# PROJECT TITLE

A COURSE PROJECT REPORT

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# FACULTY OF ENGINEERING AND TECHNOLOGY SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

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**SRM INSTITUTE OF SCIENCE AND TECHNOLOGY**

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**BONAFIDE CERTIFICATE**

Certified that this project report "**Smoke Detection and Fire prevention**" is the bonafide work of **VARUN KHAREEDU (RA1911027010118)** who carried out the project work under my supervision.

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# Computer networks – Course Project Formatting Instructions

1. Chapter number and Chapter heading – **font size 16, upper case, bold.**
2. Space between Chapter number and Chapter heading - **double spacing.**
3. Space between heading and contents – **double spacing.**
4. Abstract heading – **font size 16.**
5. Content of abstract – **font size 14, double spacing.**
6. Sample document is given below, follow it for **font size, upper/lower case , spacing**
7. Sub-heading example as follows.

# REQUIREMENT SPECIFICATION (Times New Roman 14)

* + 1. **Hardware Requirements (Times New Roman 12)**

Processor : 2.4 GHz Clock Speed RAM : 1 GB

Hard Disk : 500 MB (Minimum free space)

## Software Requirements

Operating System : Windows 7 Platform : Java

Back End : MySQL

Special Tools : OpenCV Xuggle Server : Apache Tomcat

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# ABSTRACT:

Fire is the major cause of accidents claiming valuable lives and property. Smoke detectors play an important role in a fire prevention management program. Timely detection of the fireplace is vital for avoiding a serious accident. In this project, a Fire prevention and Smoke detection system is developed. It can sense smoke and the rise in temperature and alert the user by activating the siren and also send commands on the virtual terminal of the android phone through the Wi-Fi module. Fire hazards are not uncommon. To avoid injury from fire accidents, smoke detectors are put in high-security places. The hardware used is Home Gateway, Switches, Smoke detectors, Fire sprinklers, Smoke sensor, Wi-Fi Module, and Siren. Software used Home Gateway for mobile applications. These smoke sensors detect smoke because the fire break associated invokes an early alarm. This way, before the fire spreads to different components of the building, people can be evacuated, and countermeasures can be done immediately. The detection system operates as a fire detector and smoke detector sensor. In this, we discuss the design and implementation of a smoke detection system using the Home Gateway which operates the entire system.

The Home Automation is a wireless home automation system that is supposed to be implemented in existing home environments, without any changes in the infrastructure. Home Automation let the user to control the home from his or her computer and assignations that should happen depending on time or other sensor readings such as light, temperature or sound from any device in the Home Automation network

Many people are always on the move from place to place due to business demands. Some people can spend a couple of days away from their home leaving all their household appliances without any kind of monitoring and control. Some devices are left plugged into power sockets whereas others are supposed to be plugged into and out of power sockets at different intervals depending on the time of the day. All this requires an individual to manually attend to each of the devices independently from time to time. All such monitoring and control can be done without necessarily being around or inside the home. Some devices if not controlled properly consume a lot of energy which leads to extra expenditure on electricity. Therefore, we propose to design an internet-based home automation system which will enable one to remotely manage his/her appliances from anywhere, anytime.

***Keywords:*** *SMOKE DETECTOR AND FIRE PREVENTION, FIRE, SENSORS, DETECTORS, IoT, SOMKE SENSORS*

1. **INTRODUCTION:**

Home fire detection is a matter of great concern, and thus many efforts are devoted in most developed countries to the design of automatic detection systems. A fire prevention system should reliably and in a timely way notify building occupants about the presence of fire indicators, such as smoke or high temperatures. A fire detector is usually implemented as a smoke sensor due to its early fire detection capability, fast response time, and relatively low cost. Other options for fire detection are based on gas sensors or temperature sensors fire detectors that use a single sensor, generally a smoke sensor, and present high false-siren rates due to temperature changes.

With advancement of Automation technology, life is getting simpler and easier in all aspects. In today’s world Automatic systems are being preferred over manual system. With the rapid increase in the number of users of internet over the past decade has made Internet a part and parcel of life, and IoT is the latest and emerging internet technology. Internet of things is a growing network of everyday object-from industrial machine to consumer goods that can share information and complete tasks while you are busy with other activities. Wireless Home Automation system (WHAS) using IoT is a system that uses computers or mobile devices to control basic home functions and features automatically through internet from anywhere around the world, an automated home is sometimes called a smart home. It is meant to save the electric power and human energy. The home automation system differs from other system by allowing the user to operate the system from anywhere around the world through internet connection.

In this project I present a Home Automation system (HAS) using Cisco Packet Tracer that employs the integration of cloud networking, wireless communication, to provide the user with remote control of various lights, fans, and appliances within their home and storing the data in the cloud. The system will automatically change based on sensors’ data. This system is designed to be low cost and expandable allowing a variety of devices to be controlled.

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 equipments 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.

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 inorder to prevent the spread of fire in the household.

1. **REQUIREMENT ANALYSIS:**

## 3.1 HARDWARE REQUIREMENTS:

|  |  |  |
| --- | --- | --- |
| **Requirement (#)** | **Requirement** | **Specification** |
| HR1 | Computer Hardware | Athealt 4 GB of RAM and 4 cores |
| HR2 | Processor | 2.4 GHz Clock speed |
| HR3 | Hard Disk | Minimum 500MB of free space |

## 3.2 SOFTWARE REQUIREMENTS :

|  |  |  |
| --- | --- | --- |
| **Requirement (#)** | **Requirement** | **Specification** |
| SR1 | Operating System | Any Windows/Linux |
| SR2 | Platform | Cisco Packet Tracer |
| SR3 | Execution Purpose | Packet Tracet |

## 3.2 FUNCTIONAL REQUIREMENTS :

|  |  |  |
| --- | --- | --- |
| **Requirement (#)** | **Requirement** | **Status** |
| FR1 | Smoke detectors must be able to detect the smoke in the house and should give the alert siren to all the Devices | Done |
| FR2 | The Detector should not be delayed in the smoke detection and fire preventing | Done |
| FR3 | IOT Devices should be easily monitored and controlled from our Smartphone/laptop | Done |

1. **ARCHITECTURE & DESIGN:**

First the sensors sense their respective parameters and the values sensed are converted into the appropriate format which are then fed to the actuators. The actuators are activated based on the input given following predefined conditions

#### Architecture Diagram:

The Below is the Architecture Diagram for the Smoke Detection Project of our Smart Home will give a more precise idea on what are the functions that it does. The block diagram contains temperature monitoring system, humidity monitoring system, fire detection system, co2 detection system, smart lighting system, moisture monitoring system, solar energy generator system, smart door system [9]. All the devices are connected using internet. A smart phone is used to monitor the devices in the greenhouse. Wireless devices are used to implement the designed system

Diagram

Description automatically generated

#### Sequence Diagram:

This Diagram shows the interaction between the system processes and its environment. The environment is made up of the administrator and users. The administrator sets up the NN system, carries out training and validation of the system before deploying it for users. The users who are the owners of buildings and the fire men receives alerts from the system through the process called the TPLNN output.

A picture containing diagram

Description automatically generated

#### Flow Chart:

This Flow chart shows the Operations performed in our project in a sequence way. First the sensors sense their respective parameters and the values sensed are converted into the appropriate format which are then fed to the actuators. The actuators are activated based on the input given following predefined conditions.

Diagram

Description automatically generated

These smoke & fire detection systems use automatic functions to detect the occurrence of an event that may result in a fire. They receive a sign from a fireplace sensing smoke and mechanically transmit it to the fireplace siren panel. The fire siren panel activates sprinklers and opens all windows and doors.

1. **IMPLEMENTATION:**

To implement smart home using cisco packet tracer I used different sensor, smart device and detector to make smarter. The following figure represent the home architecture that connected each other using wireless and wired medium.

In this Section, we will employ the Packet Tracer tools to build a smart home and applying a connection between smartphone and important and famous IoT devices. The proposed smart home consists of four places: the front door, the living room, the kitchen, and the garage. All these areas contain some wire-less and IoT devices, and all of them connected to a home gateway and controlled by a smartphone. The overall smart home design using Packet Tracer soft- ware presented in Figure 1. We will show how to use sensors to make IoT devices to react automatically with the condition of the environment. For example, the monitoring server can turn on the fan when the temperature is high. The important primary step is to set the home gateway parameters like the name in the Service Set Identifier (SSID) property with a suitable passkey.

The Dynamic Host Configuration Protocol (DHCP) manages the devices IP addresses. Subsequently, building the other IoT devices distributed in the four areas inside the smart home. The next step is to connect the smartphone to the home gateway; we use the same SSID, and the passkey defined before in the home gateway. Finally, the user can access to the smartphone by using the IoE monitor app and write the appropriate rules for managing and controlling all the connected devices, as shown in the next Subsections.

Currently cisco released new version of packet tracer that include IOE device with classically networking device. Boards is also added to this version those are microcontrollers (MCU-PT), single boarded computers (SBC-PT) that provide programming environment to control connected object. Benefits of new released Packet Tracer are:

* Offers a realistic simulation and visualization of IOT device
* Permits users to design, build, configure smart home, smart city by providing different smart object used for them.
* Provide board to control smart object
* Allows students to explore concepts IOE
* Provide detector for sensor

**COMPONENTS NEEDED:**

1. Smoke detectors
2. Fire sprinkler
3. Windows
4. Doors
5. Garage door
6. Siren
7. Home Gateway
8. Switch
9. Smart device

**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.

1. **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.

1. **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.

1. **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

1. **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

1. **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 13 Smoke Detection and Fire Prevention 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

1. **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

1. **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

1. **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.

**Device Configuration and Setup:**

ISP Router Configuration

Assigning hostname and Ip address for ISP router

Router>

Router>enable

Router#conf terminal

Router(config)#hostname ISP

ISP (config)#intgigabitEthernet 0/2

ISP (config-if) #ip address 10.10.220.1 255.255.255.0

ISP (config-if) #no shutdown

ISP (config)#intgigabitEthernet 0/0

ISP (config-if) #ip address 209.165.200.225 255.255.255.224

ISP (config-if) #no shutdown

ISP (config)#intgigabitEthernet 0/1

ISP (config-if) #ip address 209.165.201.225 255.255.255.224

ISP (config-if) #no shutdown

### Configurating dhcp server for cell and IOE device :

ISP (config)#ipdhcp excluded address 209.165.201.225 209.165.201.230

ISP (config)#ipdhcp pool cell

ISP (dhcp-config) #network 209.165.201.225 255.255.255.224

ISP (dhcp-config) #default-router 209.165.201.225

ISP (dhcp-config) #dns-server 10.10.220.10

ISP (config)#ipdhcp excluded address 209.165.200.225 209.165.200.230

ISP (config)#ipdhcp pool ioe

ISP (dhcp-config) #network 209.165.200.224 255.255.255.224

ISP (dhcp-config) #default-router 209.165.200.225

ISP (dhcp-config) #dns-server 10.10.220.10

**STEPS OF IMPLEMENTATION:**

🡪 Create a House:

Graphical user interface, application

Description automatically generated

🡪 Place the devices in the house:

Graphical user interface, application

Description automatically generated

🡪 Connect/configure all components with the home gateway:

Diagram

Description automatically generated

🡪 Write condition for automation of fire prevention:

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:

Table

Description automatically generated

🡪 **Running (On):**

Graphical user interface, diagram

Description automatically generated

🡪 **Running (Off):**

Diagram

Description automatically generated

**Testing:**

#### Test Case no.1

Test Case: When smoke detector detects smoke level > 0.5

Expected Output: Door open, window open, garage door open, sprinkler on, siren on.

Actual Output: Door open, window open, garage door open, sprinkler on, siren on.

Result: Pass

#### Test Case no.2

Test Case: When smoke detector detects smoke level < 0.5

Expected Output: Door close, window close, garage door close, sprinkler off, siren off.

Actual Output: Door close, window close, garage door close, sprinkler off, siren off.

Result: 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.

1. **EXPERIMENT RESULT & ANALYSIS:**

**6.1. Results:**

Smoke detectors are connected to our smartphones. As sensors detect the smoke its sends signals to siren and then from them through home gateway, they will reach the switches. The doors, windows and sprinklers all start to function as they receive the signal. Sprinklers will shower the area with water and the produced hazardous gas can be sent out through the windows and doors. We can evacuate the civilians through the doors or garage door when the respective area catches the fire. Siren helps us to take extra counter measures if there is too much of the fire and smoke is produced in an incident. Thus, we can detect the smoke and we can extinguish the fire.

The fan is moving at high speed , the door is unlocked , the siren is on , the window is open and webcam has started recording . This is based on the conditions made on the Home Gateway that the legitimate user is able to control the brightness of light (off , dim , on) , control fan speed (off , medium , high) , control door (lock , unlock) , control window (open , close) and monitor webcam recording.

Graphical user interface, diagram

Description automatically generated

In this Above Picture, it was clearly shown that the All the mentioned IOT devices are clearly opened and sprinkled at the right time. So , it clearly states that it will also be a smart home which will be operated from my smartphone anywhere.

After the successful connection to the server, the data of sensor are sent to the web server for monitoring of the system. the web server page which will allow us to monitor and control the system. By entering the assigned IP address in the web browser this web server page will appear. The web server gives the information about the temperature in different places of the house and motion state in the house. It also gives the status of the various electrical appliances like light, fan etc which we can control remotely.

**6.2. Result Analysis:**

One of the main analytical information we found from using smart smoke detector is that it can detect a fire much faster than a traditional one. A standard smoke detector works by identifying situations when there is too much smoke in each room. Smart smoke detectors go a step further than this as it will identify when a room is too hot or has experienced a dramatic increase in the temperature.

* Another added analysis we found is that smart smoke detector is that it will send out a variety of different notifications and alerts to different parties.
* These smart smoke detectors can be connected to an infrastructure system that will notify your local fire department if there is a fire present. Less prone to false alarms from cooking fumes or shower steam
* Do not contain radioactive materials, making them safer for use

**6.3. Conclusion and Future Work:**

A smoke alarm is critical for the early detection of a fire in your home and could mean the difference between life and death. Fires can occur in a variety of ways and in any room of your home. But no matter where or how, having a smoke alarm is the first key step toward your family’s safety. Smoke detectors are great because they save lives. There are smoke detectors formed as noses, to smell for smoke. There should be a minimum of two or three smoke detectors in your home. You should install a smoke detector on each floor of a house. Always have a smoke detector and fire prevention system in your home for your safety.

In this project, I implemented smart home using new released cisco packet, because this version included different IOE device used for home automation. I used home Gateway to register smart device on it to control them and Microcontroller (MCU) to interconnect different sensor and IOE device. Also, MCU provide programming environment to manage different device, different programming language available on MCU but I used JavaScript and python to control the device.

As we all are aware that the world is getting more and more connected and IoT does just that. Many tech entrepreneurs are already starting off with IoT and making huge profits out of it. Keeping the profits aside, if we think of it in a broader way, then we conclude that IoT has a great future and in the next five years, it is going to revolutionize the world. IoT is like clay that can be molded in any way we wish, if provided with enough skills and expertise.

The home automation using Internet of Things has been experimentally proven to work satisfactorily by connecting simple appliances to it and the appliances were successfully controlled remotely through internet. The designed system not only monitors the sensor data, like temperature, gas, light, motion sensors, but also actuates a process according to the requirement, for example switching on the light when it gets dark. It also stores the sensor parameters in the webpage (database) in a timely manner. This will help the user to analyze the condition of various parameters in the home anytime anywhere.

we used the Packet Tracer tools to build a smart home and applying a wireless connection between a smartphone and important and famous IoT devices. Our proposed smart home simulation model involved four places, two of them were inside the house (living room and kitchen), one on the incoming door, and the fourth one was a garage. All these areas had some wireless and IoT devices, and all of them were connected to a home gateway and were controlled by a smartphone. In this research, we concluded that the Packet Tracer simulator is simple, easy, powerful, and great for building smart homes depending on the wireless and IoT technologies. As future work, a comparison between the current model and another one can be established by measuring some metrics like the simulation time and the transmission delay.

#### Future Work:

Smoke detectors are great because they save lives. There are smoke detectors formed as noses, to smell for smoke. There should be a minimum of two or three smoke detectors in your home. You should install a smoke detector on each floor of a house. Always have a smoke detector and fire prevention system in your home for your safety.

In the Future, we can add more Technology techniques to our project, to detect the smoke and send it to the connected Smart Home/Laptop. And also, it to automatically redial to the local police station and Fire station and also, we can include the Ambulance Services. Finally, we can increase our safety to our homes and our Family.

**Maintenance:**

User manual -

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.

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