SmartHome+
Vision Document

Version <2.0>

Provided by:(Team-30)

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Revision History

Date	Rev.	Description	Author(s)
2020-07-14	1.0	Complete main parts of VD, for d1.	All
2020-07-27	1.1	Fix bugs of stakeholder, user environment, security.	Tianlin Yang, Haitun Liao Tian Wang, Wenhui Guo
2020-07-27	1.2	POD section confirm and edit.	All
2020-08-06	2.0	Finish bug fix and conflicts fix.	All

1. Introduction

1.1. Document Purpose

This document outlines the vision for the SmartHome+ home automation platform[1]. The purposes of this document are to:

- Identify the purpose of the project
- Identify the problems faced by clients and the impacts of those problems
- Identify the position of the project
- Identify the stakeholders and the user environment
- Describe the project
- Identify other requirements related to this project

1.2. Project Purpose

The SmartHome+ is a home automation platform. This software project is targeted to improve house owners' living experience. It contains six categories of functions to be developed: accessibility, environmental, energy efficiency, security, media and entertainment and automation. The platform is supported via hardware and sensor. Such as smart speakers, sensors, lights and security devices. Users could access the platform via mobile phone, tablet or pc app. It is capable of voice interaction, multimedia playback, monitoring the house, supporting security alarms, making routines and reminders, setting time alarms, streaming podcasts, weather, traffic information, and others.

2. Positioning

2.1. Problem Statement

The problem of	· Customers need SmartHome+ platform used for automating home daily tasks. · Six categories functions need to be implemented. · The existing smart devices are not used by customers. · It needs to treat different client family members separately.
Affects	The members of the house
The impact of which is	Degree of automation in the daily tasks of house members, living comfort and health, security level, energy consuming.
A successful solution would be	A flexible, cost effective home automation platform that can be easily configured by the house owners. The product enables users to automate their daily home tasks, reduce energy waste, and provide home security. And with routine requirements which includes the following three aspects of automation: 1. Wake up routine: Alarm clock, automatic coffee making machine, automatic curtain operation, light control system and hot water system 2. Coming from work routine: Garage door, house heating and air purifier control system 3.Before going to bed routine Automatic light brightness adjustment and music playing system

	In addition, a home automation platform also takes into account environmental factors(monitors can reflect the quality of water and air), energy efficiency factors (products help users allocate resources reasonably and reduce waste), and safety factors(alarm systems) The user would be able to access the system either locally or remotely and different types of users have different permissions(Childs should have different profiles with parental control)

2.2. Product Position Statement

For	The owners of the house, their children, their pets and guests
Who	Feel the need for a home automation platform that provides convenience, efficiency and security for their daily life.
The SmartHome+	IOT based platform, which could support smart devices to communicate with each other and work together.
That	Improve automate level of daily life, save money from energy cost, added high level security. etc.
Unlike	Amazon Alexa[2], don't support energy efficiency and safety functions and often be considered as a speaker related with some basic smart app.Google home is same with Amazon Alexa.The Google Home[3] can play music, but it's primarily designed as a vehicle for Google Assistant -- Google's voice-activated virtual helper that's connected to the internet and it also doesn't take into account the environment, energy efficiency, safety and other factors.
Our product	Is an integrated solution and in continuous development for more features.It supports local access and remote access by different types of users. And the summation and harmonization of all the six categories of SmartHome+ will provide for a truly rewarding living experience for the SmartHome+ users.

3. Stakeholder Descriptions

3.1. Stakeholder Summary

Name	Description	Responsibilities
End Users: house owers, their kids, their guests, pets	People who live alone or with family in a property such as a house or an apartment will interact with the platform directly and may not have knowledge of how to use the platform.	Ensures the necessary hardware requirements and feedback towards the satisfaction of this platform.
Internet service provider	A company which provides the internet services typically. Include Internet access, Internet transit, domain name registration, web hosting, Usenet service, and colocation.	Provide the internet environment and ensure the stability and capability.
Interior architect	An individual who designs building interiors, which often requires considering both the functionality and appearance of a space.	Ensure that the smart devices and cable installation properly.
Technology provider	A company produces and sells software/hardware application techniques and analysing or submitting trial data for regulatory approval.	Provide technical support for SmartHome+ related usages.
Construction worker	An individual who helps the end user establish the physical construction of the SmartHome+ built environment.	Ensure that the SmartHome+ hardwares and devices are installed properly in the end user home.
Customer service representative	An individual who interacts with customers to handle complaints, process orders, and provide information about an organization’s products and services.	Ensure that end user requests and ask help could be processed properly.

Maintenance technician	An individual who is responsible for the upkeep of a SmartHome+ devices and software.	Ensure that the SmartHome+ devices and software are in well condition.
Requirement Manager	An individual who helps the end user express their requirements.	Ensure that as many hidden requirements from the House owner as possible are elicited. Ensure that those requirements are properly communicated to the project manager.
Project Manager	An individual who is primary for leading the platform development.	Plan, manage and allocate resources ,ensure that the development for this platform finally succeeds.
Software Architect	An individual who is focused on a high level of platform development.	Ensure that the platform is going to be architectural and maintainable to support the functional and non-functional requirements.
Developer	People who get the requirements from RM and PM develop a platform that meets those requirements.	Ensure that fully understanding the requirements from RM and PM. Ensure that development achieves those requirements.
Competition Teams	Development Teams of similar products	Ensure the competitiveness of products.

3.2. User Environment

1. The SmartHome+ platform will be used by people who live alone or with family in a property such as a house or an apartment will interact with the platform directly. In addition, people may not have knowledge of how to use the platform. End users roles are shown below:
    a. house owers
    b. kids
    c. guests
    d. pets
2. The SmartHome+ platform can be accessed remotely and locally. Mobile devices are supported in the outdoor environment. The type of locations are divided below:
    a. at home (locally)
    b. in the office/vehicle/outside/in flight (remotely)
3. The system platforms that will be used are shown below:
    a. on the IOS
    b. on the Android operating system
    c. access via PC android emulator

4. The user can access this platform randomly because the amount of time spent in each activity may change. The activities for example:
    a. playing with kids

b. watching TV
c. taking a shower
d. listening music
e. cooking

5. The number of the development team keeps six people unchangeable while the number of people involved may change in the future because more end users may participate.
6. The task cycle is planned around one and a half years according to the requirements.
7. Rightnow there are no existing applications in use. Therefore no need to integrate with another platform.

4. Product Overview

4.1. Product Perspective

SmartHome+ platform provides interactive and effective solutions[4] for home automation by providing a software platform to port smart devices works together[5]. It provides a variety of smart devices like light, speaker, TV, stove, microwave/oven, water tap, biometric lock and many more. It also supports most of the smart devices available in the market sold by third parties[7]. Compared to existing platforms[8] available in the market SmartHome+ delivers an engaging and easy to use user interface and supports different input methods like touch, voice and gestures. Users can check status of device or reconfigure any device at any time through an interactive dashboard. In today's digital era, user data privacy and security is the major concern[10]. SmartHome+ provides state of the art data protection and industry standard[11] security in all smart devices. Below as Figure.1 shown is SmartHome+ home automation platform overview:

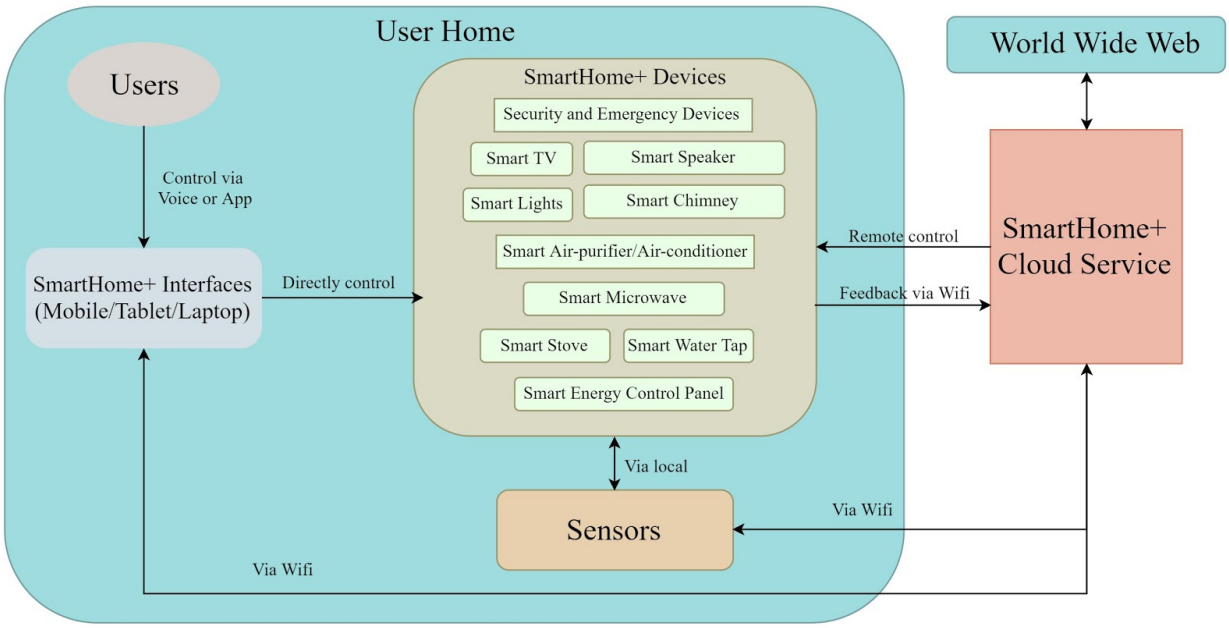

Figure 1: SmartHome+ Overview

4.2. Assumptions and Dependencies

Assumptions	Dependencies
The user know how to use application	User should be able use application with minimum efforts
Device running compatible OS	Application runs on Android & iOS
Device having internet browser	Supports most of the modern browser (e.g. Chrome, Firefox, Edge, Safari etc.)
Stable Internet Connection	Make most out of SmartHome+ services
Power failure	Should have backup power source (like inverter)

4.3. Needs and Features

Need	Priority	Features	Planned Release
Hardware purchase and installation	High	Visually pleasing devices	Iteration-1
Platform dashboard, statistics	High	Interactive website, devices status	Iteration-1
Control system through voice, gesture and touch	High	Versatile User I/O	Iteration-1
Health report of all running devices	Low	Performance report	Iteration-3
Check/Change device configuration	High	Device customization	Iteration-1
Biometric authentication, house monitoring	High	Security	Iteration-1
Internet crash, power failure, robbery	High	Emergency	Iteration-1
Wake up, Work and Goodnight routine (Set alarm/reminder, taking notes, relaxing music, dynamic lighting, upcoming meetings)	Normal	Accessibility	Iteration-2
Smart lighting control	Normal	Accessibility	Iteration-2
Work routine (house heating, air purifier, air-purifier and temperature control)	Normal	Environment	Iteration-2
Turn off kitchen appliances when not in use (stove, oven, light, chimney)	High	Efficient use of resources	Iteration-1
Smart arrange devices to sleep status	High	Efficient use of resources	Iteration-1
Smart notification about water usage	High	Efficient use of resources	Iteration-1
Monitoring the daily weather updates, Keeping a record about the UV index of the environment and the air quality index	Normal	Environment	Iteration-2
Measuring the water Ph level regularly, Carbon monoxide (CO) monitoring	Normal	Health and Safety	Iteration-2
Listen music/podcast, video streaming, latest news update	Normal	Entertainment	Iteration-2
Play game(local remote streaming)	Normal	Entertainment	Iteration-2
Traffic reports	Normal	Accessibility	Iteration-2
Find my devices	Normal	Accessibility	Iteration-2

Intercom, calling relatives	High	Communication	Iteration-1
Social updates	Low	Accessibility	Iteration-3
TV, projector control	Normal	Entertainment	Iteration-2
Support parental control for all devices	Normal	Accessibility	Iteration-2
Door, Window control	Normal	Environment	Iteration-2
Environmental control(Temperature, air purify, humidity, water temperature etc.)	Normal	Environment	Iteration-2

4.4. Alternatives and Competition

Most of the devices available in the market today only support the user's voice as an input and few of them have touch support. For example Google Home[3] and Amazon Alexa[2] have many great features to complete daily routines and both have integration with other popular third-party applications for services like music, light control and entertainment etc. But these two devices support only voice as an input. Although they have provided applications to setup and control devices but nothing else.

On the other hand Apple homekit[6] has provided an application through which users can control almost everything but it has very limited support of third party integration and has exclusive support for Apple devices.

As compared to these products SmartHome+ supports multiple input methods, has many integration with popular third parties to provide complete solutions for home automation and helps users to complete daily tasks efficiently and accurately. The basic facts comparison as shown below:

Product	Comprehensive	Smart	Automation	Device Compatibility	Cost
Amazon alexa[2]	High	Low	Low	High	Low
Google home[3]	Middle	High	Middle	High	Middle
Apple homekit[6]	Low	Middle	High	Low	High
SmartHome+	Middle	Middle	Middle	High	Middle

From the above SmartHome+ solutions presented, personal customization for each and every product is one improvisation. For example,

- Dashboard stats which are important can be controlled and shown to the user
- Certain topics in news and weather reports can be highlighted as priority notifications, mainly health related.

With the gain in popularity of artificial Intelligence, machine learning and deep learning, performance of SmartHome+ products can be increased in terms of

- Energy saving for dynamic lighting and kitchen services
- Security of biometric authentication and house monitoring will reduce fault access by outsiders
- Suggestions for best configurations for SmartHome+ devices based on available customer data related to those devices or on current users usage in that home
- Better results for systems controlled through voice and gestures using the mentioned technologies

Considering the strength and weakness of the above two mentioned, a trade off in both the fields would be a good one to use as a product cannot be highly customized (due to less awareness of

its impact and technical details) or complete dependency on technologies like artificial intelligence and machine learning as these might still fail in rare cases which user, at the point of time might expect to work.

5. Other Product Requirements

5.1. Platform Requirements

The SmartHome+ is planned to run on Android and iOS as well as through any modern browser. It will provide remote support through internet and inhouse support through local network or internet. So the client requires a device like a smartphone, tablet or laptop which can have any compatible operating system or browser to connect to the network and use the system.

5.2. Performance Requirements

This platform should be stable and safe. It needs to respond quickly to the requests, regularly update collected data to the cloud and use the backup data to recover it after the system crash or power failure. Also when there is a power failure the platform should have a corresponding way to guarantee the basic safety of the house.

5.3. Environment Requirements

Smart IOT devices to automate the home, reliable network to support the system via local network as well as through internet, sensors to collect data about home environment and actuators to allow the system to modify device physical state.

5.4. Safety and Security Requirements

Only protected certified devices could port to the platform. Avoid public internet, only use private Wifi. Utilize multWe analyzed four commercially-available smart home Self-diagnosis and repair[13] .

Encryption alone does not provide adequate privacy protection for smart homes[15]. Given the generality of our traffic analysis strategy and the limited-purpose nature of most IoT devices, we would not be surprised if many other currently available smart home devices suffer similar privacy vulnerabilities, i-factor authentication, warning abnormal situations.

In SmartHome+ platform we use Triple DES, RSA, Blowfish, AES .etc to protect the user's privacy[16]. The definitive standard for AES is FIPS PUB 197: Advanced Encryption Standard (AES) and ISO/IEC 18033-3: Block ciphers[17].

5.5. Quality Ranges

Via research on current quality standards such as ISO 25010[14], it will give a clear evaluation schema for each of them, here let's briefly divide them as such levels low, middle and high:

Feature	Quality Range	
Performance	High	Satisfy most user needs, can well interact with user and environment
Robustness	High	Platform can survive crashes due to input errors, disk failures, network overloads, or intentional attacks
Fault tolerance	Middle	Platform can identify irrational requests and reject it to guarantee security
Usability	Middle	All ages can easy to study and use this platform

5.6. Design Constraints & External Constraints

1. Sensors can accurately measure minor changes and internet connection is stable.
2. Only authorized users can control this platform, and the administrator can modify the control rights of each authorized person. compared with low level authorized person high level authorized person has more control rights.
3. Before each action, the system will check the control rights of the client and the safety of this operation to ensure security.
4. Data transmissions are encrypted for privacy.
5. The system responds quickly to user requests or changes in the environment and the system responds to local control requests faster than remote control requests.
6. Dynamic capacity, based on devices.

5.7. Documentation Requirements

This is a user-friendly platform, we will provide detailed user manuals. The user manuals will include the installation instructions, online help instructions and user guide. Any question about this system can find an answer in the user manual or through online real time help.

5.8. Priority of Other Product Requirements

Attribute	Priority	Reason
Stability	High	Platform stability and internet connection stability are very important. only guaranteed stability, the platform can carry out requests fast and safely
Benefit	Middle	What user can get from this platform is important, it decides how many people will become potential users and would like to pay for it
Effort	Middle	User will not would like to effort too much to learn how to install or operate this platform, so this platform should be user-friendly, users can effort less and gain more
Risk	High	User needs a low-risk platform, ensure this platform will guarantee security instead of letting the user environment in an unsafe environment is super important

Appendix

Questionnaire

1. **Do you want to access home by SmartHome+? And what do you hope to be Smart in your daily life?**

   We want our daily routine to be smart.
   - Wake up routine (alarm, coffee machine, curtains, light, water heating)
   - Coming from work routine (garage door, house heating, air purifier)
   - Goodnight routine (lighting, relaxing music)

2. **Which components are considered to improve your living comfortably and healthy? Especially in entertainment and environment?**

   Monitoring the quality of air and water (As mentioned in the document)
   A. Monitoring the daily weather updates
   B. Measuring the water Ph level regularly
   C. Keeping a record about the UV index of the environment and the air quality index
   D. Carbon monoxide (CO) monitoring

3. **Should different people living in the house have different rights to control the system?**

   Yes, there should be different profiles with parental control.

4. **Would you be more interested in buying a complete set of devices (all appliances that are commonly available) or few of the important devices?**

   Buying a complete set of devices (all appliances that are commonly available)

5. **How much would you like to spend on the equipment/devices which provide these SmartHome+ features?**

   We are not restricted to any number. You can purpose how much it cost to make it a smart home.

6. **Are there any special needs for the family members and guests? Especially in terms of security and accessibility?**

   No, we don't have any special needs for the family members and guests

7. **How much time do you want to allocate for doing an activity or just a headstart is enough to carry out?**

   A headstart is enough

8. **Do you want to integrate existing smart appliances with SmartHome+?**

   No, we don't have any existing smart appliances.

9. **For the services you avail, what kind of response-action plan do you need in cases of system failure and emergency situation?**

   You should purpose the different emergency plan and what will happen in case of system failure.

10. **Which resources would you like to change/optimize in terms of energy and efficiency?**

    You should purpose various methods, with which we can save energy.

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