IMPLEMENTATION OF CISCO PACKET TRACER IN ADVANCE COMPUTER NETWORK

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Abstract

In the process learning computer network systems, the use of virtual laboratories is very important. In this study, we also implemented Cisco Packet Tracer, which enables us to work on test scenarios without using any physical components virtually to design an advanced computer network. The Cisco Packet Tracer is used not only to simulate computer networks but also to learn computer networks.

In this study, we briefly introduced the Cisco Packet Tracer, the aim, the importance, the assumptions, and the limitations of the study is explained. In addition, a program system was created for an exam by used Microsoft visual studio 2017(Visual basic.net) and SQL server 2016 data base that measures the capacity and potential of the participants about the computer network and their information about the Cisco Packet Tracer. Also, the map and rules of the computer network structure were determined to design a computer network in a 6-storey hotel. In the framework of the specified network map, the configurations have been made completely and the advanced computer network has been established using the Cisco Packet tracer. Finally, five scenarios were implemented on the network in order to prove the network in the hotel is working well.

Keywords: *Cisco Packet Tracer, Network Simulation.*

GELİŞMİŞ BİLGİSAYAR AĞLARINDA CISCO İZ SÜRÜCÜ PAKETİ UYGULAMASI

Özet

Bilgisayar ağ sistemlerini öğrenme sürecinde sanal laboratuvarların kullanımı çok önemlidir. Bu çalışmada, gelişmiş bir bilgisayar ağını tasarlamak için herhangi bir fiziksel bileşen kullanmadan test senaryoları üzerinde çalışmamızı sağlayan Cisco Packet Tracer uygulamasını da uyguladık. Cisco Packet Tracer, sadece bilgisayar ağlarını simüle etmek için değil, bilgisayar ağlarını öğrenmek için de kullanılır. Bu çalışmada, Cisco Packet Tracer'ı kısaca tanıttık, çalışmanın amacı, önemi, varsayımları ve kısıtlamaları açıklandı. Ayrıca, Microsoft Visual Studio 2017 (Visual basic.net) ve katılımcıların bilgisayar ağı hakkındaki potansiyel ve kapasitelerini ve Cisco Packet Tracer hakkındaki bilgilerini ölçen SQL Server 2016 veri tabanı tarafından bir sınav için bir program sistemi oluşturuldu. . Ayrıca,

bilgisayar ağı yapısının haritası ve kuralları 6 katlı bir otelde bir bilgisayar ağı tasarlamak için belirlenmiştir. Belirtilen ağ haritası çerçevesinde, konfigürasyonlar tamamen yapılmıştır ve Cisco Packet Tracer kullanılarak gelişmiş bilgisayar ağı kurulmuştur. Son olarak, ağın otelde iyi çalıştığını kanıtlamak için ağda beş senaryo uygulanmıştır.

Anahtar Kelimeler: *Cisco Paket sürücü, Network Simulasyonu.*

1. INTRODUCTION

Today, networks can be constituted by connecting different devices such as computers, phones, printers, mobile devices, etc. wired or wirelessly. We can think of computers or computer that we use at home as part of a network. Because the internet is a network, there are only speed limits and quota. Different networks can share resources or documents with each other over the internet. Generally, it is possible to connect several computers with many cables and create a network through visual interfaces. But this will require both extra physical space and redundant cable redundancy and extra interfaces. Switches have been produced for this purpose. With these switches, we can provide multiple computers to communicate and share with each other.

As seen above, computer network is so complicated that it is not enough to give the theoretical knowledge to the students in computer network education. It is necessary to learn and practice thoroughly how the systems work to build and manage these systems. The progress of technology has made both computer specialists and computer education important, especially in the computer network area [2].

In contemporary education; it is increasingly important to be able to provide learning and feedback by living in the teaching process. Simulation technology emerges as a new development in education to be applied to network is such as simulation of network traffic and modeling of network general structure. In the simulation environment to learn how networks work on the computer gives us both time and material advantages. Simulation approach can decrease the increasing costs in education and can raise the reducing realism environment [3], [4], [5].

Network Simulation is a network modeling on a computer and testing how the network will work without being physically installed. The vast majority of network simulator programs are programs used by companies developing network products for training and design purposes. Nowadays, CISCO Company, in the education levels of CCNA, CCNP etc. are using a simulator program developed in place of laboratory applications. Packet Tracer is a network simulation tool that enables applications of Cisco branded network devices and network design to be done without using any physical machine or vehicle. Packet Tracer, which allows network topologies and subsequent configuration of associated devices, provides a good learning environment in preparation for Cisco certification exams [6][7][8].

1.1 Background

The virtual creation of real life applications through simulations reveals the concept of a virtual laboratory "Virtual Laboratory; can be defined as a computer environment that provides an interactive real-time simulation opportunity in experiments that must be performed in order to gain practical experience in

education" [1] Virtual laboratory; yet it is a computer environment that can be done in the laboratory environment or it is not possible to do it in reality, it is possible to show the applications which cannot be shown concrete but can be shown by simulation interactively with the students. Simulation; is demonstration of applications that can not actually be done or cannot be demonstrated in a computer environment; whereas the virtual laboratory is the application of the student interacting with the computer in the laboratory environment.

Computer simulation can help modeling and analyzing processes in many systems. Current areas of application include human-like systems in the fields of physics, chemistry, biology [11] and economics, finance and even social science. Simulation technology emerges as a new development to be applied to network areas such as simulation of network traffic and modeling of network overall structure. To perform network simulation, computer aided simulation tools are used. Network simulations give more importance to the performance or validity of the distributed protocol or some specific algorithm than the visual or real-time monitoring features alone. For this reason, many different tools are being produced in parallel with the rapid development of network technologies. The importance and quality of the network simulation tools developed depends on supporting algorithms and protocols commonly used in network environments [9], [10].

1.2 Packet Tracer

Network simulators are the first things that help people when they are working with network systems. Because it may not be possible to create a lab environment that can connect switches and routers immediately even if it happened, it is not always necessary. Anymore today, virtual software has been created to test it. One of them is Packet Tracer, developed by Cisco and offered free of charge to users. Packet Tracer is a powerful visualization and simulation tool that enables users to design, build, and troubleshoot network problems in a secure environment. It has an easy-to-use interface that allows you to create your topology with drag-and-drop ease [12] [13].

You can simply add and remove interfaces on the device as you want and can simply select the interfaces by selecting the devices. You do not even need to write a ping command to see if the devices are UP & Running (ie, they are running), just click on an envelope and ping it. It supports almost all networking equipment and connections that need to be tested.

The Cisco Packet Tracer program is a simulation program that enables us to perform Cisco operations or applications without using any physical machine or vehicle and provides us with a network lab environment. Most of the LAN routing applications can be done with the help of this simulation program [13].

The benefits of the Cisco Packet Tracer program include:
• It provides a comfortable and well-informed environment.
• It provides multi-user, real-time training laboratories.
• It can prepare exams for students and give points according to what they do.
• Network environment is designed, and network devices are configured using virtual equipment.

The Cisco Packet Tracer is a simulator program which is used to create network topologies and configure the aforementioned devices without the need for actual Cisco Routers and Switches. With the Packet Tracer, studies can be made to prepare for the Cisco Certified Network Associate (CCNA) and (CCNA) Security exams. In these studies Cisco Routers and Switches are configured through the CLI (command line interface), and you can see all the details of a package with advanced simulation features [13]. At the moment, Packet Tracer is running on Windows and Linux systems. There is also a mobile version for IOS and Android.

As shown in Figure 1, [14] the components of Packet Tracers are;

1. Menu bar
2. Main toolbar
3. Common toolbar
4. Logical / Physical workspace
5. Workspace
6. Real Time / simulation working mode
7. The Network component box
8. Network device identification area
9. The network device subtype determination tool
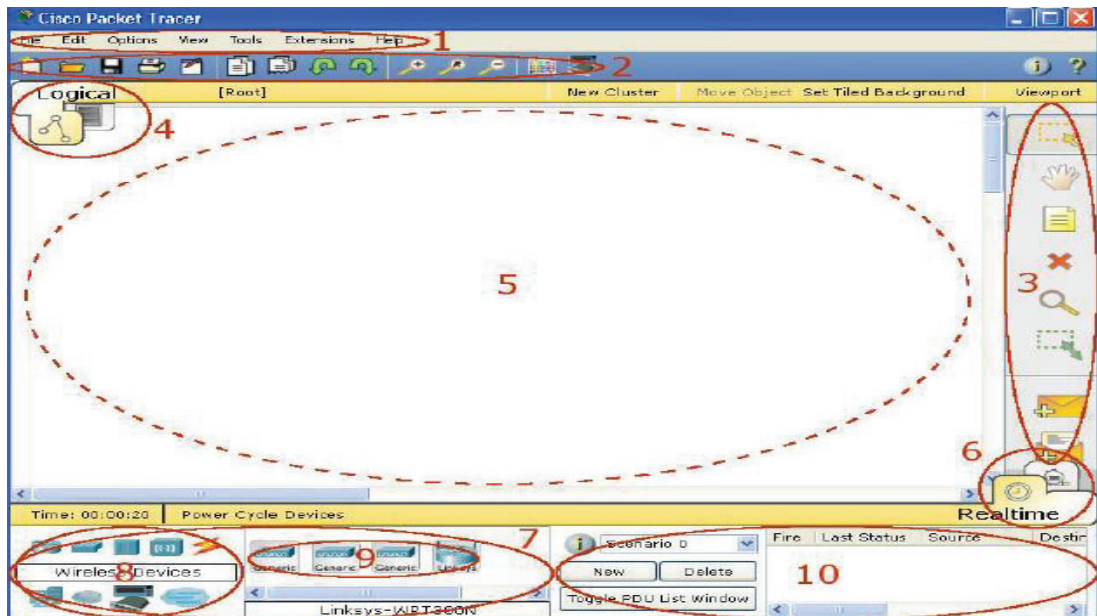10. Packet simulation monitoring window

Fig. 1. Component of packet tracers[14]

2. METHODOLOGY

2.1 Evaluate Participants System

The microsoft visual studio 2017 (Visual Basic.NET) and SQL server 2016 is used to work the system to evaluate many participants after training on Cisco Packet Tracer to implement, design, and troubleshooting for network.
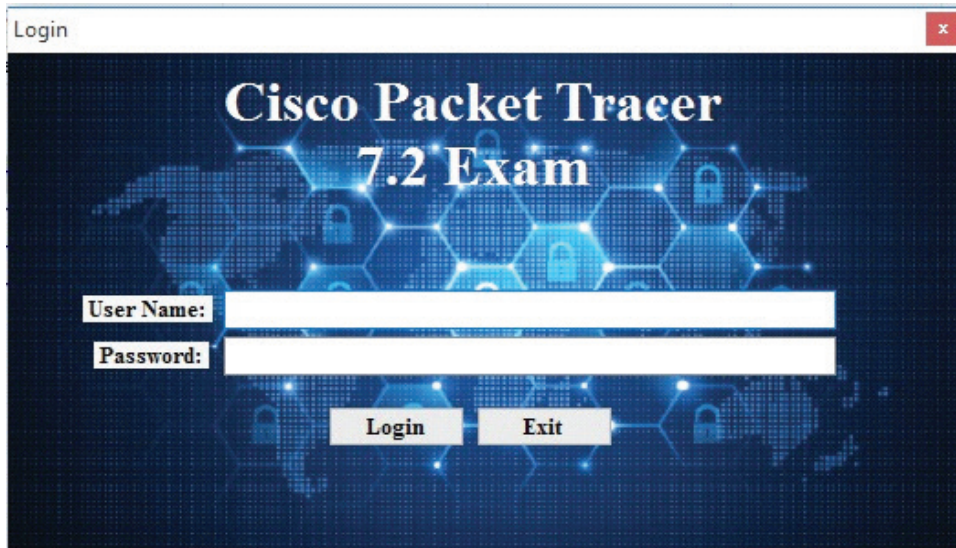

Fig. 2. Login the system

To examine and ascertain the capacity and potential of a participant skill to design computer networks and their knowledge of the Packet Tracer course, A programmed system has been created that will examine the participants.
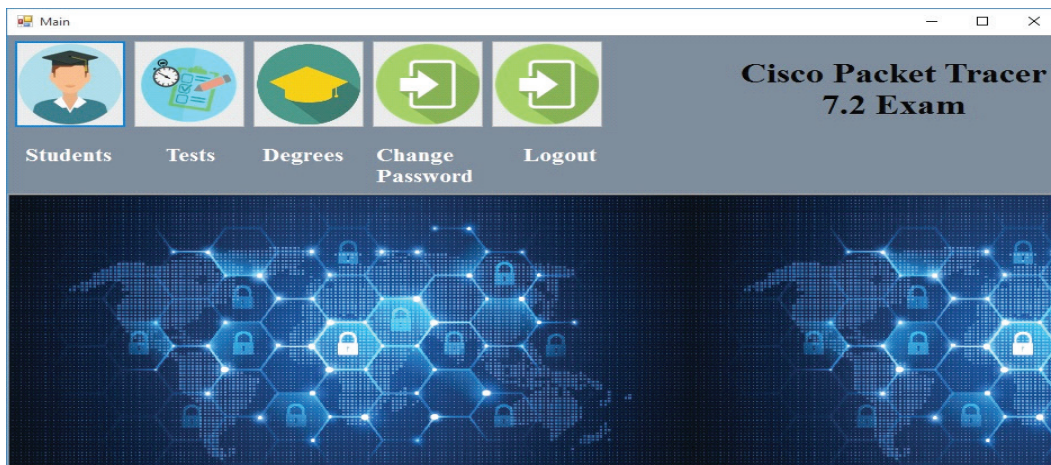
Fig. 3. Principal interface

Students can access the system for the purpose of performing the test by logging the name of the students first and then logging in the exam number of the participant. Once the examination time is over, and the questions are unanswered by the participant, the program will stop responding. Once they finish answering all the questions and pressing the end button, the system will show the outcomes of the wrong colored answers in red, as seen in the figure below (Fig 4).
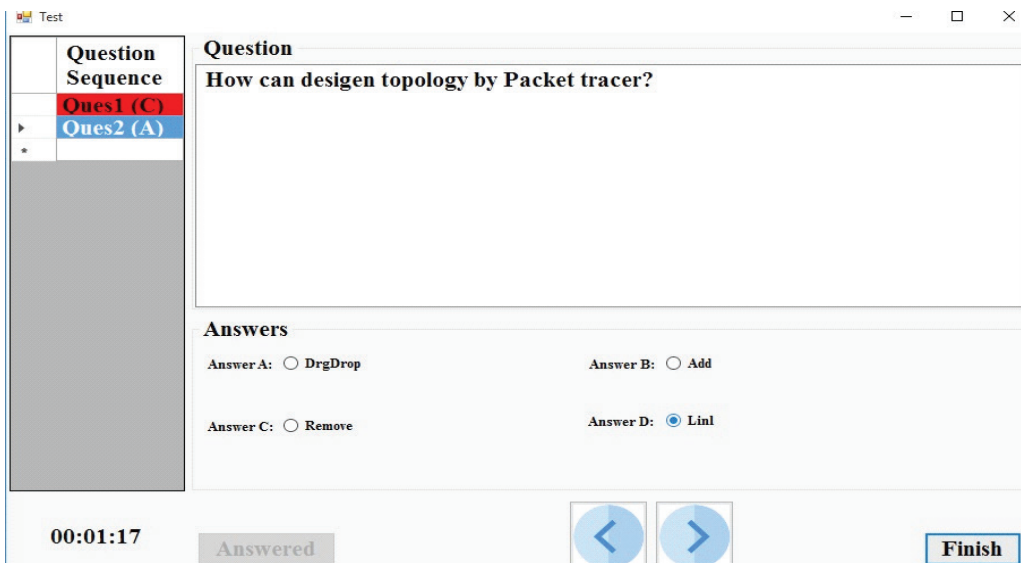

Fig. 4. Wrong answer

Right when the exam time is over and all exam takers have finished their exams and filled in their selected answers with the interface of the system. The instructors that present the exam takers with their marks by clicking on the marks icon in the principal interface (Fig 5).
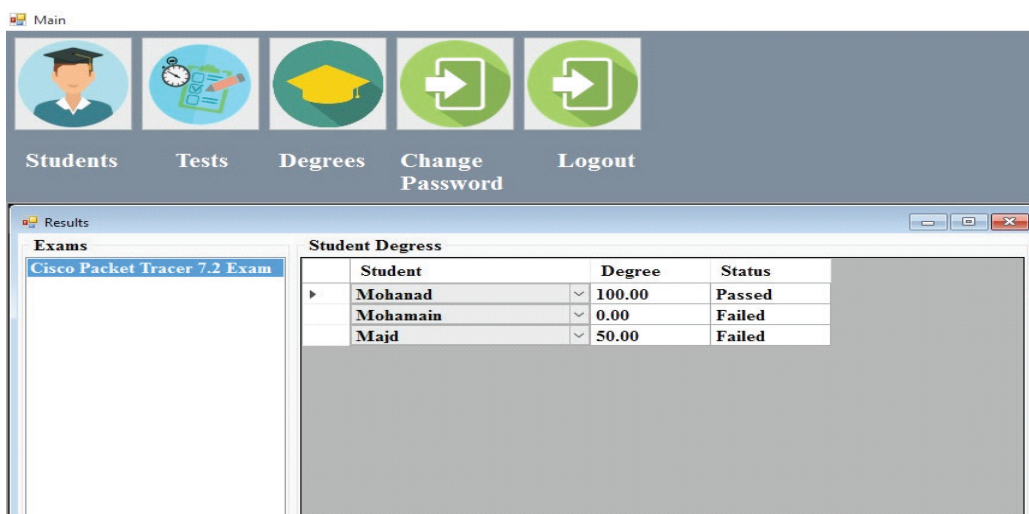

Fig. 5. Students Degrees

Then the system quantifies the exam taker's marks and presents it on the broad- screen with the total marks been presented for each exam taker to see. For example, the exam taker who obtained less than (70) will be regarded as haven failed in the test, on the other hand, the exam taker who obtained the mark of (70) will be regarded as haven passed the exam excellently, and will be recognized and believed to able to design, execute and preserve the application of the Packet tracer.

2.2 Formation of Network Topology

After the examination by the participants in the course and the result appear through the system. The network is designed and implemented by Cisco Packet Tracer Program. The topology of the computer network structure were determined to design a computer network in a 6-storey hotel. In the computer network map, 9 computers, 5 lap top computers, 6 Ip phones, 14 switches, 2 routers, 4 access points, 1 security wall, 1 http sunucu, 1 mail sunucu, 1 IoT(Internet Of Things) server, 6 cameras, 1 tablet, 1 smartphone and 1 DHCP server were used (Fig 6).
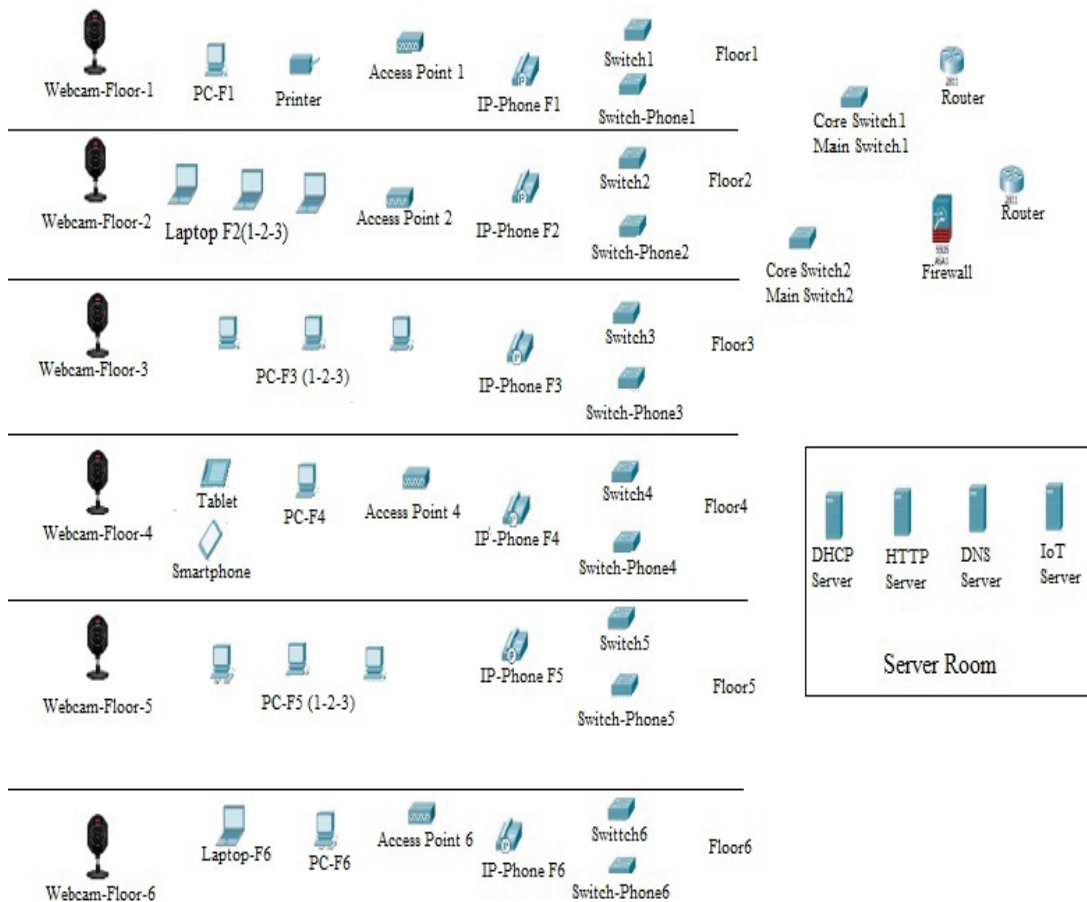

Fig. 6. Network topology

3. RESULT

The results have been produced by the Packet Tracer for the different scenarios.

3.1 Scenarios

To prove the Packet Tracer is suitable and applicable to design and implement network. In addition, the Packet Tracer is very important to use in the learning computer networks, five different scenarios have been used.

3.1.1 Send Packet (Between Two Floors) Senario

In this scenario we will send a message from computer device in the first floor to another computer device in the sixth floor and we will note how the message moves step by step in order to reach the destination as shown below:

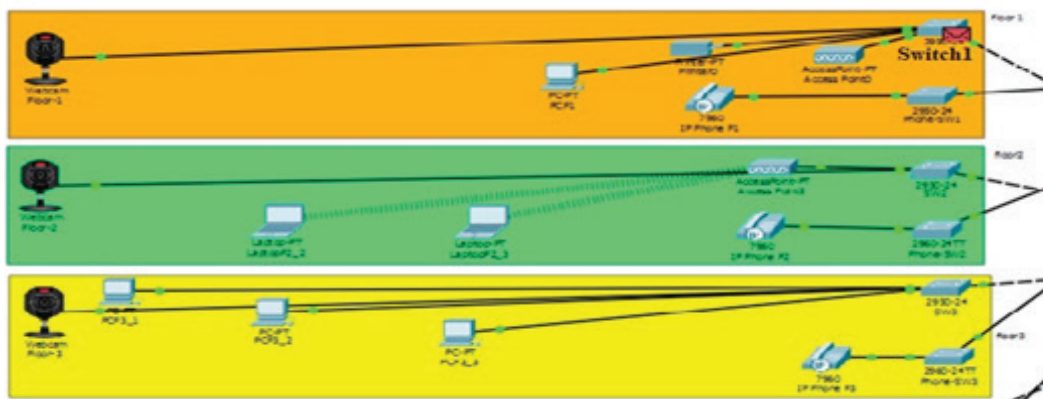• First step, the packet was redirected to Switch1 (Fig 7).

Fig. 7. Send packet step1

• Second step, Switch1 redirected the package to Core Switch2.

• Third step, Core Switch2, redirected the package to Switch6.

• Forth step, Switch6, redirected the package to Access Point6.

• Fifth step finally, the package was successfully sent from the Access Point 6 to the target user (Laptop1-F6) (Fig 8).
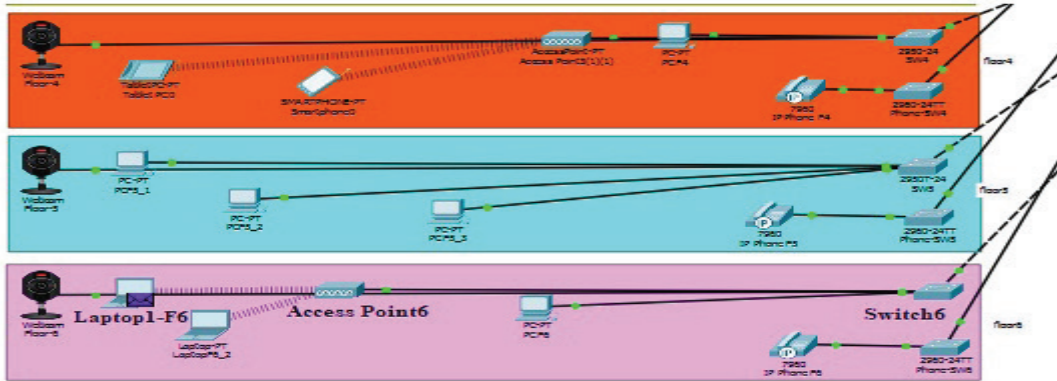
Fig. 8. Send packet step5

3.1.2 Command Line Interface (CLI) Scenario

In this scenario we will use the command line interface (CLI) between any two devices in the network to prove all devices connected between each other as shown below:

• First step, we enter the computer device interface in any floor in the hotel and login to the Command Prompt in order to send ping between any two devices (Fig 9).
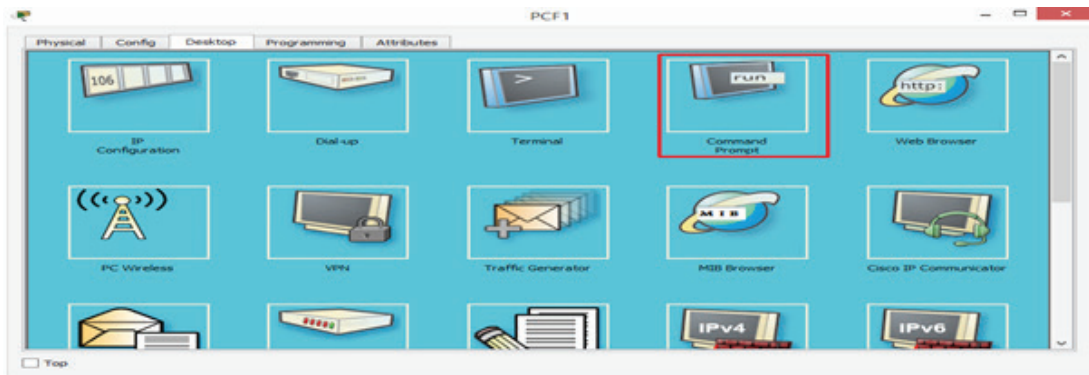
Fig 9. Command line interface(CLI) step1

• Second step, then we specify the target device IP address by giving the target ping command. For example, IP address (192.168.10.22) (Fig 10).

Fig. 10. Command line ınterface(clı) step2

3.1.3 Website Hotel Scenario

In this scenario we will implementation of the hotel's Website for the purpose of accessing the Website pages as shown below:

• First step, in order to login to the Website of the hotel, it is entered to the interface of any network device connected to the network and the Web Browser button is clicked.

• Second step: Then http://hotel.com is written on the address line. Once this is done, the DNS server will be asked for the IP address of hotel.com. Since DNS server knows the IP address of the hotel.com domain name, it directs the user to the IP address where the HTTP server is located so that the user will be faced with the web interface (Fig 11). Then, a phrase will appear on the page (Welcome to the hotel).
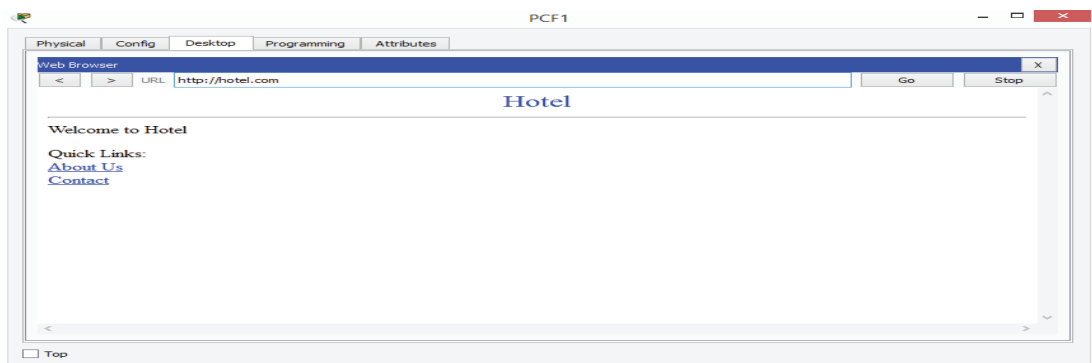
Fig 11. Web site hotel step2

3.1.4 IP-Phone Scenario

In this scenario we will use IP-Phone device to make a telephone call between two phone devices located on second floor and sixth floor of the hotel to prove that the network is also used by telephone devices well.

• First step for the first time, the interface of the phone on the second floor is entered (Fig 12).

Fig. 12. Make telephone call step1

• Second step, the sixth floor telephone number is entered into the phone (0006).

• Third step, the phone is opened by clicking on the phone.

• Forth step, the interface of the phone on the sixth floor is opened and the call is answered by clicking on the phone (Fig 13).

Fig. 13. Make telephone call step4

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3.1.5 CCTV Scenario

In this scenario to prove that the security of the hotel is very important, surveillance cameras were used to monitor all the hotel floors and connect these cameras to the network. Moreover, Thanks to CCTV, the view from the security cameras is realized. The floors can be monitored at any time thanks to the cameras which are provided with each crawler and thus the security is ensured. To monitor security cameras, enter the interface of a device connected to the network and perform the following steps:

• First step, for the first time it is entered to the interface of the networked device and the web browser button is clicked.

• Second step: Then IP address IoT server, 192.168.10.24 IP address is written on the address line. Then it is logged into the system by entering the specified username and password (Fig 14).
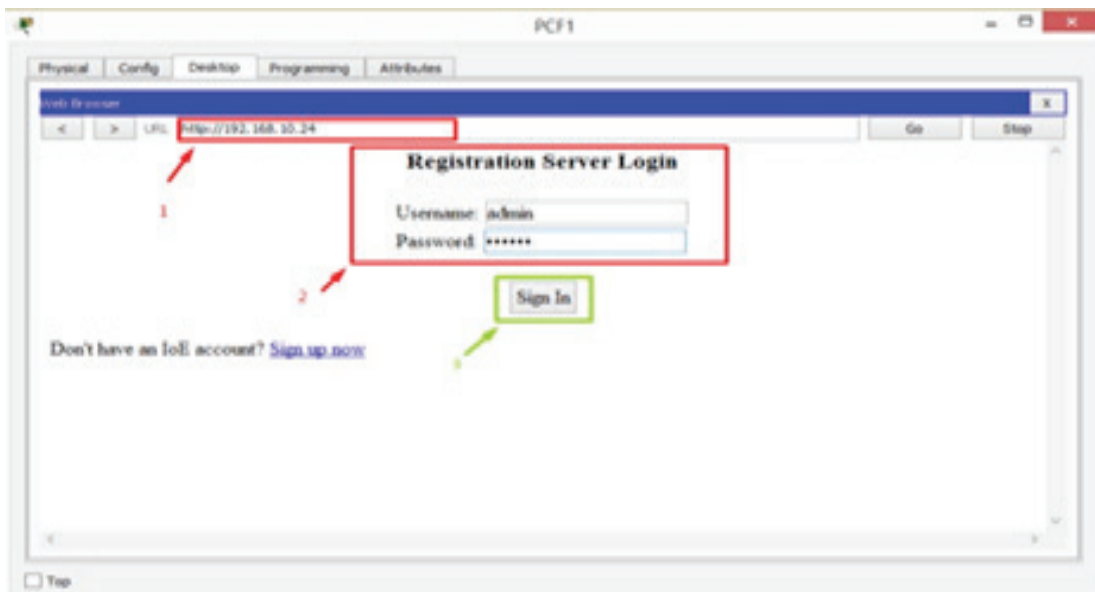

Fig. 14. CCTV step2

• Third step, after entering the system, the floor to be watched is selected.

• The fourth and last step, After selecting the floor to be seen on the screen, people who enter the floor appear to us (Fig 15).
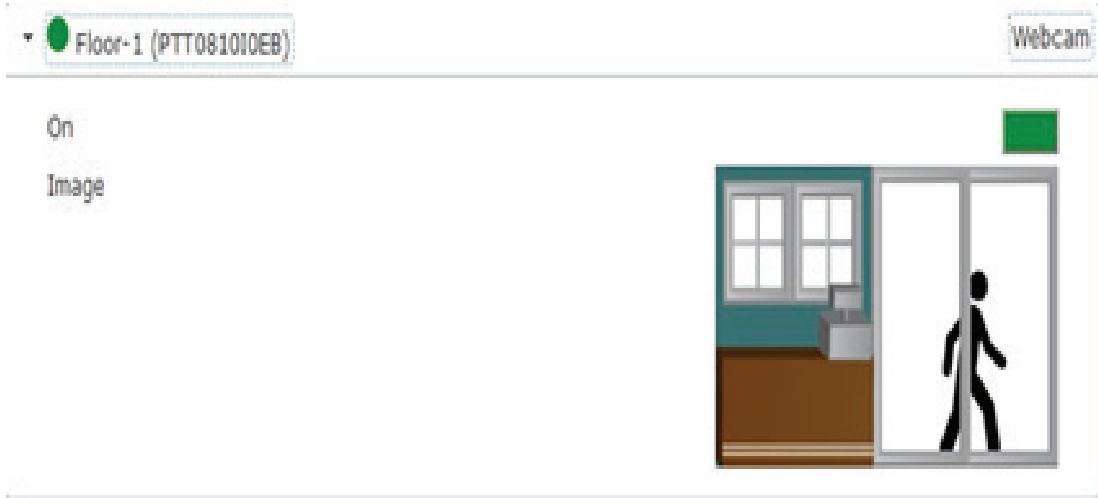
Fig. 15. CCTV step 4

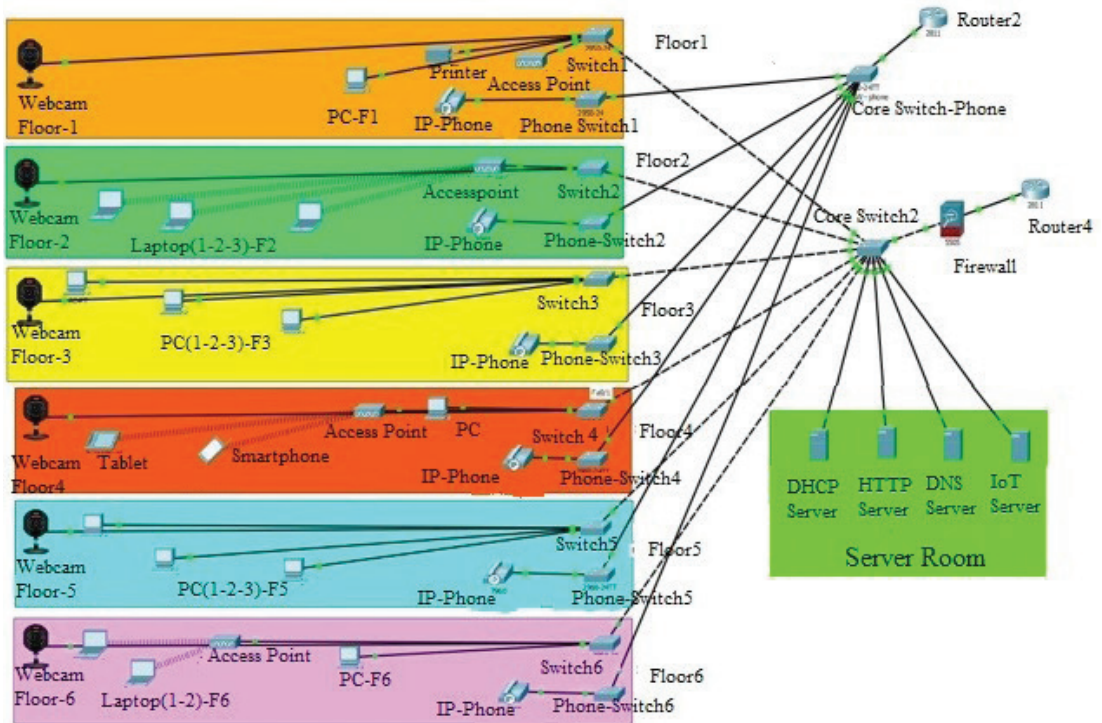## 3.2 Last image of the project

Fig. 16. Last image of the project

As a result, it was seen that the network system was operated without any problem. If there will be any problem, for example interruption of internet, the cables, DHCP, IP settings and IP's of other devices, switches and routers should be checked.

4. CONCLUSION

In this study, Cisco Packet Tracer was used not only to simulate computer networks but also to learn computer networks. First of all, a programmed system was created in which the Microsoft visual studio 2017 (Visual Basic NET) is used to evaluate many participants after training Cisco Packet Tracer to implement, design and troubleshooting for network. When the exam is over, the system qualified participant's marks and presents them on the board-screen. According to this, the participants who obtain less than 70, is regarded as haven failed in the test, on the other hand, the participants who obtain the mark of (70) is regarded as haven passed the exam excellently and is recognized and believed to able to design, execute and preserve the application of the Packet Tracer.

Also, in this study, Cisco Packet Tracer was implemented to design an advanced computer network. The map of the computer network structure was determined to design a computer network in a 6-storey hotel. In the computer network map, 9 computers, 5 laptop computers, 6 Ip phones, 14 switches, 2 routers, 4 access points, 1 security wall, 1 http server, 1 mail server, 1 IoT (Internet of Things) server, 6 cameras, 1 tablet, 1 smartphone and 1 DHCP server were used. Furthermore, in order to prove the network in the hotel was working well, five experimental scenarios which were produced by Packet Tracer, were implemented.

Everything that can be done in Cisco trainings were applied to this network simulation system. Finally, basic devices and protocols that were supposed to be in a network were used and as a result, it was seen that the network system was operated without any problem. We developed a visual basic.net program to run the system. Depending on request basic program can be updated to serve the requests. In this study, we show that anyone who wants to establish a topology, he/she will do it using the methodology that we mentioned. He/she will study by him/her self to learn how to establish a new topology by using system via internet or in the lab. By this way, he/she will establish his/her topology without wasting any equipment as logical more than one type.

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