

Introduction

Traditional building automation systems rely on conventional AI system, lack contextual understanding and adaptabilities.

Feature of Generative AI/ Large Language Model

Creates human-like text for various applications, understand, text images, audio, and video.

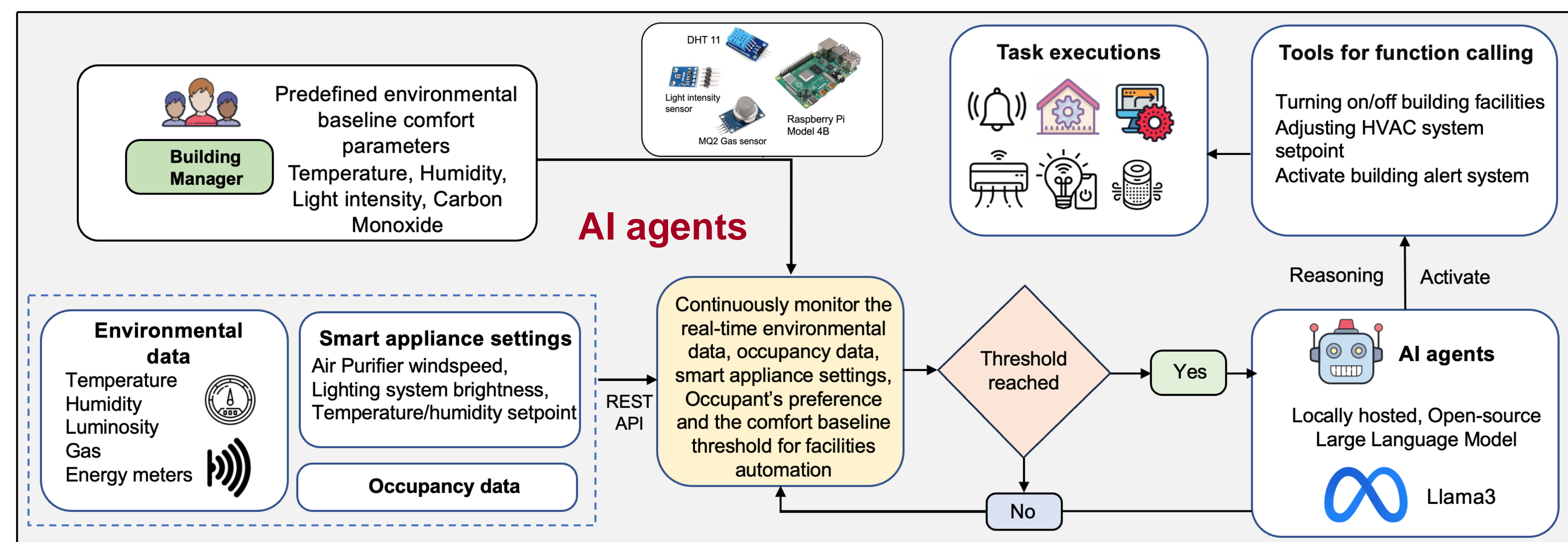
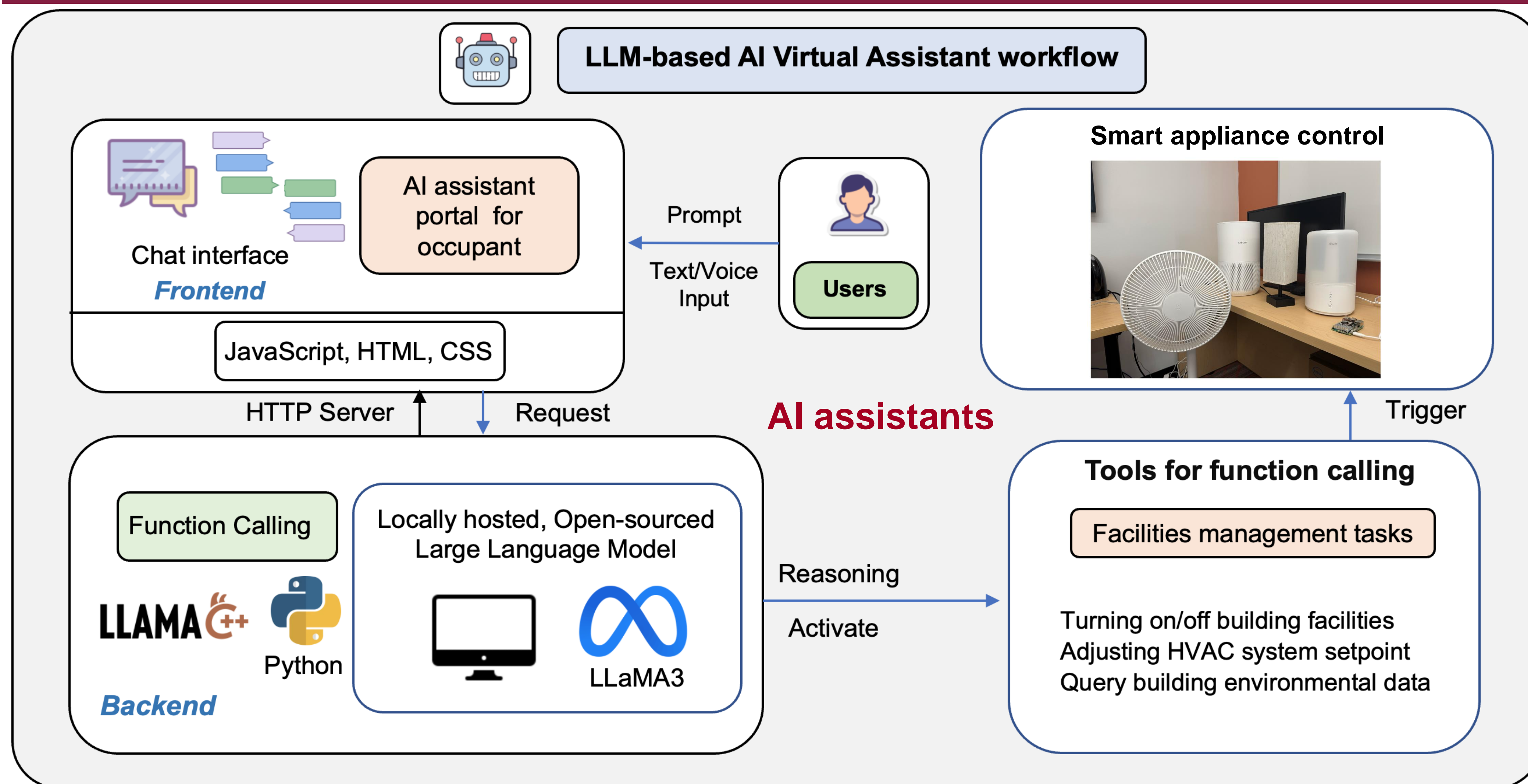
Lack of Gen AI application in building automation systems

Lack of intuitive, human-like interaction in smart building control

Lack of open-sourced Gen AI/LLM application



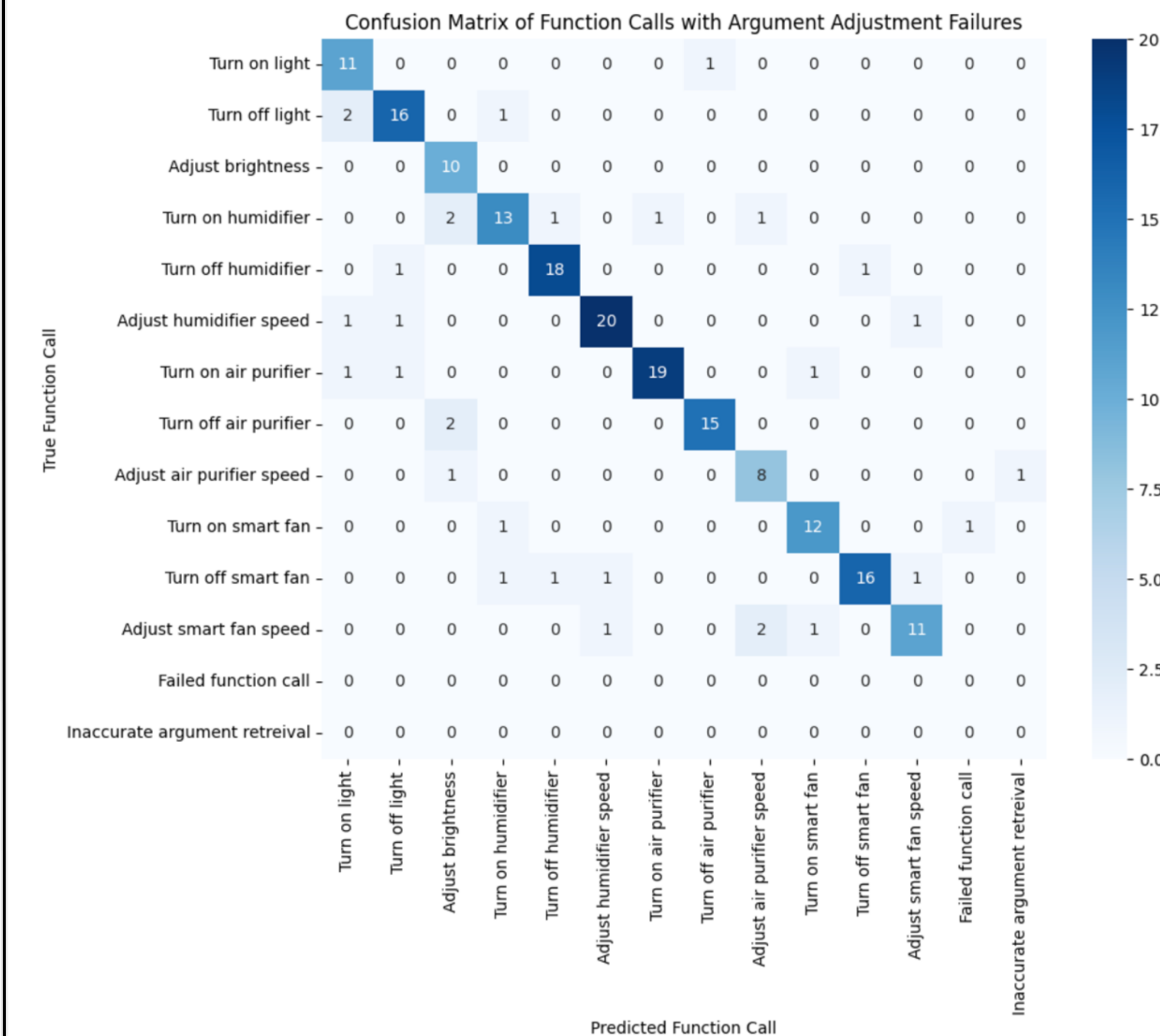
Methods



Evaluation, Result and Discussion

AI assistants

Virtual Assistant for appliance control



200 voice command for appliance control
Repeat each command 10 times for reliability test
e.g. Increase the room brightness to 60%

Scalability analysis

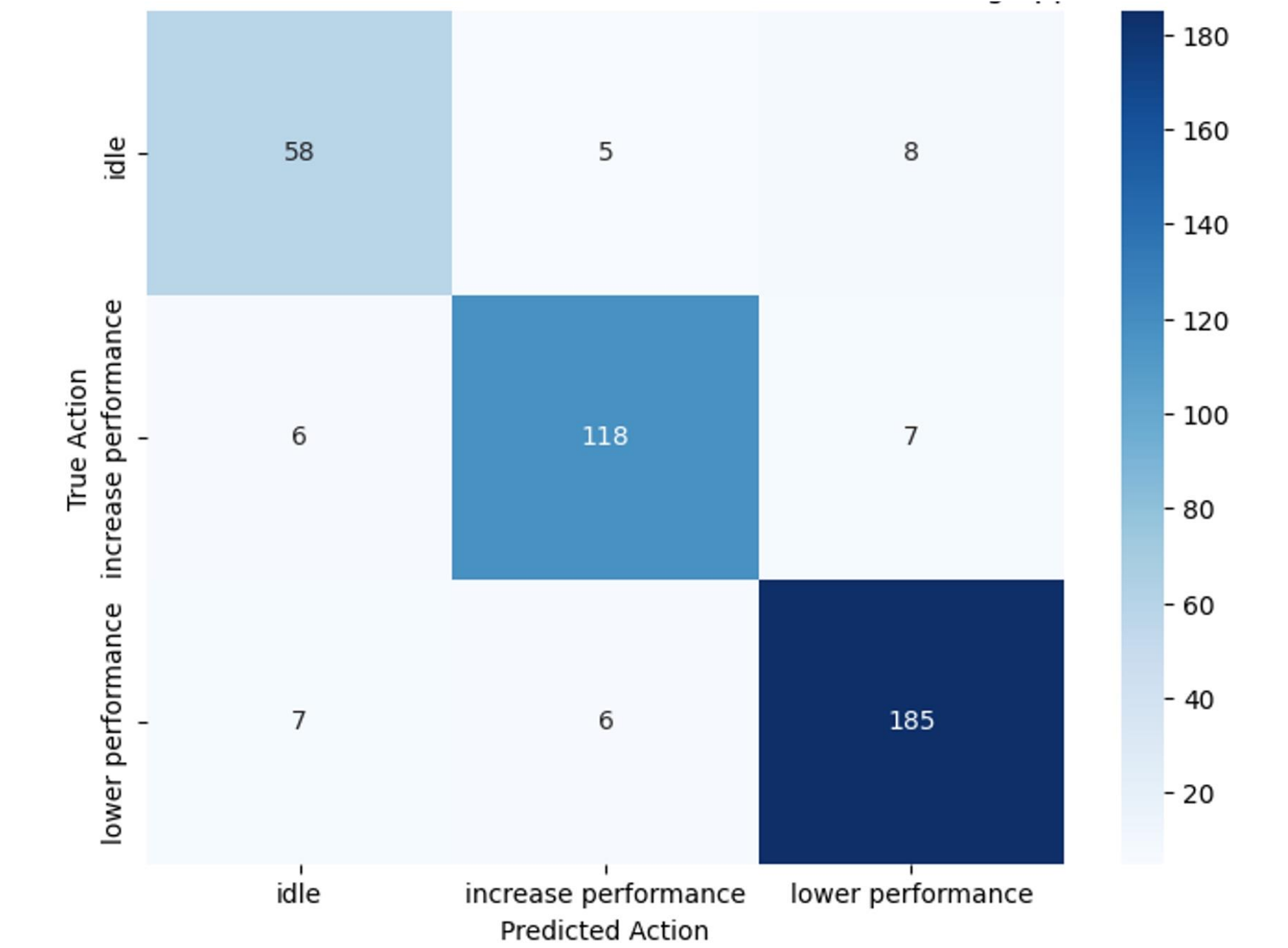
Throughput : 33.66 tokens / 20 words per second
Speed: 5 seconds per task
Concurrency : 16 parallel user requests

Workstation

M1 MAX CPU/GPU / 32 GB RAM

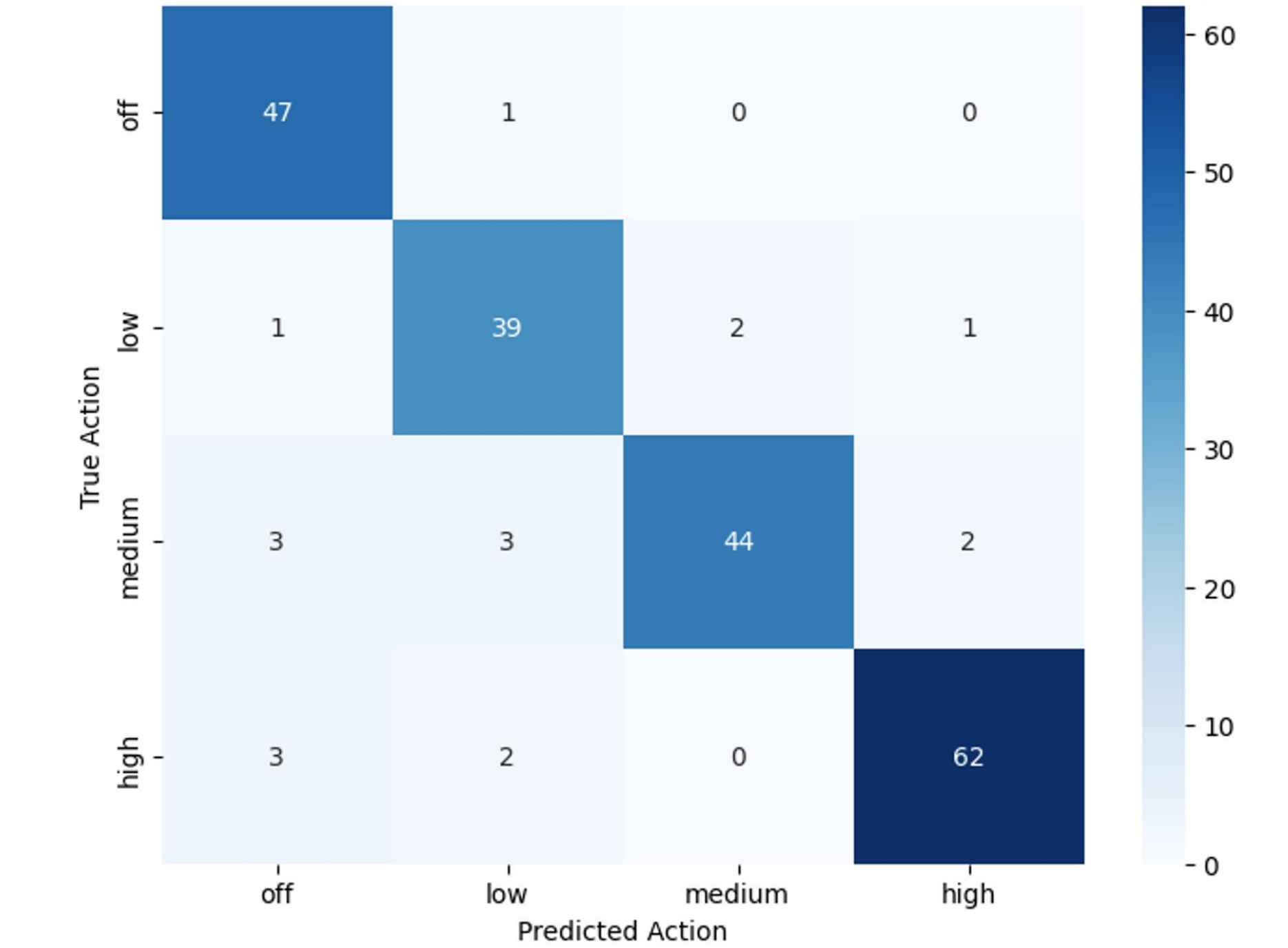
AI agents

Threshold-based automation



400 randomized environmental data points

Occupancy-based automation

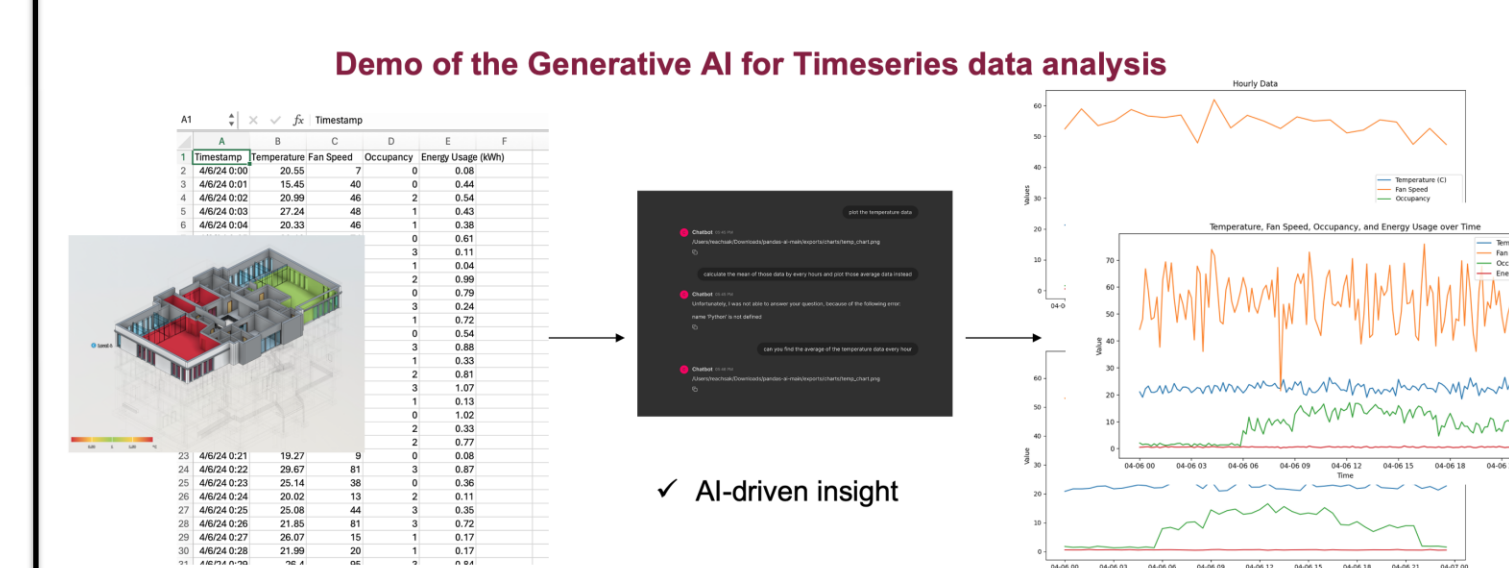


200 randomized occupancy data points

AI Systems	Task	Precision (%)	Recall (%)	F1 Score (%)	Accuracy (%)	Reliability (%)
AI Assistants	Smart appliance control task	95.91	92.75	94.17	92.75	95.45
AI Agents	Occupancy based automation	90.74	90.23	90.29	91	N/A
	Threshold based automation	88.58	88.16	88.25	90.25	N/A

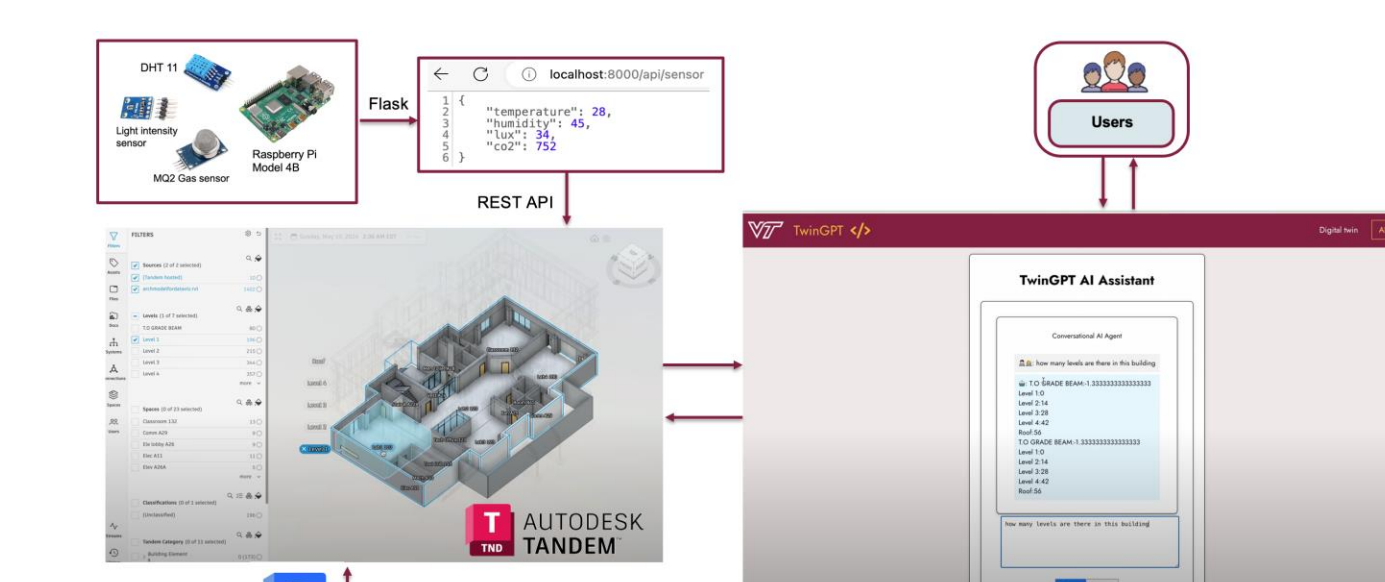
Future work

Gen AI-assisted Facilities management using Virtual Assistant



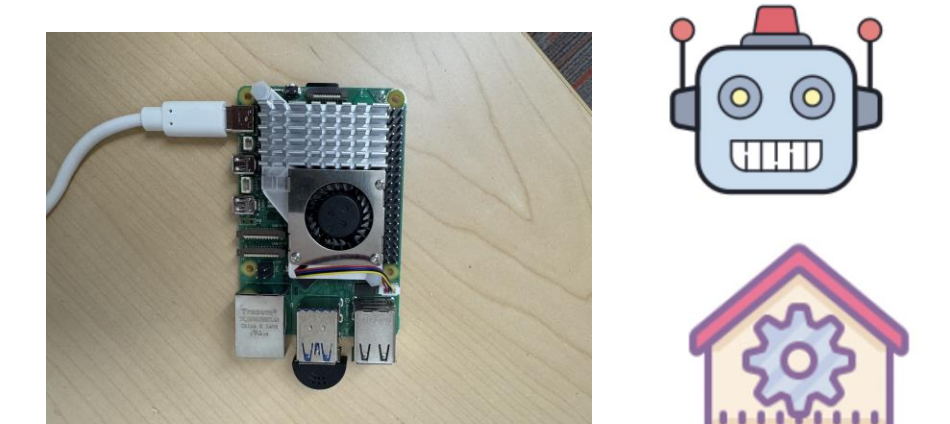
- Building data analysis
- AI-driven insight/suggestion

Query System for Digital Building Twin using LLM



Query building data with Chatbot
Enhance decision-making with AI

AI on the Edge for Smart building and Smart cities using Small language model (SLM)



- Cost effective AI solution for building infrastructure