Home Automation System Blueprint

Designed and implemented by Samuel Day

1. Project Overview

This project describes a modular, Raspberry Pi–based home automation system built around Home Assistant. The system integrates lighting, heating, environmental sensing, wearable input (Garmin), and user intent into a context-aware automation platform. The architecture prioritises safety, testability, and incremental deployment.

2. Core Architecture

- Central Controller: Raspberry Pi running Home Assistant OS
- Communication Model: Event-driven, state-based automations
- Integration Style: Local-first where possible, cloud-assisted where necessary

3. Integrated Systems

- Lighting: Philips Hue bulbs via Hue Bridge
- Heating: Hive Thermostat integration
- Cleaning: Eufy robotic vacuum (status + control)
- Wearable Input: Garmin F■nix 7X Pro via Garmin Button webhooks
- Environmental Sensors: ESP32 + PIR, CO■, pressure sensors

4. Automation Philosophy

Automations are built around three layers: inputs (events and sensors), state (helpers representing context), and actions (lighting, heating, notifications). Manual overrides are always available, particularly via the Garmin watch.

5. Key Automations

- Sleep Mode: Bed occupancy + watch input disables motion lighting and reduces heating
- Morning Briefing: TV dashboard displays Garmin sleep data, calendar, and home status
- Run-Aware Routines: Calendar + Garmin activity adjust wake-up and heating behaviour
- Vacuum Automation: Runs only when user is out and no motion is detected

6. Safety and Electrical Compliance

All mains-powered automation avoids hardwiring where possible. The system favours plug-in smart devices, low-voltage sensors, and certified equipment. Any permanent mains alterations are designed but installed by qualified electricians in compliance with UK Building Regulations Part P.

7. Development Approach

- Offline design and YAML development while travelling
- Hardware prototyping with ESP32 microcontrollers
- Version control using GitHub
- Final deployment and device binding performed in the UK

8. Project Value

This project demonstrates system architecture, IoT integration, event-driven automation, and human-centred design. It reflects real-world engineering constraints including safety, reliability, and incremental deployment.