

SMART HOME

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Abstract. *Nowadays everything tends to be smart and the place where we live is no exception. There is a lot of solution for smart home, but the problem usually we are not able to connect different components from different manufactures in one system, example being bulbs from Xiaomi and Philips that use the same communication technology, but we are unable use them in one single app. This paper presents the design of a smart home system based on Internet of Things and the possibility to connect different sensor & actuators in one user-friendly scalable solution with possible integration with the most popular central hubs like Google Home, Amazon Alexa and Apple HomeKit.*

Keywords: *Smart Home, Internet of Things (IoT), Getaway, system, sensor, actuator.*

Introduction:

There are numerous Smart Home systems, each solution comes with an application and here comes the problem, “Which solution should I choose?” because we want one application for all system not 10 applications each for its component in smart house. This solution has the possibility to integrate component from different manufactures and work with them in one application, in this case is Google Home, but it is possible to connect it with Amazon Alexa and Apple HomeKit all this is possible by using OpenHAB. An important part of smart home is security, nowadays thefts and vandalism are becoming more and more frequent [1] and to have an IP Camera, door & window sensor and motion sensor in home becomes a necessity. Also, to have a more efficient rest, people need the right temperature for each part of the day, and this can also be made by smart home. Another important part of smart home is automation, everyone has that problem “Have I turned off the iron or not?” that can be easily tuned off from any place in the world. Day routines when we leave home say, “okay google I’m leaving” and all lights is turned off thermostat is set to a lower temperature, this is a not only comfortable but also economically advantageous.

Case Study

Smart Home security:

Home and family security are one of the most important things in life. All information about who entered in home at what time, what is the real situation, if there are gas leaks can be provided by smart home. For example, home automation systems can connect motion detectors, surveillance cameras, automated door locks, and other tangible security measures throughout home so user can activate them from one mobile device before heading to bed. User can also choose to receive security alerts on various devices depending on the time of day an alert goes off and monitor activities in real-time whether you’re in the house or halfway around the globe. Each user can choose what's best and to be sure that home and family is protected and secured.

Smart Home Automation:

Automation is not about laziness, it is more about comfort and security and good resources and time management. Smart home automation allows the user to tap into high-tech functionality and luxury that wasn't possible in the past. So, the user can manage all home devices from one space, maximize home security, remote control home functionalities, increase energy efficiency, etc.

Smart Home Climate and Lighting and efficiency:

There are a lot of studies about at what temperature we are the most [2]. At 25 degrees Celsius we are most productive at the day. But in case if we are not at home, why we need to keep the temperature this high. Using smart home, we can program that when we leave home thermostat go to lower temperature and an hour before we come home to start heating the house to make temperature when we arrive perfect for us. Also, best sleep we have at lower temperature around 17 - 20 degrees Celsius [3] this also is made by smart home. Smart home made users more productive, we sleep better and pay less for heating.

OpenHab:

OpenHAB supports more than 200 different technologies and systems and thousands of devices. It runs on local hardware, doesn't require any cloud service to work, keeps data privately at home and talks directly to local devices whenever possible. At the core of this project philosophy is that user always remain in control, but if user want to have cloud integration OpenHab Integrations are available for the most popular cloud-based smart home platforms, including Google Assistant, Amazon Alexa, Apple HomeKit and IFTTT [4].

Google Home Hub:

OpenHab give the possibility to combine all sensors in one system, but to interact with these sensors OpenHab have the possibility to be integrated with google home. Google Home have assistant services that provide as best voice assistant for smart home, also have a great interface Google Nest. With google routine we can set a big number of scenarios for different situation.

System requirements:

The system should be able to collect video streaming from outdoor camera.

The system should be able to turn ON / OFF light.

The system should be able to turn ON / OFF electronic devices which are plugged in.

The system should be able to detect if the door or windows was opened.

The system should be able to know about climate situation in house.

System architecture:

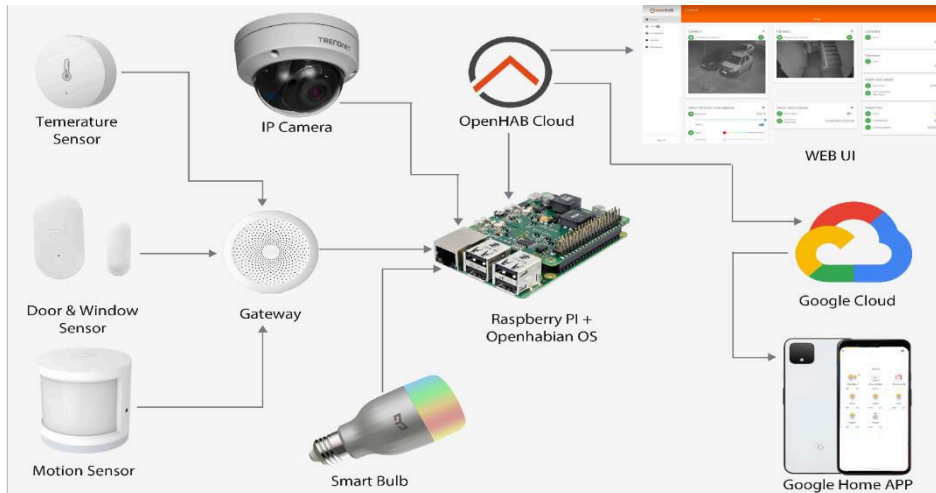


Figure 1. Generic system architecture

In this scheme is representing an example of how it works. At the left part of scheme, we can see how communication between sensors and Getaway which in turn is connected is connected to Raspberry Pi. Raspberry Pi is running on Openhabian OS that provides as a huge amount of bindings to connect different devices. Another important component is IP camera that gives possibility to see situation at home in real time by accessing WEB UI. Also it is possibility to integrate with Google Home is provided by Openhab Cloud which is connected with local Raspberry PI by UUID (Universally unique identifier) that make connection safe and we don't need to worry about security of the system. This is a representation is an example of component that can be using with this solution the basic part of the system remains Raspberry PI running on Openhabian OS and connected with Openhab Cloud. Google Cloud can be replaced with Amazon, Apple....

Implementation:

To make the system we used the following components:

Raspberry PI:

The Raspberry Pi is a small single-board computer which has operating system in this case Openhabian. It has the role of central component via which all components from different manufactures are connected. Also, it is possible to connect sensors and actuators directly in raspberry by GPIO pins that it has. Through the internet it is connected to OpenHab cloud that provides as WEB UI and connection with Google Home Cloud. All computing is made on this small computer its manage all components from out home. The scenarios are also set on it (if door open, turn on light).

Soil Moisture Sensor FC-28:

- it is used to detect moisture in soil. The two large exposed pads function as probes for the sensor, together acting as a variable resistor;

Xiaomi Door Window Sensor:

- door and window sensors which can be installed within 10mm near door or window, detecting switch status due to its higher sensitivity;

Xiaomi Motion Sensor

- is a human body sensor that uses infrared radiation (IR) to detect human movement in the surrounding environment;

Hikvision DS-2CD2132

- IP camera for video streaming.

Yeelight LED Light Bulb

- RGB Smart bulb

Google Nest Hub

- Google Home base station with display

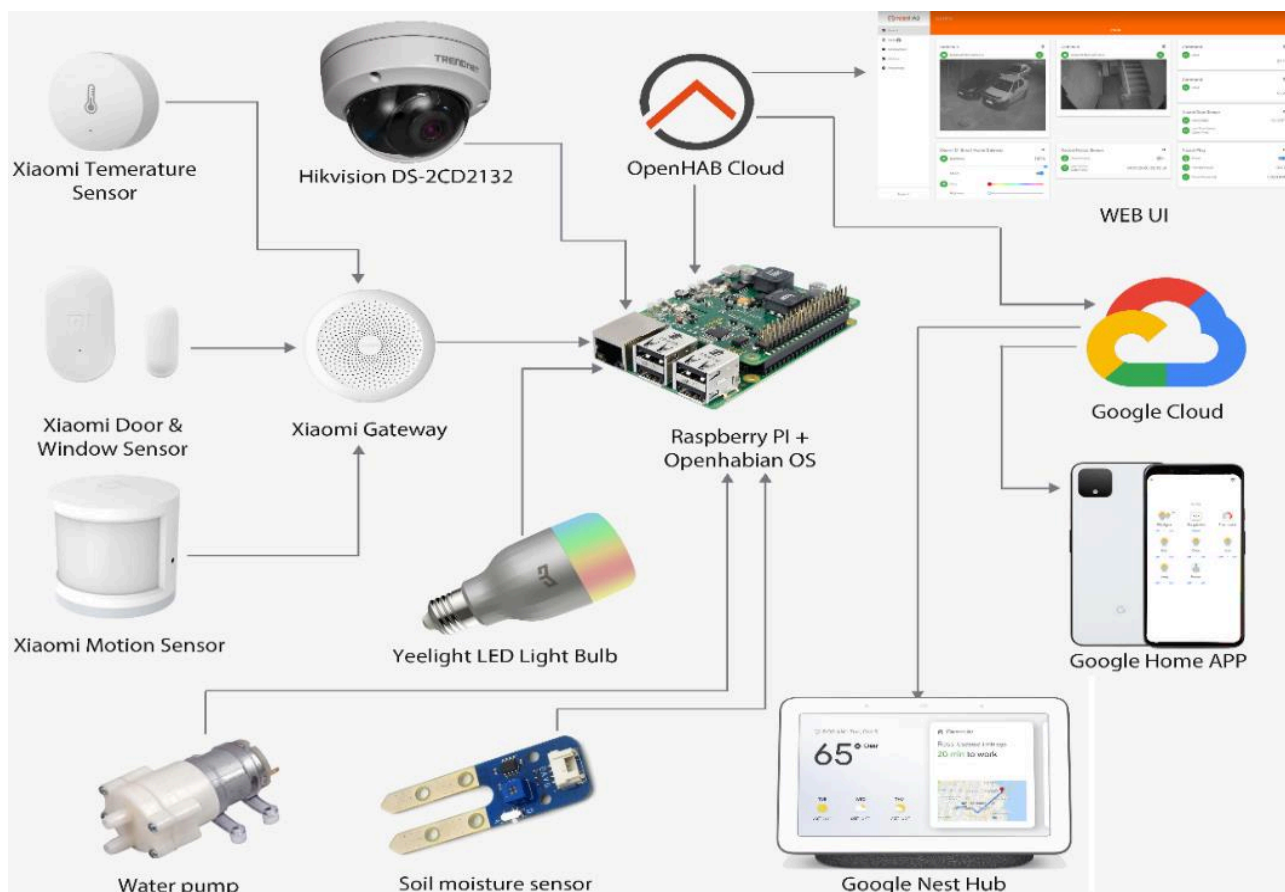


Figure 2. Smart Home implementation

Conclusions:

This paper presented the design of a Smart Home system that is proposed to solve problem of choosing components and solution, make home life more efficient safe and comfortable. User can choose components starting with professional ones and end with DIY compatible with Arduino. Smart home propose is to make life more comfortable, secure and efficient.

References

1. Nivelul infracționalității în Republica Moldova în anul 2016 [Access date 26.03.2020] <https://statistica.gov.md/newsview.php?l=ro&idc=168&id=5550>
2. The Science of How Temperature and Lighting Impact Our Productivity [Access date 26.03.2020] <https://buffer.com/resources/the-science-of-how-room-temperature-and-lighting-affects-our-productivity>
3. The Ideal Temperature for Sleep [Access date 26.03.2020] <https://www.sleep.org/articles/temperature-for-sleep/>
4. OpenHab [Access date 26.03.2020] <https://www.openhab.org>