

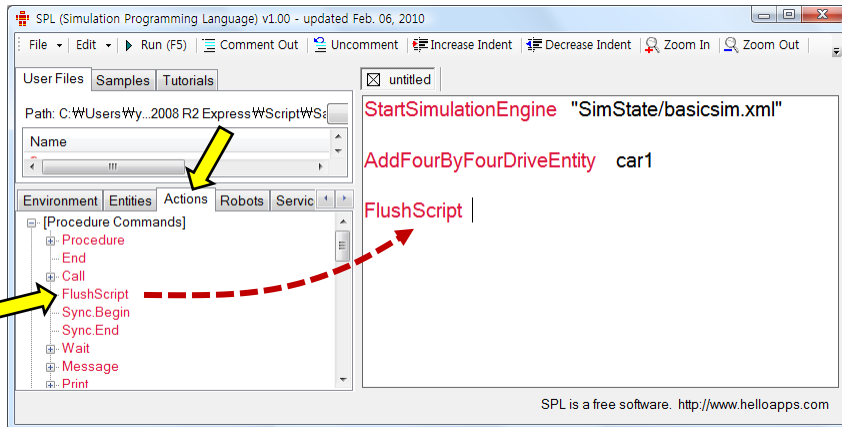
# Introduction to Game Programming and Robotics

## Unit # 10

## Acknowledgement

- Most of the examples/material presented in this presentation is taken from HelloApps.com website.

## Add FourByFour Drive Entity



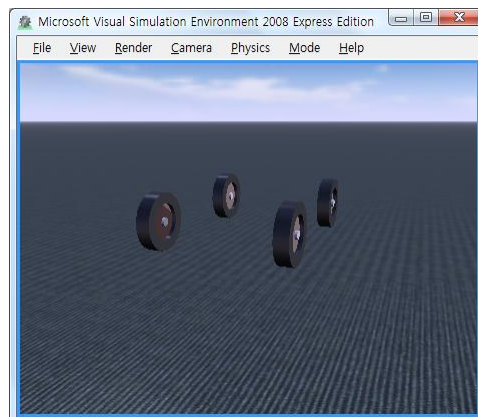
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## Add FourByFour Drive Entity (Cont'd)

- Save script with the name of "script/fourbyfour1.txt"



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## Add Box Shape

User Files | Samples | Tutorials | FourByFour2.txt

Path: C:\Users\Wy...2008 R2 Express\ScriptWk

Name

Environment | Entities | Actions | Robots | S

```

StartSimulationEngine "SimState/basicsim.xml"
AddFourByFourDriveEntity car1
AddNewEntity ent1 /Position:0 0.5 0
    /ParentEntity:car1
AddBoxShape
    /Dimensions:0.2 0.2 0.2 /Mass:0.1
FlushScript
car1.Drive()
  
```

Entities tree view:

- AddNewEntity
- AddBoxShape
- /Dimensions:
- /Mass:
- /Position:
- /Orientation:
- /Texture:
- /DiffuseColor:
- /MaterialProperties:
- /EnableContactNotifications:
- /Procedure:
- /Name:
- [Advanced]
- AddSphereShape

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## Add Box Shape (Cont'd)

- Change the "/Dimensions:" as follows

```

AddBoxShape
    /Dimensions:0.2 0.2 0.2 /Mass:0.1
FlushScript
  
```

Entities tree view:

- AddBoxShape

```

StartSimulationEngine "SimState/basicsim.xml"
AddFourByFourDriveEntity car1
AddNewEntity ent1 /Position:0 0.5 0
    /ParentEntity:car1
AddBoxShape
    /Dimensions:0.8 0.5 1.6 /Mass:0.1
FlushScript
car1.Drive()
  
```

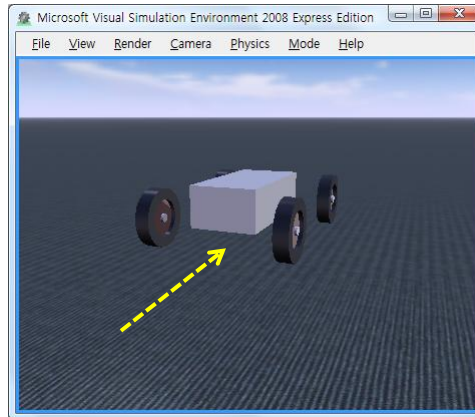
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## Add Box Shape (Cont'd)

- Save and execute script



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## Set 3D Mesh File

- Remove script lines of "BoxShape"

```
StartSimulationEngine "SimState/basicsim.xml"
```

```
AddFourByFourDriveEntity car1
```

```
AddNewEntity ent1 /Position:0 0.5 0  
/ParentEntity:car1
```

```
AddBoxShape  
/Dimensions:0.8 0.5 1.6 /Mass:0.1
```

```
FlushScript
```

```
car1.Drive()
```

Delete lines

```
StartSimulationEngine "SimState/basicsim.xml"
```

```
AddFourByFourDriveEntity car1
```

```
AddNewEntity ent1 /Position:0 0.5 0  
/ParentEntity:car1
```

```
FlushScript
```

```
car1.Drive()
```

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## Set 3D Mesh File (Cont'd)

- Change the position value as "0 0 0" of ent1

```

StartSimulationEngine "SimState/basicsim.xml"

AddFourByFourDriveEntity car1

AddNewEntity ent1 /Position:0 0.5 0
                /ParentEntity:car1

FlushScript

car1.Drive()

```

The diagram shows two code snippets. The left snippet has `/Position:0 0.5 0`. A yellow arrow points to the `0.5` value. The right snippet has `/Position:0 0 0`. A yellow arrow points to the `0` value. Another yellow arrow points from the `car1` parameter in the first snippet to the `car1` parameter in the second snippet.

```

StartSimulationEngine "SimState/basicsim.xml"

AddFourByFourDriveEntity car1

AddNewEntity ent1 /Position:0 0 0
                /ParentEntity:car1

FlushScript

car1.Drive()

```

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## Set 3D Mesh File (Cont'd)

- Add `/Mesh:` option and set the value as follows

The screenshot shows a software interface with a file browser on the left and a code editor on the right. The file browser shows a tree view of entities under 'Environment'. The 'AddFourByFourDriveEntity' is expanded, showing properties like /Position, /Orientation, /Mass, /Mesh, /FrontWheelMesh, /RearWheelMesh, /DefaultTexture, /MeshRotation, /MeshScale, /MeshTranslation, [Chassis], [Wheels], and MotorTorqueScale. The /Mesh property is highlighted with a yellow arrow. The code editor on the right shows the following code:

```

StartSimulationEngine "SimState/basicsim.xml"

AddFourByFourDriveEntity car1

AddNewEntity ent1 /Position:0 0 0
                /ParentEntity:car1
                /Mesh:"4x4Body.obj"

FlushScript

car1.Drive()

```

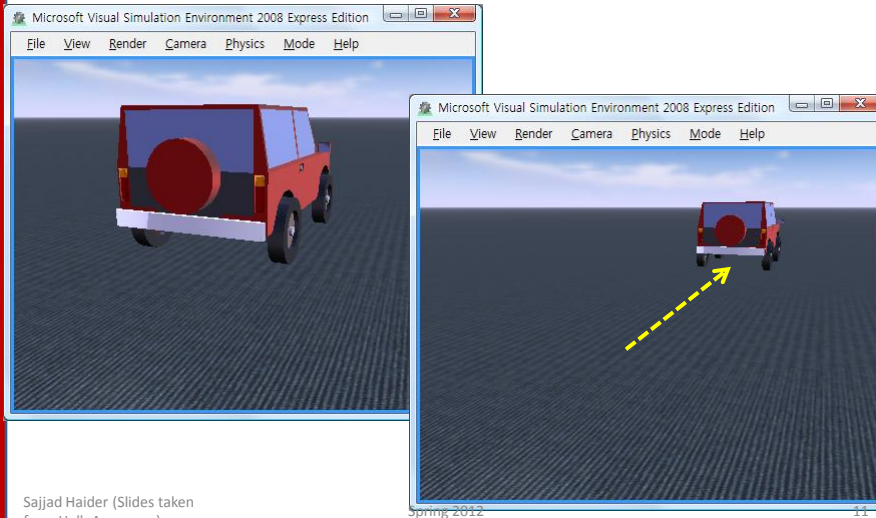
A red dashed arrow points from the /Mesh property in the file browser to the `/Mesh:"4x4Body.obj"` line in the code editor. A yellow arrow points to the `car1` parameter in the code editor.

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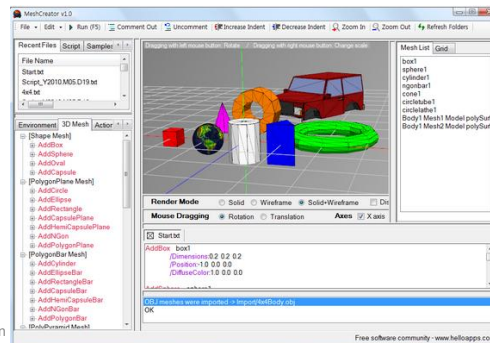
## Set 3D Mesh File (Cont'd)



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## Mesh Creator

- You can download Mesh Creator from the following link
- <http://www.helloapps.com/Mesh/>



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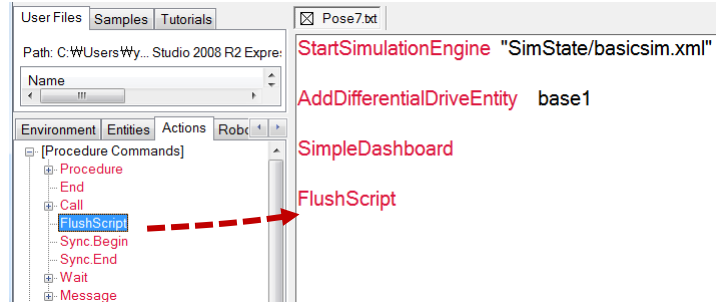
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## Simulation Environment Provided by SPL

- Modern House Environment
- Factory Environment
- Outdoor Environment
- Urban Environment

## Detect Position

## Build Basic Environment



## Detect Position and Orientation

- Add "While" Loop

```

StartSimulationEngine "SimState/basicsim.xml"
AddDifferentialDriveEntity base1
SimpleDashboard
FlushScript
while (true)
{
}

```


A yellow arrow points to the 'while (true)' line in the code block.



## Detect Position and Orientation

- Add script lines to keep the position of “base1”

```
FlushScript
while (true)
{
    px = base1.Position.X
    py = base1.Position.Y
    pz = base1.Position.Z
}
```




## Detect Position and Orientation

- Add script lines to keep the orientation of “base1”

```
FlushScript
while (true)
{
    px = base1.Position.X
    py = base1.Position.Y
    pz = base1.Position.Z

    ox = base1.Orientation.X
    oy = base1.Orientation.Y
    oz = base1.Orientation.Z
}
```




## Detect Position and Orientation

- Add script lines to print the values on the console window

```
FlushScript
while (true)
{
    px = base1.Position.X
    py = base1.Position.Y
    pz = base1.Position.Z

    ox = base1.Orientation.X
    oy = base1.Orientation.Y
    oz = base1.Orientation.Z

    print "Pos: " + px + " / " + pz
    print "Orientation: " + oy
}
```



## Detect Position and Orientation


- Add line to delay 1 sec  
– 1000 milliseconds

```
StartSimulationEngine "SimState/basicssim.xml"
AddDifferentialDriveEntity base1
SimpleDashboard
FlushScript
while (true)
{
    px = base1.Position.X
    py = base1.Position.Y
    pz = base1.Position.Z

    ox = base1.Orientation.X
    oy = base1.Orientation.Y
    oz = base1.Orientation.Z

    print "Pos: " + px + " / " + pz
    print "Orientation: " + oy

    wait 1000
}
```

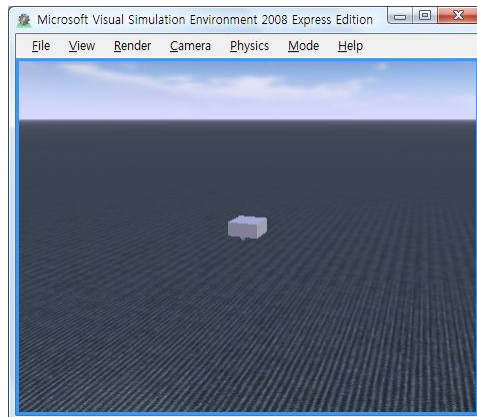


## Detect Position and Orientation

- Save script with the name of “script/Pose7.txt”

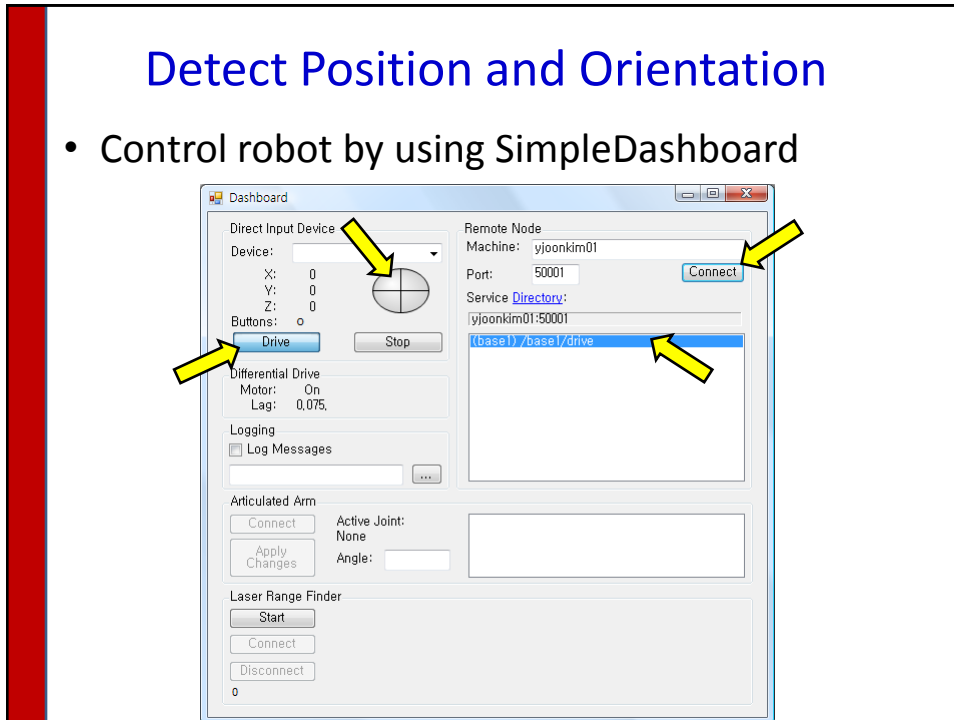
## Detect Position and Orientation

- Executed result



## Detect Position and Orientation

- Control robot by using SimpleDashboard



## Detect Position and Orientation

- Displayed Position and Orientation on the Console window

```

C:\Users\yjoonkim\Microsoft Robotics Dev Studio 2008 R2 Express\bin\Dss-Host.exe
* Pos: -0.7586281 / -0.9747065 [02/07/2010 13:05:38][http://yjoonkim01:50000/splactions/6229472e-9c14-4d4c-8124-8212125d724b]
* Orientation: 109.0406 [02/07/2010 13:05:38][http://yjoonkim01:50000/splactions/6229472e-9c14-4d4c-8124-8212125d724b]
* Pos: -1.352524 / -0.2576997 [02/07/2010 13:05:39][http://yjoonkim01:50000/splactions/6229472e-9c14-4d4c-8124-8212125d724b]
* Orientation: 162.8234 [02/07/2010 13:05:39][http://yjoonkim01:50000/splactions/6229472e-9c14-4d4c-8124-8212125d724b]
* Pos: -1.486944 / 0.4410194 [02/07/2010 13:05:40][http://yjoonkim01:50000/splactions/6229472e-9c14-4d4c-8124-8212125d724b]
* Orientation: -178.9523 [02/07/2010 13:05:40][http://yjoonkim01:50000/splactions/6229472e-9c14-4d4c-8124-8212125d724b]
* Pos: -1.487298 / 0.4333728 [02/07/2010 13:05:41][http://yjoonkim01:50000/splactions/6229472e-9c14-4d4c-8124-8212125d724b]
* Orientation: -178.9666 [02/07/2010 13:05:41][http://yjoonkim01:50000/splactions/6229472e-9c14-4d4c-8124-8212125d724b]
* Pos: -1.487298 / 0.4333728 [02/07/2010 13:05:42][http://yjoonkim01:50000/splactions/6229472e-9c14-4d4c-8124-8212125d724b]
* Orientation: -178.9666 [02/07/2010 13:05:42][http://yjoonkim01:50000/splactions/6229472e-9c14-4d4c-8124-8212125d724b]
* Pos: -1.487298 / 0.4333728 [02/07/2010 13:05:43][http://yjoonkim01:50000/splactions/6229472e-9c14-4d4c-8124-8212125d724b]
* Orientation: -178.9666 [02/07/2010 13:05:43][http://yjoonkim01:50000/splactions/6229472e-9c14-4d4c-8124-8212125d724b]

```

## Manipulating Array to Keep Position

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## Build Basic Environment

- Start with basic environment
- Add new box entity
- Add a new DifferentialDrive entity

```
StartSimulationEngine "SimState/basicsim.xml"
AddNewEntity ent1 /Position:2 0.5 0
AddBoxShape
  /Dimensions:0.2 0.2 0.2 /Mass:0.1
AddDifferentialDriveEntity base1
SimpleDashboard
FlushScript
```

## Define Array in SPL

- Add lines to define array

```
StartSimulationEngine "SimState/basicSim.xml"
AddNewEntity ent1 /Position:2 0.5 0
AddBoxShape
  /Dimensions:0.2 0.2 0.2 /Mass:0.1
AddDifferentialDriveEntity base1
SimpleDashboard
FlushScript

xArray = Util.CreateArray(double, 1000)
yArray = Util.CreateArray(double, 1000)
zArray = Util.CreateArray(double, 1000)
```



## Define Array in SPL

- Add lines to initialize Array

```
StartSimulationEngine "SimState/basicSim.xml"
AddNewEntity ent1 /Position:2 0.5 0
AddBoxShape
  /Dimensions:0.2 0.2 0.2 /Mass:0.1
AddDifferentialDriveEntity base1
SimpleDashboard
FlushScript

xArray = Util.CreateArray(double, 1000)
yArray = Util.CreateArray(double, 1000)
zArray = Util.CreateArray(double, 1000)

//Initialize array with value 0
for (i=0; i < 1000; i++)
{
  xArray[i] = 0
  yArray[i] = 0
  zArray[i] = 0
}
```



## Define Array in SPL

- Add a variable to keep the array index

```

StartSimulationEngine "SimState/basicssim.xml"
AddNewEntity ent1 /Position:2 0.5 0
AddBoxShape
  /Dimensions:0.2 0.2 0.2 /Mass:0.1
AddDifferentialDriveEntity base1
SimpleDashboard
FlushScript

xArray = Util.CreateArray(double, 1000)
yArray = Util.CreateArray(double, 1000)
zArray = Util.CreateArray(double, 1000)

//Initialize array with value 0
for (i=0; i < 1000; i++)
{
  xArray[i] = 0
  yArray[i] = 0
  zArray[i] = 0
}
arrayInd = 0
  
```



## Manipulate Array in the SPL

- Add “While” Loop

```

StartSimulationEngine "SimState/basicssim.xml"
AddNewEntity ent1 /Position:2 0.5 0
AddBoxShape
  /Dimensions:0.2 0.2 0.2 /Mass:0.1
AddDifferentialDriveEntity base1
SimpleDashboard
FlushScript

xArray = Util.CreateArray(double, 1000)
yArray = Util.CreateArray(double, 1000)
zArray = Util.CreateArray(double, 1000)

//Initialize array with value 0
for (i=0; i < 1000; i++)
{
  xArray[i] = 0
  yArray[i] = 0
  zArray[i] = 0
}
arrayInd = 0
while (true)
{
}
  
```



## Manipulate Array in the SPL

- Add lines to keep position and orientation data

```

array = Out.CreateArray(10000, 1000)

//Initialize array with value 0
for (i=0; i < 1000; i++)
{
    xArray[i] = 0
    yArray[i] = 0
    zArray[i] = 0
}

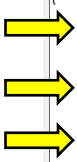
arrayInd = 0

while (true)
{
    px = base1.Position.X
    py = base1.Position.Y
    pz = base1.Position.Z

    ox = base1.Orientation.X
    oy = base1.Orientation.Y
    oz = base1.Orientation.Z

    print "Pos: " + px + " / " + py + " / " + pz
    print "Ori: " + ox + " / " + oy + " / " + oz
}

```



## Manipulate Array in the SPL

- Add lines to set values for the Array

```

//Initialize array with value 0
for (i=0; i < 1000; i++)
{
    xArray[i] = 0
    yArray[i] = 0
    zArray[i] = 0
}

arrayInd = 0

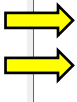
while (true)
{
    px = base1.Position.X
    py = base1.Position.Y
    pz = base1.Position.Z

    ox = base1.Orientation.X
    oy = base1.Orientation.Y
    oz = base1.Orientation.Z

    print "Pos: " + px + " / " + py + " / " + pz
    print "Ori: " + ox + " / " + oy + " / " + oz

    if (arrayInd < 1000)
    {
        xArray[arrayInd] = px
        yArray[arrayInd] = py
        zArray[arrayInd] = pz
    }
}

```





## Manipulate Array in the SPL

- Add lines to get values from the Array


```
arrayInd = u
while (true)
{
    px = base1.Position.X
    py = base1.Position.Y
    pz = base1.Position.Z

    ox = base1.Orientation.X
    oy = base1.Orientation.Y
    oz = base1.Orientation.Z

    print "Pos: " + px + "/" + py + "/" + pz
    print "Ori: " + ox + "/" + oy + "/" + oz

    if (arrayInd < 1000)
    {
        xArray[arrayInd] = px
        yArray[arrayInd] = py
        zArray[arrayInd] = pz
    }

    if ((arrayInd % 5) == 0)
    {
        print "<< Pos in array for every 5 secs>> " + xArray[arrayInd] + "/" + xArray[arrayInd] + "/" + xArray[arrayInd]
    }
}
```



## Manipulate Array in the SPL

- Increase array index

```
while (true)
{
    px = base1.Position.X
    py = base1.Position.Y
    pz = base1.Position.Z


    ox = base1.Orientation.X
    oy = base1.Orientation.Y
    oz = base1.Orientation.Z

    print "Pos: " + px + "/" + py + "/" + pz
    print "Ori: " + ox + "/" + oy + "/" + oz

    if (arrayInd < 1000)
    {
        xArray.SetValue(px, arrayInd)
        yArray.SetValue(py, arrayInd)
        zArray.SetValue(pz, arrayInd)
    }

    if ((arrayInd % 5) == 0)
    {
        print "<< Pos in array for every 5 secs>> " + xArray.GetValue(arrayInd) + "/" + xArray.GetValue(arrayInd) + "/" + xArray.GetValue(arrayInd)
    }

    arrayInd++
    wait 1000
}
```

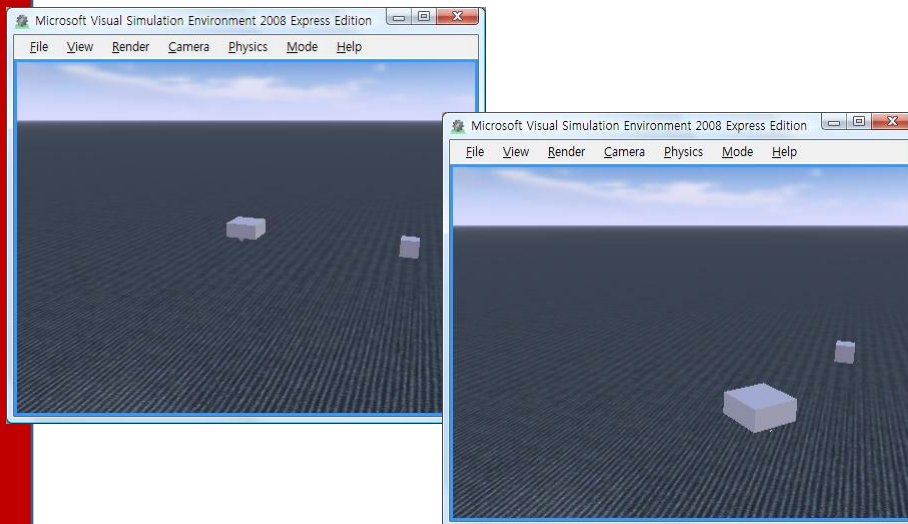


## Manipulate Array in the SPL

- Save script with the name of “script/Pose2.txt”

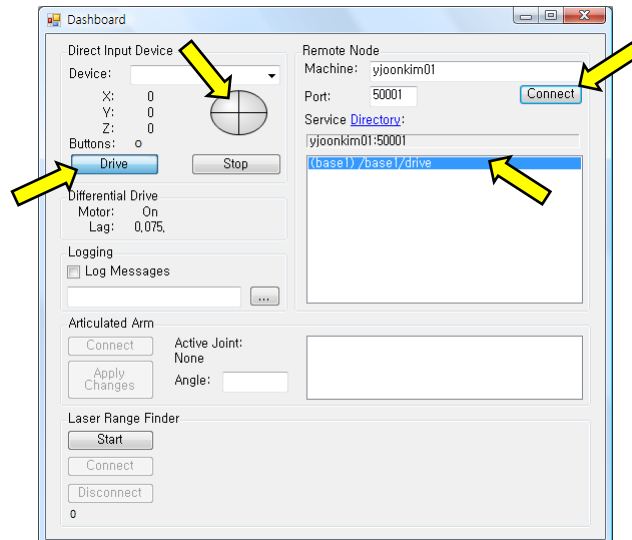
## Manipulate Array in the SPL

- Execute script



## Manipulate Array in the SPL

- Control robot by using SimpleDashboard



## Manipulate Array in the SPL

- Executed result

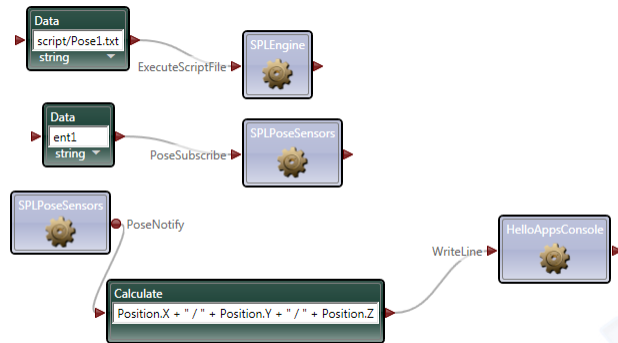
```

C:\Users\yjoonkim\Microsoft Robotics Dev Studio 2008 R2 Express\bin\DssHost.exe
nkin01:50000/splactions/7db507c0-47e8-4971-80ca-988c08bb8223]
* Pos: 1.423625 / -0.001006353 / 1.939053 [02/07/2010 16:22:33] [http://yjoonki
m01:50000/splactions/7db507c0-47e8-4971-80ca-988c08bb8223]
* Ori: -0.001994796 / 140.9376 / -0.02524082 [02/07/2010 16:22:33] [http://yjo
nkin01:50000/splactions/7db507c0-47e8-4971-80ca-988c08bb8223]
<< Pos in array for every 5 secs>> 1.42362546920776 / 1.42362546920776 / 1.
42362546920776 [02/07/2010 16:22:33] [http://yjoonkim01:50000/splactions/7db507c0
-47e8-4971-80ca-988c08bb8223]
* Pos: 1.423625 / -0.001006353 / 1.939053 [02/07/2010 16:22:34] [http://yjoonki
m01:50000/splactions/7db507c0-47e8-4971-80ca-988c08bb8223]
* Ori: -0.001994796 / 140.9376 / -0.02524082 [02/07/2010 16:22:34] [http://yjo
nkin01:50000/splactions/7db507c0-47e8-4971-80ca-988c08bb8223]
* Pos: 1.423625 / -0.001006353 / 1.939053 [02/07/2010 16:22:35] [http://yjoonki
m01:50000/splactions/7db507c0-47e8-4971-80ca-988c08bb8223]
* Ori: -0.001994796 / 140.9376 / -0.02524082 [02/07/2010 16:22:35] [http://yjo
nkin01:50000/splactions/7db507c0-47e8-4971-80ca-988c08bb8223]
* Pos: 1.423625 / -0.001006353 / 1.939053 [02/07/2010 16:22:36] [http://yjoonki
m01:50000/splactions/7db507c0-47e8-4971-80ca-988c08bb8223]
* Ori: -0.001994796 / 140.9376 / -0.02524082 [02/07/2010 16:22:36] [http://yjo
nkin01:50000/splactions/7db507c0-47e8-4971-80ca-988c08bb8223]
* Pos: 1.423625 / -0.001006353 / 1.939053 [02/07/2010 16:22:37] [http://yjoonki
m01:50000/splactions/7db507c0-47e8-4971-80ca-988c08bb8223]
* Ori: -0.001994796 / 140.9376 / -0.02524082 [02/07/2010 16:22:37] [http://yjo
nkin01:50000/splactions/7db507c0-47e8-4971-80ca-988c08bb8223]
  
```

# Detecting Position in VPL

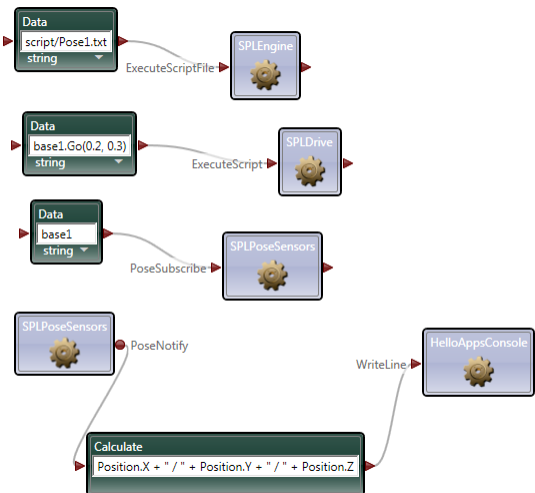
```

1 StartSimulationEngine "SimState/basicSim.xml"
2
3 AddNewEntity ent1 /Position:2 0.5 0
4
5 AddBoxShape
6 /Dimensions:0.2 0.2 0.2 /Mass:0.1
7
8 AddDifferentialDriveEntity base1
9
10 SimpleDashboard
11
12 FlushScript
    
```



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# Detecting Position in VPL (Cont'd)



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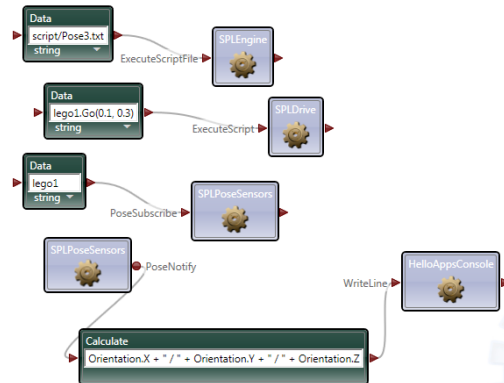
40

# Detecting Orientation in VPL

```

1 StartSimulationEngine "SimState/basicsim.xml"
2
3 AddLegoNXTTribot lego1 /Position:0 0 0
4
5 UpdateCameraView
6 /EyePosition:1 0.5 1 /LookAtPoint0 0 0
7
8 FlushScript

```



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