Instituto Tecnológico y de Estudios Superiores de Monterrey

Modeling of Multi-Agent Systems with Computer Graphics (301)

Evidence 2. Review 1.

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Campus Guadalajara

- **Team Composition:** Indicate the members of the work team. You must also identify the strengths and areas of opportunity for each of you. As well as your expectations for the block. Subsequently, prepare a brief list of what you expect to achieve and obtain as a work team in this block, as well as your commitments to achieve it.

Name	Strengths	Areas of opportunity	Expectations	Commitments
Anett Martínez Vázquez	Communication Programming knowledge	Lack of experience with graphic engines Lack of experience with simulations	Learn how multi-agent systems work Learn to represent multi-agent systems graphically Improve my teamworking skills	Finish my tasks on proper time Be open to learn new technologies and topics
Sarah Sophia Gutiérrez Villalpando	Programming knowledge and fast learning	Lack of experience with 3D models creation, little knowledge with graphic engines	Learn new skills with blender and strengthen my skills with unity	Finish everything on time, try to meet expectations in the project, and be open to learning.
Annete Montserrat Cedillo Mariscal	Programming knowledge	Lack of experience with 3D modeling softwares	Reinforce my skills in blender and unity	Help the team in everything I can.
Monserrat Morales Cañez	Communication Programming knowledge	Lack of experience with 3D modeling softwares and graphic engines	Learn new things about graphic engines and agent modeling.	Finish everything on time, meet expectations in the project, and be a strong base for the graphic part of the project.

Héctor Ayala Gutiérrez	Programming knowledge and fast learning	Lack of experience with 3D modeling softwares and graphic engines	Learn new things about graphic engines and agent modeling.	Finish everything on time, try to meet expectations in the project, and be open to learning.

- **Creation of Collaborative Work Tools:** You must create a Github repository where all generated documentation and code will be stored, as well as a communication tool among participants.

Github Repository: https://github.com/anettmava/multiAgentSystem.git

Communication tool:

- **The formal challenge proposal must consider:**

Description of the challenge to be developed.

Agriculture plays a crucial role in global food security and even economic stability. However, a large portion of agricultural production is lost annually due to pests, diseases, and plant stress, often caused by the late detection of anomalies in crops. The problem is aggravated by the dependence on manual and visual inspections, the limited availability of trained personnel, and the short harvest windows of high-turnover fruits such as strawberries and cucumbers.

To address this issue, the challenge focuses on the design and simulation of a Multi-Agent System that operates within a virtual greenhouse environment. This system will model the interactions of multiple autonomous agents that collaborate to detect, classify, and respond to anomalies in plants. The goal is to demonstrate how distributed intelligence and coordination among agents can improve the efficiency, precision, and timeliness of agricultural management.

1. Monitoring Agent (Reactive Architecture)

Role and Relationships:
The Monitoring Agent is responsible for continuously observing the virtual greenhouse environment using simulated sensor data (e.g., temperature, humidity, leaf color, and moisture levels). It communicates directly with the Analysis Agent by sending raw or preprocessed data whenever it detects changes that may indicate anomalies.

Architecture Type:
Reactive. This agent responds immediately to environmental stimuli without complex reasoning or planning.

Architectural Components:

- **Perception Layer:** Captures environmental data from sensors and plant indicators.
- **Action Layer:** Triggers alerts or sends the detected data to the Analysis Agent.

2. Analysis Agent (Deliberative Architecture)

Role and Relationships:
The Analysis Agent receives data from the Monitoring Agent and processes it to determine whether the detected changes represent actual anomalies. It uses pattern recognition and predefined rules (e.g., thresholds for leaf color deviation or temperature imbalance) to classify the type of anomaly. Once an anomaly is identified, it informs the Response Agent to take corrective actions.

Architecture Type:
Deliberative. This agent bases its decisions on reasoning and planning processes.

Architectural Components (BDI Model):

- **Beliefs:** Information received from the Monitoring Agent about environmental and plant conditions.
- **Desires:** The goal of accurately identifying and classifying anomalies in crops.

- **Intentions:** The selected actions or decision paths to validate and report detected anomalies.

3. Response Agent (Hybrid Architecture)

Role and Relationships:
The Response Agent is in charge of executing or simulating corrective measures once an anomaly is confirmed (e.g., adjusting irrigation, modifying temperature, or alerting human operators). It interacts with both the Analysis Agent (to receive anomaly reports) and the Monitoring Agent (to verify the effects of its interventions).

Architecture Type:
Hybrid. This agent integrates reactive behavior (to respond quickly to confirmed anomalies) with deliberative reasoning (to plan corrective strategies and evaluate long-term effects).

4. Work Plan

Week 2
Goal: Create the basic structure of the project.

Choose the simulation method (Python scripts, console program, or simple interface). Responsible: Entire team. Estimated effort: 3–4 hours.

Define what information each agent will send and receive. Responsible: Monserrat, Sarah, Hector. Estimated effort: 3–5 hours.

Create a simple 2D map or grid of the greenhouse to represent the plants. Responsible: Annete and Anett. Estimated effort: 4–5 hours.

Expected result of Week 2: We have the simulation method selected, the greenhouse grid ready, and a clear plan for communication between agents.

Week 3
Goal: Build data structures and create the first working agent.

Create the plant data structure (ID, position, health, anomaly status). Responsible: Anett and Annete. Estimated effort: 5–6 hours.

Build the Data Storage and Knowledge Agent that saves plant information and history. Responsible: Hector. Estimated effort: 5–7 hours.

Make a simple version of the Sensor Analysis Agent that can detect example anomalies. Responsible: Sarah. Estimated effort: 4–6 hours.

Expected result of Week 3: The system can save plant information and show when a plant has a possible anomaly.

Week 4
Goal: Add reasoning and information flow between agents.

Create the Prioritization and Reasoning Agent, which decides which anomalies are important. Responsible: Sarah and Monserrat. Estimated effort: 6–8 hours.

Connect the Sensor Agent to the Data Storage Agent and then to the Reasoning Agent, forming a full pipeline. Responsible: Entire team. Estimated effort: 5–7 hours.

Start creating the Notification Agent, which will generate warning messages for workers. Responsible: Annete. Estimated effort: 3–4 hours.

Expected result of Week 4: When the Sensor Agent detects something, the system saves it, analyzes it, and creates a warning message.

Week 5
Goal: Finish all agents, integrate everything, and test the system.

Complete the Notification Agent, creating alerts and small reports with suggested actions. Responsible: Monserrat and Anett. Estimated effort: 4–6 hours.

Connect all agents into one system (Sensor, Storage, Reasoning, Notification). Responsible: Entire team. Estimated effort: 6–8 hours.

Test the simulation with different sample cases and complete the documentation. Responsible: Entire team. Estimated effort: 5–7 hours.

Expected result of Week 5: The complete system detects plant anomalies, stores information, analyzes severity, and informs the greenhouse workers through alerts or reports.