SWINBURNE UNIVERSITY OF TECHNOLOGY

COIMBATORE INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTION AFFILLIATED TO ANNA UNIVERSITY)

HOMEGENIE – ADAPTIVE SMART HOME ASSISTANT FOR PERSONALIZED LIVING

PROJECT GUIDE:

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PRESENTATION OUTLINE

- PROJECT BACKGROUND
- PROBLEM STATEMENT
- PROJECT OBJECTIVE
- EXISTING TECHNOLOGIES
- SOLUTIONS
- FUTURE WORKS
- CONCLUSION

PROJECT BACKGROUND

- Rapid adoption of IoT-based smart home devices (lights, plugs, thermostats, cameras).
- Current assistants like Google Home, Alexa, and HomeKit are **reactive** and require explicit user commands.
- Lack of **context-awareness, habit learning, and goal-oriented automation**.
- Need for a **cost-effective, intelligent, and adaptive software solution** to unify and personalize smart home control

PROBLEM STATEMENT

Current smart home systems are siloed, reactive and require explicit user commands, lacking proactive intelligence and context-awareness. User desire cohesive , adaptive assistant that learns habits, plans multi – step actions , optimizes energy and integrates across devices and platforms seamlessly

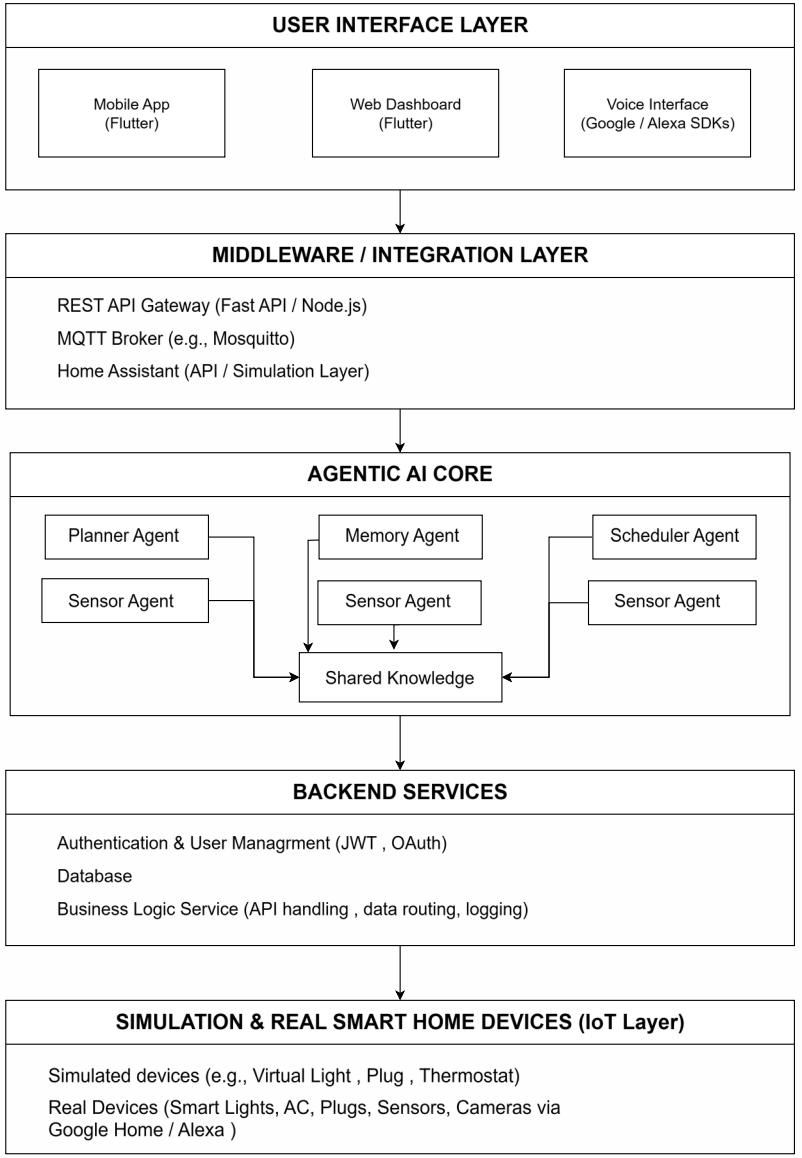
OBJECTIVE

- Build a cost-effective smart home application with agentic AI capabilities.
- Develop a multi-agent system that learns user habits plans and executes tasks autonomously.
- Provide seamless integration with both simulated and real smart home devices (Google Home, Alexa, etc.) via APIs and middleware.

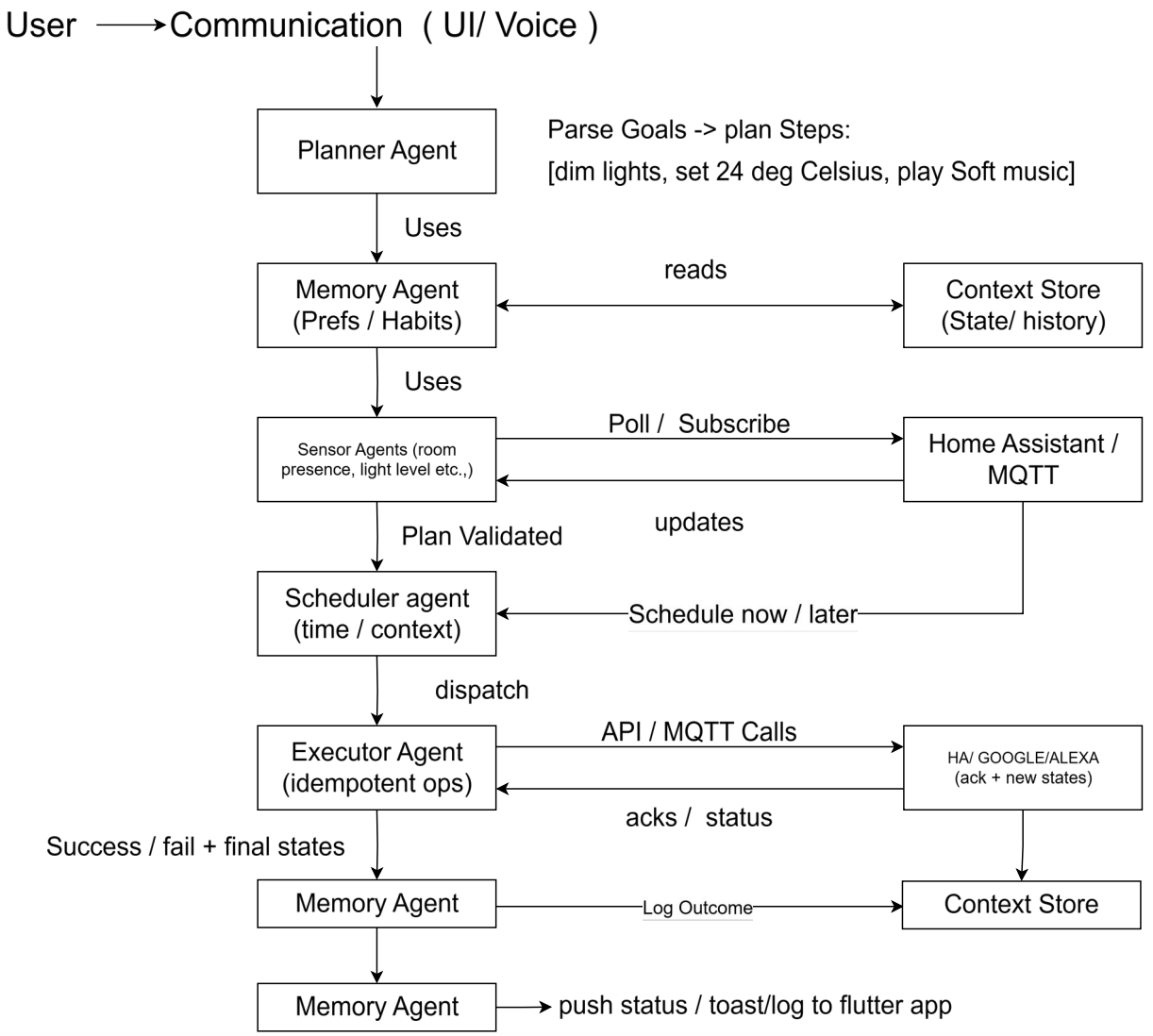
EXISTING TECHNOLOGIES

Google Home / Nest •Voice-controlled smart assistant integrated with IoT devices. •Provides routines and scheduling, but still mostly reactive.	**Amazon Alexa + Echo Devices** •Widely adopted ecosystem with "Skills" for 3rd-party devices. •Strong device compatibility but cloud-dependent.
Apple HomeKit •Secure and privacy-focused ecosystem. •Smooth integration with Apple devices, but limited to certified vendors.	**• Home Assistant (Open Source)** •Community-driven smart home hub supporting 1000+ devices. •Provides both simulation and real device integration. •Popular among researchers and hobbyists.
Samsung SmartThings •IoT hub supporting multiple standards (Zigbee, Z-Wave, WiFi). •Offers automation rules through its mobile app	**OpenHAB (Open Source)** •Framework for integrating diverse smart home technologies. •Focused on flexibility and cross-platform integration.

SOLUTIONS - ARCHITECTURE



SOLUTIONS - ARCHITECTURE



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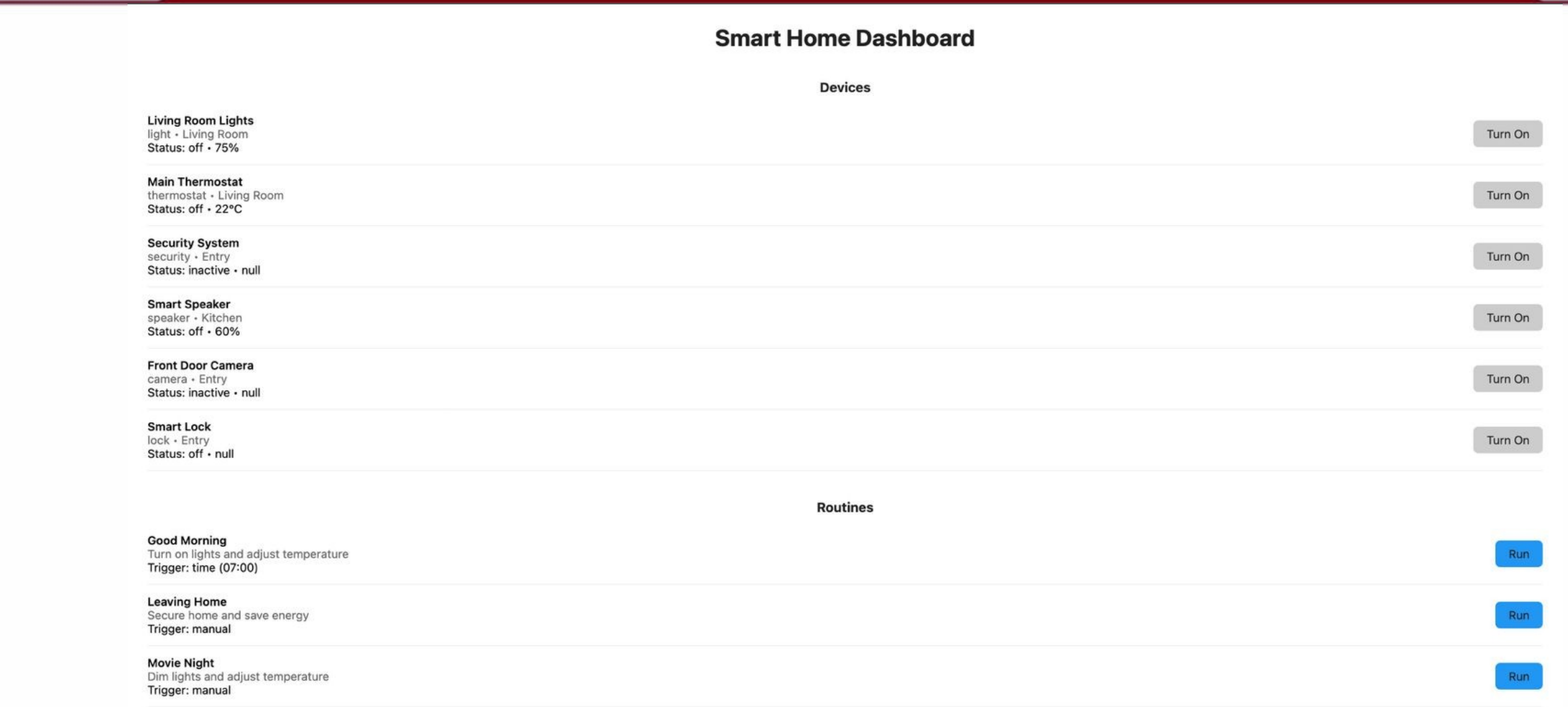
DEMONSTRATION



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DEMONSTRATION

```
(base) mithrajitkathir@Mithrajits-MacBook-Pro objective-outcomes-app-liwfyf % cd backend
(base) mithrajitkathir@Mithrajits-MacBook-Pro backend % uvicorn main:app --reload
INFO:     Will watch for changes in these directories: ['/Users/mithrajitkathir/Documents/homegenie/objective-outcomes-app-liwfyf/backend']
INFO:     Uvicorn running on http://127.0.0.1:8000 (Press CTRL+C to quit)
INFO:     Started reloader process [91324] using StatReload
INFO:     Started server process [91326]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
INFO:     127.0.0.1:59588 - "GET /devices HTTP/1.1" 200 OK
INFO:     127.0.0.1:59589 - "GET /routines HTTP/1.1" 200 OK
INFO:     127.0.0.1:59592 - "POST /devices/6/toggle HTTP/1.1" 200 OK
INFO:     127.0.0.1:59842 - "POST /devices/1/toggle HTTP/1.1" 200 OK
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INFO:     127.0.0.1:59870 - "POST /devices/1/toggle HTTP/1.1" 200 OK
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INFO:     127.0.0.1:59878 - "POST /devices/4/toggle HTTP/1.1" 200 OK
INFO:     127.0.0.1:59878 - "POST /devices/5/toggle HTTP/1.1" 200 OK
INFO:     127.0.0.1:59878 - "POST /routines/1/run HTTP/1.1" 200 OK
INFO:     127.0.0.1:59883 - "POST /devices/1/toggle HTTP/1.1" 200 OK
INFO:     127.0.0.1:59883 - "POST /devices/2/toggle HTTP/1.1" 200 OK
INFO:     127.0.0.1:59883 - "POST /devices/3/toggle HTTP/1.1" 200 OK
INFO:     127.0.0.1:59883 - "POST /devices/4/toggle HTTP/1.1" 200 OK
INFO:     127.0.0.1:59883 - "POST /devices/5/toggle HTTP/1.1" 200 OK
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INFO:     127.0.0.1:60019 - "POST /devices/2/toggle HTTP/1.1" 200 OK
INFO:     127.0.0.1:60019 - "POST /devices/3/toggle HTTP/1.1" 200 OK
INFO:     127.0.0.1:60019 - "POST /devices/4/toggle HTTP/1.1" 200 OK
INFO:     127.0.0.1:60019 - "POST /devices/5/toggle HTTP/1.1" 200 OK
INFO:     127.0.0.1:60019 - "POST /devices/6/toggle HTTP/1.1" 200 OK
INFO:     127.0.0.1:60019 - "POST /routines/1/run HTTP/1.1" 200 OK
INFO:     127.0.0.1:60019 - "POST /routines/2/run HTTP/1.1" 200 OK
INFO:     127.0.0.1:60019 - "POST /routines/3/run HTTP/1.1" 200 OK
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SOLUTIONS –TECH STACK

COMPONENT	TOOLS
FRONTEND	Flutter (Web & Mobile) / JavaScript
BACKEND	Python(FAST API)
AGENTIC AI	MULTI AGENT Architecture (LangChain / Custom Agents)
VOICE INTERACTION	Google STT & TTS
INTEGRATION LAYER	Home Assistant APIs,MQTT,Google Alexa APIs
SIMULATION	Home Assistant with Virtual Devices
DATABASE	PostgreSQL / MongoDB

FUNCTIONAL AND NON FUNCTIONAL REQUIREMENTS

FUNCTIONAL REQUIREMENTS	NON FUNCTIONAL REQUIREMENTS
User Interaction	Scalablity
Device Control and Monitoring	Security and Privacy
Multi-Agent AI System	Performance
Automation & Personalization	Reliability & Robustness
INTEGRATION LAYER	Home Assistant APIs,MQTT,Google Alexa APIs
Energy Optimization	Cost-effectiveness

FUTURE WORKS

Real Device Integration

- Extend support to physical IoT devices (Google Home, Alexa, Zigbee, Z-Wave, Matter).

Advanced Learning

- Incorporate **reinforcement learning** for dynamic habit adaptation.
- Continuous improvement of task planning and personalization.

Energy Forecasting

- Predict energy usage trends and suggest cost-saving strategies.

Expanded Ecosystem

- Multi-home or community-level automation and coordination.
- Integration with smart grid systems for energy-aware scheduling.

Enhanced Security & Privacy

- Incorporate privacy-preserving techniques (edge computing, secure data sharing).

Scalability

- Support a wide range of smart appliances and IoT protocols seamlessly.

CONCLUSION

- Current smart home solutions are fragmented, reactive, and vendor-dependent.
- HomeGenie introduces a proactive, agentic AI-driven, cost-effective software solution.
- Focused on simulation-first development → allows affordable testing and iteration.
- Multi-agent architecture ensures personalization, adaptability, and scalability.
- Paves the way for future integration with real devices and advanced AI features.
- In summary: Our system makes smart homes truly intelligent, adaptive, and user-centric.

THANK YOU!!!