CSE-310

Computer Network Sessional

Project Title: *MIST Campus - A Smart Campus Cisco Project*

GROUP-04

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1. Introduction

In Bangladesh, the integration of smart technologies into educational institutions is becoming increasingly essential to enhance learning environments and administrative efficiency. Traditional campuses often face challenges such as inefficient resource management, limited inter-departmental communication, and inadequate security measures. The Military Institute of Science and Technology (MIST) recognizes these challenges and is committed to transforming its campus into a smart campus. This initiative aims to implement advanced technologies, including IoT devices and automated systems, to improve operational efficiency, security, and the overall educational experience. Our project, 'MIST Campus', is designed to highlight and enhance the existing smart solutions at MIST while introducing new features such as RFID-based access control. This project demonstrates how a structured, technology-driven approach can make campus operations more secure, efficient, and scalable.

2. Literature Review

Most universities in Bangladesh, including **public and private institutions**, still rely on **manual or semi-automated systems** for lab and campus management. Some of the **major challenges include**:

- **Lack of Secure Network Segmentation**:
    - Most universities **lack VLAN-based isolation**, meaning students, faculty, and administrative users share the same network.
    - This can lead to **data security risks** and **network congestion**, especially in research-intensive environments.
- **Unrestricted Internet & Research Access**:
    - In many institutions, students can **access sensitive research materials**, leading to **data integrity concerns**.
    - There is no **differentiated network access control** to regulate research servers.
- **Inefficient Resource Allocation**:

    - Lab and classroom resources (computers, network bandwidth) are often **not monitored or optimized**, leading to **unnecessary energy consumption**.

- **Limited Smart Automation**:
    - Most universities **do not have IoT-driven classroom automation**.
    - Smart **HVAC, lighting control, or biometric security** is largely absent.

Lessons Learned & Improvements in Our Smart Campus Project

By analyzing these **existing challenges**, we structured our Smart Campus project to provide **clear improvements**:

- **Network Segmentation with VLANs** – Separate student, faculty, and admin access for **security & efficient data management**.
- **Role-Based Access Control (RBAC)** – Restrict **email server access** to authorized personnel only.
- **Automated Classroom & Resource Optimization** – Implement **IoT-based device monitoring** for **better energy efficiency & security**.
- **Smart Infrastructure Integration** – Use **IoT-driven risk management, smart boards, and automated security** to enhance learning experiences.

3. Objectives

The primary objectives of this project are:

- **Establish Separate IP Networks for Departments/Faculties:** Implement 21 VLANs in the Main Campus Network and 2 VLANs in the Osmany Hall Network to ensure isolated IP networks for each department, enhancing security and reducing unnecessary broadcast traffic.
- **Configure VLANs and Security Measures:** Set up VLANs on switches to segment the network without additional physical hardware, and implement security settings to control traffic flow and limit unauthorized access.

- **Implement Efficient Routing Protocols:** Utilize RIPv2 for dynamic routing between internal routers and static routing to connect the Main Campus Router to the Email Server Cloud, ensuring accurate traffic forwarding.
- **Enable Dynamic IP Allocation:** Use router-based DHCP servers to automatically assign IP addresses to devices in Building A, reducing manual configuration and ensuring efficient IP management.
- **Integrate IoT Devices for Enhanced Functionality:** Incorporate RFID card readers for automated door access, fire systems including sprinklers, piezo speakers for announcements, and fire monitors to enhance safety and operational efficiency.
- **Deploy Centralized Communication Services:** Implement Web Server, Email Server, and DNS Server, allow PCs from any VLAN to access the campus website using domain names and enable fully functional email communication within the network.

4. Methodology

The project follows a structured approach:

1. **Network Design & Segmentation:**
    - Used Cisco Packet Tracer for simulation.
    - Configured VLANs, routers, and DHCP for structured networking.
2. **Implementation of Web, Email & DNS Servers:**
    - Deployed DNS Server to resolve domain names for web access.
    - Configured Web Server to host the university's official website.
    - Set up an Email Server for internal communication.
3. **IoT Device Integration:**
    - Configured RFID-based access doors.
    - Automated fire system with connected sprinklers.

- Set up Piezo speaker announcements linked to admin alerts.

4. **Security & Routing:**
    - Used RIPv2 for inter-VLAN communication.
    - Implemented Access Control Lists (ACLs) to prevent unauthorized access.
    - Configured Static Routes to connect internal and external services.
5. **Testing & Validation:**
    - Used ping and traceroute to verify network connectivity.
    - Simulated email exchange & web browsing for functionality testing.

5. Project Implementation

The project encompasses several key features:

- **VLAN Implementation:** Configured 21 VLANs in the Main Campus Network and 2 VLANs in the Osmany Hall Network to create isolated networks for each department, enhancing security and reducing broadcast traffic.
- **Routing Configuration:** Implemented RIPv2 for dynamic routing between internal routers and static routing to connect the Main Campus Router to the Email Server Cloud, ensuring efficient traffic management.
- **Dynamic IP Allocation:** Set up router-based DHCP servers to automatically assign IP addresses to devices in Building A, streamlining network management.
- **IoT Device Integration:** Incorporated RFID card readers for automated door access, fire systems with sprinklers, piezo speakers for announcements, and fire monitors to enhance safety and operational efficiency.
- **Web, Email, and DNS Services:** Hosted the campus website accessible via pre-configured domain names, fully functional email sending & receiving system, and enabled domain resolution for campus-wide accessibility.

6. Results

The implementation yielded the following outcomes:

- **Enhanced Network Security:** The use of VLANs provided isolated networks for each department, reducing the risk of unauthorized access.
- **Improved Network Efficiency:** Dynamic routing protocols and DHCP servers ensured efficient traffic management and IP address allocation.
- **Increased Operational Efficiency:** Integration of IoT devices automated various processes, enhancing safety and functionality across the campus.
- **Email & DNS Services:** Any PC in the network can access the campus website and send/receive emails.

7. Conclusion & Future Work

The 'MIST Campus' project successfully integrates network security, automation, and centralized communication services. The combination of VLANs, IoT, and web-based services enhances connectivity and efficiency, setting a benchmark for future smart campuses in Bangladesh.

Future Improvements:

- Expansion of **cloud-based learning management systems (LMS)**.
- Advanced **AI-based network security monitoring**.
- Further **IoT automation** in campus utilities.
- Setting up its **web and app application**.

8. References

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