

# **IMMERSIVE INTERFACE DESIGN**



## PROJECT BRIEF

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Design a **VR experience** to be used in **Fire Safety Training**.  
The target users are the fire fighters & fire safety officers of **ONGC**.





**Fire Safety Training** is a VR Application for **Oculus Quest** that can be used by used to train and sensitize fire safety personnel.

# IDENTIFYING THE PROBLEM?

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**Fire Safety Training** has a big infrastructure problem. There is a shortage of facilities for training.

Fire Safety Training Facilities		
Organisation	Location	No. of Facilities
ONGC	Uttrakhand	0
	Goa	1
NAFS	Uttrakhand	2
	Goa	1



Fig-1: NAFS Training Centers

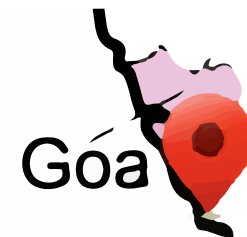


Fig-2: ONGC Training Centers

As per the ADSI-2019 report, there were **11,037** **fire accidents** reported across the country in **2019**.

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It is estimated that about **42 females** and **21 males die every day in India due to fire**.

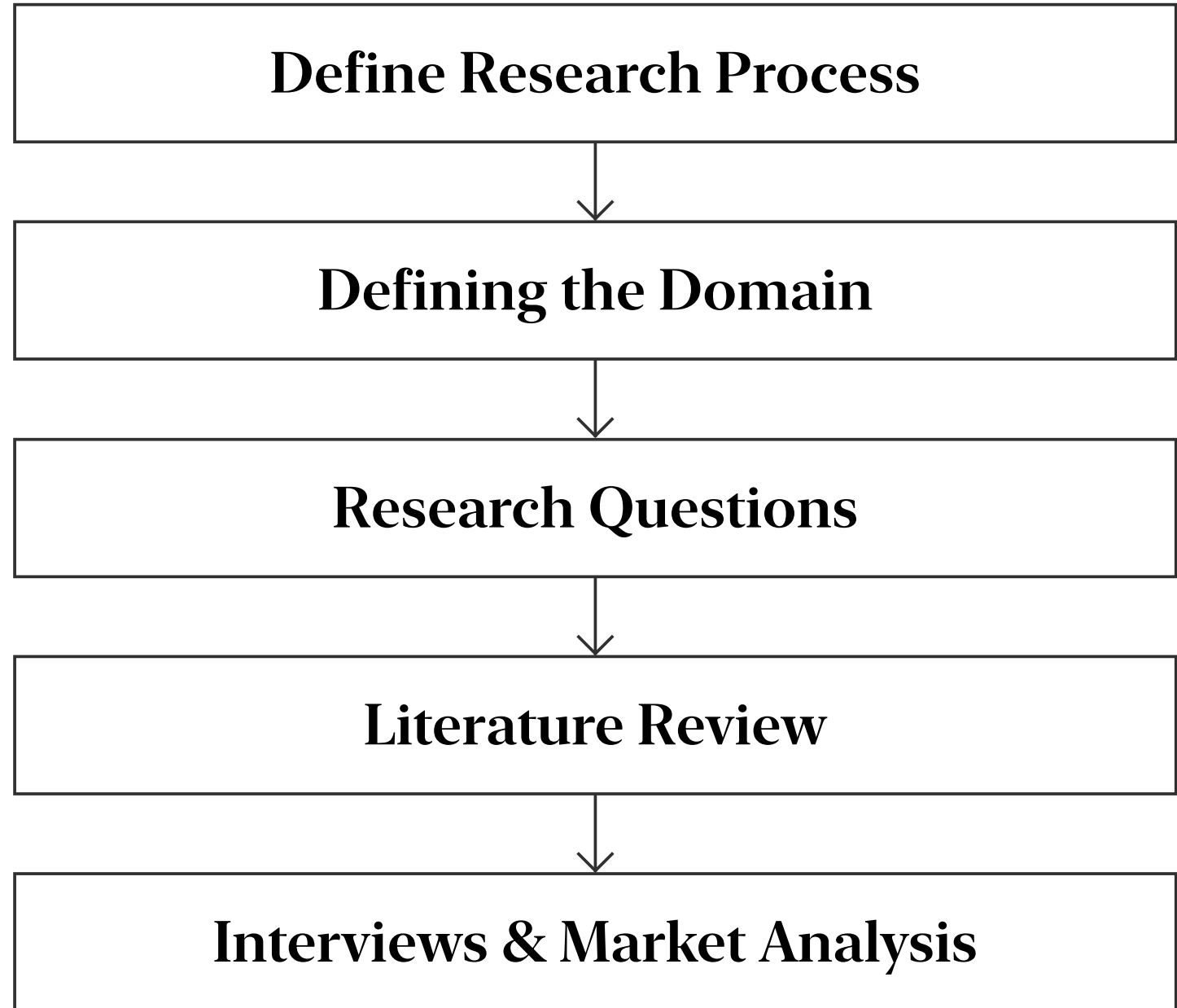
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**Inefficiency** of Fire Fighters can cause **complications** and **mishaps**.



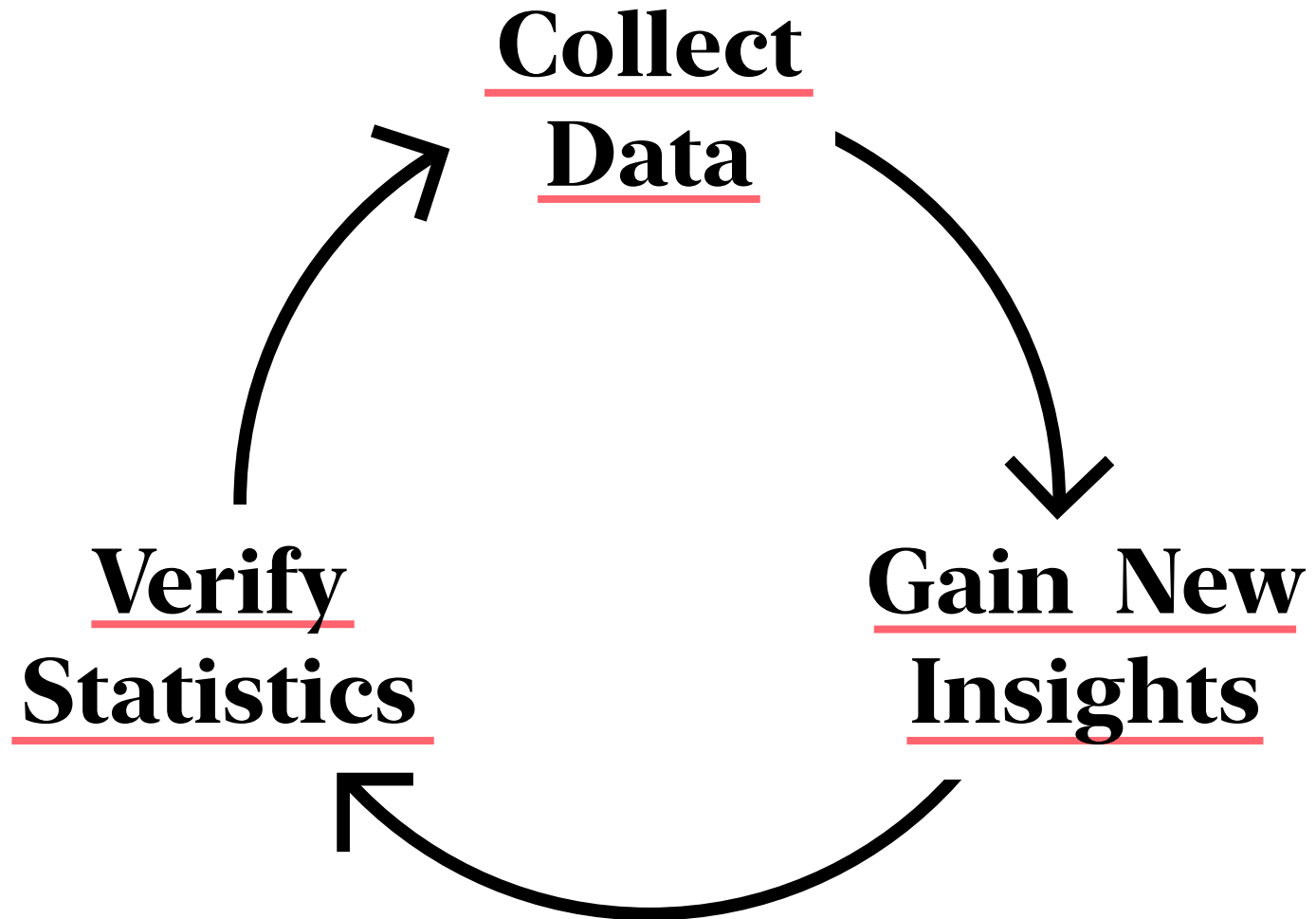
# RESEARCH

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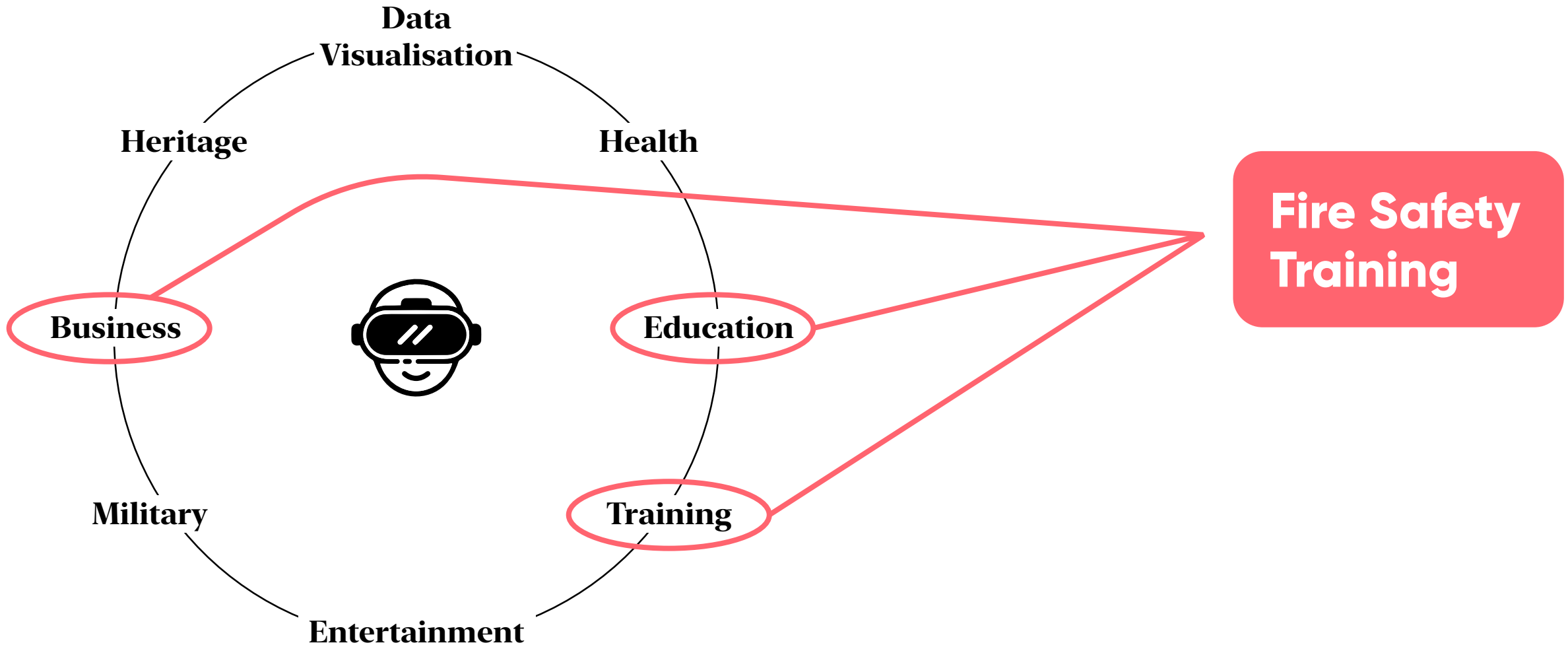
# RESEARCH PROCESS

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# DEFINING THE DOMAIN

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# LITERATURE & SELECTION FUNNEL

Virtual reality for fire safety training: Influence of immersion and sense of presence on conceptual and procedural acquisition

Sarah Morelot <sup>1,2,3</sup>, Alain Garrigou <sup>1</sup>, Julie Dedieu <sup>1</sup>, Bernard N'Koua <sup>1,2</sup>

## Abstract

A fire can have serious economic and human consequences. However, in many cases, rapid intervention and appropriate behavior can significantly reduce this threat. For this it is important that people are properly trained. Faced with the economic, ecological and organizational requirements and constraints linked to fire safety training, virtual training environments appear to be a judicious alternative to traditional training. However, before committing companies to invest in expensive devices, it is necessary to ensure the effectiveness of such devices. The literature is rich and divided on this subject, and it appears that certain characteristics of the system and of the learners are decisive. In this context, the objective of our work was to study the effects of immersion, the feeling of presence as well as the interaction between these 2 factors on the performance of conceptual and procedural learning. Certain variables were also controlled such as gender, tendency to immersion, previous experience in computers and video games. Our work shows that immersion promotes procedural but not conceptual learning, and that neither the sense of presence, nor the interaction between immersion and the sense of presence affect these two types of learning in our training task. Apart from the knowledge of fire which potentiates the effect of immersion on procedural learning, the variables considered in our study (computer experience, video game experience and genre) had no impact on performance. Understanding the impact of the technical device or the characteristics of users on conceptual and procedural learning is a major challenge in helping trainers to develop pedagogical devices in order to better exploit the opportunities offered by new technological approaches.

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## Keywords

Augmented and virtual reality; Human-computer interface; Media in education; Pedagogical issues

**T=Title**

**A=Abstract**

**K=Keywords**

**Searching Relevant Literature in databases**

**TAK Filtering through critical reading(N=30)**

**Removing duplicates & irrelevant literatures**

**Finalising Literatures N=10**

# RESEARCH QUESTIONS

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**RQ1-** Do physical props improve the transfer of virtual skills to real life scenarios?

**RQ2-** How can VR be used as a tool to solve infrastructure problem in fire safety i.e. can VR make the fire-safety training process faster and cheaper?

**RQ3-** Does immersion improve learning?

**RQ4-** Can VR be used as a method for a trainee to acquire the pre requisite knowledge more easily?

**RQ1-** Do physical props improve the transfer of virtual skills to real life scenarios?

### A VR serious game for fire evacuation drill with synchronized tele-collaboration among users



Authors: Gyutae Ha, Hojun Lee, Sangho Lee, Jaekwang Cha, Shiho Kim [Authors Info & Affiliations](#)

### Interactive Virtual-Reality Fire Extinguisher with Haptic Feedback



Authors: Sang-Woo Seo, Seungloon Kwon, Waseem Hassan, Aishwari Talhan, Seokhee Jeon  
[Authors Info & Affiliations](#)

**RQ2-** How can VR be used as a tool to solve infrastructure problem in fire safety i.e. can VR make the fire-safety training process faster and cheaper?

### Serious Games for Training Occupants of a Building in Personal Fire Safety Skills

Publisher: IEEE

[Cite This](#)

[PDF](#)

[Luca Chittaro](#) ; [Roberto Ranon](#) [All Authors](#)

### Development of fire safety behavioral skills via virtual reality

[Ünal Çakiroğlu](#) <sup>a</sup> , [Seyfullah Gököğlü](#) <sup>b</sup>

### Scenario sharing in a collaborative virtual environment for training



Authors: Stéphanie Gerbaud, Bruno Arnaldi [Authors Info & Affiliations](#)

**RQ3-** Does immersion improve learning?

Virtual reality for fire safety training: Influence of immersion and sense of presence on conceptual and procedural acquisition

Sarah Morélot <sup>a, c</sup>, Alain Garrigou <sup>a</sup>, Julie Dedieu <sup>a</sup>, Bernard N'Kaoua <sup>b</sup>

**Being More Focused and Engaged in Firefighting Training: Applying User-Centered Design to VR System Development**

[Twitter](#) [LinkedIn](#) [Reddit](#) [Facebook](#) [Email](#)

Authors: [Seung-Gon Jeon](#), [Jaeho Han](#), [Yonggeol Jo](#), [Kyungsik Han](#) [Authors Info & Affiliations](#)

**RQ4-** Can VR be used as a method for a trainee to acquire the prerequisite knowledge more easily?

**Is Computer-Based Instruction an Effective Way to Present Fire Safety Training to Long-Term Care Staff?**

Harrington, Susan S. MS, PE; Walker, Bonnie L. PhD [Author Information](#)

Journal for Nurses in Staff Development (JNSD): [May 2003 - Volume 19 - Issue 3 - p.147-154](#)

A virtual reality based fire training simulator integrated with fire dynamics data

Moohyun Cha <sup>a</sup>, Soonhung Han <sup>b</sup>, Jaikyung Lee <sup>a</sup>, Byungil Choi <sup>c</sup>

**Fire Safety Training: Its Importance in Enhancing Fire Safety Knowledge and Response to Fire**

Authors: Ilmiye Huseyin; Lata Satyen

# INTERVIEWS

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Key Interview-

**PAWAN KUMAR**

Deputy General Manager(Fire Services)  
Incharge Fire Services & HSE

Key Statement-

“ **I see huge potential  
in VR as a Fire Safety  
training method.** ”

# POTENTIAL CLIENTS

**ONGC & NAFS**

**UNIVERSITIES**



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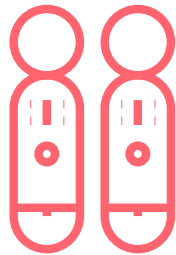


# DESIGN

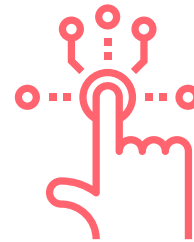
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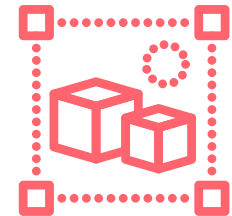
**Learning  
Modules**



**Controller  
Design**



**Interaction  
Design**



**Scenario  
Design**

# SCENE DESIGN-1 (WAREHOUSE)

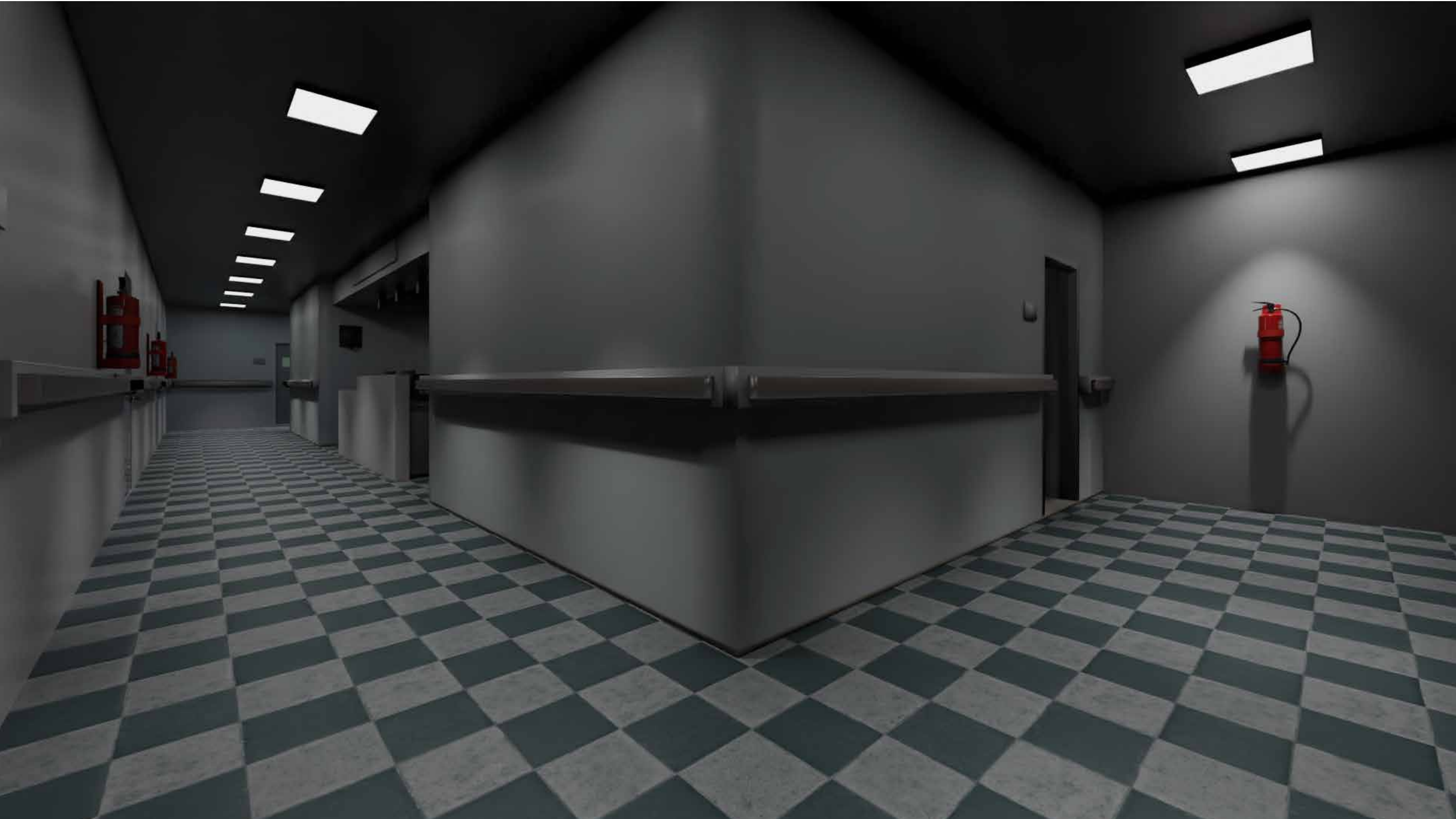






# SCENE DESIGN-1 (HOSPITAL)



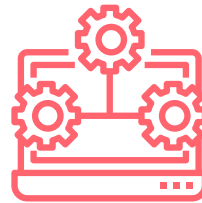


# DESIGNING THE MODULES



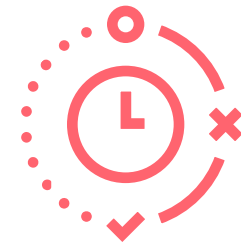
**Learning the Basics**

**MODULE-1**



**Learning to Operate**

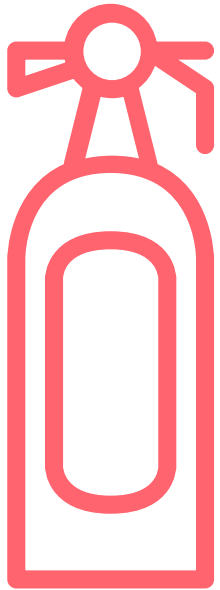
**MODULE-2**



**Scenario Based Test**

**MODULE-3**

## MODULE-1



# Learning the Basics

# RESEARCHING DIFFERENT TYPES OF FIRE



## **Wood Fire**

**-Temp: 250°C–300°C**

**-Emission Rate: 0.8 mm /min**

**-Flame decreases over time.**

# 3D MODEL RENDERING

**Flammable  
Gases**



**Flammable  
Liquids**



**Wood paper  
& Textiles**



**Electricity  
Contact**



**Cooking  
Oils & Fats**



# ANATOMY OF AN EXTINGUISHER















# 3D MODEL RENDERING





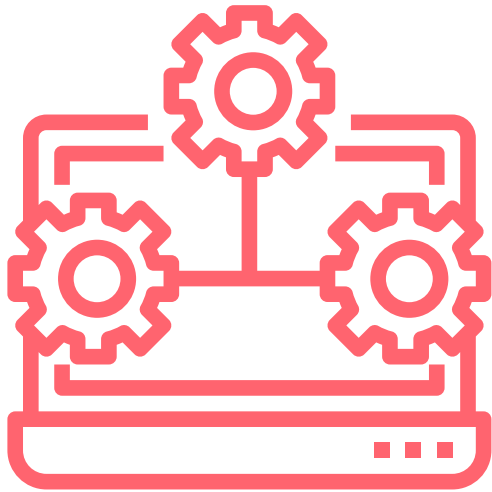
# USAGE CHART

						
		Water	Foam Spray	ABC Powder	Carbondioxide	Wet chemical
Wood, paper, textiles 		✓	✓	✓	✗	✓
Flamable liquids 		✗	✓	✓	✓	✗
Flamable gases 		✗	✗	✓	✗	✗
Electric contact 		✗	✗	✓	✓	✗
Cooking oil & fats 		✗	✗	✗	✗	✓

# MODULE-2 (LEARNING TO OPERATE)



## MODULE-2



# Learning to Operate

# Targeting



Point & Move



# Selection



Pinch to select



# Manupulation

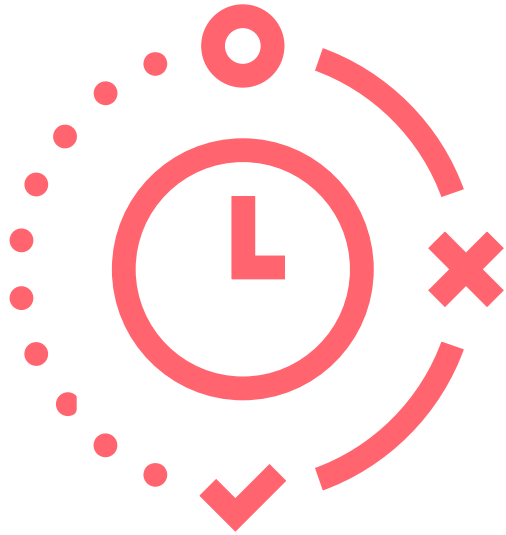


Pinch & Move





## MODULE-3



# Scenario Based Test

**Let's look at the video**

# EVALUATION



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**Mode- Online**

**Method used- Scenario Based Evaluation**

**No of participants- 3**

# RESULTS

**Task Context:** You are stuck in a burning scenario, find and extinguish all the fire spots

**Overall Scenario Outcome:**

Average rating of **4.5 (of 5)** on easy of use and satisfaction.

	<b>Performance Targets</b>	<b>Satisfactions Targets</b>
Subtask 1: Navigate to the Fire	<b>20 sec, 0 errors</b>	<b>4 on directness</b>
Subtask 2: Extinguish to the Fire	<b>50 sec, 0 errors</b>	<b>4.5 on directness</b>
Subtask 3: Exit the building	<b>22sec, 0 errors</b>	<b>5 on presence</b>