



# Artificial Intelligence Behaviour System for Minecraft

STUDENTS: ALAA SLEEK, SAMUEL KIM, BATINA SHIKHALIEVA



## Motivation

- Minecraft has over **131 million active users** each running more than **300 mob entities** per game
- Mob entities compete for resources and produce **high load** on the Minecraft server
- Optimizing mob behavior **improves** game performance and **reduces** the server cost

## System Overview

- AI Behaviour System **enhances the Minecraft** mobs ecosystem
- AI Behaviour System improves mob **performance** and system **scalability**
- AI Behaviour System allows for **efficient** use of resources



## System Design

The system spans in three main components:

### Biome AI

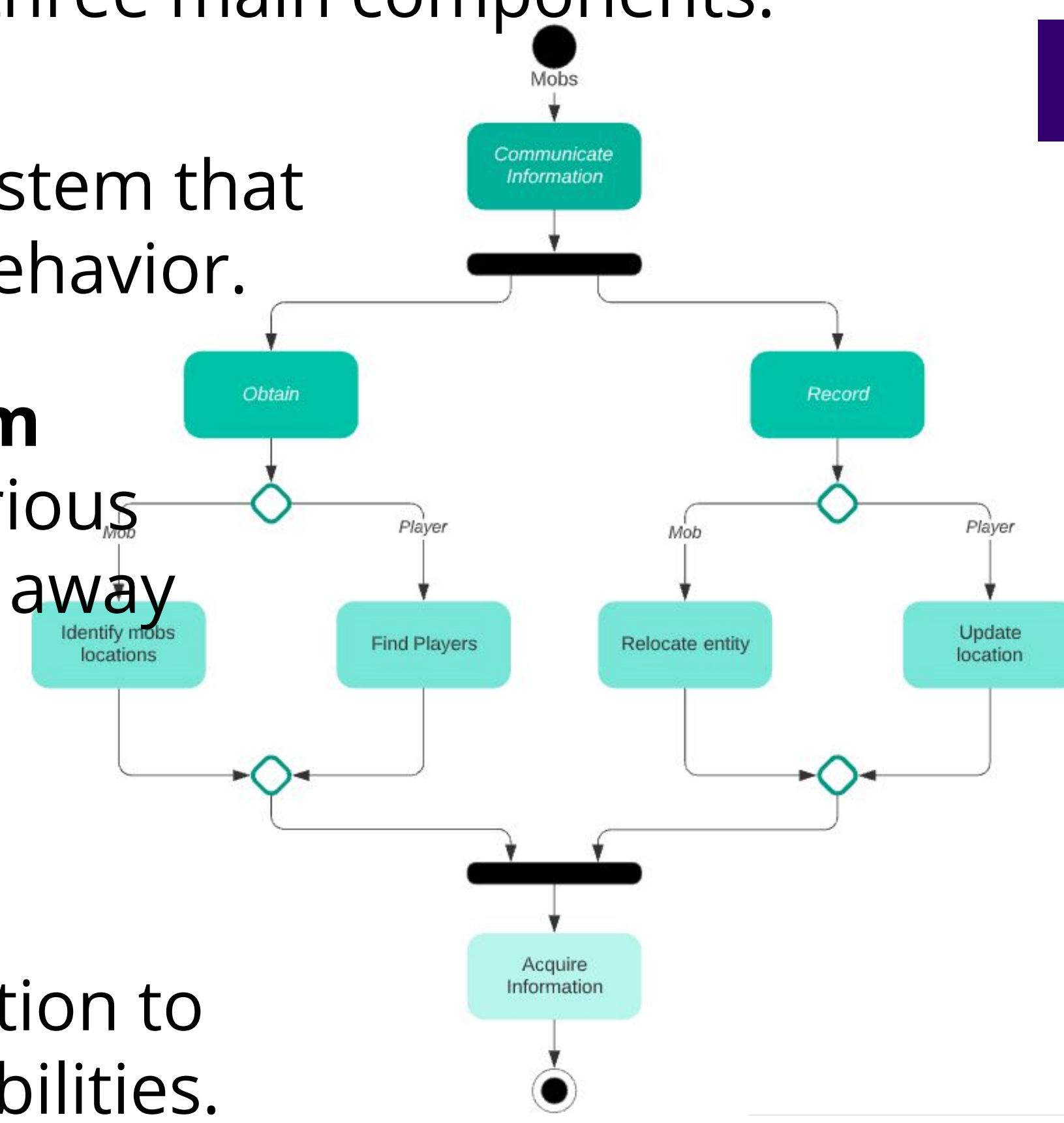
AI communication system that optimizes the mob behavior.

### ECS Behavior System

System to imitate various mobs attack and run away behavior.

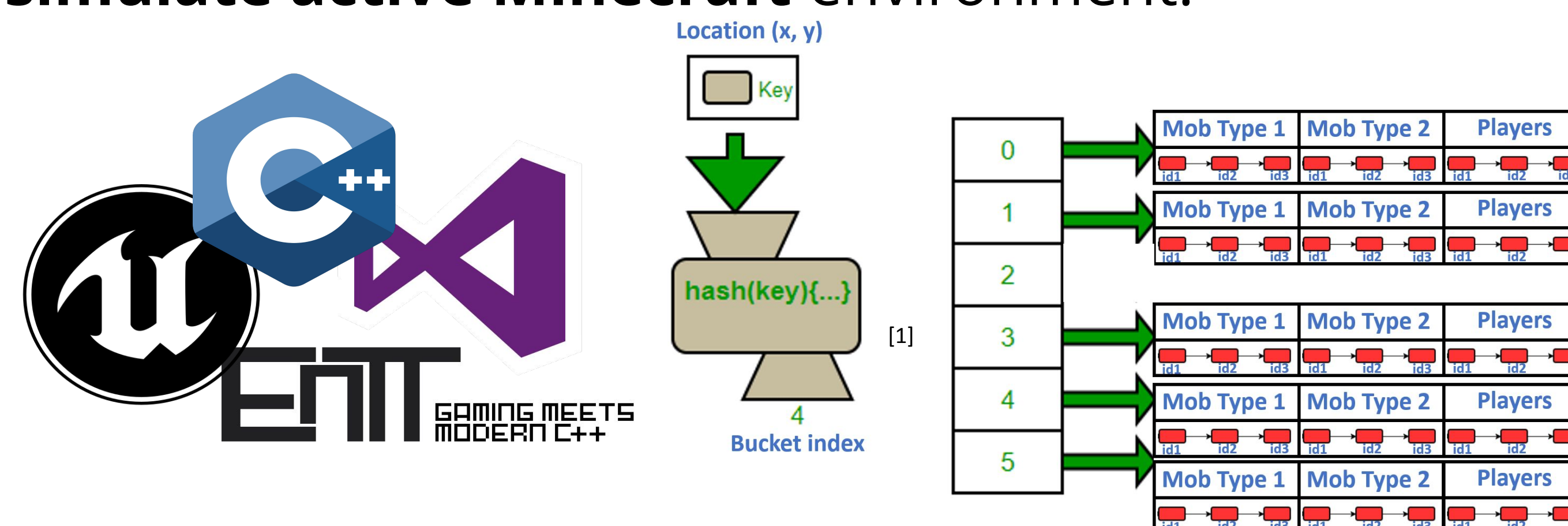
### Unreal Engine Environment

A standalone application to demonstrate AI capabilities.



## System Implementation

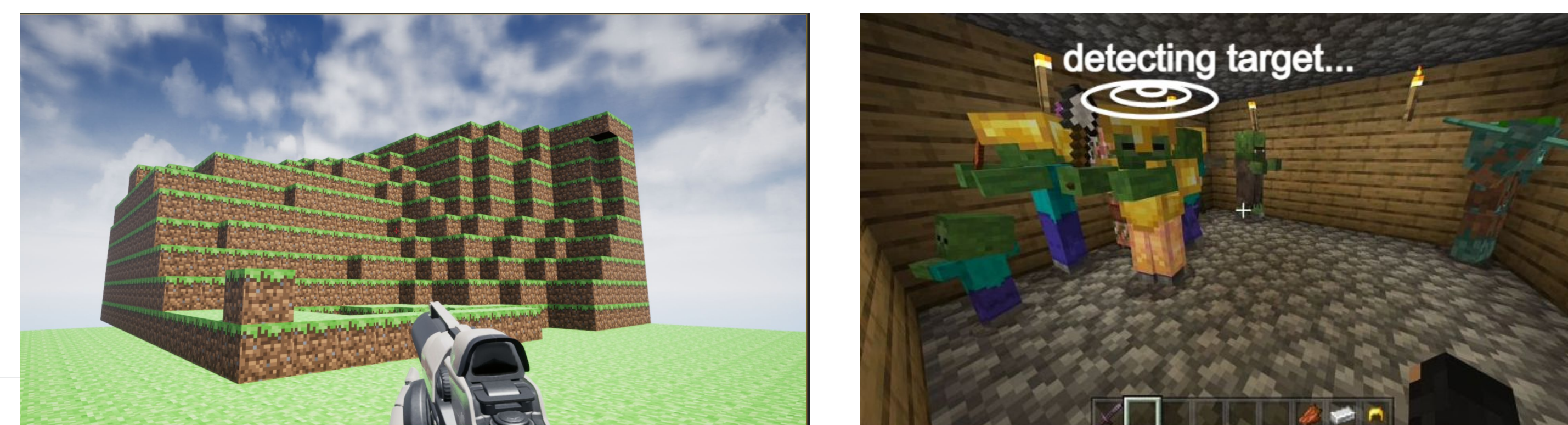
- AI System was built to act as a **communication** tool that stores information about Minecraft world in a single accessible source.
- The AI System acts as an **optimized representation** of the Minecraft entities and allows faster, more efficient approach of detecting the mob target.
- The Minecraft mobs behaviors were replicated with Entity Component System. The system part of ECS represents the behaviors that act upon entities (search for food, attack other entities, run away from enemy, etc) to **simulate active Minecraft** environment.



## Use Cases

Implementation has significant improvements as compared to the existing Minecraft environment. It offers:

- O(1) lookup for mob types in a given world location,
- O(N) mob/player relocation from one place to another,
- O(N) lookup for locations with given mobs type.



## Results

- Solution scales **better than N^2** with increasing mob counts.
- Higher **performance** and **flexibility** for modding.
- Independent and **self-sufficient** system. Implemented as ENT components separate from the current environment.
- The behaviour of mobs is recreated through data-driven mechanisms with the new AI system



## System Future

The future applications of the system:

Integration within MC existing codebase: Minecraft codebase AI assessment:

- Adaptation to the active Minecraft environment
- Estimation of the deployment resources
- Evaluation of the proposed AI algorithms
- Estimation of proposed AI mechanisms use for Minecraft environment

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