PRO-C279

Exploring Webots Design

What is our GOAL for this CLASS?

In this class, we explored Webots features and properties. We learnt to create geometric shapes like cube, cylinder, cone etc.

What did we ACHIEVE in the class TODAY?

- We explored the webots simulator.
- We designed Geometric shapes: cuboid, cone.
- We learned about Base nodes, Parent, Child and other features.

How did we DO the activities?

1. **Understood the terms used in Webots tool:**
    - A **Base node** is a Webots built-in shape.
    - **Basic time step**: The basic time step is the time step increment used by Webots to advance the virtual time and perform physics simulation.
    - **Node:** A node is a component of the scene tree. It defines a concept of the world.
    - **Parent:** When referring to a node", the *a parent of a child is a node containing the child at a relative depth of one in the scene tree. Note that a parent is always an ancestor, but an ancestor is not necessarily a parent.

- This parent and child relation is very important to understand. To initiate anything we must focus on our parents. and then related to the parent anything will act as a child.

- **Children**: When referring to a node, the children of a parent is a node directly contained inside the parent (Base Nodes) , at a relative depth of one in the scene tree. Note that a child is always a descendant, but a descendant is not necessarily a child.

- **Appearance:** The appearance field contains an Appearance or PBRAppearance node that specifies the visual attributes (e.g., material and texture) to be applied to the geometry.

- **PBR Appearance:** The PBRAppearance node specifies a physically-based visual appearance of a node. The acronym "PBR" refers to "Physically-Based Rendering", a term used to designate a class of shading models based on the physical properties of an object,

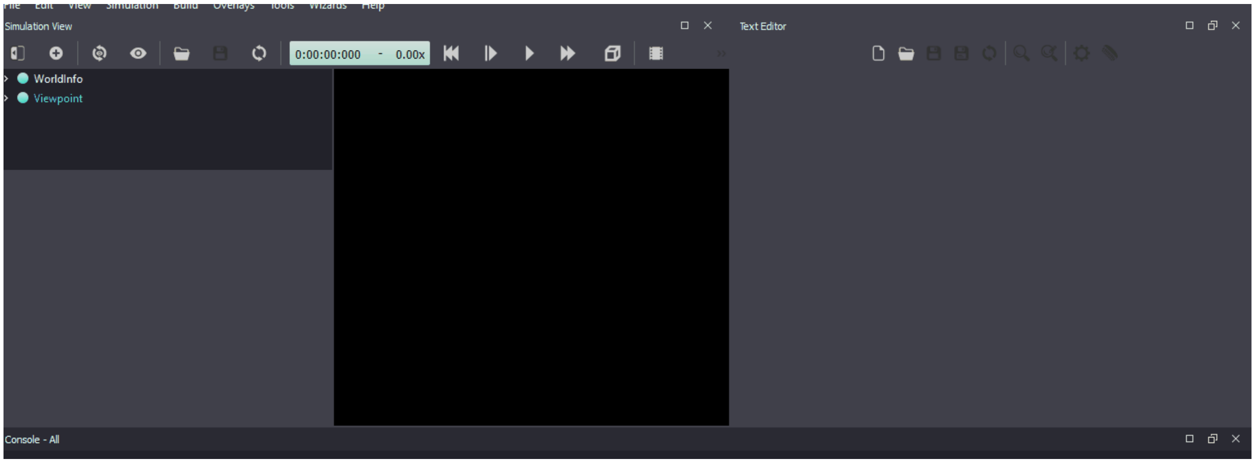
- **BaseColor:** The baseColor field specifies the base color or "albedo" of the material's surface, analogous to the diffuseColor field of the Material node.

- **Roughness :**The roughness field specifies the roughness of the material's surface, analogous to the inverse of the shininess field of the Material node. A roughness of 0 gives a perfectly smooth material, while a roughness of 1 gives a highly rough material.

- **Metalness:** The metalness field specifies how metallic the material's surface is. A metalness of 0 gives a completely non-metallic material, while a metalness of 1 gives a completely metallic material. Note: it is encouraged to use either 1 or 0 for this value as no real-world materials are partly metallic.

- **Geometry**: The geometry field contains a Geometry node: Box, Capsule, Cone, Cylinder, ElevationGrid, IndexedFaceSet, IndexedLineSet, Mesh, Plane, PointSet or Sphere. The specified Geometry node is rendered with the specified appearance nodes applied.

2. Learnt to draw geometric shapes: Box
    a. Create a new world and new project directory as shown in gif below:



b. Add object sign
c. Click on +
d. Click on **Base nodes**
    a. Select **Transform**
    b. Write name of the Function DEF **BOX** (Note: DEF is already written
    c. Click **ADD.** Function is created
    d. Now click on Arrow just before the function name
        i. Double Click on **children**
        ii. Click on **Base nodes**
            1. Select **SHAPE**
            2. Click on **ADD**
            3. Now click on **Shape**
                a. Double Click on **Appearance**
                b. **Click on Base Nodes**
                    i. Select **PBR Appearance**
                    ii. Click **ADD**
            4. **Click on Arrow PBR Appearance**

   a. Select **baseColor 0.8, 0.264, 0.264**

   b. Select **roughness 0.2**

   c. Select **metalness 0**

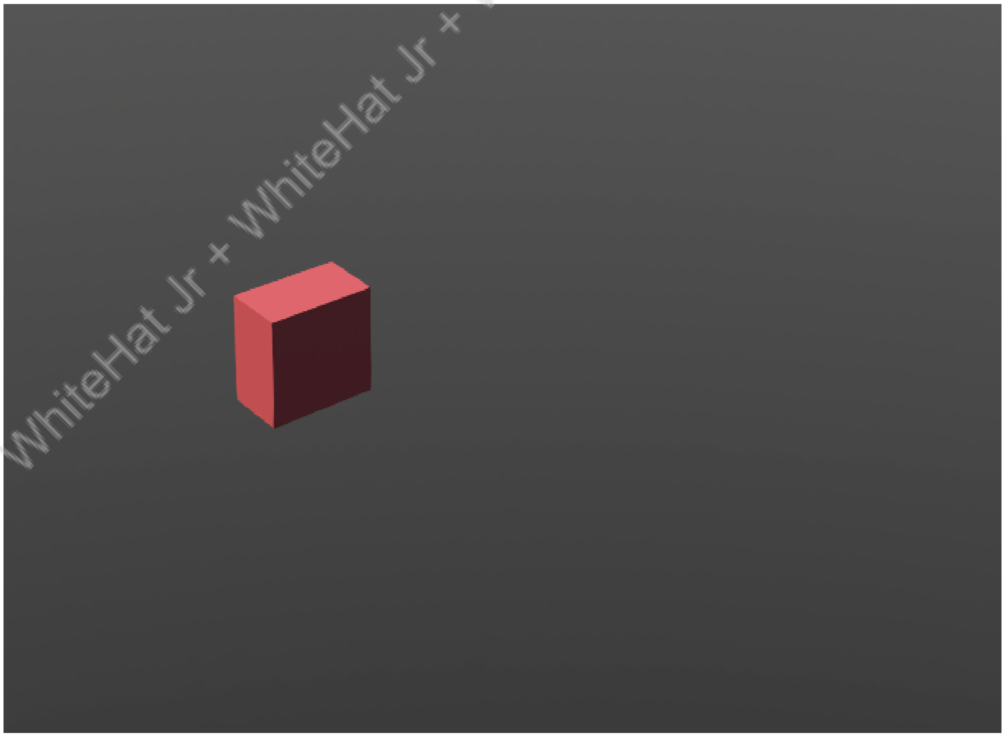
5. Double Click on **Geometry NULL**

   a. Select **Box**

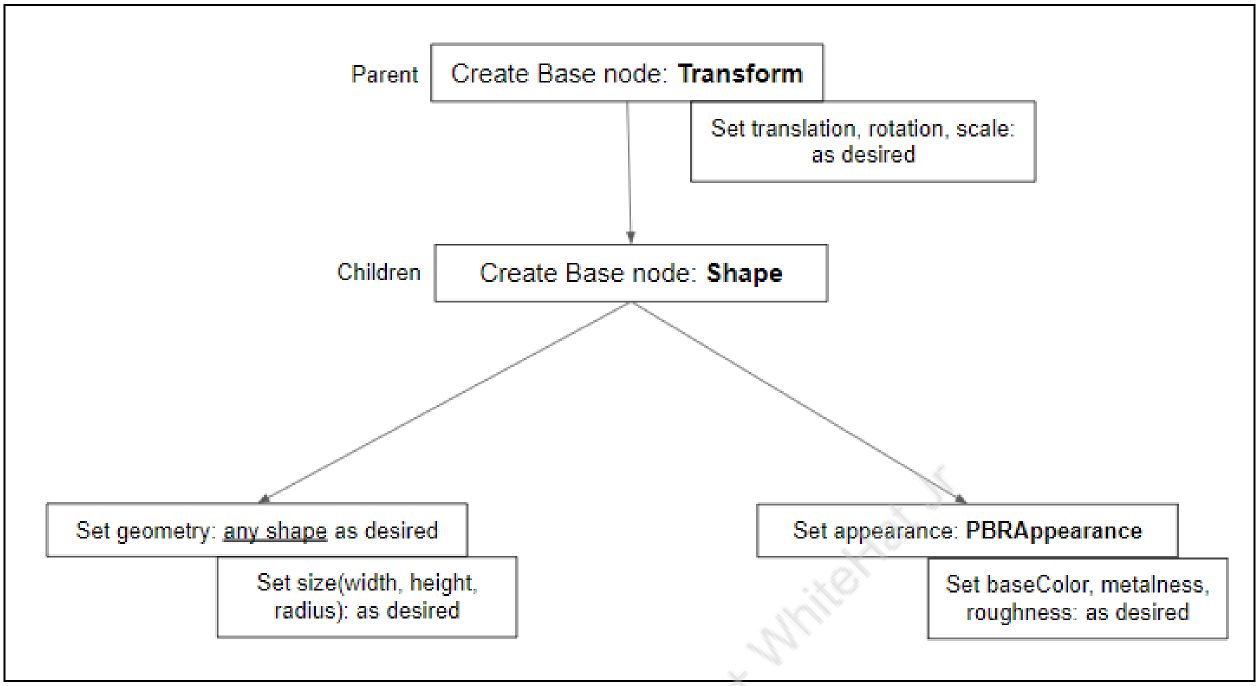
   b. Click **Add**

   c. size **0.5, 0.3, 0.4**

Save the simulation. 💾



Quick reference to draw any geometric shape using webots:

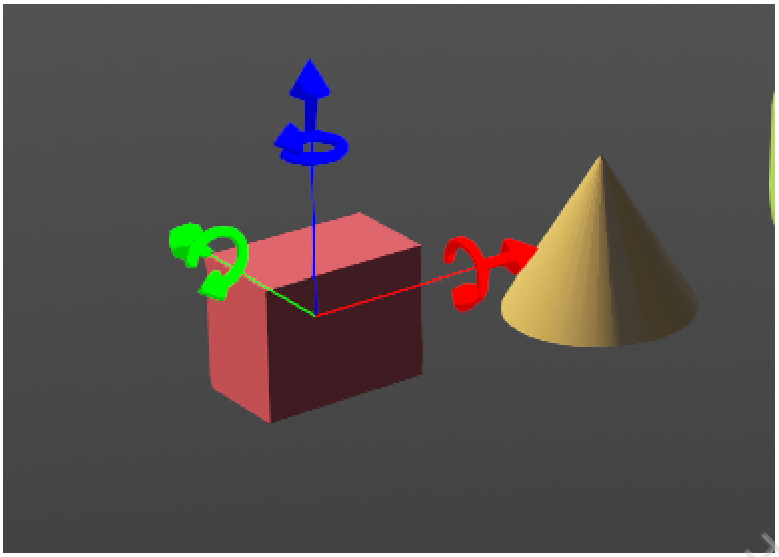

Parent
Create Base node: **Transform**
Set translation, rotation, scale: as desired
Children
Create Base node: **Shape**
Set geometry: any shape as desired
Set size(width, height, radius): as desired
Set appearance: PBRAppearance
Set baseColor, metalness, roughness: as desired

4. **Learnt to draw another Geometrical Figure: Cone**
    1. Add a new node and Click on **Base nodes**
        a. Select **Transform**
        b. Write name of the Function DEF **CONE** (Note: DEF is already written
        c. Click **ADD.** Function is created
        d. Now click on **Arrow** just before the function name
        e. Select **translation** and write value **2, 0, 0**
        f. Now click on **Arrow** just before the function name
            i. Double Click on **children**
            ii. Click on **Base nodes**
                1. Select **SHAPE**
                2. Click on **ADD**
                3. Now click on **Shape**

   a. Double Click on **Appearance**
   b. **Click on Base Nodes**
      i. Select **PBR Appearance**
      ii. Click **ADD**

4. **Click on Arrow PBR Appearance**
   a. Select **baseColor 0.8, 0.62, 0.264**
   b. Select **roughness 0.2**
   c. Select **metalness 0**
5. Double Click on **Geometry NULL**
   a. Select **Cone**
   b. Click **Add**
   c. **bottomRadius 0.3**
   d. **height 0.5**
   e. **subdivision 36**

Save the simulation. 💾



5. **Learnt to design another geometrical shape: Capsule**

    1. Click on + to add new shape
    2. Click on arrow of **Base nodes**

        a. Select **Transform**

        b. Write name of the Function DEF **CAPSULE**(Note: DEF is already written

        c. Click **ADD.** Function is created

        d. Now click on **Arrow** just before the function name

        e. Select **translation** and write value **2, 0, 0**

        f. Now click on Arrow just before the function name

            i. Double Click on **children**

            ii. Click on Arrow before the **Base nodes**

                1. Select **SHAPE**

                2. Click on **ADD**

                3. Now click on **Shape**

a. Double Click on **Appearance**

b. **Click on Base Nodes**

   i. Select **PBR Appearance**

   ii. Click **ADD**

c. **Click on Arrow PBR Appearance**

d. Select **baseColor 0.6, 0.8, 0.24**

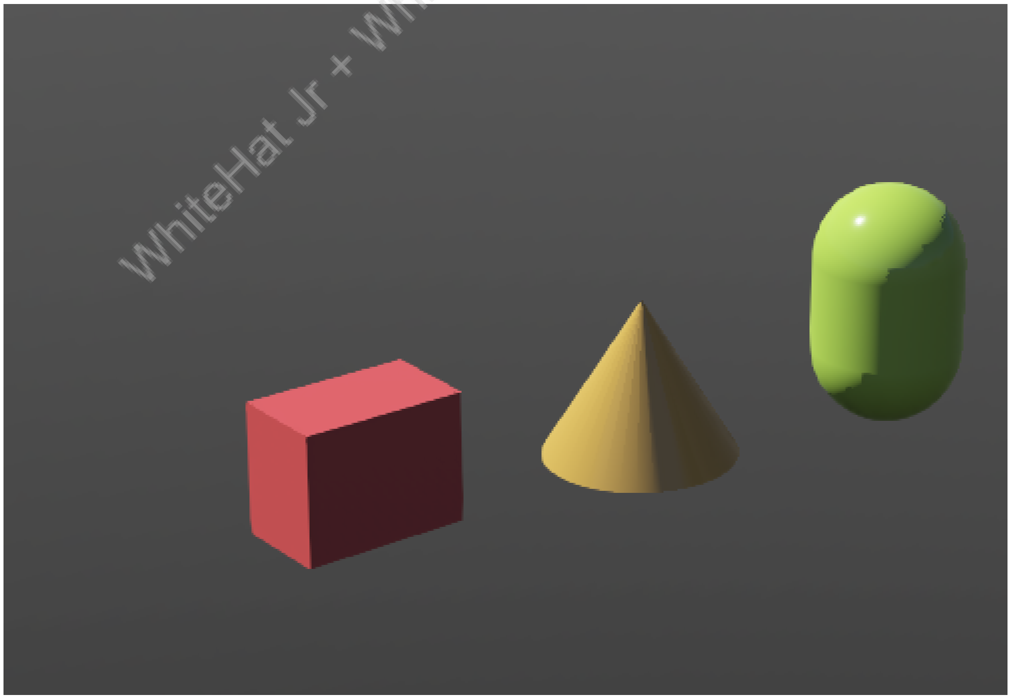
e. Select **roughness 0.2**

f. Select **metalness 0**

4. Double Click on **Geometry NULL**

   a. Select **Capsule**

   b. Click **Add**



6. **Learnt to draw Cylinder geometric shape:**

1. Click on **+** to add new shape
2. Click on arrow of **Base nodes**
    a. Select **Transform**
    b. Write name of the Function DEF **CYLINDER**(Note: DEF is already written
    c. Click **ADD.** Function is created
    d. Now click on **Arrow** just before the function name
    e. Select **translation** and write value **3, 0, 0**
    f. Click on Arrow just before the function name
        i. Double Click on **children**
        ii. Click on **Arrow** before the **Base nodes**
            1. Select **SHAPE**
            2. Click on **ADD**
            3. Now click on **Shape**
                a. Double Click on **Appearance**
                b. **Click on Base Nodes**
                    i. Select **PBR Appearance**
                    ii. Click **ADD**
                c. **Click on Arrow PBR Appearance**
                    i. Select **baseColor 0.2, 0.8, 0.24**
                    ii. Select **roughness 0.2**
                    iii. Select **metalness 0**
            4. Double Click on **Geometry NULL**
                a. Select **Cylinder**

b. Click **Add**

c. **height 0.6**

d. **radius 0.2**

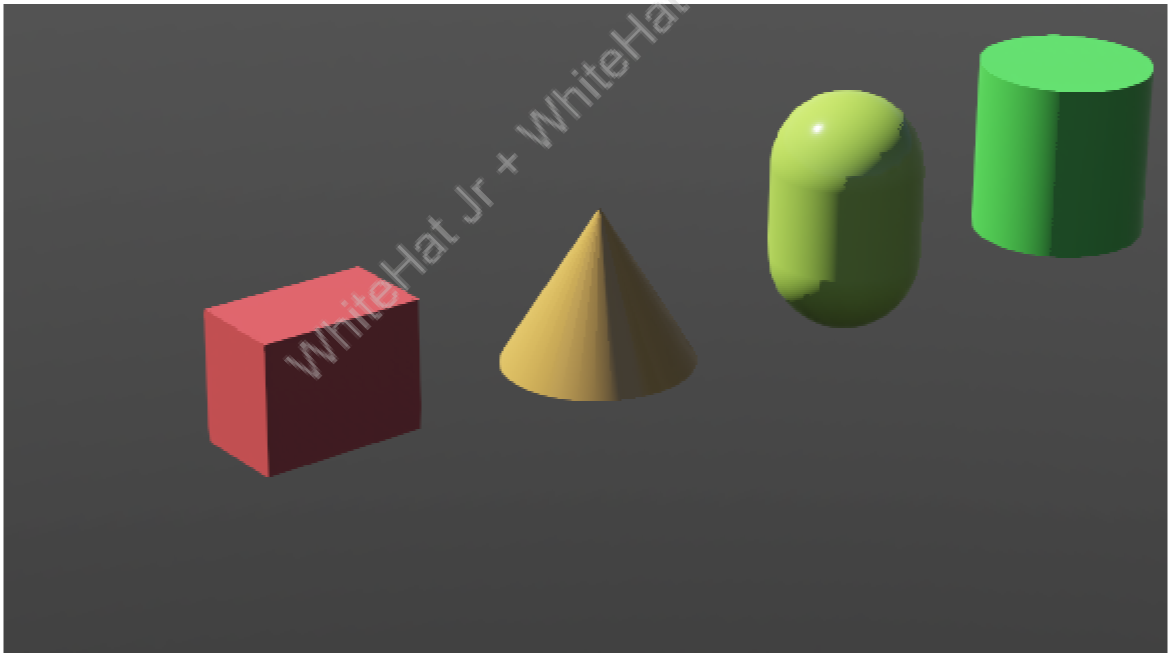
e. **subdivision 24**

c. Save the simulation. 💾 **radius 0.25**

d. **height 0.3**

e. **subdivision 24**

Save the simulation. 💾



What's NEXT?

In the **next class**, we will learn to design a ramp follower robot.

Expand Your Knowledge

To know more about **Geometries in Webots** click here.