External Project Report on Computer Networking (CSE3034)

Smoke Detection and Fire Prevention System using Cisco Packet Tracer

Submitted by

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Declaration

We, the undersigned students of B. Tech. of **Computer Science Engineering** Department hereby declare that we own the full responsibility for the information, results etc. provided in this PROJECT titled "**Smoke Detection and Fire Prevention using Cisco Packet Tracer**" submitted to **Siksha 'O' Anusandhan Deemed to be University, Bhubaneswar** for the partial fulfillment of the subject **Computer Networking (CSE 3034)**. We have taken care in all respect to honor the intellectual property right and have acknowledged the contribution of others for using them in academic purpose and further declare that in case of any violation of intellectual property right or copyright we, as the candidate(s), will be fully responsible for the same.

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Abstract

Environment has been deeply harmed by humans since a great deal of time, but with the technological advancements we can try and heal it. Detection of fire in homes is necessary to avoid destruction of property due to fire accidents both natural and induced. Detection of fire can prove to be very important as it could mean the difference between life and death. Fires can occur from anywhere and at any point of time, hence the presence of Fire Alarm System helps in keeping your family safe. An automatic smoke detecting system will notify the individual as well as take necessary actions in the home in order to prevent the fire from spreading. It will help in detecting fire or smoke at an early stage and can help in saving lives. In our proposed system we are making use of Internet of Things as the technology and though a smoke sensor we will notify various home equipment's to take appropriate actions in order to stop the fire from spreading. The system is beneficial as it not just buzzes an alarm but also alerts the home appliances to do as they are needed.

Contents

1. Introduction

1.1. Motivation

Fire is very deadly and it leads to loss of human life and property. Fire detection systems are necessary to reduce the destruction of personal belongings and caused by fire both man made and induced. One of the most destructive properties of fire is that it spreads exponentially and with the right medium can spread uncontrollably. This is why timely detection of fire is necessary for avoiding a fire hazard. The Internet of Things is a collection of sensor, actuators, software, electronics embedded with home appliances, physical devices and vehicles which connect with each other to connect and exchange date which helps in increasing the efficiency of everyday appliances using computer-based systems.

1.2. Problem Definition

Fires cause serious damage and disrupts daily life in a devastating manner. Hence preventing them or reducing their effects is a top priority. Though there are many systems that have been created to tackle this problem, false alarms are a challenge that is yet to be avoided. Our model, using smoke sensors alerts all the home appliances so that they can take their appropriate actions. The appliances that will be alerted are doors, windows, sprinklers, garage doors etc.

1.3. Scope

Our model, consisting of the smoke sensor has been conditioned to a limit of 0.5; which implies that if the smoke level detected by the sensor reaches more than the level set, appropriate actions will be taken. This can be changes according to the desire of the individual, situation or surroundings. Furthermore, there are a limited set of appliances that are prompted by the smoke sensor; which can be changed. Windows, doors and garage doors open when the smoke level exceeds the given level. The sprinklers too start spraying water in order to prevent the spread of fire in the household

2. Problem Statement

Unawareness of probable fire breakouts and inadequate time to react to such conditions has led to an alarming rate of accidents. It is of knowledge that smoke released before fire breakout is an indication to alert occupants to take up necessary action. Studies reveal In 2021, 1,353,500 fires resulted in 3,800 civilian deaths and 14,700 injuries. Fire detection systems have been designed to detect fire early and give time for evacuation. The one major limitation is that they do nothing to contain or control the fire.

This mini project is an exhaustive research on the topic fire detection and smoke prevention. It aims at giving an idea on how can we detect smoke and alert the occupants and prevent fire through the alarm system through the various connected components that make up the system. Through the use of devices interconnection, we have elaborated the working of the model and used Cisco Packet Tracer to implement the same.

3. Methodology

3.1. Computing Environment

Our Smoke detection and fire prevention project was implemented on Cisco packet tracer for

testing. Components used for our project are as follows:

1. Home Gateway: A router that forwards the data to the server and the control information to the connected devices for alerting purposes and hence allows it to take necessary actions to extinguish the fire.
2. Door: Affects Argon, Carbon Monoxide, Carbon Dioxide, Hydrogen, Helium, Methane, Nitrogen, O2, Ozone, Propane, and Smoke. When the door is opened, those gases will decrease to a maximum of 2% in total change. When the door is opened, the rate of transference for Humidity and Temperature is increased by 25%. The rate of transference for gases is increased by 100%.
3. Smoke Detector: Detects Smoke. Alarm will go off when it detects the environment variable SMOKE at the level of 40%.
4. Fire Sprinkler: Raises the water level. Affects Water Level at a rate of 0.1 cm per second. This is connected to the smoke detector.
5. Siren: Makes a loud emergency noise when activated. It is activated when certain conditions are encountered.
6. Garage Door: Affects Argon, Carbon Monoxide, Carbon Dioxide, Hydrogen, Helium, Methane, Nitrogen, O2, Ozone, Propane, and Smoke. When the door is opened, those gases will decrease to a maximum of 4% in total change. When the door is opened, the rate of transference for Humidity and Temperature is increased by 50%. The rate of transference for gases is increased by 100%.
7. Smartphone: This is the user interface that allows the user to know that

a fire occurred at their place with the help of the application running on their smartphone and the amount of smoke generated and hence take necessary steps.

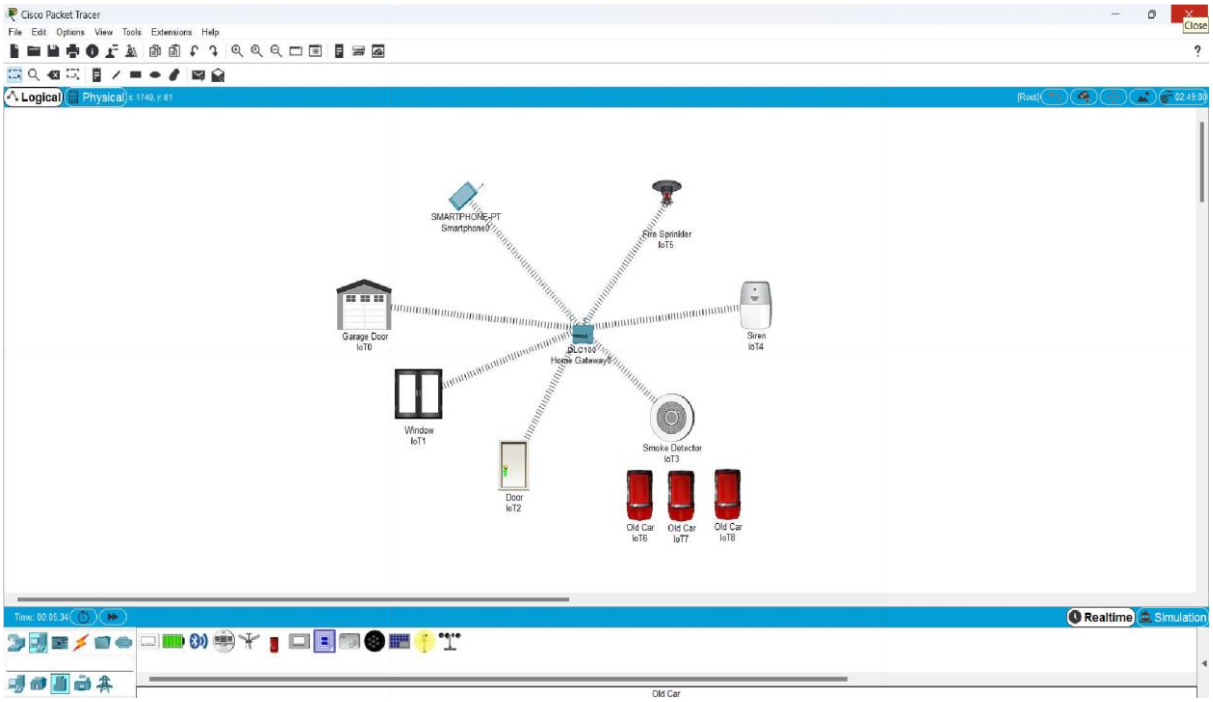
8. Window: A window is an opening in a wall, door, roof or vehicle that allows the passage of light, sound, and sometimes air.

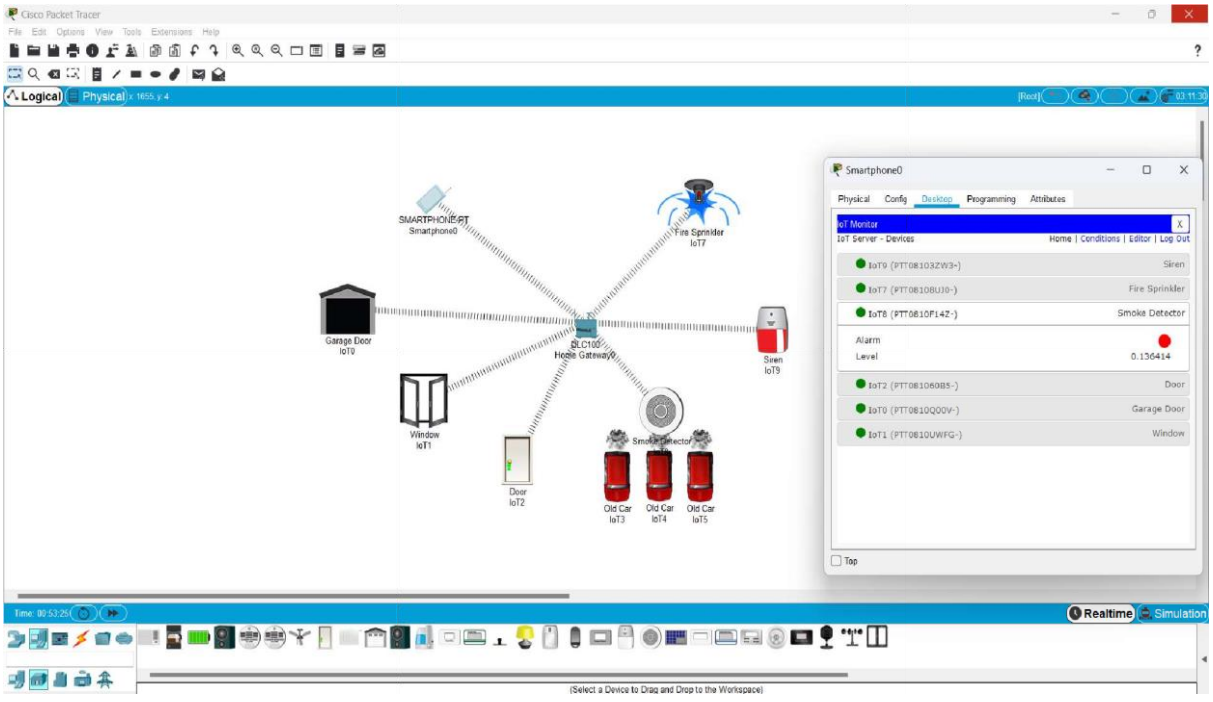
3.2 Project Implementation Schedule

Sr no.	Task Name	Duration	Start Date	End Date
1	Planning	1 days	14-01-2023	15-01-2023
2	Design	1 days	14-01-2023	15-01-2023
3	Implementation	1 days	15-01-2023	16-01-2023
4	Testing	1 days	15-01-2023	17-01-2023

The duration of the project was 15 weeks. So, the first two weeks were allocated for planning of the project. The planning included what topics to be covered and which components will be required for the project to be completed. Also, the flow of the tasks was also decided in the planning phase. Then, four weeks were allocated for the designing phase. In this phase, the architecture of the system was developed. We designed the architecture for our Wireless Network. The connection of the devices was drawn out visually. The next part was the implementation part to which we allocated 6 weeks. In the implementation part, we created our project in the Cisco Packet Tracer. We created a network and made the configurations as required. We had to make changes several times before we finally developed the complete system. The last three weeks were allocated for the testing of the developed system. In this phase, we created many test cases based on our system. These test cases were then checked in the system to get a result on whether the system is performing as desired or is there any malfunction. The test cases were covered for almost all the modules in the project.

4. Implementation





4.1. Configuration

1. DLC Home Gateway
   - Created a web page with username and password to connect and gain control of the system.
   - Registration can be done on this router.
   - Range of the router is set to maximum (1000 meters or 1km).
   - Ip address is assigned as 192.168.25.1 dynamically.

2. Smartphone
   - Connect to the system by going to the web browser and entering the IP of the registration server and logging in using ID and Password.
   - Ip address is assigned as 192.168.25.100 dynamically.

3. Smoke Detector
   - Smoke Detector is used to detect any smoke. E.g., When a fire breaks out the smoke detector will detect it. And in our project when the smoke level goes beyond 0.5, certain conditions are triggered such as door, windows are opened and fire sprinkler and siren are turned on.
   - It is connected to Home Gateway using advanced setting in I/O config i.e.

   (PT-IOT-NM-1W) network adapter setting.
   - Dynamic IP address is assigned using DHCP.

4. Window
   - A window is an opening in a wall that allows the passage of light, sound, and sometimes air.
   - It is connected to Home Gateway using advanced setting in I/O config i.e.

   (PT-IOT-NM-1W) network adapter setting
   - Dynamic IP address is assigned using DHCP

5. Door
   - A door is an opening from where people can enter or leave in a normal routine life as well as in emergency.
   - It is connected to Home Gateway using advanced setting in I/O config i.e.

(PT-IOT-NM-1W) network adapter setting
• Dynamic IP address is assigned using DHCP

6. Garage door
   • A Garage door is an opening from where vehicles can enter or leave. In our case this is very crucial as garage doors are huge and can help the air escape when there is a fire outbreak, releasing carbon dioxide and other gases into the air and helping any people to take clean air if they are stuck in the house.

   It is connected to Home Gateway using advanced setting in I/O config i.e. (PT-IOT-NM-1W) network adapter setting
   • Dynamic IP address is assigned using DHCP

7. Fire sprinkler
   • The fire sprinkler sprays streams of water to suppress or extinguish the fire when ordered by the home gateway. This happens when smoke detector detects smoke level more than 0.5.
   • It is connected to Home Gateway using advanced setting in I/O config i.e.

   (PT-IOT-NM-1W) network adapter setting
   • Dynamic IP address is assigned using DHCP

8. Siren
   • A siren is device which makes a loud emergency sound when the smoke detector detects smoke level greater than 0.5.
   • It is connected to Home Gateway using advanced setting in I/O config i.e.

   (PT-IOT-NM-1W) network adapter setting
   • Dynamic IP address is assigned using DHCP

9. Car
   • In Cisco-packet tracer there is no object or entity which can simulate the generation of smoke other than a car.
   • So, we have used 3 cars to represent smoke generation which is similar to smoke generated during fire.

Condition: To implement the project, we need to specify certain conditions on which all the devices can be activated and deactivated. Based on how

and when these conditions change, there will be changes in the state of the devices. To simulate smoke, we have used 3 cars. The conditions which are mentioned above and are crucial for this simulation are as follows

IoT Server - Device Conditions

Home | Conditions | Editor | Log Out

Actions	Enabled	Name	Condition	Actions
Edit Remove	Yes	Smoke detction	Smoke Detector Level >= 0.5	Set Garage door On to true Set Siren On to true Set Door Lock to Unlock Set Window On to true Set Fire Spinkler Status to true
Edit Remove	Yes	Smoke Detector off	Smoke Detector Level < 0.5	Set Garage door On to false Set Siren On to false Set Door Lock to Lock Set Window On to false Set Fire Spinkler Status to false

5. Results & Interpretation

Test Case no.	Test Case	Expected Output	Actual Output	Result
1	When smoke detector detects smoke level > 0.5	Door open, window open, garage door open, sprinkler on, siren on.	Door open, window open, garage door open, sprinkler on, siren on.	Pass
2	When smoke detector detects smoke level < 0.5	Door close, window close, garage door close, sprinkler off, siren off.	Door close, window close, garage door close, sprinkler off, siren off.	Pass

Deployment

This system can be of great in domestic as well as industrial settings to detect smoke and alert people on an impending fire since smoke is a precursor for fire, instead of relying on heat/temperature sensors which sounds alarm when the fire has already started. This can go a long way in helping to save human life.

Maintenance

1. All the components must be regularly checked for proper working.
2. Based on the condition set, check whether all devices are working.
3. The Home gateway is up all the time.
4. Smoke Detector should be able to detect presence of smoke all the time.

6. Conclusion

In this Mini Project, we used the Packet Tracer tools to build a Smoke & Fire Detection System and applying wireless connection between an Access Point, Registration Server and important and famous IoT devices. Speaker and Default Warning Station Connected through a Bluetooth Connection. Our proposed Smoke &Fire Detection System simulation model involved Nine places, two of them were Access Point, Registration System, Siren, Window, Garage Door , one on the incoming door, and the Speaker Connected with Default Warning Station. All these areas had one wireless and IoT devices, and all of them were connected to a home gateway and were controlled Via Access Point.

In this Mini Project, we concluded that the Packet Tracer simulator is simple, easy, powerful, and great for building smart homes depending on the wireless and IoT technologies.

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