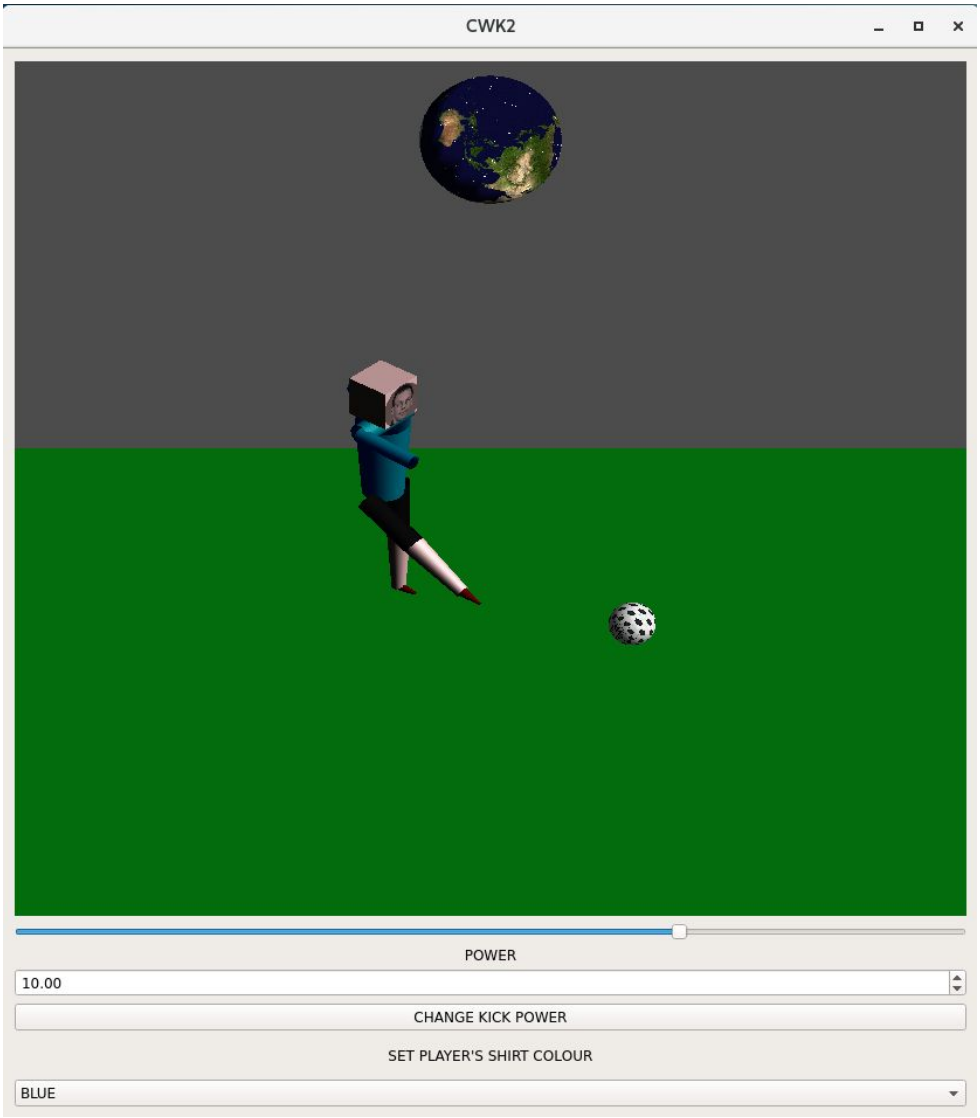
Robert Elmes

Robert Elmes Graphics CWK2 Report

The following report explains the scene that I have created in OpenGL using QT with C++, with reference to how the elements of the scene fulfil each band of the mark scheme. Unless specified otherwise, references to code refer to the ‘CWK2Widget.cpp’ file, where most of the interesting code lies.



Firstly, the light properties were chosen to give the scene a clear and realistic look, with the light shining from the upper right hand side of the scene, this can be seen in the ‘resizeGL’ function. Many different materials were created, with different specular, ambient and diffuse values to give different objects different looks and also to aid user interaction with the scene. A simple example of use of materials is with the plane at the bottom of the scene, which is given a green material (called ‘greenMaterial’) to make it look like a grassy floor.

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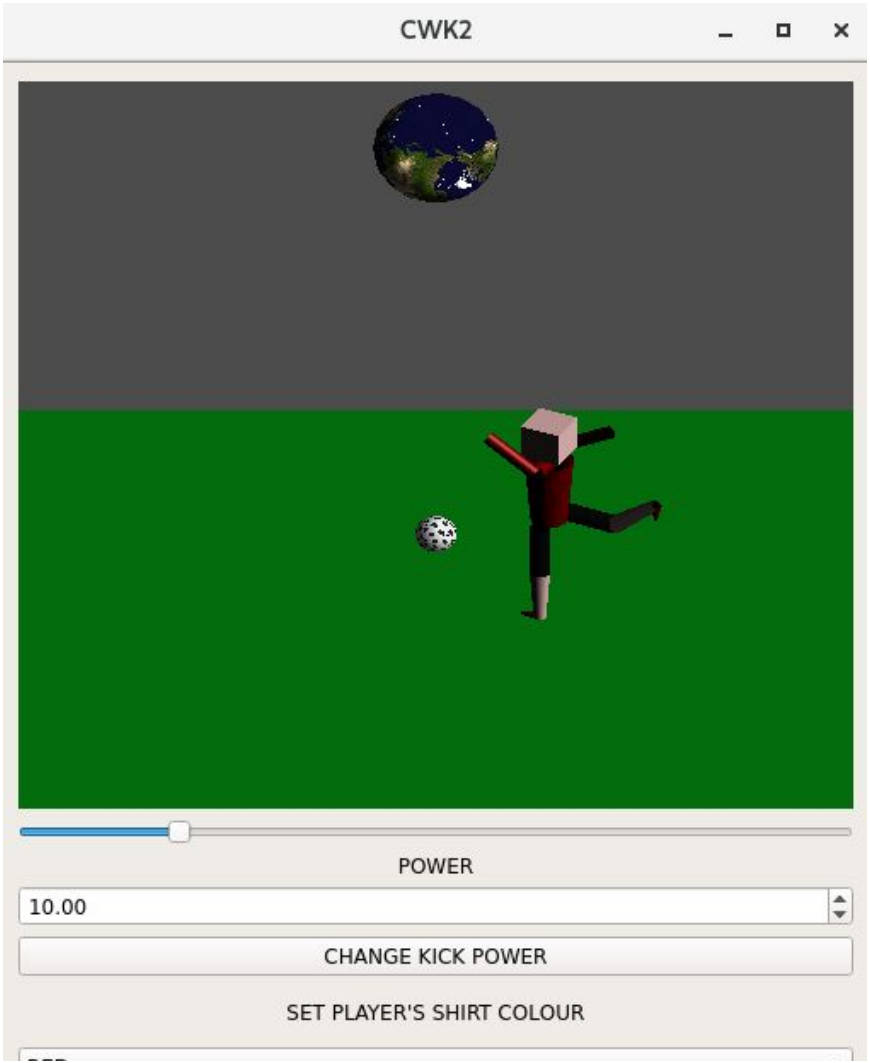
The core element of focus in the scene is the player. The player is made of a group of gluQuadratic objects, with a cube for the head. All the body parts are stored in an array of size 11, declared in the CWK2Widget constructor. So each element of the array holds a separate body part. For example, the second element in the array is for the shoulders. The player is a single entity in itself as it moves around the scene in a circle around the football. As it moves, it's angle of rotation constantly adjusts to ensure it is facing the ball. This works by everytime the time timeout() signal triggers the updateAngle() function in 'CWK2Window.cpp', it increases the angle of the circular path the player is on around the ball by 1 and then calculates the new x and z coordinates of the player using trigonometry. These new coordinates are used to globally translate the position of the player in the paintGL() function. The angle the player faces is also updated by 1 degree, to keep it facing the football.
As well as the player moving as one unit, his separate limbs can move as well, demonstrating hierarchical modelling. This can be seen through the use of the slider, where moving the slider forwards and backwards causes the right thigh, shin and foot to move and rotate individually to create the animation of kicking the football. The calculations for this can be seen in the 'kick()' function, which is triggered when the slider is moved. The thigh, shin and foot angles are updated in different ways depending on the value of the slider, to simulate how a leg actually looks when kicking a ball. Due to the angles changing of the thigh, the shin position therefore had to be calculated with some trigonometry to ensure that it is always at the bottom of the thigh, this can be seen in the paintGL() function (the same is true for the foot's position being calculated based on the shin angle). The arms also move separately in this animation.



Individual materials were chosen for different parts of the player. A function ‘changeMaterial’ was created to assist with this. The player’s shorts are black, boots are red, the shins and head are a pink skin-colour and his shirt can either be red, blue or yellow. The shirt material can be changed between these three colours through the shirt colour dropdown menu. The ‘changeShirtColour’ function is used as the slot to change the colour depending on the dropdown choice. This gives the user good customisation of the scene and adds another element of user interaction to the scene on top of the slider.
Finally, it is important to note that the player’s cube head is textured on the front facing side, with the image ‘moi.ppn’. I thought this would be funny as it makes the player look a bit like he’s “Marc de Kamps”, who I’m sure is a fantastic football player.

Next, it is important to discuss both the football and the globe. Both are convex objects constructed from polygons (triangles), created with the same function called ‘createpolySphere’. This function takes two integer values to determine how smooth the sphere looks and one double value to determine its size. As can be seen, the size of the globe is bigger than that of the football. The globe spins over time and the football moves in the slider ‘kick’ animation. When the slider is moved to the point that the player ‘kicks’ the football, the football then moves in the direction of the kick, giving the impression that the player is actually kicking the football. This calculation can be seen in the ‘kick’ function, and was quite complicated to figure out. The value for how hard the football is kicked can be modified by the user, in the ‘Power’ text box, which is a QDoubleSpinBox. Once the value is modified, pressing the ‘change kick power’ button causes the change to be made (using the ‘changePower’ function). So if the power is increased from 10.0 to 20.0, the ball will move twice as fast in the direction of the kick, when the slider is moved. This provides a third element of user interaction with the scene. It is important to note that each element of interaction is different from the other.

Finally, the scene uses texturing to give individual objects a more complex and realistic look than simply using a material of one colour. I used 3 textures, two of which were provided and one texture of a football. They are stored in an array of textures called ‘textures’, and are set up in the initializeGL function. The ‘moi.ppm’ texture is used for the player’s face in the ‘head’ function, using glTexCoord2f to specify the coordinates the texture maps onto. The ‘earth.ppm’ texture is similarly used for the spherical globe, in the ‘createPolySphere’ function and the football texture is used for the spherical ball. This not only demonstrates that my scene implements texture mapping but also shows that it uses it for 2 different types of surface with 3 different textures.

So overall, this scene involves lighting choices and different materials with collections of objects to represent things such as the football player, satisfying the 40-50% band. The scene contains a slider for user interaction, which satisfies the 50-60% band. On top of this, it contains

animation with the spinning globe, the player which moves in a circle and more importantly, the football kick. It contains two convex objects made from triangles (the globe and football) and uses texture mapping with both the provided files and a football image. Together, this satisfies the 60-70% band. Finally, it contains the player, which demonstrates hierarchical modelling through it's circular movement through the scene, in conjunction with the leg animation where the separate leg parts move individually to kick the football. Various elements of user interaction are used, with not only the slider which controls the core animation, but also a text box for specifying the power that the ball is kicked with as well as a drop down menu to choose the player's shirt material. This satisfies the final band.