



**ODTÜ METU**

KUZEY KIBRIS KAMPUSU  
NORTHERN CYPRUS CAMPUS

# **CNG 476 System Simulation Proposal Report**

Spring 2024/2025

## **Forest Protection System**

*Written By:*

Sarp Erim Ercan (2454346)

Ulas Demir (2385300)

# Contents

1	Objective	2
2	Structure	3
3	Parameters of Simulation	4

# 1 Objective

The purpose of this project is to simulate a forest protection system that can detect fires from a long range distance using the LoRa [4] technology. The simulation structure will be created using OMNeT++ [3] and its FLoRa [1] package. The random number generation, probability models, and stochastic processes will be implemented in C/C++ by hand to achieve a greater understanding of the topic.

## 2 Structure

The system will consist of several sensors such as temperature, humidity, heat, smoke, and gas, all of which can detect different stages of a fire.

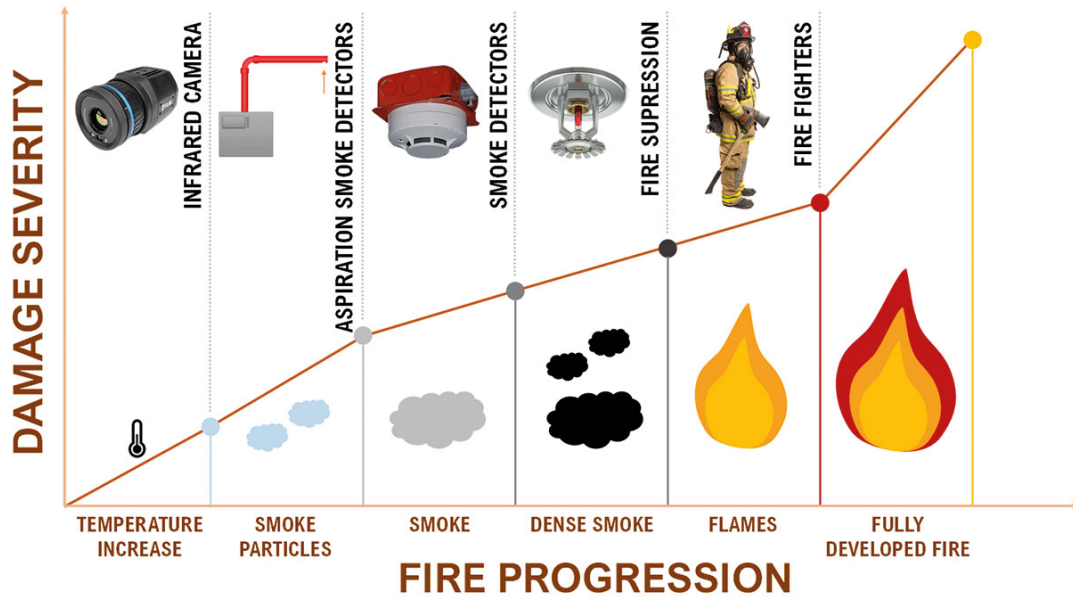


Figure 2.1: Fire progression graph [2]

These sensor nodes will be LoRa enabled, and will connect to a central LoRa gateway device to transfer the data via the Internet to a computer, where the data can be studied or analysed.

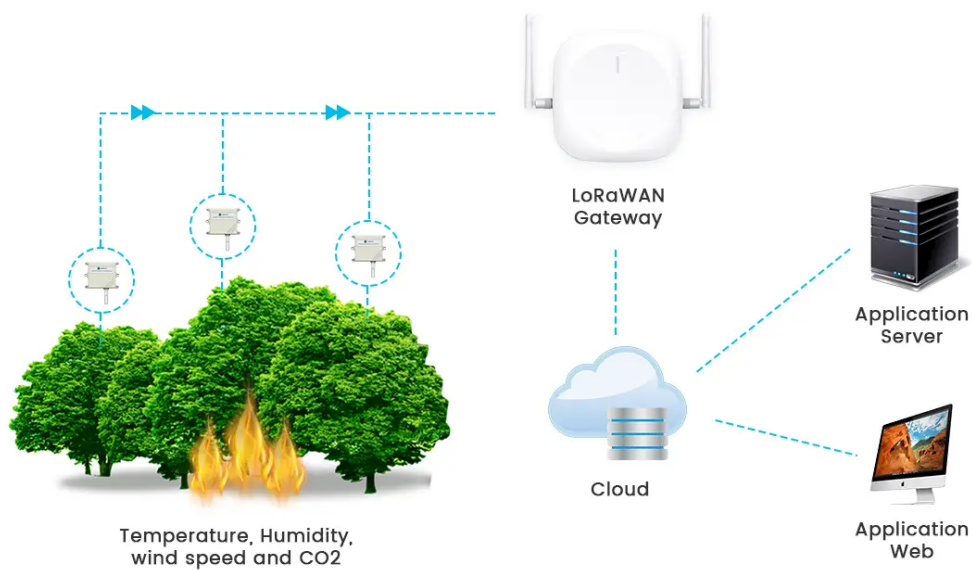


Figure 2.2: Example structure of a LoRa network [2]

### 3 Parameters of Simulation

Because this simulation will be concerned with the progression of fire at different stages as shown in Figure 2.1, parameters such as the temperature level, the densities of the smoke particles and CO<sub>2</sub>, CO gases will have to be tracked. These parameters and their probability of increasing or decreasing are, by their nature, going to be dependent on each other as the existence of one of them suggests the threat of another, it is a chain reaction.

Therefore, the crucial part will be designating a starting point and calculating what could happen next. What is the probability of a smoke according to the current state of the system? What is the probability of a fire if there is a probability of smoke? All the modelling and the randomness will have to be set up according to this nature of the parameters.

**Temperature + Humidity + Wind Speed → Smoke + CO + CO<sub>2</sub> → Fire**

## References

- [1] FLoRa. *A framework for LoRa simulations with OMNeT++*. URL: <https://flora.aalto.fi/>.
- [2] Silvio Gerard. *Forest Fire Detection Made Better with LoRaWAN IoT Technology*. URL: <https://www.mokolora.com/forest-fire-detection-made-better-with-lorawan/>.
- [3] OMNeT++. *What is OMNeT++?* URL: <https://omnetpp.org/intro/>.
- [4] Semtech. *What is LoRa?* URL: <https://www.semtech.com/lora/what-is-lora>.