



A ROLE OF INTERNET OF THINGS IN HUMAN LIFE : A PERSPECTIVE OF SMART HOME

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Abstract : Smart home is the automation and control of electronic appliances and light energy systems.. In this paper, a smart home system was designed and implemented using Internet of Things (IoT). The system consists of two sub systems the Remote System and Cloud System. The Remote System (mobile system or remote-control device) is a messaging service used to send and receive data messages from the Application Program Interface. The cloud system consists of all the remote business logic and networking. This paper introduces new design for smart home which is based on 3D Virtual technology. The Virtual 3D engine is used to create a remote virtual home in user application. Users are able to monitor and control their remote virtual smart home using 3D virtual reality from remote application. This system utilizes a Virtual Machine Manager as a Wi-Fi-based gateway to connect different sensors and updates their data in Home Assistant cloud server. The collected data from several sensors can be accessed via remote devices such as smart phones and laptops over the Internet regardless of their location.

Index Terms - Smart home, 3D virtual model, Internet of Things, Virtual Machine, Cloud System, Remote System, 3D Virtual technology, home appliances.

I. INTRODUCTION

Internet of Things is a collective network of physical objects embedded with sensors, software and other technologies which exchanges the data with other devices and system through the internet. These physical devices range from household to sophisticated industrial tools. It is a collective network of connected devices and the technology that facilitates communication between devices and the cloud, as well as between the devices themselves. Today 10 billion IOT devices are interconnected over internet and that may grow 22 billion by 2025. In the 21st century, the Internet of Things plying vital role in human life by connecting everyday objects such as kitchen appliances, thermostats, cars and baby monitors through the internet. The Internet of Things facilitates low-cost computing, collect and share data among the cloud, big data, analytics and mobile technologies and physical things with minimum human intervention. The Internet of Things is making the world as digital with more smarter and responsive, merging the digital and physical universes.

A smart home is also one of the applications of Internet of Things. It achieved tremendous popularity in this decade which increases the comfort and quality of life. The success of smart homes depends on their adoption and use by people in the context of daily life. Smart home setup includes home appliances and equipment can operate in remote with Smartphone or network computer with internet facility. It is a residential extension of building automation that involves the control and automation of all its embedded technology. The smart home includes appliances, heating, lighting, air conditioning, computers, TVs, refrigerators, security and camera systems capable of communicating with each other being controlled remotely. Smart home provides security, energy efficiency, low operating costs and convenience. Installation of smart products provides convenience and savings of time, cost and energy.

Smart applications are that incorporate actionable, data-driven insights into the user experience. The derived insights that enable users to more efficiently fulfill the desired task and actions. This paper presents the development of Smart home using Internet of Things to reduce the human intervention. The organization of the rest of the paper is as follows. The Section 2 describes the related work focusing on prior work on smart home using IOT. The section 3 states the overview spectrum & taxonomy of Smart home. The section 4 presents design and development of smart home using IOT. Finally, concluded with future extension in the Section 5.

II. LITERATURE SURVEY

Over the years eminent theorists and researchers have worked on smart home systems in the domain of Internet of Things. These concept taxonomy can be useful to extend the knowledge discussion for developing smart home systems and its appliances. The good number of researchers provided research contributions in the field of Internet of Things is as follows

- Abdel Rahman H. Hussein et al[1], highlighted the recent development of Internet of Things technologies and its applicability in the various areas such as health care, town planning, agriculture, logistics and retail. The IOT can make the human life as more smart in forthcoming generations.
- Ahmad Bilal Zia et al[2], delineates Frugal Las IoT Platform (FLIP) for building IoT enabled Smart Home. The components of smart home and its applications implemented with FLIP proposed structure which uses sensors, security gadgets. The proposed smart home structure controlled and monitored using OCTAVE Allegro.
- Jyotsna P et al[3], discussed the various issues and solutions of smart homes system using Internet of Things and shown research directions. They presented architecture of IOT which monitored and controlled the smart home devices and home appliances. The paper presented not only problems and challenges of IOT and shown the solutions to overcome these problems and challenges.
- Piyare.P and Tazil discussed that, the most of smart homes are controllable remotely through the internet or smart phone when the user is not at home. There are various factors to be considered in designing the smart home system. The system should be affordable, scalable so that new devices can be easily integrated to provide user friendly environment [4].
- Quynh Le et al[5] proposed the framework with basic features such as Automation, Multi-functionality, Adaptability, Interactivity and Efficiency. The proposed framework is ability to perform automatic functions, ability to generate various outcomes, adjusts to meet user needs, ability to interact among user community and provides the features in terms of time and cost reduction.
- Rahul Kumar chawda et al[6], focused on Internet of things and applicability in home automation. He highlighted advantages of Internet of things, need of smart home and security attacks on smart homes services.
- Satyendra K et al[7] presented a paper on sensible residential automation controller which convert the home appliances to smart intelligent devices with the support of design control. It requires Home Assistant a library that support MQTT and virtual Machine to code microcontroller. This multi modal system uses Google Assistant together with a web-based application to regulate the smart phone.
- Shardha Somani et al[8] focused on Home Automation with IOT application which can easily control the camera module and provides home security. The android application converts Smartphone into a distant for all home appliances. Home automation that consists of; fan light and door controller, and security module that consists of; smoke sensor motion sensor and camera module.
- Shreelakshmi et al [9] presented paper on applicability of Internet of Things for disabled People. Currently billion people including children are living with disability. Due to lack of support services most are depending on their families. The Internet of things provides a solution for their disability and achieves the good quality of life in terms of social and economical.
- Syeda Ayesha Unisa et al[10] presented research paper on home automation with cost reduction. They designed IOT based system devices. The smart home controlled with firmware and reduces the human intervention with usage of NodeMCU, open source IOT platform to execute the automation.
- Tekenli T.S et al[11] expressed as the home automation is more beneficial in safety and security aspects. It is more advance and precise in terms of slight degree of house appliances. Home automation system is more efficient and highly approachable smart home technique.
- Vijaya Kumari. J et al [12], presented research paper on low cost and flexible controlled home automation system. It includes micro-web server in Node MCU microcontroller with IP connectivity for controlling devices and applications from remote side. All devices can be controlled through a web application or Android based Smart phone app. The proposed system need not require dedicated PC. and offers a novel communication protocol for home environment monitoring and control.
- Vikram N et al[13] proposed a strategy to supply a low-cost Home Automation system (HAS) using local area networks. The HAS various modules provides features such as gas leakage warning system, temperature and humidity sensor, fire alarm system, rain sensing, switching and regulation of load & voltage and current sensing monitored using Smartphone application.

III. OVERVIEW SPECTRUM AND TAXONOMY OF SMART HOME

The term 'Internet of Things' first coined in 1999 by the computer scientist Kevin Ashton. While working at Procter and Gramble, Ashton proposed putting radio frequency identification chips on product to track them through Supply chain. Today, Billions of physical devices connected around the globe with internet for collecting and sharing the data. The advantage of super-cheap computer chips and ubiquity of wireless networks possible to turn anything. The Internet of Things makes the world as more smarter and responsive with merging the digital and physical devices. The internet of Things is network of physical objects that are connected to the internet which exchange the data and information in order to improve the efficiency, productivity and services.

The Internet of Things is a combination of computing devices, mechanical and digital machines and people that are unique identifies and ability to exchange the data over the network without requiring human intervention. The IoT has made with development of technologies, sensors, real-time analytics, embedded systems, wireless systems, control systems and machine learning. The role of IOT is in various areas such as Consumer applications, Smart Home Applications, Medical and Health Applications, Care Applications, Building applications, Transport Applications, Manufacturing and Industrial Applications, Agriculture Applications, Military Applications, Infrastructure and Energy Management Applications etc.

Advantages of Internet of Things:

- New business opportunities that IOT can ability to transfer the data over network and use advance analytics for finding the business insights.
- Rapid Response
- Improve the productivity
- Predictive Analytics
- Reduction human intervention and human errors
- Improved monitoring with IOT sensors and smart devices.

Smart home also often called as home automation which provides the security, comfort, convenience and energy efficiency by allowing and controlling smart devices using the Smartphone or other wireless network devices. Smart home is greater control over energy usage such as temperature control, turning on and off lights, window operations and adjusting irrigation on weather condition. It provides insights of ecological factors and pinpoint areas where more energy needed and cut back in those areas and save money.

Need for Smart-Home :

- Home functions can controlled remotely
- Improve the functionality of home appliances.
- Extract the insights of Home management.
- Increased energy efficiency
- Improved home security.
- Manage all home devices from Smartphone app
- Flexibility for new devices and appliances.

Smart homes are equipped with technology that allows to communicate with smart devices and give the homeowner more control over their environment. Smart homes are customized, energy-efficient and convenient; however, downsides more expensive and internet dependence. Hence, this read is designed to abreast you with all the aspects of smart homes. The advantages and disadvantages for smart home is as follows.

Advantages of smart-home

New Applications and devices used for development
Technology Optimizations
Reduced wastage of resources
Usage of AI facilities
Customization of user comfort
Improved data collection and accountability

Disadvantages of smart-home

Security and Privacy issues
Internet Dependency
Interactive Life Style
Expansive Installation
Complicated user interfaces

The various internal and external threats identified in smart home applications. The internal threats for instance, due to the fact that home residents are have the exposure of security and solution to their own houses, apart from that the companies do not make sure of the use of security requirements in order to avoid attacks. Analyzing the Smart home security problem frequently is mandatory when it is used.

Smart home Assistant is a open source software for designed for home automation which will provide the central control over the smart home devices and appliances with local control and privacy. The smart home assistants includes Amazon Alexa, Amazon Echo, Samsung Smart Things Hub, Insteon Hub Pro, Wink Hub, LG Smart TV, Ecobee4 and Google Assistant. Some smart home systems can be created from scratch such a Raspberry Pi or other prototyping board.

IV. DEVELOPMENT OF SMARTHOME

Home automation can be described as introduction of controlled home environment to provide convenience, comfort, security and energy efficiency to its occupants. The design and development of Home automation using Internet of Things are getting more popular, which facilitate remote data transfer, sensing and control by using wireless technologies such as Bluetooth, Wi-Fi, RFID, and cellular networks. The studies in have presented Bluetooth based home automation systems using Android Smart phones without the Internet controllability. The home automation devices are physically connected with Bluetooth technology which can be accessed and controlled by the Smart phone. Further, the Researchers connected home automation with network interoperability to control devices and appliances in remote using home gateways. Proposed mobile IP based architecture and its potential applications in Smart homes security and automation without any actual deployment and testing. Lately few researchers have also implemented Web services, simple object access protocol (SOAP) to access home automation systems. The drawback of using SOAP based Web a service is complex and resulting in slower operation and higher bandwidth.

4.1 Proposed System

In order to address the mentioned issues of flexibility and functionality in the cited literature, we designed a standalone, flexible and low-cost home controlling and monitoring Web based Application. The system consists of a micro Web Application works on WINDOWS Operating system Virtual Application Software, software interface modules and the Android compatible Smart phone application.

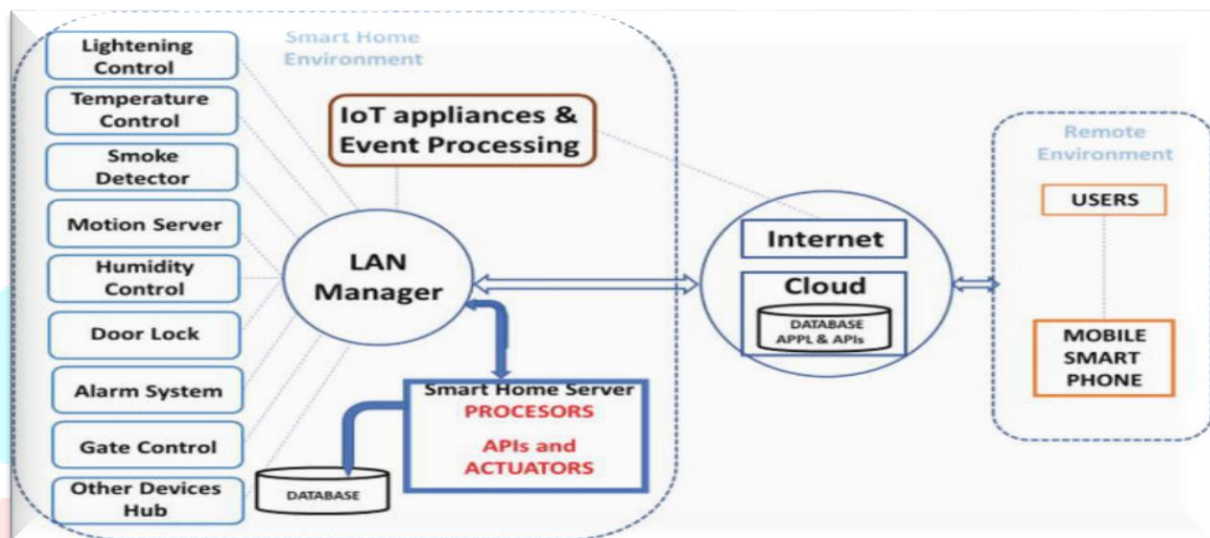


Figure 4.1. Architecture of Smart Home Application

In this Project the work can be customized in different ways in order to accommodate different application scenarios with designing and planning new device is added or deleted to the Web-Application which automatically reflected in the smart phone application. All devices are connected through LAN network consists with smart home server, the server IP address is mapped to web application and stores the data in cloud with support of Internet.

4.2 Designing and Planning

Designing the 3D floor plan by using Sweet Home 3D, which easily design model the house architecture and control different aspects, such as the dimensions and the square footage. The number of rooms and the overall architecture of the home are defined according to the requirements. The smart devices supported files are imported from the library.



Figure 4.2. Smart home place design with amenities

4.3 Construction

Construct the 3D Smart Home according to the using floor plan. All the user requirements are implemented in floor plan and constructed with same measurements by the ratio of floor plan and it will appear three-dimensional model of the smart home.

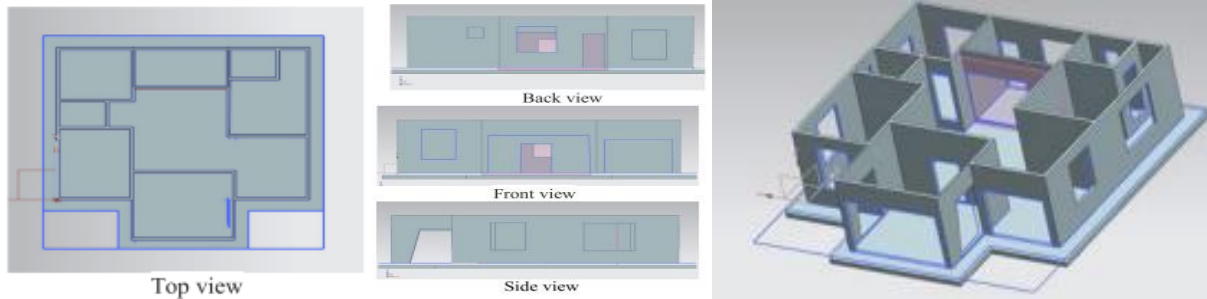
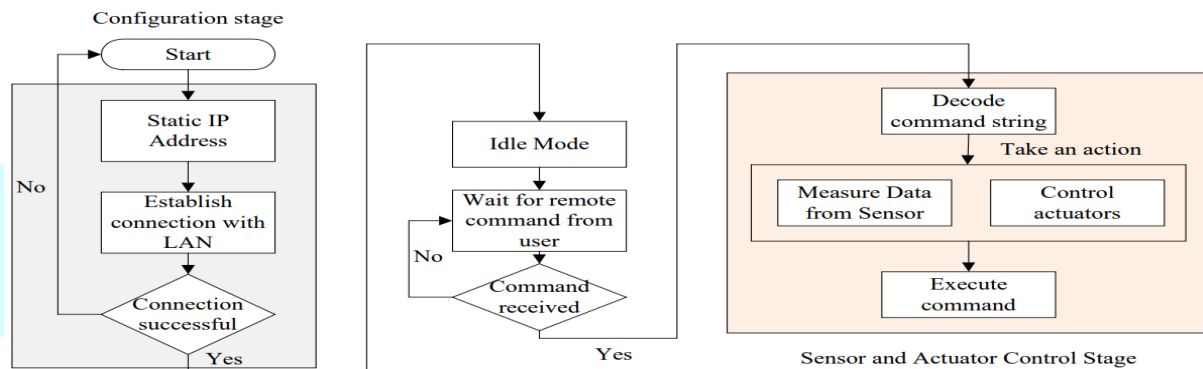


Figure 4.3. Smart home with various dimensionalities

4.4 System Implementation

Software of the proposed home automation system is divided into two parts: Virtual manager software and web server application. The Virtual manager software is a library implementation of a Web-server running on virtual machine using the source files[14]. To successfully communicate between remote user and the Home Gateway, configuration stage and sensor/actuator control stage layers have been implemented on the virtual manager shows the flowchart of connection establishment between the virtual machine and the Internet[14].



Home Gateway flow chart for the connection establishment with the Internet.

Figure 4.4 Logical Representation of Smart home Application

V. CONCLUSION

The idea of smart home project support a lot of home automation systems. Its design, fabrication, and implementation are portable, user-friendly, and less expensive using Internet of Things. The developed smart Home system can be easily implemented in real time environment. Several devices are connected to LAN network, which updated the data to the IoT server. The obtained data can be monitored via MQTT Dash mobile application and Home Assistant Web server through laptops/PC. The observations of developed system can increase the safety, security, intelligence, and comfort of users. Design and development of secure system can be the part of future work. The significant installation cost, technological problems in connected home, maintenance and repair issues and security issues is other part of the smart home automation.

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