虚拟现实大作业开发文档

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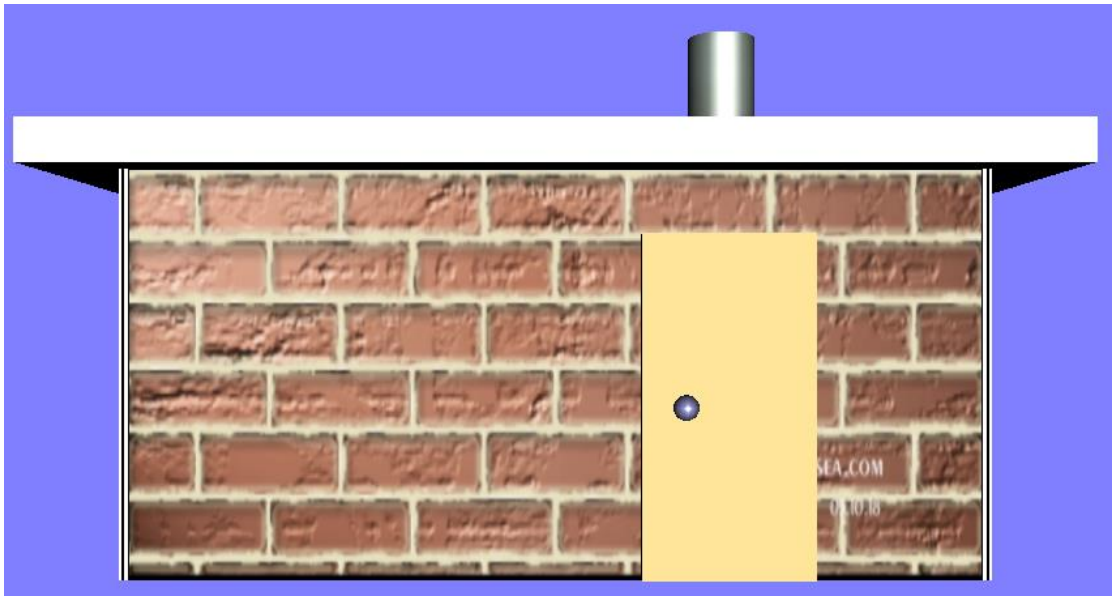
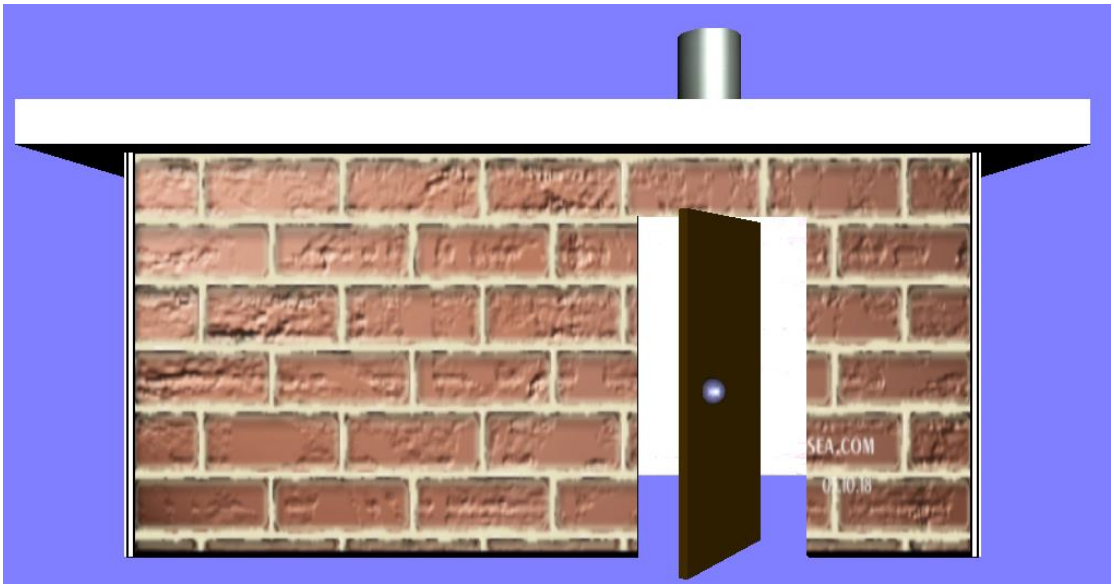
一、功能概述

在 VrmlPad 中编写程序，构造了一个虚拟世界。主要场景是一个房子，门可以转动。房子内部包括一个时钟和一个电视机。房子后面是很多座风车和两排树。房子内的时钟可以运转，电视机循环播放视频，风车可以转动，场景中还包括背景音乐。

二、详细说明

1、房子





代码如下：

```
#VRML V2.0 utf8

Background {
    skyColor 0.5 0.5 1
}

DEF house Transform    {
    children [
        DEF walls Group    {
            children [
                DEF box1 Shape {                        #backside of the house
                    appearance Appearance {             #房子后侧墙面
                        material Material {             #一个长方体
                            diffuseColor 0.3 0.3 0.5
                            ambientIntensity 0.3
                            shininess 0.1
                            specularColor 0.7 0.7 0.8
                        }
                        texture    ImageTexture {       #纹理贴图
                            url    "my texture/wall.jpg"
                        }
                    }
                    geometry Box {
                        size 10 5 0.1
                    }
                }

                DEF box2 Transform {                    #leftside of the house
                    translation      -5 0 2.45          #房子左侧墙面
```

```
        rotation 0 1 0 1.5708
        scale 0.5 1 1
        children [
        USE box1
        ]
    }

    Transform {                                  #frontside without the door
        translation      -5 -2.5 5               #房子正面墙面
        rotation 1 0 0 -1.5708
        children [
            Shape {
                appearance Appearance {
                    material Material {
                        diffuseColor 0.3 0.3 0.5
                        ambientIntensity 0.2
                        shininess 0.1
                        specularColor 0 0 0
                    }
                    texture    ImageTexture {
                        url   "my texture/wall.jpg"
                        repeatS   TRUE
                        repeatT   TRUE
                    }
                }
                geometry Extrusion {             #Extrusion 挤出造型
                    crossSection [               #形状为后侧墙面除去门
                        0 0,6 0,6 4,8 4,8 0,10 0,10 5,0 5,0 0
                    ]
                    spine [
                        0 0 0,
                        0 0.1 0
                    ]
                }
            }
        ]
    }

    Transform {                                  #rightside of the house
        translation      10 0 0                  #右侧墙面是左侧墙面的平移
        children [USE box2 ]
    }

    DEF roof Transform {                     #roof of the house
```

```
        translation     0 2.5 2.5           #屋顶是一个长方体
        children [
            Shape {
                appearance Appearance {
                    material Material {
                        diffuseColor 0.2 0.2 0.8
                        ambientIntensity 0.1
                        shininess 0.15
                        specularColor 0.8 0.8 0.8
                    }
                    texture    ImageTexture {
                        url   "my texture/wall6.jpg"
                    }
                }
                geometry Box {
                size 12 0.5 6
                }
            }
        ]
    }

    DEF chimney Transform {                  #chimney of the house
        translation     2.5 3.75 1.25       #烟囱是一个圆柱体
        children [
            Shape {
                appearance Appearance {
                    material Material {
                        diffuseColor 0.2 0.2 0.8
                        ambientIntensity 0.1
                        shininess 0.15
                        specularColor 0.8 0.8 0.8
                    }
                    texture    ImageTexture {
                        url   "my texture/wall6.jpg"
                    }
                }
                geometry Cylinder {
                    radius 0.5
                    height 2
                }
            }
        ]
    }
]
```

```
}

Group {                                          #door of the house
    children [                                   #房门是长方体加球形门把手
        DEF door Transform {
            translation 2 -0.5 5
            children [
                Group{
                    children [
                        Transform    {
                            translation 0 0 0
                            children [
                                Shape {
                                    appearance Appearance {
                                        material Material {
                                            diffuseColor 0.3 0.2 0.0
                                            ambientIntensity 0.4
                                            shininess 0.2
                                            specularColor 0.7 0.7 0.6
                                            transparency 0.0
                                        }
                                    }
                                    geometry Box {
                                        size 2 4 0.1
                                    }
                                }
                            ]
                        }
                        Transform {              #the doornob
                            translation -0.5 0 0.1
                            children [           #球形门把手
                                Shape {
                                    appearance Appearance  {
                                        material Material    {
                                            diffuseColor 0.5 0.5 0.7
                                            ambientIntensity 0.4
                                            shininess 0.2
                                            specularColor 0.8 0.8 0.9
                                            transparency 0
                                        }
                                    }
                                    geometry Sphere {
                                        radius 0.15
                                    }
```

```
                                    }
                                ]
                            }
                        ]
                    }
                    DEF door_cs CylinderSensor {        #开门动作由圆柱检测器控制
                        autoOffset TRUE
                        diskAngle       0.262
                        enabled TRUE
                        autoOffset TRUE
                        maxAngle 1.5708                 #最大开门角度是 90°
                        minAngle 0.0
                        offset 1.576
                    }
                ]
            }
        ]
    }
]
}

ROUTE door_cs.rotation_changed TO door.set_rotation
```

2、电视

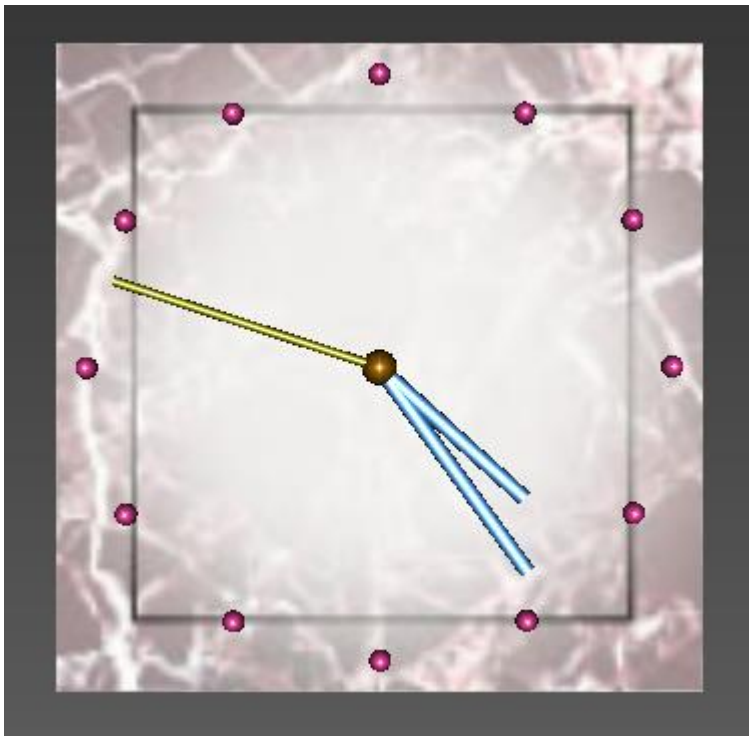
代码如下：

```
#VRML V2.0 utf8

Transform {                                          #biankuang
    translation     0 0 0                            #电视边框
    children [                                       #一个窄长方体
        Shape {
            appearance Appearance {
                material Material {
                    diffuseColor 0.3 0.3 0.3
                }
            }
            geometry Box {
                size 5.1 3.4 0.2
            }
        }
    ]
}
```

```
Transform {                                                    #pingmu
    translation     0 0 0.1                                    #电视屏幕
    children [                                                 #一个窄长方体
        Shape {
            appearance Appearance {
                texture DEF    film MovieTexture {             #电影纹理，控制播放视频
                    url    "my file/xqdz1.MPG"
                    loop TRUE
                }
            }
            geometry Box {
                size 4.5 3 0.01
            }
        }
    ]
}

Transform     {                                                #zhijia
    translation     0 -2 0                                     #电视支架
    children [                                                 #一个圆柱体
        Shape {
            appearance Appearance {
                material Material {
                    diffuseColor 0.3 0.3 0.3
                }
            }
            geometry Cylinder {
                radius 0.1
                height 0.6
            }
        }
    ]
}

Transform     {                                                #dizuo
    translation     0 -2.25 0                                  #电视底座
    rotation 1 0 0 1.5708                                      #一个扁长方体
    children [
        Shape {
            appearance Appearance {
                material Material {
                    diffuseColor 0.3 0.3 0.3
                }
```

```
                }
                geometry Box {
                    size 3 2 0.2
                }
            }
        ]
}

Transform {                                                    #guizi
    translation     0 -3.25 0                                  #用来放电视的柜子
    children [                                                 #一个长方体
        Shape {
            appearance Appearance {
                material Material {
                    diffuseColor 0.3 0.3 0.3
                }
                texture    ImageTexture {
                    url    "my texture/wood.jpg"
                }
            }
            geometry Box {
                size 5.5 2 3.5
            }
        }
    ]
}
```

3、时钟



代码如下：

```
#VRML V2.0 utf8

DEF clock Group    {
      children [
Shape {
      appearance Appearance {
            material Material {
                  diffuseColor 0.8 0.8 0.8 }
                  texture     ImageTexture {                              #给表盘纹理贴图
                        url    "my texture/clock.jpg"
                  }
            }
      geometry Box {      size 4 4 0.2      } }
DEF time1 TimeSensor {
      cycleInterval 1
      loop TRUE
      enabled    TRUE }
DEF an Transform {
      translation       0 0 0.15
      children   [
      DEF ts0 TouchSensor {}
            Shape {
                  appearance Appearance {
```

```
                material Material {
                    diffuseColor 0.5 0.3 0
                    ambientIntensity 0.4
                    specularColor 0.7 0.7 0.6
                    shininess 0.2 } }
            geometry Sphere    { radius 0.11 }
        }    ]    }
Transform {
    translation     0 0 0.15
    children [
    DEF p1 Transform {
            translation     0 0.9 0.05
            children [
             DEF ts1 CylinderSensor {}                          #秒针
                Shape {
                    appearance Appearance {
                        material Material {
                            diffuseColor 0.5 0.5 0
                            ambientIntensity 0.4
                            specularColor 0.8 0.8 0.9
                            shininess 0.2 } }
                    geometry Cylinder {
                        height 1.62
                        radius 0.03     }
                }    ]    }
    DEF p2 Transform {                                          #分针
            translation     0 0.8 0
            children [
                DEF ts2 CylinderSensor {}
                Shape {
                    appearance Appearance {
                        material Material {
                            diffuseColor 0.3 0.6 0.9
                            ambientIntensity 0.4
                            specularColor 0.8 0.8 0.9
                            shininess 0.1 } }
                    geometry Cylinder {
                        height 1.5
                        radius 0.05     }
                }   ]   }
    DEF p3 Transform {                                          #时针
            translation     0 0.6 0
            children [
                DEF ts3 CylinderSensor {}
```

```
        Shape {
            appearance Appearance {
                material Material {
                    diffuseColor 0.3 0.6 0.9
                    ambientIntensity 0.4
                    specularColor 0.8 0.8 0.9
                    shininess 0.1    }    }
            geometry Cylinder {
                height 1.2
                radius 0.05      }
        }     ]     }
DEF bkd Transform {                                    #整点位置
    translation      0 1.8 0
    children [
        Shape {
            appearance Appearance {
                material Material {
                    diffuseColor 0.8 0.2 0.5
                    ambientIntensity 0.4
                    specularColor 0.8 0.8 0.9
                    shininess 0.2    }    }
            geometry Sphere    {
                radius 0.07      }
        }    ]    }
        Transform {
    rotation 0 0 1 0.524
    children [
        USE bkd  ]}
        Transform {
    rotation 0 0 1 1.048
    children [
            USE bkd  ]}
        Transform {
    rotation 0 0 1 1.572
    children [
        USE bkd      ]}
        Transform {
    rotation 0 0 1 2.096
    children [
        USE bkd  ]}
        Transform {
    rotation 0 0 1 2.620
    children [
        USE bkd    ]}
```

```
                Transform {
            rotation 0 0 1 3.144
            children [
                USE bkd ]}
                Transform {
            rotation 0 0 1 3.668
            children [
                USE bkd ]}
                Transform {
            rotation 0 0 1 4.192
            children [
                USE bkd ]}
                Transform {
            rotation 0 0 1 4.716
            children [
                USE bkd ]}
                Transform {
            rotation 0 0 1 5.240
            children [
                USE bkd ]}
                Transform {
            rotation 0 0 1 5.764
            children [
                USE bkd ]}
    ]}
DEF Controller Script {
    eventIn    SFTime clicked
    eventOut SFBool enabledt
    eventOut SFBool setenabled
    field    SFInt32   i    1
    field    SFInt32   j    1
    field    SFInt32   k    1
    field    SFInt32   on 0
    field    SFFloat   sz -0.10472
    field    SFFloat   mz -0.10472
    field    SFFloat   hz -0.10472
    eventOut SFTime miao
    eventOut SFTime fen
    eventOut SFTime xshi
    eventIn SFTime sec_xz
    eventIn SFRotation xuanzhuan_sec
    eventIn SFRotation xuanzhuan_min
    eventIn SFRotation xuanzhuan_hou
    field    SFNode sec USE p1
```

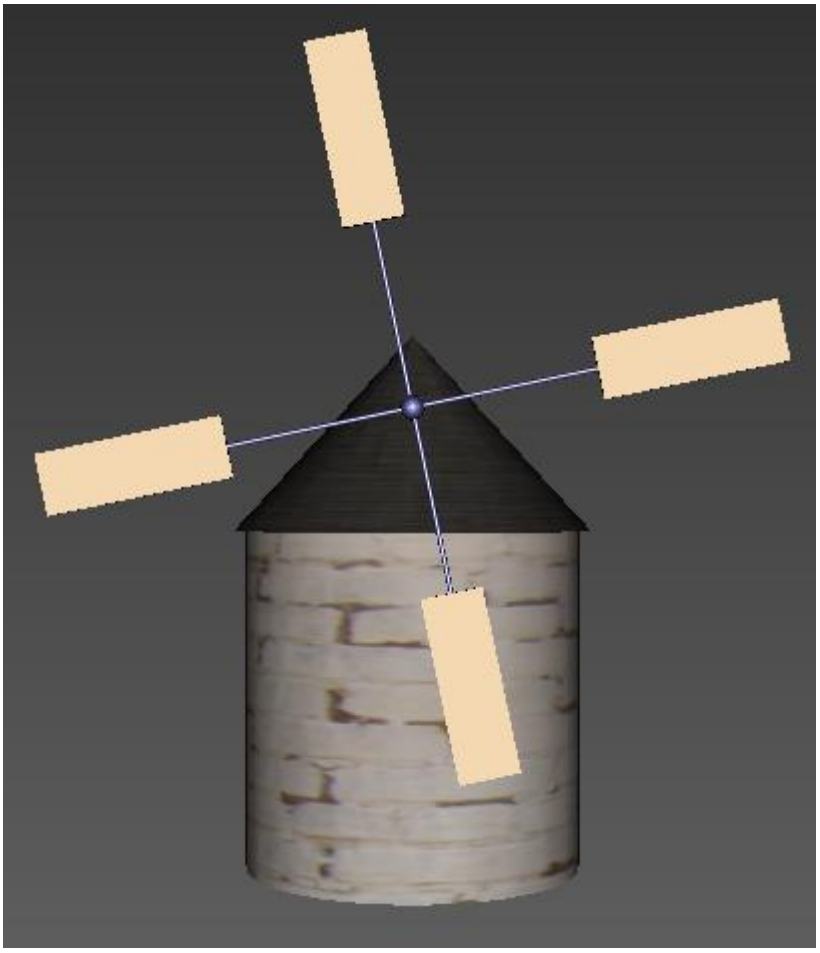
```
field    SFNode min USE p2
field    SFNode hou USE p3
url "vrmlscript:
function initialize(){
   print('ťЪ퓽');
   enabledt=TRUE;
   setenabled=TRUE;
   mydate=new Date();
   year=mydate.getFullYear();
   mont=mydate.getMonth();
   date=mydate.getDate();
   hour=mydate.getHours();
   minu=mydate.getMinutes();
   seco=mydate.getSeconds();
   deff1=seco;
   deff2=minu*60+seco;
   print('酮='+year+"+mont+"+date+"+hour+"+minu+"+seco+");
   if (deff2>720){                    //ת1720=3600*12/60
      deff2=deff2-720*Math.floor(deff2/720); }
   hour1=hour+minu/60;
   loop=2*3.14159*hour1/12/0.10472;
   while(k<=loop){
   xuanzhuan_hou();}
   minu1=minu+seco/60;
   loop=2*3.14159*minu/60/0.10472;
   while(j<=loop){
   xuanzhuan_min(); }
   loop=2*3.14159*seco/60/0.10472+1;
   while(i<=loop){
   xuanzhuan_sec(); }
   setenabled=FALSE;
   }
function clicked(value){
      enabledt=!enabledt;
      setenabled=!setenabled; }
function sec_xz(a){
      a=a+hour*3600+minu*60+seco;
      if (on==0){
            on=1;
            miao=a;
            fen=a;
            xshi=a;    }
            if (a-miao>=1){
         hd=1.57+sz*i;
```

```
            y=0.9*Math.sin(hd);
            x=0.9*Math.cos(hd);
            z=0.05;
            with (sec){
               rotation[0]=0;
               rotation[1]=0;
               rotation[2]=1;
               rotation[3]=sz*i;
               translation[0]=x;
               translation[1]=y;
               translation[2]=z; }
            i=i+1;
            miao=a;   }
               if (a+deff1-fen>=60){
            hd=1.57+sz*j;
            y=0.8*Math.sin(hd);
            x=0.8*Math.cos(hd);
            z=0;
            min.rotation[0]=0;
            min.rotation[1]=0;
            min.rotation[2]=1;
            min.rotation[3]=sz*j;
            min.translation[0]=x;
            min.translation[1]=y;
            min.translation[2]=z;
            j=j+1;
            fen=a;
            deff1=0; }
               if (a+deff2-xshi>=720){    //ת1720=3600*12/60
            hd=1.57+sz*k;
            y=0.6*Math.sin(hd);
            x=0.6*Math.cos(hd);
            z=0;
            hou.rotation[0]=0;
            hou.rotation[1]=0;
            hou.rotation[2]=1;
            hou.rotation[3]=sz*k;
            hou.translation[0]=x;
            hou.translation[1]=y;
            hou.translation[2]=z;
            k=k+1;
            xshi=a;
            deff2=0; }         }
function xuanzhuan_sec(){
```

```
        if (setenabled){
            hd=1.57+sz*i;
            y=0.9*Math.sin(hd);
            x=0.9*Math.cos(hd);
            z=0.05;
            sec.rotation[0]=0;
            sec.rotation[1]=0;
            sec.rotation[2]=1;
            sec.rotation[3]=sz*i;
            sec.translation[0]=x;
            sec.translation[1]=y;
            sec.translation[2]=z;
            i=i+1;    }        }
    function xuanzhuan_min(){
        if (setenabled){
            hd=1.57+sz*j;
            y=0.8*Math.sin(hd);
            x=0.8*Math.cos(hd);
            z=0;
            min.rotation[0]=0;
            min.rotation[1]=0;
            min.rotation[2]=1;
            min.rotation[3]=sz*j;
            min.translation[0]=x;
            min.translation[1]=y;
            min.translation[2]=z;
            j=j+1; }        }
    function xuanzhuan_hou(){
        if (setenabled){
            hd=1.57+sz*k;
            y=0.6*Math.sin(hd);
            x=0.6*Math.cos(hd);
            z=0;
            hou.rotation[0]=0;
            hou.rotation[1]=0;
            hou.rotation[2]=1;
            hou.rotation[3]=sz*k;
            hou.translation[0]=x;
            hou.translation[1]=y;
            hou.translation[2]=z;
            k=k+1;    }    }
    "  }
       ]
}
```

ROUTE time1.time TO Controller.sec_xz
ROUTE ts0.touchTime TO Controller.clicked
ROUTE Controller.enabledt TO time1.enabled
ROUTE ts1.rotation_changed TO Controller.xuanzhuan_sec
ROUTE ts2.rotation_changed TO Controller.xuanzhuan_min
ROUTE ts3.rotation_changed TO Controller.xuanzhuan_hou

4、风车



代码如下：

```
#VRML V2.0 utf8

Group {                                    #该组包括两个互相垂直的扇叶和中间部分金属球
    children [
        DEF bars Transform {                          #定义一个名为 bars 的
            translation      0 5 3.5                  #内容为互相垂直的扇叶
            children [
                DEF bar1 Transform{                   #定义 bar1
                    translation      0 0 0            #bar1 包括一个杆和两片扇叶
                    children [
                        Transform {
```

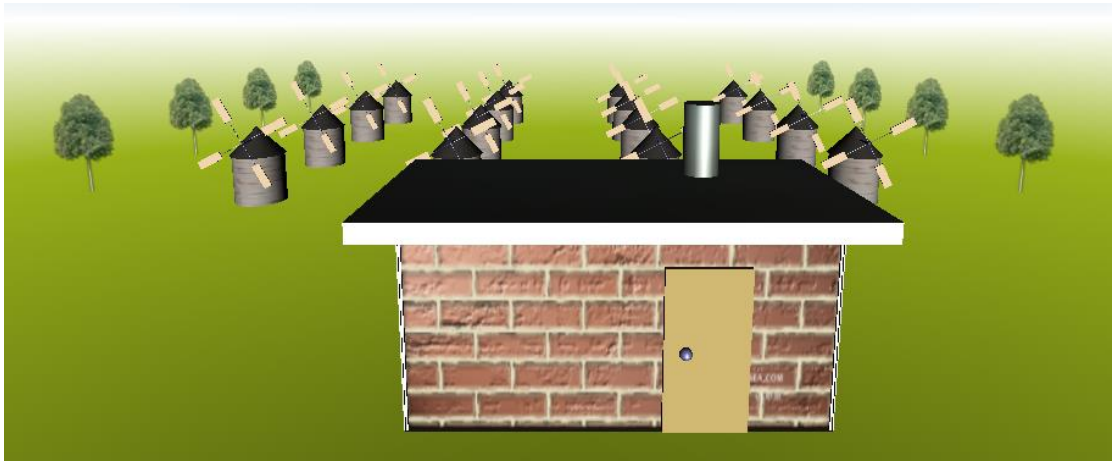
```
        translation      0 0 0
        children [
            Shape {
                appearance Appearance {
                    material Material {
                        diffuseColor 0.3 0.3 0.5
                        ambientIntensity 0.3
                        shininess 0.1
                        specularColor 0.7 0.7 0.8
                    }
                }
                geometry Cylinder {     #圆柱形杆
                    radius 0.04
                    height 12
                }
            }
        ]
    }

    DEF a1 Transform {                  #长方体形扇叶
        translation      0 4.5 0
        rotation 1 0 0 1.5708
        children [
            Shape {
                appearance Appearance {
                    material Material {
                        diffuseColor 0.3 0.6 0.9
                    }
                    texture    ImageTexture {
                        url    "my texture/wall4.jpg"
                    }
                }
                geometry Box {
                    size 1 0.1 3
                }
            }
        ]
    }

    DEF a2 Transform {
        translation      0 -9 0
        children [
            USE a1
        ]
```

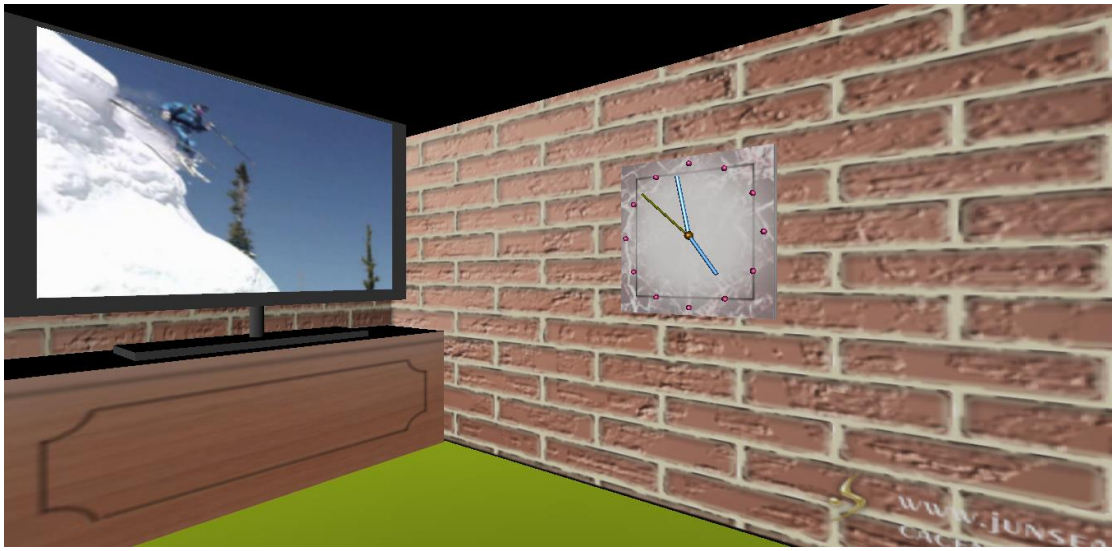
```
                }
            ]
        }

        DEF bar2 Transform {                    #bar2 是将 bar1 沿 z 轴旋转 90°
            rotation 0 0 1 1.5708
            children [
                USE bar1
            ]
        }

        Transform {                             #两个 bar 交点处的金属球
            children [
                Shape {
                    appearance Appearance {
                        material Material {
                            diffuseColor 0.3 0.3 0.5
                            ambientIntensity 0.3
                            shininess 0.1
                            specularColor 0.7 0.7 0.8
                        }
                    }
                    geometry Sphere    {
                        radius 0.2
                    }
                }
            ]
        }
    ]
}
DEF Time TimeSensor   {                         #时间传感器
    cycleInterval 6.0                           #周期为 6
    loop TRUE                                   #循环转动
}
DEF fengche OrientationInterpolator    {        #朝向插补器控制风车转动
    key  [
        0.0,0.2,0.4,0.6,0.8,1.0
    ]
    keyValue [                                  #绕 Z 轴转动
        0.0 0.0 1.0 0.0                         #一个周期转动一周
        0.0 0.0 1.0 1.256
        0.0 0.0 1.0 2.512
        0.0 0.0 1.0 3.768
        0.0 0.0 1.0 5.024
```

```
                0.0 0.0 1.0 6.280
            ]
        }
    ]
}
ROUTE Time.fraction_changed    TO fengche.set_fraction
ROUTE fengche.value_changed    TO bars.set_rotation


Transform {                                                    #风车主体
    children [                                                 #一个圆柱体
        Shape {
            appearance Appearance {
                material Material {
                    diffuseColor 0.3 0.6 0.9
                }
                texture    ImageTexture {
                    url    "my texture/wall2.jpg"
                }
            }
            geometry Cylinder {
                radius 3
                height 6
            }
        }
    ]
}

Transform {                                                    #风车主体的顶部
    translation    0 4.75 0                                    #一个圆锥体
    children [
        Shape {
            appearance Appearance {
                material Material {
                    diffuseColor 0.3 0.6 0.9
                }
                texture    ImageTexture {
                    url    "my texture/wall3.jpg"
                }
            }
            geometry Cone {
                bottomRadius 3.2
                height 3.5
            }
```

```
            }
        ]
}

Transform {                                                    #用来连接扇叶和主体顶部的杆
        translation       0 5 2.5                              #圆柱形金属杆
        rotation 1 0 0 1.5708
        children [
            Shape {
                appearance Appearance {
                    material Material {
                        diffuseColor 0.3 0.3 0.5
                        ambientIntensity 0.3
                        shininess 0.1
                        specularColor 0.7 0.7 0.8
                    }
                }
                geometry Cylinder {
                    radius 0.1
                    height 2.3
                }
            }
        ]
}
```

5、vrml 主程序





代码如下：

```
#VRML V2.0 utf8

DEF outside Viewpoint{                          #two viewpoints
        position -5 35 110                      #设置第一个视点，可以看到整体场景
        orientation     -1 0 0 0.15
        fieldOfView     1.1717
        description     "outside"
}

DEF inside Viewpoint {                          #设置第二个视点，看到室内场景
        position 12 0 45
        orientation     0 1 0 0.65
        fieldOfView     1
        description     "inside"
}

Background {                                    #skycolor and groundcolor
        skyAngle [1.309 1.571]                  #设置背景颜色
        skyColor [
                0.0 0.0 0.8
                0.2 0.5 0.7
                1.0 1.0 1.0
        ]
        groundAngle   [1.396 1.571]
        groundColor   [
                0.0 0.0 0.0
                0.6 0.7 0.1
                1.0 1.0 1.0
        ]
```

```
}

Transform {                                          #inline a house
      translation       0 0 20                       #内联房子程序
      scale 5 5 5                                    #调整坐标位置和大小
      children [
            Inline {
                  url   "house.wrl"
            }
      ]
}
                                                     #inline a clock
Transform {                                          #内联时钟程序
      translation       2 2 20.8
      scale    2 2 3
      children [
            Inline {
                  url   "clock.wrl"
            }
      ]
}

Transform {                                          #inline a television
      translation       -20 5 32.5                   #内联电视程序
      rotation 0 1 0 1.5708                          #调整方向
      scale 4 4 2
      children [
            Inline {
                  url   "TV.wrl"
            }
      ]
}

DEF fcs Group {                                      #a group of windmills
      children [                                     #内联风车程序，并复制出一列风车
            DEF fc Transform {
                  translation       -35 -4 -40
                  scale 2 2 2
                  children [
                        Inline {
                              url   "fengche.wrl"
                        }
                  ]
            }
```

```
            Transform {
                translation     0 0 -40
                children [
                    USE fc
                ]
            }

            Transform {
                translation     0 0 -80
                children [
                    USE fc
                ]
            }

            Transform {
                translation     0 0 -120
                children [
                    USE fc
                ]
            }
        ]
}

Transform {                                         #移动复制一列风车，形成方阵
    translation     50 0 0
    children [
        USE fcs
    ]
}

Transform {
    translation     100 0 0
    children [
        USE fcs
    ]
}

Transform {
    translation     -50 0 0
    children [
        USE fcs
    ]
}
```

```
DEF trees Group    {                                    #a group of trees
    children [                                          #一组树
        DEF tree Transform {
            translation     100 -5 -30
            scale 3 3 3
            children [
                Billboard {
                    children [
                        Shape {
                            appearance Appearance {
                                material Material {
                                    diffuseColor 0.8 0.8 0.8
                                    ambientIntensity 0.2
                                }
                                texture    ImageTexture {
                                    url   "my texture/tree.PNG"
                                }
                            }
                            geometry IndexedFaceSet    {          #形状为索引面
                                coord Coordinate {
                                    point [
                                        -2 0 0.015
                                        2   0 0.015
                                        -2 8 0.015
                                        2   8 0.015
                                    ]
                                }
                                coordIndex [0,1,3,2,-1]
                                texCoord TextureCoordinate {
                                    point [
                                        0.005 0.005,
                                        0.995 0.005,
                                        0.005 0.995,
                                        0.995 0.995
                                    ]
                                }
                            }
                        }
                    ]
                    axisOfRotation 0 1 0
                }
            ]
        }
```

```
        Transform {                                          #复制，形成一列树
            translation       0 0 -40
            children [
                USE tree
            ]
        }

        Transform {
            translation       0 0 -80
            children [
                USE tree
            ]
        }

        Transform {
            translation       0 0 -120
            children [
                USE tree
            ]
        }
    ]
}

Transform {                                                  #将上面的一列树复制移动
    translation       -220 0 0
    children [
        USE trees
    ]
}

Sound {                                                      #background music
    source AudioClip {                                       #添加背景音乐
        url    "my file/Bandari liulihupan.mid"              #班得瑞的《琉璃湖畔》
        description      "sound"
        loop TRUE
        pitch 1.0
    }
    direction 0 0 1
    intensity 1
    location 0 0 0
    maxBack 500
    maxFront 500
    minBack  0
```

```
    minFront 0
    spatialize TRUE
}
```

三、开发过程概述

在课堂上听老师分析实例，课下参考书籍了解原理，然后在网上搜集 vrml 程序，熟悉编程语言。然后着手编写简单事物模型，再在静态模型基础上添加贴图和动画。然后将各个事物模型添加到一个场景中，不断完善，构成了最终的虚拟场景。

变成过程中遇到过很多问题，反复琢磨之后找到了原因并改正。能掌握一项新的技能，自己还是很满足的！

四、运行环境说明

编程环境：WIN7
编程软件：VrmlPad
浏览器：Cortona 3D Viewer