

# Multithreaded AI Bot Arena

Team M&Ms

*Masa Cirkovic*

*Mete Harun Akcay*

## Project Goal

The objective of this project is to build an AI Bot Arena in C++ where multiple bots—each with their own strategies and behaviors—compete in a shared environment. The arena will be grid-based (like a simplified game board) where bots can move, attack, defend, or gather resources. This system will simulate real-time interactions among independent agents and showcase concurrent decision-making in a shared world.

## Use of Parallel Computing

Parallel computing is core to this project. Each bot will operate as an independent thread, allowing it to make decisions concurrently with others. The arena will function as a shared environment where bots read the state and attempt to modify it (e.g., moving, attacking another bot). This introduces challenges like thread synchronization and race conditions, which will be managed using mutexes and possibly lock-free data structures. The use of multithreading:

- Allows scalable simulations with varying numbers of bots running in real time.
- Demonstrates how concurrency impacts shared resource management and conflict resolution.
- Improves the simulation's responsiveness and realism.

## Expected Outcome

We aim to produce a fully functioning AI bot battle simulator that:

- Allows multiple bots to compete simultaneously using parallel threads.
- Features turn-based or time-stepped logic where each bot reads/writes to the arena state.
- Demonstrates performance improvements and concurrency control through logging or visual output.

The project will include benchmarking of thread performance and documentation of design challenges encountered while managing concurrent agents in a shared world.