

# Session State Save Template

## Session Metadata

**Date:** September 9, 2025

**Session #:** 1

**Duration:** ~2 hours

**Claude Model:** Claude Sonnet 4

## Project Overview

**Project Name:** Home Automation Fire Safety & CCTV System

**Project Type:** IoT Hardware/Software Development with Safety Systems

**Objective:** Create a comprehensive home automation system focused on fire safety and safe ventilation for 3D printing operations, with integrated CCTV monitoring and secure network architecture.

**Timeline:** Multi-month project with safety systems prioritized first

## Current Status

### Completed This Session

- Created comprehensive project prompt defining system architecture
- Designed 4-VLAN network topology with hybrid management approach
- Developed OpenWrt firewall configuration for GL.iNet GL-MT6000 router
- Integrated Bambu Labs P1S printer into safety system
- Resolved remote CCTV access through secure Home Assistant bridging
- Created network diagram showing device placement and data flows
- Established security zones isolating critical safety systems from internet
- Designed session state save template for project persistence

## Overall Progress

**% Complete:** 15%

**Current Phase:** Network Architecture & Planning

### Key Milestones Reached:

- Network security architecture finalized
- Device IP allocation scheme established
- Firewall rules defined for all security zones
- Remote access strategy confirmed (VPN + HA bridge)

## Active Components/Elements

- **Network Diagram:** Complete 4-VLAN architecture with device placement
- **Firewall Configuration:** OpenWrt rules for hybrid management approach
- **Project Prompt:** Comprehensive system requirements and phases
- **Device Inventory:** IP assignments for all planned components

## Key Decisions & Context

### Critical Decisions Made

1. **4-VLAN Hybrid Architecture:** Combined management and automation into single VLAN (20) to reduce complexity while maintaining security
2. **IoT Complete Isolation:** VLAN 50 (sensors/smart plugs) completely blocked from internet for maximum safety
3. **Remote Camera Access:** CCTV isolation maintained while enabling remote monitoring through Home Assistant bridge
4. **Bambu P1S Integration:** Printer placed in IoT VLAN with temporary setup rule for initial cloud login

### Important Context/Background

- Primary safety focus: Fire detection and prevention for 3D printing operations
- Two enclosed printers: SLA and FDM with dedicated sensors and smart plugs
- GL.iNet GL-MT6000 router running OpenWrt firmware at 192.168.1.1
- MINIX mini PC running Proxmox with Home Assistant and Frigate VMs
- Raspberry Pi NAS for CCTV footage storage
- Network must balance security isolation with remote access needs

### Assumptions & Dependencies

- OpenWrt firmware successfully flashed to GL-MT6000 router
- Proxmox will run stable with multiple VMs on 16GB RAM
- All IoT devices support VLAN configuration
- POE switch adequate for planned camera count
- Raspberry Pi NAS sufficient for CCTV storage requirements

## Next Steps

### Immediate Next Actions (Next Session)

1. Create VLAN interface configuration for OpenWrt

2. Design device inventory tracking system with MAC addresses
3. Research specific sensor models and Home Assistant integration methods
4. Plan Proxmox VM resource allocation and configuration

## **Upcoming Priorities**

- OpenWrt router setup and VLAN implementation
- Proxmox installation and VM deployment
- Home Assistant initial configuration and device discovery
- Sensor selection and procurement planning
- 3D printed ventilation system design

## **Questions to Address**

- Specific sensor models for temperature, humidity, pressure, smoke, and VOC detection
- Home Assistant integration methods for chosen sensors
- Servo control mechanisms for ventilation dampers
- Emergency protocols and fail-safe implementations
- Power backup considerations for safety systems

## **Technical Details**

### **System Architecture**

4-VLAN network with security zones:

- VLAN 20: Automation & Management (192.168.20.0/24) - Internet access
- VLAN 30: CCTV (192.168.30.0/24) - No internet, HA bridge access
- VLAN 40: Storage (192.168.40.0/24) - No internet, Frigate access
- VLAN 50: IoT Sensors (192.168.50.0/24) - No internet, HA control only

### **Dependencies & Requirements**

- GL.iNet GL-MT6000 router with OpenWrt
- MINIX Mini PC (i3-N350, 16GB RAM, 512GB SSD)
- Proxmox virtualization platform
- POE switch for cameras
- Raspberry Pi for NAS
- Various sensors and smart plugs
- WireGuard VPN for remote access

## Current Specifications

- Router IP: 192.168.1.1
- Home Assistant VM: 192.168.20.101
- Frigate NVR VM: 192.168.20.102
- Admin laptop: 192.168.20.10
- Raspberry Pi NAS: 192.168.40.50
- Smart plugs: 192.168.50.71-73
- Bambu P1S: 192.168.50.90

## Resources & References

### Files/Documents Created

- **Network Diagram:** Mermaid diagram showing 4-VLAN architecture and device placement
- **Firewall Configuration:** Complete OpenWrt configuration script with security rules
- **Project Prompt:** Comprehensive system requirements and implementation phases
- **Session State Template:** Reusable template for project persistence

### External References

- OpenWrt documentation for GL.iNet GL-MT6000
- Home Assistant integration guides
- Proxmox virtualization best practices
- Fire safety regulations for workshop environments

### Tools/Platforms Used

- Mermaid for network diagramming
- OpenWrt for router firmware and configuration
- Home Assistant for automation hub
- Proxmox for virtualization
- Frigate for CCTV management

## Issues & Blockers

### Current Blockers

- Need to procure and test OpenWrt flash for GL-MT6000
- Sensor model selection requires research
- Power backup strategy undefined

## Known Issues

- Bambu P1S requires temporary internet access for initial setup
- Resource allocation for multiple VMs on single mini PC needs validation
- Emergency protocols and fail-safes need detailed design

## Risk Factors

- Fire safety system failure could result in property damage
- Network misconfiguration could compromise security isolation
- Single point of failure with one mini PC hosting critical services

## Session Notes

### Key Insights

- Hybrid management approach reduces VLAN complexity without sacrificing security
- Home Assistant acts as secure bridge enabling remote access to isolated systems
- Temporary firewall rules needed for device setup phases
- Emergency protocols must include manual override capabilities

### Process Notes

- Network diagram essential for visualizing complex security zones
- Firewall configuration benefits from detailed commenting
- Session state template enables complex multi-day project management
- Safety considerations must drive all architectural decisions

### Miscellaneous

- Consider UPS backup power for critical safety systems
- Document all device MAC addresses during setup
- Plan for future expansion of sensor network
- Regular firewall rule auditing recommended

## Potential Improvements & Future Enhancements

### Security Enhancements

- **Network Intrusion Detection:** Consider adding Suricata or similar IDS to monitor network traffic
- **Certificate Management:** Implement proper SSL/TLS certificates for all web interfaces
- **Multi-factor Authentication:** Add MFA to Home Assistant and critical admin interfaces

- **Network Monitoring:** Deploy network monitoring tools (PRTG, LibreNMS) for traffic analysis
- **Security Camera Analytics:** Advanced AI-based threat detection in camera feeds

## System Reliability Improvements

- **Redundant Internet:** Secondary internet connection for critical alerts
- **Hardware Redundancy:** Backup Raspberry Pi or second mini PC for failover
- **Distributed Sensors:** Multiple sensor nodes per area to prevent single points of failure
- **Watchdog Systems:** Hardware watchdogs to auto-restart failed services
- **Database Backup:** Automated backup of Home Assistant configuration and sensor data

## Performance & Scalability

- **Load Balancing:** Multiple Home Assistant instances if system grows large
- **Storage Optimization:** Implement proper log rotation and old data archival
- **Network Optimization:** QoS rules to prioritize safety-critical traffic
- **Caching Layer:** Redis or similar for improved Home Assistant response times
- **Edge Computing:** Local processing for time-critical fire safety decisions

## Advanced Features

- **Machine Learning:** Predictive analytics for fire risk based on sensor trends
- **Integration Expansion:** Weather data integration for ventilation optimization
- **Voice Alerts:** Text-to-speech announcements for emergency situations
- **Mobile Push Notifications:** Critical alert delivery via multiple channels
- **Automated Reporting:** Weekly/monthly safety system performance reports

## User Experience Improvements

- **Custom Dashboard:** Dedicated fire safety monitoring dashboard
- **Historical Analytics:** Long-term trend analysis of air quality and safety metrics
- **Maintenance Scheduling:** Automated reminders for sensor calibration and system checks
- **Remote Diagnostics:** VPN-accessible system health monitoring
- **Documentation Portal:** Web-based documentation system for procedures and troubleshooting

## Physical System Enhancements

- **Environmental Controls:** Automated temperature and humidity control for print quality
- **Air Quality Monitoring:** PM2.5 and other particulate sensors
- **Automated Fire Suppression:** Integration with fire suppression systems (beyond just cutoffs)

- **Smart Lighting:** Automated lighting control integrated with safety systems
- **Material Detection:** RFID or barcode scanning for filament tracking and safety profiles

## Integration Opportunities

- **Smart Home Ecosystem:** Integration with broader home automation (HVAC, lighting)
- **External Services:** Weather services, emergency services notification integration
- **Cloud Analytics:** Optional cloud-based analytics for system optimization (with privacy controls)
- **Insurance Integration:** Automated reporting to insurance providers for premium reductions
- **Compliance Monitoring:** Automated compliance checking against safety regulations

## Cost Optimization

- **Energy Monitoring:** Smart plugs with energy monitoring for efficiency optimization
  - **Predictive Maintenance:** Sensor-based maintenance scheduling to prevent failures
  - **Resource Sharing:** Shared resources between 3D printing and other home automation
  - **DIY Components:** Custom PCB designs for sensor nodes to reduce costs
  - **Bulk Procurement:** Group purchases of sensors and components for future expansion
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## Restoration Instructions

### To continue this project:

1. Paste this entire state document into a new Claude conversation
2. Add: "Please review this project state and confirm understanding. I'm ready to continue from where we left off."
3. Ask Claude to recreate any artifacts mentioned in the "Files/Documents Created" section
4. Begin with the "Next Steps" items listed above

**State Document Version:** 1.0

**Last Updated:** September 9, 2025