

**SE 3XA3:  
Module Guide  
CraftMaster**

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| <b>Date</b> | <b>Editor(s)</b> | <b>Change</b>              |
|-------------|------------------|----------------------------|
| Mar 9       | Sida             | General Content added      |
| Mar 13      | Weidong          | Edited for Rev0 submission |
| Mar 13      | Sida             | Minor Modification         |

Table 1: **Revision History**

# 1 Introduction

## 1.1 Project Overview

CraftMaster is a re-implementation of [Michael Fogleman's Simple Minecraft-inspired Demo](#) (referred to as **original project** in the following content), which is developed in Python and Pyglet. The CraftMaster design team has initiated and completed multiple requirements (specified in the [Software Requirement Specifications\(SRS\)](#)) to add new features, including new block types, day and night mode shift, game saving, and game menu frames, to the original project. During the software design process, the team has also applied software architecture design patterns and software design principles to increase the quality of the software design. The specification of those design methodologies will be described in this document.

In terms of the software product characteristics, CraftMaster is a 3D Sandbox Game that allows players to control the character and build the game world based on their imagination. We believe that CraftMaster will be beneficial to teenagers and children in the way that it inspires them to unleash their creativity.

## 1.2 Context of Module Guide

The [SRS](#) document shows the features, functionalities and desired properties that the system should have. The **Module Guide(MG)** is generated based on the [SRS](#), which further evaluates how requirements are achieved and also specifies the modular structure decomposition of the software system. It will be distributed to help potential readers easily identify the decomposed parts of the software. The potential readers are as follows:

- **New Project Members:** The **MG** acts as a guideline for the new project members to easily and quickly understand the modular structure of the system and its decomposition specifications. With this document, those new members can search for relevant modules more efficiently.
- **Designers:** The **MG** is used to help software system designers check for the consistency among modules, the flexibility of the design, and the feasibility of the modular decomposition.
- **Developers:** The hierarchical structure specified in the **MG** will give the developers a better understanding of the system decomposition and use relationships between different modules.
- **Maintainers:** The hierarchical structure of the system improves the maintainers' understanding of either the system as a whole or individual modular parts when they need to make changes to the system and the documents.

The **Module Interface Specifications(MIS)** is another section of the Design Specifications Documents other than the **MG**. The **MIS** shows the semantics and syntax of exported functions for each module in details. The **MG** should be an entry document for the design specifications and the readers should read the **MG** first to get an overview of the system, then browse the **MIS** for further references once they identify which module(s) they are searching for.

### 1.3 Design Principles

- **High Cohesion and Low Coupling:** This principle has been applied to the project in the way that the modules are designed to be strongly related and the dependency has been minimized.
- **Open-Closed Principle:** The modules are designed to be closed to modification and the system is designed to easily extended. For instance, the **screen** module is implemented as a template and all other scenes(such as **gameScene**, **mainScene** and **settingScene**) inherit it. There might be new scenes to be implemented in the future to easily extend the system.
- **Liskov Substitution Principle:** The inheritance relationships among modules follows the Liskov Substitution Principle.
- **Dependency Inversion Principle:** The inheritance design pattern is used to support the abstraction of the system. With the abstraction, the dependency inversion principle can be followed.
- **Interface Segregation Principle:** The inheritance design pattern minimizes the interfaces of subclass modules, which follows the Interface Segregation Principle.
- **Law of Demeter:** The abstraction of the system supports the principle of the Law of Demeter. The communications only depend on the interfaces as limited knowledge.
- **Information Hiding:** The information hiding principle is supported by abstraction and private methods.

### 1.4 Content Structure

The rest of the document is organized as follows:

- Section 2 lists the anticipated and unlikely changes of the software requirements.
- Section 3 summarizes the module decomposition that was constructed according to the likely changes.
- Section 4 specifies the connections between the software requirements and the modules.

- Section 5 gives a detailed description of the modules.
- Section 6 includes two traceability matrices. One checks the completeness of the design against the requirements provided in the SRS. The other shows the relation between anticipated changes and the modules.
- Section 7 describes the use relation between modules.

## 1.5 Naming Conventions and Terminology

The naming conventions and terminology section will aid readers from different backgrounds to clearly understand the content of this document. The naming conventions and terminologies used in this document are listed below:

- **OS:** Operating System.
- **GUI:** Graphical User Interface, which allows the user to interact and visualize the program by graphics instead of text.
- **Sandbox Game:** A type of game that allows player to create, modify, and destroy the environment.
- **Pyglet:** The Python library for the design of graphical user interface and multi-media.
- **Player/Gamer:** The person who controls the PC to play the game.
- **Character:** The fictional character who is controllable by the player/gamer(not visible to the player).
- **3D Game:** A game in three dimensions.

## 2 Anticipated and Unlikely Changes

This section lists possible changes to the system. According to the likeliness of the change, the possible changes are classified into two categories. Anticipated changes are listed in Section 2.1, and unlikely changes are listed in Section 2.2.

### 2.1 Anticipated Changes

**AC1:** The specific hardware on which the software is running.

**AC2:** More static block types such as **Dirt** and **Sand**, shown in Figure 1.

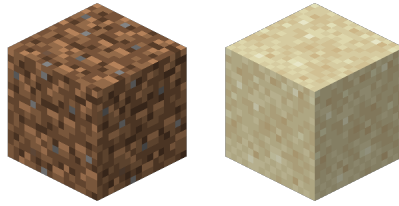


Figure 1: Dirt and Sand Block

**AC3:** The dynamic block types including **Lava** and **Water**, shown in Figure 2, which provide explicit interactions with the game character.

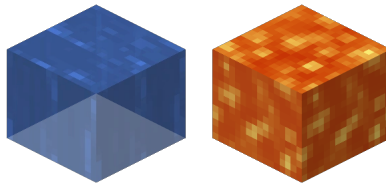


Figure 2: Lava and Water Block

**AC4:** Objects that can interact with the game character, such as **Chicken** and **Cow**, shown in Figure 3.





Figure 3: Chicken and Cow Object

## 2.2 Unlikely Changes

This section specifies the changes that are planned out but difficult to implement due to the limitation of the utilities of Pyglet.

**UC1:** Input Devices such as game console controller.

**UC2:** Saving more game scenes, as the maximum game saving is two for now.

**UC3:** Inventory System.

## 3 Module Hierarchy

This section provides an overview of the module design. Modules are summarized in a hierarchy decomposed by secrets in Table 2. The Hardware-hiding section hides the hardware machine or the “virtual machine” provided by the Pyglet. The Software decision section hides internal data structures and algorithms. The Behaviour hiding section hides input formats, screen formats, and text messages. The modules listed below, which are leaves in the hierarchy tree, are the modules that will actually be implemented.

**M1:** block

**M2:** button

**M3:** creature

**M4:** devTools

**M5:** game

**M6:** loadSource

**M7:** main

**M8:** gameScene

**M9:** mainScene

**M10:** settingScene

**M11:** player

**M12:** processQueue

**M13:** screen

**M14:** shape

**M15:** world

| Level 1                  | Level 2                                                                                           |
|--------------------------|---------------------------------------------------------------------------------------------------|
| Hardware-Hiding Module   | <b>Pyglet</b>                                                                                     |
| Behaviour-Hiding Module  | game<br>gameScene<br>mainScene<br>settingScene<br>screen                                          |
| Software Decision Module | creature<br>block<br>player<br>processQueue<br>shape<br>world<br>devTools<br>button<br>loadSource |

\*Note that the main module only acts as a trigger to the program and does not support information hiding and therefore it is mentioned in either this table or Section 5.

Table 2: Module Hierarchy

## 4 Connection Between Requirements and Design

The design of the system is intended to satisfy the requirements developed in the SRS. In this stage, the system is decomposed into modules. The consistency between requirements and modules is listed in Table 3. The Non-functional Requirements are realized highly based on the functionalities of the hardware.

## 5 Module Decomposition

### 5.1 Hardware Hiding Modules (M16)

**Secrets:** The algorithm used to implement the virtual hardware that controls the mouse, keyboard, monitor and audio player.

**Services:** Serves as a virtual hardware used by the rest of the system. This module provides the interface between the hardware and the software. So, the system can use it to display outputs or to accept inputs.

**Implemented By:** OS and Pyglet

### 5.2 Behaviour-Hiding Module

#### 5.2.1 game Module (M5)

**Secrets:** The interactive game frame(GUI).

**Services:** Provide the game frame(GUI) that controls the scenes switches and game world initialization.

**Implemented By:** game.py

#### 5.2.2 gameScene Module (M8)

**Secrets:** The interactive content of the game scene that will be rendered on the GUI.

**Services:** Render the interactive content of the game Scene on the GUI.

**Implemented By:** gameScene.py

#### 5.2.3 mainScene Module (M9)

**Secrets:** The main menu scene that will be rendered on the GUI.

**Services:** Render the main menu on the GUI.

**Implemented By:** mainScene.py

#### **5.2.4 settingScene Module (M10)**

**Secrets:** The setting menu scene that will be rendered on the GUI.

**Services:** Render the setting menu on the GUI.

**Implemented By:** settingScene.py

#### **5.2.5 screen Module (M13)**

**Secrets:** The interactive scene template.

**Services:** Provide a basic template for other scenes.

**Implemented By:** screen.py

### **5.3 Software Decision Module**

#### **5.3.1 creature Module (M3)**

**Secrets:** The moving object in the game world.

**Services:** Provide a basic template for the moving objects in the game world.

**Implemented By:** creature.py

#### **5.3.2 player Module (M11)**

**Secrets:** The game character.

**Services:** Provide a game character with its operations in the game world.

**Implemented By:** player.py

#### **5.3.3 block Module (M1)**

**Secrets:** The game blocks.

**Services:** Provide a basic template for the game blocks in the game world.

**Implemented By:** block.py

#### **5.3.4 processQueue Module (M12)**

**Secrets:** The processQueue data structure.

**Services:** Provide a data structure to store processes.

**Implemented By:** processQueue.py

### 5.3.5 shape Module (M14)

**Secrets:** The shape drawing algorithm.

**Services:** Provide an algorithm to draw 2-dimensional and 3-dimensional shapes.

**Implemented By:** shape.py

### 5.3.6 world Module (M15)

**Secrets:** The game world.

**Services:** Provide a game world and its operations.

**Implemented By:** world.py

### 5.3.7 devTools Module (M4)

**Secrets:** The image process and formating algorithm.

**Services:** Provide an algorithm to process and produce texture images in a certain format.

**Implemented By:** devTools.py

### 5.3.8 button Module (M1)

**Secrets:** Buttons.

**Services:** Provide two types of buttons(switches by OnOffButton and Toggles by Button).

**Implemented By:** button.py

### 5.3.9 loadSource Module (M6)

**Secrets:** The algorithm of loading media.

**Services:** Provide algorithms to load texture images, background music and on-click effect sound.

**Implemented By:** loadSource.py

## 6 Traceability Matrix

This section shows two traceability matrices: between the modules and the requirements and between the modules and the anticipated changes.

| Req.    | Modules                                  |
|---------|------------------------------------------|
| FR1     | M5, M7, M16                              |
| FR2     | M5, M9, M16                              |
| FR2.1   | M2, M8, M9, M10, M13, M14                |
| FR2.1.1 | M2, M5, M8, M11, M12, M13, M14, M15      |
| FR2.1.2 | M2, M5, M8, M11, M12, M13, M14, M15      |
| FR2.1.3 | M2, M5, M10, M13, M14                    |
| FR2.1.4 | M2, M5, M9, M10, M13, M14                |
| FR3     | M3, M5, M8, M11                          |
| FR4     | M5, M8                                   |
| FR4.1   | M5, M8                                   |
| FR5     | M5, M8, M11, M16                         |
| FR5.1   | M5, M8, M11, M16                         |
| FR5.2   | M5, M8, M11, M16                         |
| FR5.3   | M5, M8, M11, M16                         |
| FR5.4   | M5, M8, M11, M16                         |
| FR6     | M5, M8, M11, M16                         |
| FR7     | M5, M8, M11, M16                         |
| FR8     | M5, M8, M11, M16                         |
| FR8.1   | M5, M8, M11, M16                         |
| FR8.2   | M5, M8, M11, M16                         |
| FR8.3   | M5, M8, M11, M16                         |
| FR9     | M1, M5, M8, M11, M14, M15                |
| FR10    | M1, M5, M8, M11, M12, M14, M15, M16      |
| FR11    | M1, M5, M8, M11, M12, M14, M15, M16      |
| FR11.1  | M1, M5, M6, M8, M16                      |
| FR11.2  | M1, M5, M6, M8, M16                      |
| FR11.3  | M1, M5, M6, M8, M16                      |
| FR12    | M5, M8, M10, M13, M16                    |
| FR12.1  | M5, M8, M9, M10, M13                     |
| FR12.2  | M5, M8, M9, M10, M13                     |
| FR13    | M5                                       |
| FR14    | M6, M7, M16                              |
| FR15    | M5, M6, M8, M11, M12, M13, M14, M15, M16 |
| FR16    | M15                                      |
| FR17    | M5, M8, M15                              |
| NFR2    | M6                                       |
| NFR5    | M16                                      |
| NFR6    | M16                                      |
| NFR7    | M16                                      |
| NFR8    | M16                                      |
| NFR10   | M16                                      |
| NFR11   | M16                                      |
| NFR14   | M16                                      |

Table 3: Trace Between Requirements and Modules

| AC  | Modules             |
|-----|---------------------|
| AC1 | M16                 |
| AC2 | M4, M6, M8, M15     |
| AC3 | M4, M6, M8, M15     |
| AC4 | M3, M4, M6, M8, M15 |

Table 4: Trace Between Anticipated Changes and Modules

## 7 Use Hierarchy Between Modules

In this section, the uses hierarchy between modules is provided. Arrow represent USES relationship between modules. The **Hardware Hiding Module** refers to **OS** and **Pyglet** modules, which belong to external program. The figure contains two software components, **Software Game** and **Texture Image Processor**. The **Software Game** component demonstrates the use hierarchy between modules in the implementation of the game program itself. The **Texture Image Processor** is a software tool implemented by the team to produce texture images in a certain format that will be implicitly used by the block module, which is shown with a dashed arrow line.



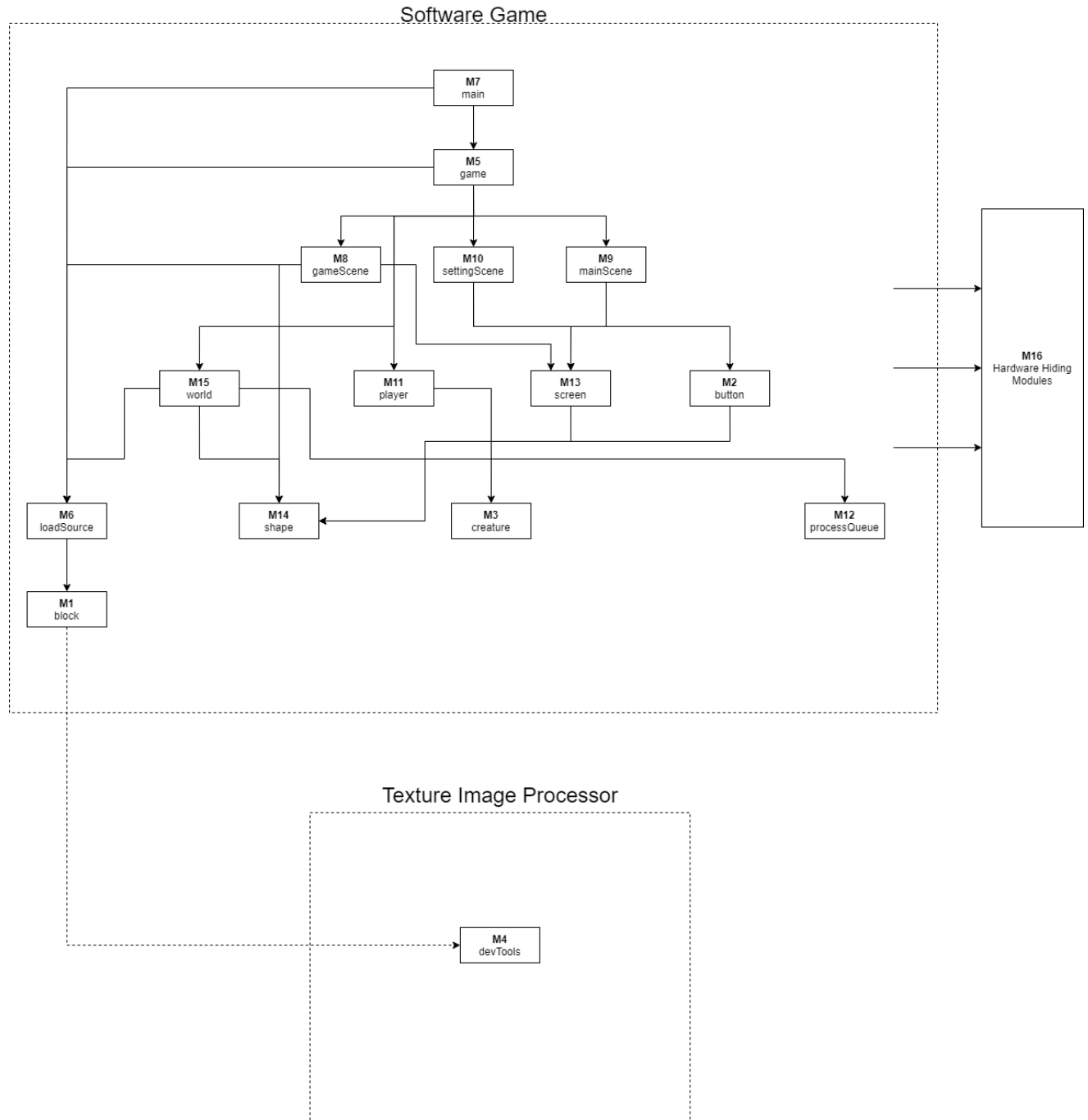


Figure 4: Use hierarchy among modules