SWARM INTELLIGENCE IN STARCRAFT 2

DEMONSTRATION

SWARM INTELLIGENCE

Collective behaviour from a collection of animals/insects

Every entity/agent self-contained in a decentralised population

Simple rules to guide every agent

Repulsion and Attraction

StarCraft 2

- Real Time Strategy Game
- Dynamic Environment
- Plethora Of units
- Not a simulation like argos
- Balancing and refining the game since 2010
- Initial StarCraft 1 launch dates back to1998

MOTIVATION AND OBJECTIVES

- No prior work exist regarding swarm intelligence in SC2
- Variety of environments ,building and units

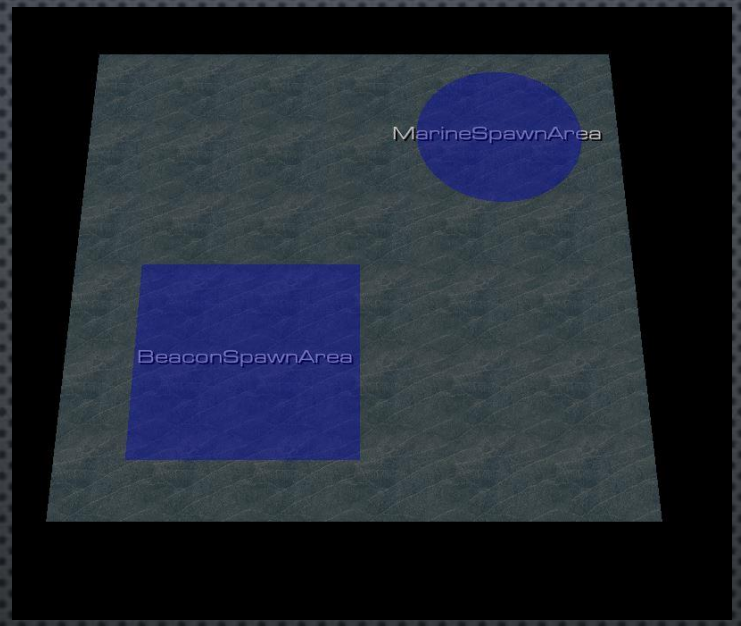
- Try to implement the basics of swarm intelligence (Repulsion and attraction)
- Guided by previous work that focused on a swarm/flock of robots
- Main source of inspiration :
  - Swarm Intelligence in Swarm Robotics https://hal.archives-ouvertes.fr/hal-01405919/document
  - Self-organized flocking with a mobile robot swarm https://hal.archives-ouvertes.fr/hal-01406049/document

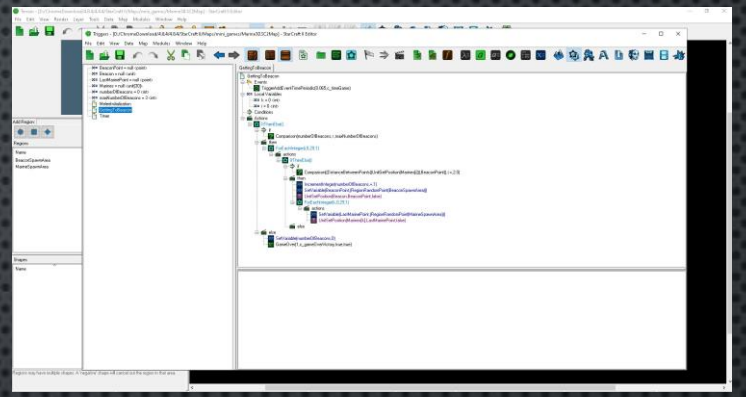
Limitations and Obstacles

- Available APIs are :
  - PySC2 from deep mind(Reinforcement Learning)
    - Agent->Action->Environment->Rewards/Penalty
    - Not direct access to unit actions
  - Python-sc2 adaptation from the official C++
    - C++ api complex concurrency problem
    - Python-sc2 the most stable given starcraft 2 4.0.4 is used

GettingToBeacon

- GettingToBeacon
  - Events
    - TriggerAddEventTimePeriodic(0.065,c_timeGame)
  - Local Variables
    - k = 0 <int>
    - i = 0 <int>
  - Conditions
  - Actions
    - IfThenElse()
      - if
        - Comparison(numberOfBeacons,<,maxNumberOfBeacons)
      - then
        - ForEachInteger(i,0,29,1)
          - actions
            - IfThenElse()
              - if
                - Comparison([DistanceBetweenPoints[(UnitGetPosition(Marines[i])),BeaconPoint)],<=,2.0)
              - then
                - IncrementInteger(numberOfBeacons,+,1)
                - SetVariable(BeaconPoint,[RegionRandomPoint(BeaconSpawnArea)])
                - UnitSetPosition(Beacon,BeaconPoint,false)
                - ForEachInteger(k,0,29,1)
                  - actions
                    - SetVariable(LastMarinePoint,[RegionRandomPoint(MarineSpawnArea)])
                    - UnitSetPosition(Marines[k],LastMarinePoint,false)
              - else
      - else
        - SetVariable(numberOfBeacons,0)
        - GameOver(1,c_gameOverVictory,true,true)





MAP CREATION

StarCraft 2 editor to create the environment

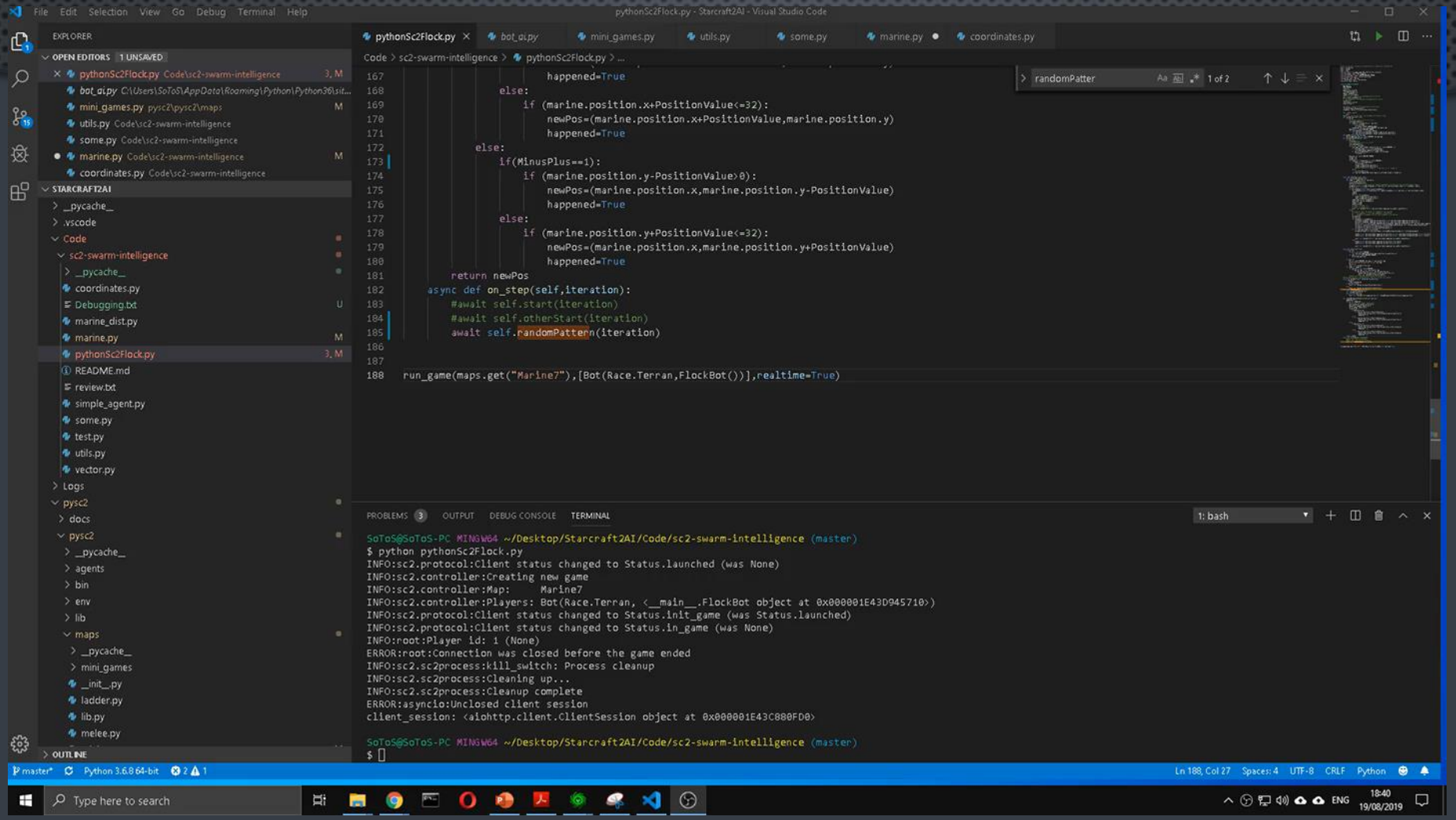
Behavioural loop

- Initialisation phase
  - Sync marines
  - For every marine
    - Find neighbours(based on range or closest)
    - Check marine is not too far from the swarm, join back the swarm
    - Calculate the force of movement based on neighbours
    - Add additional force for informed marines

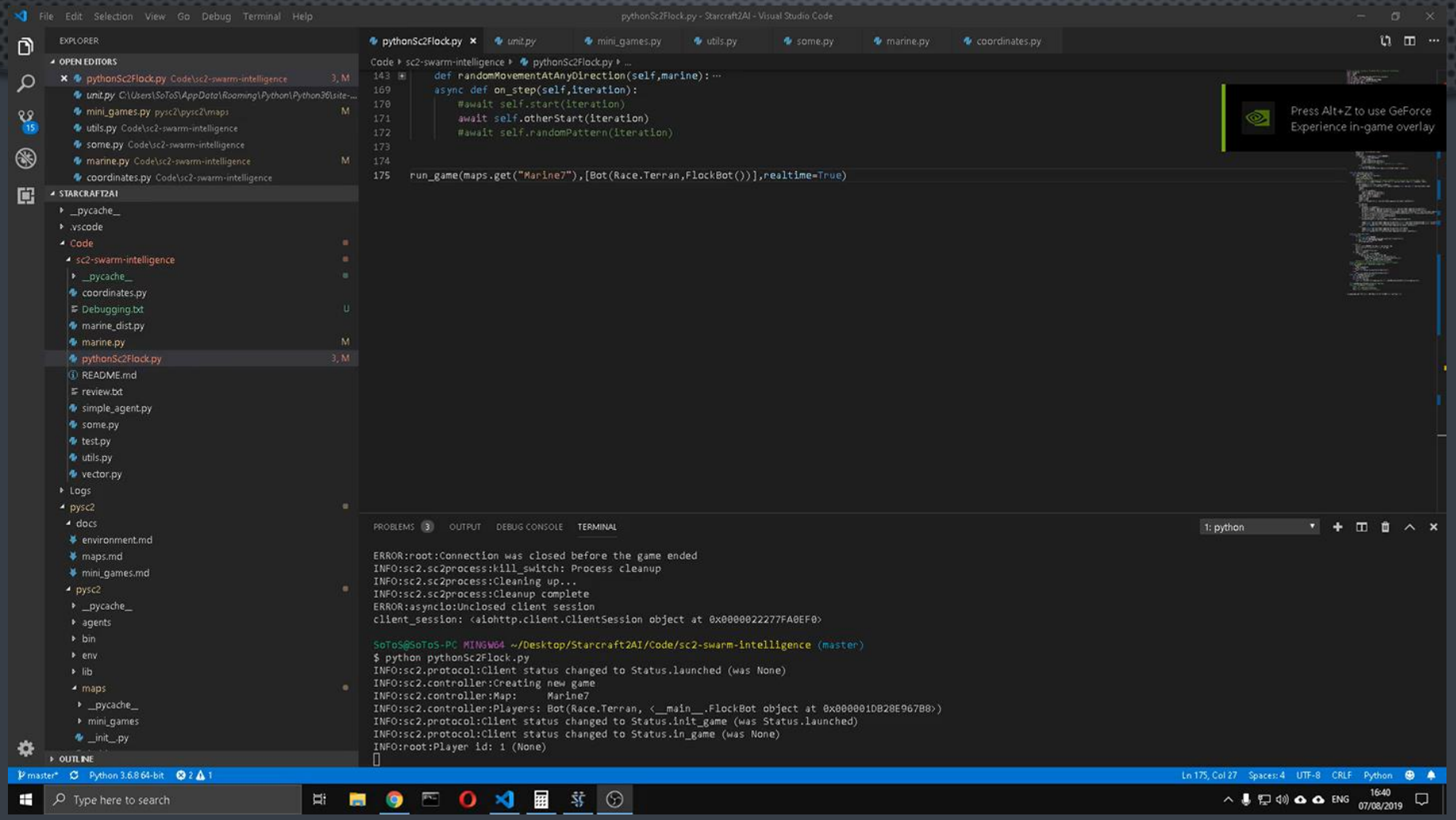
IMPORTANT PARAMETERS

- Population size
- Number of informed
- Amount of neighbours
- Minimum closest neighbours
- Social, individual and elasticity
- Desired distance threshold
- Neighbour radius

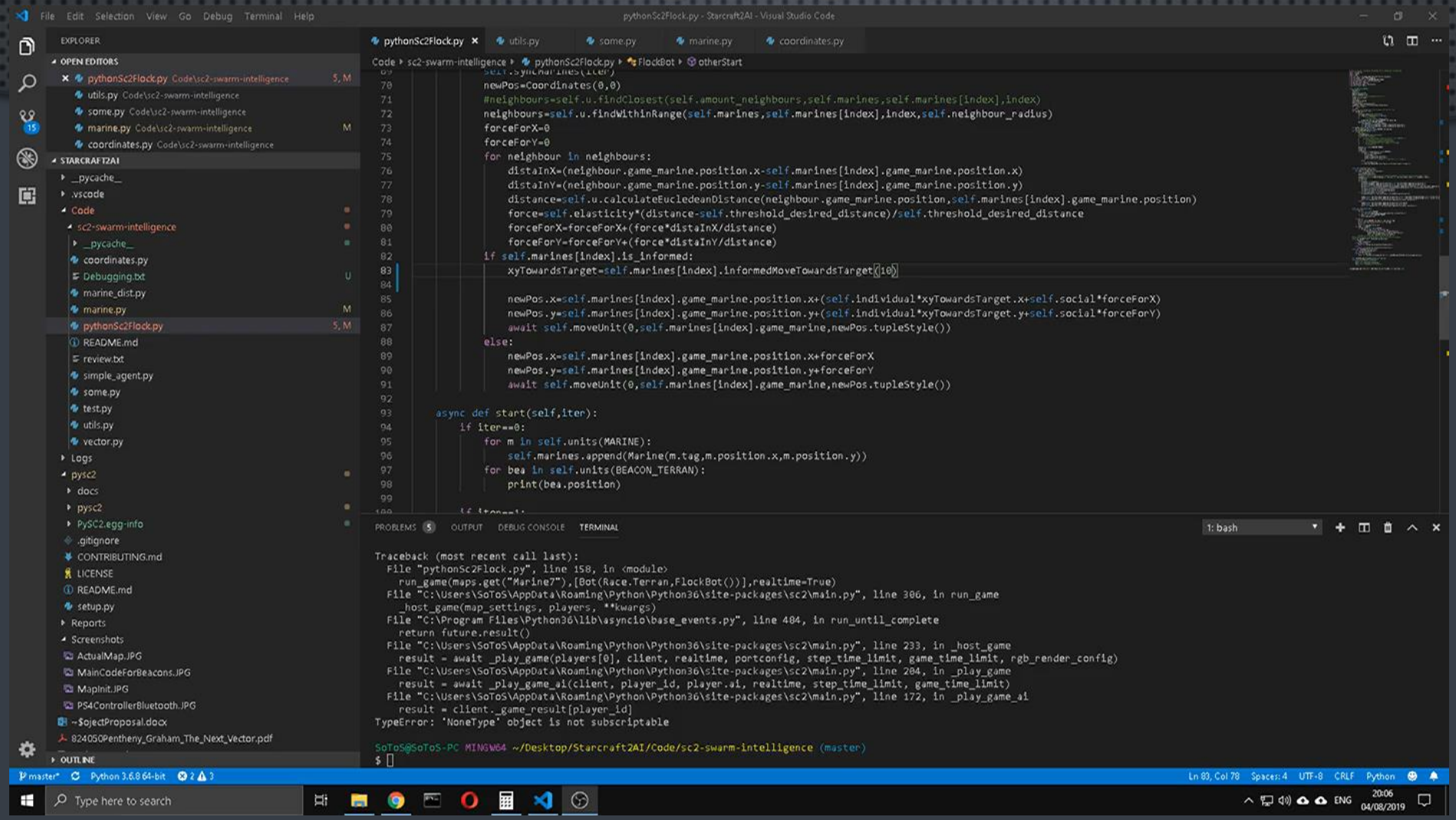
RANDOM MOVEMENT



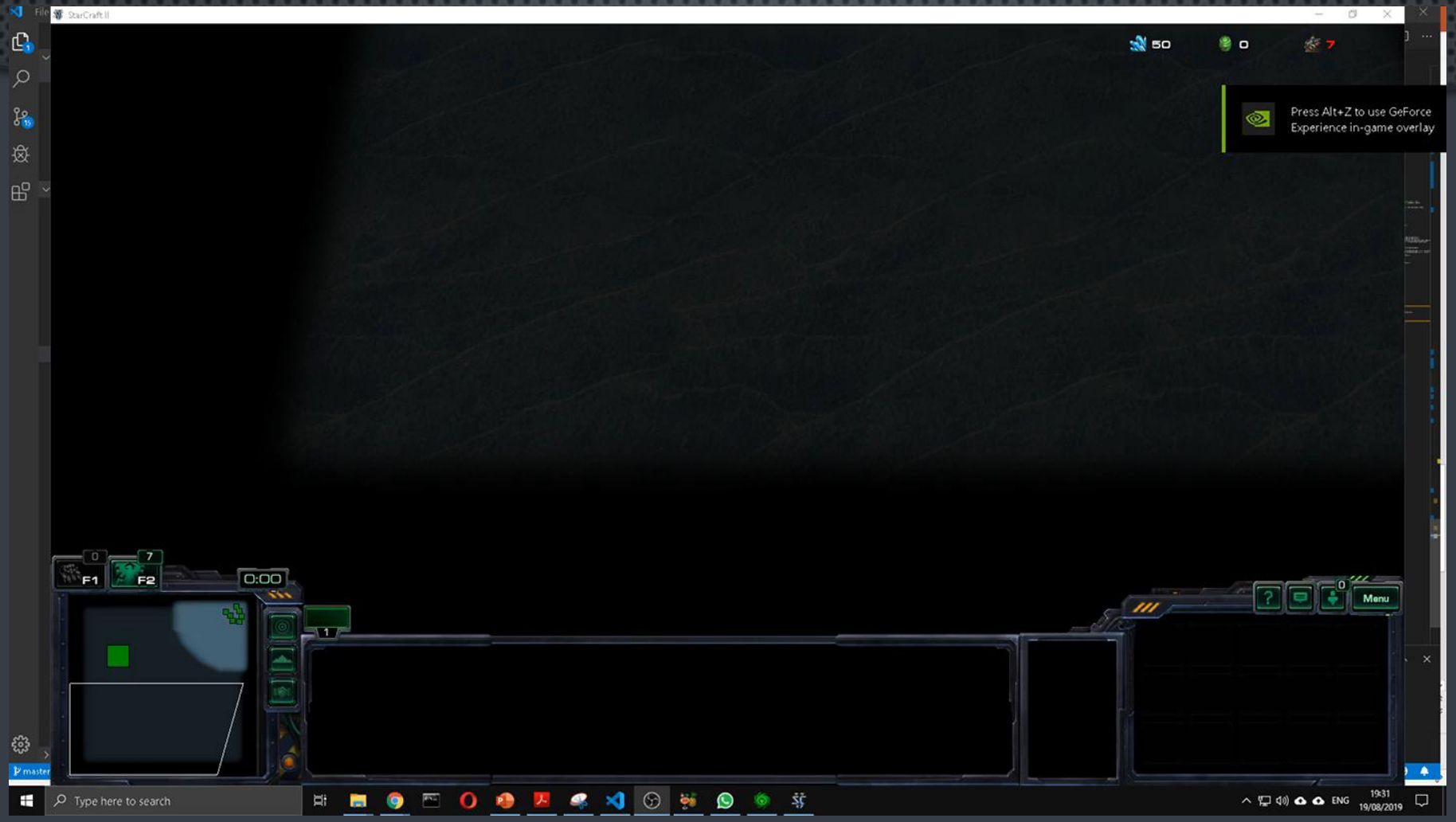
FLOCKING BEHAVIOUR



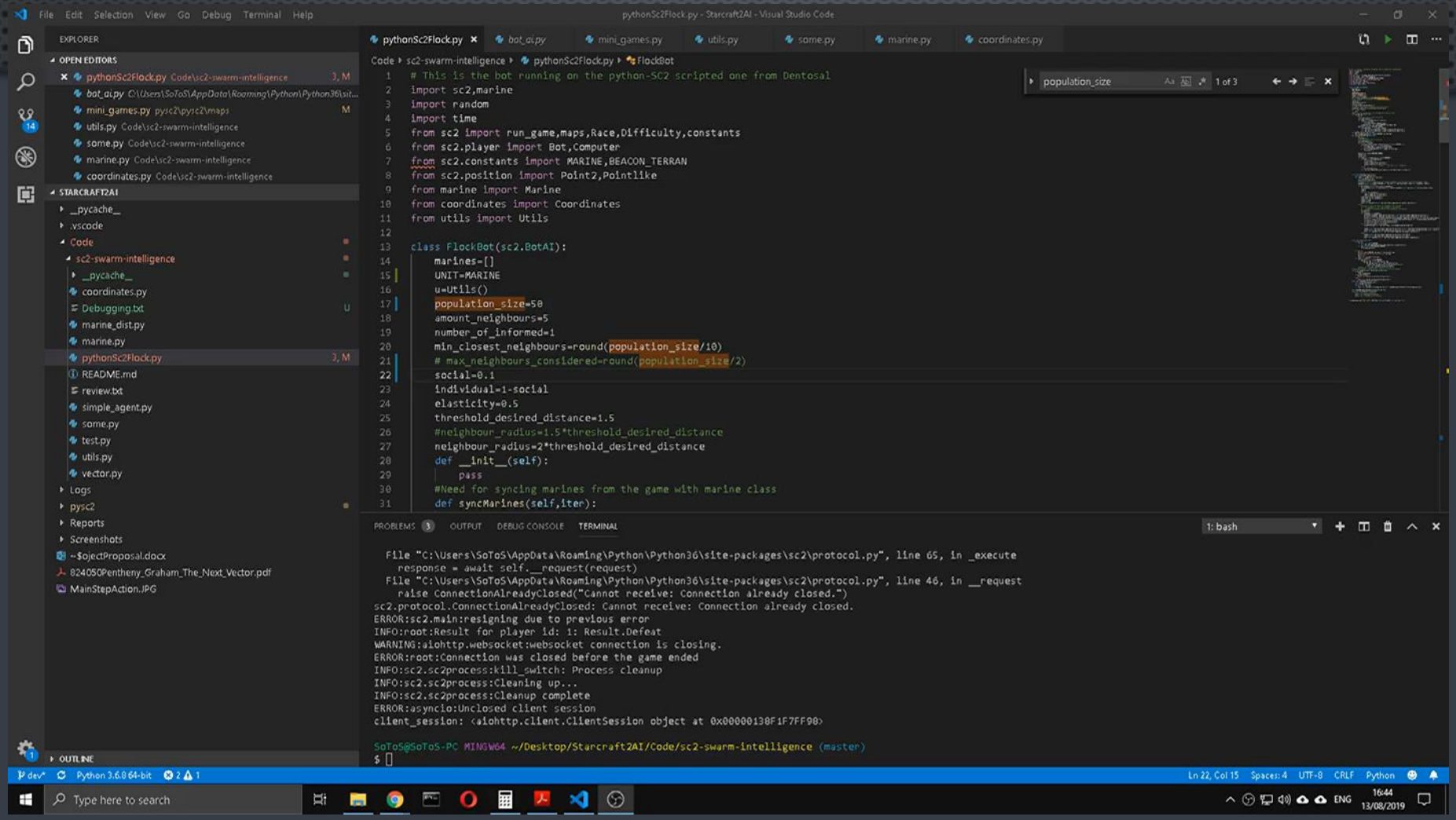
DIRECT MOVEMENT



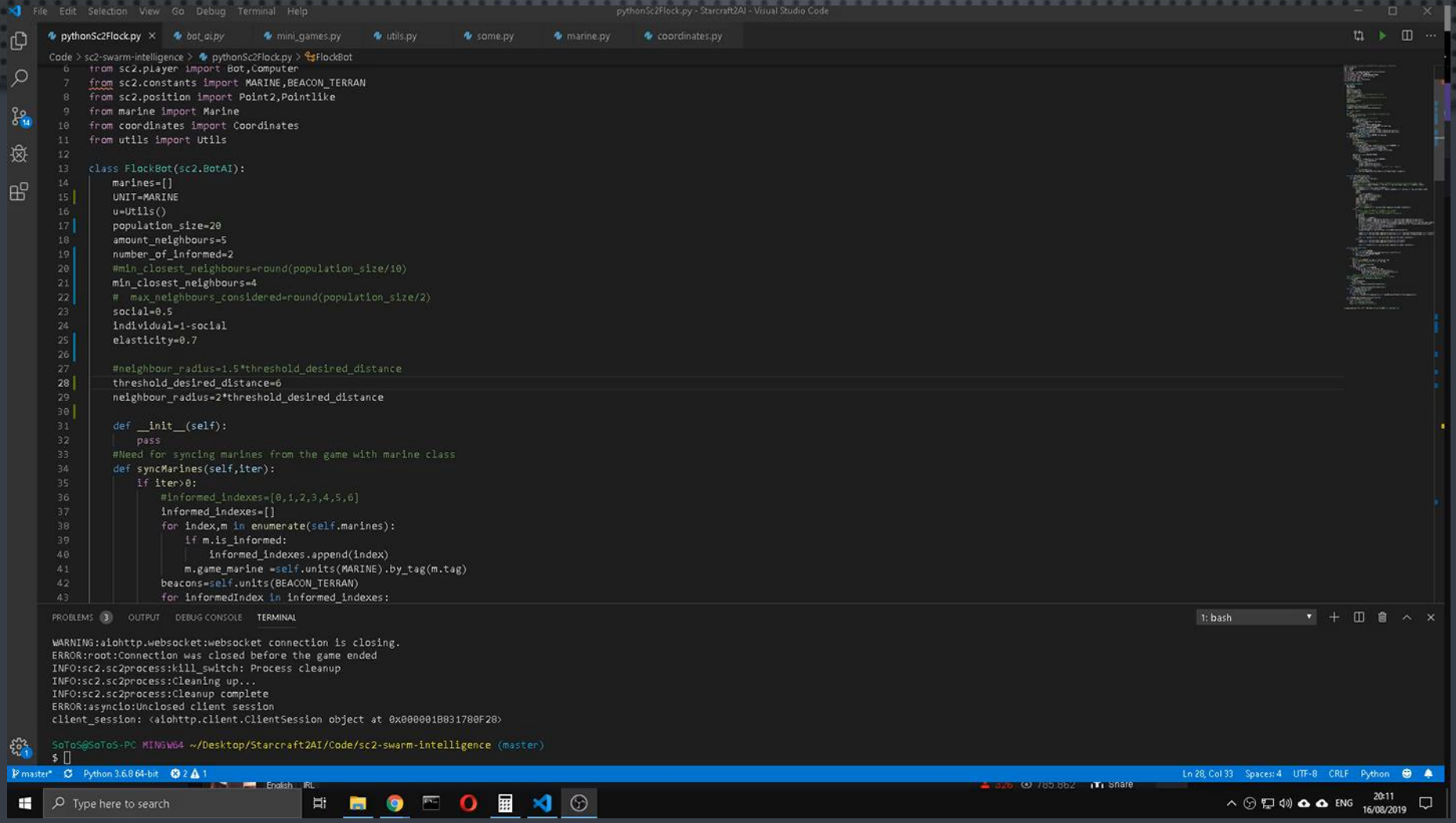
FLOCKING WITH CANNON



FLOCKING IN LARGER NUMBERS



PROPER FLOCKING IN LARGE NUMBERS



Future Work

- Due to parameter tuning pedantic phase can be avoided with evolutionary algorithms that can find a local maximum or even aim for a global maximum
- Identifying a reward/penalty system(time or spread of the flock)
- Modification in the API to provide return values instead of immediate termination

THANKS FOR YOUR ATTENTION

QUESTION TIME