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A Mini Project Report on

Design and Implementation of Smoke Detector and Fire Prevention System using Cisco Packet Tracer

for the subject

Computer Communications

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ABSTRACT

Wireless networks, Internet of Things (IoT), Internet of Everything (IoE), and smart homes have become extremely important terms in our present-day life. Most of the buildings, companies, institutions, and even homes depend on these technologies for interaction, communication, automation, and everything surrounding humans. To understand the advanced topics in wireless networks and IoT devices, it is necessary to use one of the practical learning tools, called Packet Tracer. This wireless network simulator is freely available by Cisco Networking Academy. In this project, we will use Packet Tracer to design a smart home smoke and fire detection alarm based on wireless and IoT devices and illustrate how to create different networking scenarios to make our homes more comfortable and safe.

OBJECTIVE

The conflagration of fire is still a serious problem caused by humans, and houses are at a high risk of fire. Recently, people have used smoke alarms which only have one sensor to detect fire. Smoke is emitted in several forms in daily life. A single sensor is not a reliable way to detect fire. With the rapid advancement in Internet technology, people can monitor their houses remotely to determine the current condition of the house.

The fire alarm is very important at home automation stations . This system is controlled by the smoking detector of CO2. The kitchen, living room, and bedrooms are used in the fire alarm system. If the CO2 of smoking from the kitchen or other rooms is detected, the smoking alarm and sprinkler will be opened. If the fire or CO2 is detected, the fire alarm or sprinkle will be operated. This system is connected to the fired station via the network by using a fiber optic. If the fire or CO2 is not detected, the fire alarm or sprinkle will be stopped.

INTRODUCTION

What Does Smoke Detector Mean?

A smoke detector/fire detector is a sensor that detects smoke as a primary indication of fire.
It provides a signal to a fire alarm system in a large building, or produces an audible and visual signal locally in a room or a home.
Smoke detectors are usually housed in a small, round shaped plastic case, and placed at the roof where there are risks of fire or fire hazards.

Smoke Detector
IoT0

why fire detection/smoke detection necessary?

Early fire detection is crucial and plays a very important role in protecting and saving lives and properties.
Having a fire detection system can significantly reduce damages and maximize fire control efforts.
It is also one of the most fundamental steps you can take for fire safety measures.
Even if you are sleeping or busy working, early fire detection will warn you and help you respond quickly so you'll be out of danger.
Here are some good reasons why you need fire detection systems at home or your business.

purpose of smoke detector/fire detector.....

Smoke alarms are important home safety tools because they increase your chances of escaping from a house fire.

Very often confused with smoke detectors that simply sense smoke then trigger a separate alarm system, a self-contained smoke alarm can sense smoke and heat before sounding the alarm contained in the unit.

It's the smoke alarm, not the smoke detector, that is found in most homes, and an alarm that's properly functioning gives early warning that makes escape more likely.

Having smoke alarms properly installed and regularly checked so they can do their job when needed is crucial.

Findings

Smoke alarms detect particles in the air. They most commonly do this using two types of detection technologies.

First, there are ionization detectors. These use a small bit of safely shielded radioactive material that electrically charges, or ionizes,
the air molecules between two metal plates. This produces a small electric current flowing from one plate to the other in the air.
When particles enter the chamber, they attract the ions and carry them away, reducing the current.

When the number of particles entering the chamber is enough to reduce that current below a certain amount,
the device will register those particles as smoke and the alarm will sound.
(And about that radioactive material?
Most of its radiation is blocked inside the device, and even then, the radiation

levels in the device are much lower than the natural background radiation to which we are exposed every day.)

The other type of commonly used detection technology is called photoelectric.

This technology works by detecting light that is reflected off particles from a light beam inside the sensing chamber.
When no particles are present in the sensing chamber, the light from the beam does not strike the light detector, indicating all clear.

When there are particles present and the amount of light registered by the light detector reaches a certain threshold level, the alarm sounds.

Both kinds of detectors can detect either slow-burning “smoldering” fires or fast-burning “flaming” fires, but each technology has its particular strengths. Ionization-based alarms tend to detect small black soot particles from flaming fires more quickly because they are produced in greater numbers and take away more current from between the plates. Photoelectric detectors tend to be more sensitive to particles that are larger in size and white or light-colored, and thus more reflective, like those emitted by smoldering fires.

As important as smoke alarms are for protecting your family and your property, many times they can be a nuisance.

Smoke alarms near kitchens can detect the particles coming off your food as it cooks, even if you don’t burn it.

Sometimes something as simple as turning on a toaster can set them off.

So as with many safety measures, smoke detectors have a trade-off. They can be made sensitive enough to detect almost any smoke.
But if they did, they would detect the smoke you don’t want them to detect (such as from cooked food) and even other things such as dust.
Less sensitive detectors would have fewer nuisance alarms, but in an actual fire, they may not go off in time to save lives or property.
Or they may not give off a signal at all.

Researchers are developing new tests and standards to make smoke alarms better at detecting the kinds of smoke we want them to detect and not the kinds we don’t,

so we’re never tempted to disable the alarms and put ourselves in danger. As a result, the next generation of smoke detectors promises to cut down on the number
of nuisance alarms while also signaling real fires more quickly. And with fire, time is everything when it comes to saving lives and property.

A smoke detector is an electronic fire-protection device that automatically senses the presence of smoke,
as a key indication of fire, and sounds a warning to building occupants.
Commercial and industrial smoke detectors issue a signal to a fire alarm control panel as part of a building’s central fire alarm system.
By law all workplaces must have a smoke detection system.

Household smoke detectors, or smoke alarms, issue an audible and/or visual alarm locally from the detector itself.
They can be battery-powered single units or several interlinked hardwired (mains-powered) devices backed up by batteries.
The latter must be installed in all new buildings and after major refurbishments.

Smoke detector types

There are two basic types of passive smoke detectors: **photoelectric (optical)** and **ionisation (physical process).**
A combination of the two types of alarm (dual sensor smoke alarm) is recommended for maximum protection from both fast flaming and slow smouldering fires.

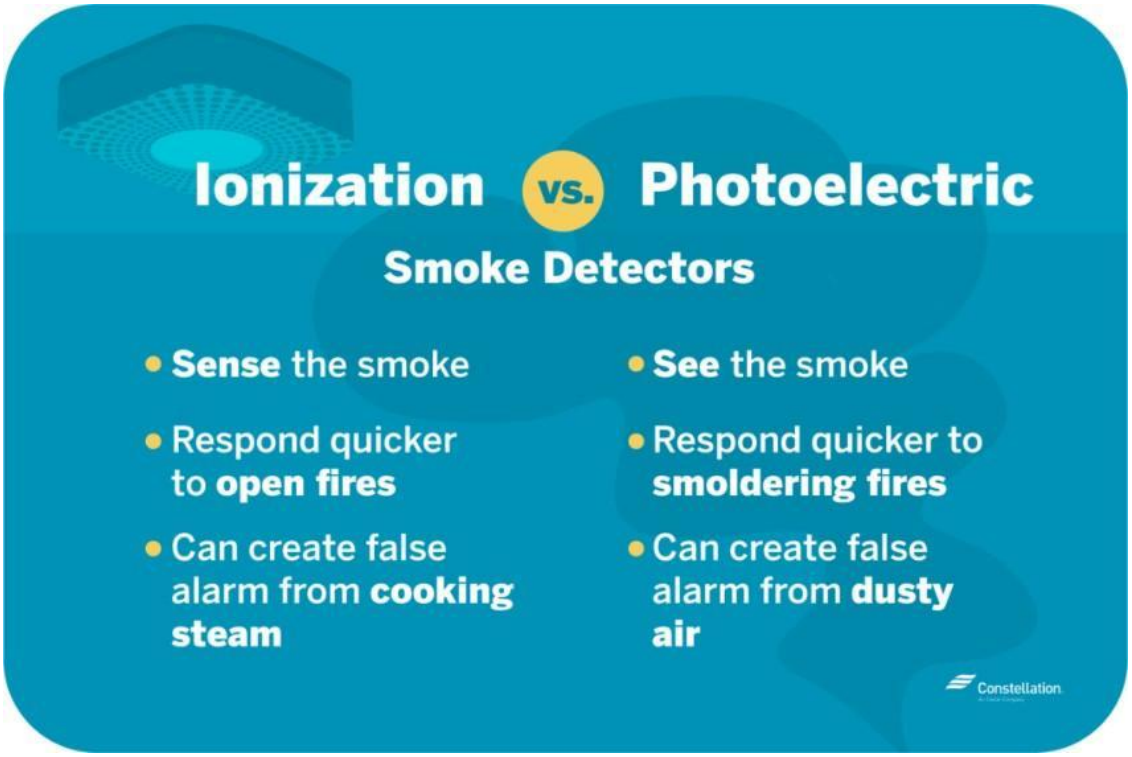
Combined optical smoke and heat alarms and combined smoke and carbon monoxide alarms are also available.

A **photoelectric detector** senses sudden scattering of light when smoke enters the detector chamber, triggering the alarm.

Photoelectric smoke detectors respond an average of 15 to 50 minutes faster to fire in its early, smouldering stage, before it breaks into flame,
than ionisation alarms. They can be installed near kitchens. Some dual optical models are available.

Ionisation smoke alarms are highly sensitive to small smoke particles and typically respond about

30 to 90 seconds faster to fast flaming fires than photoelectric smoke alarms, but not to smouldering fires.
They may be too easily set off if they are installed too close to kitchens, or garages.



Ionisation alarms carry a small amount of radioactive material between two electrically charged plates, which ionises the air and causes current to flow between the plates. When smoke enters the chamber, it disrupts the flow of ions, thus reducing the flow of current and activating the alarm.

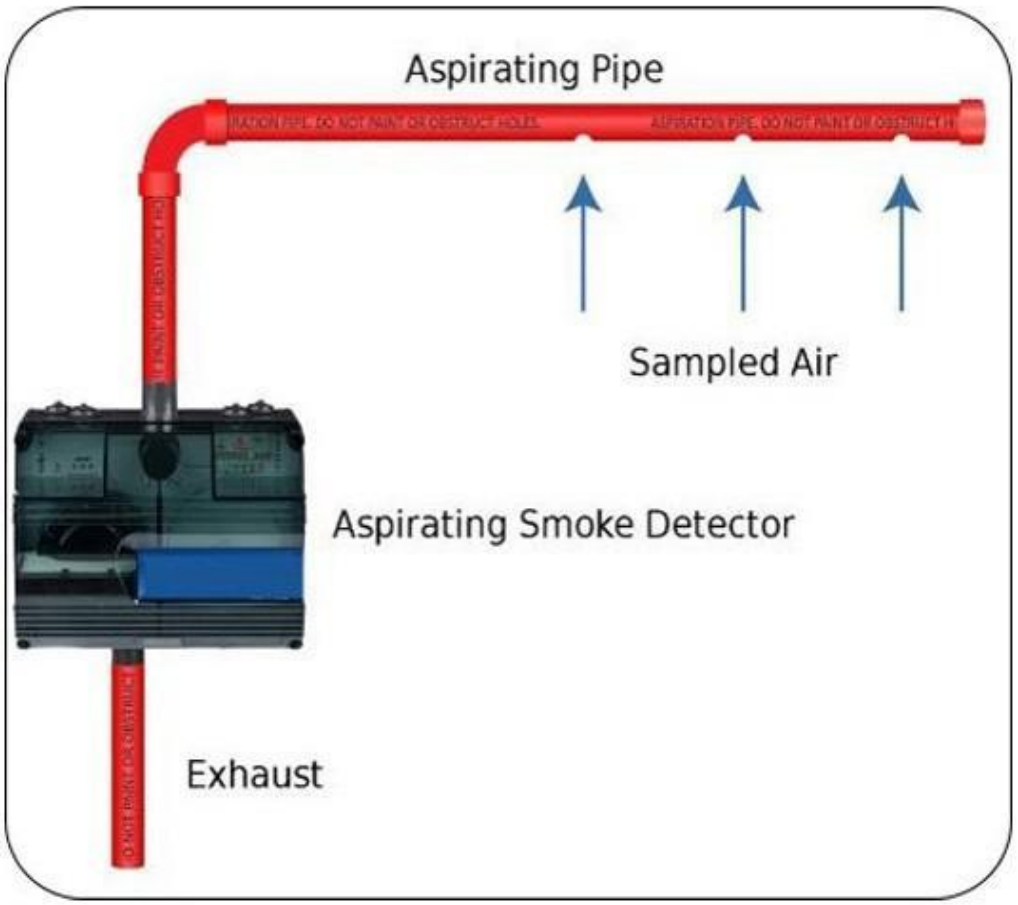
The appropriate type of smoke detector must be installed to avoid them being disabled because dust or condensation sets them off falsely.
A more appropriate detector, such as UV or infrared system which is not triggered by particles, should be installed if that is the case.

Aspirating smoke detectors

There is also an increasing number of aspirating smoke detectors (ASD) on the market – more advanced, highly-sensitive,
technologies that provide earlier warning detection and are used as part of active fire protection.

ASD systems work by drawing in air from each room through small, flexible tubing. The air is then analysed to identify
the presence of minute smoke particles in a continuous process. They are not reliant on room air flow, so can detect smoke before it is even visible.

Aspiration systems are widely used and preferred in challenging situations such as areas of high airflow, where condensation is present,
or where very early detection is required in locations such as communications and computer rooms.



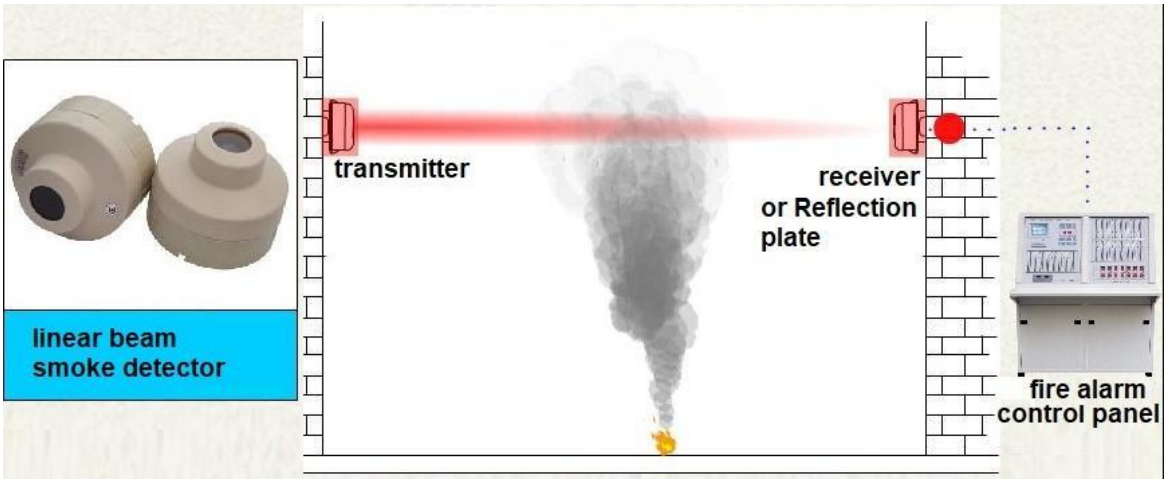
VESDA (very early smoke detection apparatus)

Systems, a brand name of Honeywell, are laser-based advanced ASDs that give a pre-fire warning.

They are beneficial in areas where high smoke sensitivity and easy access is required, such as computer rooms, cold rooms and high-ceilinged buildings like warehouses and churches, because the detectors can be located at accessi ble levels for maintenance purposes.

Auto-aligning optical beam smoke detectors

The latest type of intelligent smoke detector is a laser-assisted infrared optical beam smoke detector that self-aligns in less than a minute.
They are used to protect large commercial and public spaces such as theatres, shopping malls and sports centres with large skylights,
lofty ceilings or condensation issues.



Some models can be installed with up to four detector heads per system.

Incidentally, some smoke detectors are not smoke detectors at all, but security devices incorporating hidden cameras.

Heat alarms

Heat alarms detect an increase in temperature caused by a fire, although they are insensitive to smoke.
They are suitable for use in a kitchen, garage, or dusty room but should not be the sole means of fire detection.

HEAT DETECTOR TEMP. & COLOR CODE

According to NFPA 72 - 2019

- Heat detectors of the fixed temperature or rate compensated, spot type shall be marked with a color code in accordance with the table below.
- If the overall color of a heat detector is the same as the color code marking, one of the following arrangements, shall be applied:
  (1) Ring on the surface of the detector
  (2) Temperature rating in numerals at least (9.5 mm) high.

Temp. Classification	Temp. Rating Range (°C)	Max. Ceiling Temp. (°C)	Color Code
Low	38 - 56	28	Uncolored
Ordinary	57 - 79	47	Uncolored
Intermediate	80 - 121	69	○
High	122 - 162	111	●
Extra High	163 - 204	152	●
Very Extra High	205 - 259	194	●
Ultra High	260 - 302	249	●

#FPS, #Keeping_You_Up_To_Code

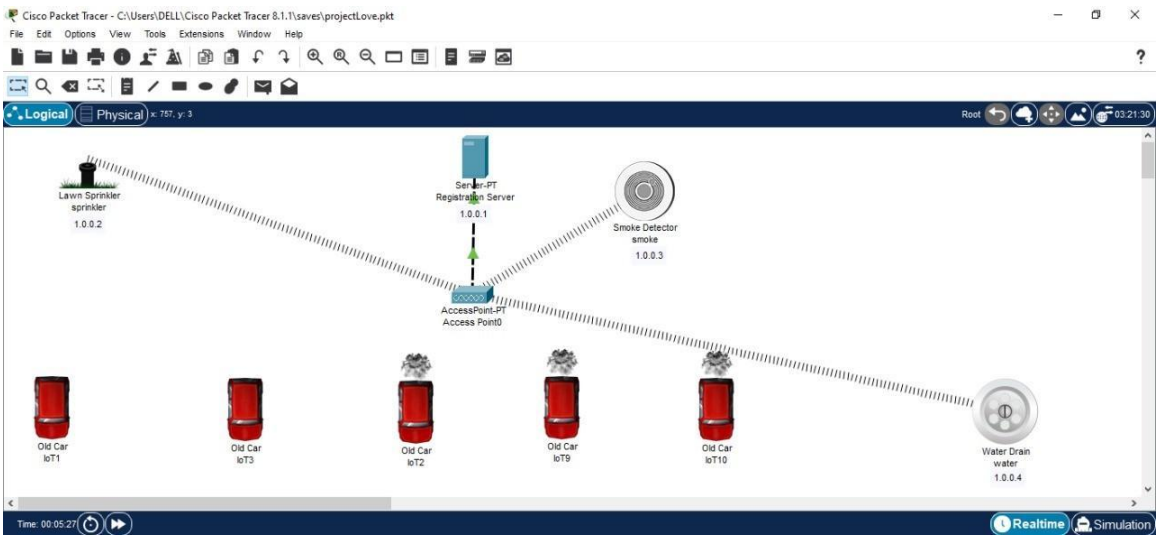
Smoke detector installation and maintenance

Mains-powered alarms must be installed by a qualified electrician or installation professional.

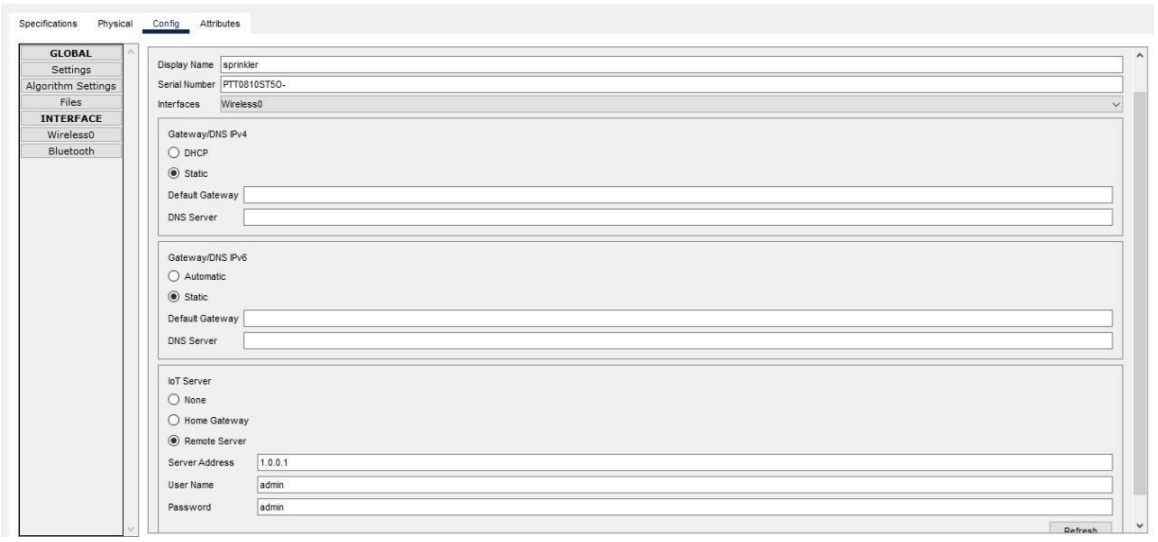
Domestic smoke alarms are much easier to install as no wiring is required, but they must be installed and maintained correctly and checked regularly.

Smoke detectors have an average life of about eight to 10 years. Detectors need to be checked periodically, ideally once a week,
and the batteries changed when required, at least once a year. A hard-wired smoke detector can last 10 years.

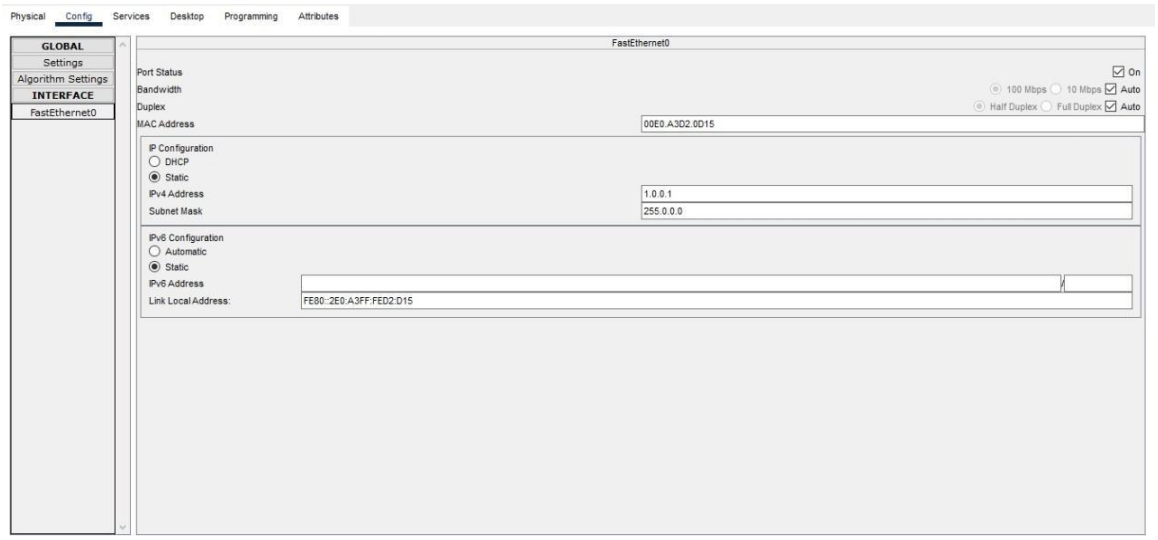
Smoke Detector And Fire Alarm System



Sprinkler Configuration



Registration Server Configuration

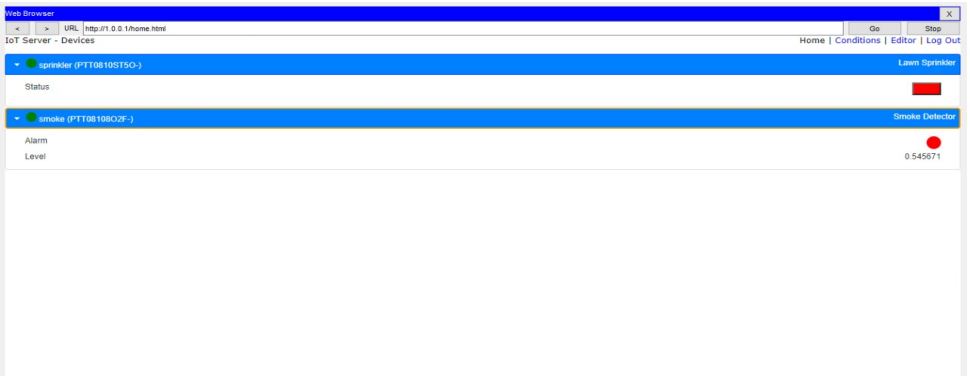


Smoke Detector Configuration

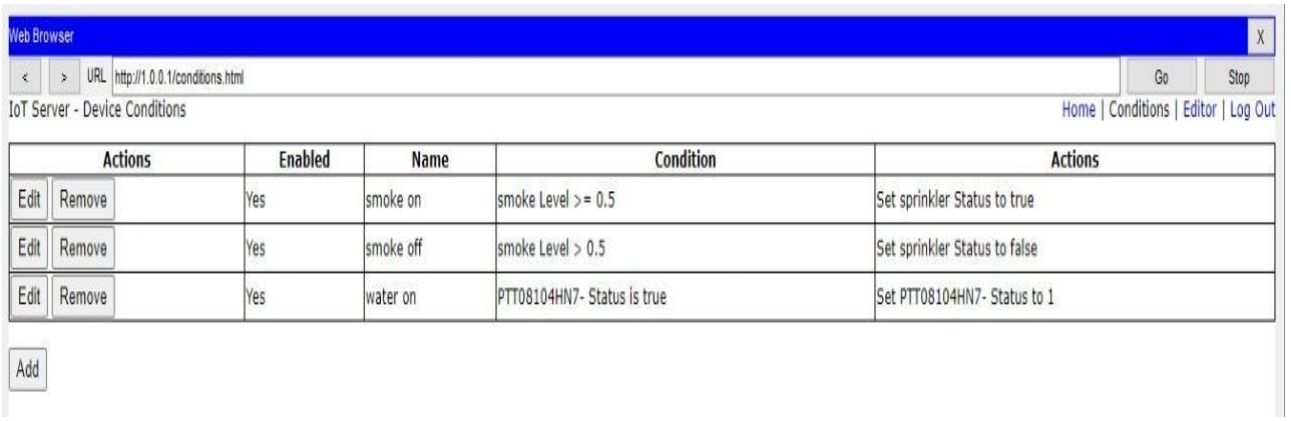
Alarm Condition

ON Condition

OFF Condition



Condition of Activation And Deactivation



Fire Safety and Burns--Injury Statistics and Incidence Rates

Burn injury and incidence rates

The following statistics are the latest available from the National SAFE KIDS Campaign and the United States Fire Administration (part of the Federal Emergency Management Agency):

Injury and death rates:

- The majority of fire-related deaths are caused by smoke inhalation of the toxic gases produced by fires. Actual flames and burns only account for about 30 percent of fire-related deaths and injuries.
- The majority of fires that kill or injure children are residential fires.
- The majority of children ages 4 and younger, who are hospitalized for burn-related injuries, suffer from scald burns (65 percent) or contact burns (20 percent).
- Fires kill about 500 children ages 14 and under each year.
- Hot tap water scald burns cause more deaths and hospitalizations than any other hot liquid burns.

Causes:

- The leading cause of home fires and related injuries is home-cooking equipment. However, most fire-related deaths are from residential fires ignited by smoking materials such as cigarettes.
- The leading cause of residential fire-related death and injury among children ages 9 and under is carelessness.
- The most common causes of product-related thermal burn injuries among children ages 14 and under are hair curlers, curling irons, room heaters, ovens and ranges, irons, gasoline, and fireworks.
- Most scald burns to children, especially small children between the ages of 6 months and 2 years, are caused by hot foods or liquids spilled in the kitchen, or other areas where food is prepared and served.

Where and when:

- Over half of children ages 5 and under who die from home fires are asleep at the time of the fire. Another one-third of these children are too young to react appropriately.
- Deadly residential fires are most likely to start in a living or sleeping area.
- Residential fires and related deaths occur more often during cold-weather months, December through February, due to portable or area heating equipment.

- Most child play related home fires begin in a bedroom or living room where children are left unattended. The majority of these fires are started by children playing with matches or lighters.

Who:

- Children in homes without working smoke alarms are at greater risk of fire-related death and injury in the event of a fire.
- Children ages 5 and under are more than twice as likely to die in a fire than any other age group.

Smoke alarm and sprinkler system statistics:

- By 2004, the majority of homes (96 percent) in the United States had at least one smoke alarm. However, only three-quarters of all homes had at least one **working** smoke alarm.
- Automatic sprinkler systems reduce the chance of dying in a residential fire by approximately 73 percent.
- Smoke alarms and sprinkler systems combined can reduce fire-related deaths by 82 percent and injuries by 46 percent.

REFERENCE

- www.researchgate.net
- www.packettracernetwork.com