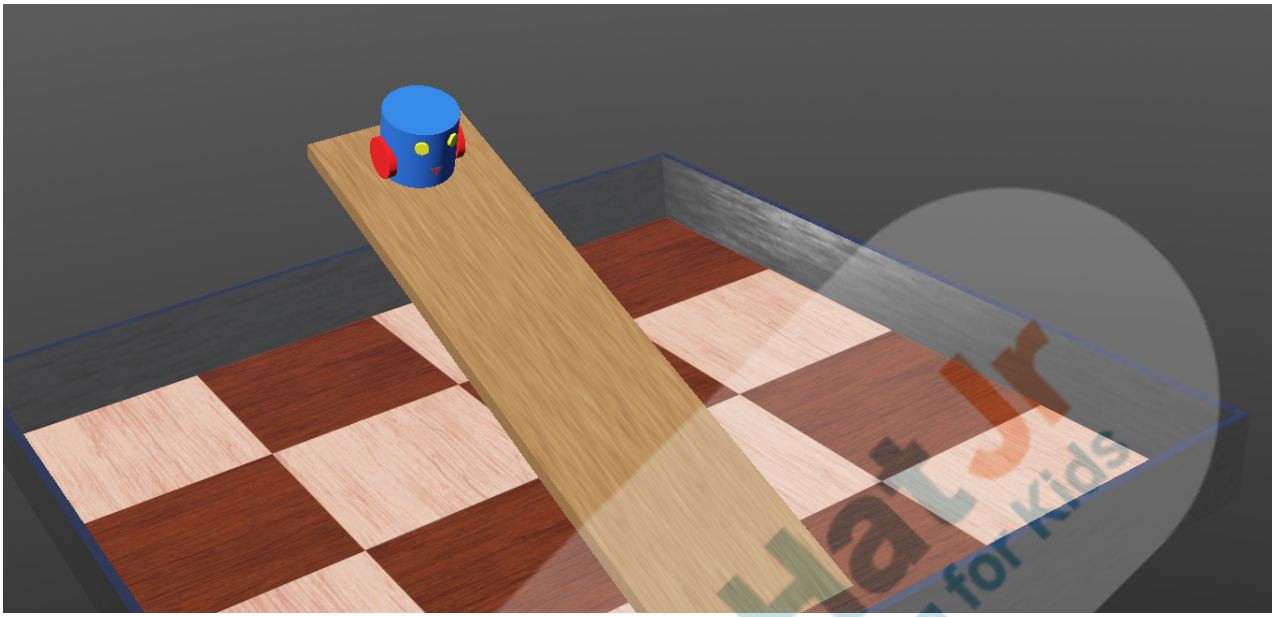
1. Double Click on **Appearance**
2. **Select PBR Appearance**
3. **Click Add**
4. **Set base color 0.72 , 0.54 0.52(Pink color)**



Note : Color can be selected from ColourBox too as per student wish.If not then use the mentioned one.

5. **Set Roughness 1**
6. **Set metalness 0**
7. Under **Appearance** there is **Geometry Null.** Double Click on **geometry Null**
8. Select **Cylinder under Base nodes**
9. Click **Add**
    a. Set **Height**

0.018 **b.** Set **Radius** **0.009** **c. Select** **subdivision 3**	
If there are any design errors, Save the file first and then open the file with Notepad++. Open the Teacher reference file code with Notepad, Check if something is missing Actual Output will look like this:	



So our Robot is ready, but it's not working.

Now we should work on his working part . But that we will do in the next class.

Teacher Guides Student to Stop Screen Share

WRAP-UP SESSION - 05 mins

Activity details

Following are the WRAP-UP session deliverables:

- Appreciate the student.
- Revise the current class activities.
- Discuss the quizzes.

WRAP-UP QUIZ
Click on In-Class Quiz

Activity Details

Following are the session deliverables:

- Explain the facts and trivia
- Next class challenge
- Project for the day
- Additional Activity (Optional)

FEEDBACK

- **Appreciate and compliment the student for trying to learn a difficult concept.**
- **Get to know how they are feeling after the session.**
- **Review and check their understanding.**

Teacher Action	Student Action
You get “hats-off” for your excellent work! In the next class, we will learn how to add a controller to work on the movement of the robot.	*Make sure you have given at least 2 hats-off during the class for:* 

PROJECT OVERVIEW DISCUSSION

Refer the document below in Activity Links Sections

Teacher Clicks ✖ End Class

ACTIVITY LINKS		
Activity Name	**Description**	**Links**
Teacher Activity 1	Boilerplate Code	https://github.com/procodingclass/Pro-C281_Reference-Code
Teacher Activity 2	Reference Code	https://github.com/procodingclass/PRO-C282-Reference-Code
Teacher Reference 1	Project	https://s3-whjr-curriculum-uploads.whjr.online/a5ef35c0-dc68-46b2-b74c-c48e21443260.pdf
Teacher Reference 2	Project Solution	https://github.com/procodingclass/PRO-C282-Project-Solution
Teacher Reference 4	In-Class Quiz	https://s3-whjr-curriculum-uploads.whjr.online/9a27732f-6ae3-4f63-8c9d-de04016f0840.pdf
Student Activity 1	Boilerplate Code	https://github.com/procodingclass/Pro-C281_Reference-Code