# A Review on Applications, Systems and Methods used in Connected Home based on Component Technologies and Internet of Things

[1]Dr. Mrs. S. Prasanna, [2]Ms. K. Vaishnavi
[1]Assistant Professor, Department of BCA,
ShriShankarlalSundarbaiShasun Jain College for Women, T. Nagar, Chennai 600 017.
[2]Student, PG Department of Computer Science,
ShriShankarlalSundarbaiShasun Jain College for Women, T. Nagar, Chennai 600 017.

**Abstract :** Smart Home technology started for more than a decade to introduce the concept of networking devices and equipment in the house. The smart home technology is the integration of technology and services through home networking for a better quality of living. Many tools that are used in computer systems can also be integrated in Smart Home Systems. In this research paper we present about the connected home using Internet of Things (IOT) and the Software tools like Open HAB (Open Home Automation Bus), Open Motics and hardware efficiency kits like RFID (Radio Frequency Identification), IP (Internet Protocol), Wi-Fi (Wireless Fidelity), Zigbee , Z-waves, WSN (Wireless Sensor Networks) and Network technology trends such as Voice Control and Networking for Connected home. We also present the communication functions between the devices and the user's connectivity with the architecture of connecting the devices such as Smart Phone Centric Architecture (with or without cloud), Hub – Centric Architecture (with or without cloud) and Cloud Centric Architecture (without hub) in it. The techniques which are used for ON / OFF are LAN (Local Area Network) Communication, Bluetooth Communication and GSM (Global System for Mobile) Communication are also discussed in this research article. The Component Technologies such as Application Layer, Software Infrastructure based on component, Network Layer and Perceptive Layer, the Connected Home Technology under CES 2018 and Database of connected home like support time – series, tagged data and efficiently shared data homes and its security partare also briefly explained.

**Keywords:** RFID, IP,Zigbee, Z-waves, software, OpenHAB, OpenMotics,Smart Phone Centric, Cloud Centric, Hub-Centric, Perceptive Layer, CES 2018.

## 1. Introduction

The **Internet of Things** (**IOT**) is the network of physical devices, vehicles, home appliances, and other items embed with electronics, software, sensors, actuators, and connectivity which enables these things to connect and exchange data for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits, and reduced human exertions.

**Connected Home**is the term commonly used to define a residence that has appliances, lighting, heating, air conditioning, TVs, computers, entertainment audio & video systems, security, and camera systems that are capable of communicating with one another and can be controlled remotely by a time schedule, from any room in the home as well as remotely from any location in the world by phone or internet.[1]

## 2. Technologies Used In Connected Home

**2.1 RFID – Radio Frequency Identification:** RFID technology using wireless RF bi-directional transmission of data between the reader and tag, has reached the target identification and the purpose of data exchange. The most basic RFID system consists of three parts: the electronic tags (Tag), the reader (Reader) and pass the RF signal between the tag and the reader miniature antenna.[2]

**2.2 IP – Internet Protocol: Wi-Fi** is the fast and reliable wireless communication, with a range of around 25m.**Zigbee** is a wireless protocol which operates in a mesh network and uses a device to relay a signal to other devices, strengthening and expanding the network. **Z-Wave**is similar to Zigbee and this is an open source mesh network protocol. The main difference between the two is the data throughput—Z-wave is roughly 6 times slower than Zigbee.

**2.3 WSN – Wireless Sensor Networks:** Wireless Sensor Networks (WSNs) provide several types of applications providing comfortable and smart-economic life. Communication can be performed using three main access technology architectures: IEEE 802.15.3 and 802.15.4 for Wireless Personal Area Network (WPAN), IEEE 802.11g and 802.11 for Wireless Local Area Network (WLAN), and High Speed Downlink Packet Access (HSDPA) and Long-Term Evolution (LTE) for Wireless Wide Area Network (WWAN) [3].

## 3. Connected Home Software

a. **Openhub – OPEN Home Automation Bus:** Device control through OpenHUB can also be done through the associated iOS and Android apps. OpenHUB also comes with design tools which a user plays around and come up with their own interface and experience.

b. **OpenMotics:** It provides a hardwired solution for creating a unified platform. OpenMotics does not differ from the other kind of solutions in terms of accessibility.[4]

## 4. Home Network Trends

**4.1 Voice Control:**Voice control platforms like Amazon Alexa, Apple Siri, Google Assistant and others can operate our home's lights, audio equipment, thermostats, and complete home automation systems by uttering a string of verbal instructions.

**4.2 Networking forthe Connected Home:** For Connectivity, the Internet of Things, drones, and robust networking all have contributed to a home environment that is able to communicate its needs and actively listen and respond to clues, be it a voice command or a signal from door lock or surveillance camera. [5]

## 5 Architecture Of Connected Home

**5.1 Smartphone Centric Architecture (with or without cloud):** Using this technology, a light bulb is connected directly to a smartphone via Bluetooth. Thus, the light bulb does not have a direct link to the Internet and depends on the proximity of the smartphone.

**5.2 Hub-Centric Architecture (with or without cloud):** It is working as an intermediary for connecting a bulb to the smartphone and to the Internet, since it usually connects to the home Wi-Fi or Ethernet network.

**5.3 Cloud Centric Architecture (without hub):** This is a smart device that is directly connected to the home Wi-Fi network and does not need any additional hub to work. It has a simple setup process for the customer and looks similar to the Smartphone Centric Architecture but with the benefit of a direct and constant connection of the device to the Internet. [6]

## 6. On / Off Techniques

**6.1 LAN Communication:** This technique enables, designing client-server models which communicate via RJ45 LAN cable using Socket programming. The server can monitor as well as control the appliances via LAN communication. Firstly, the client and server will set the IP address. If the IP address matches then the connection is established. Then the domain name is confirmed and the data communication is done using Socket programming.

**6.2 bluetooth communication:** For Android Communication, make the Blue tooth pairing of Bluetooth modem connected to μC and the Bluetooth of Android Phone. After the pairing is enabled then the data can be transferred to mobile using Bluetooth medium. After sensing the data, the μC will send the data on its serial port at 9600 baud rate. The data is then transferred to the blue tooth modem connected to μC. The Blue tooth modem will then transfer the data wirelessly to the other Bluetooth module in the mobile phone. Since they are paired, we can receive the data on Mobile phone using Bluetooth port.

**6.3 GSM Communication:** Here the user can ON/OFF the electrical appliance via SMS using "AT" commands. The μC is connected to GSM Modem which is first initialized using AT commands via RS 232 Protocol. Then, the SMS that is sent by user is received By GSM Modem. The μC will receive the SMS and store the SMS in internal RAM and display the frame on LCD. Depending on frame the μC can turn ON/OFF the home appliances. [7]

## 7. Component Technologies

There are four layers in the architecture of smart home application based on IoT and component technologies. The below explains the different layers used in this technology. They are application layer, software infrastructure based on component, network layer and perceptive layer. In the application layer, there are family security, medical, data, entertainment and business services. In the software infrastructure, there are web service platform and SOA framework. Under the network layer there are Wi-Fi, satellite

communication, wide network and 3G mobile. In the perceptive layer, there are RFID, sensor, energy management and video sensing [8].

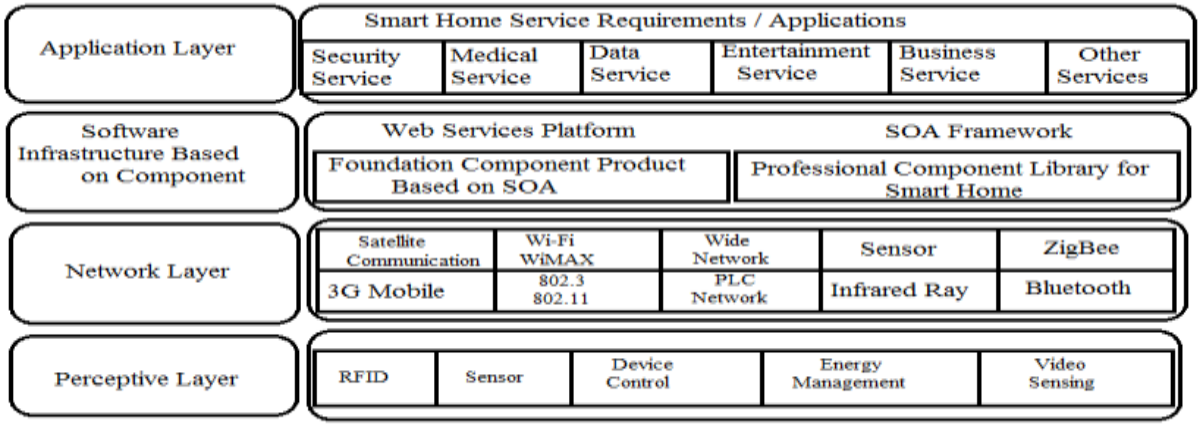


**FIG - 1: The Architecture of Smart Home Application Based on IOT and Component Technologies**

## 8. Connected Home Technology Trends

**CES 2018:** CES 2018**,** the global consumer show was held from 9 January to 12 January 2018. There were solar powered smartwatches, HTC Viva Pro, the wall by Samsung, inches rollable OLED TV, and Lenovo Mirage Solo available.

### 8.1 Connected Home Technology At The CES 2018

**Health Sensors**: From fitness trackers to breathing sleep robot, everything seemed to be useful. With Lenovo vital Motorola Moto Mod, we can measure our respiratory rate, heart rate, blood oxygen levels, and body temperature. Another important health sensor is the Sensio Air, that determine pollen, mold and dust particles. It will prove to be vital for people with different allergies.

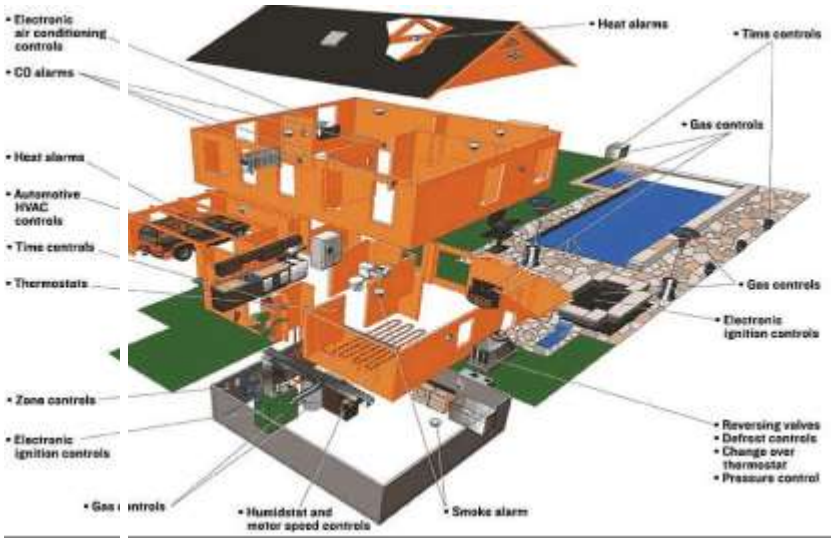


**FIG – 2: SMART HOME TECHNOLOGY TRENDS**

**Wireless Charging:** This technology was introduced byQi Wireless Chargers. Due to addition to latest iPhone models, many companies have introduced it to the consumer market. The tech giants like LG,

Samsung have also manufactured similar chargers.Fig. 2 explains the devices which can be used to form a connected home and also shows the places to fit those devices. [9]

## 9. Connected Home Devices

**9.1 Garmin Index Smart Scale:** This scale provides the exact metrics that user require in order to track their weight progress. Garmin index smart scale measures weight in lbs, st, and Kgs. It also gives efficient metrics of body fat/water percentage, skeletal muscle mass and body mass index.

**9.2 Char-Broil Digital Electric Smoker:** An electric smoker like this comes with all necessary insulation. There is double wall construction around it as well as an advanced control panel. This electric smoker also has a removable food thermometer in addition to large locking latch for a smoke-tight seal. [9]

## 10. Database Management System

**10.1 Support Time-Series, Tagged Data:** Most applications generate time-series data and retrieve it based on time windows. The data may also be tagged and queried using application-specific concepts.

**10.2 Efficiently Share Data Across Homes:** Both DNW and EDA fall in this category. Online storage services, like Dropbox or OneDrive, can simplify cross-home sharing, but they will unnecessarily synchronize large quantities of data. [9]

## 11. Connected Home Security

**11.1 Fire Alarm System:** This is divided into three parts; the first part is the signal that reaches from fire alarm system sensors as an indicator for announcing the outbreak of a fire in the house, the second part is the output signal that sends after the processing of input signal, and finally the controlling system and data processing. Smoke detector and heat detector are used. The system will send a short message service (SMS) to house owner and to the firefighter's office to inform them of the existence of fire. [9]

## 12. Example Application

**12.1 Digital Neighborhood Watch (DNW):** DNW helps neighbors jointly detect suspicious activities (e.g., an unknown car cruising the neighborhood) by sharing security camera images. The DNW instance in each home monitors the footage from security cameras in the home. When it detects a moving object, it stores the object's video clip as well as summary information such as:

Time: 15:00 PDT, 25th July, 2018
ID: 001
Type: human
Entry Area: 2
Exit Area: 1
Feature Vector :{114, 117, ... , 22}.

**FIG 3 – Information provided by Digital Neighborhood Watch**

**12.2 Energy Data Analytics (EDA):** Utility companies around the world are deploying smart meters to record and report energy consumption readings. Given its fine grained nature, compared to one reading a month, data from smart meters allows customers to get meaningful insight into their energy consumption habits.

## 13. Smart Home Appliances for Physically Challenged Individuals

If an individual has difficulty moving around effectively, they are often forced to dependonothers for care. With the implementation of smart home appliances, such as an effectivesecurity system, those with physical challenges are often able to live on their own. A smarthome security system allows the homeowner to remotely view visitors on a camera, andspeak to them via microphone and speakers. If the visitor is welcome, the security systemunlocks and opens the door to allow the visitor access to the home. Smart home securitysystems can also learn which visitors are always allowed, and what areas they may have access to. [10]

## 14. Conclusion

A Connected Home system integrates electrical devices in a house with each other. The techniques which are going to use in home automation include those in building automation as well as the control of domestic activities, such as TV, fan, electric tubes, refrigerator and washing machine. It was supported by remote control system as a sub controlling system. The system also is connected to the internet to monitor and control the house equipment's from anywhere in the world.Development of such Smart Home achieve by using Internet of Things technologies. By using these system we can actually manage to make low cost, flexible smart homes to adjust its environmental conditions and resolve its errors with energy saving.

## References

1. SmartHomeUSA.com "What is a Smart Home" http: // www. Smarthomeusa.com/info/ smarthome /

2.Yan, M., Shi, H. " Smart Living Using Bluetooth-Based Android Smartphone", International Journal of Wireless & Mobile Networks (IJWMN), vol. 5, no.5, pp. 65-72 (2013)

3.Molly Edmonds "How Smart Homes Work - Setting Up a Smart Home" http://home.howstuffworks.com/home-improvement/energy-efficiency/smart-home1.html

4. Kiho Lee, Ronnie D. Caytiles and Sunguk Lee "A Study of the Architectural Design of Smart Homes based on Hierarchical Wireless Multimedia Management Systems", International Journal of Control and Automation Vol.6, pp.261-266, (2013),http://dx.doi.org/10.14257/ijca.2013.6.6.25

5.Dipti p. Wale, prof. S. S. Patil, dr. S. V. Anekar"Home Automation using Cloud Network and Mobile Devices", International Journal of Innovative Technologies, Vol.03,Issue.01, Pages:0054-0058,May – 2015), www.ijitech.org

6. Baoan Li, Jianjun Yu (2011), "Research and application on the smart home based on component technologies and Internet of Things", SciVerseScienceDirect, www.sciencedirect.com

7. PrachiDeokar, Dr. M. S. Nagmode, "A Survey on Home Automation using Cloud Network and Mobile Devices", IJLTET, Vol. 3 Issue 3, 2014.

8. Trinabh Gupta, *The University of Texas at Austin;* RaymanPreet Singh, *University of Waterloo;* Amar Phanishayee, Jaeyeon Jung, and RatulMahajan, "Bolt: Data management for connected homes", *Microsoft Research* (April – 2014).

9. https://www.usenix.org/conference/nsdi14/technical-sessions/presentation/gupta

10. Victoria Nicks (2009), "Smart Home Appliances",http://artificialintelligence.suite101.com/article.cfm/smart_home_appliances