

# System design document - HowDoIFlyThisThing

*System design document for the HowDoIFlyThisThing project*

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## 1 Introduction

### 1.1 Design goals

The design must be modular and it should be easy to implement new functionality and gameobjects. Rendering functionality must be completely separated from everything but itself, in order to implement an easy client-server architecture.

### 1.2 Definitions, acronyms

- GUI, graphical user interface
- Java, platform independent programming language
- JRE, the Java Run time Environment. Additional software needed to run an Java application.
- Host, a computer where the game will run.
- ECS, entity-component-system architecture.
- Component, a class of data and methods whose functionality is used to realize corresponding interfaces

## 2 System design

### 2.1 Overview

The application will use the MVC-pattern. The model will be completely standalone, as will the view. The controller knows and owns both the model and the view.

#### 2.2.1 Model overview

##### 2.1.1.1 Model concept of design

The models core functionality resides in the gameworld class whose role is to execute the functionality of gameobjects within the game, such as Asteroids and Spaceships. This is inspired from the Entity-Component-System way of architecture, where every gameobject is a collection of components of data which is then used for calculation in a system. This is not true

in this application as the components are responsible for calculation aswell. On top of the gameworld there are classes for implementing rounds and network-sessions. Gameworld is the caller of the components calculation-methods.

#### 2.1.1.2 Components in GameWorld

The components are classes which are instanciated inside a gameobject. This gameobject implements an interface, ie IMovable. IMovable provides a method move(), which should do moving calulations. The MoveComponent also provides a move() method which is forwarded and realizes move() within spaceship. This is a modular and robust design that's easy to maintain. HashMap of Moveables exists within Gameworld, which is looped through and within the loop move() is called on each IMoveable (value is the interface and key is the object). This makes sure order of GameObjects is irrelevant.

#### 2.1.1.3 Deletion of GameObjects

Whenever an GameObject is deleted from the GameWorld, for example a SpaceShip is destroyed, the HashMaps of interfaces within GameWorld that are looped through in gameWorld.update() should be notified of this particular GameObject that is destroyed and erase the interfaces from each HashMap. This is done by maintaining a HashMap of Lists of Hashmaps. First tier hashmap is indexed by object, it returns the value - a list of the hashmaps which the objects resides in. In this way each object can via observer pattern fire a onDeath event, which the GameWorld listens to, and then the GameWorld can remove the source of the onDeath event from each list which the source was belonging to.

#### 2.1.1.4 Creating of GameObjects

All GameObjects such as spaceships and asteroids are created from a corresponding global, singleton factory such as SpaceshipFactory or AsteroidFactory. This doesn't solve any problem for now other than having an uniform source of object creation.

#### 2.1.1.5 Event handling

Events within the model are dealt with through the GameWorld as a listener, and whenever an object is created from a factory and then added to the gameworld via gameWorld.add(GameObject) method, Gameworld starts listening for events from objects. Events are used whenever something that doesn't happen reguraly occurs. Whatever happens reguraly, on each game-loop tick, are done via components and systems in GameWorld.

### **2.1.2 Controller overview**

The controller knows the view and the model. It forwards data neccesary for the view in order to draw things via the IDrawable interface. This interface provides position, rotation and enum which tells what type it is - a spaceship or asteroid for example. Note that with this approach the

model is completely independent of the view, Slick2D - no Slick2D classes is ever used within the model.

A class User is used for maintaining keybindings to specific spaceships. User takes advantage of the state-pattern, it can be either in spectator-mode or play-mode. User enters play-mode whenever a new round starts. A newly created spaceship is binded to the user. User listen to its spaceship, whenever spaceship explodes and sends it's death-event User will switch state and enter spectator-mode in which user keybindings no longer affects the spaceship.

### **2.1.3 View overview**

The view is placed on a thread of it's own, due to Slick2D. The only data that passes through the Main thread (Model and Controller) to the view thread is the list of IDrawables, which controller gives to the view (not vice versa!). This is properly synchronized between the two threads. Upon recieving the list of IDrawables the view translates the enum type of the drawables to an actual Slick2D image.

## **2.2 Software decomposition**

The application is decomposed into the following modules:

- Model
  - Gameworld (Closely related to the commonly known System manager from ECS)
  - Factories
- Controller
  - Input handling via Users
- View

## **2.3 Concurrency issues**

There were issues with getting list of IDrawables from model to view, due to model writing to this list while view was iterating through it. Solved by sending a copy of the list to the view thread.

Also input is recieved from view thread and passed over to the main thread. This is currently out of shape and somewhat broken, with crashes happening fairly frequently (average lifetime before concurrencyModification exception is about 5min).

## **2.4 Persistent data**

N/A. No write to harddrive occurs at any point.

## **2.5 Access control and security**

N/A

## **2.6 Boundary conditions**

Application launched as normal application but existed via in-game menu. This is possibly subject to change in future SDDs due to lack of time implementing GUI.

## **3 References**

## **Appendix**