**Racing Game – Report**

# AI Technique – States

A state is where an NPC is engaged in an action due to a set condition, examples of a state would be idle, launch, drive and so forth. These states can be transitioned from one to another via a condition becoming true. Within a game this is all set up in a FSM (finite state machine) which holds a list of all states and checks for transitions, also it invokes state call-backs when a transition occurs.

In the racing game I am going to make, I am trying to achieve reaction and event style behaviour from the AI using this state machine. The state machine will help me achieve this reactive response to the scene and player controller by guard conditions being met. An example of a reactive response to the scene would be when the cars in drive state it would have to cross the finish line in order to transition into the finish state.

# AI Technique – Senses

Within a game a vision model can be created to give NPC’s a human like sense of sight, direction and location in reference to a target object. The vision model consists of a few steps to cast a ray which include; finding view range and checking the distance between itself and the target, whether the target is within field of view which can be determined by trigonometry, are any obstacles in the way which would then finally leading to casting the ray.

The behaviour in the game I need senses to achieve is a form of direction and a self-purpose to locate nodes. Senses vision model will help me achieve this because the target could be nodes around the race track which the car could then follow. The ray cast will help the car drive smoother and be able to detect obstacles such as other cars in its way.

# AI Technique – Probability

Probability is an AI technique that plays a big part in a lot of games; this is mainly because players are unpredictable especially if they can enter quite a few inputs. Probability can be used to counter this by calculating the percentage chance that a player will do something, but that’s not the only use for it, AI can also have a probability chance of performing an action due to a reaction. There is also intelligent probability where frequencies of actions are recorded overtime; these records will give an overall percentage for each action in comparison to other actions.

Implementing probability to the AI in my racing game will show a decision style of behaviour. Probability will help me show a decision for the AI at the start of the race. The probability in this is there will be a chance that the AI will take route 1 or route 2 around the track. The game at the start of the race in idle state will generate a random number from 2 values, which from these two values will determine the route to take.

# AI Technique – Vehicle Navigation

Vehicle navigation is a very specific technique used on the wheels of a vehicle. It uses wheel colliders which are specific in detecting collisions, adding wheel physics, friction and torque. These very specific colliders allow you to manipulate suspension properties and add friction curves. The colliders are also responsible for steering the vehicle they are attached to by calculating the angle required to steer the vehicle in the correct direction. This kind of steering can be used to steer the vehicle to a specific point within the scene which is its navigation.

Vehicle navigation is a big contribution to making the racing car in my game, by giving it a more realistic type of behaviour. It achieves this because the wheel colliders incorporate physics into the car; it also helps by giving the car suspension and friction. The suspension adds a bounce and resistance to the car making it look more like the characteristics of a real car.

# AI Technique – PID

PID (Proportional Integral Derivative) is a technique used to apply torque to the wheels of a vehicle; this torque determines the velocity and acceleration based on mass, gravity and friction. The torque is used to allow the car to maintain a target velocity but it wouldn’t be possible without a control system. A control system consists of two loops, an open-loop system which provides no feedback or a closed-loop system where it takes a measure of the output and feeds it back as an input. The output produced by the PID controller is a measure of the error, the error being the difference in the target and actual values. Overall the PID controller uses different values and calculations to control the speed of the vehicle due to physic changes.

Adding a PID controller into my game is a vital part, it makes the cars have a more realistic behaviour. The reason that it is vital part for realism in my game is because no speed or acceleration is constant when driving a car over different terrains, whereas this AI technique allows that.

# Combination of Techniques

All the techniques I have described above are going to help me make a realistic AI within my game. In the style of game I am making the human like behaviour I am looking for are how a person would drive a race car and how the car is going to react to the environment.

Vehicle navigation and PID go hand in hand by both working with torque to allow realism of suspension and a cars speed change. Another technique that also links to vehicle navigation is senses because they both work with directions where senses locate the direction, whereas vehicle navigation actually turns the car in that direction. States allow car realism because cars do change between different states for example gear changes and whether it’s parked. Probability creates realism of chance in the game because when driving there’s loads of different ways to react to certain situations.