

1. INTRODUCTION

This project involves the design and simulation of a smart loft home network using Cisco Packet Tracer. The purpose of the project is to model a modern smart home environment that integrates multiple IoT devices with a centralized network infrastructure. Devices such as smart lights, sensors, and security components are connected through a wireless access point and managed using an IoT controller.

The project demonstrates important networking concepts including IP addressing, wireless networking, routing, and basic automation. By simulating a smart loft apartment, the design reflects a realistic home environment where comfort, security, and automation can be managed through a networked system.

Figure 1: Smart Loft Network Topology

2. PROJECT OBJECTIVES

The objectives of this project are as follows:

- To design and simulate a functional smart home network
- To implement static IP addressing and subnetting
- To connect IoT devices wirelessly using an access point
- To test network connectivity using ICMP (ping)
- To simulate basic automation using an IoT controller
- To document the network design and performance

These objectives ensure that both networking and IoT concepts are demonstrated within the same system.

Figure 2: Deployed IoT Devices

3. NETWORK DESIGN OVERVIEW

The smart loft home is divided into three logical areas:

- A bedroom zone containing lighting, motion detection, and a smart door lock
- A living area containing lighting, a thermostat, a temperature sensor, and a smart television
- A control zone containing the networking equipment

All IoT devices connect wirelessly to the access point, which forwards traffic to the switch and router. The router functions as the default gateway and enables communication between all devices within the network. This design simplifies management while maintaining reliable connectivity.

Figure 3: Core Network Infrastructure

4. DEVICE INVENTORY

Device	Function
Router	Default gateway and routing
Switch	Central wired connection point
Wireless Access Point	Provides Wi-Fi for IoT devices
IoT Controller	Automation and device management
Admin PC	Configuration and testing
Smart Lights	Lighting control
Smart Lock	Door security
Motion Sensor	Movement detection
Thermostat	Climate control
Temperature Sensor	Environmental monitoring
Smart TV	Entertainment device

5. IP ADDRESSING & SUBNETTING

5.1 Subnet Design

Network Address: 192.168.10.0 /24

Subnet Mask: 255.255.255.0

Usable Hosts: 254

This subnet was selected because it provides more than enough addresses for a small smart home while allowing for future expansion without redesigning the network.

5.2 IP Allocation Table

Device	IP Address
Router	192.168.10.1
Access Point	192.168.10.2
Admin PC	192.168.10.5
IoT Controller	192.168.10.6
Bedroom Light	192.168.10.11
Bedroom Lock	192.168.10.12
Bedroom Motion Sensor	192.168.10.13
Living Light 1	192.168.10.14
Living Light 2	192.168.10.15
Thermostat	192.168.10.16
Temperature Sensor	192.168.10.17
Living TV	192.168.10.18

Static IP addressing was used to ensure predictable communication between devices and to simplify troubleshooting.

Figure 4: Router IP Configuration

6. WIRELESS CONFIGURATION

The wireless network operates on the 2.4 GHz band using an access point named LoftWiFi. All IoT devices connect to this SSID in order to communicate with the router and IoT controller.

Wireless security was disabled during initial setup to prevent connection issues and allow easier testing. In a real-world environment, WPA2 or WPA3 security would be enabled to protect the network.

Figure 5: Wireless Network Configuration

7. CONNECTIVITY TESTING

Network connectivity was tested using ICMP echo requests (ping) from the Admin PC. The router, IoT controller, and selected IoT devices were tested.

Successful replies confirmed that IP addresses were correctly assigned, the router was functioning as the default gateway, and wireless communication was working as expected.

Figure 6: Connectivity Test Results

8. AUTOMATION

Basic automation rules were created using the IoT controller. These rules allow devices to react automatically to sensor input. For example:

- Lights turn on when motion is detected
- The thermostat responds to changes in temperature

This reduces the need for manual control and improves user convenience.

Figure 7: Automation Configuration

9. BUDGET ESTIMATION

Item	Qty	Unit Cost (\$)	Total (\$)
Router	1	150	150
Switch	1	80	80
Wireless AP	1	70	70
IoT Controller	1	200	200
Smart Lights	3	30	90
Smart Lock	1	120	120
Motion Sensor	1	40	40
Thermostat	1	100	100
Temperature Sensor	1	35	35
Smart TV	1	300	300

Estimated Total Cost: \$1,185

10. SECURITY CONSIDERATIONS

Several security measures can be applied to improve the network:

- Enabling WPA2 or WPA3 wireless encryption
- Applying passwords to the IoT controller and router
- Implementing VLAN segmentation
- Using firewall rules to limit access

These measures help prevent unauthorized access and protect device communication.

11. CONCLUSION

This project successfully demonstrates the design and implementation of a smart home IoT network using Cisco Packet Tracer. The system integrates wireless networking, static IP addressing, and basic automation into a functional model. The design is scalable and can be expanded with additional devices or enhanced security features in future implementations.