SMART COLLEGE NETWORK DESIGN

Using Cisco Packet Tracer

By

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BONAFIDE CERTIFICATE

Certified that this project report entitled "**SMART COLLEGE NETWORK DESIGN Using Cisco Packet Tracer"** is a bonafide work of **Shaurya Gupta - 18BLC1092, Gauri Madaan - 18BLC1097, Siddhant Thakur - 18BLC1113** who carried out the Project work under my supervision and guidance for **ECM2001 – DATA COMMUNICATION NETWORKS.**

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ABSTRACT

Smart College Network Design refers to the design of a college system which is converted to adapt to recent times. It covers the entire university, displaying smart classrooms and admin rooms to monitor the classes in a pandemic situation. It provides different service such as connect user to internet, data sharing among user, accessing different web service for different functionalities. Special care is provided to follow the COVID rules so that no touch is necessary to operate simple IoT devices which are used on daily bases. The system is designed in such a way that it can eb operated through anyone with a smart phone and doesn't distinguish the user. when implemented will be a smart, efficient, and comprehensible college campus network which will not be just a bunch of devices connected to each other through VLAN. The network technology is intelligent and scalable in both size and enhancement of the technology. There is complete access to the entire classroom or lab through an admin providing control of each function to the user. There is a remote access to the devices connected to the network which can be used to do on the fly operations through long distances. Different activities in campus network, starting form corridors, to classrooms is designed to provide the ease and efficiency, in recent changed daily life of a student, faculty and university staff alike.

Existing system present in our college reflect a Campus Networking Site that is for college students and the hostels, along with security provided thorough video sharing. It contains standard network content, like classroom, light bulbs etc which can be turned off when power is turn off but not as efficiently as a smart system may provide. At Arizona State University, sensors have been installed throughout campus facilities to monitor and communicate environmental factors like noise, humidity, and temperature with staff. Additionally, they can detect factors such as running faucets, parking availability and concession stand lines and report in live time to users running the monitoring software. Our system takes inspiration to a better life in colleges and tries to adapt it in this condition for easy and viable implementation of a smart college network.

ACKNOWLEDGEMENT

We wish to express our sincere thanks and deep sense of gratitude to our project guide, **Dr. Kalaivanan K,** Assistant Professor Senior, School of Electronics Engineering, for his consistent encouragement and valuable guidance offered to us in a pleasant manner throughout the course of the project work.

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We thank our parents, family, and friends for bearing with us throughout the course of our project and for the opportunity they provided us in undergoing this course in such a prestigious institution.

SHAURYA GUPTA **SIDDHANT THAKUR** **GAURI MADAAN**

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CHAPTER 1
INTRODUCTION

1.1 OBJECTIVES

- Design the Smart College Network Design.

- Covering different domains in a college and establishing a sample network of the entire university.

- Connecting student to internet, data sharing among different people, accessing different devices for different functionalities.

- Providing students, teachers, and different university members for assessable applications, to sustain different activities in the university following the Social Distancing rules.

- Imitate the behavioural characteristics of humans and create their individual relationships based on the rules or requirements placed by their owner with the advantage of enhancing the network scalability in information/service discovery.

- computational IOT nervous system for colleges to keep track of major resources, create smarter classrooms, design secure campuses, add no touch- devices, and much more with its set of advanced tools.

1.2 PROBLEM IDENTIFICATION

The Problems identified are as listed below:

1. In **complex networks** there can be **looping** which will be **unnecessary collisions** which can lead to **dysfunctional** system cause **data losses**.

2. In wireless communication there can hidden node and hidden terminal problem that can occur when there is discrepancy to the **object's placement** and its **listening** and **transmitting ranges**. This again can cause dysfunction by listening to other nodes when there is no need nor authorization.

3. We had proposed to have **automatic attendance system** in our model, but it posed a problem as to which **methodology** must be implemented for the same.

4. There was also energy saving measures proposed like a**utomatic light switch off** when **no one is available in the room**. The implementation of it posed a problem as to which devices to use to manage this task.

5. Connecting the microcontroller to the home gateway was a problem we faced.

6. In the wake of the **COVID-19 Pandemic** we had proposed an **automatic sanitization using sprinklers** with sanitizer fluids, the implementation of this without a microcontroller posed a problem.

7. **System security** as there is **remote access** for devices in the room by a **subscriber and control node** which when accessed by the wrong entity can control system and endanger security.

The problems were taken care of by:

1. Using **Spanning Tree Protocol** which nullifies the formation of loops problem.

2. The devices that could be **hidden terminals and hidden nodes** are kept out of each other's **listening and transmitting range** and preferably in separate rooms.

3. Since in our college there is an **RFID card** in each **ID card** it gave the solution of using the **RFID** Sensor as the key for each one's identity in the **automatic attendance system**.

4. There are trip exit sensors which are placed at the exit doors which detect people leaving and switches all the electrical appliances off.

5. **Avoided** the use of the **microcontroller** and connected many devices directly to the home gateway.

6. The sprinklers can be switched on and off using the authorized device at any time manually for sanitization. However in case of fire they will turn on by themselves.

7. Each room has a **subscriber and control node** in the form **one Authorized device** for the access of all the IOT devices **remotely**. The **IP address** of this device is configured in the gateway and it is also **protected** by an **admin login**. Hence, it's a **two fold protection** where the **misuser** will have to **get hold of the authorized control device** first and then **crack through the admin login** to misuse the system.

1.3 BENEFITS

The Internet of Things (IoT) describes a world in which objects used daily are connected to a network so that data can be shared. Many of us already carry 'smart' phones with us to college, but a phone is not smart unless it is used with the affirmation to make life easier. It helps its user to make smarter decisions. Smartphones are only the beginning. In the future of IoT we will carry sensors that will automatically enter our attendance, automated library system and also help in how we move around in the college environment. During this unknown time, the technology must establish it's hold on to every random/fast paced fact and here in our project we tackle exactly that. The Smart College system is fast, efficient and follows all rules there are to a enhance the experience and provide a safer environment in these times. The system has been tested and verified.

1.4 FEATURES

- Facilities of the network can provide the convenience of continuing the class without the presence of the admin on site while can still monitor the class through the cameras connected to the internet.
- Student/Admin can control operations both on site and offsite, authorized by username and a password.
- Conserve resources like electricity, since, the devices left on can be seen and remotely switched off.
- RFID sensors can be used to the for automatic attendance purposes using the ID card RFID chip.
- PIR sensor can be used to detect human presence and a timeout adjusted to it can help the automation of devices switch off like lights, fan, air-conditioner etc. when no human is detected for a substantial amount of time.
- Trip sensor to enclose many commands and save time.
- Smartphone is used, fast and accessible device which everyone carries.

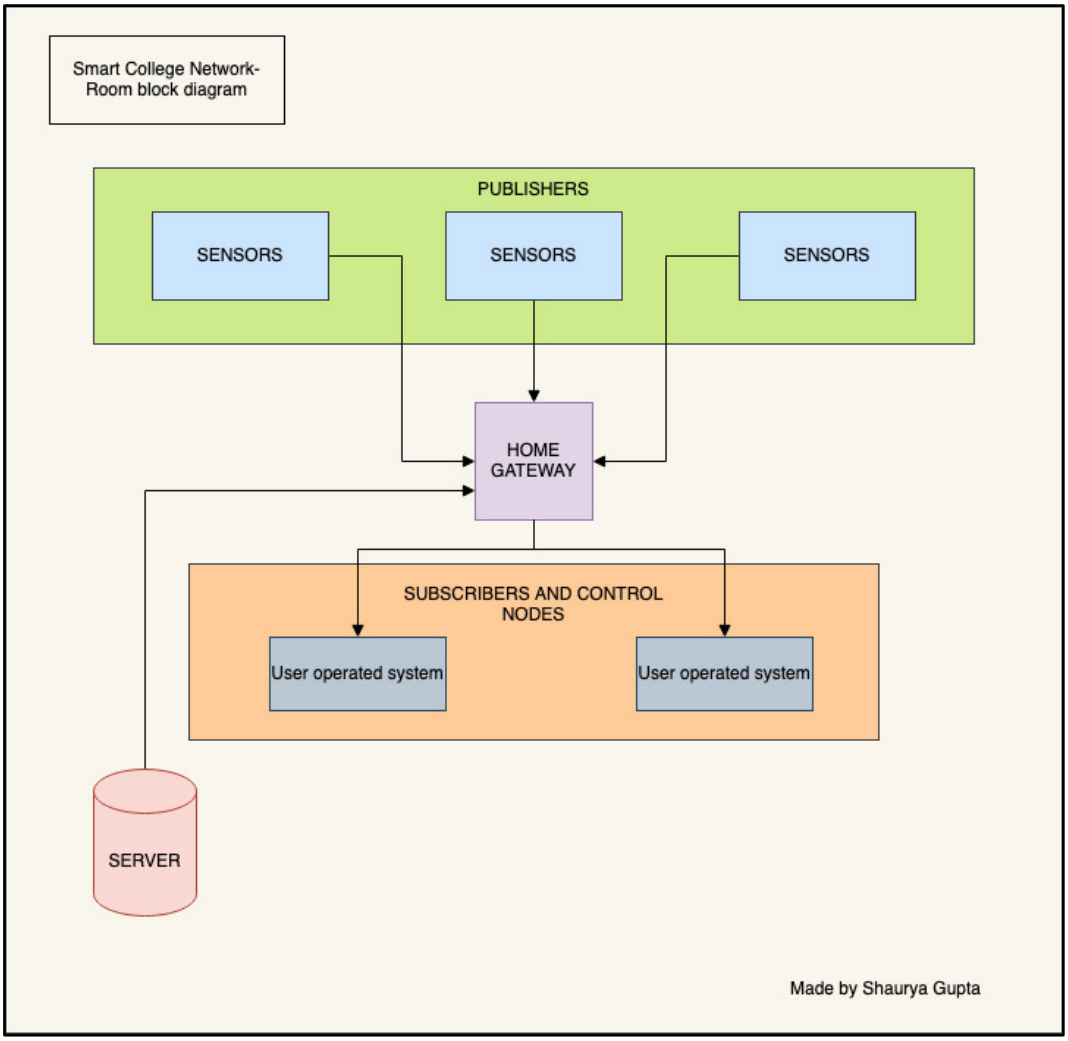
CHAPTER 2

SMART COLLEGE DESIGN USING CISCO PACKET TRACER - DESIGN

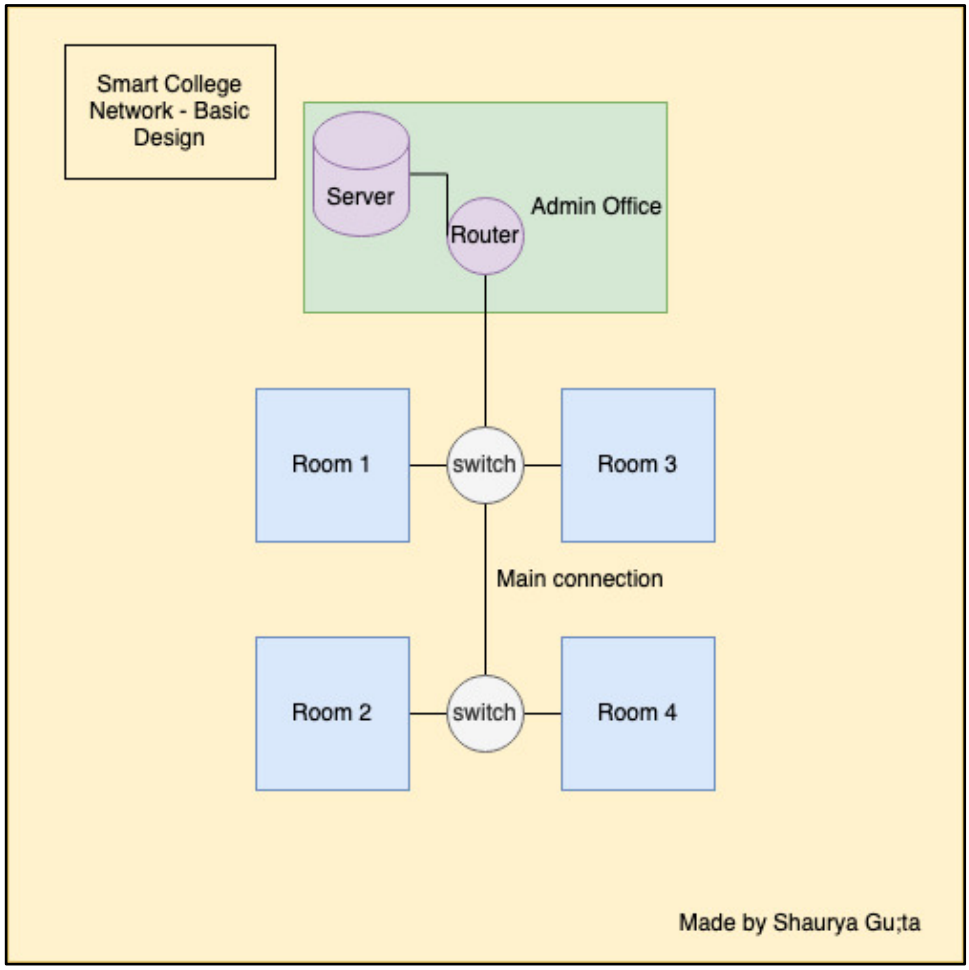
2.1 BLOCK DIAGRAM

The four main features of the basic block diagram (given below) are

- Publishers (Sensors)
- Home Gateway
- Subscribers and control nodes (User operated systems such as smart phones).
- Server for database.



Room block diagram



Basic Network Design

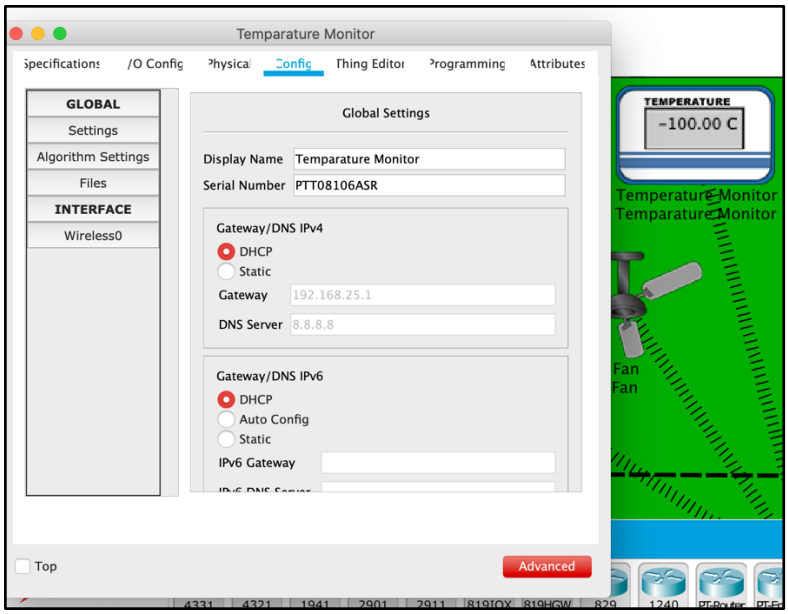
2.2 HARDWARE SPECIFICATIONS

In today's college system much of the data released to date is enabled to be human-readable, and not machine-readable. For this reason, our project targets the more accessible device, Smartphone. A digital skin is showcased connecting with various sensors and controlled by our smartphones, over the college campus. Following components are found in cisco packet tracer but can be implemented on ground-based scale thus, counted under hardware specifications.

2.2.1 SENSORS

2.2.1.1 Temperature monitor

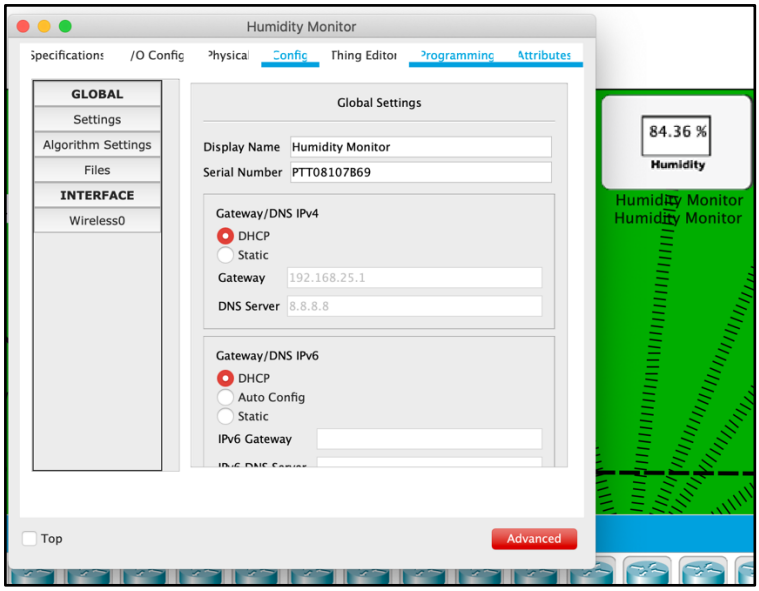
Temperature Monitor Sensors measure the amount of heat energy or even coldness that is generated by an object or system, allowing us to “sense” or detect any physical change to that temperature producing either an analogue or digital output. Temperature monitoring sensor calculates its operating temperature, and monitor other IoT device function which configure on how the temperature of a room is, for example, if temperature is detected as high, more then (>10 degree Celsius), then Fan/ Air Conditioner turns on.



TEMPERATURE MONITOR CONFIG

2.2.1.2 Humidity monitor

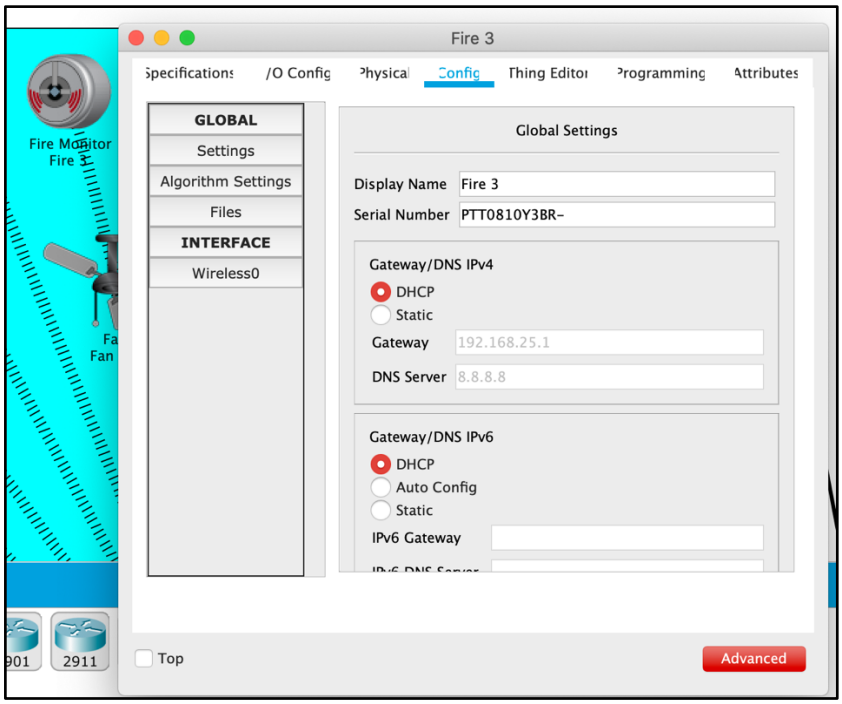
Humidity sensors working is by detecting changes that alter electrical currents or temperature in the air. It will monitor minute changes in the atmosphere in order to calculate the humidity in the air.. We monitor, the humidity as the indoor humidity fluctuates to undesirable levels, then preventive measure, like turning on windows are done. By supervising the indoor climate, the wireless Humidity Sensor helps maintain the ideal comfort level and protect the interior, electronics, musical instruments, furniture, artwork, and any other humidity-sensitive student-items in a classroom.As a hardware device, the Humidity Sensor protects buildings and belongings by monitoring temperature and humidity levels.



HUMIDITY MONITOR CONFIG

2.2.1.3 Fire monitor

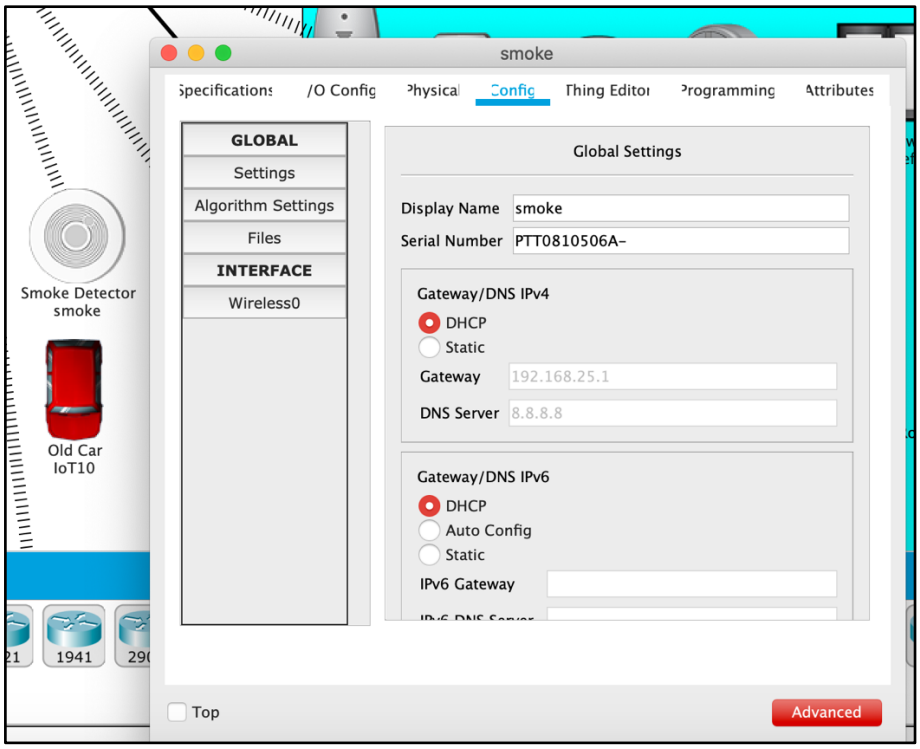
Flame or Fire detector is a sensor designed to detect and respond to the presence of a flame or fire or burning temperatures .Fire-detection systems play a pivotal role in any building. By detecting a fire quickly and accurately (i.e., by not sacrificing speed or causing false alarms) and providing early warning notification, a fire-detection system can limit the emission of toxic products created by combustion, providing safety to students and staff which can be produced by the fire itself. Automatic fire detection used senses smoke or heat(necessary conditions for fire) can be useful in conditions like this, and necessary steps can be taken like water sprinkler, opening windows etc.



FIRE MONITOR CONFIG

2.2.1.4 Smoke detector

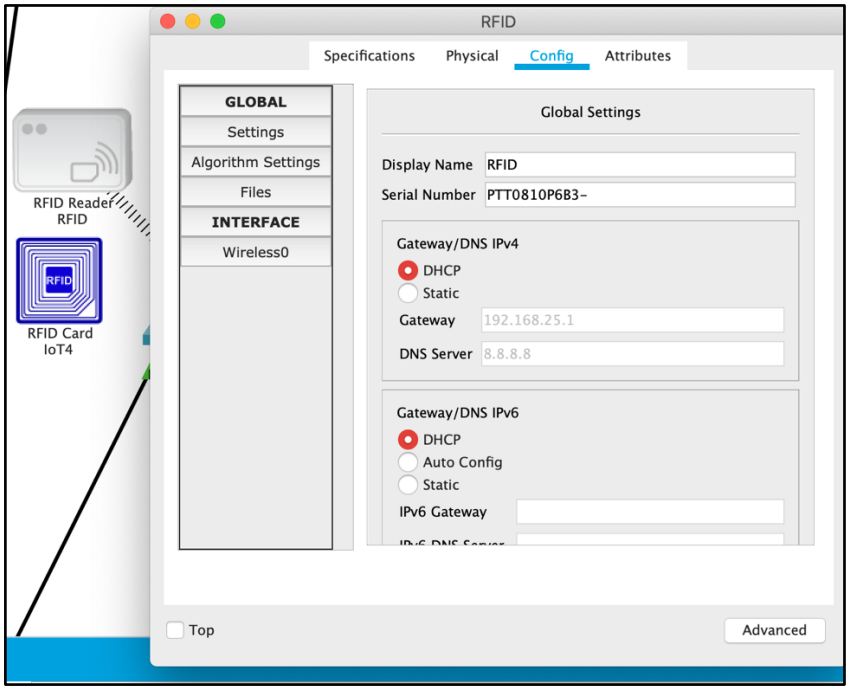
A smoke detector is a device that detects smoke and can be used to trigger an alarm when the smoke in environment increases to a certain point. A smoke detector sends signals to other IoT devices when it detects smoke and triggers an alarm to alert nearby people of the threat of a potential fire. It is imperative that smoke detectors are regularly maintained and checked that they operate properly. This will ensure early warning to allow emergency responses to occur well before a fire causes serious damage.



SMOKE DETECTOR CONFIG

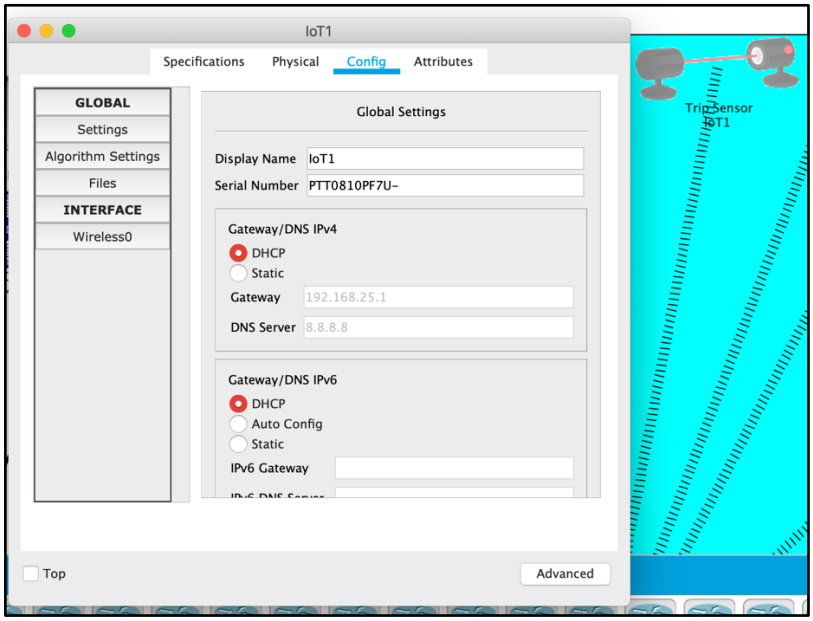
2.2.1.5 RFID reader

RFID is an acronym for “radio-frequency identification” and refers to a technology whereby digital data encoded in RFID tags or smart labels (defined below) are captured by a reader via radio waves. RFID is similar to barcoding in that data from a tag or label are captured by a device that stores the data in a database. RFID, however, has several advantages over systems that use barcode asset tracking software. Our RFID Readers are offered in id cards where students can tag them and system reads a human detection in the classroom or corridors.



2.2.1.6 Trip sensor

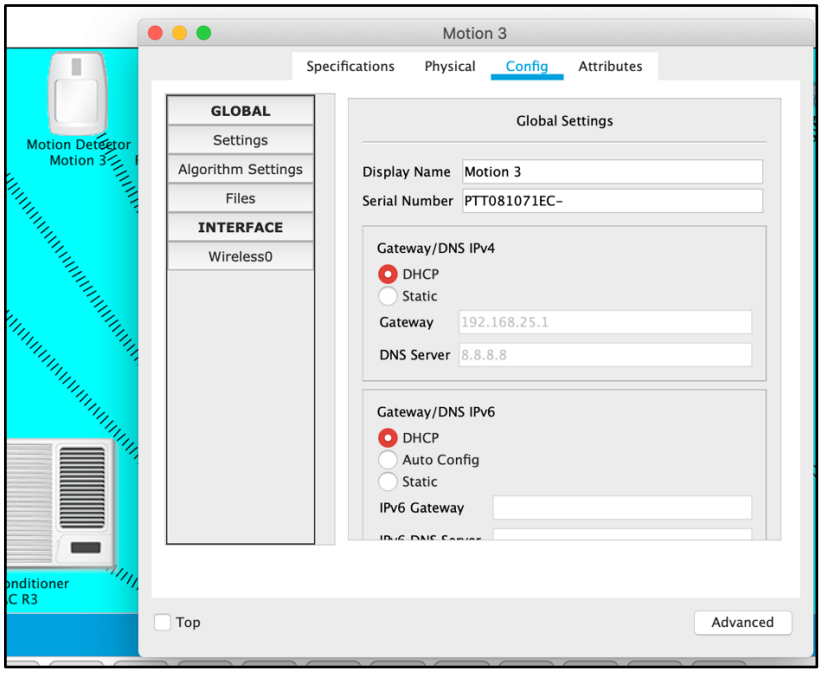
TRIP or PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. We are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.



TRIP SENSOR CONFIG

2.2.1.7 Motion Detector

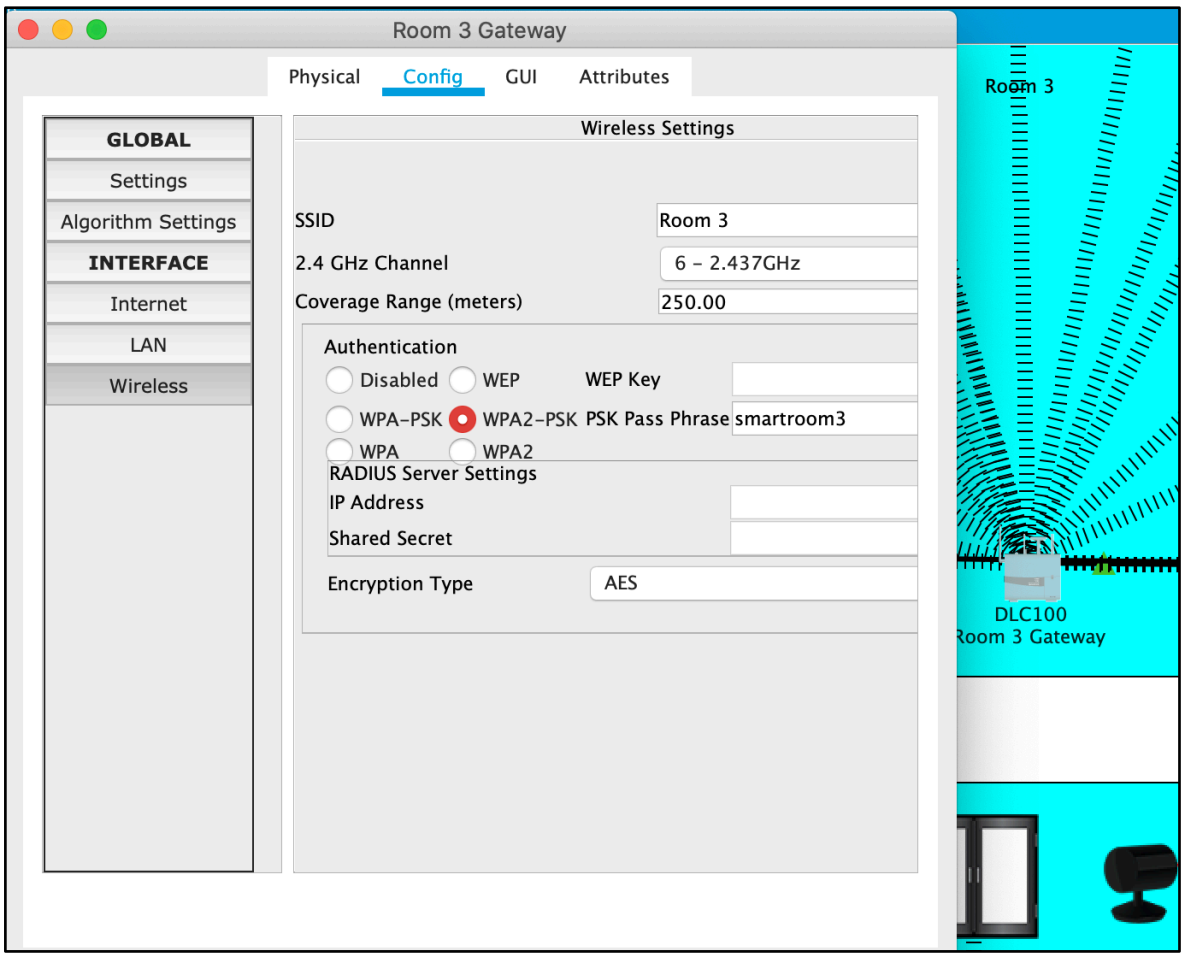
A motion sensor (or motion detector) is an electronic device that is designed to detect and measure movement. Motion sensors are used primarily on the door to detect human movement to follow social guidelines.



MOTION DETECTOR CONFIG

2.2.2 Home gateway

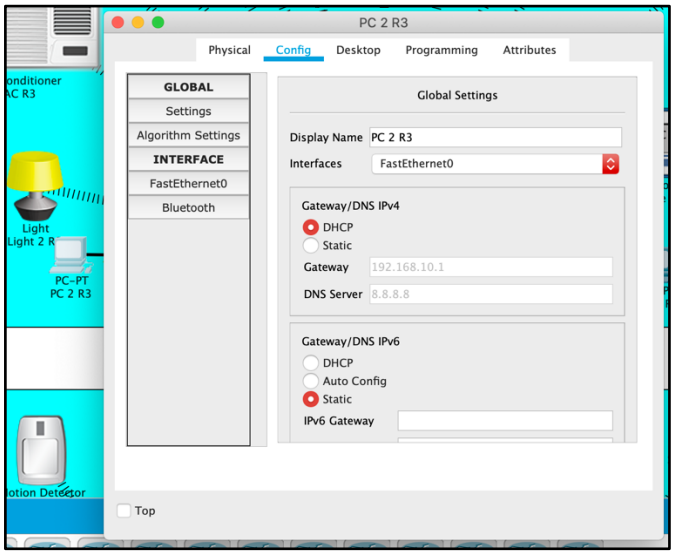
A home/residential gateway is a gateway that allows the connection of a local area network (LAN) to a wide area network (WAN). So a home gateway actually helps to connect a smaller network to a larger network or directly helps in connecting to the internet. The home gateway maintains a database, commonly called a home location register (HLR), of all of the extensions that are owned by the home gateway. Here, the gateway opens on a RFID detection(human detection).



HOME GATEWAY CONFIGURATION AND AUTHETICATION

2.2.3 PC

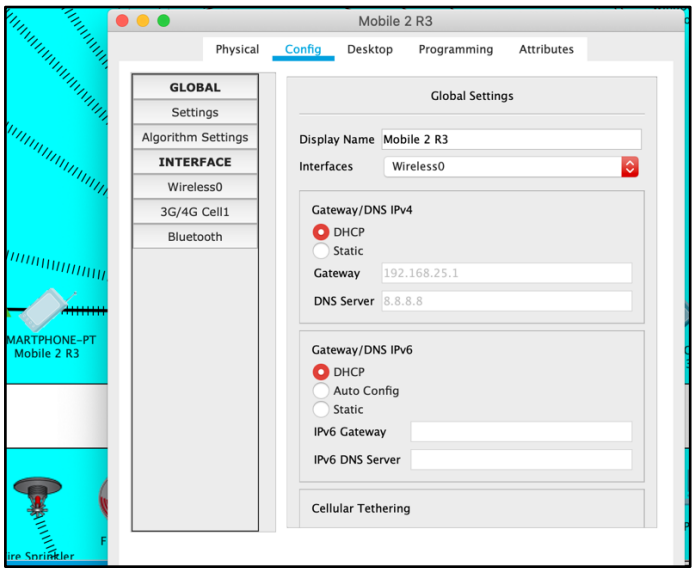
PC or Personal Computer are what most of us use on a daily basis for work or personal use. A typical PC includes a system unit, monitor, keyboard, and mouse. Most PCs today also have a network or Internet connection, as well as ports for connecting peripheral devices, such as digital cameras, printers, scanners, speakers, external hard drives, and other components. A student's laptop may be considered a PC.



PC CONFIG

2.2.4 Smartphone

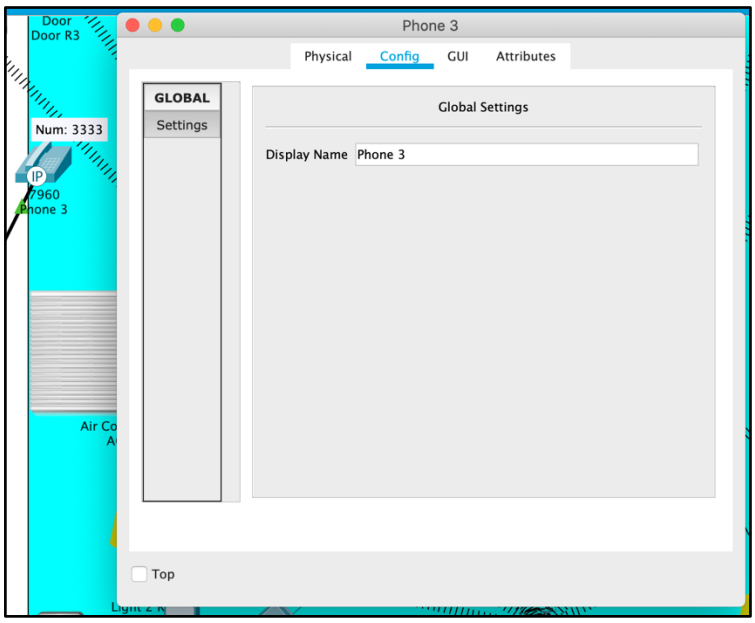
Any personal mobile phone a student or staff possess, which is very common that performs many of the functions of a computer, typically having a touchscreen interface, internet access, and an operating system capable of running downloaded apps. This smart will be the remote to our IoT devices and is of utmost importance.



SMART PHONE CONFIG

2.2.5 Telephone

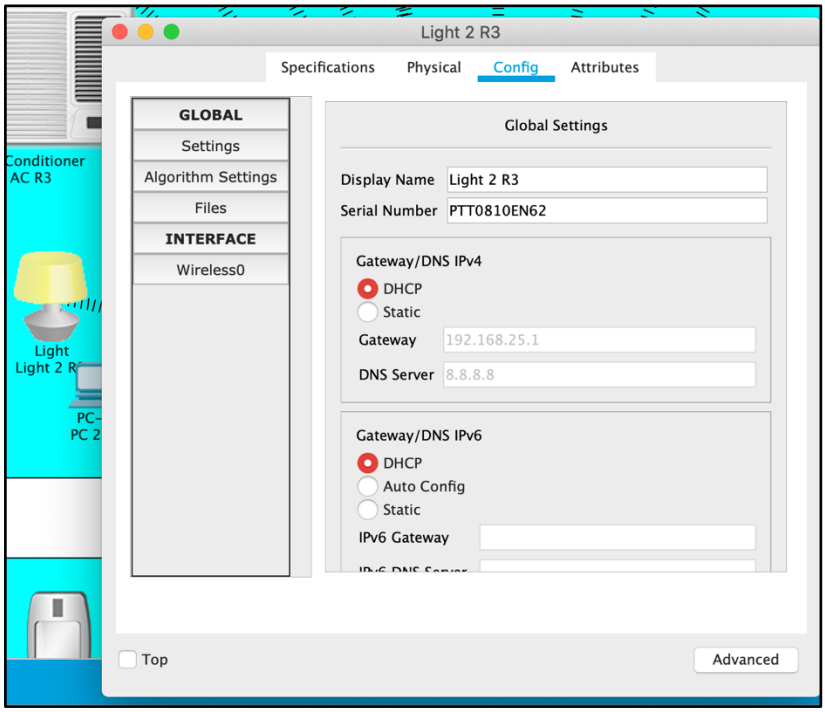
Any other telecommunication devices, except then smartphone can be considered in this.



TELEPHONEPHONE CONFIG

2.2.6 Light

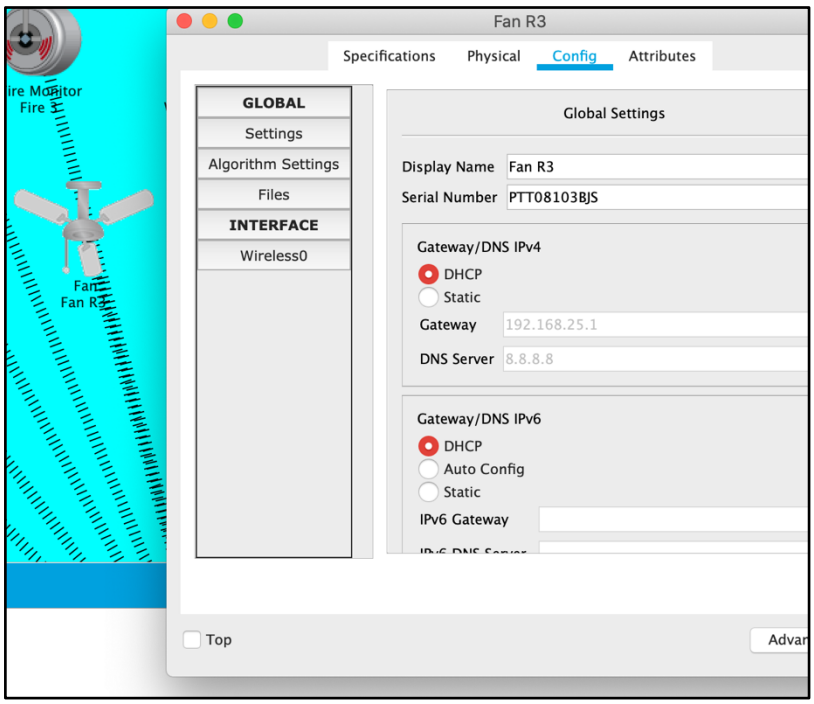
A light source is anything that makes light, whether natural and artificial. Here our device is considered in Tube light, Bulb etc.



LIGHT CONFIG

2.2.7 Fan

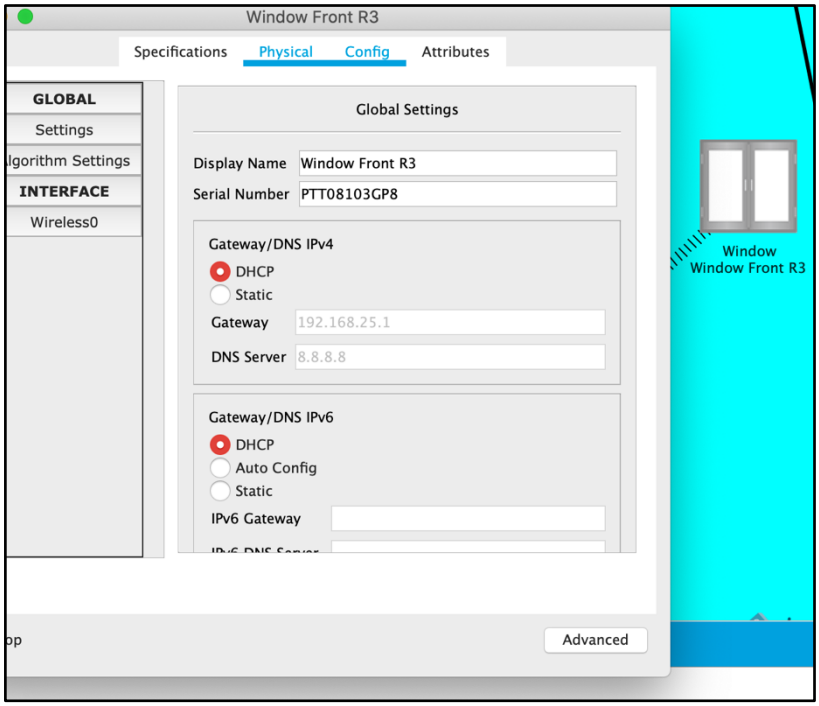
A device to provide a flow of air, either an object that you wave in front of you or a device with blades that are turned by a motor.



FAN CONFIG

2.2.8 Window

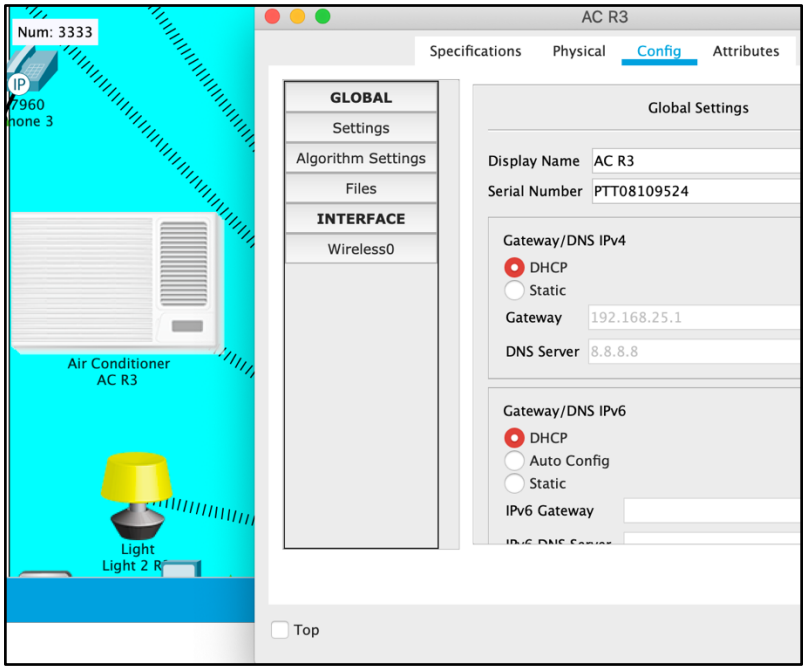
An opening in the wall or roof of a building or vehicle, fitted with glass in a frame to admit light or air and allow people to see out.



SMART PHONE CONFIG

2.2.9 Air Conditioner

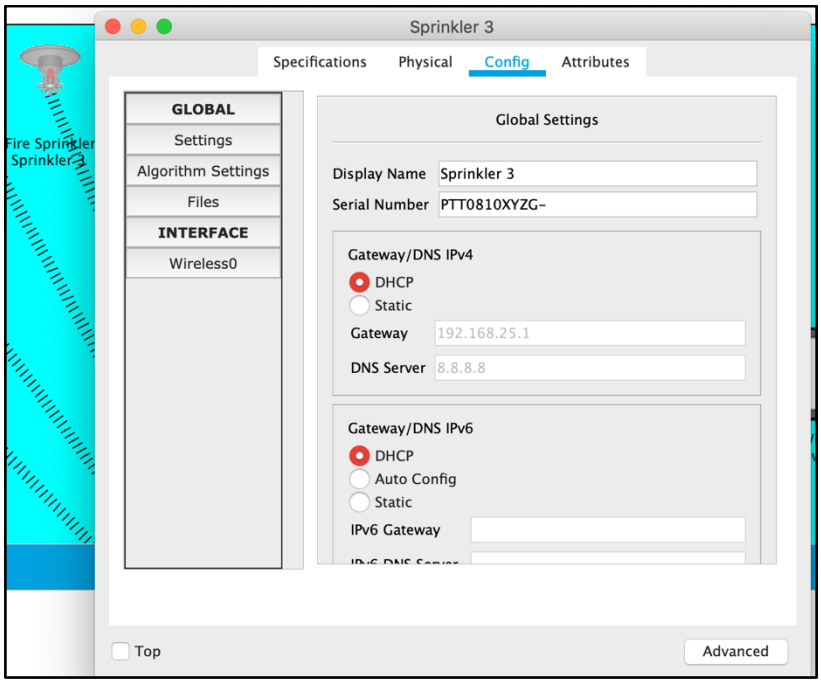
A system for controlling the humidity, ventilation, and temperature in a building or vehicle, typically to maintain a cool atmosphere in warm conditions.



AC CONFIG

2.2.10 Fire sprinkler

Fire sprinkler systems have strategically placed sprinkler heads with glass bulbs containing a glycerine-based liquid. Sprinkler systems detect a fire through rising temperatures, corridor will be installed and detection will be done throughout.



FIRE SPRIKLER CONFIG

2.3 SOFTWARE SPECIFICATIONS

- Cisco packet Tracer 7.0

CHAPTER 3

SYSTEM IMPLEMENTATION AND ANALYSIS

This section describes system implementation and results with inferences.

3.1 SYSTEM IMPLEMENTATION

Fig3.1 Design

Our System consists of 1 floor as sample. 4 Classrooms, and 1 Admin room. All the classrooms have a variety of IoT devices used by a student. Accommodation per room is for 3 students, here devices like PC, Telephone, Smartphone are individual. Common devices like Fan, Air Conditioner, Window etc are common in the room and they function on human detection of minimum of 1 person.

Corridors are attaching to rooms and the office and the have common devices too like fire detector, water sprinkler etc which will activate on increased temperature for a potential fire.

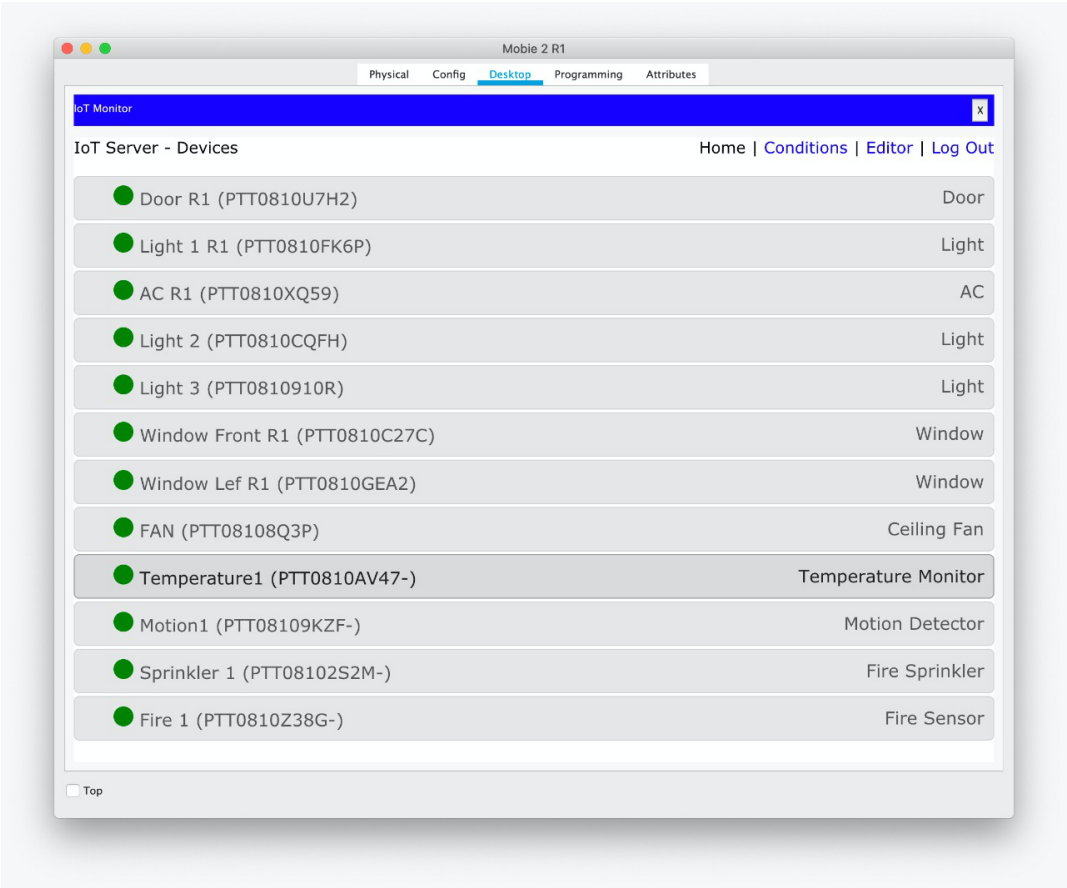


Fig3.2 Smartphone Desktop

Smartphone of Staff or an Individual Student, will contain the following options to control all the devices set up in the room. These devices can be controller and monitored on your smartphone.

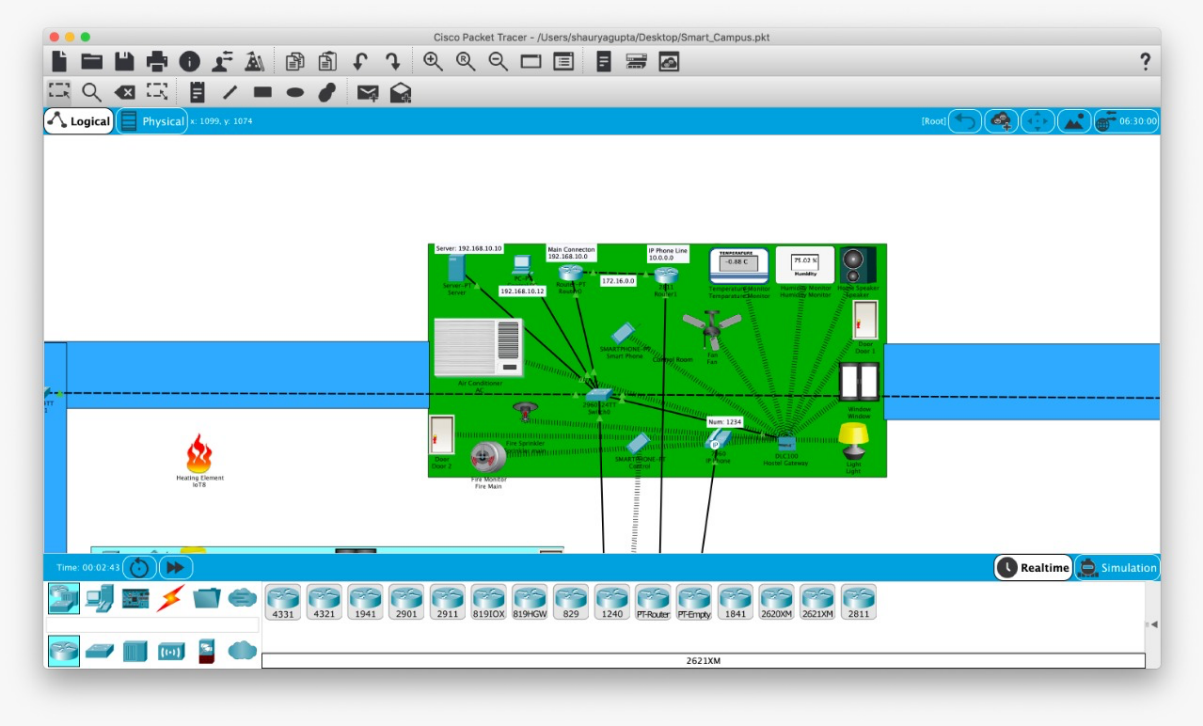


Fig.3.3

Admin Room: In each floor within a building there are organizational management units called admin rooms. They connect with telephone lines across all classroom, and manage the sensor detections.

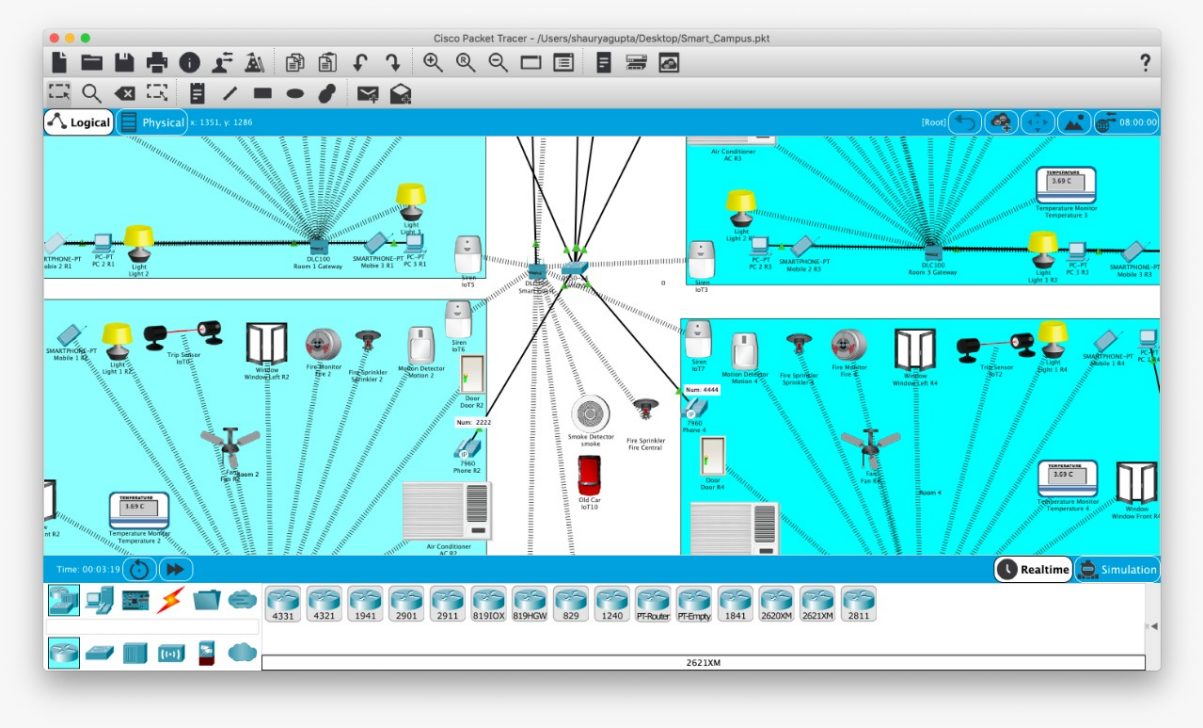


Fig. 3.6 **COORIDOR**

RFID takes auto-ID technology where each student has an RFID it already attached to the I-card like a key card. Rooms with and without RFID sensors are present representing either labs or classrooms.

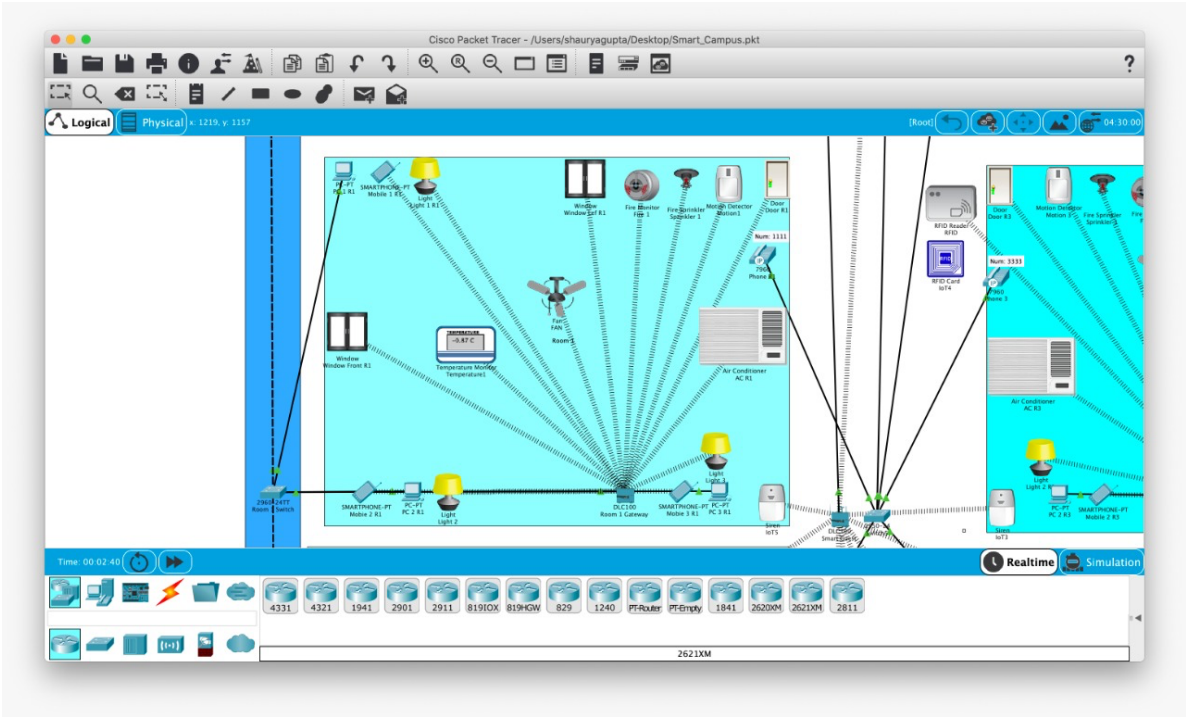


Fig 3.4 **Classroom without RFID Sensor**

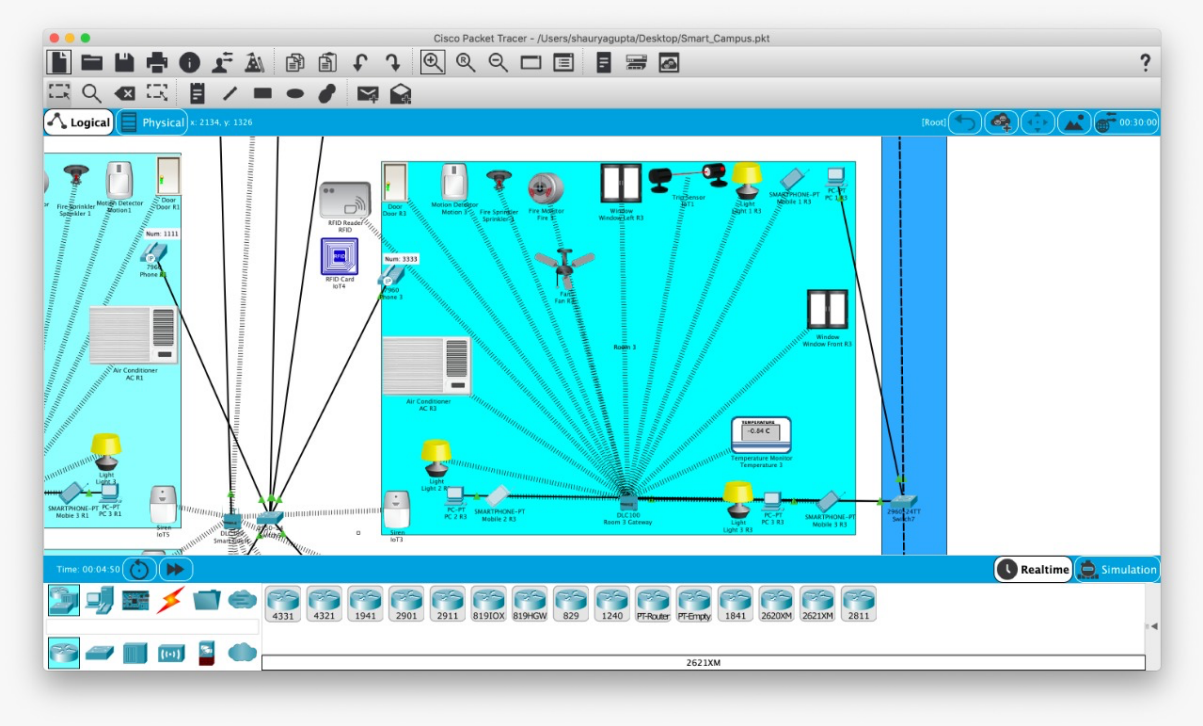


Fig3.5 Classroom with RFID Sensor

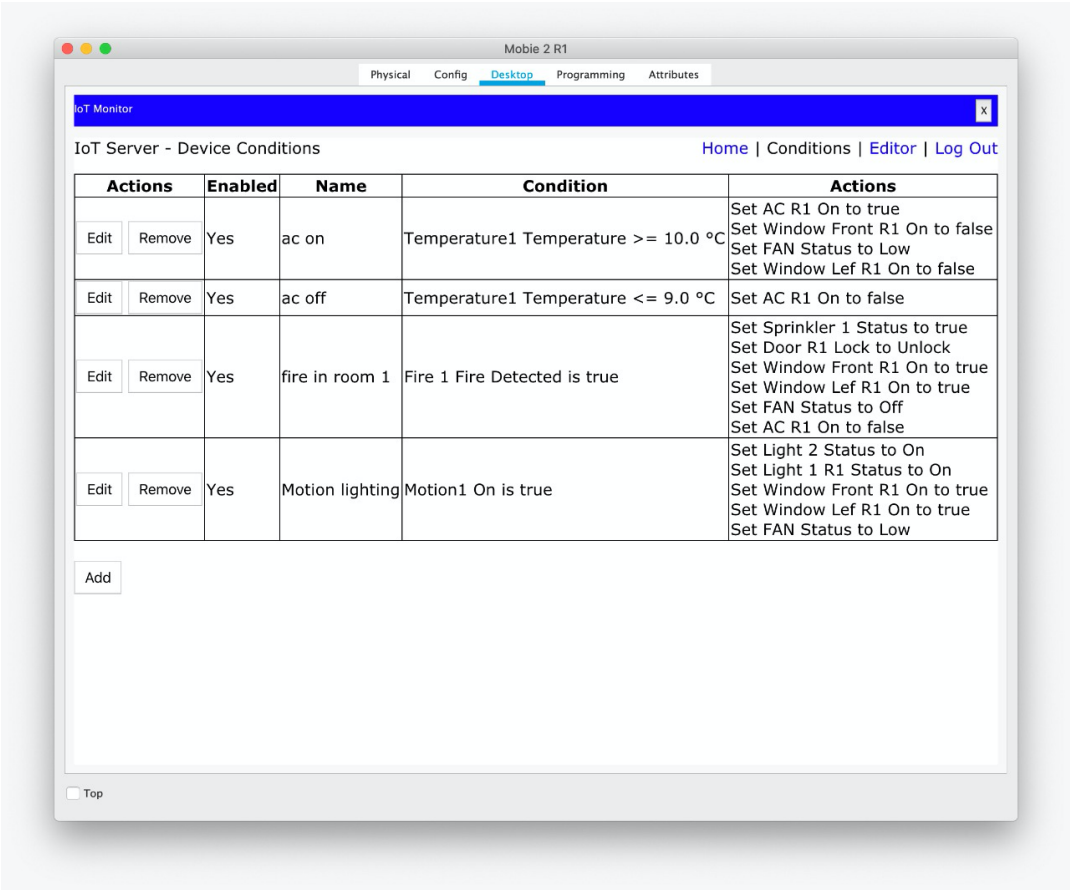


Fig 3.5 **CONDITIONS FOR TEMPERATURE**

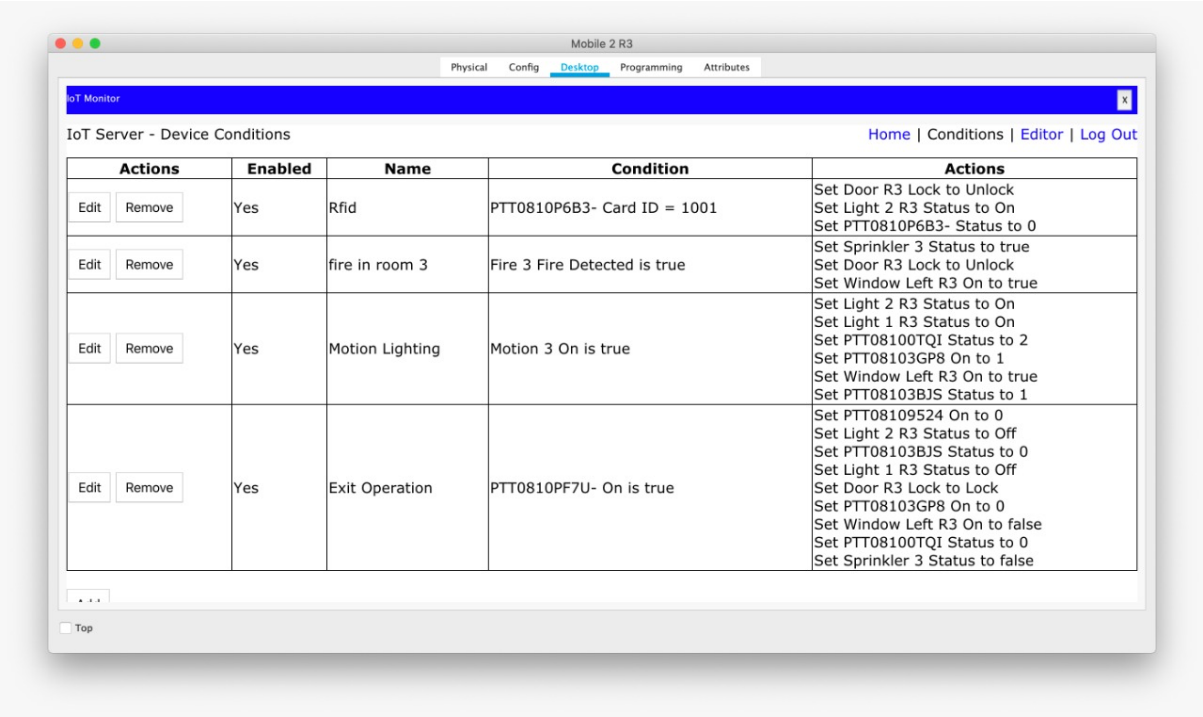


Fig3.8 **CONDITIONS FOR FIRE DETECTION**

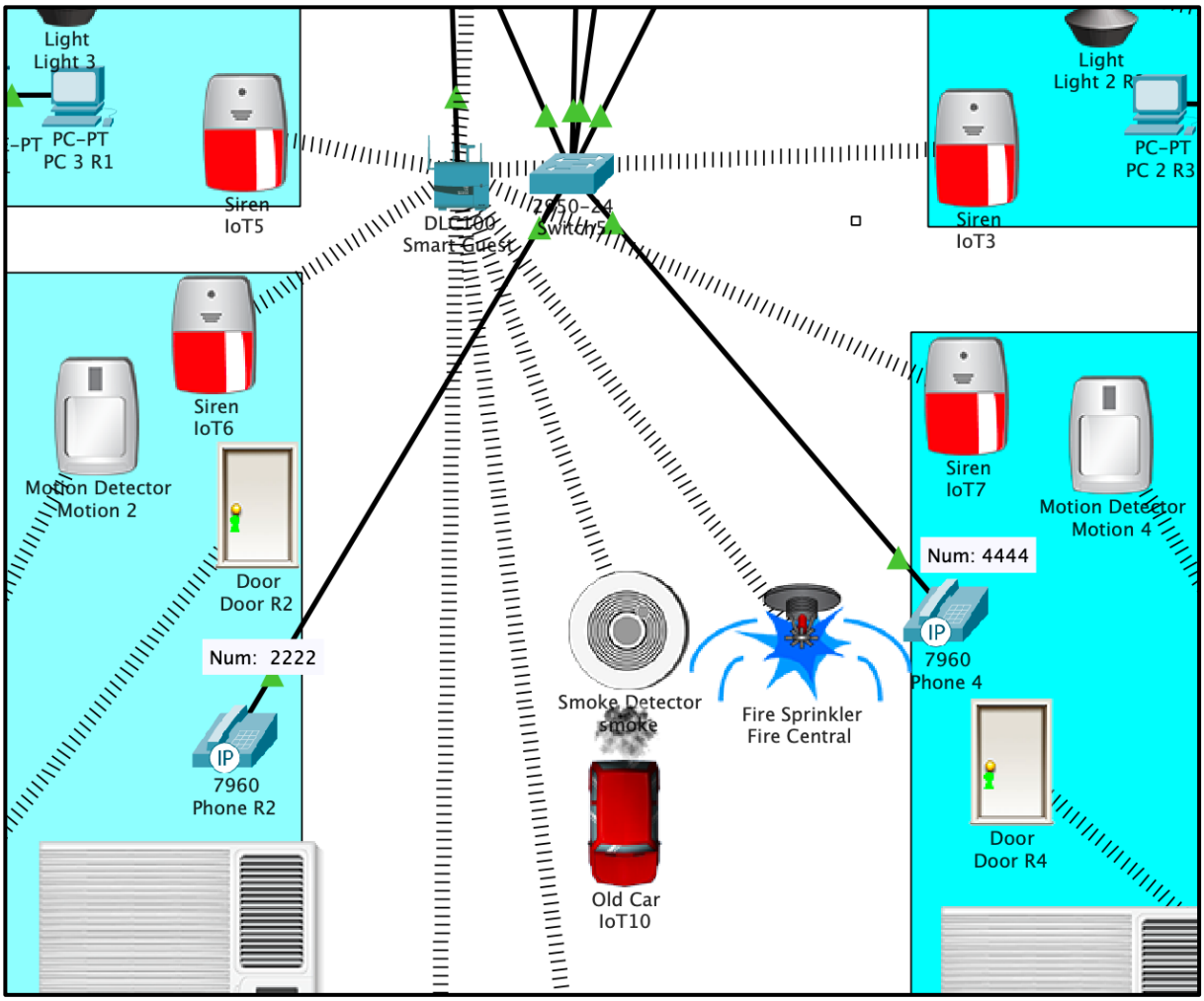


Fig3.9 **CONDITIONS FOR SMOKE DETECTOR ARE MET**

CHAPTER 4

CONCLUSION AND FUTURE WORK

4.1 CONCLUSION

- The smart college network was built and implemented.
- Various sensors, IOT devise, routers and switches were deployed.
- The system implemented a wireless network inside the rooms using a home gateway.
- Various conditions were set inside the IOT monitor of the home gateway and devices were configured to connect to the home gateway.
- The prototype design was based in hostel which can later be implemented around classes.

4.2 FUTURE WORK

- In the times of the present pandemic crisis the network can be added with an IR thermometer to monitor the temperature of each student on entry and to alert the admin when someone is symptomatic.
- RFID sensors can be used to the for automatic attendance purposes using the ID card RFID chip.
- The sprinklers can be used to sanitize the class rooms.
- A PIR sensor can be used to detect human presence and a timeout adjusted to it can help the automation of devices switch off like lights, fan, air-conditioner etc. when no human is detected for a substantial amount of time.

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