



SIMULATION AND ANALYSIS OF SMART HOME ARCHITECTURE

P. Saleem Akram¹, Ramesha M² and T. V. Ramana³

¹Koneru Lakshmaiah Education Foundation (Deemed to Be University), Vaddeswaram, Guntur (D.T), Andhra Pradesh, India

²GITAM School of Technology, GITAM (Deemed to Be University), Nagadenehalli, Bengaluru, Karnataka, India

³GITAM Institute of Technology, GITAM (Deemed to Be University), Visakhapatnam, Andhra Pradesh, India

E-Mail: psaleemakram@gmail.com

ABSTRACT

The use of advanced technology in our everyday lives has grown day by day. This improving technology has made human life less complicated in completing our daily necessities. IoT is one of those advanced technologies, which is the result of human curiosity and an objective to make lifestyle convenient and more connected, reducing the labor and by abolishing the probabilities of human errors. Smart Home makes use of this IoT to Control Multiple Smart Home operations automatically. The IoT devices are attached to the internet to monitor and control all the home appliances like opening and closing the door, heating, lighting, alarming, and cooling. In our research, we designed smart home network architecture by using a cisco packet tracer simulator. It is the new version of the software in which various IoE devices that were utilized for intelligent home automation are incorporated. After setting up the architecture, we configured all home appliances to the home gateway through which we will control the devices with the help of IoT. We also showed the simulation (motion) pictures and their working conditions and managing from Home gateway. The same simulation architecture can be implemented in real-time with CISCO networking devices. In this we are going to experiment and analyse the results by using Cisco Packet Trace simulation tool.

Keywords: cisco packet tracer simulator, IoT, IoE devices, sensors, VLAN.

INTRODUCTION

Today, IoT will play a major role in human life in the developing world. A house that integrates smart objects with multiple functions is a smart home. i.e., the introduction of an intelligent home is meant to improve safety and efficiency; we can control home appliances without the help of users by Tracking movements in the home using different sensors [1-2]. (Temperature, Moisture, Smoke, Wind and Sound). Testing methods often usually exist, and devices that are controllable and automatic can be accessed via an internet-connected computer or smart mobile device.

A local area network is a network managed by an owner of a single network [3]. This network is built as a VLAN group [4] that essentially divides system efficiency and improves network management [5]. Although IoT was recently coined, smart objects are referred to as the "IoE devices" [6]. In this analysis, we considered the creative stuff to be the devices and functions recorded on the IoE server as an administrator-controlled home gateway over the internet. Smart Home network Design (SHND) [7-8] is a suggested approach for developing smart home networks by integrating the internet of things with the networking tools to perform specific operations on campus networks. This model involves Hierarchical Network Design [9] since it is used to organize devices into various network frames.

Core layer: The distribution layer is connected to web delivery.

The layer of distribution: It interlinks with smaller local networks.

Access layer: It offers the host network, smaller artifacts, and end system interconnections.

We used the cisco packet tracer simulator tool in this project to model the smart home network [10-12].

Despite giving security, the smart home can likewise give various highlights like programmed security utilizing different alert frameworks, LCD, and Alarm sound and sending messages to legitimate customers when a sensor identifies security concerns [13]. Home computerization notes using a microcontroller or PC invention to take care of and observe home stuff. Computerization is routine, as this makes the process quick and safe as well as profitable. Smart Home [14] takes on customer commitment in following home settings and working home appliances by recalling various sensors for home robotization [15-16].

IoT and IoE are a knowledgeable innovation that relies on smart devices and sensors that operate together on the web to advance life. All (IoE) networks are a theory which extends the accentuation of machine-to-machine communication (M2M) over the Internet of Things (IoT) to represent a more complex framework which also involves people and processes. IoT is a smart connected man, strategy, details, and relationship stuff [17].

DESCRIPTION

Internet of Things (IoT)/The Internet of Everything

IoT was developed due to the convergence of various real time analytics technologies, machine learning, commodity sensors, and embedded systems. Traditional areas of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and everything else relate to the Internet of Things [18]. The Internet of Everything (IOE) is a familiar concept relating to internet-connected devices and consumer goods and is fitted with expanded online functionality. It is a hypothesis in which technology's future



consists of several different types of tools and artifacts connected to the global internet. The Internet of Everything (IOE) is a common term in connexion with internet-connected devices and consumer goods. It is a hypothesis in which the future of technology is composed of several different types of devices and artifacts linked to the global internet [19-20].

The History of IoT and its Evolution

According to Gartner's reports, the sum of connected IoT devices, except computers, smartphones, and tablets, would exceed more than 20 billion, effectively surpassing the human world population. In recent years, the term "IoT" itself has been commonly used to describe and refer to various technologies [21]. The word, for example, was used by the network industry in the early 1990s to refer to an abstract layer of data delivery in heterogeneous public and semi-public networks and is still being used. The breakthrough came in 2002 when Amazon.com launched the Amazon Web Service (AWS), offering a range of enterprise-oriented services including remote computing, power generation, storage, and other services. Amazon launched the Elastic Compute Cloud (EC2) products in 2006 to enable corporations and private individuals to 'share' computing resources to run their apps. The Mobile App Engine was released in 2009, some years later, too [22].

Overview Cisco Packet Tracer

Cisco Packet Tracer is a proprietary Cisco multi-platform tool that enables students to construct networking and IoT simulations without hardware or pre-existing networking [23]. The device is portable, runs on major operating systems, and is available for all students and teachers with a valid NetAcad account to download from the Cisco NetAcad web site. The resource was known to all students taking part in Cisco courses over the years and was created to assist practical activities for students completing the Cisco Associated Network (CCNA) Accredited Academy courses [24-25].

According to the 2017 Corporate Social Responsibility Study Cisco Networking Academy, also known as NetAcad, had educated more than 7.8 million people in more than 170 countries over the years, the latest update available when this thesis report was released. This consists of more than twenty-two thousand educators worldwide and can depend on more than ten thousand collaborator organizations [26]. Most of those students made use of Cisco Packet Tracer in their Cisco education. This tool was built to allow students to network experiments without costly network infrastructure and long-term hardware configuration procedures [27-28].

METHODOLOGY

Home Gateway is used to monitor objects and sensors that provide a programming domain to handle related products and provide control resources by enrolling smart devices from Home Gateway.

In this analysis, apply journals and observational analysis methods in journals, e-books, and reference books in the research collected from print media and the Internet media. The house is constructed using a software test system consisting of various gadgets and IOT passages with corresponding brilliant computers, as well as an IoT server, DNS server, and IoT cloud (WAN)[29-30], as can be seen from the following performance.

The server consists of

- a) Internet of things server (IoT)
- b) Domain name server (DNS)

By entering a username and password [31], the IoT server stores all specified work environment information and gives endorsed access to the benefits to clients.

Algorithm

The following description for the Algorithm

- **Phase 1:** Begin.
- **Phase 2:** Open and save the cisco packet tracer file.
- **Phase3:** Install the required modules into the workspace, as shown above.
- **Phase 4:** Link all workspace devices with the aid of cables.
- **Phase 5:** Set up device router and internet service provider interface.
- **Phase 6:** Link the Network to the Home Gateway.
- **Phase 7:** Prefix smart devices for wifi
- **Phase 8:** Link Network End User Devices
- **Phase 9:** End

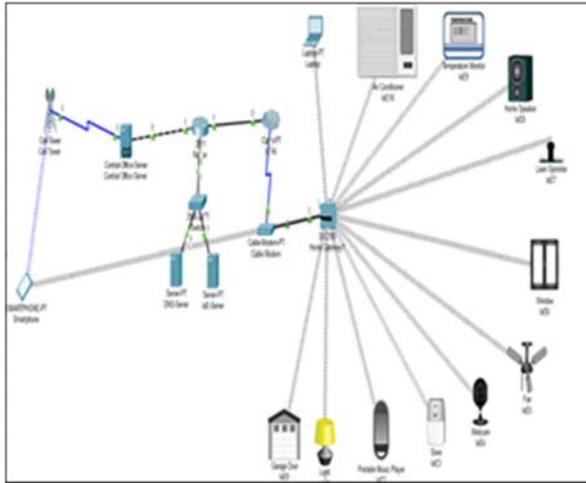
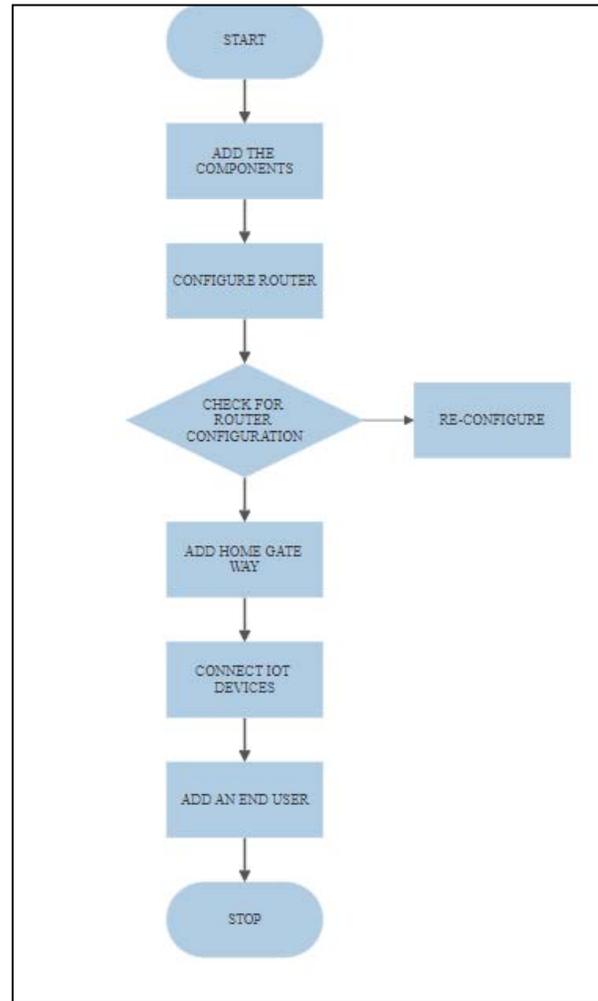


Figure-1. Setup of smart home architecture.

The above Figure-1 shows the architecture model of a smart home where several intelligent devices connected to Home Gateway to be monitored and controlled. We used the cisco packet tracer simulator program in this project to model intelligent home network design. Despite giving security, the smart home can likewise give various Highlights such as programmed protection using multiple warning systems, LCD, and alarm tone, and sending messages to legitimate clients when a sensor detects protection issues [32-33]. The connections can be made both wired and wireless. All the devices that are nearer are connected in wired form, i.e., in our home, the servers, computer, routers are all connected via the wired form. And remaining IoE devices like home appliances, are connected via a wireless form using DHCP Protocols. The above circuit diagram shows exactly how the connections are made for the network formation.

Flowchart



The above flowchart describes the step by step process to create smart home architecture, starting from adding intelligent devices to central router and there after controlling the devices with internet.

The Architecture of the Network

The IOE things can join with the IOE administration directly in the Home portal or network database. The Home Gateway includes 4 Ethernet ports and a six-channel remote communication point with the SSID "Home Gateway". Designing WEP / WPA-PSK / WPA2 organizations to remote connections that are ok for associations is conceivable. Figure-1 shows 7 IOE stuff related to a Home Gateway. The home passage via the WAN Ethernet port is connected to the Internet. It is all but difficult to deal with the IOE system with a home portal and a web interface. The IP address inside of the Home Gateway (LAN) is 192.168.25.10. However, it appears to be reached before the internet, using even its IP address.

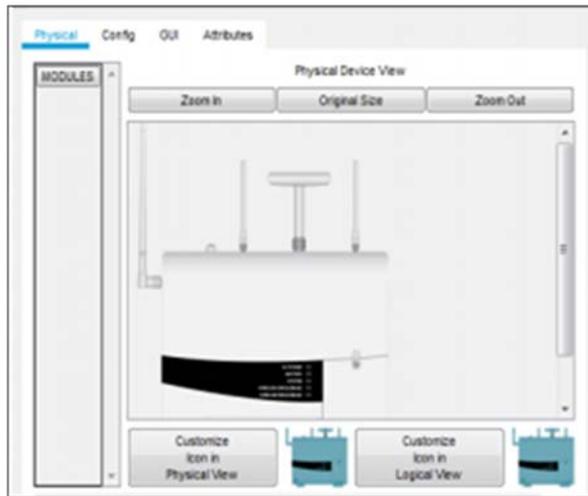


Figure-2. Home gateway.

The above Figure-3 shows the Home gateway setup in packet tracer, where we configure the smart devices.

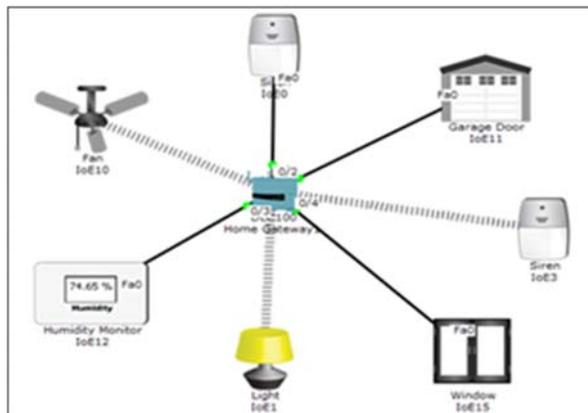


Figure-3. Smart Home portal with seven linked smart things.

Figure-4 shows the smart device setup and its configuration in the simulation tool.

SIMULATION ANALYSIS

Device Configurations

Here we configure all smart devices to Home gateway with IP address, with different Classes of IP address.

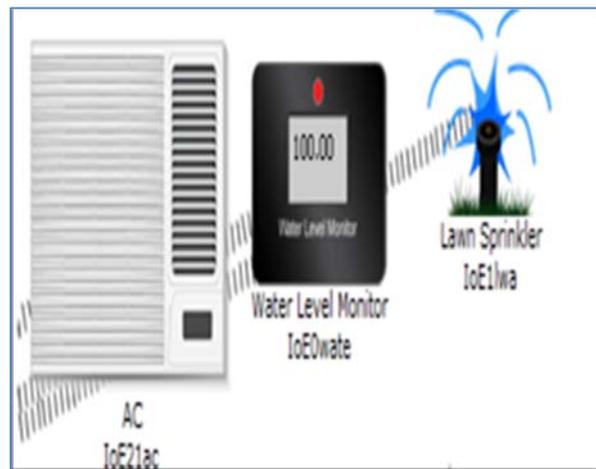


Figure-4. The plant is sprayed using the lawn sprinkle.

Simulation Result Analysis

The above Figure-4 shows the simulation results, i.e., the working models of the smart devices, i.e., water sprinkler in the garden, water level monitor, air conditioner.

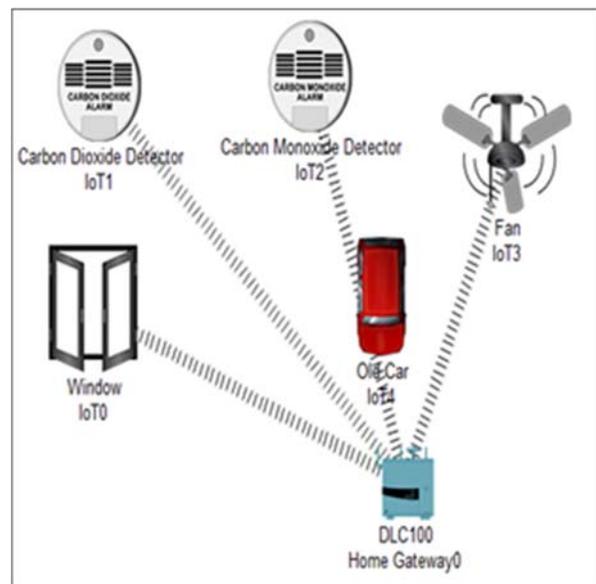


Figure-5. Detection of CO and CO₂ for aerating.

The above Figure-5 is identical to Figure-4, showing the simulation (working) of connected devices; when carbon monoxide and carbon dioxide are detected using a carbon monoxide and dioxide detector; the fan and window open. The old car is used for scenario analysis because the old car is a lot of trouble with the Co and Co₂ rising.

CONCLUSIONS

This article represents the simulation results that will be practically implemented with the hardware setup. In this, we executed a smart home by propelled the Cisco



packet tracer, which incorporates distinctive IOE, a gadget utilized for home robotization, which employs Portal to enroll keen gadgets on it and afterward control the devices. We also exhibited the simulation results (motion pictures) of all the connected devices to check their working conditions. We also managed the ON/OFF conditions of each connected device with a home gateway operated by IoT.

FUTURE SCOPE

Cisco packet tracer is a network simulator tool primarily used to practice Cisco test labs. With the help of this method, you can build your network topology and practice different scenarios. Also, we can use it for research purposes. Suppose if you want to apply any changes to your production network, you can use the packet tracer to check the changes you need first. It permits us to make a system with a practically unlimited number of gadgets. As the future of networking grows, the tracer tools are far essential and impendent for the Application.

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