Design Document for **Dragon Ball Game**

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Demonstration video link: https://youtu.be/mtv1ut0h_DE

Introduction

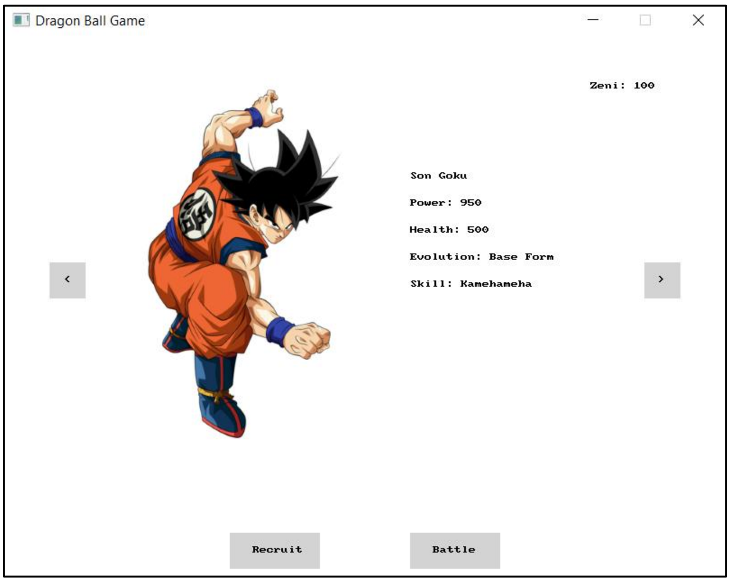
In this document, I will demonstrate my custom program for Distinction task and its functionalities. This program is a simple battle simulation game inspired from the Dragon Ball universe. The objective of the game is for players to recruit powerful characters, transform them into many different forms, and engage in strategic battles against challenging villains. The game implements object-oriented principles and has several key design patterns, making it an ideal demonstration of OOP concepts.

Program's Functionalities

Game Menu

The Game Menu is where players start the game. It allows them to view their characters and stats, their amount of zeni (using GameMenu class) and choose between different actions (using InputHandler class):

- Character Recruitment: Recruit new characters for the player's list.
- Character Selection: Select which character to use in battle.
- Start a Battle: Begin a fight against a villain with the selected character.



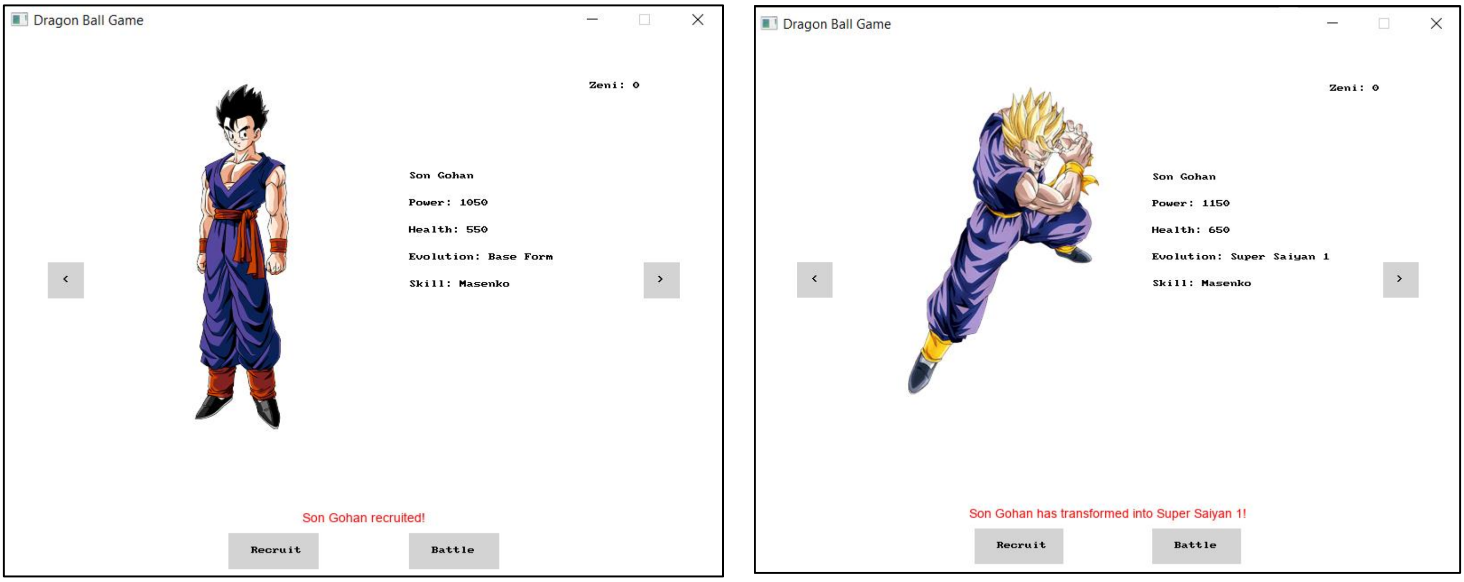
Zeni: 100

Son Goku
Power: 950
Health: 500
Evolution: Base Form
Skill: Kamehameha

Figure 1: Game Menu

Character Recruitment

The player begins with only Son Goku but can recruit more characters by spending Zeni, which can be earned by winning battles. Each character has unique abilities and transformations but all derived from a base Character class. If a player recruits a duplicate character, the original one evolves to the next transformation level, making them stronger. This feature is handled by RecruitSystem class, which follows the Singleton pattern to ensure there is only one recruiter managing characters throughout the game.



Dragon Ball Game

Zeni: 0

Son Gohan

Power: 1050

Health: 550

Evolution: Base Form

Skill: Masenko

Son Gohan recruited!

Dragon Ball Game

Zeni: 0

Son Gohan

Power: 1150

Health: 650

Evolution: Super Saiyan 1

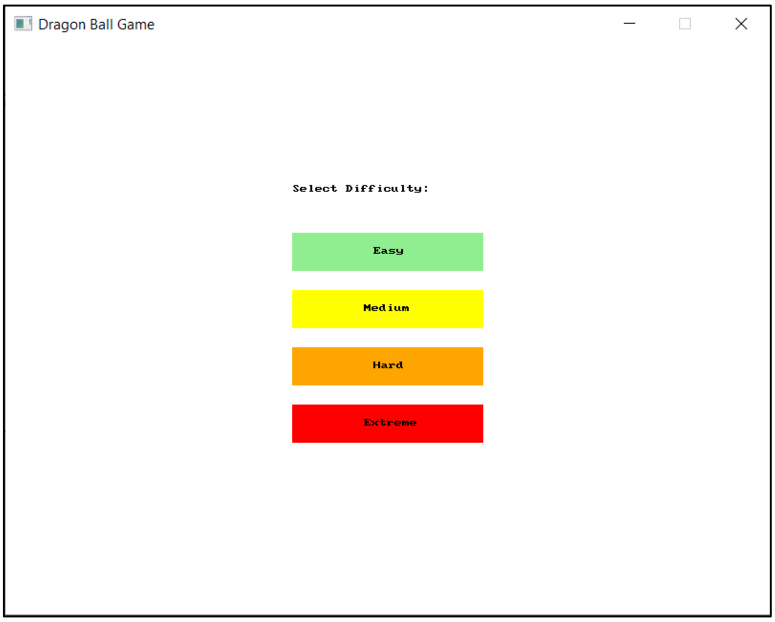
Skill: Masenko

Son Gohan has transformed into Super Saiyan 1!

Figure 2, 3: Character recruited and evolved

Difficulty Selection

The difficulty selection menu appears when starting a battle. This feature is managed by the BattleManager class and allows player to choose Easy, Medium, Hard, and Extreme level by clicking the buttons on the screen. The BattleSystem uses the difficulty level chosen to create an appropriate villain through the CharacterFactory, which centralizes character creation.



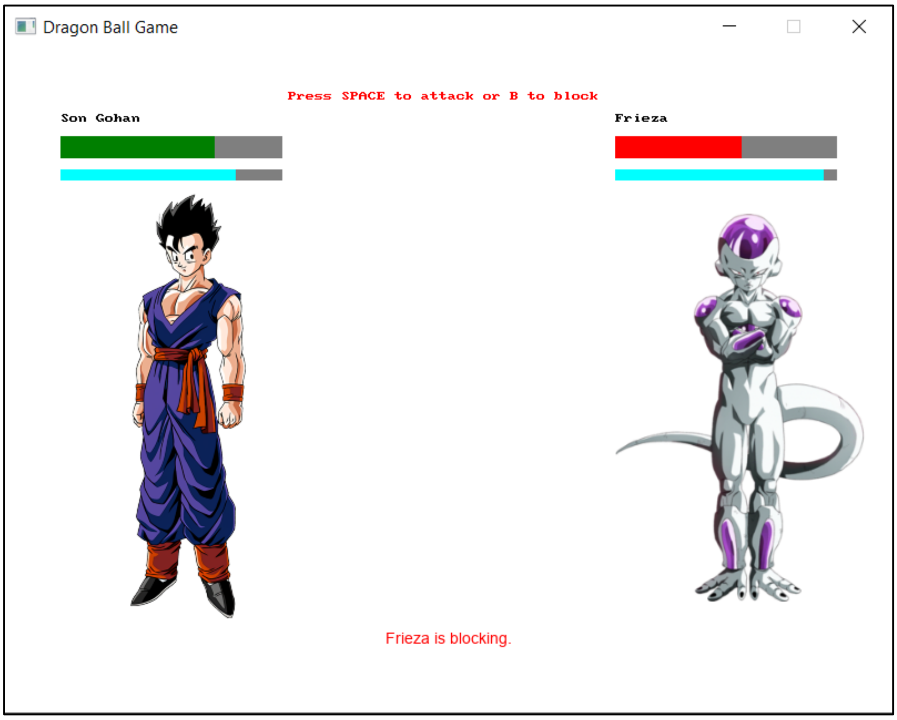
Dragon Ball Game

Select Difficulty:

Figure 4: Difficulty Selection Menu

Battle Mechanics

I implemented a turn-based battle mechanics for this game in BattleSystem class. During a battle, players can attack or block. Both actions charge the character's energy bar, and when it reaches 100, the character can perform a special attack with increased damage. The blocking mechanism reduces incoming damage by a half, adding a layer of strategy for players to decide whether to attack or block. The player and villain take turns, and the battle continues until one side's health reaches zero. The BattleUI class handles drawing character health, energy bars, and messages to the screen after each action taken.



Press SPACE to attack or B to block

Frieza is blocking.

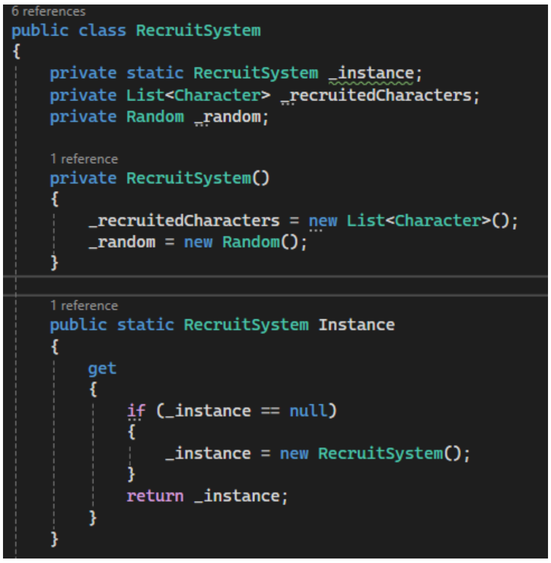
Figure 5: Battle Interface

Villain’s AI

The villain’s AI is implemented using the VillainAI class with the Strategy Pattern to dynamically adjust the villain’s behavior. The AI uses different strategies (aggressive, defensive, default) based on the villain's health during the battle and power compared to the player. The VillainAI chooses the appropriate strategy (AggressiveVillainStrategy, DefensiveVillainStrategy, DefaultVillainStrategy) at each turn. This AI logic ensures that villains adapt to the player's actions: for example, if a villain’s health is low, they are more likely to block. This feature makes it more challenging for players as they need to be prepared for both offensive and defensive style from the bot.

Design Patterns Used

Singleton Pattern: The RecruitSystem class uses the Singleton pattern, ensuring there's only one instance managing the recruitment process. This approach helps maintain consistency when recruiting or evolving characters.



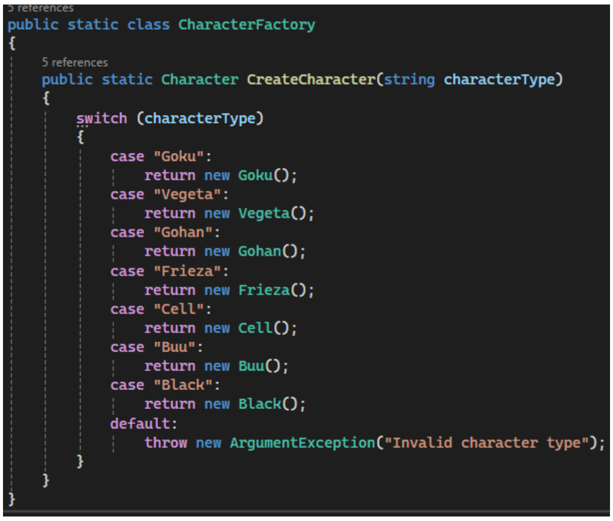
```
6 references
public class RecruitSystem
{
    private static RecruitSystem _instance;
    private List<Character> _recruitedCharacters;
    private Random _random;

    1 reference
    private RecruitSystem()
    {
        _recruitedCharacters = new List<Character>();
        _random = new Random();
    }

    1 reference
    public static RecruitSystem Instance
    {
        get
        {
            if (_instance == null)
            {
                _instance = new RecruitSystem();
            }
            return _instance;
        }
    }
```

Figure 6: RecruitSystem public instance

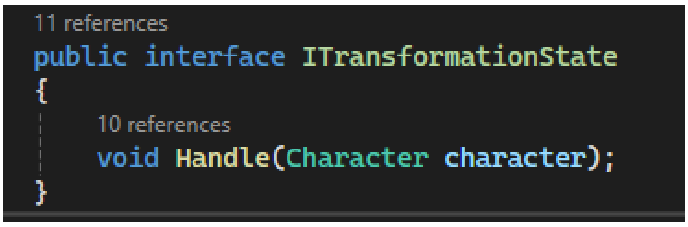
Factory Pattern: The CharacterFactory class employs the Factory pattern to simplify character creation like Goku, Vegeta, or villains based on the current needs of the game. This makes adding new characters straightforward.



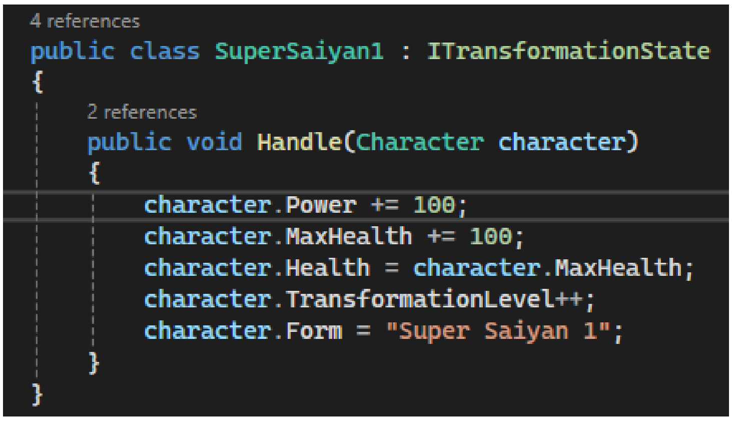
```
5 references
public static class CharacterFactory
{
    5 references
    public static Character CreateCharacter(string characterType)
    {
        switch (characterType)
        {
            case "Goku":
                return new Goku();
            case "Vegeta":
                return new Vegeta();
            case "Gohan":
                return new Gohan();
            case "Frieza":
                return new Frieza();
            case "Cell":
                return new Cell();
            case "Buu":
                return new Buu();
            case "Black":
                return new Black();
            default:
                throw new ArgumentException("Invalid character type");
        }
    }
}
```

Figure 7: CharacterFactory class

State Pattern: State pattern was implemented for handling character transformations. The ITransformationState interface and classes like SuperSaiyan1, 2, 3… manages different transformations. When characters evolve, they transition between these states, allowing them to increase stats.



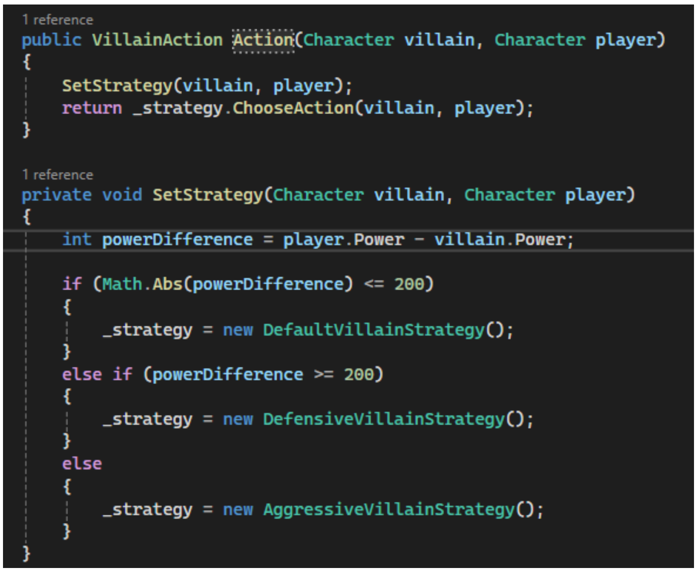
```
11 references
public interface ITransformationState
{
    10 references
    void Handle(Character character);
}
```



```
4 references
public class SuperSaiyan1 : ITransformationState
{
    2 references
    public void Handle(Character character)
    {
        character.Power += 100;
        character.MaxHealth += 100;
        character.Health = character.MaxHealth;
        character.TransformationLevel++;
        character.Form = "Super Saiyan 1";
    }
}
```

Figure 8, 9: Interface and class for transformation state

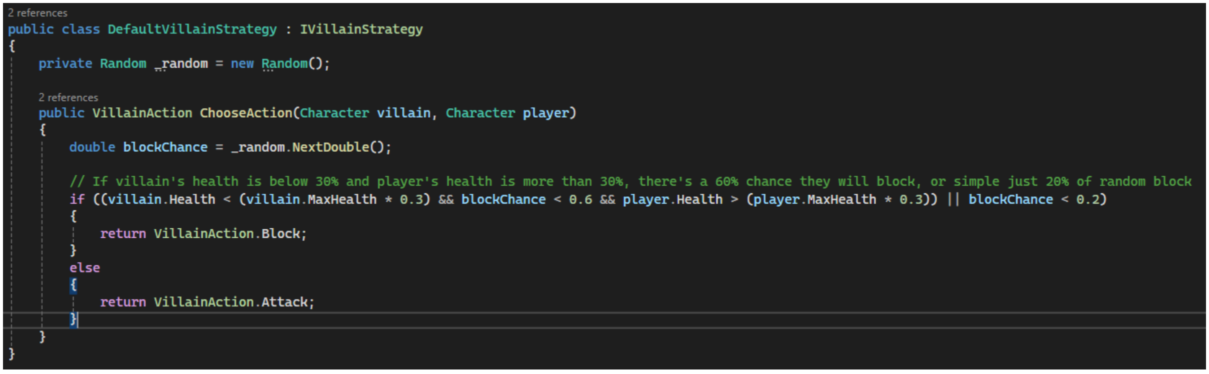
Strategy Pattern: The villain's behavior uses the Strategy pattern. The VillainAI class dynamically selects a strategy for each villain's action based on their health and the difference in power compared to the player. Different strategy classes encapsulate specific behavior, enhancing modularity and making it easy to adjust villain tactics.



```
1 reference
public VillainAction Action(Character villain, Character player)
{
    SetStrategy(villain, player);
    return _strategy.ChooseAction(villain, player);
}

1 reference
private void SetStrategy(Character villain, Character player)
{
    int powerDifference = player.Power - villain.Power;

    if (Math.Abs(powerDifference) <= 200)
    {
        _strategy = new DefaultVillainStrategy();
    }
    else if (powerDifference >= 200)
    {
        _strategy = new DefensiveVillainStrategy();
    }
    else
    {
        _strategy = new AggressiveVillainStrategy();
    }
}
```



```
2 references
public class DefaultVillainStrategy : IVillainStrategy
{
    private Random _random = new Random();

    2 references
    public VillainAction ChooseAction(Character villain, Character player)
    {
        double blockChance = _random.NextDouble();

        // If villain's health is below 30% and player's health is more than 30%, there's a 60% chance they will block, or simple just 20% of random block
        if ((villain.Health < (villain.MaxHealth * 0.3) && blockChance < 0.6 && player.Health > (player.MaxHealth * 0.3)) || blockChance < 0.2)
        {
            return VillainAction.Block;
        }
        else
        {
            return VillainAction.Attack;
        }
    }
}
```

Figure 10, 11: Villain's strategy code

Required Classes / Interfaces

Table 1: Core classes and interfaces

Class/Interface	Type Details	Description
Character	Abstract class	Base class for all characters, containing core attributes like health, power, transformation level, and methods for evolving, attacking, and blocking.
Goku, Gohan, Vegeta	Class (inherit from Character)	Derived classes from Character, each representing a specific character with unique attributes, transformations, and special abilities.
Frieza, Cell, Buu, Black	Class (inherit from Character)	Derived classes from Character, representing villains with unique attributes and abilities.
ITransformationState	Interface	Represents different transformation stages for characters, allowing for polymorphic behavior when handling state transitions.
SuperSaiyan1, 2, 3…	Interface (implement ITransformationState	Represents different transformation states for characters, allowing them to evolve into more powerful forms.
CharacterFactory	Class (Factory)	Implements the Factory pattern to create instances of different characters, allowing centralized character creation.
Player	Class	Represents the player, managing Zeni, recruited characters, and interactions with game systems.
RecruitSystem	Class (Singleton)	Responsible for recruiting new characters and evolving existing ones when duplicates are recruited. Implements Singleton pattern to ensure a single instance exists.
InputHandler	Class	Handles user input, such as mouse clicks, for navigating the character selection and battle menus.

ImageManager	Class	Manages character images and loads the correct image based on the character's transformation state.
MessageManager	Class	Manages messages displayed to the player during the game, ensuring that they are clear and visible for a limited duration.
BattleManager	Class	Manages the initiation of battles, including difficulty selection and interaction with the `BattleSystem` to carry out battles.
BattleSystem	Class	Manages the turn-based combat logic, including player and villain actions, energy accumulation, special attacks, and invoking the villain AI strategy.
BattleUI	Class	Handles graphical representation and user interaction, such as drawing health and energy bars, and refreshing the screen during battle.
IVillainStrategy	Interface	Defines a method for villain action selection. Implemented by various strategy classes (e.g., AggressiveVillainStrategy, DefensiveVillainStrategy).
Default/Aggressive/ DefensiveVillainStrategy	Class (implements IVillainStrategy)	Implements specific villain strategies for deciding actions during battles.
VillainAI	Class	Implements different strategies (aggressive, defensive, default) to decide how villains react based on health and power difference during battles.
GameMenu	Class	Manages the main game menu, allowing players to navigate options such as character recruitment and starting battles.

Table 2: Enumerations details

Enumeration	Description
VillainAction	Defines possible actions for villains (Attack, Block).
RecruitStatus	Defines the possible outcomes when recruiting characters (NotEnoughZeni, NoAvailableCharacters, NewCharacterRecruited, CharacterEvolved).

UML Class Diagram

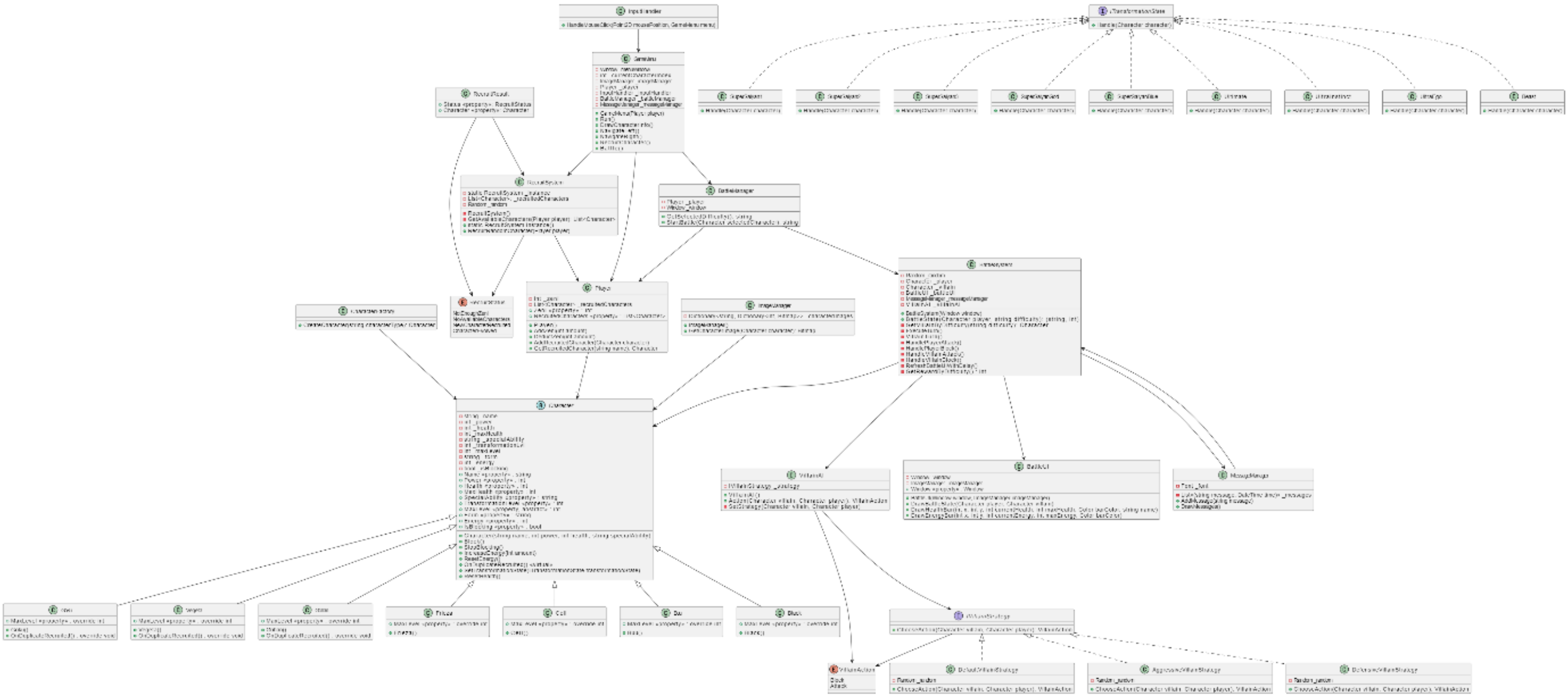


Figure 12: UML Class Diagram for Dragon Ball Game