Topic	Ramp Follower Robot - I	
Class Description	**Students will learn from scratch to design the first Ramp Follower Robot and learn about the components needed to design the same. Students will also learn about a few design parameters and their functions.**	
Class	**PRO C280**	
Class time	**45 mins**	
Goal	• Introduction to Drive Robots • Introduction to Altimeter • Design of Robots	

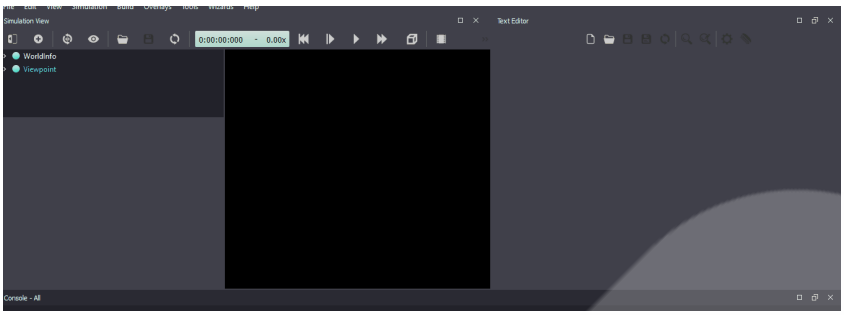
Resources Required	• Teacher Resources:
	  ○ Laptop with internet connectivity
	  ○ Earphones with mic
	  ○ Notebook and pen
	  ○ Smartphone
	• Student Resources:
	  ○ Laptop with internet connectivity
	  ○ Earphones with mic
	  ○ Notebook and pen	

Class structure	**Warm-Up** **Teacher Activity** **Student-Led Activity** **Wrap-Up**	**05 mins** **10 mins** **25 mins** **05 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.	
TEACHER-LED ACTIVITY - 10 mins	
Teacher Initiates Screen Share	
• **Introduction to Drive Robots** • **Introduction to Altimeter**	
Teacher Action	**Student Action**
Any doubts from the last class! *The teacher will clarify if there are any doubts!* So we installed and explored webots and we saw how inbuilt robots work. But that one is pre-built. Don't you want to design your	**ESR:** Varied! **ESR:** Yes!

own robot? As I told you in the last class, Robot design is not an easy job but not that tough either. We need proper knowledge of components and design of the Robots very well! Although we will learn everything while doing it. So today's target will be to design **Ramp Follower two wheel Drive Robot.** **Ramp Follower Drive Robot:** A differential wheeled robot is a mobile robot whose movement is based on two separately driven wheels placed on either side of the robot body. The robot moves on a slope or Ramp. Its Altimeter sensor is used to switch direction when the robot is close to the slope's/Ramp border. Ramp Follower Robot will focus on an altimeter which is used to control the robot's ascent and descent position on the ramp/Slope. *Note: This activity will be student driven.Teacher will guide the student to follow the same.But teacher should practice all the activity beforehand.* I will show you first what we are designing today. *Note: Teacher will open the file with webots software and show case to students how to design the same.*	
Teacher will click on Teacher Activity 1	Students will observe.
To design a robot we must focus on what things we need.	

As the name suggests **Ramp Follower Two Wheel Robot** we would be need these components: 1. Ramp/Slope: For Ascent and Descent 2. Robot Design & Body 3. Distance Sensors to follow the ramp/Slope size 4. Two Wheel: To drive Robot 5. Altimeter: An altimeter or an altitude meter is **an instrument used to measure the altitude of an object above a fixed level.** *So let's start with the design part: Robot's design usually takes patience and time.Please follow instructions to get exact designs.*	
A new Simulation: This simulation will contain a simple environment (a rectangle arena with floor and walls),	
Create a new world: **World:** A World defines the initial state of a simulation. A world is stored in a file having the **".wbt" extension.** ● Click on **Wizards** Wizards ● Select **New Project Directory.** ● Click on **Next** ● **Write_Project _name** ● Click on **Next** ● Tick mark the box next to **Add a Rectangle Arena** ● Click on **Next** ● Click on **Finish** Follow the steps as mentioned in the GIF. ***Note: Do tick mark on Rectangle Arena***	



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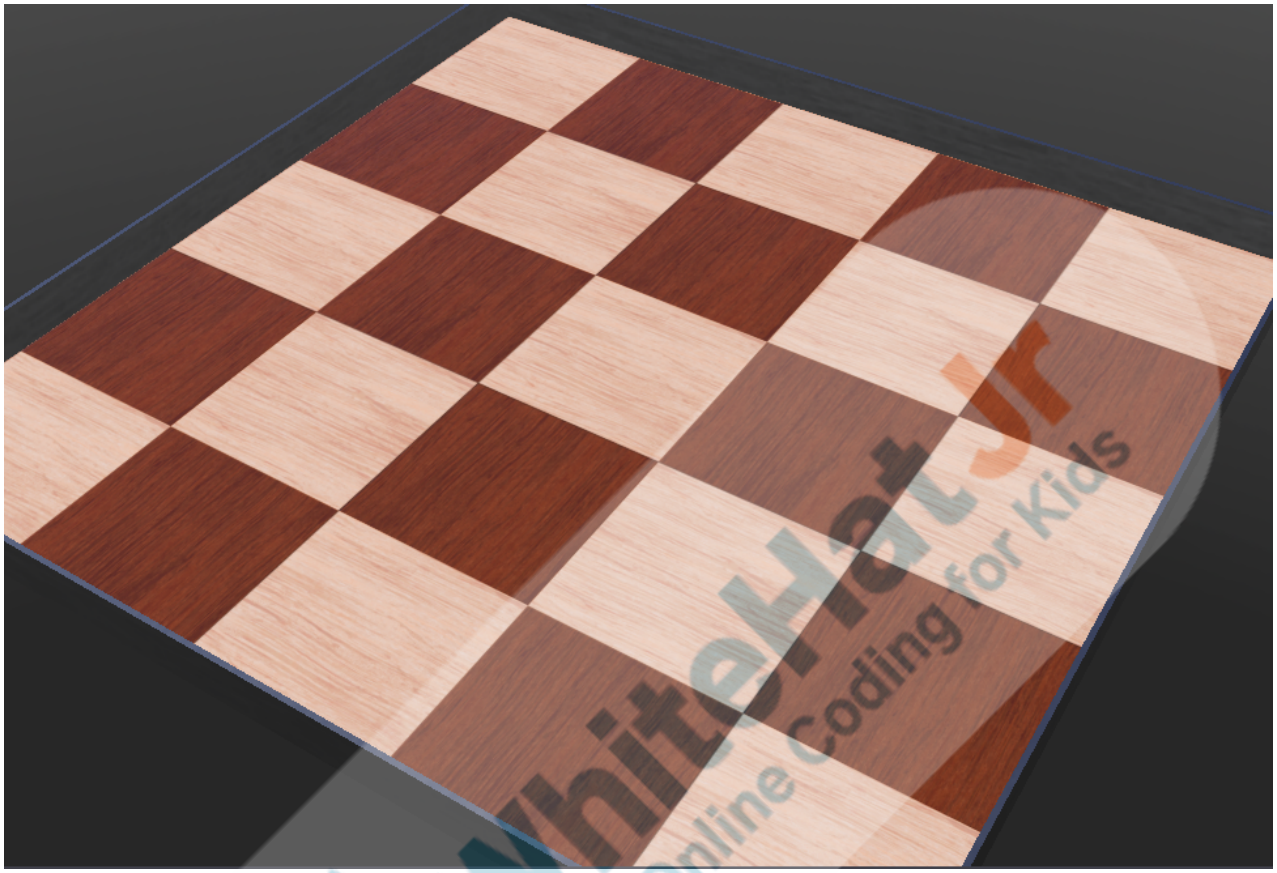
You will see a small rectangle arena, No need to increase the size for the rectangle arena, we will change the view option to make it large. 1. Go to **view** 2. Select **Orthographic Projection or press F10**	
Output will look like this:	



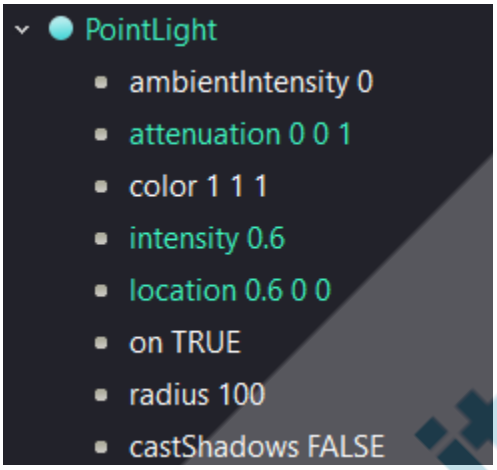
So the rectangle arena is set, the next task is to make a slope/Ramp and put some light on the Floor to focus on the slope.	
While designing anything we need to take care of a lot of things like: 1. Which shape needs to be choose for designs 2. Coordinates i.e x,y, z. 3. Parent or child node while designing the environment for Robot World. Parent is your main function and all settings come under parent acts as a child function. We will learn this with examples. 4. From the top view, left view, right view, It should look	

the same.	
Having these rules in mind, we can start designing the node hierarchy used to model the robot. The first step is to determine which part of the robot should be modeled as a Solid node. **Solid node**: A Solid node represents an object with physical properties such as dimensions, a contact material and optionally a mass. Our Robot can be divided into two solid nodes: the body and the wheels.	
Let's start with Point of Light to brighten Rectangle Arena **PointLight:**The PointLight node specifies a light source that emits light equally in all directions. The emitted light can be detected by a LightSensor node. Putting a PointLight onboard a robot allows the PointLight to move with the robot.	
Procedure PointLight: 1. Click on **Rectangle Arena** 2. Click on **+** 3. Select **Base nodes** 4. Click **Base nodes drop down** a. Select **Point of Light** b. Click **ADD**. c. Now click on the drop down just before the **Point of Light.** i. Select **attenuation 0 , 0 , 1**	

ii. Select **Intensity 0.6**

iii. Select **location 0.6, 0, 0**

Save the simulation. 



Next task is to design **ramp/Slope**

Procedure for Slope:

Procedure Ramp/Slope

5. Click on **PointLight**
6. Click on **+**
7. Select **Base nodes**
8. Click **Base nodes drop down** 
9. Select **Solid**
10. Click on **Add**

11. Write the name of DEF function **SLOPE**

a. Write value for **translation 0, 0, 0.15**

Note: (translation will define x,y,z coordinates)

b. Write value for **rotation 0, 1, 0 . 0.4**

Note: (Rotation will define the axis as per x, y, z coordinates.)

c. Double Click on **children**

Note: This will be a child node

d. Select **Base nodes**

e. Click **Base nodes drop down**

f. Select **Shape**

g. Click on **Add**

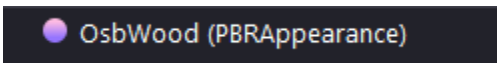
h. **Click on Drop Down of Shape**

i. **Double Click on Appearance Null**

ii. Select **Proto Nodes (Webots Projects)**

iii. Click on **Appearance**

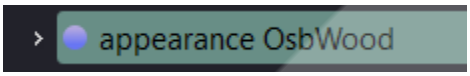
iv. Select OsbWood



v. Select **location 0.6, 0, 0**

vi. **Click on Add**

vii. **Click on Drop down of**



1. Double Click on **texture TransformNull**
2. Select **Texture Transform** under Base nodes
3. Now just below **Texture Transform** there is **Geometry Null.** Double Click on **Geometry Null**
4. Select **Box under Base nodes**
5. Click **Add**
6. Write the name of the DEF is **BOX0**

a. **Click on Drop Down**

b. Set Size **0.8, 0.2, 0.02**

Save the simulation. 

So our Ramp and Arena is set. Next Task is to make Robot.

I have set the base for you. But now the main task is to become Robot.

So are you enjoying it?	**ESR:** Yes.
Student Stops Screen Share	
So now it's your turn. Please share your screen with me.	
STUDENT-LED ACTIVITY 25 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 of Robots**	
Teacher Action	**Student Action**
We have seen our Robot. So can you tell me what components we need to design a Robot. Our Robot is composed of four Led's,2 Wheels, 2 distance sensors in the form of eyes and one face. But before that we must know how to control our Rectangle Arena You can scroll Rectangle Arena, By clicking Left and scroll button together. To make it at center position right click on Rectangle Arena Select Move point To Object option or Press Alt 5	Student opens the code downloaded from Student Activity 1.

Set Rectangle Arena Projection like this:	
	
Next task is to design **Robot** **Make a Robot as a parent class and all the components will be acts as a Child nodes** **Procedure Robot Parent Class** 1. Click on **DEF SLOPE SOLID** 2. Click on **+** 3. Select **Base nodes**	

4. Click **Base nodes drop down** 
5. Select **Robot**
6. Click on **Add**
    a. Write value for **translation 0.286, 0, 0.286**

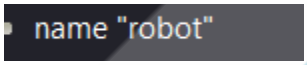
Note: (translation will define x,y,z coordinates)

    b. Write value for **rotation -0.199, 1, 0.98 .**

    3,14

Note: (Rotation will define the axis as per x, y, z coordinates.)

    c. Name of the Robot **"MyBot"**



    d. ContactMaterial **"body"**

Note: Robot Name.Write the same name and do the same settings, as this is the first class and we need to use the same name in the Program also.

When students will be familiar with settings and Programming they can change their settings and naming later on.

Now it's time to do Child node setting.In child node all components will come like wheels, sensors, altimeter, and body of the Robot. So all components settings should be done under children. **Let's start with Altimeter.** a. Double Click on **children** b. Select **Base nodes** c. Click **Base nodes drop down**  d. Select **Altimeter** No need to change the settings of Altimeter. Keep it with Default settings.	
Next task is to make a Robot Body.This will come under the child node. 1. Double Click on **children again** ***Note: These children will be under Robot Parent class, Don't choose other children option*** 2. Select **Base nodes** 3. Click **Base nodes drop down**  4. Select **Transform**	

5. Click on **Add**

   a. **Set Translation 0, 0, 0.0415**

   b. **Set Rotation 0 0 1 0**

   c. **Double click on children under Transform**

      i. Click **on Drop down of Base node**

      ii. Select **Shape**

      iii. Click **Add**

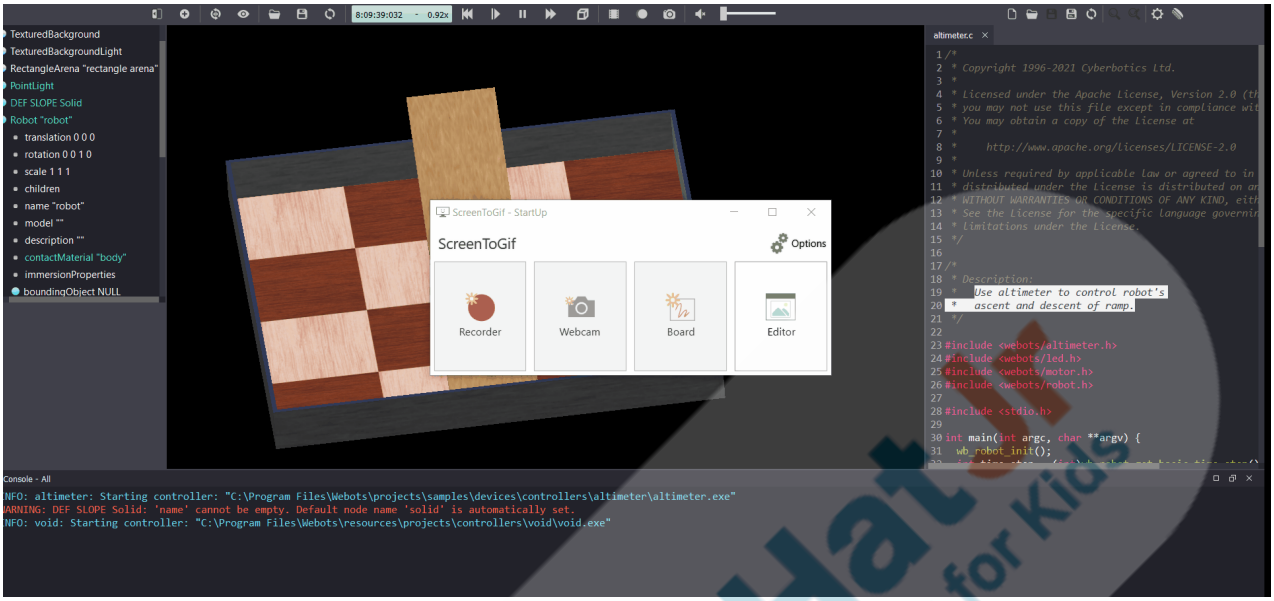
      iv. Double click on drop down of **Shape**

         1. Double Click on **Appearance**
         2. **Select PBR Appearance**
         3. **Click Add**
         4. **Set base color 0.0820075, 0.364, 0.8**

Note : Color can be selected from ColourBox too.

         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** 10. Write the name of the DEF is **BODY** a. **Click on Drop Down**  b. Set **Height 0.08s** c. Set **Radius 0.045** Save the simulation. 	
Gif is for your reference to showcase children nodes:	



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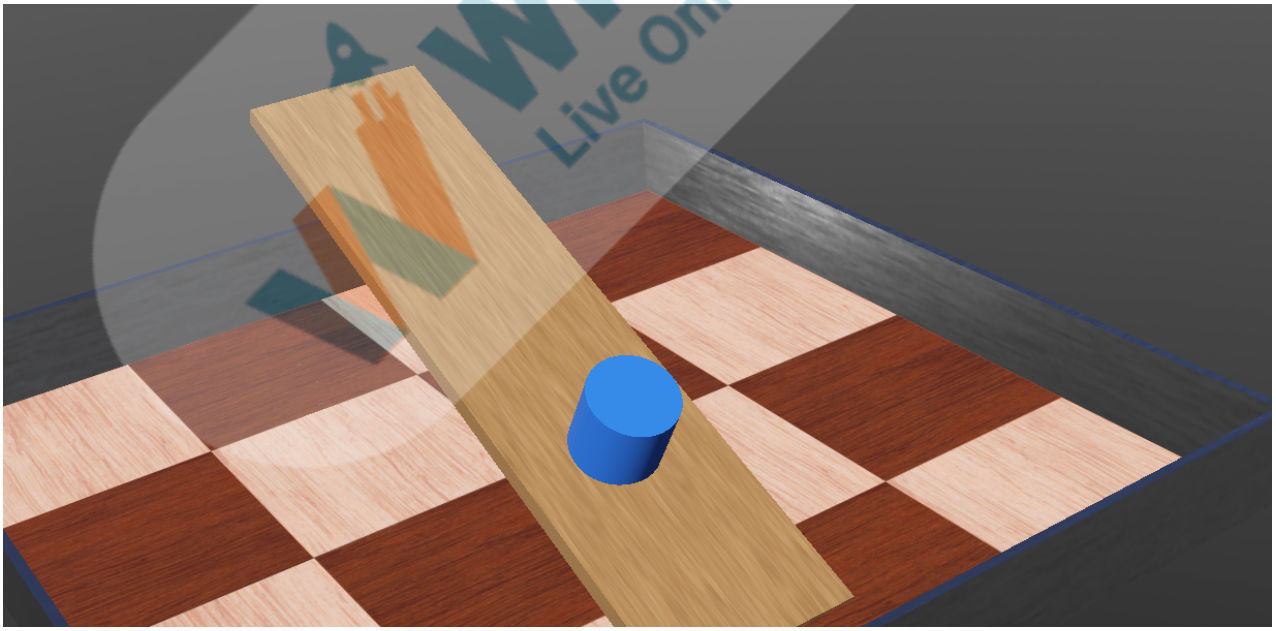
Output will be look like this:



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.	
Now the next task is to set wheels and sensors. We will do 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 about wheels and sensors.	*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 	

ACTIVITY LINKS		
Activity Name	**Description**	**Links**
Teacher Activity 1	Final Ramp Follower File	https://github.com/procodingclass/PRO-C283-Ramp-Follower-Reference-Code
Teacher Activity 2	TA Reference Code	https://github.com/procodingclass/PRO-C280-TEACHER-ACTIVITY-REFERENCE-CODE
Teacher Activity 3	Reference Code	https://github.com/procodingclass/PRO-C280-REFERENCE-CODE
Teacher Reference 1	Project	https://s3-whjr-curriculum-uploads.

		whjr.online/ae9422b3-39c6-4d8a-a417-c703f983dffd.pdf
Teacher Reference 2	Project Solution	https://github.com/procodingclass/PRO-C279-ProjectSolution
Teacher Reference 4	In-Class Quiz	https://s3-whjr-curriculum-uploads.whjr.online/31b15f1f-bc03-4f01-bb6d-f49f85fa1296.pdf
Student Activity 1	Boilerplate Code	https://github.com/procodingclass/PRO-C280-STUDENT-ACTIVITY-BOILERPLATE