Dar El Behy

Smart Home Automation

Louey Dridi **Dhia eddin chedly** **Mohamed Belgacem** **Achref Msekni**
Mohamed Amine Saoudi

Advisor: Dr. Ameni Azouz

Tunis Business School

18/12/2025

Table of Contents

Introduction

- **Dar El Behy** is a JavaFX-based smart home control system.
- Centralizes control of multiple smart devices through a graphical interface.
- Supports voice commands, real-time energy monitoring, and prayer times integration.
- Designed for usability, security, and future extensibility.

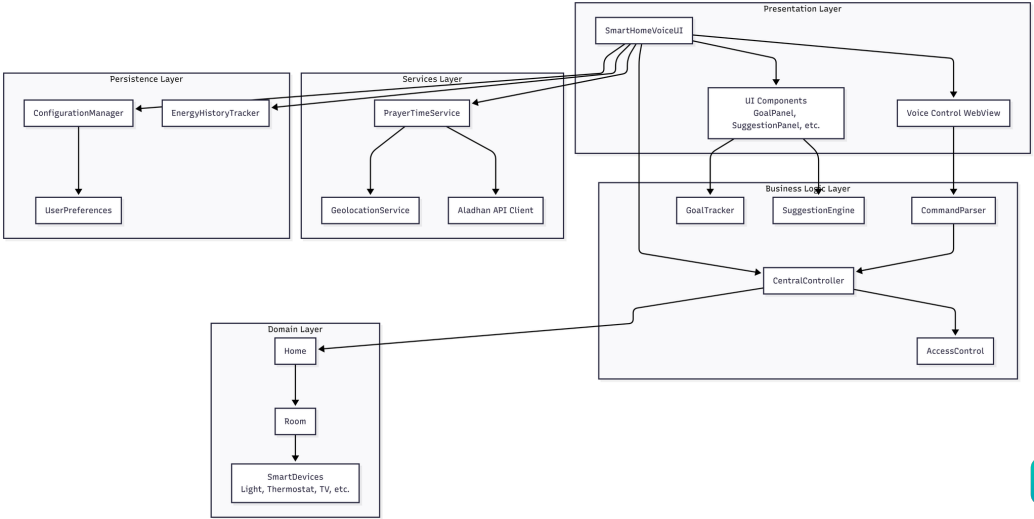
Technologies and Tools

- **Language:** Java 25 (Object-Oriented Programming).
- **UI Framework:** JavaFX 25.0.1 with WebView and CSS.
- **APIs:** Aladhan (Prayer Times), IP-API (Geolocation), Web Speech API.
- **Storage:** JSON for configuration, CSV for energy history.

System Architecture

- Layered architecture with clear separation of concerns.
- Presentation (UI components), Business Logic (Controllers), Domain (Core entities & analytics), Services (External API integrations), and Persistence layers (Data storage and retrieval).
- CentralController acts as a facade for system operations.
- Architecture supports scalability and maintainability.

System Architecture



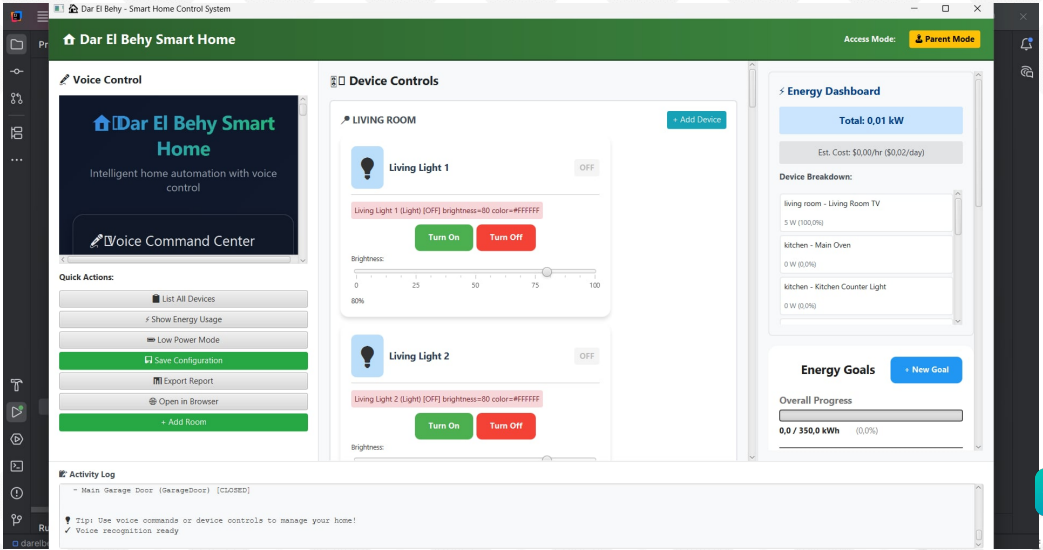
Core Components

- **SmartDevice** abstract base class with 11 concrete device types.
- **CentralController** orchestrates commands and device interactions.
- **CommandParser** processes natural language voice commands.
- **GoalTracker** monitors energy consumption and goals.

User Interface

- JavaFX-based interface with room-oriented device control.
- Integrated voice command panel and activity console.
- Energy dashboard with goals and real-time monitoring.
- Parent and Child modes with PIN-based access control.

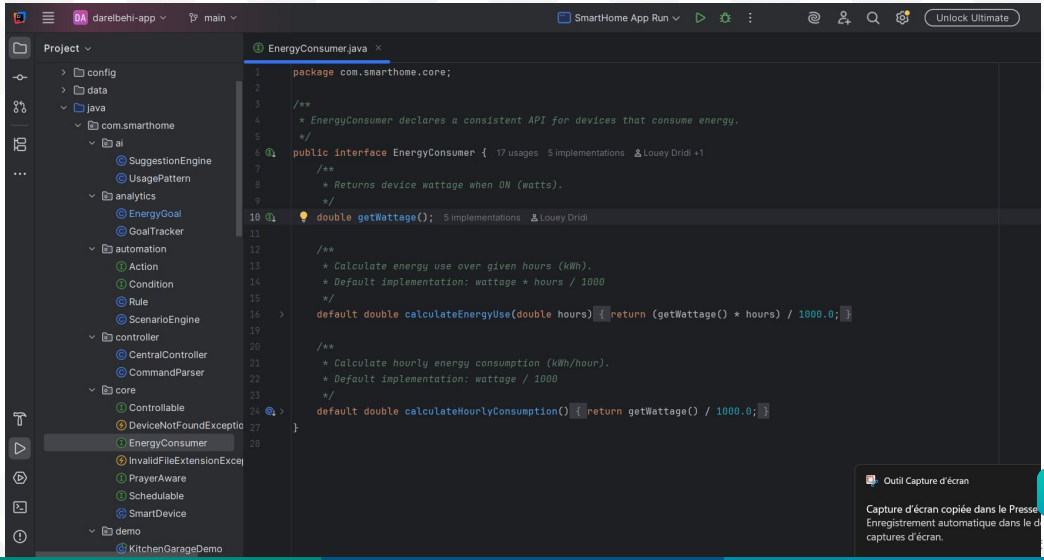
Interface


Dar El Behy - Smart Home Control System
Dar El Behy Smart Home
Access Mode:
Parent Mode
Voice Control
Dar El Behy Smart Home
Intelligent home automation with voice control
Voice Command Center
Quick Actions:
List All Devices
Show Energy Usage
Low Power Mode
Save Configuration
Export Report
Open in Browser
+ Add Room
Device Controls
LIVING ROOM
+ Add Device
Living Light 1
OFF
Living Light 1 (Light) [OFF] brightness=80 color=#FFFFFF
Turn On
Turn Off
Brightness:
0
25
50
75
100
80%
Living Light 2
OFF
Living Light 2 (Light) [OFF] brightness=80 color=#FFFFFF
Turn On
Turn Off
Brightness:
Energy Dashboard
Total: 0,01 kW
Est. Cost: $0,00/hr ($0,02/day)
Device Breakdown:
living room - Living Room TV
5 W (100,0%)
kitchen - Main Oven
0 W (0,0%)
kitchen - Kitchen Counter Light
0 W (0,0%)
Energy Goals
+ New Goal
Overall Progress
0,0 / 350,0 kWh
(0,0%)
Activity Log
- Main Garage Door (GarageDoor) [CLOSED]
Tip: Use voice commands or device controls to manage your home!
Voice recognition ready

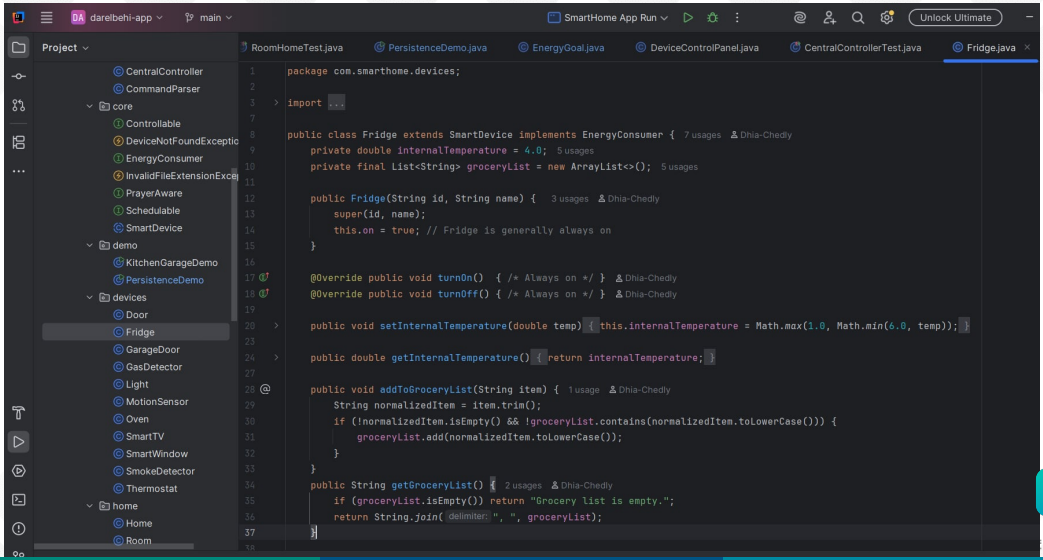
Key Features

- **Voice Control:** Web Speech API processes voice commands through a WebView and executes them via the CentralController.
- **Energy Management:** Real-time energy tracking every 5 minutes with goals, alerts, and CSV reports.
- **Prayer Times & AI:** Automatic prayer times via Aladhan API and AI-based energy saving suggestions.

Code snippets



Code snippets



UML Overview

Use Case Diagram

Defines interactions between Parent, Child, System, and External APIs.

Sequence Diagrams

Illustrates voice command processing, energy tracking, and prayer time loading.

Class Diagram

Shows SmartDevice hierarchy, interfaces, and Home–Room composition.

Security Considerations

Parent and Child modes with PIN-protected access to critical devices.

Rate Limiting

Prevents excessive API calls and brute-force PIN attempts.

Future Improvements

PIN hashing, encrypted configuration files, and multi-user authentication.

Testing Strategy

Automated Testing

JUnit tests for CentralController, CommandParser, and Home/Room logic.

Coverage Areas

Device state management, energy calculations, and command parsing.

Manual Testing

Voice recognition, UI responsiveness, and prayer times accuracy.

Installation and Usage

- JDK 25, JavaFX SDK 25.0.1, and an internet connection.
- Application launched using `run.bat` after JavaFX configuration.

Voice Commands

"Turn on all lights in living room", "Set thermostat to 22".

Scalability

- **SOLID Principles**

  Modular and extensible system design

- **Data Persistence**

  Decoupled and scalable data access

Conclusion

A complete JavaFX smart home system with voice control, energy analytics, and prayer times.

11 device types, layered architecture, persistent configuration.

Future Work

Cloud sync, mobile app, IoT integration, and machine learning.