Smart City Using Cisco Packet Tracer

Submitted by : Srijita Bandyopadhyay
Reg no : 22BEE0188
Institute: Vellore Institute of Technology (Vellore Campus)
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AIM:

To design and simulate a Smart City model in Cisco Packet Tracer incorporating intelligent street lighting, smart surveillance, and emergency response systems. The system integrates IoT-based sensors and automation using Python scripts to trigger actions based on real-time conditions.

PROBLEM STATEMENT:

Traditional urban infrastructures lack intelligent automation and real-time responsiveness to environmental and safety conditions. Manual operations for street lighting, surveillance, and emergency alerts result in delays, inefficiencies, and increased risks.

The problem is to design and simulate a smart urban environment that integrates sensor-based IoT solutions for intelligent lighting, automated surveillance, and emergency response systems. The simulation must be developed using Cisco Packet Tracer, incorporating secure wireless communication, automation scripts, and sensor-actuator interaction to create a functional and scalable Smart City prototype.

SCOPE OF THE SOLUTION:

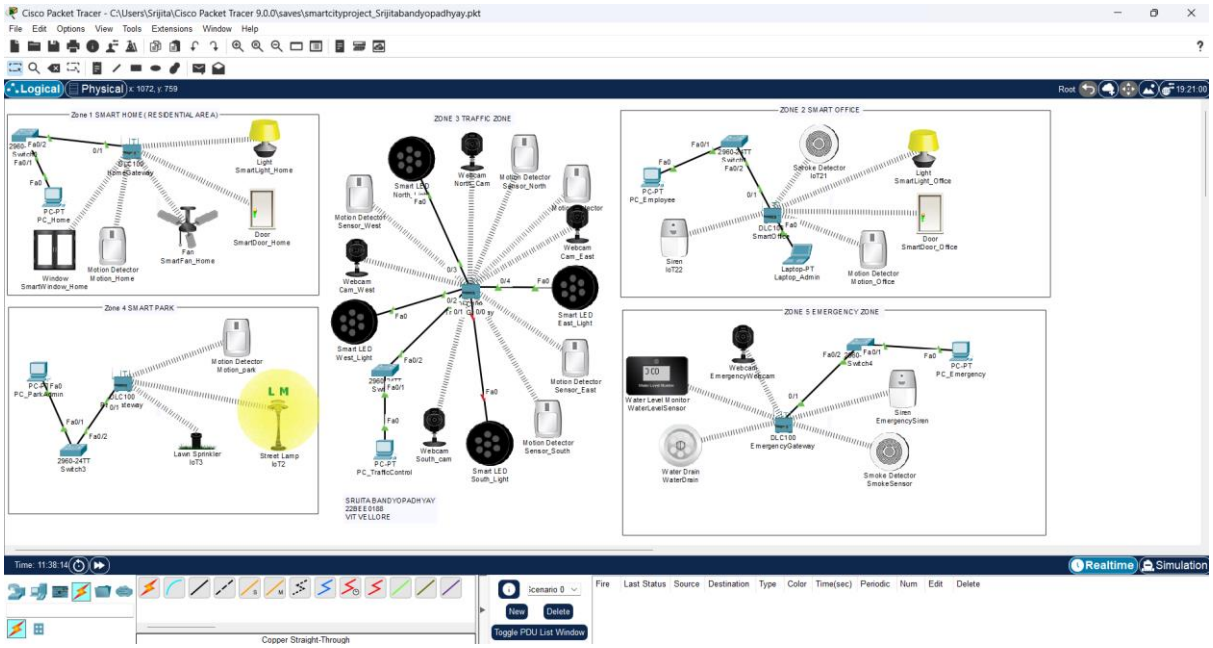
The proposed smart city simulation is structured into five logically distinct zones: Smart Home, Smart Office, Smart Traffic, Smart Park, and Emergency Zone. Each zone is equipped with IoT-enabled sensors and actuators to perform automated actions through wireless communication and is logically controlled using Python-based automation in Cisco Packet Tracer 9.0.

The simulation focuses on the following scope:

- **Zone 1 – Smart Home**: Automates lighting, fan, window, and smart door using motion sensors. Ensures comfort and energy efficiency in a residential setup. In the **Smart Home zone**, devices such as smart light, smart fan, smart window, and door are controlled using motion detection, aiming to enhance residential comfort and reduce unnecessary energy usage. Wireless communication is handled by a home gateway, and all devices are assigned static IP addresses.
- **Zone 2 – Smart Office**: Implements workplace automation through smart lighting, door control, and smoke detection using PC and laptop devices connected to a central office gateway. The **Smart Office zone** simulates automation in a workplace environment. A PC and laptop act as employee and admin systems respectively, while smart light and door are activated via motion sensors. Smoke detection is also implemented to trigger emergency responses in case of fire hazards. This improves safety and operational efficiency within the workspace.
- **Zone 3 – Smart Traffic**: Uses motion and IR sensors with smart LED street lights and surveillance webcams to simulate intelligent traffic monitoring and lighting. focuses on intelligent street lighting and surveillance. Motion detectors are placed in all directions, each linked to smart LED streetlights and IP webcams. The system enables lights to switch on only when movement is detected and simulates a surveillance network through camera triggering, enhancing both safety and energy efficiency.
- **Zone 4 – Smart Park**: Controls lawn sprinklers and street lamps through motion sensors and a gateway to simulate smart outdoor environment management.
- **Zone 5 – Emergency Zone**: Integrates smoke and water level detectors to trigger a siren, emergency camera, and a water drain system for flood/fire management. A smoke detector and a water level monitor are connected to a siren, emergency webcam, and water drain system. These are activated automatically via Python scripts upon detecting threats such as fire or potential flooding, making it a vital safety feature of the city model.

The entire setup uses wireless gateways for each zone, centralized switching, IP configuration, and scripted sensor-based automation using Python. This simulation demonstrates real-time urban automation aligned with Industrial IoT practices.

OVERVIEW / ARCHITECTURE OF THE SOLUTION:



The smart city solution is divided into five zones, each representing a different aspect of urban infrastructure. Every zone uses a local Home Gateway device to manage wireless IoT components such as sensors and actuators. These gateways are connected to network switches and PCs for administrative control. Python scripts are used to automate system responses to sensor inputs in real time.

The zones are structured as follows:

- **Zone 1 – Smart Home**: Includes a motion detector to trigger a fan, smart light, door, and window for home comfort automation.
- **Zone 2 – Smart Office**: Incorporates office automation including motion and smoke detection, smart light and door, managed by a PC and laptop.
- **Zone 3 – Smart Traffic**: Features multiple smart street lights, motion detectors, and webcams for automated lighting and surveillance.
- **Zone 4 – Smart Park**: Uses motion sensors to control lawn sprinklers and street lighting, simulating sustainable public park management.
- **Zone 5 – Emergency Zone**: Monitors fire and flood conditions via smoke and water level sensors. Responds by activating a siren, webcam, and water drain.

All zones use **wireless connectivity via WPA2-secured SSIDs**, with each device assigned a static IP. Scripts were written in Python to handle automation logic such as turning on lights or alarms based on sensor inputs.

REQUIRED COMPONENTS TO DEVELOP SOLUTIONS:

Zone	Devices Used
Zone 1 – Smart Home	Home Gateway, PC, Motion Detector, Smart Fan, Smart Light, Smart Window, Smart Door
Zone 2 – Smart Office	Home Gateway, PC, Laptop, Motion Detector, Smoke Detector, Smart Light, Smart Door
Zone 3 – Smart Traffic	Home Gateway, PC, 4 Motion Detectors (N/S/E/W), 4 Smart Street Lights, 4 IP Webcams
Zone 4 – Smart Park	Home Gateway, PC, Motion Detector, Smart Street Lamp, Lawn Sprinkler
Zone 5 – Emergency System	Home Gateway, PC, Smoke Detector, Water Level Monitor, Siren, IP Webcam, Water Drain

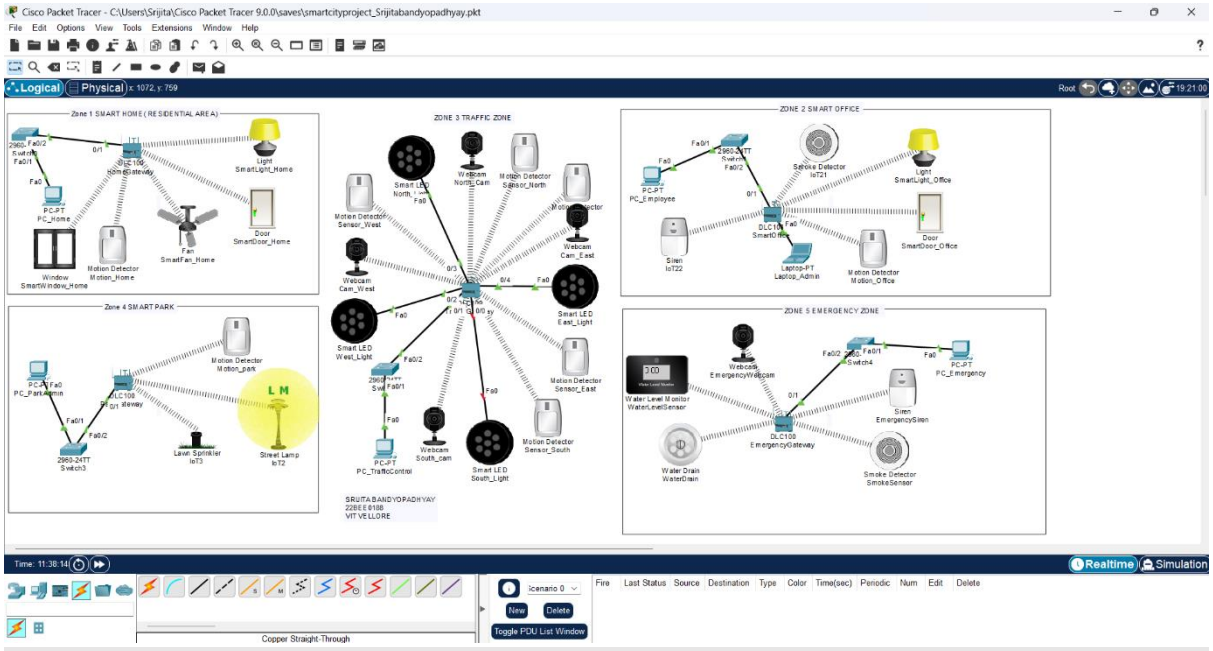
Additional Components Used:

Type	Component
Networking	Cisco 2960 Switches, Copper Straight-Through Cables
Connectivity	WPA2-secured Wireless SSIDs via Home Gateway
Automation	Python scripting in Programming tab (due to Blockly absence)
Software	Cisco Packet Tracer 9.0
Simulation	Packet Tracer Simulation Mode, JavaScript Logs (for output simulation only)

SIMULATED CIRCUIT (SCREENSHOT):

The following diagram shows the complete layout of the smart city divided into five zones. Each zone is equipped with its respective IoT devices, home gateway, switch, and administrative PC. Devices are wirelessly connected via WPA2-secured networks, and all automation was programmed using Python. Zone-wise automation logic is demonstrated through simulation.

Screenshot of the simulated circuit:



EXECUTION VIDEO OF THE DEMO:

A video demonstration of the smart city simulation has been recorded to showcase automation across all five zones. Each zone is tested individually using sensor triggers such as motion, smoke, sound, and water level. The system's response is displayed in real-time through device actions like lights, fans, alarms, and smart drain activation. The simulation mode was also used to visually represent data exchange between components.

Video Link:

https://github.com/Srijita-17/SmartCity_CiscoPT/blob/main/SmartCity_ProjectDemoVideo.mp4

https://github.com/Srijita-17/SmartCity_CiscoPT/blob/main/SimulatedCircuit_SmartCity_Srijita.png

https://github.com/Srijita-17/SmartCity_CiscoPT/blob/main/smartcityproject_Srijitabandyopadhyay.pkt