AAMAS 2019 Project Proposal
Group 3

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1. THE PROBLEM

A full restaurant may have its kitchen staff be preparing several dozens of dishes at any moment. With this heavy burden, the staff is going to have to communicate rapidly, effectively, and often make decisions on what dishes to prioritise in order to maximise the kitchen's efficiency. This problem requires agents to move around the kitchen space effectively, while not getting in each other's way. The agents will also have to organize themselves so that each agent can do part of a recipe and still end up with a complete dish. This is useful for optimizing how people are organised in a real-world kitchen, or for hypothetical kitchen robots to be able to cooperate properly and prepare dishes in a real environment where orders come quickly and peak efficiency is required.

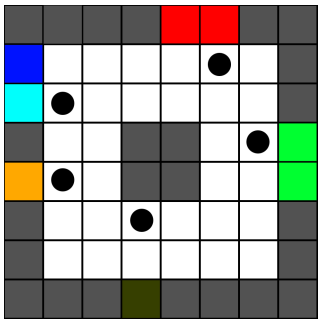

Figure 1: A draft of the system. Dots are agents, light green blocks are ingredients, red are chopping blocks, orange are cooking stations, dark green is a trash bin, and light blue and dark blue are dish preparing stations and dish delivery respectively.

2. PROPOSED SYSTEM

Our system's environment is based on an $N \times M$ sized grid (Figure 1). This grid has cells where agents can move and counters (like a real-world kitchen). These counters may be different types of cells: they may contain different types of ingredients, chopping blocks for cutting them, cooking stations (such as ovens, stoves or deep fryers), dish stations (for preparing the dish itself) and trash bins (for when ingredients become burnt, or a dish is misprepared).

The agents are all cooks, and they have the following sensors:

- Whether it's carrying an ingredient;
- The type of ingredient it's carrying;
- What type of cell it is currently facing (such as the aforementioned ones);
- Alarms (such as burning food in a cooking station);
- The other agents' positions;
- How long ago has the agent started the ongoing tasks (the agent can do other tasks while the food is cooking)

They also have the following actuators:

- Moving forward;
- Rotating;
- Grabbing an ingredient;
- Dropping an ingredient;
- Interacting with a cell (cutting, roasting, frying, boiling, building the plate, delivering the plate, throwing the plate out)

As for evaluation metrics, the overall system will be evaluated by the amount of time it takes the agents to do a set amount of dishes, and how many mistakes they make in that time. We'll analyze this metric by comparing such things as the "staff" size and whether each agent knows where their colleagues are (so that agents can settle conflicts such as moving around or using occupied cells).

3. AGENT/ENVIRONMENT PROPERTIES

The system's agents are autonomous, hybrid (they learn to work in the kitchen better as the time passes), rational, mixed (for example, the agents must react to failures such as burnt food), proactive, sociable, collaborative, mobile. They're not, however, curious , believable, and they don't have personality or veracity.

As for the environment, it is inaccessible, asynchronous (because the agents all move at the same time and don't always wait for each other), non-deterministic, dynamic (due to it being asynchronous), discrete and non-episodic.