Software Design Description Document (Architecture Section)

6.1 Introduction

Akemi Isles is a 2D narrative-driven adventure game built in Unity (C#), where players explore an island, collect and use items, and interact with NPCs to progress through the story and save the island from disaster. This document presents the architecture and detailed design for the software of Akemi Isles. The project performs a cohesive gameplay system by organizing key components - such as item collection, dialogue management, and story progression - under a unified game manager which coordinates all interactions and maintains the global game state. The following sections describe the system's objectives, interfaces, and high level architecture.

6.1.1 System Objectives

The objective of this application is to provide a narrative-driven player experience where exploration and item usage advance the story. By having a centralized Game Manager that manages game state consistently, the application can track player progress, inventory, and story triggers. The seamless interaction between components such as the inventory manager, dialogue system, and in-game objects (doors, NPCs, items) is possible because of the Game Manager. With all of this implemented, Akemi Isles offers an intuitive 2D user interface for collecting, viewing, and using items.

6.1.2 Hardware, Software, and Human Interfaces

Details of each are explained individually below.

6.1.2.1 Unity Game Engine Interface

The base system of Akemi Isles interfaces primarily with Unity Engine Version 6000.0.31f1 using the C# scripting API. Unity acts as the framework for rendering, physics, scene management, and asset handling. All game logic (item interaction, player control, dialogue progression, etc.) is implemented in C# scripts that interface with Unity's Monobehavior lifecycle methods (Start(), Update(), OnTriggerEnter2D(), etc.). Unity's built in SceneManager is used for scene transitions with the game manager.

6.1.2.2 Input Hardware Interface

The game interfaces with standard keyboard and mouse input hardware.

- Keyboard: used for player movement (WASD or arrow keys + spacebar)
- Mouse: used for UI interactions, such as selecting items in the inventory or clicking dialogue options. All input is handled through Unity's Input System Package, using event-based input actions for better flexibility and rebind support.

6.1.2.3 Graphic User Interface

The user interface (UI) is implemented using Unity's Canvas System and TextMeshPro for rendering text. The main GUI elements include:

- Inventory Menu: displays collected items, item descriptions, and allows item usage
- Dialogue Box: shows NPC dialogue lines, name tags, and dialogue options
- Interaction Prompts: appear when the player is near interactable objects
- Pause Menu: Allows players to resume, quit, or access settings


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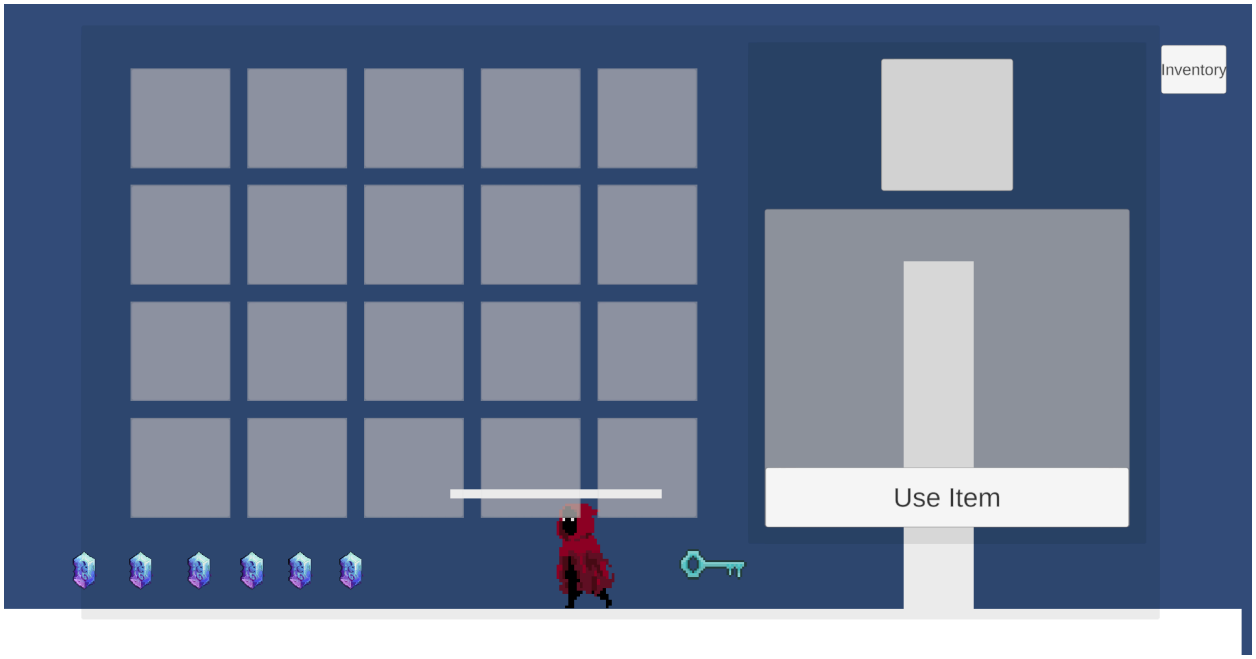

Inventory
Use Item

6.1.2.4 File Interface

As of now, Akemi Isles does not implement persistent save data. However, the system architecture allows future implementation using Unity's PlayerPrefs API or JSON-based file serialization for local saves. No external databases or online storage are used.

6.1.2.5 Third-Party Libraries and Assets

The following third-party assets are integrated into the system:

- TextMeshPro (Unity built-in) - used for high-quality text rendering throughout the UI and dialogue system
- Cinemachine (Unity package) - provides smooth camera control and tracking for the player
- 2D Sprite Assets (imported PNGs) - used for characters, environment, and item sprites

6.1.2.6 Game Manager Interface

The GameManager singleton coordinates:

- Player Controller (movement, interactions)
- Inventory Manager (item collection / usage)
- Dialogue Manager (NPC dialogue progression)
- Scene Controller (scene and story changes)

6.1.2.7 Hardware and Platform Interface

The game is designed to run on Windows 10+ systems as well as MacOS and supports both keyboard and mouse input devices. The game runs in 2D with a resolution of 1920x1080 by default and supports fullscreen or windowed play.

6.2 Architectural Design

Akemi Isles uses a modular architecture centered around a single persistent Game Manager that coordinates all gameplay systems. This approach allows individual subsystems (inventory, dialogue, player control) to remain independent while still communicating through shared state variables and events.

6.2.1 Major Software Components

Component	Description
Game Manager	The central controller that maintains global game state, tracks quest progress, and triggers story events based on collected items or completed objectives.
Player Controller	Handles player movement, interaction input, and collision detection in the 2D world
Inventory Manager	Manages the player's collected items, displays the inventory UI, and handles item use logic (ex: open door with key)
Item System	Defines collectible objects through Scriptable Objects, storing

	data such as name, sprite, and effects on player stats or world objects.
Dialogue System	Manages NPC conversations, tracks dialogue branches, and adapts responses based on the current game state provided by the Game Manager.
World Interaction System	Includes triggers (e.g., doors, chests, switches) that respond to player actions or specific items being used.
UI System	Displays inventory, dialogue boxes, and other on-screen feedback. Communicates closely with both the Game Manager and Inventory Manager.

6.2.2 Major Software Interactions

The following describes typical communication and control flow between components during gameplay events:

1) The **Player Controller** detects nearby interactable objects and passes the interaction request to the **Game Manager**.
2) The **Game Manager** queries the **Inventory Manager** to verify whether the player has the required item.
3) If conditions are met, the **Game Manager** triggers an event in the **World Interaction System** (e.g., opening a door, updating NPC state).

4) The **Dialogue System** uses data from the **Game Manager** to determine which dialogue lines or branches are available.
5) The **UI System** displays updated information, such as removed or newly acquired items, changed dialogue, or new objectives.
6) Future save/load features will serialize the **Game Manager's** state for persistence between play sessions.

6.2.3 Architectural Design Diagrams

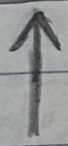
6.2.3.1 Use Case Diagram

Purpose: Illustrates all major ways the player interacts with the game system.
Description: The system boundary is represented by a rectangle labeled "Akemi Isles." Within it, oval-shaped nodes represent use cases such as "Collect Item," "Open Inventory," "Talk to NPC," "Use Item," and "Trigger Story Event." The external Player connects to each use case, representing user-initiated actions. This diagram emphasizes how gameplay actions flow through the main systems (inventory, dialogue, and story progression).

Akemi Isles Game

Use Cases

- move character
- collect item
- open inventory
- talk to NPC
- solve puzzle
- progress story
- view dialogue choices
- pause / resume game



Player

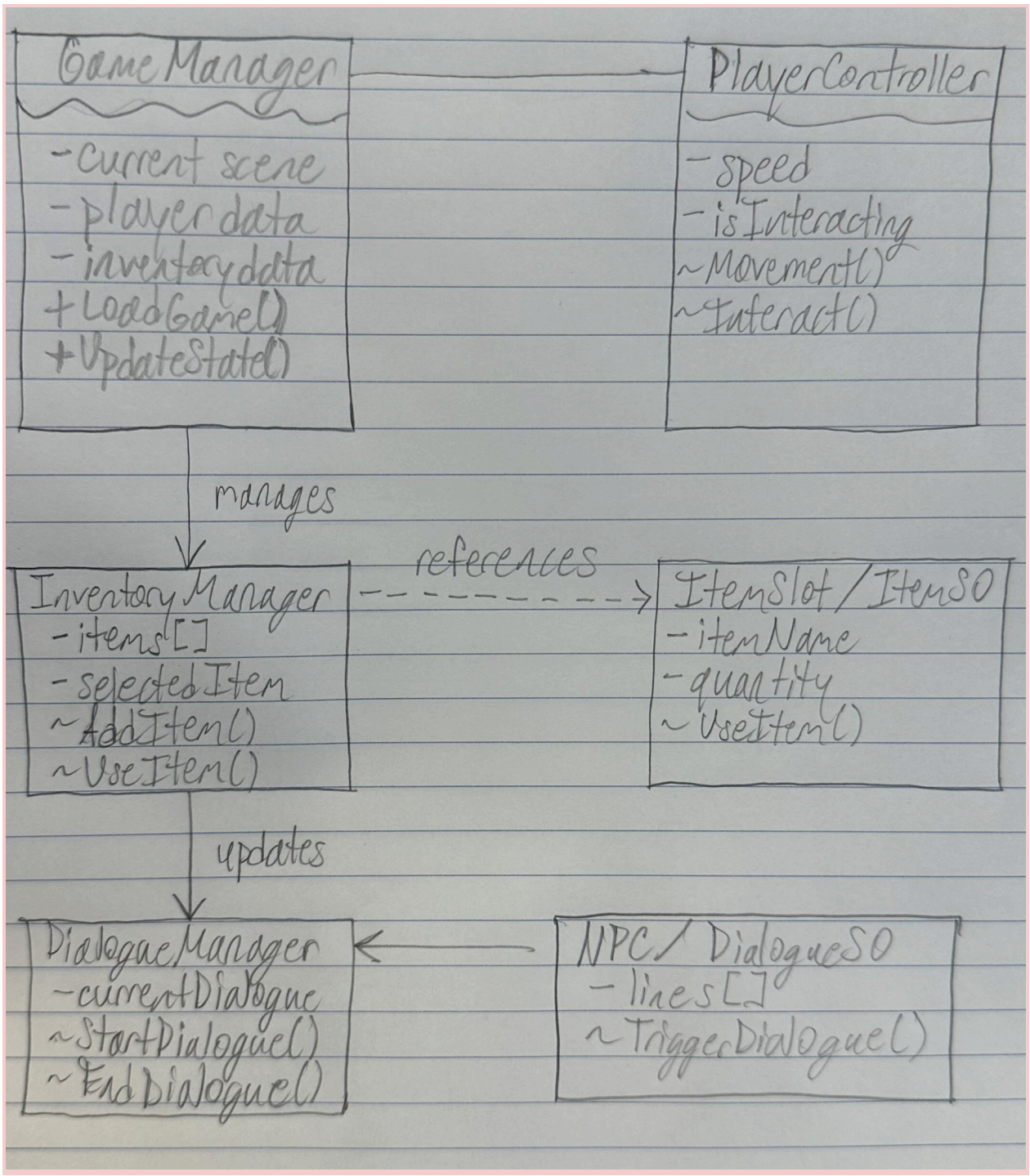
6.2.3.2 Top-Level Class Diagram

Purpose: Shows the relationships between the main classes and systems in the game.

Description: The GameManager is the central class responsible for maintaining the global state and coordinating interactions. It holds references to major subsystems:

- PlayerController – handles player input and movement.
- InventoryManager – manages a collection of ItemSlot objects that store ItemSO data.
- DialogueManager – controls NPC dialogues and scene-triggered conversations.

Classes interact via public methods and shared events. The structure enforces modularity, making each system independently maintainable while remaining coordinated by the GameManager.


GameManager
-current scene
-player data
-inventory data
+LoadGame()
+UpdateState()
PlayerController
-speed
-isInteracting
~Movement()
~Interact()
manages
InventoryManager
-items[]
-selectedItem
~AddItem()
~UseItem()
references
ItemSlot / ItemSO
-itemName
-quantity
~UseItem()
updates
DialogueManager
-currentDialogue
~StartDialogue()
~EndDialogue()
NPC / DialogueSO
-lines[]
~TriggerDialogue()

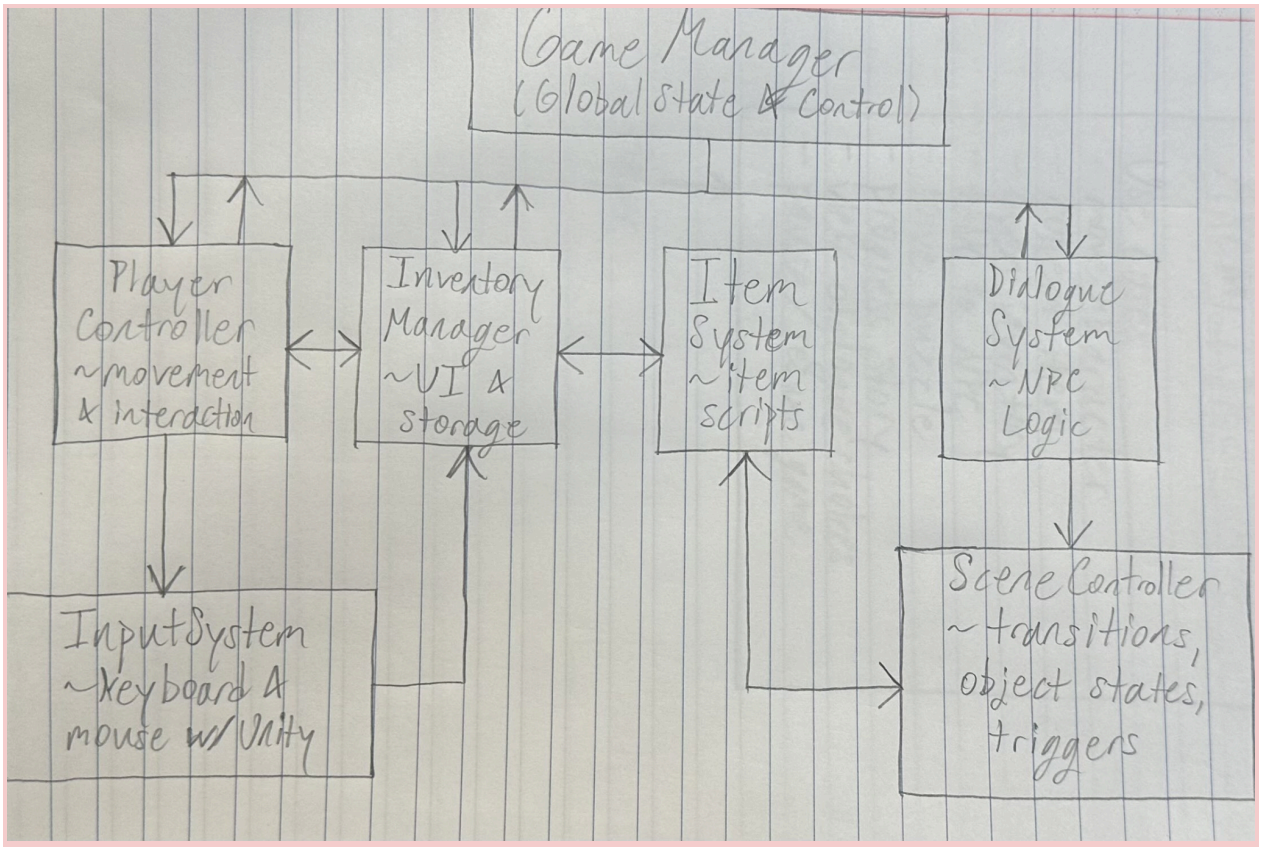
6.2.3.3 Component / Deployment Diagram

Purpose: Displays how different systems and components interact at runtime.

Description: The GameManager acts as the hub of communication between gameplay systems.

- Player Controller, Inventory Manager, Dialogue System, and Scene Controller connect to the GameManager.
- Item System supplies data and scripts for items that can be picked up or used.
- Input System sends keyboard and mouse events to the Player and UI elements.
- UI Layer displays menus and dialogue boxes, updating in response to data changes in the GameManager.

  This architecture ensures loose coupling between components and allows the GameManager to maintain consistent global state across all scenes.



6.3 Detailed CSC and CSU Descriptions

The Akemi Isles application (the CSCI) is composed of multiple Computer Software Components (CSCs), each representing a core subsystem of the game. Each CSC contains multiple Computer Software Units (CSUs), which correspond to the major C# classes and scripts used to implement that subsystem. Together, these modules define the functional behavior of the Akemi Isles gameplay loop — including player control, inventory management, dialogue interaction, and global state persistence.

CSC 1: Game Management System

Purpose: Coordinates all high-level game logic and manages the persistence of global state between scenes.

Contained CSUs:

+ GameManager.cs - Singleton that tracks player progress, inventory, active quests, and scene transitions. Provides centralized access to subsystems.

+ SceneController.cs - Handles scene loading, unloading, and transition effects through Unity's SceneManager API.

+ PersistenceHandler.cs - (Planned) Responsible for saving and loading the global state data (quests, inventory, dialogue progress).

CSC 2: Player System

Purpose: Handles user input, player movement, and interactions within the 2D world.

Contained CSUs:

+ PlayerController.cs – Manages keyboard input (WASD or arrow keys) and applies motion using Unity's Rigidbody2D.

+ PlayerInteraction.cs – Detects interactable objects (items, doors, NPCs) and sends interaction requests to the GameManager.

+ CameraFollow.cs – Controls the 2D camera using Cinemachine to follow the player smoothly between areas.

CSC 3: Inventory and Item System

Purpose: Allows players to collect, view, and use items that affect gameplay or unlock interactions.

Contained CSUs:

+ InventoryManager.cs – Manages a list of ItemSlot objects, handles UI updates, and communicates with GameManager for usage validation.

+ ItemSlot.cs – Represents an individual inventory slot, storing a specific ItemSO reference and quantity.

+ ItemSO.cs (ScriptableObject) – Stores static item data, including sprite, name, and item type (Key, Consumable, QuestItem).

+ Item.cs – Attached to in-world item objects; triggers pickup behavior when the player collides with them.

CSC 4: Dialogue and Quest System

Purpose: Facilitates conversations between the player and NPCs, manages branching dialogue, and integrates basic quest tracking.

Contained CSUs:

+ DialogueManager.cs – Displays dialogue text via the UI, advances lines, and controls branching logic. Communicates with GameManager to unlock quests or trigger events.

+ DialogueTrigger.cs – Attached to NPCs; triggers the start of a conversation when the player interacts.

+ QuestManager.cs (planned) – Manages active and completed quests, rewards, and triggers dialogue changes based on quest progression.

CSC 5: World Interaction System

Purpose: Handles interactions with environmental objects that respond to items or dialogue conditions.

Contained CSUs:

+ Door.cs – Example of a conditional interaction object; checks if the required item (e.g., “Key”) exists in the player’s inventory before opening.

+ InteractableObject.cs – Base class for any world object that can respond to player interaction.

+ TriggerZone.cs – Used for automatic story or quest triggers when the player enters a certain area.

CSC 6: UI System

Purpose: Displays all graphical interfaces and connects player inputs to system-level functions.

Contained CSUs:

+ UIManager.cs – Oversees showing and hiding UI menus such as inventory, dialogue, and pause screens.
+ DialogueUI.cs – Controls the dialogue box visuals and TextMeshPro components for name and dialogue display.
+ InventoryUI.cs – Handles layout of inventory slots and displays item info when selected.

6.3.1 Detailed Class Descriptions

The following sections provide detailed descriptions of all classes used in the Akemi Isles application. Each class is listed with its fields and methods, along with a short explanation of its role in the system.

6.3.1.1 GameManager

Description:

The GameManager maintains a global state and acts as the communication hub between all systems.

Fields:

- static GameManager instance — Singleton instance for global access.
- InventoryManager inventoryManager — Reference to inventory subsystem.
- DialogueManager dialogueManager — Reference to dialogue subsystem.
- Bool questProgress — Tracks active quest flags and completion states.

Methods:

- void RegisterItem(ItemSO item) — Adds a collected item to inventory.
- bool HasItem(string itemName) — Checks if the player possesses a given item.
- void ChangeScene(string sceneName) — Loads a new scene and maintains persistent data.
- void TriggerEvent(string eventID) — Triggers story or quest events.

6.3.1.2 PlayerController

Description:

Handles player input and movement via Unity's Input System.

Fields:

- float speed — Controls player movement speed.
- Rigidbody2D rb — Reference to player's physics body.

Methods:

- void Update() — Handles movement input each frame.
- void FixedUpdate() — Applies movement to Rigidbody2D.
- void Interact() — Sends interaction requests to GameManager.

6.3.1.3 Other Key Classes

In addition to the GameManager, we also have several other important classes that handle specific systems within the game:

- **InventoryManager** – Handles all item management, including adding, removing, and using items. It also controls the inventory UI and ensures it stays synchronized with player data.
- **DialogueManager** – Controls conversations and quest-related dialogue between the player and NPCs. It will later integrate with persistence to remember completed quests and dialogue choices.

- **ItemSO (Scriptable Object)** – Defines item data such as name, description, sprite, and stat effects. It allows for easy creation and management of new items without changing code.
- **Door** – Manages scene transitions and access control. For example, a door may only open if the player has a specific item or meets a quest condition.

6.3.2 Detailed Interface Descriptions

This section describes how each subsystem interfaces with one another.

Interface Name	Communicating Systems	Description
Game ↔ Inventory	GameManager ↔ Inventory Manager	GameManager queries inventory for item checks and updates collected item lists.
Game ↔ Dialogue	GameManager ↔ Dialogue Manager	DialogueManager sends quest triggers and receives story state updates.
Player ↔ World	PlayerController ↔ Interactable Object	Player interaction triggers responses (pickups, dialogue, doors).

UI ↔ Game Systems	UIManager ↔ All Managers	UI components display data and allow player to trigger inventory or dialogue actions

6.3.3 Detailed Data Structure Descriptions

ItemSO

- **Type:** ScriptableObject
- **Fields:**
    - string itemName — Item identifier.
    - Sprite itemIcon — Displayed image in inventory.
    - ItemType itemType — Enum representing item function.
- **Purpose:** Defines data for reusable item templates accessible across multiple scenes.

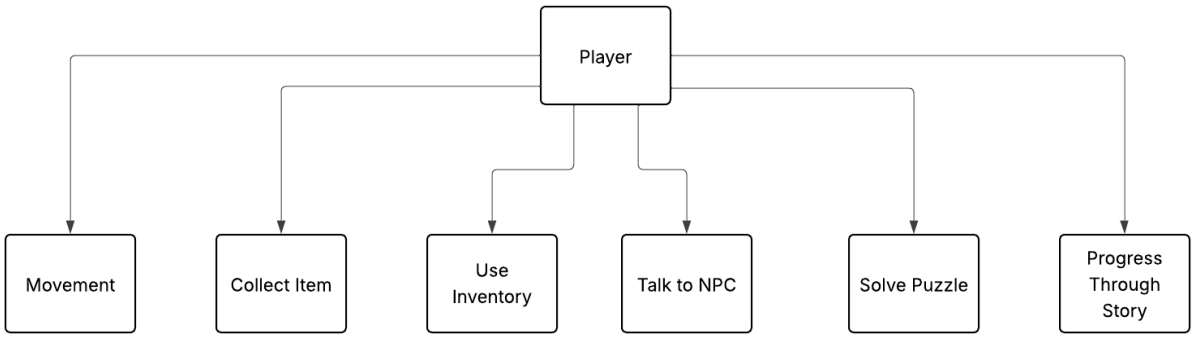
Quest Data

- **Type:** Serializable Class (future)
- **Fields:**
    - string questID — Unique identifier.
    - bool isComplete — Completion state.
    - string[] requiredItems — Items needed to finish the quest.
- **Purpose:** Used by QuestManager and DialogueManager to coordinate quest-based dialogue.

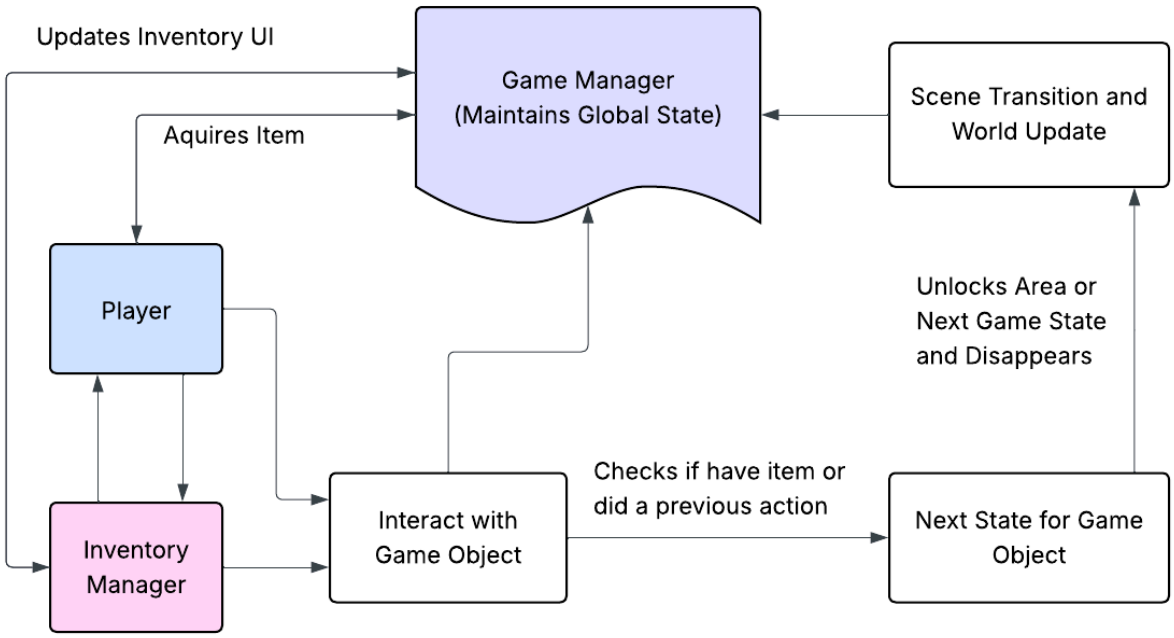
6.3.4 Detailed Design Diagrams

Included diagrams:

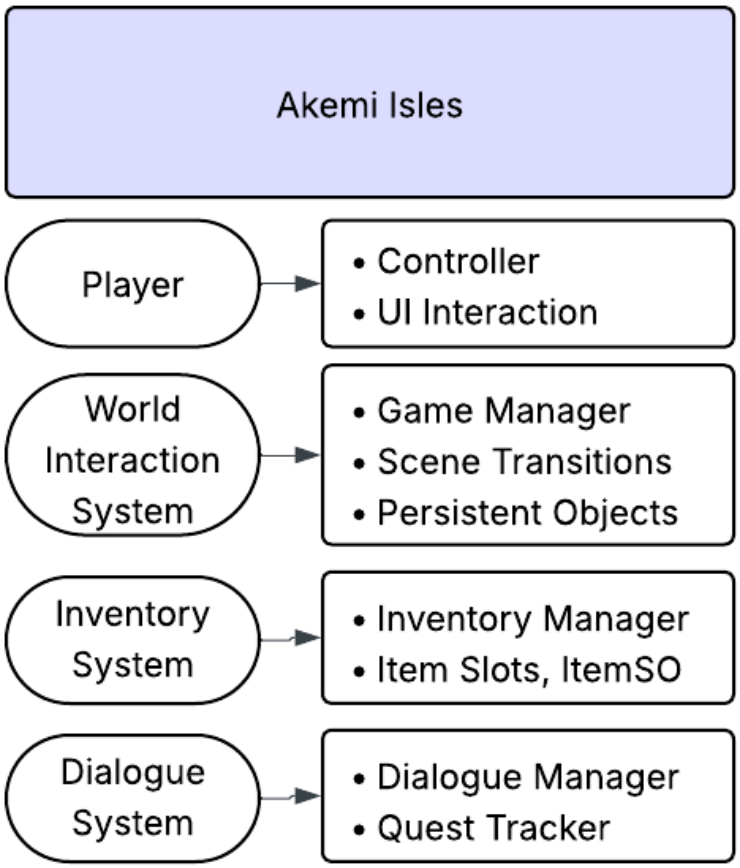
1. **Use Case Diagram — Player Interactions**



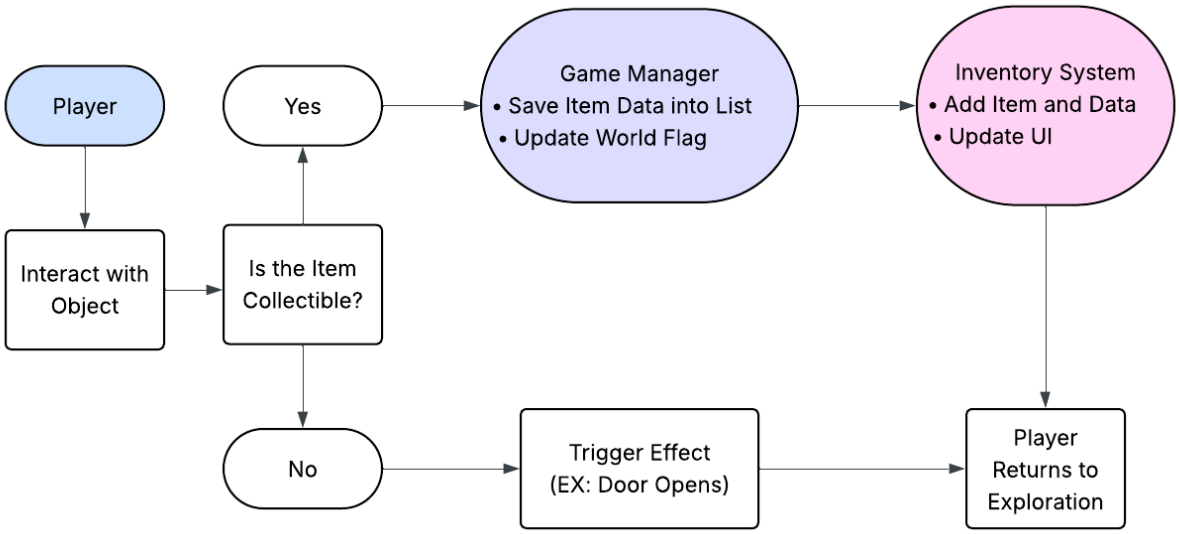
2. **Use Case Diagram — World Interactions**



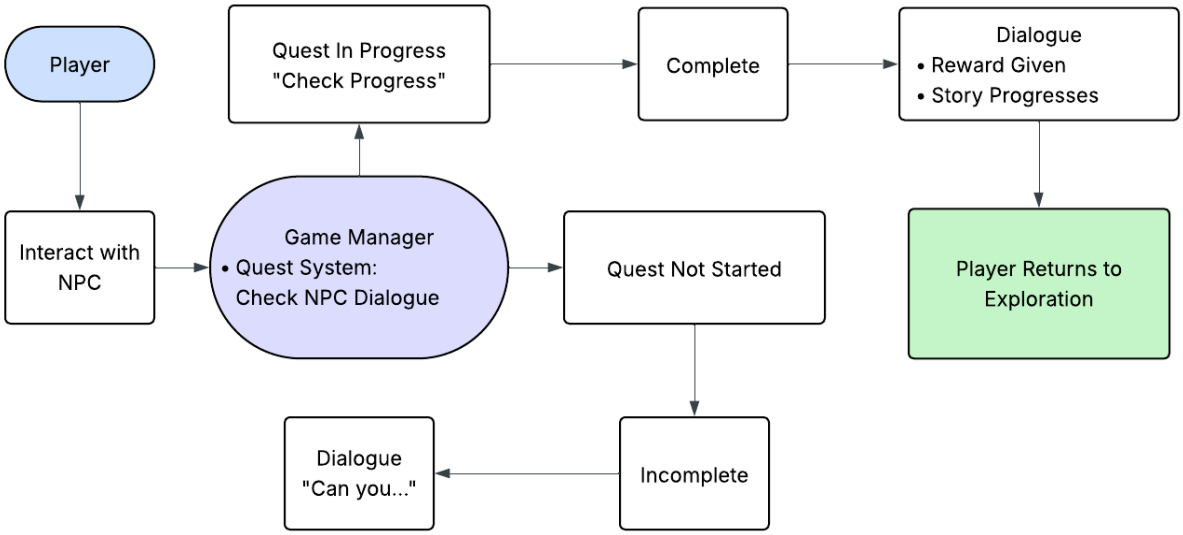
3. **Class Diagram — Core Systems Overview**



4. **Activity Diagram — Item Collection and Interaction Flow**



5. **Activity Diagram — Dialogue and Quest Flow**



These diagrams together depict how systems and objects in Akemi Isles interact dynamically and structurally to achieve a cohesive gameplay experience.