**SMART CAMPUS SIMULATION USING DHCP**

**WITH CISCO PACKET TRACER**

**PROJECT REPORT**

***Submitted by***

Shaurya Singh Srinet (RA2111032010006)

K. Ananya (RA2111032010011)

Ninaad Arora (RA2111032010014)

Zafarul Hasan (RA2111032010016)

Akshat Singh (RA2111032010021)

Shounak Chandra (RA2111032010026)

Parth Galhotra (RA2111032010029)

Deep Gupta (RA2111032010053)

***Under the Guidance of***

Dr. Swathy R.

**Assistant Professor, Department of Networking and Communications**

***In partial satisfaction of the requirements for the degree of***

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE AND ENGINEERING

with specialization in Internet of Things



SCHOOL OF COMPUTING

COLLEGE OF ENGINEERING AND TECHNOLOGY

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY KATTANKULATHUR - 603203

**OCTOBER 2023**

|  |  |
| --- | --- |
| Logo, company name  Description automatically generated | COLLEGE OF ENGINEERING & TECHNOLOGY SRM INSTITUTE OF SCIENCE & TECHNOLOGY  S.R.M. NAGAR, KATTANKULATHUE – 603 203  Chengalpattu District |

**BONAFIDE CERTIFICATE**

Certified that this mini project report “**Smart Campus Design using DHCP Protocol**” is the bonafide work of “**Shaurya Singh Srinet (RA2111032010006), K. Ananya (RA2111032010011), Zafarul Hasan (RA2111032010016), Akshat Singh (RA2111032010021), Shounak Chandra (RA2111032010026), Parth Galhotra (RA2111032010029), Deep Gupta (RA2111032010053)**” who carried out the project work for **18CSE345T – IOT ARCHITECTURE AND PROTOCOLS** under my supervision at **SRM INSTITUTE OF SCIENCE AND TECHNOLOGY**, Kattankulathur during the academic year 2023 – 2024.

|  |  |
| --- | --- |
| **SIGNATURE**  Faculty In-Charge **Dr. Swathy R.** Assistant Professor  Department of Networking and Communications SRM Institute of Science and Technology | **SIGNATURE**  **HEAD OF THE DEPARTMENT**  **Dr. Annapurani Panaiyappan. K**  Professor and Head,  Department of Networking and Communications SRM Institute of Science and Technology |

**TABLE OF CONTENTS**

|  |  |  |
| --- | --- | --- |
| **S. NO** | **TITLE** | **PAGE NO** |
| 1 | ABSTRACT | 1 |
| 2 | INTRODUCTION | 2 |
| 3 | OBJECTIVE | 3 |
| 4 | ARCHITECTURE | 4 |
| 5 | MODULES | 5 |
| 6 | IMPLEMENTATION | 18 |
| 7 | INFERENCE | 19 |
| 8 | REFERENCES | 20 |

i

**ABSTRACT**

This report delves into the Smart Campus Simulation Project, a pioneering initiative showcasing the potential of IoT technology within a university campus environment. A key focus of the project is the Dynamic Host Configuration Protocol (DHCP), which plays a central role in streamlining network configuration and bolstering security.

By automating IP address allocation, DHCP simplifies the complex task of network provisioning, replacing manual configurations with a dynamic system that ensures seamless connectivity for various IoT devices.

The report highlights how DHCP optimizes resource allocation, contributing to resource conservation and cost reduction. By exploring DHCP's multifaceted role, this report prepares us for a future where the integration of diverse IoT devices and networks in higher education institutions becomes seamless, secure, and resource efficient.

1

**INTRODUCTION**

The Smart Campus Simulation Project represents a pioneering venture into the realm of Internet of Things (IoT) technology, specifically within the intricate landscape of a university campus. This report offers a comprehensive insight into the project's central focus on the Dynamic Host Configuration Protocol (DHCP) and its pivotal role in establishing an efficient, secure, and scalable network infrastructure within this dynamic environment.

DHCP emerges as a linchpin in the Smart Campus simulation, facilitating network configuration in a landscape brimming with diverse IoT devices. By automating the allocation of IP addresses, DHCP simplifies the intricate task of provisioning a network in a large-scale campus setting, replacing manual configurations with a dynamic system that ensures seamless connectivity for a myriad of devices, ranging from smartphones to IoT sensors.

The project's primary themes include strengthening security measures and optimizing resource allocation. DHCP plays a crucial role in these aspects, with a keen emphasis on access control management, distinguishing between authorized and unauthorized devices, and thereby bolstering the overall security infrastructure of the campus network. Moreover, DHCP demonstrates its resource efficiency by adeptly allocating IP addresses in various scenarios, including the management of intelligent sport field watering systems. This not only fosters resource conservation but also contributes to cost reduction, which is of paramount importance in the sustainability of the campus infrastructure.

In summary, this report delves into the multifaceted role of DHCP within the Smart Campus Simulation Project, offering a comprehensive exploration that prepares us for a future where the integration of diverse IoT devices and networks within higher education institutions becomes not only seamless but also secure and resource efficient. This introductory section sets the stage for a detailed examination of DHCP's contributions to shaping the future of IoT technology within the realm of higher education.

2

**OBJECTIVE**

Objectives of the DHCP Protocol in the Smart Campus Simulation Project:

• Efficient IP Allocation: Automate IP address allocation for seamless device connectivity.

• Network Scalability: Easily accommodate new IoT devices as the campus network expands.

• Enhanced Security: Implement access control to distinguish authorized from unauthorized devices.

• Resource Optimization: Optimize resource usage for sustainability and cost reduction.

• Simplified Administration: Streamline network management for operational efficiency.

• Preparation for IoT Integration: Provide insights for seamless, secure IoT integration in the future.

• Monitoring and Analysis: Collect data for network health, issue identification, and security incident response.

• Documentation and Reporting: Create comprehensive documentation for network administrators and stakeholders.

.

3

**ARCHITECTURE**

**Smart Campus Architecture:**

**Diagram

Description automatically generated**

4

**MODULES**

**Network Layout**

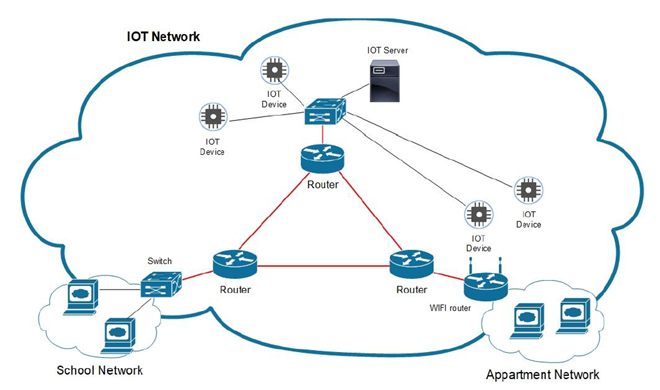
The network layout in this exercise is more complex compared to previous lab exercises. This network topology includes:

• Backbone router network

• Traditional switch-based classroom wired network

• Wireless LAN for the apartment buildings

• Dedicated IoT network based also on switch.



**Part 1: Backbone Router Network**

**Diagram

Description automatically generated**

5

1. Set the router interface IP addresses as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Router Name** | **Interface** | **IP Address** | **Subnet** |
| Campus Class | FastEthernet to Switch | 150.150.0.10 | 255.255.0.0 |
| Serial 2/0 | 162.150.0.1 | 255.255.0.0 |
| Serial 3/0 | 162.170.0.1 | 255.255.0.0 |
| Campus Apartment | FastEthernet to Wireless Router | 210.140.0.1 | 255.255.0.0 |
| Serial 2/0 | 162.190.0.2 | 255.255.0.0 |
| Serial 3/0 | 162.170.0.2 | 255.255.0.0 |
| IoT Router | FastEthernet to Switch | 10.0.0.1 | - |
| Serial 2/0 | 162.150.0.2 | 255.255.0.0 |
| Serial 3/0 | 162.190.0.1 | 255.255.0.0 |

1. Implement RIP protocol on all the three routers as shown below:

Graphical user interface, text, application

Description automatically generated

Graphical user interface, application

Description automatically generated

Graphical user interface, application

Description automatically generated

6

**Part 2: Setting up Campus Class Network**

1. Add devices as shown in the above diagram.

2. Setup a DHCP server. A DHCP Server is a network server that automatically provides and assigns IP addresses, default gateways and other network parameters to client devices. Therefore, one a DHCP server is configured, there is no need to add IP Addresses to the remaining client devices.

Graphical user interface, application

Description automatically generated

Graphical user interface, application, email

Description automatically generated

7

Graphical user interface, application, email

Description automatically generated

3. For all the devices, turn on the connected port and refresh the DHCP option. The port is allocated an IP address by the server.

10

Graphical user interface, application

Description automatically generated

8

4. For all the devices, refresh the DHCP option in the settings. The Gateway and DNS IP Address configured in the DHCP server will appear.

Graphical user interface, application

Description automatically generated

**Part 3: Setting up Campus Apartment Network**

Diagram

Description automatically generated with low confidence

1. Setup the wireless router WRT300N as shown below. We setup a wireless network through which various devices can connect.

Graphical user interface, text, application, email

Description automatically generated

9

Graphical user interface, text, application, email

Description automatically generated

**Part 4: Setting up IoT Network**

Setup the wireless router WRT300N as shown below. We setup a wireless network through which various devices can connect.

Diagram

Description automatically generated

However, you will find that the switch does not have enough FastEthernet port to connect all devices. Therefore, we add the ports to the switch as follows:

1. Shut down the switch. Drag the PT-SWITCH-NM-1CFE to the empty slots on the right side of diagram.

A picture containing table

Description automatically generated

12

10

1. Make sure the IoT devices have FastEthernet ports. If not use the Advanced button on every IoT device. That will provide an I/O Config option, where you can change the port connectivity type.

Graphical user interface, application

Description automatically generated

1. After adding all the devices and auto cabling them, we start with configuring the devices.
2. First, we configure the IoT Server. Add IP Address to the IoT Server as shown below.

Graphical user interface, application, email

Description automatically generated

1. In Global Settings, configure the Name, Gateway IP and the DNS IP.

Graphical user interface, text, application

Description automatically generated

11

1. Add IoT Registration services as performed in previous labs.

Graphical user interface, application

Description automatically generated

1. Add DNS services on the IoT Server.

Graphical user interface

Description automatically generated

1. Add DHCP service on the IoT Server so it can assign IP addresses to IoT devices.

Graphical user interface

Description automatically generated

12

1. Add DHCP service on the IoT Server so it can assign IP addresses to IoT devices.

Graphical user interface, text, application, email

Description automatically generated

Graphical user interface, text, application, email

Description automatically generated

13

1. When all the devices are properly connected, the devices will show up in the IoT Registration Service. The Registration service can be accessible using the Web Browser and IP address 10.0.0.10

Graphical user interface, text, application, email

Description automatically generated

**Part 5: Adding IoT Device Conditions**

There are 2 ways to add IoT Conditions.

• Add a micro-controller, connect the devices, and program the conditions

• Add the conditions in the IoT Registration Server.

We will use the second approach as we do not need to change the topology.

Graphical user interface, application

Description automatically generated

1. Add conditions for Lawn Sprinkler ON and OFF.

Graphical user interface, text, application

Description automatically generated

14

Graphical user interface, text

Description automatically generated

1. We now add RFID cards for the Apartment Doors

A picture containing graphical user interface

Description automatically generated

1. Configure the above RFID cards as follows:

Graphical user interface, text, application, email

Description automatically generated

1. Select the Programming option and double click on RFID Card (Python)

Graphical user interface, application

Description automatically generated

15

1. Double click on the main.py. And change the value of Card\_ID to 01. Click Run. Similarly add 02 and 03 to RFID Card 2 and 3 respectively.

Graphical user interface, application

Description automatically generated

1. We now configure the RFID Reader. Add the following conditions in the Condition section in the IoT Registration Service website. Perform the following for all the RFID readers:

* We first set all the RFID into a waiting mode and set room doors to lock status.

Graphical user interface, text

Description automatically generated

* We set the unlocking conditions for the door.

Graphical user interface, text

Description automatically generated

16

* We set the locking conditions for the door.

Graphical user interface, text

Description automatically generated

* The door will unlock with proper RFID Card

Diagram

Description automatically generatedDiagram

Description automatically generated

17

# IMPLEMENTATION

Graphical user interface, diagram

Description automatically generated

18

# INFERENCE

The DHCP Protocol plays a pivotal role in the Smart Campus Simulation Project, addressing a range of critical objectives. By efficiently automating IP address allocation, it ensures that the diverse array of devices on the campus network can connect seamlessly, simplifying network administration and reducing the potential for errors. This scalability promotes future growth, allowing for the integration of more IoT devices as needed without complex reconfiguration.

The project's emphasis on enhancing security through access control strengthens the campus's overall security infrastructure, safeguarding sensitive data and resources. Simultaneously, resource optimization, particularly in applications like intelligent sport field watering, contributes to sustainability by conserving resources and reducing operational costs.

Moreover, DHCP implementation facilitates a forward-looking approach, preparing the campus for the future of IoT integration, where diverse devices and networks will be seamlessly integrated within higher education institutions. Monitoring and analysis tools ensure network health and security incident response, while comprehensive documentation and reporting serve as valuable resources for network administrators and stakeholders.

In conclusion, the implementation of DHCP within the Smart Campus Simulation Project is a multifaceted strategy that aims to create a dynamic, secure, and efficient IoT environment within the university campus. These objectives collectively contribute to the project's success and its readiness for the evolving landscape of higher education and IoT technology.

19

# REFERENCES

[1] J. Chen and H. Wu, "Smart Campus: From Vision to Reality," Journal of Software Engineering and Applications, vol. 12, no. 6, pp. 250-263, 2019. doi: 10.4236/jsea.2019.126018.

[2] J. Fan, S. Wang, and G. Chen, "An IoT-based Campus Security System," in 2018 17th IEEE International Conference on Communication Technology (ICCT), pp. 1303-1307, 2018. doi: 10.1109/ICCT.2018.8539584.

[3] A. Khan and N. Nizamuddin, "IoT-based Intelligent System for Water Management of Agriculture Fields," International Journal of Emerging Technologies in Learning (iJET), vol. 14, no. 14, pp. 105-116, 2019. doi: 10.3991/ijet.v14i14.10753.

[4] Y. Lu and X. Liu, "Research on IoT technology application in university campus environment," in Proceedings of the International Conference on Education, Management and Systems Engineering (EMSE 2017), pp. 290-297, Atlantis Press, 2017. doi: 10.2991/emse-17.2017.55.

[5] S. Wang, J. Jiang, and Y. Wang, "IoT-based Intelligent Campus Energy Management System," in 2018 International Conference on Cyber-Enabled Distributed Computing and Knowledge Discovery (CyberC), pp. 190-194, IEEE, 2018. doi: 10.1109/CyberC.2018.00041.

20