

# A Review on Smart Home Automation Technology

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**Abstract-** *The rapid smart home automation system is the main important part in day to day life for the security, safety and comfort purpose. Twentieth century is the era of automation majorly in the entire field for the elimination of human error, effort and time. There are numerous technologies available today for smart home that can be enable communication between user and appliances for controlling and monitoring the particular application for home appliance from any remote location. This review paper mainly focus on the advance smart home automation and control system. The available technologies presented along with uses, advantages and disadvantages of automation technology.*

**Keywords-** wireless communication; smart home; home automation; remote control.; insert.

## I. INTRODUCTION

Automation means use of electronic devices for controlling process, which leads to reduce human effort [1]. In the twentieth century, all homes will have the dedicated artificial intelligence, sensors, monitoring and controlling abilities required to control the all operating activities of home. This will helpful for more efficient interaction between user and home appliances, which result in improving human comfort, security as well as safety of human and energy savings[2]. Typically smart home involving the lighting, heating and cooling system(HVAC), which is generally controlled and monitored from the different location in the building itself. But in case of building automation user can control, monitoring and scheduling functions from any remote location.

Industrialist and researchers are working for making energy efficient building and cheap automatic systems to monitor and control different systems of home like fans, lights etc. Automation makes not only an efficient home but also reducing the consumption of electricity and water which will turn as efficient use of natural resources.

The objective of developing smart home system technology is to fulfill their promise of vastly improving the lifestyle of families through socially appropriate and timely assistance

It is monitoring of energy consumption and controlling environment in buildings, schools, offices and museums by using different types of sensors and actuators that controls lights, temperature and humidity.

## II. LITERATURE REVIEW

Smart home equipment connected to various communication protocol to exchange the data or commands by the use of internet.

Cloud based sever system is used for exchanging data between user and controlling device by the use of mobile application [1]. This proposed system is require very low power consumption so it is cost effective

Embedded system Raspberry Pi is act as the communication media mobile and Konnex-Bus (KNX) smart home automation system [2]. It stores information within the sensors of smart home system and it is energy efficient.

Wi-Fi system [3] is used in the home automation system. This is better and flexible system available commercial home automation system. In this user can access the particular web based application from the server from the remote location by just log in into the server.

Android based platform is used for the controlling smart home applications from any remote location with the help of Arduino Ethernet based micro web-server [4]. In this system sensor or array are directly connected to main controller. This system proposes better control on HVAC system as well as lighting system by siren or email notification system

Cloud based platform is used for monitoring and controlling home appliances system. In this data send to cloud based server to store on HDFS (Hadoop distributed file system) [5] process and use to provide this data to user at remote locations.

PIC16F887 microcontroller for home appliances, use of GSM for controlling of the home appliances [6]. In this data is processed through GSM network for controlling the home appliances. This system doesn't have information about devices, but it expecting user to track it.

Interface media card is developed on the base of android platform [7]. It is used for doing communication between user and server, raspberry pi card and the home Appliances form any remote location. This application can be installed in the smart phone to control shutter of the window. This interface card has been understood signal between device and raspberry pi card.

Shih-Pang Tseng et al. [8] proposed Smart House Monitor & Manager (SHMM), based on the ZigBee system. In this system all sensors and actuators are connected by a ZigBee wireless network to perform monitoring and controlling activity. In this user can use PC or Mobile phone to monitoring home appliances.

Arduino microcontroller to receive user commands to perform action through an Ethernet shield. House network should use wired X10 and wireless ZigBee technologies [9]. Arduino microcontroller communicates through HTTP protocol or android applications.

Dual tone multi frequency (DTMF) used in telephone lines [10]. Three main components of this system receiver and ring detector, interface unit and PC. The PC detects ringing in the line and verify to user and used keypad tone to control device as required

Various algorithms are used for intelligence smart home system for the interaction purpose. Similarly location detection algorithm for detection of user's exact location for gathering information [11]. Artificial neural network (ANN) can be used for the future state of home for identifying the usage of particular home appliances. This approach is also useful for modeling of human behavior by use of neural network. This technique is very useful for designing complex smart home system. But ANN requires the high processing power and too much of data generated due to this, so high storage device is required. C4.5 algorithm is the popular algorithm to sort the data according to various applications which is required for the future smart homes. The disadvantage of this algorithm is long CPU time and extra memory required for behavioral models. Case based reasoning (CBR) algorithm mainly used for the context awareness features in the smart home. SVM algorithm is used for activity recognition in the smart home [11].

The main function of algorithm is to process data and perform the functions. So algorithm is main part of the smart home research. Although the different algorithm cannot tackle the multiple functions at a time.

### III. TASK OF HOME AUTOMATION SYSTEM

Smart home means use of new technology for making or convenient human life. The different task of home can be automated. These are listed below

#### A. Lightening

It includes various lighting in the hall, bedroom and washrooms. To control all the lightening in the home by following ways

- Adjusting electric light intensity with respect to natural light available in the respective room
- To control all the lighting in the home
- Replace manual switches to automated switches that can control by remote device

#### B. HVAC

Heating ventilation and air condition (HVAC) controlling in the home is the important aspect for making smart home. It includes AC, room temperature and fans in the home. To maintain the inside home conditions like temperature, humidity etc., with respect to outdoor climatic condition, by the use of automation system. In this user can individually control the rooms heating and cooling.

#### C. Security

User can closely watch the camera live in the home for security purpose. Security camera usually records the activities happening inside the home through the smart device. In the security system can capture unauthorized movement in the home by giving notification to user

#### D. Audio and video

It contains the access of user to control the audio and video activities in the multiple TVs. Also useful for selection of audio/video source in the multiple rooms. Video integration with intercom of telephone for viewing the door entry of the unknown person by the resident. Audio switching and audio distribution features helps in controlling the voice requirement in each room or multiple room.

#### E. Intercoms

Intercoms is the communication media between the multiple rooms of the smart home. It is done by remote control using internet, wireless device, PC etc.

**IV. COMPONENTS OF SMART HOME SYSTEM**

The smart home system is the control of the each system of the home by the use of sensor for reducing the human effort. The components of smart home systems are broadly classified in to the following component as shown in Fig. 1.

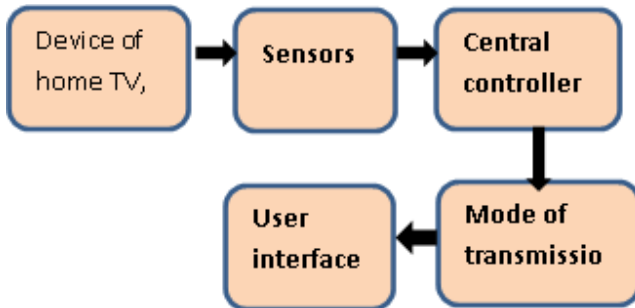


Fig 1. Components of smart home system

**A. Sensors**

Sensors are used for the controlling the physical conditions like temperature, humidity, light of the home as mentioned in table 1. It is computer control device monitors or measure the performance of electronic device. It sends the important information to main controller to take the necessary action. These sensing inputs can be converted into data that can be displayed to user or send to controller device for further

Table 1. The category and purpose of smart home devices

Category	Operation	Purpose
Sensor	Light	Light intensity measurement
	Temperature	Room temperature and body temperature
	Water	Water level, usage
	Power	Consumption details
	RFID	Object identification
Health	ECG	Pulse rate variability
	Weight	Weight measurement
	Pulse	Heart rate
	Panic	Emergency
Entertainment	Speaker	Alert and information
	TV	Visual information
	Audio device	Information and instruction
	Microphone	Voice command
Security	CCTV	Door entry security
	Fire alarm	Safety

**B. Controlling Device**

Controlling device is the device whose operations can control by external device. It is an important part of the system which can control the activities according to received signal from sensing device. There are various controlling devices are available that can control the activities of smart home which includes audio/video, temperature, lightning devices.

**C. User Interface**

It is the junction between user and computer. It is nothing but communication media between user and controlling device. It can be mechanical device or microphone, mobile, monitor, computer that can give order to control system of the all home appliances.

**D. Mode of transmission**

It the way of data transmission takes place between user and the control system. It can be wired connection or wireless connection. In wireless connection different modes are available that are – Bluetooth, Infrared, GSM etc.

**E. Electronic Devices**

It is nothing but the devices in the home that are AC, TV, which can transmit data to controller system.

**V. BENEFITS OF SMART HOME**

Smart home is the use of automation technology for the comfort of family in terms of security, entertainment, healthcare etc. The smart home is the integration of mechanical and electronic devices for the automation purpose. Integration allows the communication of one system to other system by the use of home controller to perform the various task simultaneously. This helps to owner to perform system simultaneously, smoothly and

There are several benefits of smart home system [12, 13] more efficiently.

**A. Security**

Security mode can be control the various applications like lighting, HVAC, television so that it turns vacant home becomes someone is living in home. CCTV camera can be used for the viewing the door entry of guests/unknown person in the television at home. Also along with this gas & fire alarm detector sensor detect abnormal condition, so home controller can shut down the respective device.

**B. Convenience**

Smart home automation system controls the temperature, humidity, lightening inside home according to outside environmental condition. Also getting access of the home from the remote location.

#### C. Time and effort saving

Control over the light system, television volume control and telephone volume control in the day, night or sleep mode.

#### D. Comfort

Smart home system adjust the various system like HVAC, bathroom heaters according to the users comfort.

#### E. Accessibility

Customized system by the use of user voice to control the various application of system this system is specifically for physically challenged peoples or oldies. So this system helps to user to perform their functions independently.

### VI. SMART HOME- CHALLENGES

There are many problems associated with the smart home system. The major role of internet of things (IoT) as rapidly increasing the use of different applications at a time is difficult. Many key challenges discussed by different authors that are [14, 15, 16]

1. Standardization- It is an important part of system. Because it is available globally but for usage purpose need to define one standard which will be reliable, secure for making the entire system trustworthy.
2. Security – There are some security concerns with the smart home system. As the hackers can access the smart device or network system. So that they can control security system for their purpose.
3. Adaption to new environment – as the different new innovations are available on the market for security purpose as well as for device controlling purpose. So it is difficult to find better one to suits the individual requirement
4. High initial cost- smart homes are mainly designed for the convenience and reducing human effort. But for making smart home cost require is very high because for making automation different electronic system and sensors are required.

5. Data storage – for the mainly security reasons the data generated are huge. So for saving this data requires more storage device or space.

### VII. CONCLUSION AND FUTURE SCOPE

Instead of using separate home appliances, it is integrated as one system through use of network, so to provide user with added value. So smart home is the potential area in the twentieth century as its significance rapidly growing due to industry demands. This work represents the general overview of smart home technology by considering all the basic component of the system. The work done by various authors gives the idea about automated smart home and range of applications. It also discuss about the smart home technology advantages and its limitation. This paper also discuss the various algorithm, communication protocol used in the smart home. Apart from the above this paper also describes the problems and challenges that could come. The main challenge for the industry is to educate the user about various functions by the system integration. And all system used in the smart home to be work as one unit and user friendly. Smart home gains popularity in future for intelligent control and better connected to various service providers to automate or optimize the service.

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