IoRT multi-agent for assistive homes: First Test

F. A. O. Mota[1], C. B. da Silva[1], E. A. B. Huayhua[1], B. M. Portela[1], E. Rohmer[1]
[1]Dept. Computer Engineering and Industrial Automation, FEEC, UNICAMP

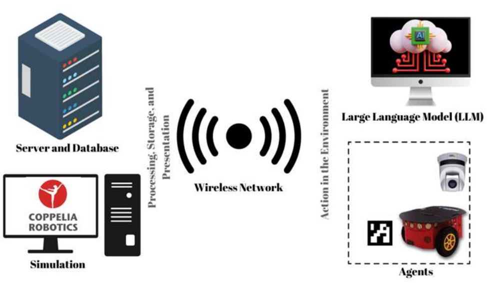
Introduction: The deployment of a multi-agent solution consists of the joint action of agents in a specific environment. Agents must perceive the environment and act based on defined objectives, which determine their actions [1]. Allied with the definitions of Internet of Robotic Things (IoRT), the agents form an ecosystem with local and distributed intelligence, capable of acting on the environment while moving within it [2]. The current project is developed to be applied in assistive homes for the elderly or people with disabilities, and it delineates three types of agents: robotic, human, and IoT. Additionally, a normalization system is used to convert natural language into machine language. The objective of article is to present the structuring and validate the first test.

Materials and Methods: A mobile robot P3DX was used for navigation in the laboratory with the assistance of three AXIS PTZ 214 cameras. The cameras act as IoT agents, while human agents are represented by objects with ArUco tags distributed throughout the space. Everything is managed by a REST server, with agents and the server following predefined standards for communication. The test involved detecting the position of the human agent and navigating the robot in response to the agent's requests.

Results: The environment operates on a Wi-Fi network, where agents use a Large Language Model (LLM) to interpret requests. Actions are executed and visualized in real-time in a simulated environment (Figure 1). The server stores data divided into three databases: agents, rooms, and objects. Agents interact with each other, objects are targets of action, and rooms represent fixed areas. The server allows operations of querying, updating, inserting, and deleting in the database, with security restrictions applied to the rooms. To detect human agents, two cameras were used, positioned inside the room and in the hallway where the robot was. The system accurately detects and identifies agents, mapping their positions correctly in the simulator. The robot's navigation is facilitated by the LLM; upon receiving requests in natural language, the robot moves to the specified location, accurately reflecting the actions in the simulator. In both instances, the communication with the server remained stable.

Discussion/Conclusion: The computational performance or device configuration has not been evaluated yet. However, the proposed framework managed to correlate all present agents and display their arrangement in relation to the environment. The simplified server communication structure facilitates scalable and interoperable work. Therefore, the future goal is to increase the number of agents and incorporate actions for object manipulation, expanding the possibilities for assisted domestic activities.

Figure 1: Organization of the First Test



References: [1] Gomez MA et al., doi:10.1016/j.robot.2018.05.001 [2] Batth RS et al., doi:10.1109/ICCS.2018.00033.