SmartHome+ - A home automation solution

Supplementary Specification and Glossary

Version 1.0

Revision History

Date	Rev.	Description	Author(s)
07-30-2020	0.1	Draft version	Divya
08-05-2020	0.2	Reviewed version	Apoorv
08-06-2020	0.3	Reviewed version	Sakib
08-06-2020	0.3	Reviewed version	Nikhil
08-06-2020	0.4	Reviewed version	Manik

Table of Contents

Supplementary Specifications

1. Introduction

This document defines the supplementary requirements for SmartHome+ solution as an Internet of Things (IOT) based Home Automation Platform. The Supplementary Specifications together with the Use-Case model constitute the Software Requirement Specification (SRS), which provides a complete set of requirements for SmartHome+ solution.

1.1. Purpose

The supplementary specifications try to capture those requirements which are not easy to express in the use cases of the Use-Case Model. This document is primarily targeted towards software engineers, developers, users and other stakeholders that have some relation to the system.

1.2. Scope

This supplementary specification document pertains to the SmartHome+ solution. The SmartHome+ is an integrated home automation solution which primarily caters to HomeResident's life style needs and comforts by focusing on the following 6 dimensions:

- Accessibility (an easy to use solution)
- Environment Monitoring (better living conditions inside house)
- Energy efficiency control (optimized energy utilization)
- Enhanced security and safety from unforeseen situations
- Improved Media and entertainment experience
- Automation of mundane household tasks

This specification document details design constraints, non-functional requirements like reliability, performance, security and standards, and any functional requirements not defined in the use case model.

1.3. Definitions, Acronyms and Abbreviations

- **Controller** – Central Control Unit comprising of various sub-components for the SmartHome+ solution.
- **Devices** – Refers to the Smart Devices that can be connected to the SmartHome+ solution using appropriate interfaces.
- **Firmware** – Software dealing with low-level controls for a device's specific hardware.
- **ZWAVE** – Mesh Network and low-energy radio waves based wireless communication protocol to enable communication between controller and smart devices.
- **ZIGBEE** - A suite of high-level communication protocols used for home automation purposes. It is based on IEEE 802.15.4 specification.
- **WiFi** - Wireless Fidelity - Network communication protocol
- **Bluetooth** – Network Communication protocol
- **HVAC** - Heating, ventilation, and air conditioning
- **NTP** – Network Time Protocol - Networking protocol for clock synchronization between computer systems.

- **HTTPS** - Hypertext Transfer Protocol Secure – Communication Protocol over the internet with added support for security.
- **CE** – Conformité Européenne – French for European Conformity - indicates conformity with health, safety, and environmental protection standards for products sold within the European Economic Area (EEA).
- **FCC** - Federal Communications Commission – United States based agency that regulates communications by radio, television, wire, satellite and cable.
- **UL** - Underwriter Laboratories – An independent product safety testing, certification and inspection organization.
- **NFPA** – National Fire Protection Association - international nonprofit organization devoted to eliminating death, injury, property and economic loss due to fire.

1.4. References

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1.5. Overview

In the following sections this document will establish the functional requirement not covered in the use case model, the nonfunctional requirements Usability, Reliability, Performance and Supportability. The document also describes the design constraints, required hardware and software interfaces. Lastly it also touches upon some of the required licensing, legal and standard requirements.

2. Functionality

2.1. Booting and System Check

2.1.1. When powered on it is during the booting process, the system will load all the required kernel modules and necessary device drivers.

2.1.2. System will contact the NTP server to get the current timestamp and time zone and update the systems time accordingly.

2.1.3. System will check connectivity between all the installed devices and components and notify any failures.

2.1.4. System will verify connectivity to Wi-Fi, Broadband and 4G networks.

2.2. Errors and Logging

2.2.1. All system related events will be appropriately logged in persistent files.

2.2.2. System shall offer appropriate ways to extract these log files.

2.2.3. The log messages will include timestamp, log level, error codes (if applicable) and the messages.

2.2.4. In case of fatal error system will do a heap and thread dump and restart the required process.

2.3. Installation

Users will have the opportunity to install the system using a usable, self-guided interface, provided as part of the solution.

2.4. Home equipment automation

2.4.1. For multiple users in an environment average of temperature and brightness will be applied or the recent logged in user's preference will be applied

2.4.2. If user access notification from any Access control unit (APP, Local controller) the notifications should not be displayed in other controller unit

2.4.3. In case of rain and snow window sensor should shut window but AC/Lights should not be affected

2.4.4. Seasonal preference (Winter, Summer, Fall) for all home residents needs to be tracked

2.5. Cooking Automation

2.5.1. Notification needs to be voiced base in case phone is switched off, user involved kitchen activities

2.5.2. User can be notified to put dishes in the refrigerator.

2.5.3. User grocery list should be generated from frequent recipes and eating habits

2.6. Automate home theatre

2.6.1. Send user reminder for streaming service renewal if pattern analyzer detects a subscription has ended.

2.6.2. To protect user privacy logout after a user is absent form room for a certain period.

2.6.3. Save user's login credential when a user voice is authenticated automatically login to streaming services.

3. Usability

3.1. Ease of Use

The user interface for browser and mobile applications shall be easier to use with minimal to no training.

3.2. Supported Browsers

The remote application should support latest version of Firefox, Chrome, Safari and Edge.

3.3. Supported Mobile versions

The mobiles application should support latest iOS and Android versions and should also provide support some older versions released since 2016.

3.4. Voice based assistants

The solution should integrate seamlessly with voice-based assistants like Amazon Alexa, Apple Siri and Google Assistant.

4. Reliability

4.1. Available Storage Space

4.1.1. At any point of time, 30% of the total storage space will be available for use.

4.1.2. If the available space goes below 30% of the total space, system will free up space by deleting files in first in first out manner.

4.2. Mean Time to Repair (MTTR)

MTTR for firmware upgrades will be 15 minutes.

4.3. Availability

4.3.1. 24 hours battery back up in case of power failure.

4.3.2. Only devices/components configured as critical will be monitored during power failure.

4.4. Remote connectivity

System shall automatically switch over to using 4G/LTE (controller installed SIM) in case of Broadband/Wi-Fi failure.

4.5. Encryption

All transmissions to and from the controller will be encrypted to ensure privacy and data integrity through authenticated login.

4.6. Authenticity

4.6.1. System shall remind the users to change their passwords once after every 60 days.

4.6.2. Controller will prompt the user reset the default password of the installed third-party devices once the device is paired with the controller.

5. Performance

5.1. Response time

5.1.1. Acceptable latency to send and execute commands locally from within the house should be less than 1 second.

5.1.1. Acceptable latency to send and execute commands remotely over the internet devices is between 2 - 4 seconds depending on the signal strength at user's remote location.

5.1.2. Acceptable latency for receiving notification is 1-2 seconds after the occurrence of the event

5.2. Capacity

5.2.1. System will support 4 simultaneous user logins for remote application.

5.2.2. Each login session will be identified using a session id.

5.2.3. No two sessions can have the same login id.

5.3. Transaction time

Any interact between the cloud server and the controller should take less than 500 milliseconds.

6. Security

6.1. Home Security

6.1.1 System shall be able to detect any wear and tear for mechanically moving parts by observing a difference in the time it takes to open/close or lock/unlock any points of entry and exit. System shall the notify users to get it repaired.

6.1.2 On an event of detecting multiple emergencies at the same time say for instance intrusion and fire/smoke together, system shall not automatically go by the default actions steps for both the emergencies instead it would first notify and ask user about which emergency handling sequence of action should get preference.

6.2. System Security

6.2.1 System shall operate on a network behind a firewall to avoid any unwanted and unethical access to system.

6.2.2 User's System Control Application shall take into consideration appropriate security measures like face recognition, fingerprint scan and two factor authentication.

7. Supportability

7.1. Maintenance and Upgrade

7.1.1. System will support upgrade of firmware.

7.1.2. System shall support live software upgrades wherein no specific downtimes are required and upgrades get effective after a quick self-reboot.

7.1.3. Maintenance and upgrade will only happen when the system is in normal state (i.e. non alarming state)

7.1.4. Primary mode of upgrade will be via Broadband and secondary mode will be 4G.

8. Design Constraints

8.1. Platform Requirements

8.1.1. Controller runs on LINUX – as the Operating System

8.1.2. Controller supports the Java runtime environment.

8.1.3. Firmware is implemented in Java.

8.2. Methodology

Agile methodology will be used as project management process:

8.2.1. To lower the cost of product development

8.2.2. To have a working solution delivered early on with some essential and more critical features first and other less important features in upcoming releases.

9. Online User Documentation and Help System Requirements

User manual and installation documentation shall be produced which instructs on recommended installation and usage of the system.

10. Purchased Components

- System supports integration with other third-party Smart Devices which can be purchased separately.
- Third party devices procured externally shall require meeting the necessary licenses.

11. Interfaces

11.1. User Interfaces

11.1.1. An Interactive GUI application (both desktop and mobile) would be provided as part of the solution that enables the users to:

- Configure the system
- Send Commands to the controller
- Receive Notifications from the system
- Generate and view system reports

11.1.2. Any remote User Interface (trying to connect to system using Internet) will use HTTPS protocol in port 8080 for secure communication.

11.2. Hardware Interfaces

11.2.1. Controller should be equipped with SD card slot.

11.2.2. Controller should be equipped with an on device SIM card slot.

11.2.3. Controller shall support connectivity to rechargeable battery.

11.3. Software Interfaces

System shall support communication with the supported third-party devices through Rest APIs exposed by the vendors for successful integration with SmartHome+.

11.4. Communications Interfaces

11.4.1. The controller will have the required hardware interface modules to enable communication using Wi-Fi, Bluetooth, ZWAVE and ZIGBEE.

11.4.2. Controller shall have independent access 4G/LTE connectivity using an on device SIM.

11.4.3. Controller shall have 1 WAN port for Broadband connectivity.

11.4.4. Controller shall have 1 LAN port for troubleshooting purposes

12. Licensing Requirements

Depending on the province of installation below are a few important licenses that might be necessary for an authorized installation:

- Electrical license for doing installations of smart in-wall switches and outlets

- HVAC or superseding line voltage license for thermostats.
- Locksmith license for installation of smart locks.
- Security and Emergency Alarm registration with 911 services.

13. Legal, Copyright and Other Notices:

The provided set of documents, design related artifacts and the software development artifacts are all protected under the Copyrights Law and any unauthorized distribution or modification of it would account to an outright violation of the law.

14. Applicable Standards

14.1. Wifi

IEEE 802.11a

14.2. ZIGBEE

IEEE 802.15

14.3. ZWAVE

ITU-T G. 9959

14.4. Device standards

Devices and controller are compliant with CE and FCC standards.

14.5. NFPA

Sensors and equipment are certified under Safety standards

14.6. UL

The controller will be UL certified.

14.7. Air Quality Index

Threshold limit for the air quality score will be set based on the air quality index recommendation by the local government.

15. Glossary

Refer Section 1.3 for all the necessary definitions.