Simulation of Human Behavior Through LLM-Based Autonomous Agents

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Introduction

The advent of Large Language Models (LLMs) such as ChatGPT allows for a computer to generate human-like text. Utilizing LLMs, we decided to create a simulation of human interactions and society. However, this requires storing a large and increasing set of memories and repeated calling of an LLM. Doing this through an API costs money, and existing solutions by Park et al. [1] (shown in Figure 1) call the API multiple times every second, costing thousands in the long term. Our goal was to create the simulation while minimizing costs and running the LLM locally.

Methods

As shown in Figure 2, we use a planning system for our simulation. At the start of the day, each agent creates a general plan using the LLM. As each timestamp arrives, a more detailed plan is then developed. Another vital part of the project is the storage of memory. We used a system where every observation is shown, then separated into categories to make retrieval easier. Our project heavily reduces the demand for computing power of LLMs by storing the memories of agents through a database system, reducing the need to query an LLM with all memories for each decision of an agent. By cutting down on the cost of running such a simulation, we allow smaller game developers, scientists, etc. to run such simulations. For our project, we used Ollama hosted locally as our LLM, completely taking away the API cost. For the simulation itself, we used the pygame game engine library in Python.

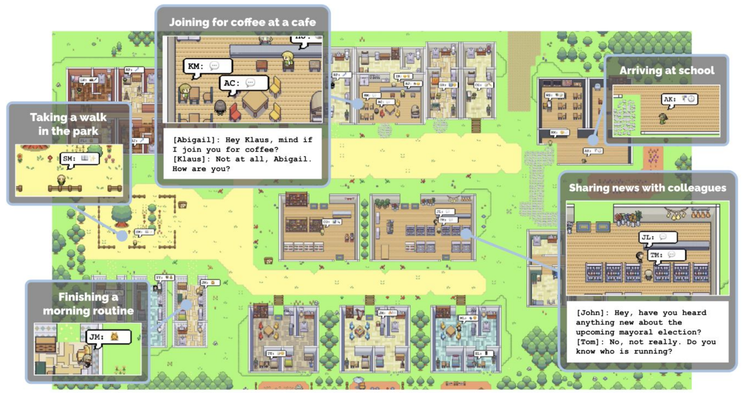


Figure 1. Snapshot of a Simulation of a Town from Research by Park et al. [1]

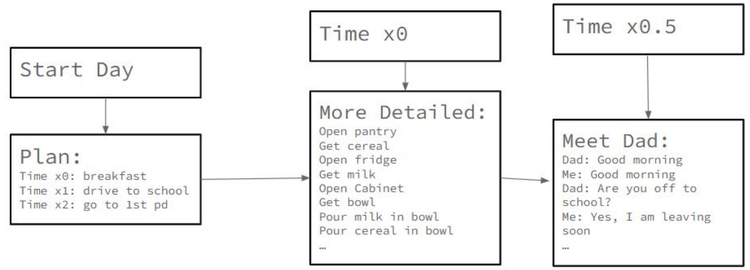


Figure 2. Example Task List Generated for Agent

Experiments and Results

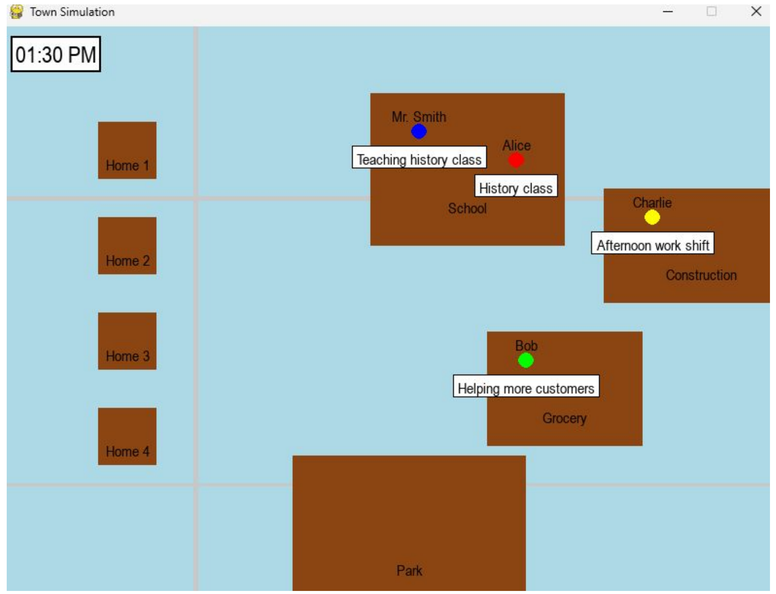
Figure 3 is a snapshot of the simulated town from our project. As can be seen, we were able to simulate a realistic day for a group of four people where they properly carried out on the tasks that they planned. We accomplished our goal of creating a simulation of human behavior and society without any monetary costs. In our demo, we gave the four agents predefined profiles that were provided to the LLM to generate tasks for them to accomplish.

Then, they would move to the locations associated with their tasks at the according times, would interact and have conversations with other agents. In the future, we can implement the simulation with different environments and agents, and also make it more of a game by allowing users to interact in real-time.

Agent Profiles:

Alice: You are a student, and you enjoy playing basketball and video games

Mr. Smith: You are a teacher who teaches math and history, and enjoys reading



Classroom Conversation at 01:30 PM:

Mr. Smith: Today we're discussing the American Revolution. Alice, can you name one cause?

Alice: Was it because of taxation without representation?

Mr. Smith: Excellent! That was indeed one of the main grievances.

Alice: I read about the Boston Tea Party last night.

Mr. Smith: Good preparation! That was a key event leading to the revolution.

Figure 3. Snapshot of Simulation of a Town from Our Demo

References:

[1] Park et. al, https://arxiv.org/pdf/2304.03442