



**Network Solution for
LABYRINTH MALL
Diploma in Network Engineering
Final Project Proposal**

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Introduction

Welcome to Labyrinth Mall, the epitome of shopping and entertainment in the heart of our vibrant city. Designed as a unique blend of elegance, convenience, and diversity, Labyrinth Mall offers an unparalleled shopping experience that caters to every taste and need.

Spread over four expansive floors, including a well-appointed basement, the mall features a wide array of over 70 shops. From high-end fashion boutiques to essential service stores, every visit promises something new and exciting. Our thoughtfully curated retail mix ensures that whether you're updating your wardrobe, searching for the perfect gift, or simply indulging in some retail therapy, your expectations will not just be met, but exceeded.

Anticipating over 10,000 visitors daily, Labyrinth Mall is not just a shopping center, but a bustling hub of activity. It's a place where friends meet, family bond, and memories are made. The mall's vibrant atmosphere is complemented by a range of dining and entertainment options, making it the perfect destination for a day out.

At Labyrinth Mall, we believe in creating experiences that last a lifetime. Join us for a journey through the corridors of fashion, fun, and flavors. Your ultimate shopping adventure awaits!

Proposed Solution

In addressing the specific needs of Labyrinth Mall, we propose a comprehensive network infrastructure solution that significantly enhances connectivity, security, and operational efficiency throughout the mall. This solution includes the installation of advanced access points, switches, and servers to ensure robust and reliable Wi-Fi coverage across the entire mall, accommodating the high footfall and diverse needs of retailers and visitors alike.

Key to our network design is the implementation of VLANs, which will segregate network traffic to improve performance and security for users and services. This segmentation strategy is crucial for managing the complex network demands of a mall.

Along with scalability and flexibility, our plan also integrates heightened security measures, such as a comprehensive CCTV system, to ensure the safety and security of all within the mall. Additionally, the deployment of IP phones will enhance internal communication. By implementing this state-of-the-art network infrastructure, complete with VLANs, Labyrinth Mall will elevate its day-to-day operations, providing a secure, efficiently segmented, and connected shopping experience.

Technologies and Protocols used.

- **HSRP (Hot Standby Router Protocol):** HSRP enhances network reliability in our mall by automatically redirecting traffic to a standby router if the primary router fails, preventing downtime and ensures continuous operations.
- **VTP (VLAN Trunking Protocol):** VTP makes it easy to organize our mall networks by letting you change VLAN settings in one place, and those changes automatically apply to all switches.
- **DHCP (Dynamic Host Configuration Protocol):** DHCP automates the process of giving devices IP addresses and network settings. In malls, it's handy for handling network setups for stores, security cameras, Wi-Fi, and guest devices, making it simpler to manage everything.
- **NAT (Network Address Translation):** NAT lets many devices in a mall use one public IP for internet, saving public IPs. It keeps the internal network private and secure while enabling internet access for all devices.
- **ACL (Access Control List):** ACLs enhance security by regulating network traffic. They decide what's allowed or blocked based on criteria like IP addresses and ports. This protects the mall from unauthorized access or attacks.

- **SSH (Secure Shell):** SSH makes safe connections in insecure networks, like secure remote management for mall devices. It encrypts data, keeping it safe from prying eyes.
- **STP (Spanning Tree Protocol):** STP stops network loops in our malls which consist of many switches. It keeps the network stable, preventing issues like broadcast storms and ensuring smooth operation.
- **EIGRP (Enhanced Interior Gateway Routing Protocol):** Using EIGRP is a smart way to decide how data moves within a mall's network. It's fast, can handle different types of traffic, and ensures efficient communication between different parts of the mall, like stores, departments, and customer areas.
- **PORT SECURITY:** Port security in our malls restricts network access to approved devices using MAC addresses. This keeps out unauthorized devices that might cause security issues or strain network resources. It ensures only allowed equipment like payment terminals can connect.
- **ETHERCHANNEL:** EtherChannel combines multiple Ethernet links into one, boosting speed and reliability. In malls, it's used to increase network capacity between key points like distribution frames, making the network stronger and faster.

Aims

Our network plan for the new mall is designed for a seamless digital experience. From widespread availability and optimized performance to efficient management, cost-effectiveness, and prioritized user experience and disaster recovery

Objectives

Network Availability and Scalability: The network at Labyrinth Mall ensures constant availability through strategic placement of access points and redundant systems, while its scalable design with modular components and cloud integration efficiently supports mall growth and increasing user demand.

Exemplary Performance: High network performance is guaranteed through advanced design, including load balancing, efficient routing protocols, and Quality of Service (QoS) configurations.

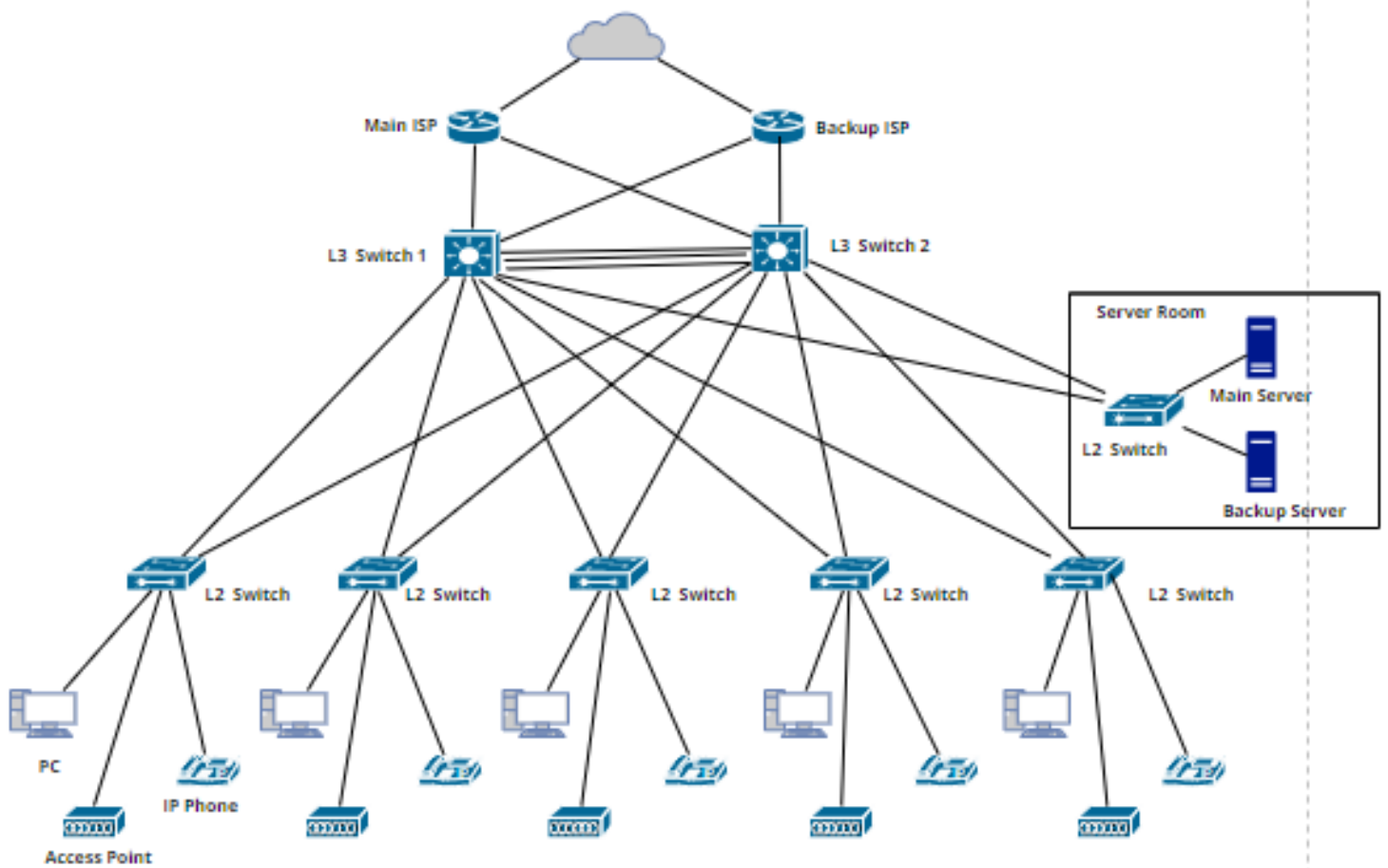
Post-Implementation Management: The network will be centrally managed with continuous monitoring and updates for smooth operation.

Cost-Effectiveness: It's designed for economy, using scalable, energy-efficient components to optimize value and minimize costs.

User/Customer Experience: User experience is a priority, with easy-to-access wireless networks and continuous improvements based on customer feedback.

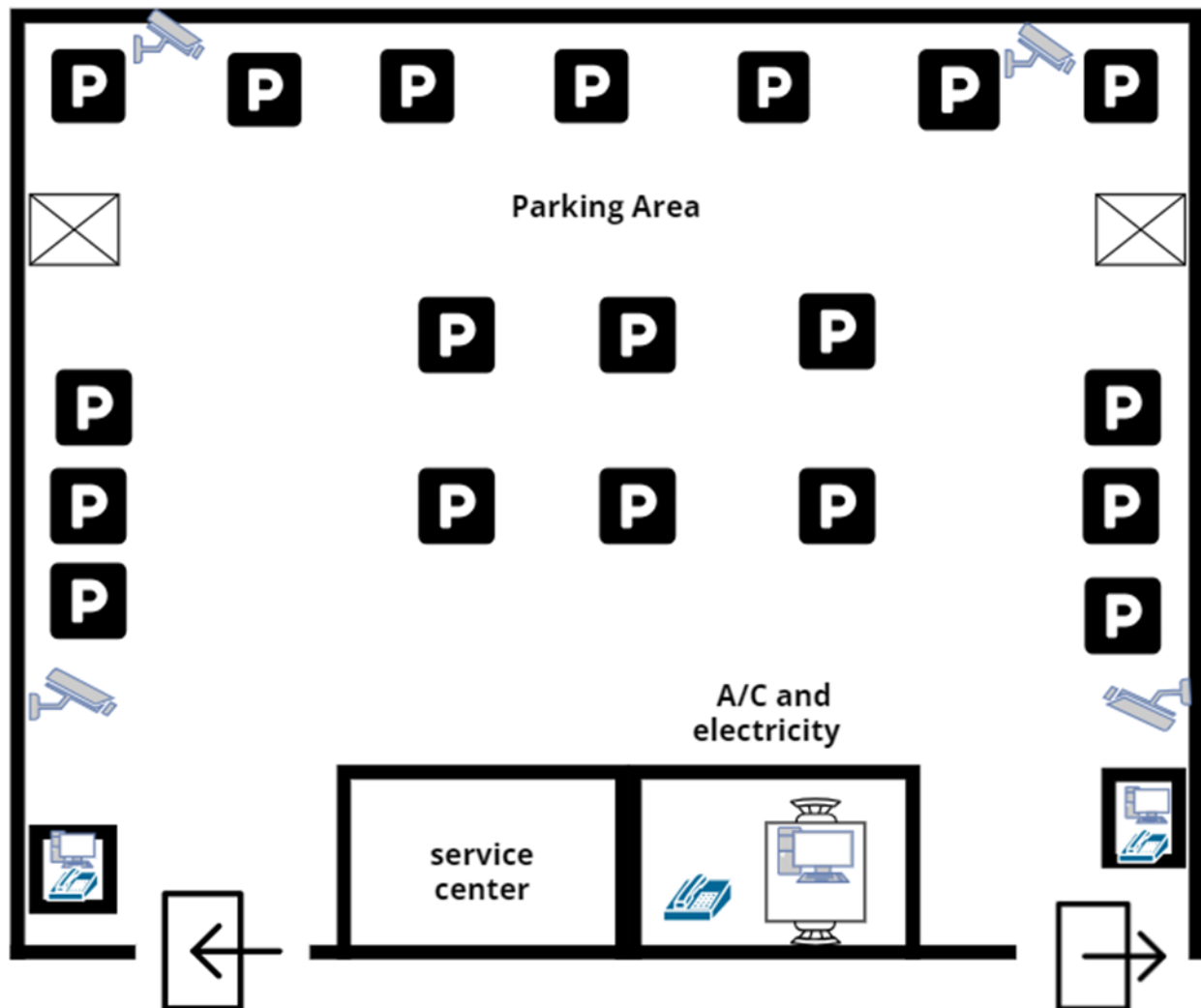
Disaster Recovery: The network features disaster recovery plans with redundancy and regular backups to maintain operations and minimize disruptions during unexpected incidents.

Network Diagram

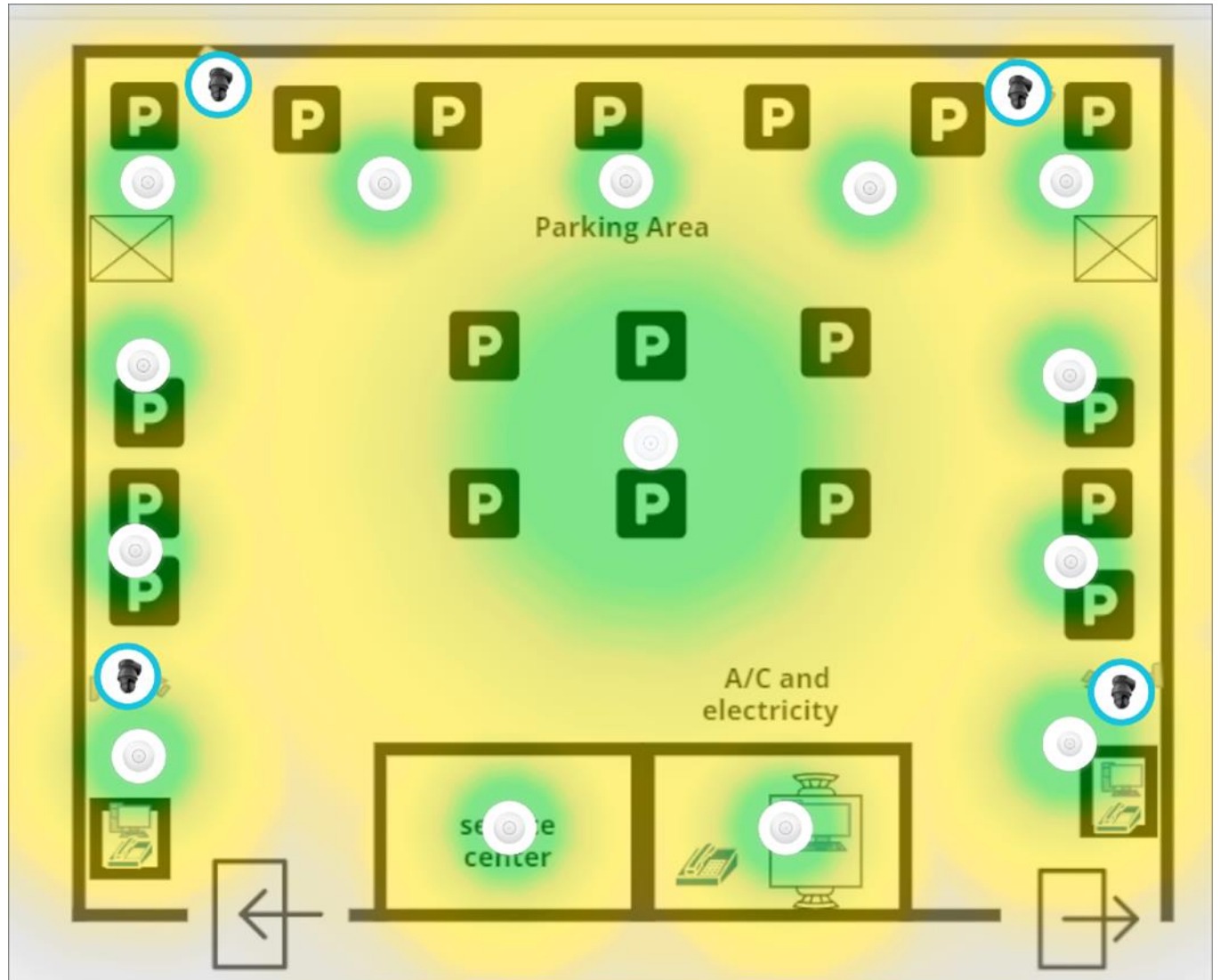


FLOOR PLANS AND HEAT MAPS

1. Basement Floor-plan



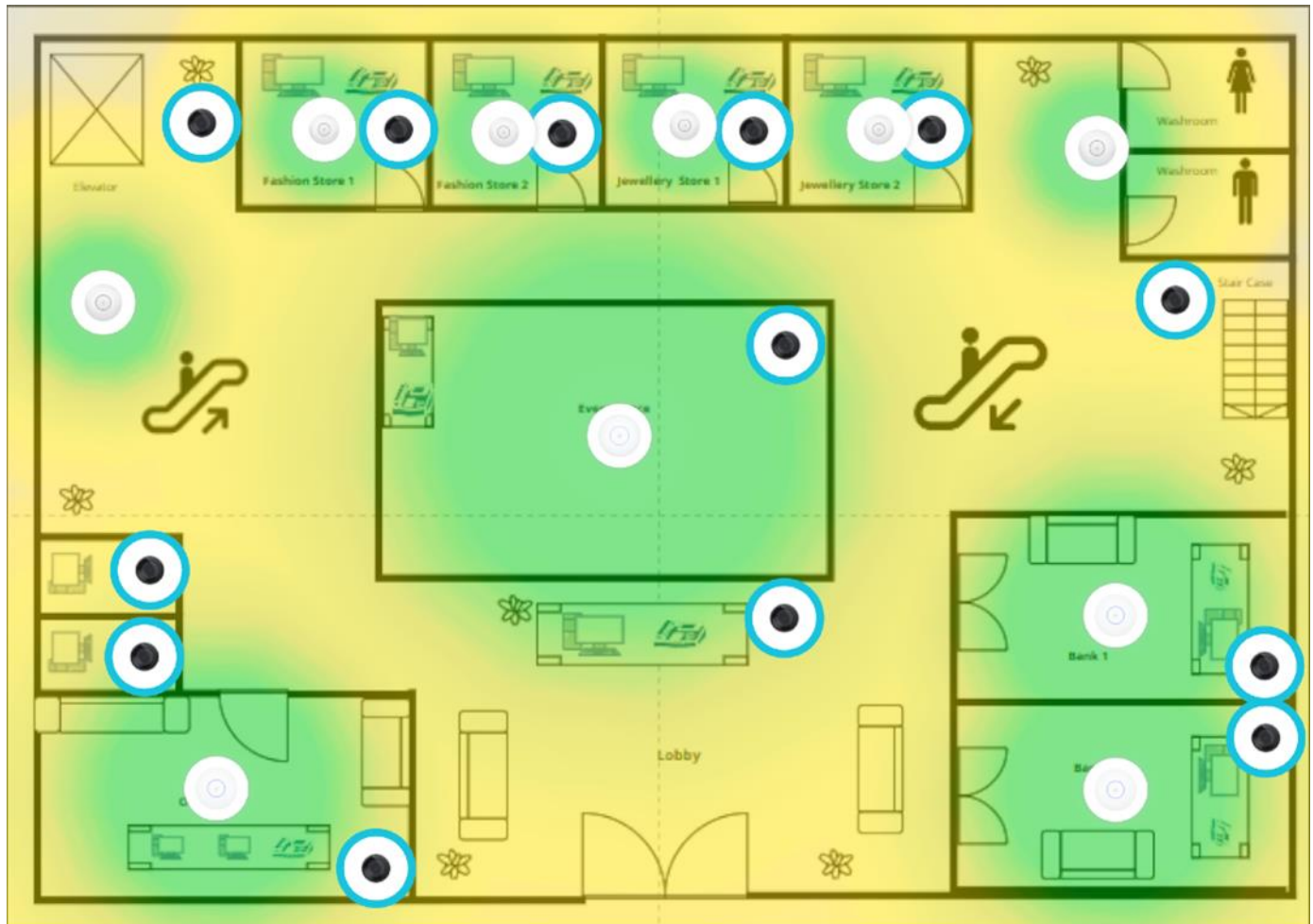
Basement Heat-map



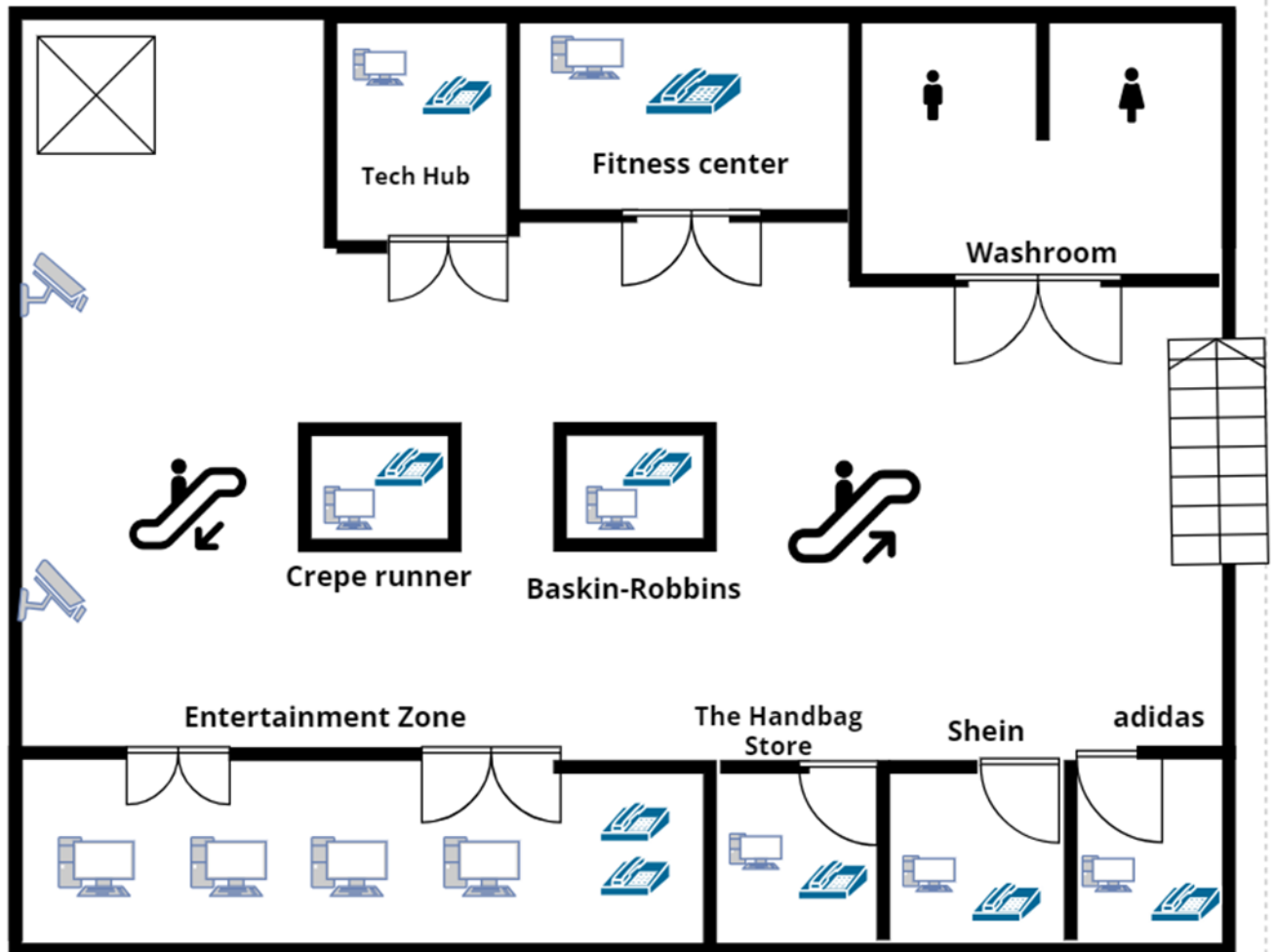
2. Ground-floor Floor-plan



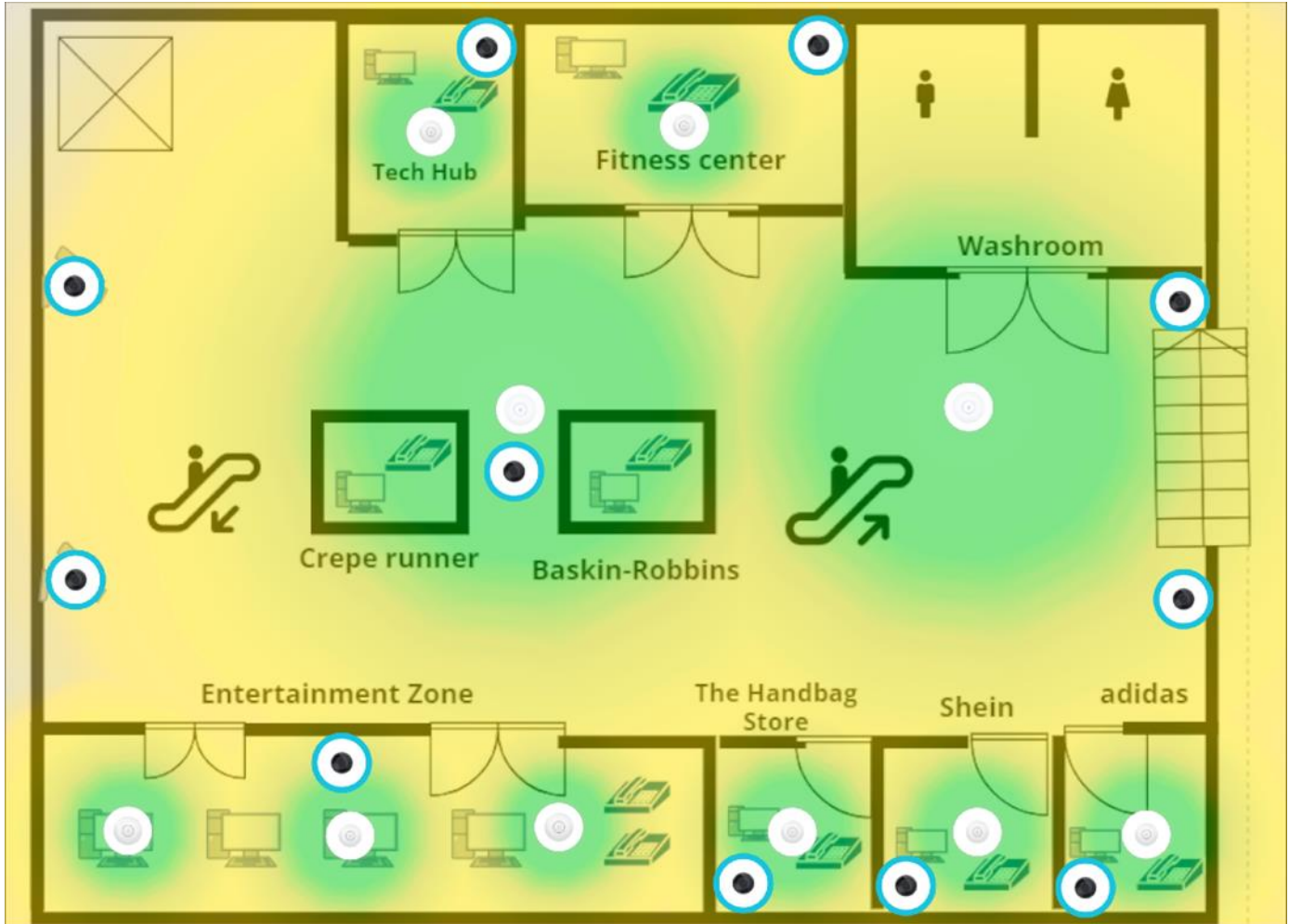
Ground-floor Heat-map



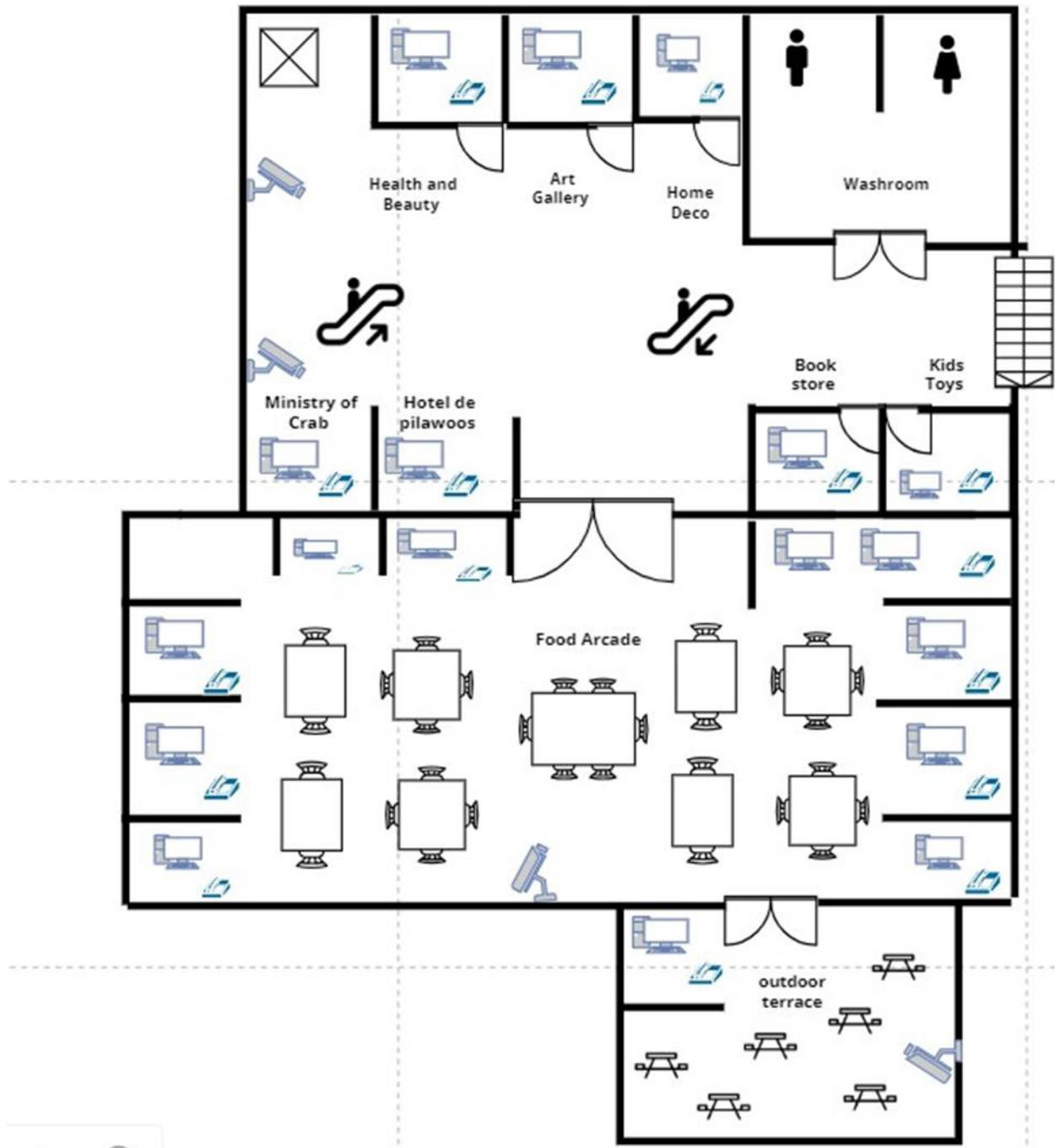
3. 1st-floor Floor-plan



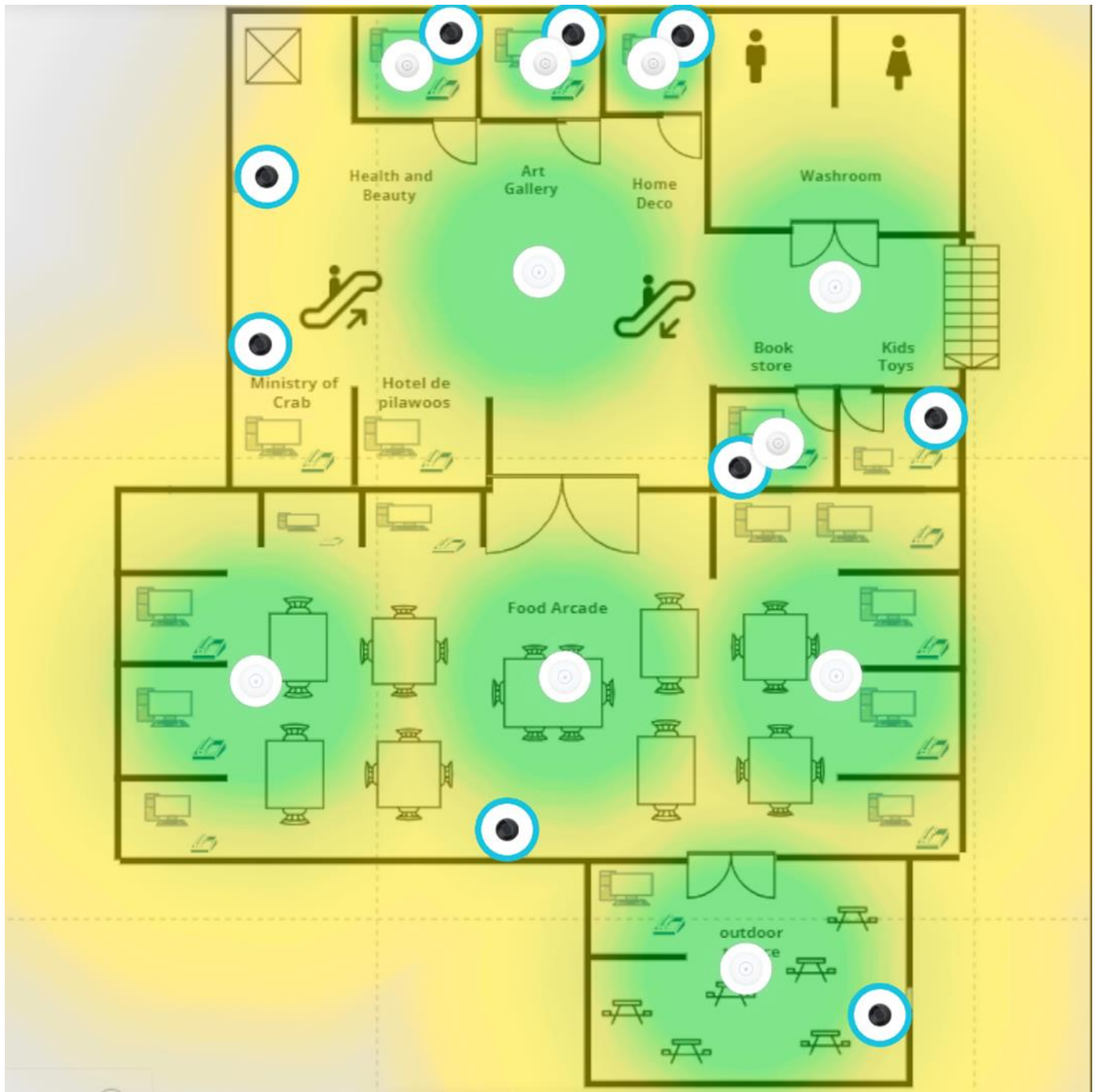
1st-floor Heat-map



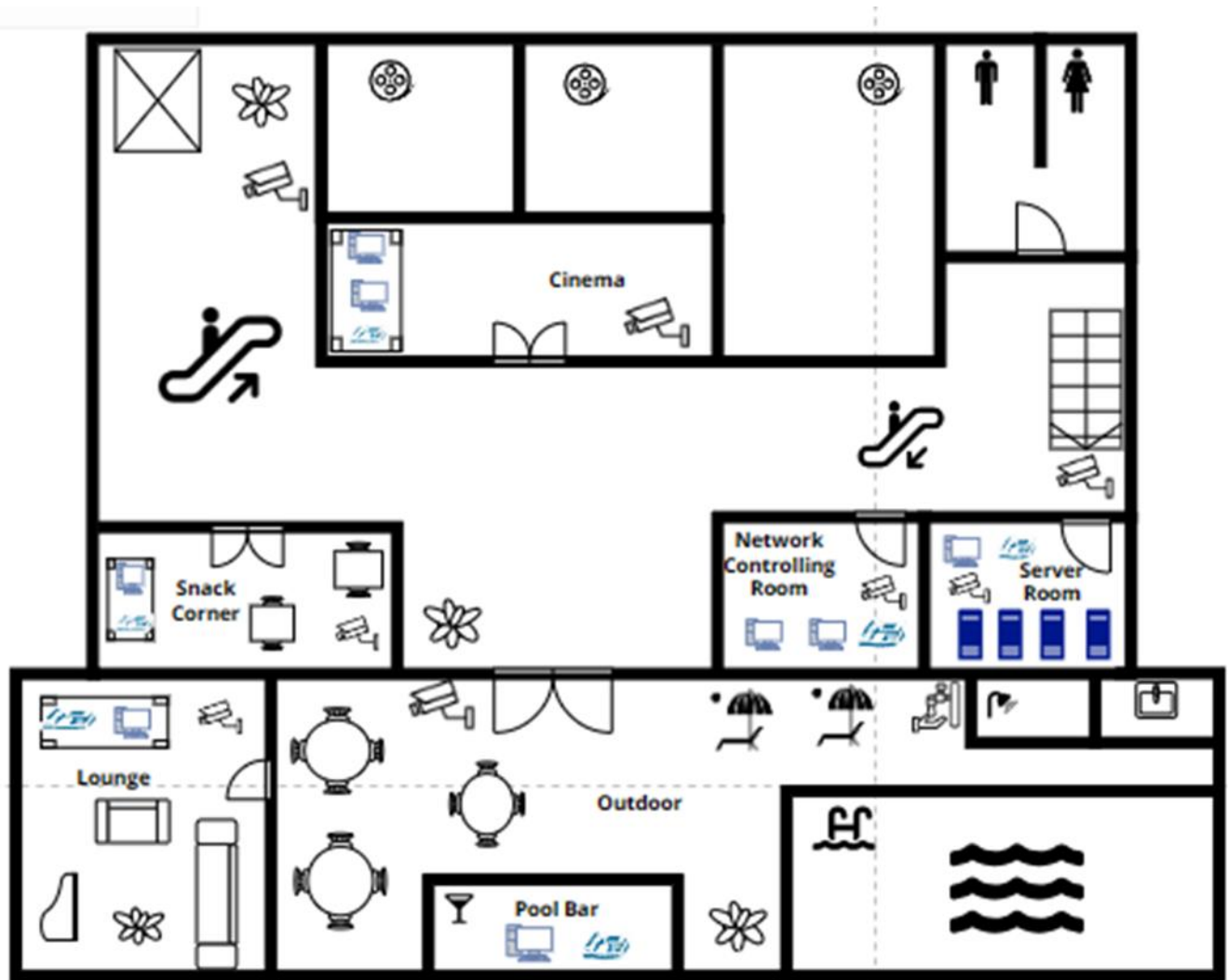
4. 2nd-floor Floor-plan



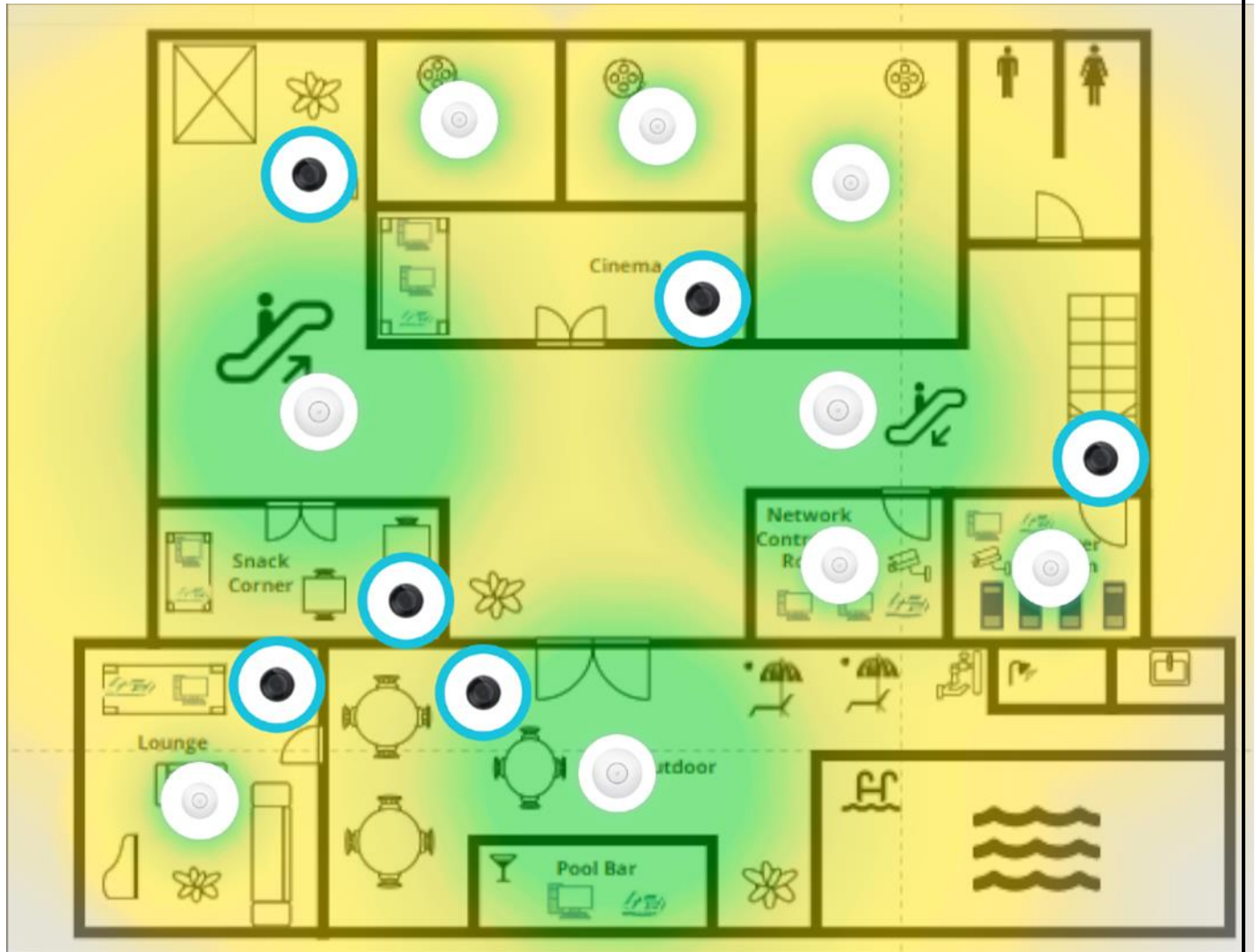
2nd-floor Heat-map



5. 3rd-floor Floor-plan



3rd-floor Heat-map



REQUIRED DEVICES AND SPECS

The following is a list of devices we intend to implement in the network plan of this mall. This list includes the device specifications and a reference picture.

Cisco ASR 1009-X Router



- Up to 200 Gbps of total system bandwidth and up to 130 mpps packet-forwarding performance
- Three 200 Gbps line card slots that are future proof for high- density 1, 10, 40, and 100 Gigabit Ethernet ports.
- Power on demand with up to six AC or DC power supplies with N+1 redundancy
- Three field replaceable fan trays for front-to-back airflow

C9500X-28C8D switch



- Intel® 2.43-GHz x86 CPU with 8 cores and 32-GB of DDR4 memory allowing for application hosting.
- 80MB of dedicated buffer to allow for low latency packet forwarding.
- 8GB of on-demand High Bandwidth Memory (HBM) providing very deep packet buffers and route table expansion.
- Up to 960 GB of SSD local storage for container-based application hosting (2x 10G KR ports)

Cisco Catalyst 9300 Series Switch



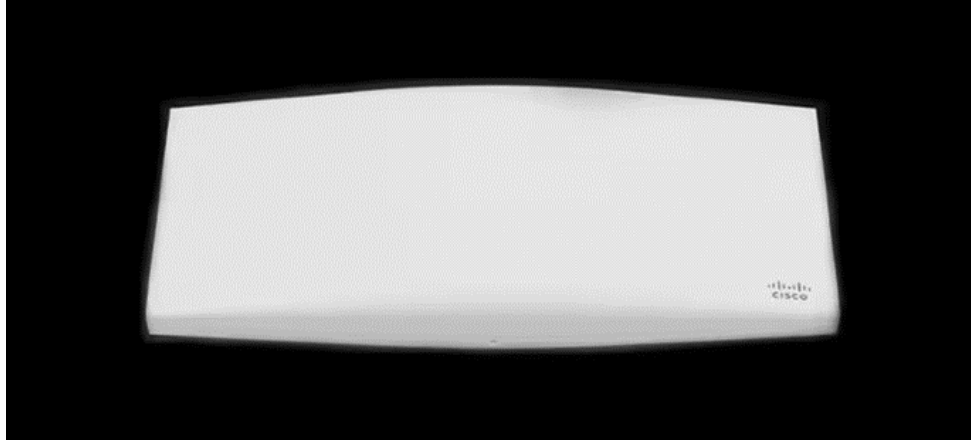
- Industry-leading 1TB stacking bandwidth with Stackwise-1T and a versatile uplink architecture.
- A range of uplink options including 100G, 40G, 25G, Multigigabit, 10G, and 1G.
- Stack Power compatibility with mixed Catalyst 9300 and 9300X stacks for enhanced power resilience.
- Improved Application Hosting with double capacity, extra RAM, QAT, and 10G AppGig Ports for hosting multiple applications.
- Integrated Cisco ASAc Firewall and cloud-based management and monitoring capabilities.

PowerEdge R7525 Rack Server



- 2x AMD EPYC™ processors, up to 8x PCIe Gen4 slots, and 4TB of memory.
- Configurations with AMD's MI100 Instinct GPUs and NVIDIA A100.
- Up to 24 direct connect NVMe supports all flash AF8 vSAN Ready Node
- Maximized IOPS, storage, and memory configurations enabled by up to 8 x PCIe Gen4
- Accelerated by both the AMD MI100 and NVIDIA A100

Cisco MR56 Access Point



- Four radios: 2.4 GHz, 5 GHz, dual-band WIDS/WIPS, and Bluetooth® Low Energy.
- 4-stream UL/DL MU-MIMO 802.11ax (2.4GHz).
- 8-stream UL/DL MU-MIMO 802.11ax (5GHz).
- 5.9 Gbps dual aggregate frame rate.
- One 2.5 Gbps multigigabit Ethernet port.
- PoE: 802.3at

Cisco MR86 Outdoor Access Point



- IP67-rated, tested for dust, shock, vibration, and moisture.
- Four radios: 2.4 GHz and 5 GHz, dual-band WIDS/WIPS, and Bluetooth® Low Energy.
- 4-stream UL/DL MU-MIMO 802.11ax, up to 3.55 Gbps dual- aggregate throughput.
- One multigigabit Ethernet port, PoE: 802.3at

Cisco IP Phone 8800



Cisco IP phones offer 720p HD video collaboration, mobile device integration, optional key expansion modules, and wired/wireless expansion for versatile and efficient communication solutions.

Hikvision DS-2CD6365G0-IVS



- Heatmap: based on deep learning algorithms, the camera counts people and presents an intuitive map
- Multi dewarping modes: the image can be dewarped to normal image for viewing intuitively.
- Built-in mic and speaker: the camera supports two-way audio for real-time audio security monitoring and communication.
- Built-in IR light: an IR range of 15 meters provides good visibility in low or even zero-light environments.
- High resolution 6 MP: capturing clear images even when dewarped into 4-image PTZ mode.
- Water and dust resistant (IP67) and vandal resistant (IK10)

BUDGET ESTIMATION

Device Type	Model	Units	Price of 1 unit
Router	Cisco ASR 1009-X	2	US\$9,640.00
L3 switch	Cisco C9500X-28C8D	2	US\$92,696.18
L2 switch	Cisco catalyst 9300	6	US\$2,999.00
Indoor Access Point	Cisco MR56	52	US\$690.00
Outdoor Access point	Cisco MR86	1	US\$1,195.00
Network Camera	Hikvision DS-2CD6365G0-IVS	45	US\$489.00
Servers	Dell Powered R7525	3	US\$4,439.00
IP Phones	Cisco IP phone 8800	44	US\$592.00
TOTAL			US\$320,571.36

NETWORK PLAN IMPLEMENTING TIME-SPAN

