Software Requirements Specification

For

SMART HOME

Version 1.0 approved

Prepared by BSE 20-43

<organization>

<date created>

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Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Date** | **Reason For Changes** | **Version** |
|  |  |  |  |
|  |  |  |  |

# Introduction

## Purpose

This project is about the design and development of an automated home system.

Smart home should provide security and safety features by automating on/off of lights, opening door, and different home appliances like TV, AC, refrigerator, alarms, and CCTV cameras for houses that are going to use this system.

The requirements document will include some details about the problem or the need for a smart home system as well as the solution specifications or what is expected from a smart home system.

## Document Conventions

Main Section Title:

Font: Times New Roman Face: Bold Size: 14

Sub Section Title:

Font: Times New Roman Face: Bold Size: 12

Other Text Explanation Face: Normal Size: 12

## Intended Audience and Reading Suggestions

This SRS is useful for developer, user, external guide and internal guide. Each of them can easily understand how to use our product by reading this SRS.

## Product Scope

This product will focus primarily on automating of lights, opening door, and different home appliances like TV, AC, refrigerator, alarms, and CCTV cameras as the end users can understand and use this features easily. When users will make use of this product and are comfortable with it, they can expect new features to be added in future versions to make their home a more comfortable place to live by the use of other new automated home related services.

All scenarios of actions and status information can be viewed through internet (web server) in which statistical data’s are accumulated. As well as viewing, user can send orders to the coordinator box in order to change home appliances’ activities in real time.

## References

|  |  |
| --- | --- |
| [1] | B. 20-43. [Online]. Available: https://softwaredev91930750.wordpress.com/. |
| [2] | [Online]. Available: http://cit4.mak.ac.ug/projects/. |

# Overall Description

## Product Perspective

Smart Home is a generic solution that will automate usage and control of different home appliances and will add an extra layer of security to the home by detection of an intrusion and alerting the home owner respectively. The system will work automatically through use of different sensors light, motion detectors, temperature sensors which data will trigger certain events turning on and off of lights, turning on and off of ACs and(or) fans, opening and closing of doors. The client will also have the ability to override the system through use a mobile app after being authenticated and authorized by the system.

## Product Functions

In our home automation system, the user indicates the person purchasing the product to take advantage of energy efficiency for his/her home. The user basically has rights to choose a device, turn it on & off, getting & updating the sensor info of the device and adjust it according to the configurations types of the device

For Home Automation of:

         Home Appliances such as Lights and Fans on/off, TV, coolers.

         Automation of Home doors as open and close.

         Smoke Detection.

For Security:

         Sensor-based IR (infrared) Security system

         Notification of user in case of smoke detection.

## User Classes and Characteristics

This project is intended to be used by mainly one user class namely: -

* Home owners:
  + User interface provided by SMARTHOME is easy-to-use and user friendly, in turn allows an average computer user to control home appliances they own.
* The users of the system should be able to
  + turn on and off lights
  + Open and close doors
  + Login into the system by providing a password
  + Turn on and off TV, fans and ACs.

## Operating Environment

The system will operate in a smart Home Environment but can also be adapted to a small office.

In this project, Wi-Fi network adapter would be used to obtain a wireless communication between a master controller and home appliances as well as various sensors to collect data from home environment.

A master controller software working on Arduino Uno will be developed. In addition, a database deployed on web server would be needed to keep the data collected from home appliances on the web and show this data when required by the user.

PIC Microcontroller Board would also be used to simulate home appliances within the development process by imitating the response of home devices.

## Design and Implementation Constraints

* Budget constraints are a limitation since physical items, such as the networking equipment, servers, furniture, and appliances, must be purchased.
* Expert knowledge and quality control are limitations, for the reason that without a definitive expert on IoT, all knowledge is subject to student research.
* Time is a limitation because development the initial requirements and framework development are done as course projects, which will thus be measured on a semester scale.

## User Documentation

<List the user documentation components (such as user manuals, on-line help, and tutorials) that will be delivered along with the software. Identify any known user documentation delivery formats or standards.>

## Assumptions and Dependencies

Our application is an android based app and it will only work on the android mobile phone and not suitable for window phones and IOS. Our software is customized software made on demand of customers and clients. This software is not free and has some cost.

# External Interface Requirements

## User Interfaces

The user shall interface with the system through an android application. Below are some of the screens the user will use to perform the desired functionality.

### Login Screen

When the user opens the application, he/she is required to provide his login details in order to access the system.

### Choose Device

After the user has been successfully authenticated into the system, he is prevailed with a list of home appliances he is supposed to configure. For example lights, doors, TV, coolers etc.

### Control Device

Here the user will be presented with the different options available for configuring a device. For example if the user selected lights, the available options will be to turn on or off.

### View notification

Here the user will be able to see notifications sent by the controller in case of smoke detection and someone trying to temper with the door if it has been locked. This will also act as a security mechanism.

## Hardware Interfaces

### Wi-Fi

In order to communicate over long distances without running wires, we came up with a convenient way of communicating with our sensors. The different I/O devices are controlled using TCP/IP over the IEEE 802.11g standard protocol. Data being gathered from sensors, such as temperature sensors, light sensors, and laser tripwire sensors, is being processed on an Arduino Micro-controller and then broadcast with an attached WI Shield v2.0 to a server using the TCP/IP protocol.

### Arduino Micro Controller Unit (MCU)

We have used an Arduino MCU with a WI Shield v2.0 Wi-Fi 802.11b wireless adapter network card that supports static IP address assignments. The power usage of the Wi-Fi Shield with Arduino is low. It requires 5-7 volts.

### Android Mobile

These are mobile devices on which the users will be using to access the system.

## Software Interfaces

The main functionality of software is to be responsible for monitoring the changes in attached hardware and to initiate controlling statements that, depending on the data received, would trigger an event based on that condition.

* + Monitor analog inputs go gather temperature change in a room and light intensity in order to turn on a digital output.
  + Create software serial communication in order to communicate with other MCU controllers responsible for controlling power strip plugs
  + Create an Arduino hosted web server responsible for keeping track of sensor information and current states of attached devices.
  + Gather and store power sensor information and store it for clients to see.

Software is based on Arduino code that is based on the C programming language. It consists of libraries that create web servers for Arduino MCU’s Wi-Fi and also libraries responsible of setting up software serial communication to another MCU controller

## Communications Interfaces

This application uses Wi-Fi to communicate Android devices and the different. It will also use TCP/IP to send data from the different sensors to the Micro Controller Unit.

# System Features

<This template illustrates organizing the functional requirements for the product by system features, the major services provided by the product. You may prefer to organize this section by use case, mode of operation, user class, object class, functional hierarchy, or combinations of these, whatever makes the most logical sense for your product.>

## System Feature 1

## Light Sensor

4.1.1 Description and Priority

It is used to sense the presence or absence of sunlight for the purpose of controlling lights.

Priority: high

On a scale of 1 to 9, one being low and nine being high this requirement is rated as follows

|  |  |  |  |
| --- | --- | --- | --- |
| Benefit | Penalty | Cost | Risk |
| 9 | 9 | 7 | 5 |

4.1.2 Stimulus/Response Sequences

|  |  |
| --- | --- |
| User action/ Stimulus | System response |
| When it becomes dark due to no sunlight. | The system turns on the lights. |
| When it becomes bright due to sunlight. | The system turns off the lights. |
| When the owner chooses to turn lights on or off on mobile phone. | The system turns on or off the lights. |

4.1.3 Functional Requirements

|  |  |
| --- | --- |
| REQ-1: | The system should sense the light rays from the sun. |
| REQ-2: | The system should turn the lights on or off. |
| REQ-3 | The system should respond to actions from mobile phone. |

## Motion sensor

4.2.1 Description and Priority

This is used to detect the motion of people in and out of a room.

Priority: medium

On a scale of 1 to 9, one being low and nine being high this requirement is rated as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Benefit | Penalty | Cost | Risk |
| 8 | 9 | 7 | 5 |

4.2.2 Stimulus/Response Sequences

|  |  |
| --- | --- |
| User action | System response |
| Owner enters a room | The system puts on lights if it is dark. |
| Owner walks towards door | Door opens. |

4.2.3 Functional Requirements

|  |  |
| --- | --- |
| REQ-4: | The system should detect motion of people in home.. |

## Temperature sensor

4.3.1 Description and Priority

It is a device that measures the temperature of the home.

Priority: medium

On a scale of 1 to 9, one being low and nine being high this requirement is rated as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Benefit | Penalty | Cost | Risk |
| 9 | 9 | 7 | 9 |

4.3.2 Stimulus/Response Sequences

|  |  |
| --- | --- |
| User action | System response |
| Temperature is high | The system turns on cooler. |
| When temperature is very low | The system turns off cooler. |

4.3.3 Functional Requirements

|  |  |
| --- | --- |
| REQ-5: | The system should be able to read the room temperature. |

## Alarm

4.4.1 Description and Priority

It is used to alert the owner in case of any security or safety problem.

Priority: medium

On a scale of 1 to 9, one being low and nine being high this requirement is rated as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Benefit | Penalty | Cost | Risk |
| 9 | 10 | 4 | 3 |

4.4.2 Stimulus/Response Sequences

|  |  |
| --- | --- |
| User action | System response |
| User forcefully opens door. | The system sounds alarm |
| Smoke detected in room | System sounds alarm |
| User turns off alarm using mobile control. | The system turns off alarm. |

4.4.3 Functional Requirements

|  |  |
| --- | --- |
| REQ-6: | The system should alarm in case of smoke in room. |
| REQ-7: | The system should alarm in case of break in. |
| REQ-8: | The system should turnoff alarm when user chooses to turn it off. |

## Smoke detector

4.5.1 Description and Priority

It is used to detect smoke in room.

Priority: high.

On a scale of 1 to 9, one being low and nine being high this requirement is rated as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Benefit | Penalty | Cost | Risk |
| 9 | 10 | 5 | 5 |

4.5.2 Stimulus/Response Sequences

|  |  |
| --- | --- |
| User action/Stimulus | System response |
| Smoke detected in room | System sounds alarm |
| User turns off alarm using mobile control. | The system turns off alarm. |

4.5.3 Functional Requirements

|  |  |
| --- | --- |
| REQ-9: | The system should detect smoke in room. |

## TV controller

4.6.1 Description and Priority

This feature is a mobile application used to control the television of home.

Priority: medium

On a scale of 1 to 9, one being low and nine being high this requirement is rated as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Benefit | Penalty | Cost | Risk |
| 7 | 3 | 10 | 2 |

4.6.2 Stimulus/Response Sequences

|  |  |
| --- | --- |
| User action | System response |
| User selects on button on mobile phone. | The system should turn on TV. |
| User selects off button on mobile phone. | The system should turn off TV. |
| User selects channel button on mobile phone. | The system should change TV channel. |

4.6.3 Functional Requirements

|  |  |
| --- | --- |
| REQ-10: | The system should control the Tv using a mobile device. |

## Mobile application

4.7.1 Description and Priority

It is used to override the other automatic features of the system.

Priority: High

On a scale of 1 to 9, one being low and nine being high this requirement is rated as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Benefit | Penalty | Cost | Risk |
| 9 | 9 | 9 | 9 |

4.7.2 Stimulus/Response Sequences

|  |  |
| --- | --- |
| User action | System Action |
|
| User selects to control any feature in system. | The system connects to a network.  The system turns the feature/ device on or off. |

4.7.3 Functional Requirements

|  |  |
| --- | --- |
| REQ-11: | The system should provide a mobile application control of its features. |

# Other Nonfunctional Requirements

## Performance Requirements

The Smart Home system must perform well and be reliable. Because a Smart Home system integrates devices in the home it is subject to a high number of possible failures like power cuts, power surges etc. The Smart Home system must therefore be able to check and monitor the status of the controlled devices. Also the system must allow users to use these devices even if the automation link between these devices has broken down.

## Safety Requirements

## Security Requirements

There are security risks associated with using the Smart Home System as it is designed to operate on a network like the Internet.When accessing the system the user needs to be assured that intruders, such as hacker attempts and third party invasions, cannot have access to the Smart Home System. The user therefore needs to be confident that the Smart Home System is secure. The ability to authenticate user connections to the system is required.

To prevent unauthorised access the user has to log in to a mobile application in order to have access to the Smart Home System. A secure system to validate the username and password information is required. The system will accept this information as proof of the identity and allow the user to access the Smart Home System.

## Software Quality Attributes

<Specify any additional quality characteristics for the product that will be important to either the customers or the developers. Some to consider are: adaptability, availability, correctness, flexibility, interoperability, maintainability, portability, reliability, reusability, robustness, testability, and usability. Write these to be specific, quantitative, and verifiable when possible. At the least, clarify the relative preferences for various attributes, such as ease of use over ease of learning.>

## Business Rules

* The user cannot control more than one appliance at the same time. i.e controlling lights and doors at the same time.
* When there is no internet connection, the user cannot override the system functionality via the smart phone otherwise they need to get an internet connection.
* The user can only override system functionality by logging into the system through use of username and password.

# Other Requirements

Data requirements: The data for the Smart Home System will need to be stored and accessed in a reliable and accurate way. A database will store the username and passwords of several users at any one time. The database will also keep track of the number and recorded status of all available automated appliances.

Several text files will also be used to store initial start-up configuration details for the Smart Home System. The following table illustrates the data required;

|  |
| --- |
| **Database Tables** |
| Administrator Details |
| User Details |
| Device Details |
| Levels of Access |

Hardware requirements: a flexible hardware arrangement will be desirable for adding new devices to the system.

User interfaces requirements: a very important point is the ease of use of the system. The system and the mobile application has to be intuitive and easy to use. Furthermore, it must be also taken into account that the Smart Home system can be used by people with physical disabilities.

Appendix A: Glossary

<Define all the terms necessary to properly interpret the SRS, including acronyms and abbreviations. You may wish to build a separate glossary that spans multiple projects or the entire organization, and just include terms specific to a single project in each SRS.>

Appendix B: Analysis Models

<Optionally, include any pertinent analysis models, such as data flow diagrams, class diagrams, state-transition diagrams, or entity-relationship diagrams.>

Appendix C: To Be Determined List

<Collect a numbered list of the TBD (to be determined) references that remain in the SRS so they can be tracked to closure.>