Spike: Agent Markmanship
Title: Agent Markmanship

Author: Tran Duc Anh Dang | 103995439

Goals / deliverables:

Create an agent targeting simulation with:

- an attacking agent
- a moving target agent
- a selection of weapons

Be able to demonstrate that the attacking agent that can successfully target (hit) with different weapon properties:

- Rifle
- Rocket
- Hand Gun
- Hand grenade

Technologies, Tools, and Resources used:
List of information needed by someone trying to reproduce this work

- Python 3+
- Built in Python libraries.
- IDE or Code Editor (Visual Studio Code)

Tasks undertaken:
- Install Python: Download and Install Python 3+ via https://www.python.org/downloads/
- Set up a code editor or IDE: Download and install a python compatible ide or code editor such as Visual Studio Code, PyCharm
- Open and familiarize with the code by reading through, paying attention to the comments that had been made.
- Run the code: Execute the code and observing the output.

What we found out:

1. Projectile Class represents a projectile object in the simulation, and it has the following properties and methods:
- Properties:
  world: the world in which the projectile exists
  weapon: the weapon that fires the projectile
  target_enemy: the enemy targeted by the projectile
  pos: the position of the projectile, represented by a Vector2D object

vel: the velocity of the projectile, represented by a Vector2D object
max_speed: the maximum speed of the projectile
damage: the damage inflicted by the projectile
hit: a boolean representing if the projectile has hit its target

- Methods:
  update(delta): updates the position and state of the projectile based on the given delta
  render(): renders the projectile as a circle on the screen
  detect_hit(): checks if the projectile has hit any enemy, and returns the hit enemy or False otherwise
  calculate(): calculates the initial position, velocity, and maximum speed of the projectile

2. Weapon Class represents a weapon object in the simulation and it has the following properties and methods:

- Properties:
  proj_speed: the speed of the projectiles fired by the weapon
  accuracy: the accuracy of the weapon
  fire_rate: the fire rate of the weapon
  color: the color of the weapon
  fire_rate_tmr: a timer for the fire rate of the weapon
  damage: the damage inflicted by the weapon's projectiles
  projectiles: a list of projectiles fired by the weapon
  agent: the agent holding the weapon
  world: the world in which the weapon exists

- Methods:
  update(delta): updates the position of all projectiles in the simulation based on the given delta
  render(): renders the weapon as a circle on the screen, along with its projectiles
  shoot(target_enemy): creates a new Projectile object targeting a specific enemy and adds it to the list of projectiles

These classes form the basis of a projectile and weapon simulation, allowing for the creation, rendering, and management of projectiles and weapons within a given world.

3. Agent class contains properties and methods related to its agent's weapons as well as its behavior and actions.

- Properties:
  weapon: the current weapon object of the agent
  weapons: a dictionary containing multiple weapon objects with different characteristics
  current_weapon: the name of the agent's currently equipped weapon
  shooting_distance: the distance at which the agent is capable of shooting

- Methods:
  calculate(delta): calculates the current steering force based on the agent's mode (attack or wander) and separation from other objects
  update(delta): updates the agent's state, weapon, and shooting actions based on the given delta
  update_weapons(delta): updates all the weapons in the agent's inventory
  switch_weapon(weapon_name): switches the agent's current weapon to the specified weapon_name if it exists in the weapons dictionary
  attack(): determines the agent's attack behavior based on the closest enemy and the distance and angle to that enemy; returns the force needed to arrive at the target position

The Agent class uses the Weapon class to manage different weapons and their properties, allowing the agent to switch between weapons and control its actions depending on the current mode and target enemy.

Overall, the agent marksmanship simulation demonstrates the ability of an attacking agent to target and hit moving objects with different weapon properties. This project aimed to showcase the agent's capability to use a variety of weapons, including:

Fast moving accurate projectile (Rifle)
Slow moving accurate projectile (Rocket)
Fast moving low accuracy projectile (Hand Gun)
Slow moving low accuracy projectile (Handgrenade)