

CSCI3260 Course Project

0 **Working Environment** The project is developed in Visual Studio 2012, Windows 8.1. The EXE executable file is \ProjectFramework\TrainFiles\Debug\Train.exe

1 Functionality

1.1 TRACKS

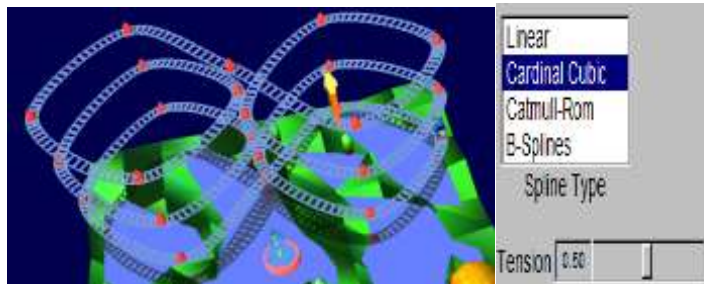


Figure 1 Cardinal cubic(C.C.) with tension 0.5 ($T = 0.5$)

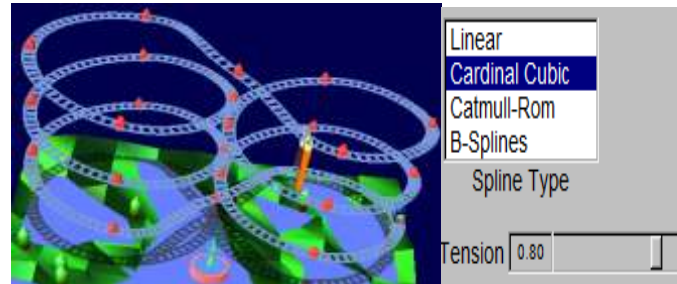


Figure 2 Cardinal cubic with tension 0.8



Figure 3 B-splines

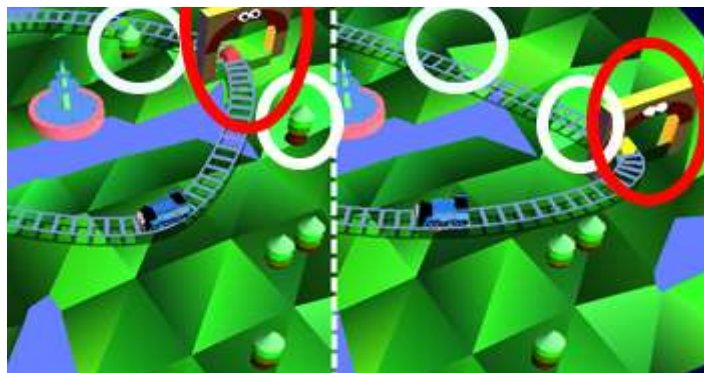


Figure 4 C.C., $T = 0.5$; trees and door moved for track changed



Figure 5 Linear, After moved control points, snowmen moved

We implemented Cardinal cubic for C1 track, B-splines for C2 track, and linear for C0 track. Tension of Cardinal cubic can be adjusted by users from 0.05 to 1.00. Users can change the track by moving the control points (i.e. the control points can be edited manually.) When the track is changed, the trees and the snowmen may move from the original position to end up in the position without superimposing with the track. And the door will move with control point 0.

1.2 & 1.3 & 1.6 TRAIN(MOVEMENT & ORIENTATION & SPEED)

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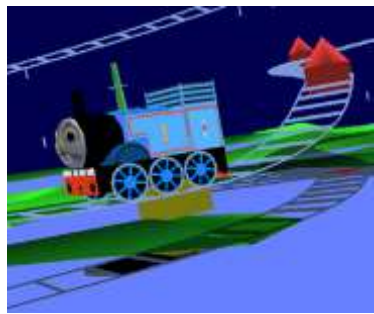


Figure 6 Train

It goes around the track with speed control (The train movement speed is independent with other animations.) and the wheels rotate when it is moving.

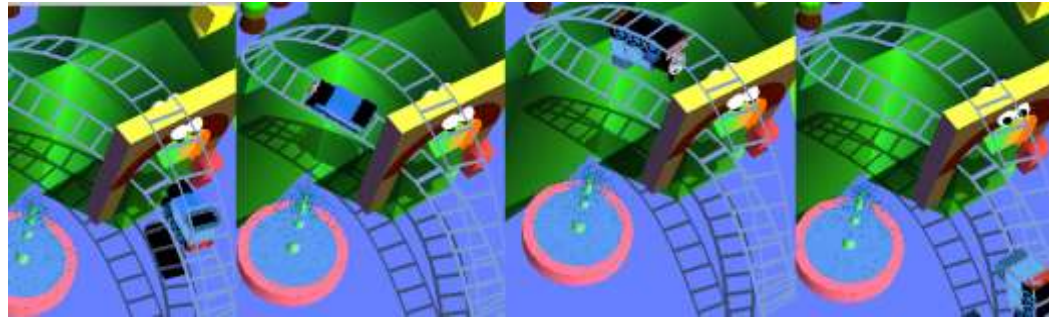


Figure 7 A set of screen shots when the train runs in a loop

The train always on the track. It faces forward and changes its orientation according to the track. It is obvious which end is the front.

1.4 & 1.5 RIDE AND SCENERY: A fountain, a balloon, a wooden house, a door, some trees/snowmen and the land relief.



Figure 8 Riding on the train

By pressing a Train button, the user can "ride" the train (i.e. look out from the front of the train).(Figure 8)

The door set on the point 0. The eyes on the door will look around randomly. (Figure 8)

The hot air balloon rises up and down. Reflection on water/icy surface contains colors, while the shadow on ground do not has colors (Figure 10).

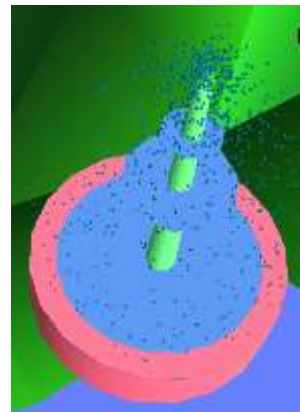


Figure 9 fountain

The fountain is in the center of the ground. It works when the run button is pressed. It is implemented by using particle system.

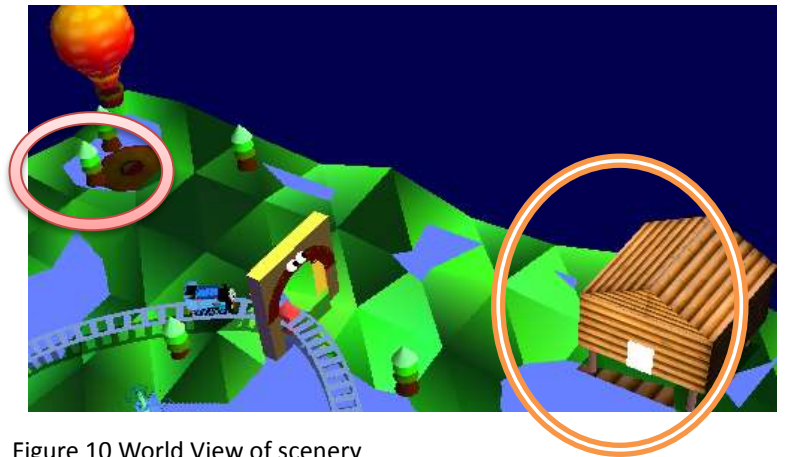


Figure 10 World View of scenery

The positions of trees and snowmen are random. When the control points of track changes, trees/snowmen will move to other free position. (part 1.1, Figure 4 & Figure 5)
There is also a house with wooden texture. Snow on roof is shown when it is snowing (Figure 8).

(Figure 9)

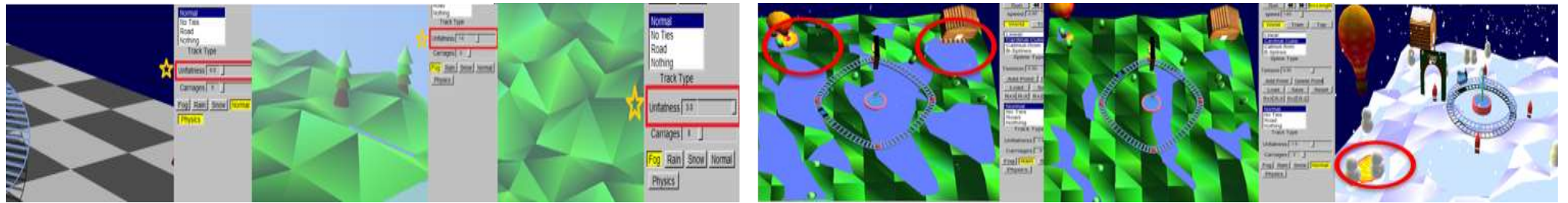


Figure 11 Ground with different level of unflatness and under different weathers

The ground can be adjusted to different level of unflatness (0 is flat ground initially provided). When it is raining, the water level goes up, and slowly decreases when rain stops (i.e. Return to normal section). When it is snowing, the water freezes and the world turn into icy look. There are also reflections on the water/icy surfaces.

2 Advance feature

2.1 ARC-LENGTH

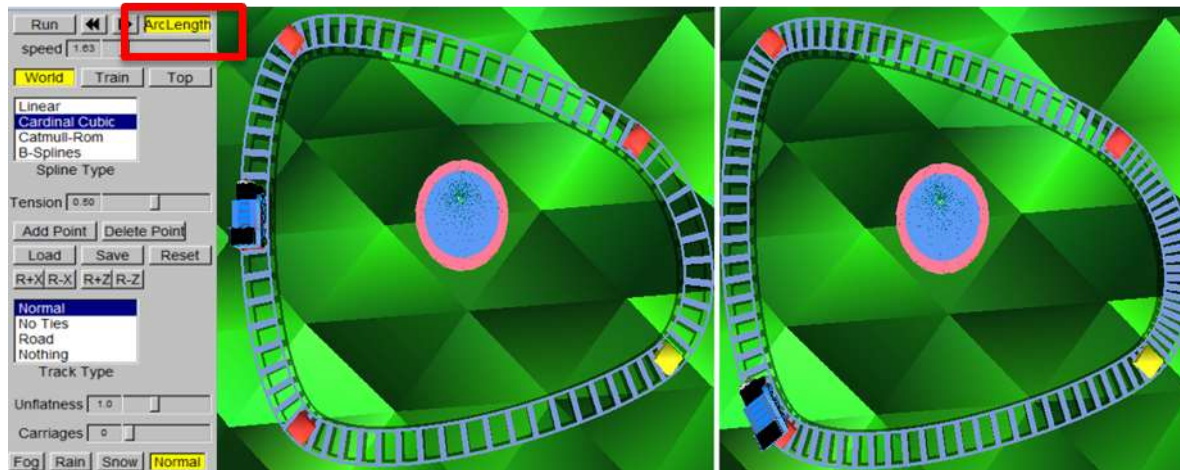


Figure 12 Left, track with reference to arc length. Right, fixed number of ties for each curve segment

2.2 MORE CARRIAGES

The train moves at an approximately constant velocity, no sudden speed up or slow down when it pass through different control points, no matter the length of arcs are what.

For the tracks, some approximation is used to make the distance between ties appear more natural, but they are not following the arc length parameterization same as the train.

There is a button to allow arc-length parameterization to be switched on and off to emphasize the difference.

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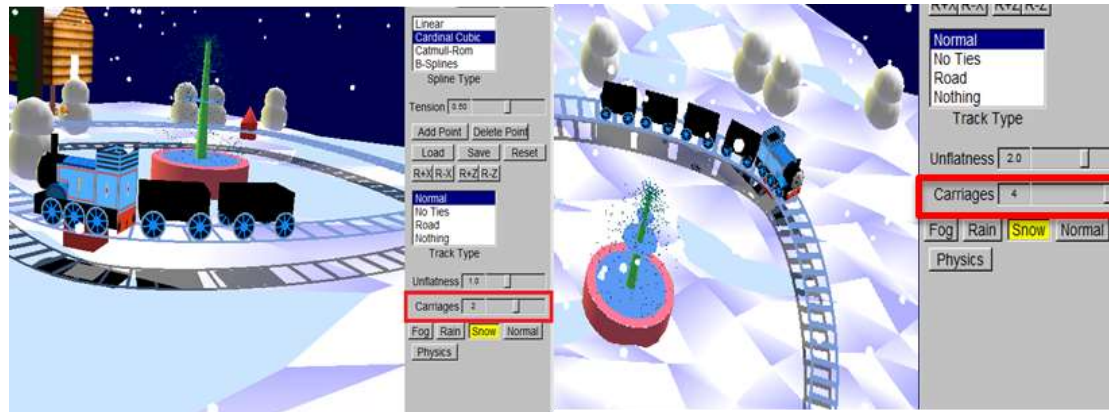


Figure 13 More carriages added on the train

The carriages are always on the track and each of them keeps in a correct distance apart.

Users can add 1-4 carriages on the train by sliding under Cardinal cubic track with tension larger than 0.5 or with B-Splines track. As the carriages move, they do not distort and extend.

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2.3 SIMPLE PHYSICS

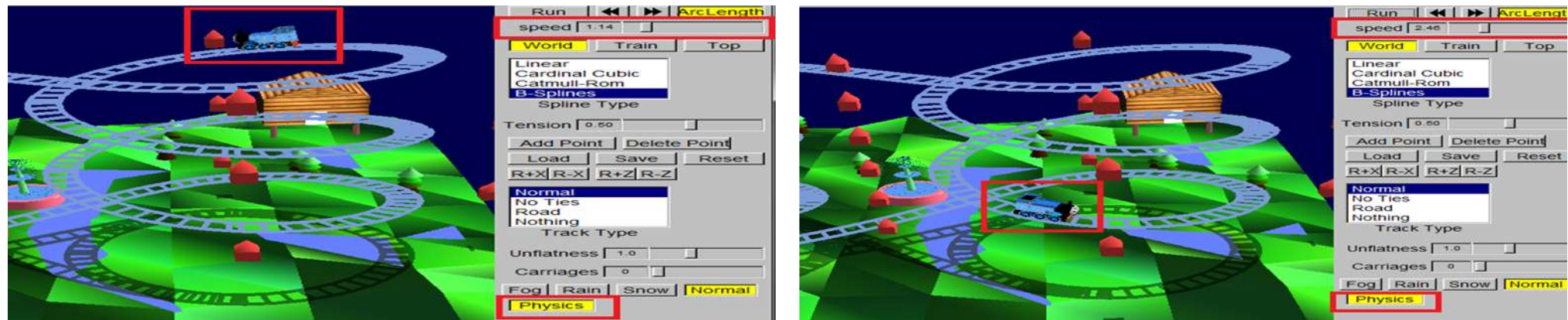


Figure 14 Left, train at higher position; right, train at lower position.

We use the Kinetic Energy - Potential Energy constant approach. The speed of train is calculated based on the height of train (y position in the coordinate system). The calculated velocity is shown in the speed control slide. (When it is in Physics mode, user cannot adjust the speed)

2.4 PARTICLE SYSTEM: The fountain and the snow effect are implemented by particle system. (Figure 9)

2.5 WEATHER

There are four weathers for users to choose: Fog, Rain, Snow and Normal. There is reflection on the water/icy surfaces. (e.g. figure 13)

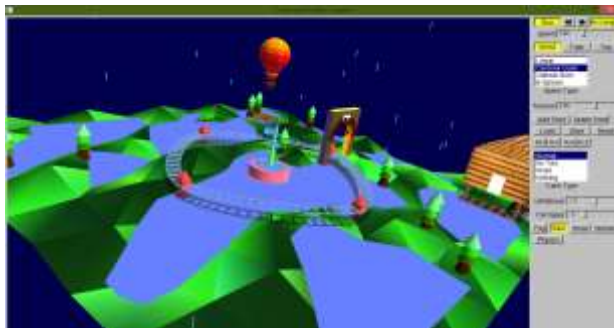


Figure 15 User interface (weather = rain)



Figure 16 User interface (weather = snow)

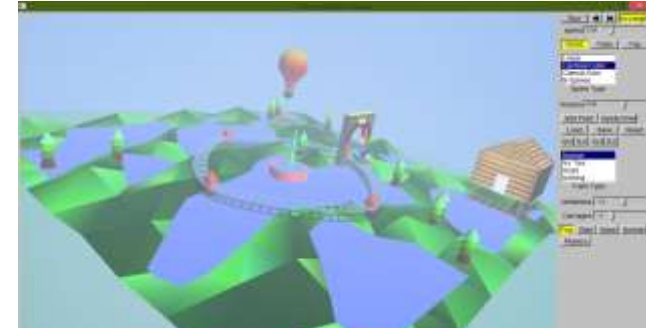


Figure 17 User interface (weather = fog)