CARIN

Design Overview Document

Italic and Bold word means class.
Italic word means interface.
Red and Bold word means design pattern.

Model-View-Controller

Model:

- timeUnit
- Unit
    - Type
    - Unit stats
- Virus
- Antibody
- Field
- Objective
- Currency

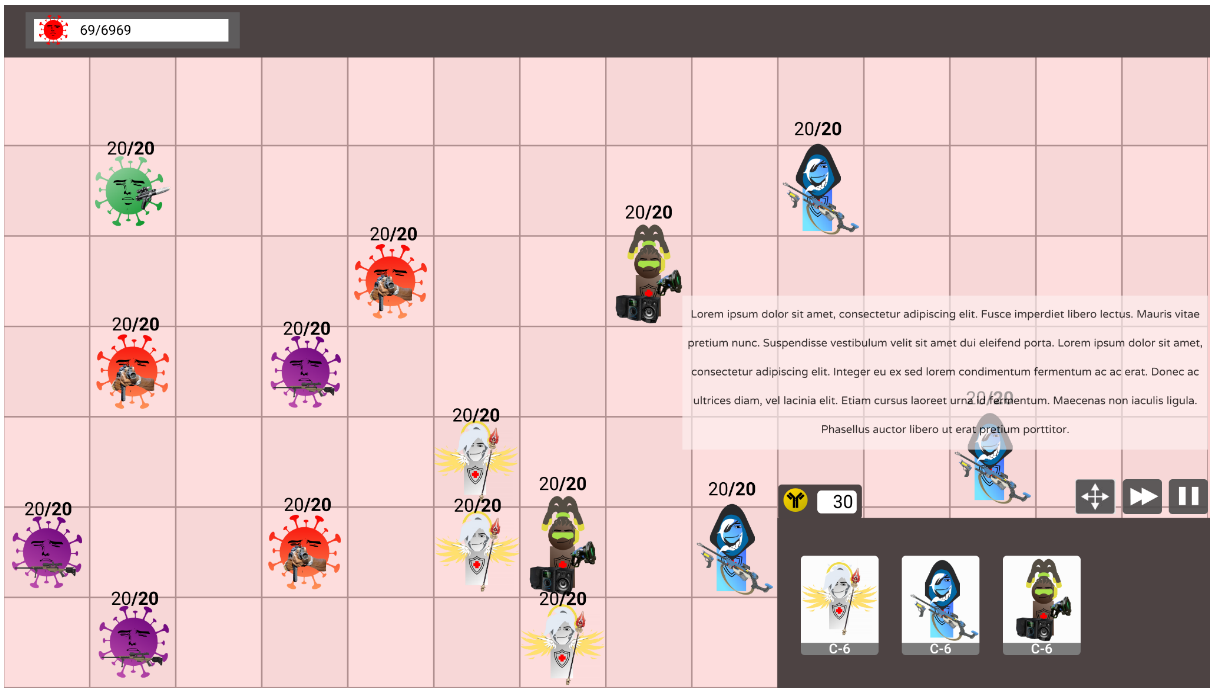
View:

- Button
    - Move
    - Speed
    - Pause
    - Cancel
- Virus & Antibody
- Antibody Tiles
- Cell Tiles
- Currency Tabs
- Objective Bar
- Unit Description
- HP Gauge

Controller:

- Button
- Mouse Status
- Keyboard Binding

Display Outline :



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Design:

- Architecture:

Game Classes:

- implements from *Unit*
    - class ***Virus***
        - **Rep Invariants:**
            - **position will not exceed the dimension of body (m,n)**
            - **every stat is always an positive int**
            - **genetic code must be appropriate grammar format**
        - bindings : Map<String,int>
            - unit's local variables
        - position : Pair<int,int>
        - stats
            - health : int
            - attack : int
        - cost : int
            - unit's cost
        - geneticCode : String
            - unit's genetic code
        - program : *Executable*
            - this is where this unit execute the genetic code by calling execute()
        - move({x,y} : Pair<int,int>) **Observer**
            - notify ***Game*** that this Unit want to move
        - shoot(direction : String)
        - destruct() **Observer**
            - notify ***Game*** that this Unit dies
            - update ATBD health //health restoring
        - setter() stats modifying method
        - takingDamage(enemy : ***ATBD***) - modify health and record attacker

Currently, we design 3 types of virus which each of them have different genetic codes and stats this maybe change in the future for game balance possible extension: defensive stat *still need further testing

- class ***ATBD***
    - **Rep Invariants:**
        - **position will not exceed the dimension of body (m,n)**
        - **Every stat is always an positive int**

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        - **Genetic code must be appropriate grammar format**
    - bindings : Map<String,int>
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        - unit's genetic code
    - program : *Executable*
        - this is where this unit execute the genetic code by calling execute()
    - move({x,y} : Pair<int,int>) **Observer**
        - notify ***Game*** that this Unit want to move
    - shoot(direction : String)
    - destruct() **Observer**
        - notify ***Game*** that this Unit dies
        - notify ***Game*** to spawn new virus that has the same genetic code of ***ATBD*** that it kills
    - setter() - stats modifying method
    - takingDamage(enemy : ***Virus***) - modify health and record attacker

3 types of ATBD. different costs and stats; players need to utilize them according to the circumstances.

*extensions are expected to be added after the game is completed.

- class ***Shop*** : **Singleton** class to manage ATBD purchasing function for Frontend displaying. If currency reaches a tower's cost its tile glows and becomes clickable.
    - **Rep Invariants : Currency is always positive**
    - currency : int
    - Map<ATBD,Boolean> true if currency >= ATBD.cost this field will affect displaying(frontend)
    - updateBool():for loop of the Map to update the boolean value in each time unit This method will be called by ***Game*** class

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- class ***Game*** : **Singleton**
    - **Rep Invariants :**
        - **spawn's, remove's and move's parameters will not exceed dimension of body (m,n)**
        - **order must not have a duplicated Unit.**
        - **objective Pair<x,y> x always >= 0 | y always >= 1**
    - geneticEvaluator : **GeneticEvaluator**
        - evaluator for genetic code.
    - shop **: Shop**
    - state : int
        - the current state of the game
    - Field : **Unit**[m][n]
        - contains units in the field.
    - order : List<**Unit**>
        - evaluation order
    - config file variable :
        - m,n : int
            - the dimension of field (m - rows , n - columns)
        - virusSpawnRate : double
            - probability of virus spawned
            - value between 0 - 1
        - baseCredits : int
            - the antibody credits you get in the beginning of the game.
        - placementCost : int
            - the cost of antibody placement.
        - baseVirusHP : int
            - maximum HP of viruses.
        - baseATBDHP : int
            - maximum HP of antibodies.
        - baseVirusDamage : int
            - virus attack damage.
        - baseVirusAttackGain : int
            - the amount of healing when a virus attacks an antibody.
        - baseATBDDamage : int
            - antibody attack damage.
        - baseATBDKillGain : int
            - the amount of healing when an antibody kills a virus.
        - moveCost : int
            - antibody move cost.
    - objective : Pair<int, int>
        - number of remaining viruses to be eliminated and maximum amount of viruses to be spawned.

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- virusLimit : int
    - the maximum number of viruses in the field.
- config()
    - method used in parsing configuration file
- spawn(unit : *Unit* , {x,y} : Pair<int, int>)
    - spawn a unit in a specified location in field
- remove({x,y} : Pair<int, int>)
    - remove a unit from specified location in field
- move(unit : *Unit* , {x,y} : Pair<int, int>)
    - move a unit to another specified location
- sensorClosestVirus(unit : *Unit*) : int
    - find the closest virus from this unit.
- sensorClosestATBD(unit : *Unit*) : int
    - find the closest antibody from this unit.
- sensorNearby(unit : *Unit* , direction : String) : int
    - find the closest unit in the specified direction from this unit.
- update() // Run everything in one time unit
    - spawnVirus()
        - spawning virus in the field.
    - runGeneticCode()
        - evaluate the genetic code of all units in order.
    - updateShop()
        - update the purchasable tile in the shop.
    - updateField()
        - update all the variables in the field.
    - updateObjective()
        - update the remaining objective
- main()
    - use in running games

Parser Classes:

- implements from *Evaluable*
    - class ***Number***
        - **Rep invariants:**
            - **The number must be a nonnegative integer.**
        - number : int
        - eval() : int
            - Return the value of the number.

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- class **Identifier**
  - **Rep invariants:**
    - **The identifier's name must not be a reserved word.**
  - binding : Map<String, int>
  - identifier : String
  - eval() : int
    - Return the value of the variable.
- class *BinaryArith*
  - **Rep invariants:**
    - **Division or Modulo by zero is not allowed**
  - leftEval : *Evaluable*
  - rightEval : *Evaluable*
  - operation : String
  - eval() : int
    - Return the result of the mathematical operation between two expressions.
- class ***SensorExpression***
  - command : String
  - direction : String // If *nearby* is parsed.
  - eval() : int
    - Return the value of the direction obtained by command.
- class ***RandomValue***
  - eval() : int
    - Return the random value between 0 - 99.

- implements from *Executable*
  - class ***BlockStatement***
    - **Rep invariants:**
      - **statements can have zero or more *Executable***
    - statements : List<*Executable*>
    - execute()
      - When executed, execute all statements in the block.
  - class ***IfStatement***
    - trueStatement : *Executable*
    - falseStatement : *Executable*
    - expression : *Evaluable*
    - execute()
      - When executed, check the condition to choose what statement will be executed next.

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- class ***WhileStatement***
    - statement : *Executable*
    - expression : Evaluable
    - execute()
        - When executed, execute the statement until the value of expression is zero or the loop count reaches 1000 times.
- class ***AssignmentStatement***
    - identifier : String
    - expression : *Evaluable*
    - bindings : Map<String , int>
    - execute()
        - When executed, it will assign a value into the variable of that Unit.
- class ***MoveCommand***
    - direction : String
    - execute()
        - When executed , it will make Unit move in the direction specified by the genetic code.
- class ***AttackCommand***
    - direction : String
    - execute()
        - When executed , it will make Unit shoot in the direction specified by the genetic code.

- implements from *tokenizer*
    - class ***Tokenizer***
        - **Rep invariants:**
            - **genetic code must only have alphanumeric character and 11 special characters [+ , - , * , / , % , ^ , (,) , { , } , =]**
        - Used in parsing genetic code.
        - src : String
            - the genetic code
        - next : String
            - store the next token of tokenizer
        - peek()
            - Return the next token.
        - consume()
            - Remove the next token and return it.
        - peek(token : String)
            - Check if the next token is equal to the desired string. If not, throw an error.
        - consume(token : String)
            - Check if the next token is equal to the desired string. If not, throw an error. Otherwise, remove the token and return it.

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- class ***GeneticEvaluator*** **Singleton**
    - **Rep invariants:**
        - **genetic code must be appropriate grammar format**
    - tkz : ***Tokenizer***
    - unit : *Unit*
    - bindings : Map<String,int>
        - to store bindings of this unit.
    - geneticEvaluator : *Executable*
        - This is where you execute genetic code from a Unit.
    - grammar parser method
        - parseProgram() : *Executable*
        - parseStatement() : *Executable*
        - parseCommand() : *Executable*
        - parseAssignmentStatement() : *Executable*
        - parseActionCommand() : *Executable*
        - parseMoveCommand() : *Executable*
        - parseAttackCommand() : *Executable*
        - parseDirection() : *Evaluable*
        - parseBlockStatement() : *Executable*
        - parseIfStatement() : *Executable*
        - parseWhileStatement() : *Executable*
        - parseExpression() : *Evaluable*
        - parseTerm() : *Evaluable*
        - parseFactor() : *Evaluable*
        - parsePower() : *Evaluable*
        - parseSensorExpression() : Evaluable

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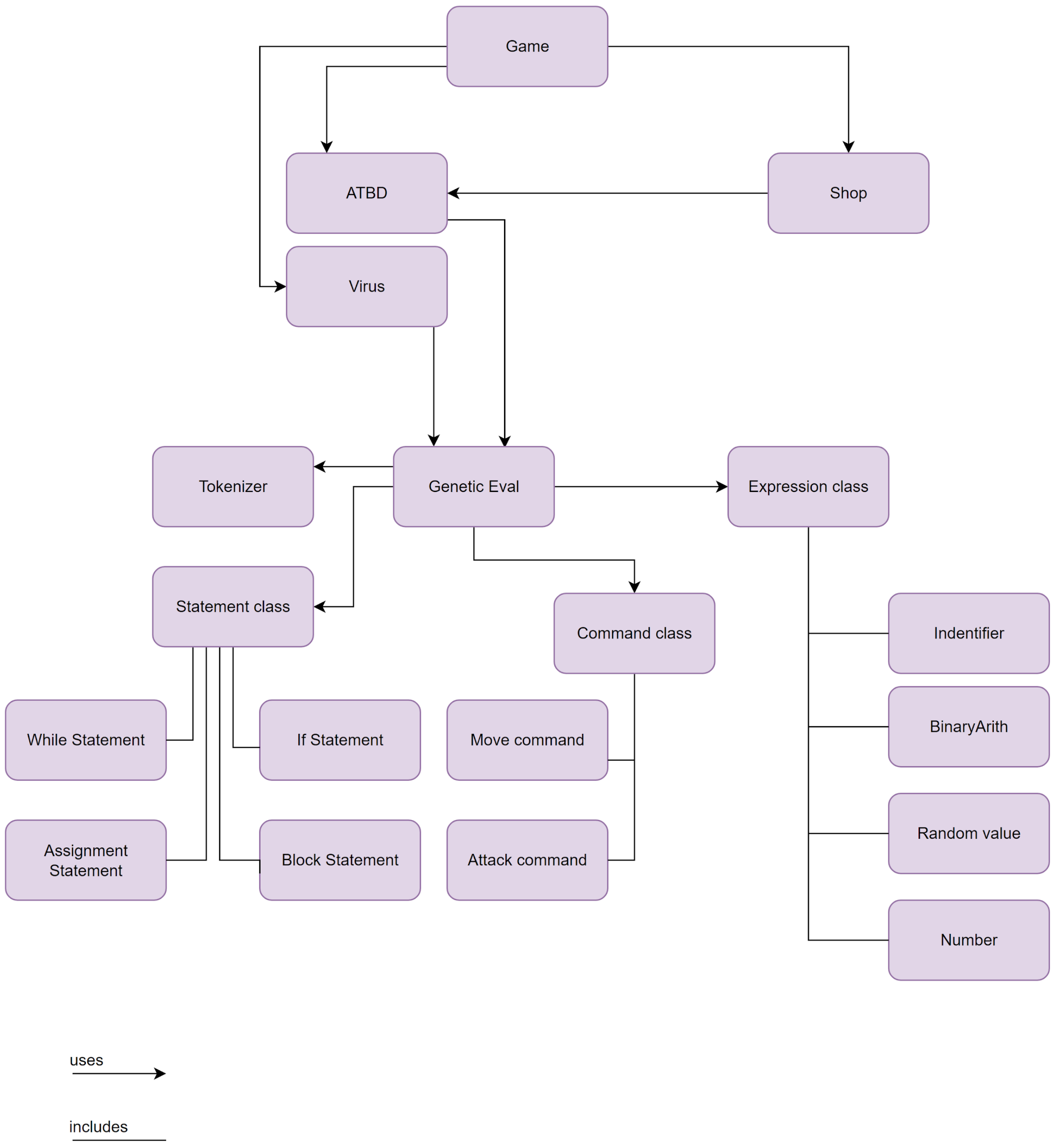
Dependency Graph:



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Key Interfaces:

- Unit (Virus and Antibody)
    - move()
    - shoot()
    - destruct()
    - setterMethod method to modify private field such as setHP()
- token - interface for creating tokenizer for parsing genetic code
    - peek()
    - consume()
- Evaluable - Node in AbstractSyntaxTree for evaluable expression
    - eval() : int
- Executable - Node in AbstractSyntaxTree for executable statement
    - execute()

Design Pattern:

Singleton - use with object that only need 1 instance
=> class Shop , class Game , class GeneticEvaluator

Observer - use with object's method that need to communicate
move(),destruct() in Unit

State - button in frontend since they have state for example toggling

- ## Code Design:
    - Data Structures
        - Pair<x,y> :to store any two data that need to use at the same time
        - List<> : to store data that need to be store/use with order which is the ***Unit***
        - Array[][] : to store ***Unit***; representing their position in the field
        - Map<> : to store the word mapped to value , used to get the value of variable in genetic code
    - Design Goal and Trade-off
        - Our team wants to make the game "simple" so the implementation will be quite straightforward and easy to understand. But, the implementation and runtime may be inefficient in some cases.

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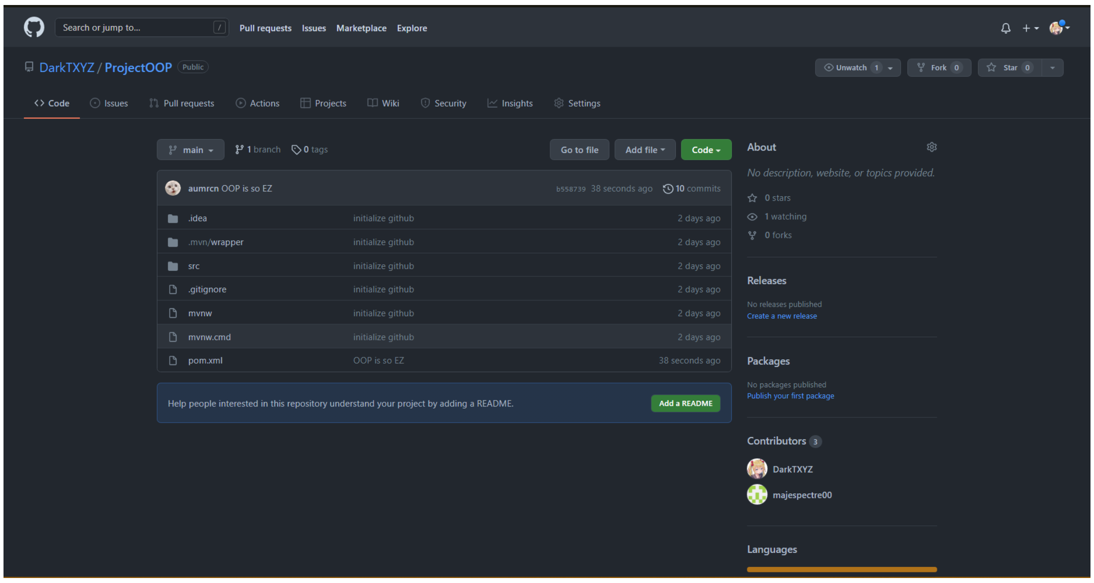
- **Tools:**
    - Display Design : Figma
    - Backend : Java(VScode, IntelliJ)
    - Frontend : Spring Framework , HTML , React
    - Communication : Discord

- **Github Screenshot:**
    - https://github.com/DarkTXYZ/ProjectOOP



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1 branch 0 tags

aumrcn OOP is so EZ b558739 38 seconds ago 10 commits

.idea	initialize github	2 days ago
.mvn/wrapper	initialize github	2 days ago
src	initialize github	2 days ago
.gitignore	initialize github	2 days ago
mvnw	initialize github	2 days ago
mvnw.cmd	initialize github	2 days ago
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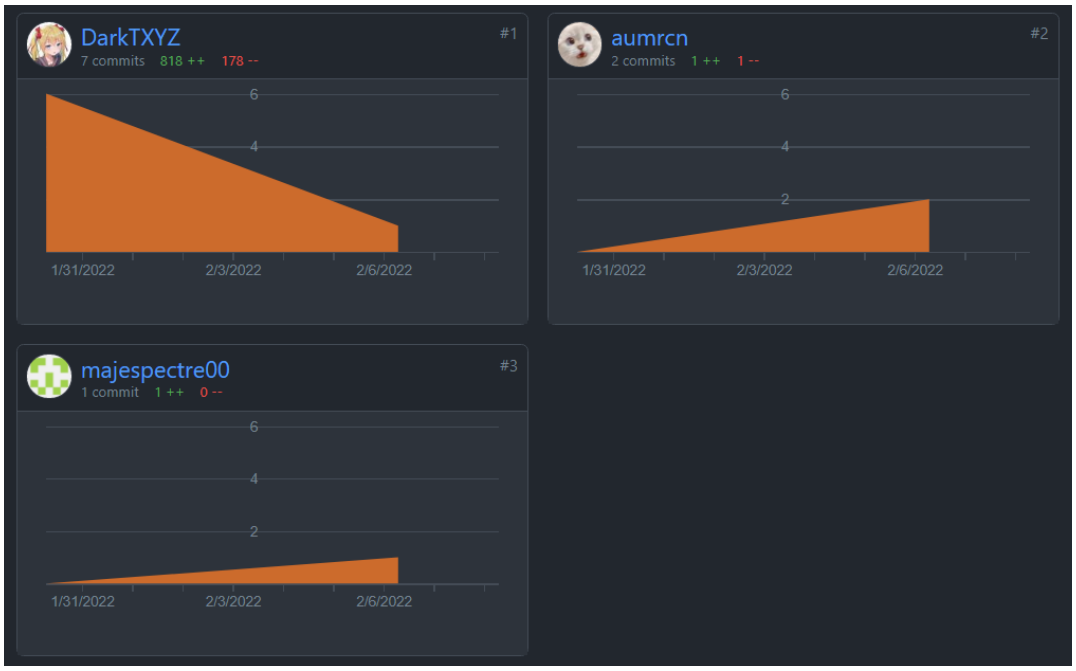
DarkTXYZ
majespectre00

Languages



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- **Testing**
  - Will your test cases have enough coverage of the input space?
    - testing ordinary user inputs. input(function calling) which come from frontend player’s controller we provide such as moving, purchasing ATBD, choosing cell
    - testing from project specification

  - Will your test cases have enough coverage of your code?
    - test all written functions and their branches
    - mostly testing parser and unusual inputs in functions which possibly happen by ***Game*** class
    - Evaluator Testing
      - Input (can detect error and throws an exception)
        - Wrong format/grammar of genetic coding
        - Negative number in genetic coding
        - Use reserved word as identifier
      - Math error from Expression

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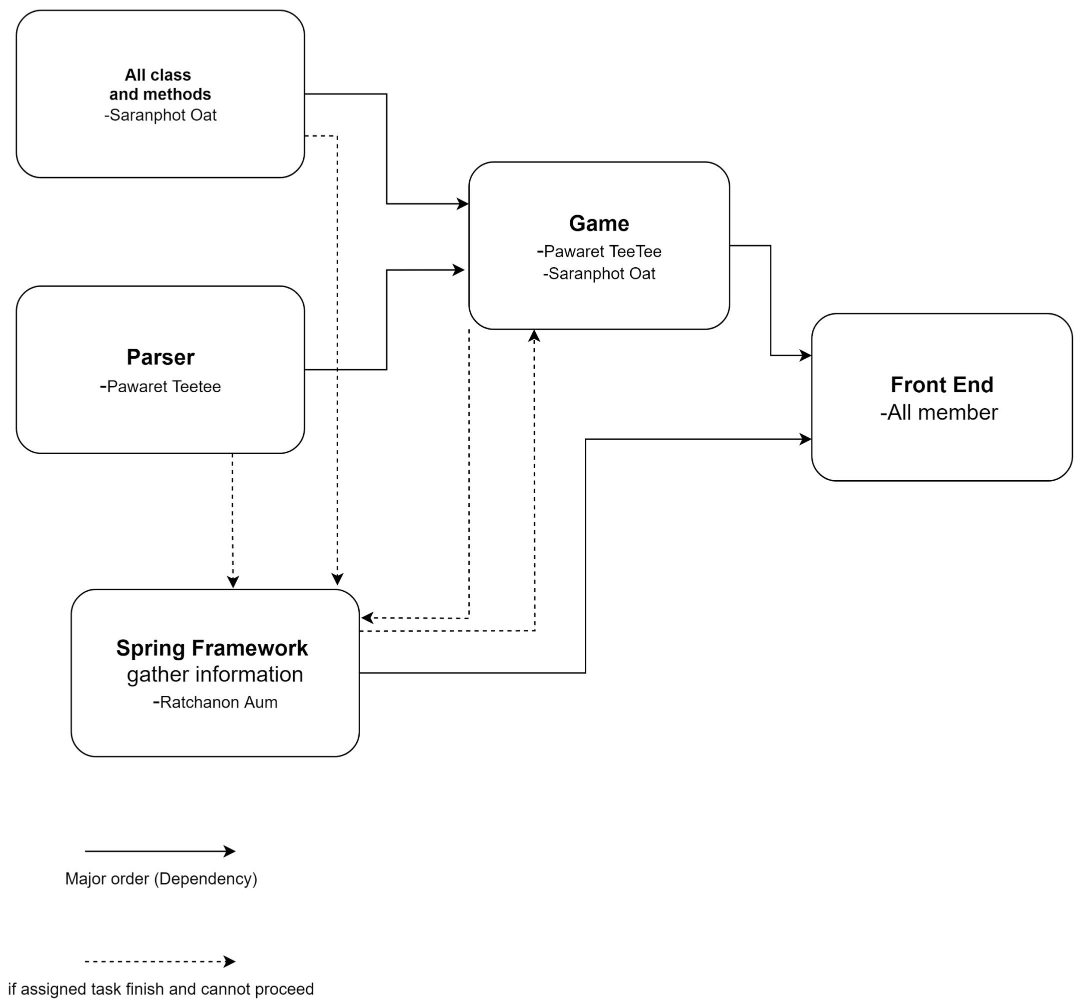
Work Plan:

มีการแบ่งงานให้ 2 ส่วนคือ งาน front-end กับ back-end

- (1 คน) ส่วน Front-end จะไปศึกษาเรื่อง Spring Framework และการใช้งาน
- (2 คน) คนที่ทำงานส่วน Back-end จะแบ่งอีก 2 ส่วน คือ เขียน Evaluator กับ เขียน Class ที่ใช้ในเกม ซึ่งหากมีคนใดคนหนึ่งทำเสร็จแล้ว จะต้องไปช่วยฝั่ง Front-end ก่อน
- เส้นตรง คือ dependency ของงาน คือต้องทำงานที่หางก่อนจึงทำงานที่หัวลูกศรได้
- เส้นประคือในกรณีที่งานหลักของแต่ละคนเสร็จแล้ว อาจจะไปช่วยเหลือตามเส้นประ



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Known problem:

- Frontend Development Problems
    - ไม่แน่ใจ interactions ระหว่าง frontend กับ backend เบื้องต้นเข้าใจว่าเราให้ backend จัดการ process ของเกมทั้งหมด แล้ว frontend ทำการ display ข้อมูลเกมออกมาและรับ input มาให้ backend ทำการ process แต่ frontend จะส่ง input ให้ backend ยังไงนั้นยังไม่ชัดเจน
- Work Time
    - ในกลุ่มของเราได้มีการวางแผนที่จะทำงานให้ทันกำหนดส่ง ดังนั้นหากมีการขยายระยะเวลาการทำงาน จะยังคงทำตามแผนเดิมอยู่ แต่เวลาในส่วนที่เพิ่มมานั้น จะใช้สำหรับตรวจสอบงาน
    - แต่ถ้าเกิดปัญหาขึ้นมาระหว่างการทำงานแล้วทำให้งานล่าช้า เวลาที่เพิ่มมานั้นจะเป็นผลประโยชน์กับกลุ่มของเราเป็นอย่างมาก

Comments:

- How much time did you spend on the design?
    - 20.00 - 01.00 daily
    - ~20hrs
- What advice should we have given you before you started?
    - advices about spring framework or a head start
- What was surprising about the design?
    - At first, we thought the scope of design was small and narrow. But when we design a class, we know that the scope is bigger than we can imagine.
- What was hard about the design?
    - the design 😢 ـิ.ـั

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