Lecture 4

Frame Rate Controller

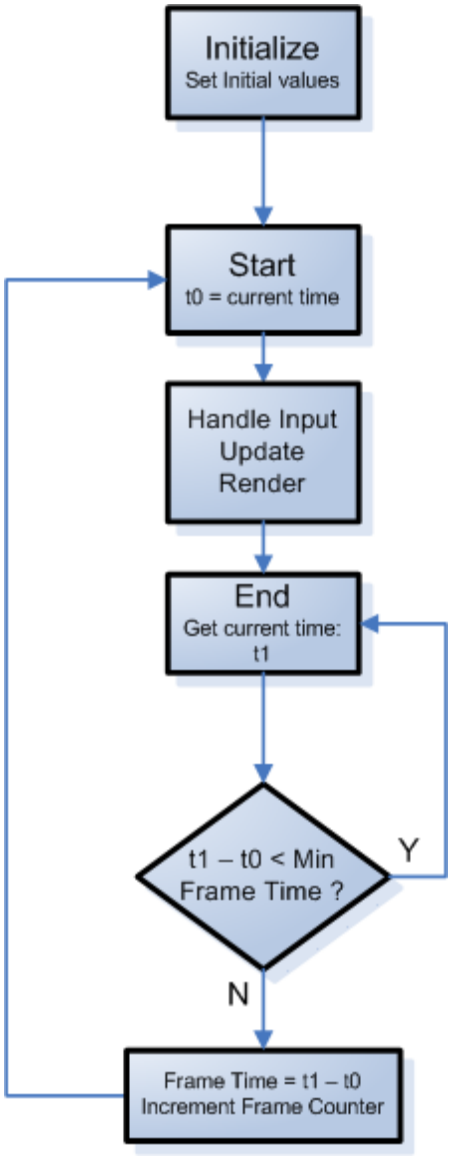
CS230
Game
Implementation
Techniques

1. Game Engine Design

1.1. System Components

- **Game state manager**
  - (Explained in previous session)

- **Frame rate controller**
  - In games, the amount of time needed to complete 1 frame (That is updating the objects, updating AI, checking for collision, reflection, physics, checking/updating input, updating general gameplay, rendering...) is extremely inconsistent. It depends on many factors like:
    - Detail level
    - Number of visible objects
    - Number of effects (lights, normal mapping, shadows...)
    - AI depth
    - Collision types (Precise collision checks take more time than basic collision checks)
    - Physics iterations
    - Etc...
  - The main job of a frame rate controller is to make sure the game is running at a consistent speed.
  - This is done by making sure each frame is taking a certain pre-set amount of time.
  - Simply, whenever a frame is completed and it's time to go back to the beginning of the game loop (which is the beginning of the next frame or loop), we check how much time the current frame took.
  - If it's less than the pre-set amount, then we keep the game “waiting” - which is basically creating an empty loop – until that amount of time is reached.
  - On the other hand, if the amount of time taken to complete 1 frame is already greater than the wanted amount, then the way to fix it is by doing some optimizations (Like avoiding rendering objects outside the viewport's boundaries), reduce the number of effects used..



- The frame rate controller can have other secondary functionalities like:
  - The number of frames since the game started
  - The number of frames since the current game state started
  - How much time the last frame used (This info could be used by time dependent objects, like animations and physics)

- Since the frame rate controller needs to know the time at the beginning and end of each loop, its functions should be called at these points.

Frame rate controller pseudo code:

```
Initialization
        Frames counter      = 0
        Max Frame Rate      = 60
        Frame Rate          = Max Frame Rate
        Frame Time          = 1 / Frame Rate
        Min Frame Time      = 1 / Max Frame Rate

Frame Controller Start
        Frame Start         = Current Time

Frame Controller End

        While((Current Time – Frame Start) < (Min Frame Time))
                Frame End           = Current Time
                Frame Time          = Frame End – Frame Start

        Increment Frame Counter
```

- Note that the time received from the system (Current Time in the pseudo code) should have at least a 1 millisecond precision in order for the frame rate controller to work.

- This is the game flow chart after implementing a frame rate controller: