FIRE DETECTION SUPPORTED BY COGNITIVE AGENTS

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SUMMARY

- Introduction;
- Theory Overview;
- Proposal;
- Case Study;
- Results;
- Future Work.

INTRODUCTION

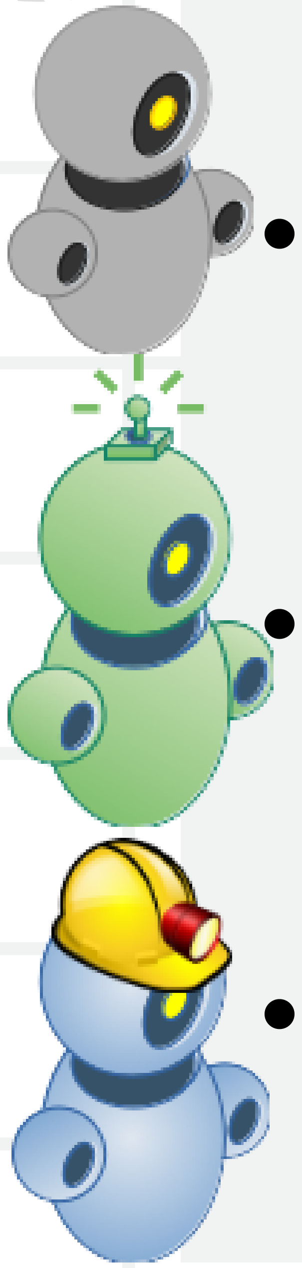
CONTEXT AND MOTIVATION

- Relevance of fire safety in residential, commercial, and industrial environments;
- History of severe incidents in Brazil (Kiss Nightclub, Joelma Building, Gran Circus, etc.);
- 2020 data: More than 700 daily fires in Brazil (SENASP);
- Electrical overload: the main cause of domestic fires (Abracopel).

THEORY OVERVIEW

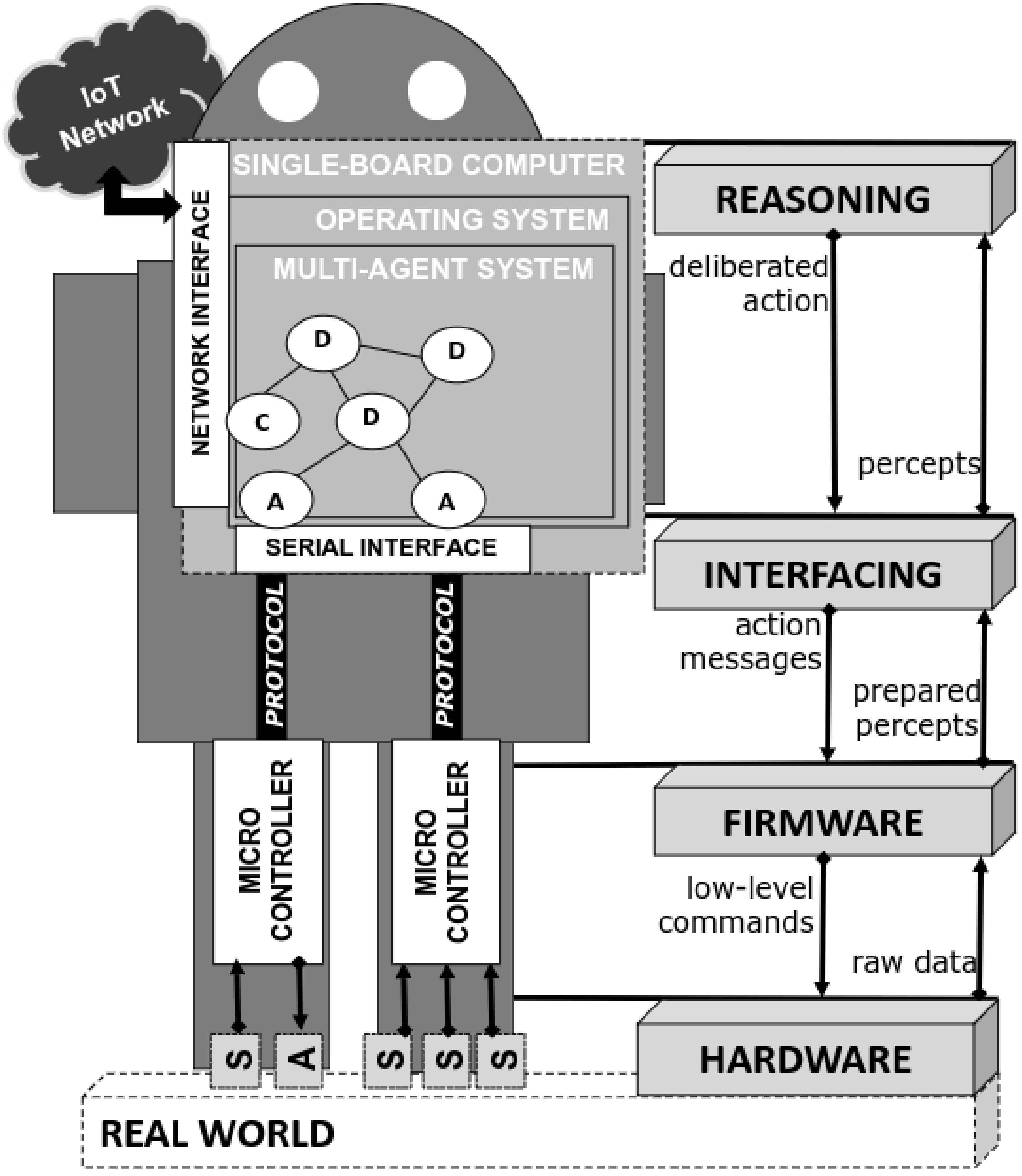
- Multi-Agent Systems and Cognitive Agents;
  - Definition and Types of Agents;
- Embedded MAS and Architecture;
  - Four-Layer Architecture;

THEORY OVERVIEW



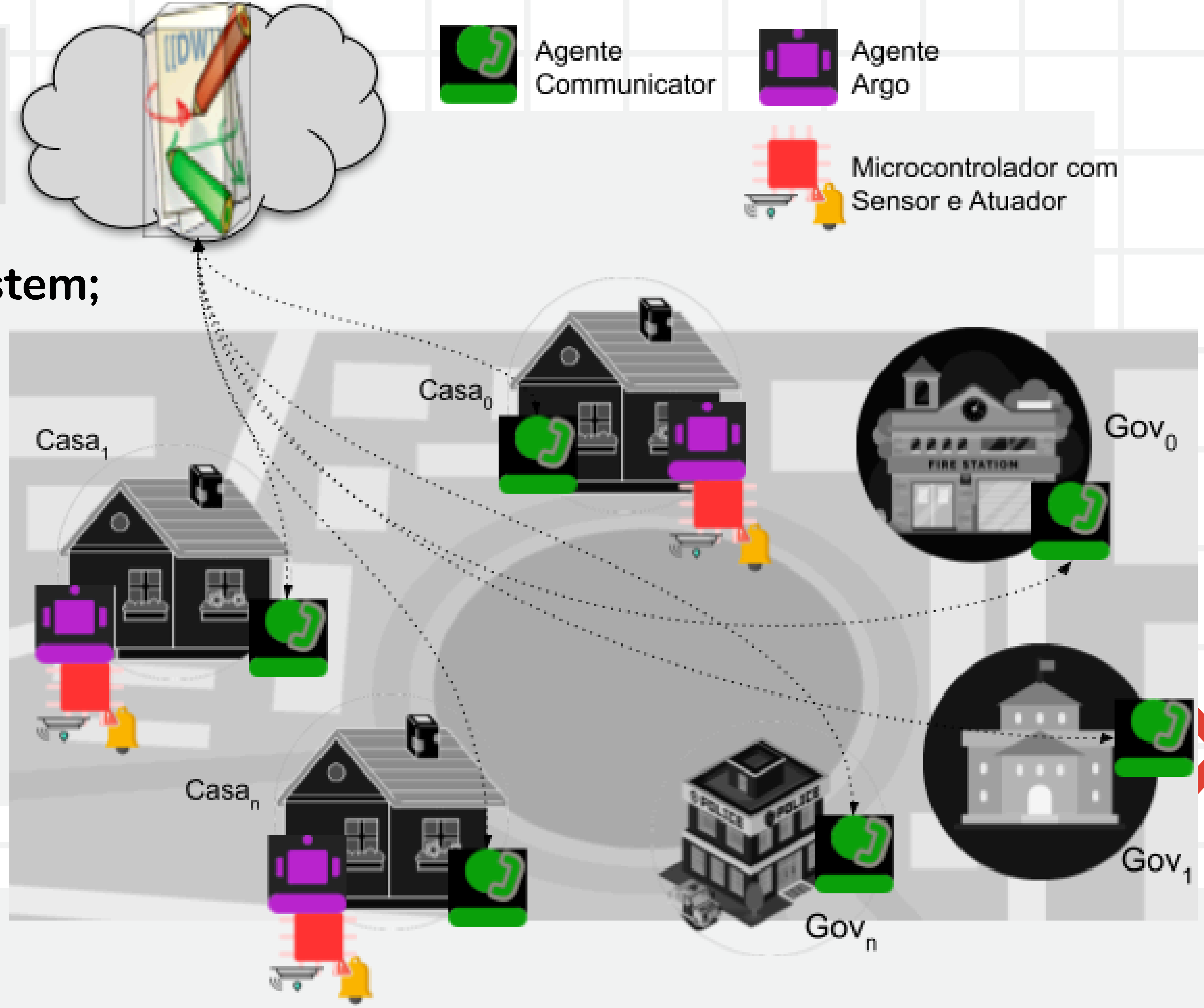
- Jason agent[1] is a common agent that develops its reasoning process based on information provided by the environment, its desires and beliefs, and messages received from other agents.
- Communicator agent[2] is an extension of a Jason agent, with the ability to communicate with agents from other external MAS, in addition to moving to other MAS, through an IoT network.
- ARGO agent[3], in turn, has the ability to manifest itself in the physical environment, perceive information and modify it, via sensors and actuators connected to a microcontroller.

- **Embedded MAS and Architecture;**
    - **Four-Layer Architecture;**



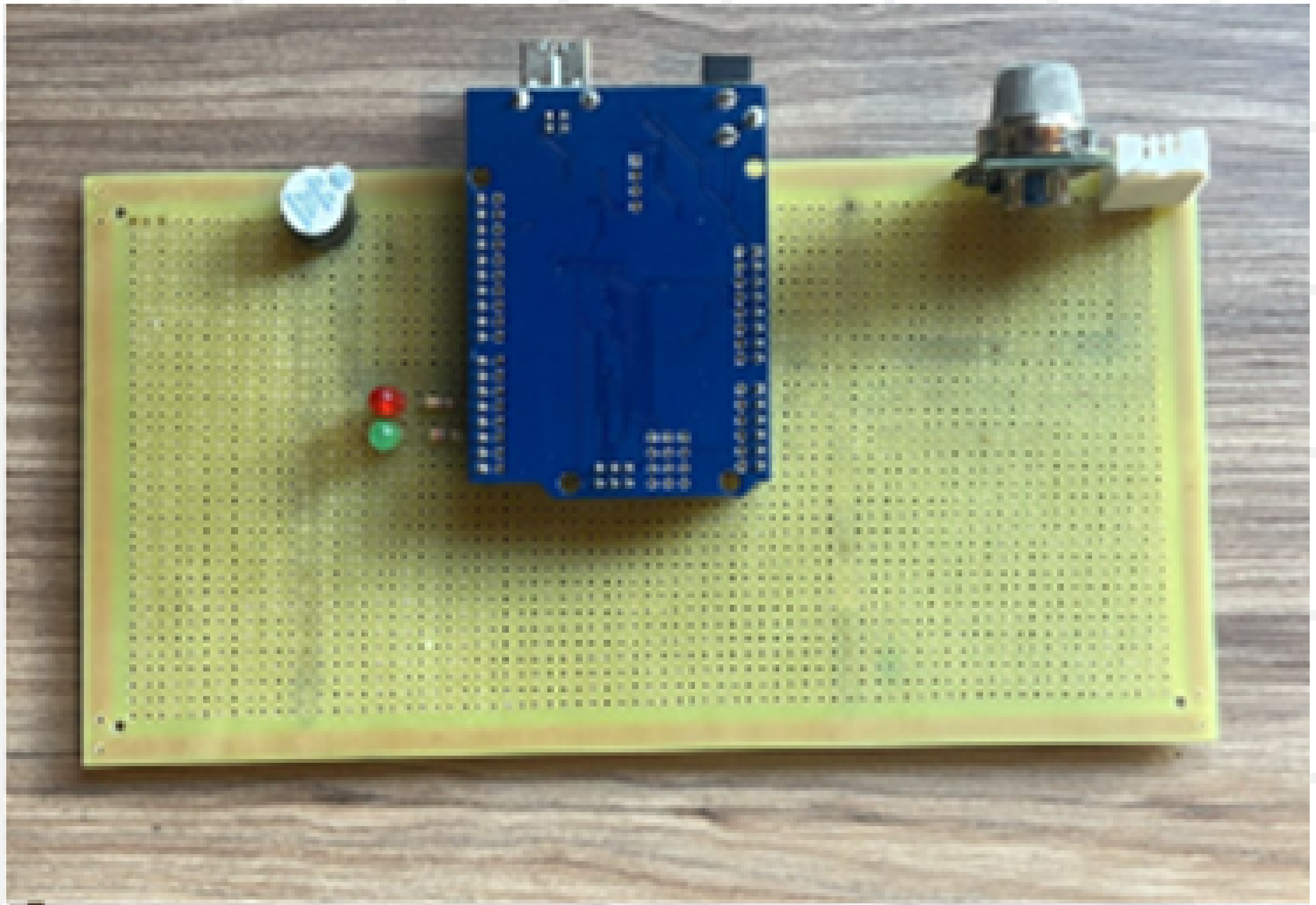
PROPOSAL

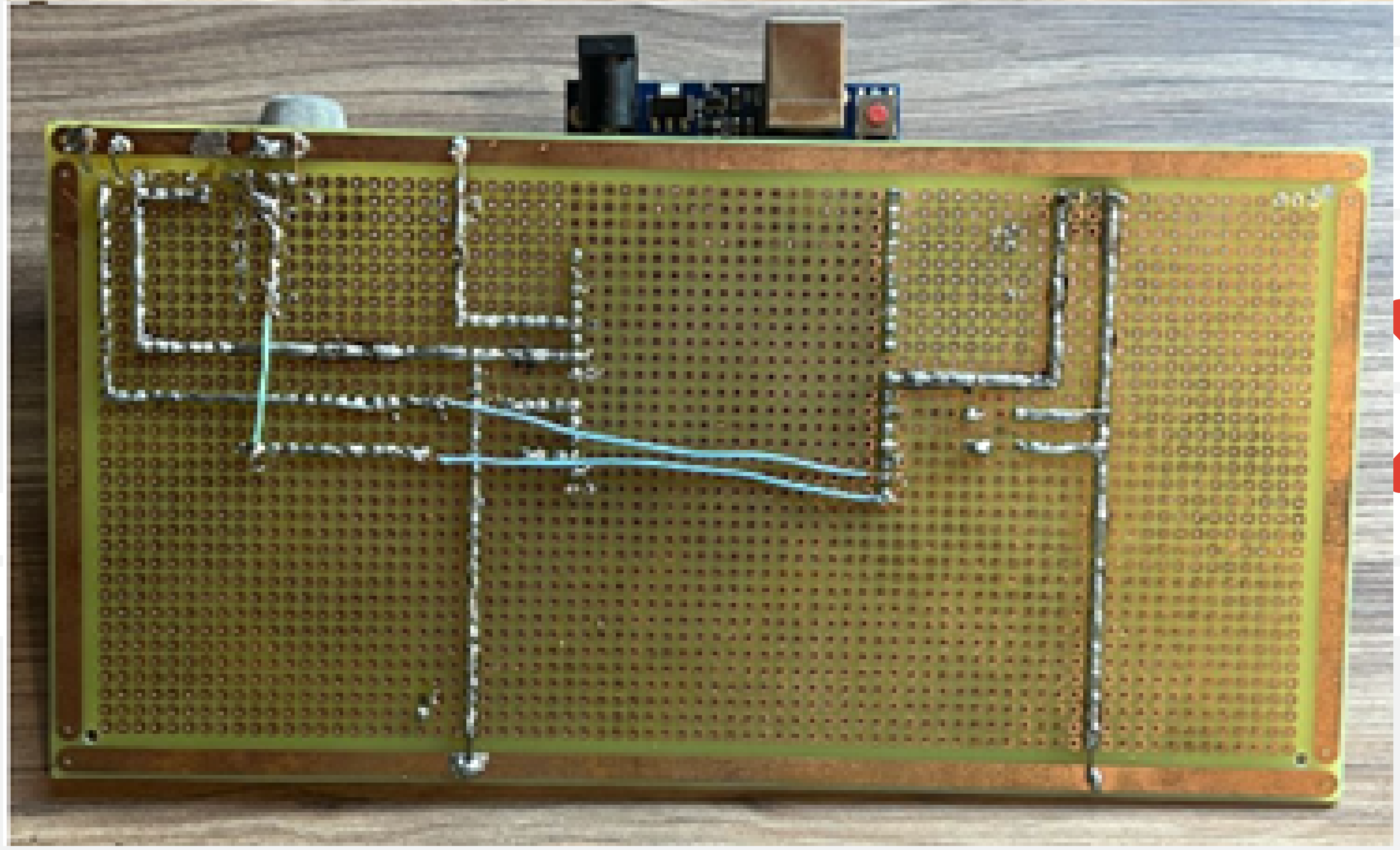
- Fire Monitoring System;
- System Structure:



PROPOSAL

- Embedded MAS in Homes:

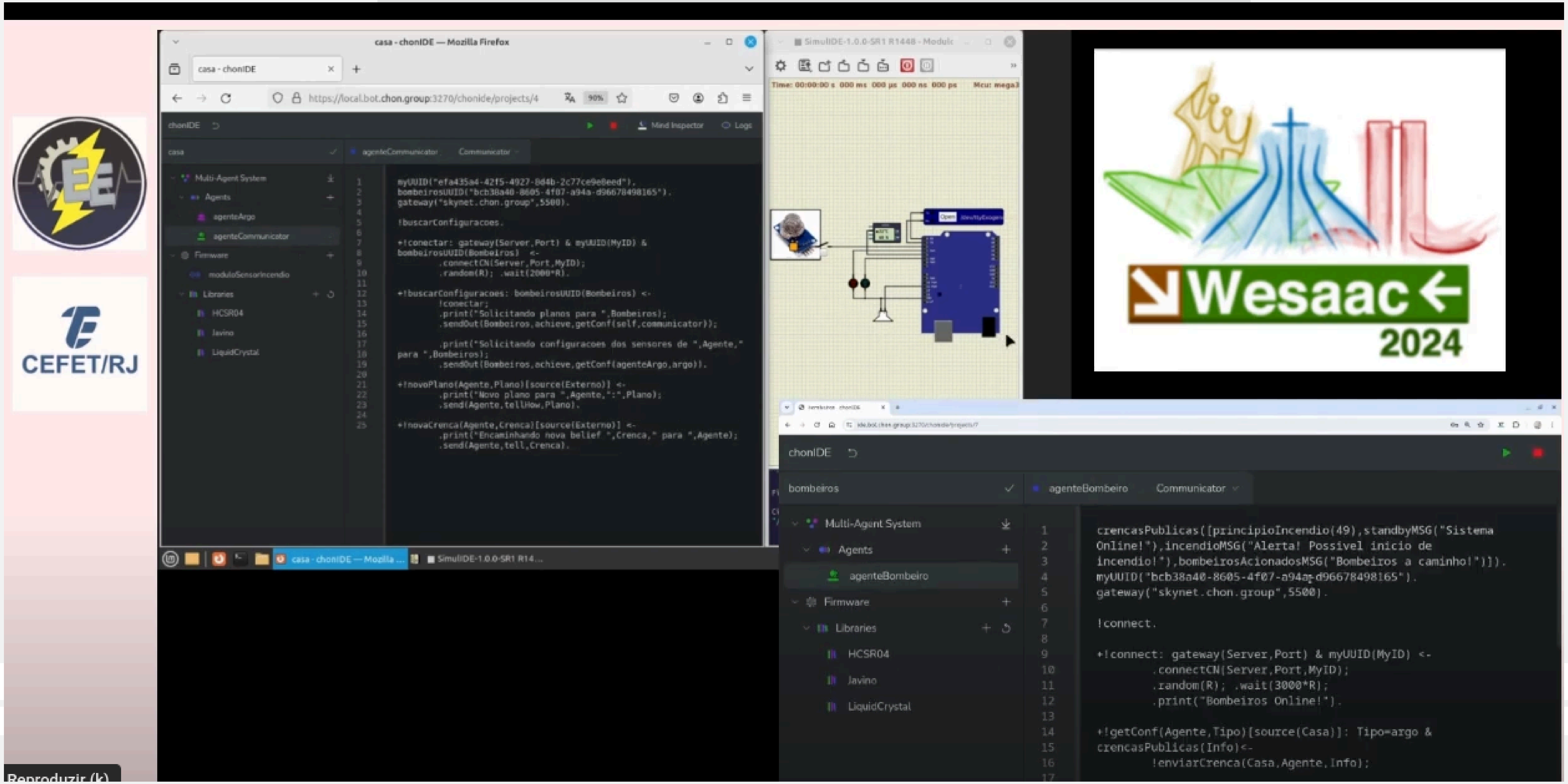




CASE STUDY

- Integration:
  - Home: Embedded MAS with Argo agents (sensors and alarm) and Communicator (alerts to firefighters);
  - Fire Department: MAS with Communicator agent (guidance and response);
- Simulation: Use of two virtual machines for the home and fire department MAS.

CASE STUDY



https://papers.chon.group/WESAAC/2024/deteccaoIncendio/

RELATED PAPERS

In this work, we explore the convergence between fire detection technology and the Artificial Intelligence of Things (AI of things - AIoT) paradigm [Zhang and Tao 2021], through embedded cognitive agents [Pantoja et al. 2016] to identify fire threats and optimize rescue time.

RELATED PAPERS

Unlike [Mahzan et al. 2018] and [Yadav and Rani 2020], we present communication via an IoT network, which allows integration with other cognitive systems running in government agencies, enabling fire detection parameters to be dynamically defined by an authority, without the need for firmware reprogramming.

RELATED PAPERS

Unlike [Perilla et al. 2018], we analyze the technologies that allow the construction of cyber-physical systems using the AIoT paradigm, managed by cognitive agents, capable of perceiving and acting in the physical world. Finally, we aim to demonstrate the potential positive impact of using Multi-Agent Systems (MAS) in fire prevention.

FUTURE WORK

- Exploration of other contexts and applications of the BDI model;
- Utilization of the JasonEmbedded framework and ChonIDE development environment;
- Development of cognitive devices to enhance emergency response systems.