# Maze Discovery using Multiple Robots via Federated Learning

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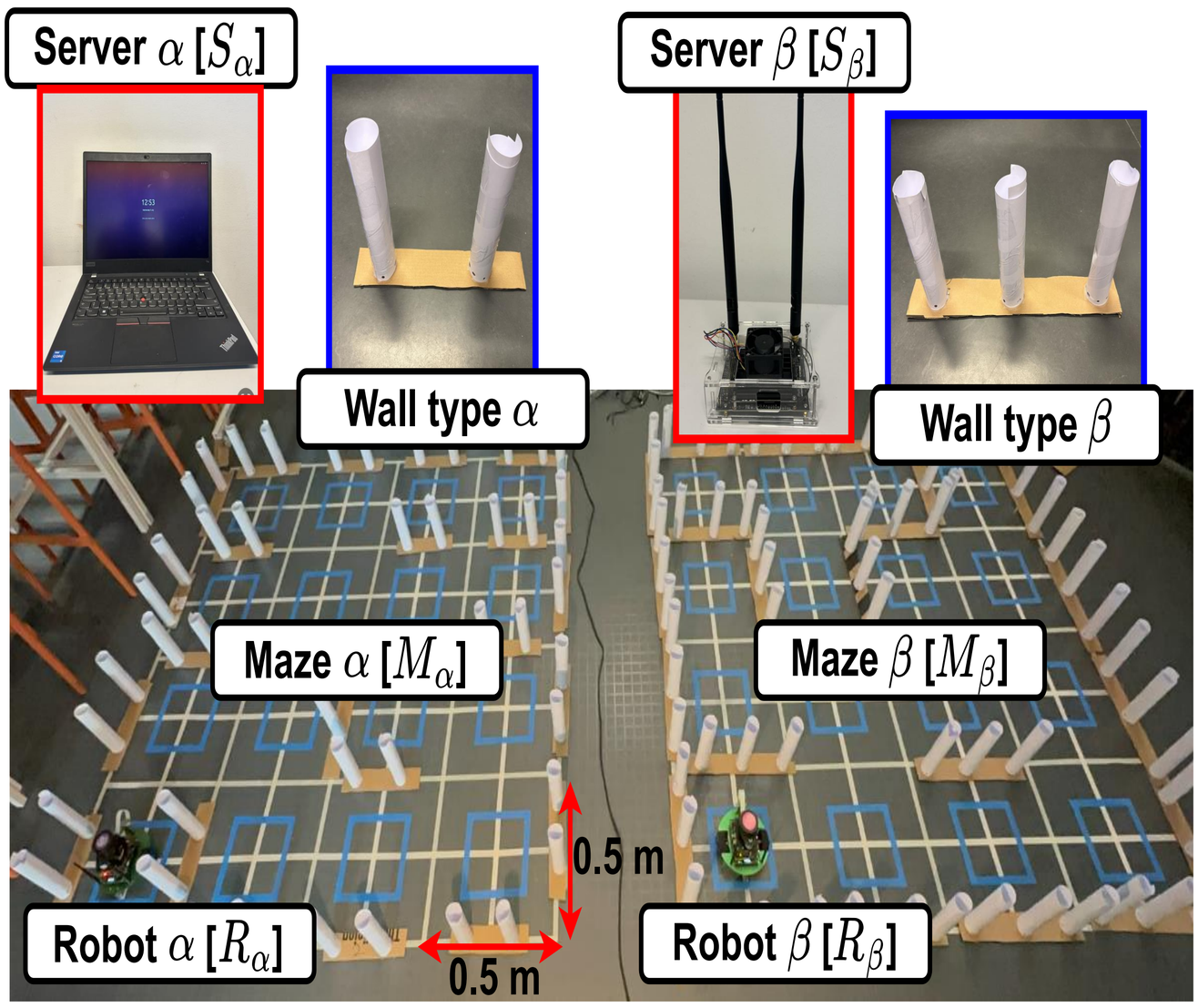
## Introduction

Robotic navigation in complex environments requires accurate perception and understanding of surroundings. **Federated learning (FL)** enables multiple robots to collaboratively train machine learning models without sharing raw data. This demo illustrates FL's effectiveness in **maze discovery** using **autonomous robots** in two distinct maze environments.




## Implementation Steps

**Data Collection**

- Predefined paths and manual variations to enhance dataset diversity.

**Model Training**

- **Baseline:** Local Training Model
- **Proposed Method:** Federated Learning Model
- **Model Architecture:** Feed-forward Neural Network

**Navigation**

- Vision-based line following system using cameras.

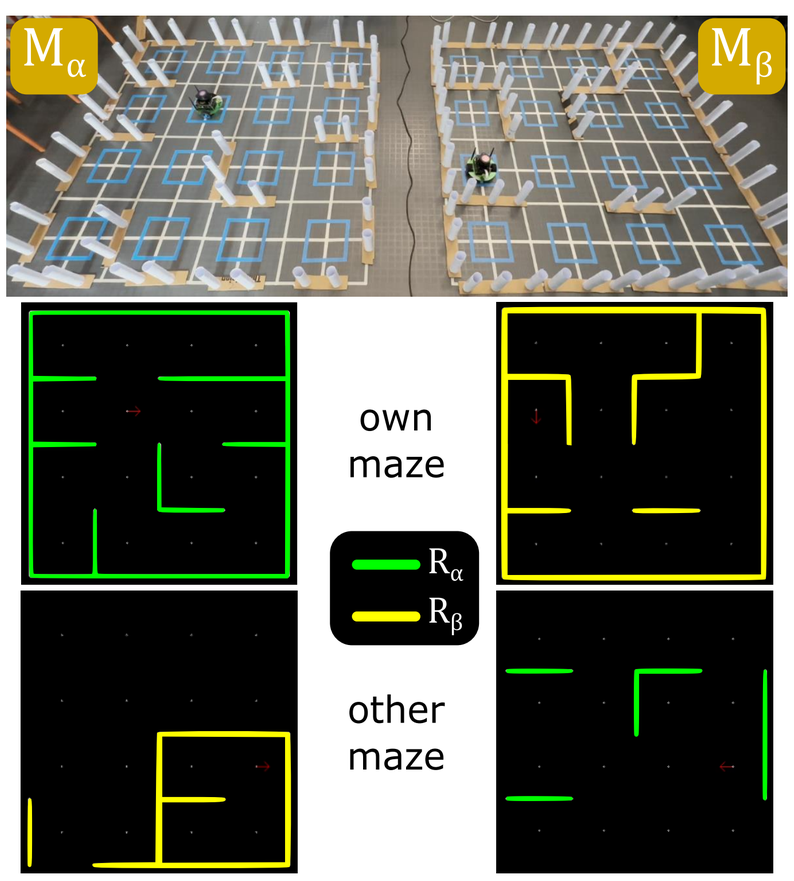
**Evaluation**

- Evaluation of locally trained models and FL models in both mazes.

## Hardware

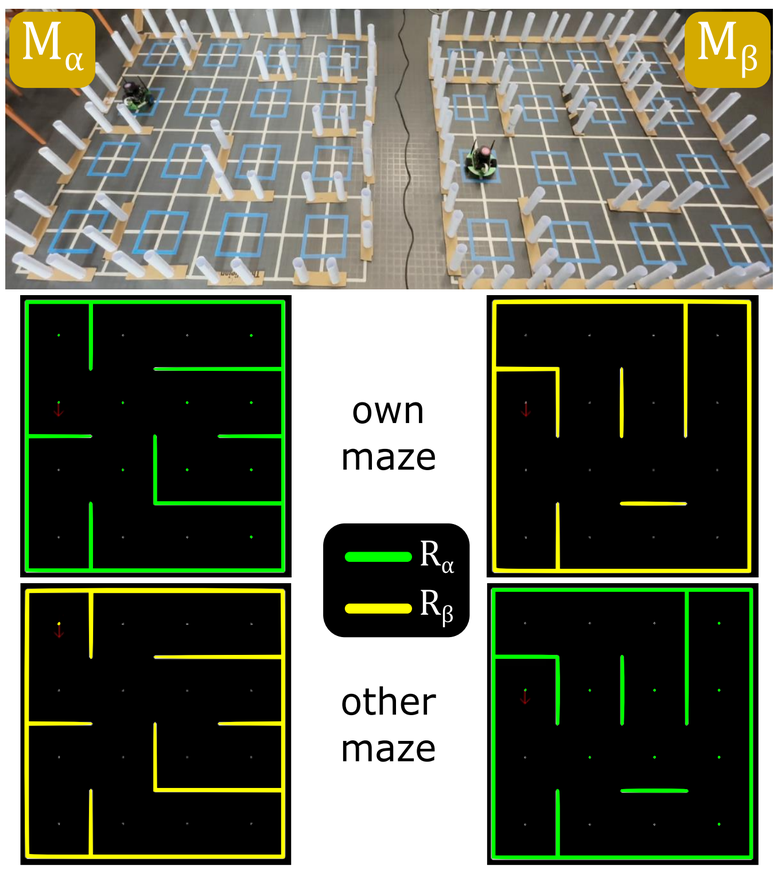
- **Robot**: Waveshare "JetBot ROS AI Kit", including a Nvidia Jetson Nano developer module.

  **Sensors**:
  - RPLiDAR A1
  - Inertial measurement unit (IMU) sensor
  - motor encoder sensors
- **Servers:** Lenovo Thinkpad and Jetson Nano for visualization and monitoring.




## Results

- **Local Training:** High accuracy (99%) on local data, but poor adaptation to unseen mazes.
- **Federated Learning:** High accuracy (99%) on both mazes, demonstrating FL's effectiveness in adapting to new environments.




## References

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