Smart Home Automation System (SHAS)

Version 1.0

Released: 29.04.2021

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Preface Page:

Home automation is building automation for a home called a smart home or smart home. A home automation system will monitor and / or control home features such as lighting, climate, entertainment systems, and devices. It can also include home security such as access control and alarm systems. Home devices are an essential component of the Internet of Things when connected to the Internet. Home automation systems allow us to change the functionality of things in the house as we want, using sensors or with the help of tablets, smartphones.

In the documents I sent before, I drew Functional and non-functional requirements, Qualification Provisions, Requirements Diagram, Component Diagrams, Use Case Diagrams and Activity Diagrams. In addition, I prepared a document for the development and testing of the project I developed.

Project Proposal Report:

In this document I updated Reference Document part and Estimated Budget parts.

Project Name and Shortname:

- Project name is Smart Home Automation System
- Project shortname is SHAS

Subject and Contents:

Home automation is building automation for a home called a smart home or smart home. A home automation system will monitor and / or control home features such as lighting, climate, entertainment systems, and devices. It can also include home security such as access control and alarm systems. Home devices are an essential component of the Internet of Things when connected to the Internet.

In this project, I aim to use:

- Heat sensor
- Light sensor
- Sound sensor

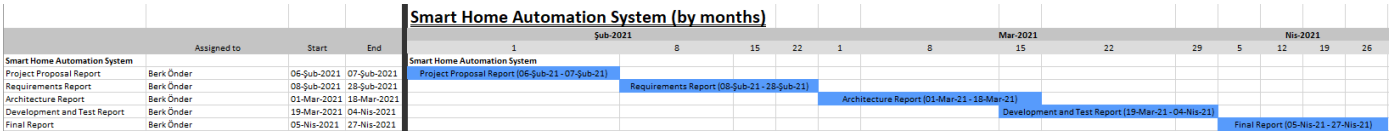
Short Description:

Home automation systems allow us to change the functionality of things in the house as we want, using sensors or with the help of tablets, smartphones.

In the World, there are some similar home automation projects such as:

- ENCORE
- AUVESY
- TUYA

Schedule:



	Assigned to	Start	End
Smart Home Automation System			
Project Proposal Report	Berk Önder	06-Şub-2021	07-Şub-2021
Requirements Report	Berk Önder	08-Şub-2021	28-Şub-2021
Architecture Report	Berk Önder	01-Mar-2021	18-Mar-2021
Development and Test Report	Berk Önder	19-Mar-2021	04-Nis-2021
Final Report	Berk Önder	05-Nis-2021	27-Nis-2021

Methods to be used:

In the development phase of this project, I will try to develop a home automation system by purchasing arduino and various sensors. During the development process, I will send the following reports:

- Project Proposal Report
- Requirements Report
- Architecture Report
- Development and Test Report
- Final Report

I will use C ++ while coding for Arduino

Estimated Budget:

In this project, I have to buy Arduino tool kit with some sensors. I will use C++ for coding Arduino. My estimated budget is like that:

- Arduino Uno R3 SMD CH340 Chip – Klon – 28 TL
- Arduino Sensor Set (37 pieces) – 116 TL

In total my total budget is around 150 TL

Effort Estimation:

Effort estimation; manhours/man months

1 Worker (me) X 90 Days X 1 hours per day = 90 hours

Referenced Documents:

- "How To Calculate The Cost Of Your Projects With Man Hours". ITM Platform Projects Programs Portfolio, 2021, https://www.itmplatform.com/en/blog/how-to-calculate-the-cost-of-your-projects-with-man-hours/.

System Requirements Specifications:

In this document I added Referenced Documents.

Scope:

Identification:

- Project title is Smart Home Automation System,
- Abbreviation is SHAS,
- Version number is v1.0.

System Overview:

- Purpose and general nature of the system is to make homes safer, technological and simpler.
- Home automation systems allow us to change the functionality of things in the house as we want, using sensors or with the help of tablets, smartphones.
- In the history of system development, I created my project name and shortname, subject and contents, short description, schedule, methods to be used and estimated budget.
- Operation and Maintenance.
- Sponsor of the project is self-sponsor.
- Acquirer of the project is Berk Önder.
- Developer of the project is Berk Önder.
- User of the system is people are who live with my house.

Document Overview:

- My purpose in this document is to determine the functions of the home automation system I will do, to create its diagrams (Component, Requirements, Use Case, Activity), to determine other requirements (Non-Functional, Interfaces, Securty, Safety, Data etc.), States and Modes,

Qualification Provisions Traceability and determining the scope of the project (Identification, System Overview, Document Overview)

- The confidentiality of this document will remain only between the instructor of the course, Hürkan Orkun Zorba, and myself, Berk Önder, who made the project.

Referenced Documents:

- "What Is Component Diagram?". Visual-Paradigm.Com, 2021, https://www.visual-paradigm.com/guide/uml-unified-modeling-language/what-is-component-diagram/.

States and Modes:

- Init state: When the application is stated this, the application will expect an input from the user and it become an active state
- Emergency state: In this state, If an unexpected error occurs in the application, an error message will be sent to the user and it become a degraded state.
- Active state: In this state, the application will execute the user's request and put itself in active state and it become an idle state.

Capability Requirements; Functional:

- Display status: The system shall enable user to display the current status of the home in terms of light of the home, heat of the home.
- Change light status: The system shall enable user to change light status of the home in terms of on/of.
- Change heat status: The system shall enable user to change heat status of the home.
- Alarm Ringing: The system shall enable user to open the sound sensor at the home. With this way, if the burglar enters the house, the alarm will sound and a message will be sent to the user.

- Send Notification: The system shall enable user when there is a problem in the sensors, it send a notification to the user.
- Get information: The system shall enable user to show the information of the lights of the home
- Set Sound Sensor Level: The system shall enable user the change the sound sensor level.

Other Requirements; Non-Functional, Interfaces, Security, Safety, Data etc.:

- Availability: System will be up 7/24 active.
- Performance: The system will open in less than 5 seconds while the user opens the application from the phone or tablet.
- Response Time: The system will response user input less than 5 seconds.
- Usability: The system will be easy to use. Application will be very simple in terms of UI. There will be some buttons to open and close the light.
- Tool & Language: The system will be implemented in Arduino IDE and C++ will be used.
- Communication with Arduino will be provided via Wifi, bluetooth.

Qualification Provisions:

- Test: The operation of the system, or a part of the system, using instrumentation or other special test equipment to collect data for later analysis. All tests for buttons for on/off and change will be done while executing the code (Unit testing)
- Demonstration: The operation of the system, or a part of the system, that relies on observable functional operation not requiring the use of special equipment or analysis. I'll test the keys(on/off and change) and demonstrate with a little demo

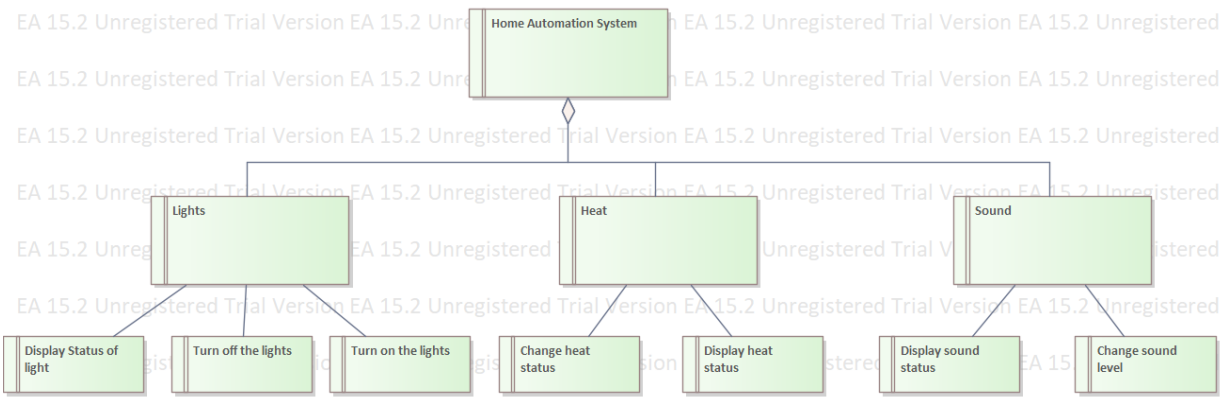
- Analysis: The processing of accumulated data obtained from other qualification methods. Examples are reduction, interpolation, or extrapolation of test results. I will analyze the times that I have determined in non-functional requirements.
- Inspection: The visual examination of system components, documentation, etc. I will visually examine whether it meets the requirements I have written at the end of the project.

Traceability:

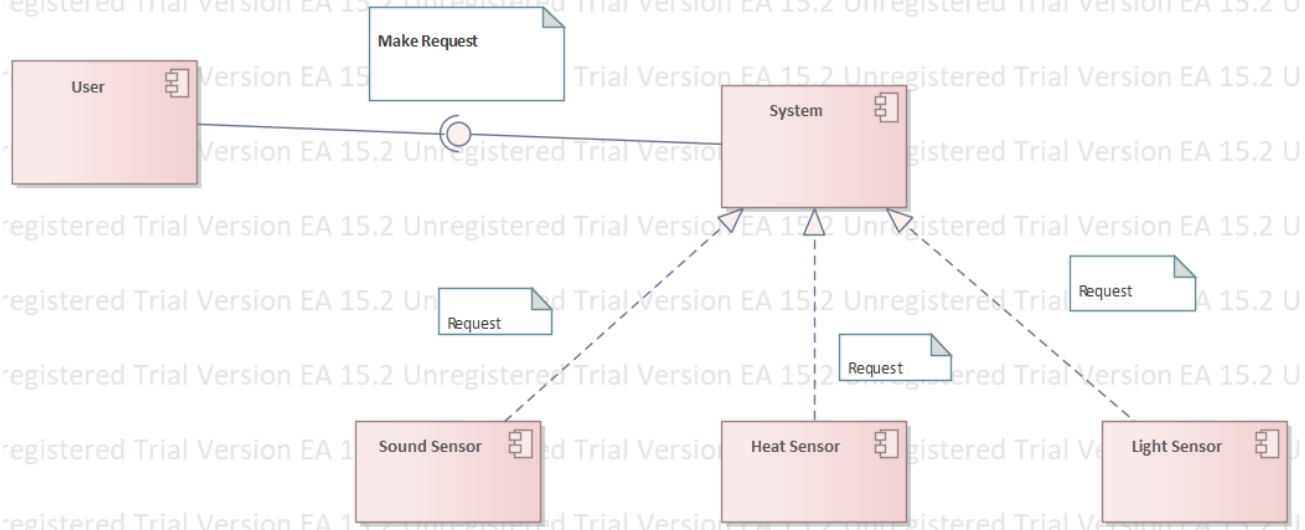
- User Requirement 1: User can turn on/off the lights from their phones and tablets. This requirement is equal to Change light status in functional requirements.
- User Requirement 2: User can display the light status of their homes. This requirement is equal to Display status in functional requirements.
- User Requirement 3: User can change the heat status of their homes. This requirement is equal to Change heat status in functional requirements.
- User Requirement 4: User can change the sound sensor level in their homes. This requirement is equal to Set sound sensor Level in functional requirements.

Diagrams:

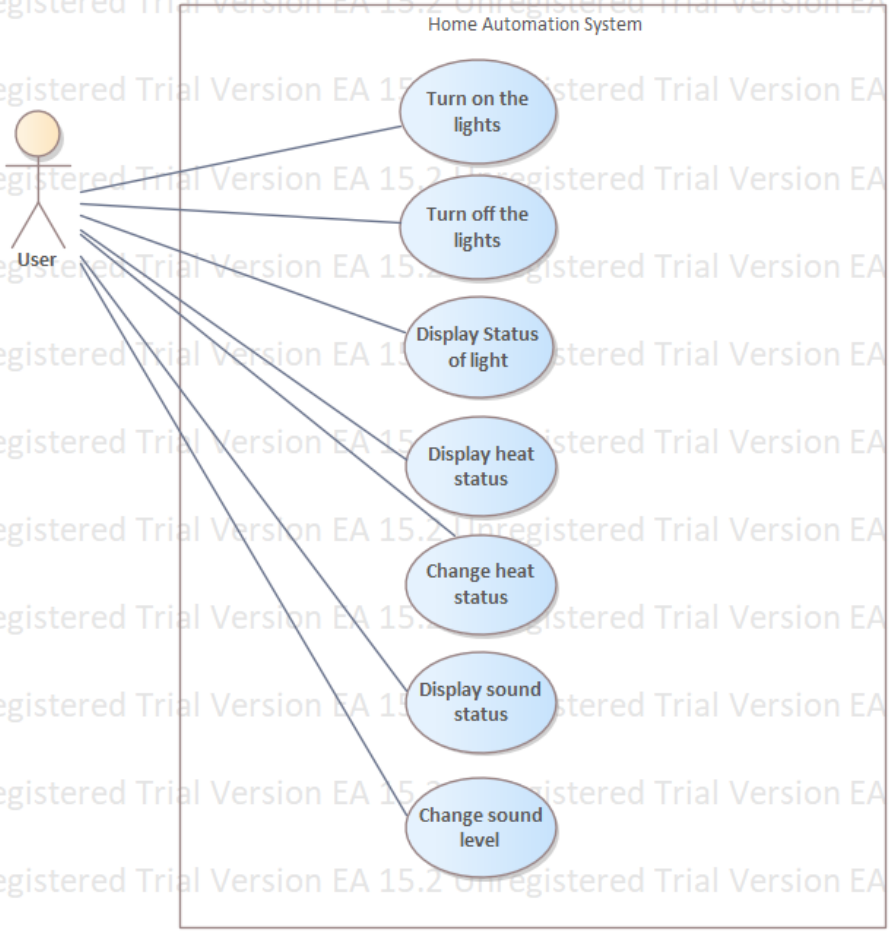
Requirement Diagram:



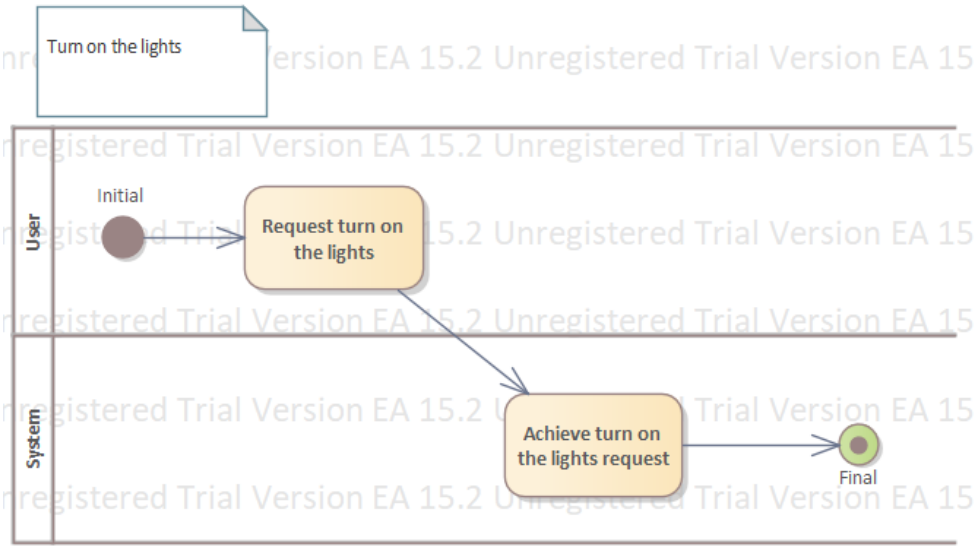
Component Diagram:



Use Case Diagram:



Activity Diagram:



System/Subsystem Design Description:

In this document I added Referenced Documents.

Scope:

Identification:

- Project title is Smart Home Automation System,
- Abbreviation is SHAS,
- Version number is v1.0.

System Overview:

- Purpose and general nature of the system is to make homes safer, technological and simpler.
- Home automation systems allow us to change the functionality of things in the house as we want, using sensors or with the help of tablets, smartphones.
- In the history of system development, I created my system requirement specification document. In this document I stated that, I determined my functional vs non functional requirements. I also extracted the use case, requirement and component diagrams of the system.
- Operation and Maintenance.
- Sponsor of the project is self-sponsor.
- Acquirer of the project is Berk Önder.
- Developer of the project is Berk Önder.
- User of the system is people are who live with my house.

Document Overview:

- My purpose in this document is to decide System-wide design decisions, make decisions about the system's behavioral design and other decisions. Also, System architectural design of my project and System components. My document will finish with the System components, Concept of

execution, Interface design, identification, diagrams and requirements traceability of my project.

- The confidentiality of this document will remain only between the instructor of the course, Hürkan Orkun Zorba, and myself, Berk Önder, who made the project.

Referenced Documents:

- "3. System-Wide Design Decisions — DIMS Architecture Design 2.10.0 Documentation". Dims-Ad.Readthedocs.Io, 2021, https://dims-ad.readthedocs.io/en/latest/systemwidedecisions.html.

System-wide Design Decisions:

- The smart home automation system always expects an input from the user. This input is waiting from the user's phone or tablet. Whenever there is an input, the system will give an output for the incoming input. In this project, there are inputs that can come from the user such as light on-off, temperature adjustment and sound detection from the sound sensor. The smart home automation project will behave in this way by the user's point of view.
- In terms of meeting the requirements, 3 sensors will be used in the project: sound, heat, light. Whenever the user wants to turn the light on or off in any part of the house, he will be able to meet this requirement via wifi or wireless from the application. The same will be true for heat and sound sensors. In this way, the project will meet the requirements.
- On the security and privacy side, only people in my own home will use this application. Arduino will be used in this project and the data flow between sensors, Arduino and mobile device will not be accessible from outside. Communication between Arduino and mobile devices will take place via wifi or wireless signals. In this respect, the system will be secure and confidential. In addition, when there is any breakdown or trouble in the

system, the code maintenance will be done from the Arduino. If there is a burning or malfunction in the sensors, the sensor will be changed and the error will be eliminated by coding this sensor again. When we look at it from this perspective, we see that the system is flexible and maintainable.

- When we look at the shapes of the Arduino and the sensors, they are square or rectangular and weigh about 2-3 kilograms. They are usually green or white in color.

Inputs:

- Display status: The system shall enable user to display the current status of the home in terms of light of the home, heat of the home.
- Change light status: The system shall enable user to change light status of the home in terms of on/off.
- Change heat status: The system shall enable user to change heat status of the home.
- Alarm Ringing: The system shall enable user to open the sound sensor at the home. With this way, if the burglar enters the house, the alarm will sound and a message will be sent to the user.
- Send Notification: The system shall enable user when there is a problem in the sensors, it send a notification to the user.
- Get information: The system shall enable user to show the information of the lights of the home
- Set Sound Sensor Level: The system shall enable user the change the sound sensor level.

Note: When we look at the input and output part, when any input comes from the user, the system will process it in less than 5 seconds and output an input to the user. For example: When the user presses the turn on the hall light button on his mobile device, the hall light will be turned on within 5

seconds and an output will be returned to the user that the light has been turned on.

System Architectural Design:

States and Modes:

- **FF-RQ-01:** *Init state:* When the application is stated this, the application will expect an input from the user and it become an active state
- **FF-RQ-02:** *Emergency state:* In this state, If an unexpected error occurs in the application, an error message will be sent to the user and it become a degraded state.
- **FF-RQ-03:** *Active state:* In this state, the application will execute the user's request and put itself in active state and it become an idle state.

Design Conventions:

- **Keep it Simple:** All designs and shapes to be made in this project will be quite simple and understandable.

System Components:

- Arduino, sound sensor, temperature sensor, light sensor, mobile device, tablet.

Purpose of Components:

- **Arduino:** The aim of Arduino in this project is to establish a connection between sensors and users' mobile devices and tablets by writing code into it.
- **Sound Sensor:** The purpose of the sound sensor in this project is to inform the user when a certain sound is heard or when a certain sound level is exceeded.
- **Temperature Sensor:** The heat sensor, on the other hand, gives the user the chance to adjust the temperature.

- **Light Sensor:** The light sensor, on the other hand, shows users the status of the light anywhere in the house and allows it to turn on and off.
- **Mobile Devices and Tablets:** Users can send input to the system with their mobile device or tablet and receive an output in return.

Development Status:

Component	Development Status
Arduino	In Progress
Sound Sensor	In Progress
Temperature Sensor	In Progress
Light Sensor	In Progress
Mobile device and Tablets	In Progress

Concept of Execution:

- **Diagrams:** All diagrams will be at the end of the document.

Interface Design:

- When we look at the interface design, there will be simple and easy-to-use interfaces. When the user selects the light section, he will be able to turn off the light of the room he wants with the on or off button. The same will be true for the sound and temperature sensor.

Requirements Traceability:

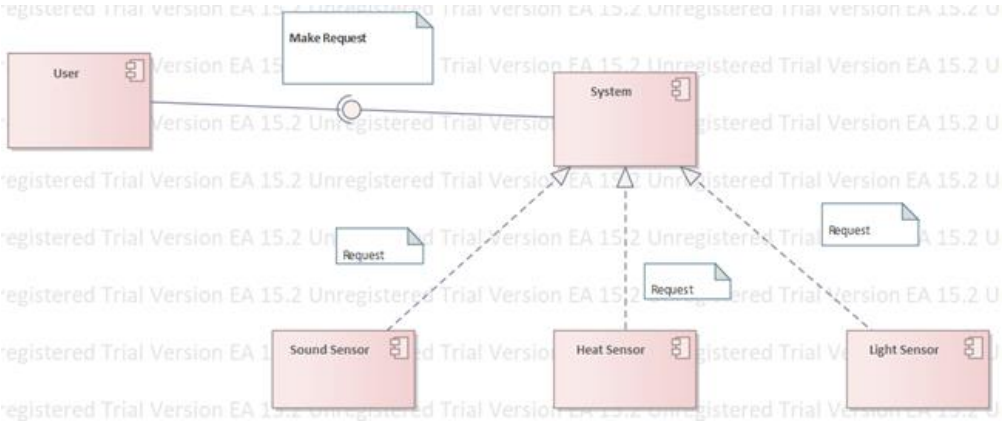
ID	Requirements Id	Component	Category	Priority	Specification	Test Cases
1	SHAS_REQ_01	Arduino	Mandatory	High	In Progress	-
2	SHAS_REQ_02	Sound Sensor	Mandatory	High	In Progress	-
3	SHAS_REQ_03	Temperature Sensor	Mandatory	High	In Progress	-
4	SHAS_REQ_04	Light Sensor	Mandatory	High	In Progress	-
5	SHAS_REQ_05	Mobile Device and Tablet	Mandatory	High	In Progress	-

Notes:

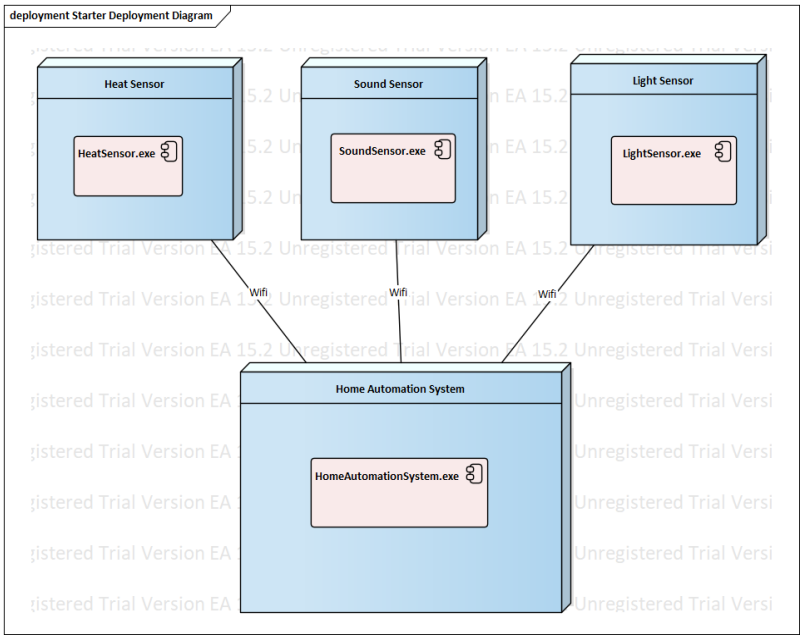
- **General information:** In this document, I stated the designs and decisions I will make, my inputs and outputs, components and their purposes.

Diagrams:

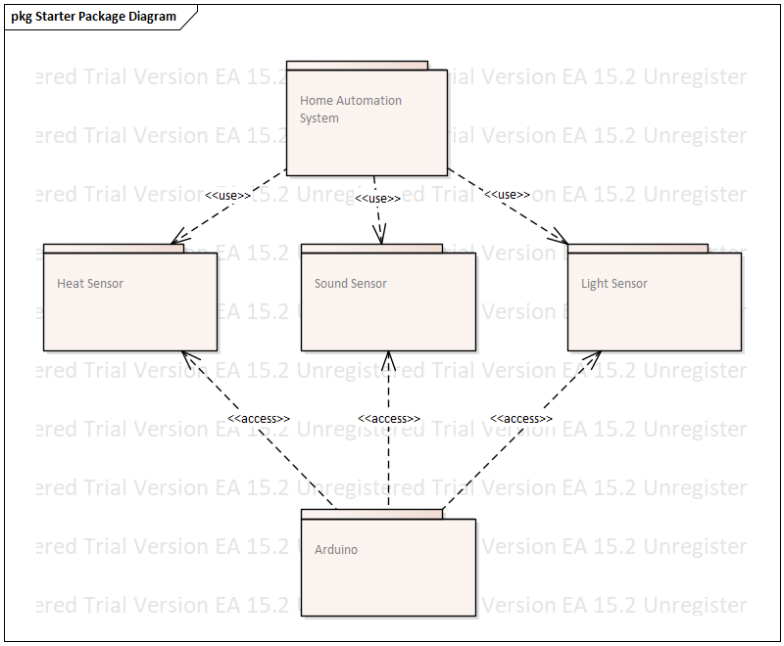
Component Diagram:



Deployment Diagram:



Package Diagram:



Development and Test Report:

Scope:

Identification:

- Project title is Smart Home Automation System,
- Abbreviation is SHAS,
- Version number is v1.0.

System Overview:

- Purpose and general nature of the system is to make homes safer, technological and simpler.
- Home automation systems allow us to change the functionality of things in the house as we want, using sensors or with the help of tablets, smartphones.
- I made System / Subsytem Design Description in my previous report. In this report, I have cited my System-wide Design Decisions and inputs. I specified my states and modes and set my Design Convention as keep it simple. Also, I drew my Development Status, Requirement Traceability and Component, Deployment and Package Diagrams.
- Operation and Maintenance.
- Sponsor of the project is self-sponsor.
- Acquirer of the project is Berk Önder.
- Developer of the project is Berk Önder.
- User of the system is people are who live with my house.

Document Overview:

- My aim in this document is to introduce the arduino I made in terms of software and hardware. Also to explain the libraries and harware links I have used. Finally, there are test cases and results and logs that I have done on the sensors.

- The confidentiality of this document will remain only between the instructor of the course, Hürkan Orkun Zorba, and myself, Berk Önder, who made the project.

Referenced Documents:

- "Control LED By Clap Using Arduino And Sound Sensor". Arduino Project Hub, 2021, https://create.arduino.cc/projecthub/iotboys/control-led-by-clap-using-arduino-and-sound-sensor-e31809.
- "Displaying Sensor Values On LCD". Arduino Project Hub, 2021, https://create.arduino.cc/projecthub/Guitarman1/displaying-sensor-values-on-lcd-c0c44f.
- Campbell, Scott. "How To Set Up The DHT11 Humidity Sensor On An Arduino". Circuit Basics, 2021, https://www.circuitbasics.com/how-to-set-up-the-dht11-humidity-sensor-on-an-arduino/.

Development:

- While developing, I purchased the kit called Arduino Uno Super Starter Kit. There were quite a few parts in this kit. The materials I used while making my project are: 1 x Infrared Receiver, 1 x Arduino Uno R3 SMD CH340 Chip (Clone), 5 x LED Light, 1 x Breadboard, 1 x Female-Male Dupond Line, 1 x Remote Control, 1 x IIC 1602 LCD 1 x Temperature Module, 1 x Sound Module.
- The brands and names I use as Hardware and Software are as follows:
    - Hardware: DHT11 Temperature and humidity sensor, I2C 2X16 LCD Display, HW-484 Sound sensor, USB cable, Breadboard, Arduino UNO R3 SMD CH340 Chip, 8 LEDs, VS18388 Infrared receiver, Remote control (Car MP3)
    - Software: I made all of my codes in Arduino software program using C++. I made all of my codes in Arduino software program using c ++. As the library, I used the dht11 library for the temperature and

humidity sensor, the LiquidCrystal_I2C library for the LCD screen, and the IRremote library for remote control and infrared connectivity.

- I connected the long legs of the LED lamps from the 2nd pin to the 12th pin, and the short legs to the GND. I connected the middle leg of the infrared receiver to GND, the left leg to pin 13 and the right leg to 5V. I connected GND of my LCD screen to GND, VCC to 5V, SDA to A4e and SCL to A5. I also connected my temperature and humidity sensor and my sound sensor to 5V and GND in the same way.

Test Descriptions:

- As a test environment, I will test my LED lamps, sensors, remote control and infrared receiver, LCD screen, USB and cables with C++ written in Arduino software in computer environment.

Test Case: DHT11 Temperature and Humidity Sensor

#	Test Step	Inputs	Expected Outputs
1	USB cable recognized to the system.	Arduino chip, USB cable, LCD Screen and Temperature and Humidity Sensor.	Computer will recognized and energize to the arduino.
2	Open Arduino Software and run the Temperature and Humidity code	Open the code file and run the code.	Code run process successful.
3	Check the LCD screen	See the LCD Screen.	Temperature and Humidity values is seen in the LCD screen

Test Case: HW-484 Sound sensor

#	Test Step	Inputs	Expected Outputs
1	Open Arduino Software and run the Sound Sensor code	Arduino chip, USB cable, Sound Sensor and LED lights	Code run process successful.
2	Make sound and see the LED lights	See that 5 LED lights are on	LED lights turn on when the sound is made and turn back when the sound is over.

Test Case: Infrared receiver and Remote control

#	Test Step	Inputs	Expected Outputs
1	Open Arduino Software and run the Infrared receiver and Remote control code	Arduino chip, USB cable, Infrared receiver, Remote control, 3 LED lights	Code run process successful.
2	Try to turn on the lights with 0,1,2,3,4 keys from the remote	See that LED lights are on and off with the related buttons from the remote control	All LEDs turn on and off with the keys to which they are connected

Test Results:

#	Test Case	Test Step	Degree	Definition of Defects	Solution Proposal	Status
1	DHT11 Temperature and Humidity Sensor	3	3	There is no Defects	-	Close
2	HW-484 Sound sensor	2	3	There is no Defects	-	Close
3	Infrared receiver and Remote control	2	3	There is no Defects	-	Close

- When we look at the test results, all of the test cases I wrote gave the expected output and it works smoothly.
- Logs:
    - 19:46:24.269-> Hum: %41.00
    - 19:46:24.269-> Temp: 25.00 C
    - 19:49:20.145-> Sound Level: 60
    - 19:51:22.325-> Green Light is open
    - 19:51:23.100-> Green Light is close