



GSMA Internet of Things Case Study How Cellular Technology Enables Anti-Fire Drones

INTRODUCTION

Unmanned Aerial Vehicles (UAVs) are already used for a multitude of applications, particularly where they can offer public value.

Telefónica in collaboration with partners Dronitec, Divisek and the Intelligent Systems Lab, from Universidad Carlos III de Madrid, developed an anti-fire UAV solution to fight forest fires. The purpose of the project was to support emergency teams to respond to fire rapidly and in a safe and efficient manner by providing real-time information and the condition of the fire. A demonstration of the pilot has been successfully achieved in Spain.

The problem of forest fires in Spain is considerable, and providing a quick response is limiting the impact on the ecosystem, the local economy and health of fauna and human beings (see Figure 1).

Currently, the emergency team needs to estimate the manpower and equipment needed based on their experience, but without having much information about the actual fire condition and behaviour. This could lead to an inappropriate response or to an increased risk.

THE PROBLEM

FOREST FIRES
BURN EVERY
YEAR

WORLD
309,000,000
HECTARES

EUROPE
800,000
HECTARES

SPAIN
178,234
HECTARES

EQUIVALENT TO
THE SURFACE AREA
OF...


Argentina


Puerto Rico


**Fuerteventura
(Canary Islands)**

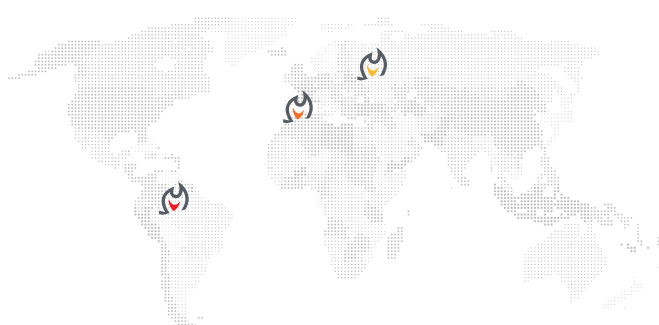


Figure 1: Impact on forest fire in the world

Sources: kew.org | European Commission | Ministerio de Medio Ambiente

Telefonica

HOW MOBILE NETWORKS ENABLE UAVS

This IoT solution leverages the telecom towers infrastructure, real-time mobile connectivity and UAVs. In brief, the solution (see Figure 2) consists of:

- Several sensors (thermal, smoke, wind, etc.) are deployed on Telefónica communications towers. These sensors can detect a potential fire in a surrounding area up to 15 kilometres.
- A UAV equipped with a Telefónica IoT SIM, which is protected in a hangar collocated in the base station

area, including a recharging station. The UAV is also equipped with cameras (thermal and optical) and sensors.

- A dashboard where the emergency team can see the real time information sent by the UAV and remotely send the UAV to a different location.

The ubiquity of mobile networks and the locations of the already existing towers fit very well for supporting this use case and for detecting forest fires. In addition, the existing tower infrastructure provides the system with an electrical supply, communications network and a secure installation protected by fences.

THE IMPACT

Flora

- A **forest** needs **decades** to regenerate



Fauna & Human Being

Starvation
Migrations
Intoxications
Diseases
Deaths



Economy

- **1,800 million Euros**
annual economic losses caused by forest fires in Spain



Sources: WWF

THE SOLUTION

EFFECTIVE EARLY FIRE DETECTION AND INFORMATION SYSTEM BASED ON SENSORS IN TELECOM TOWERS AND IoT DRONES

- 1 **Distributed sensors** (thermal, smoke, wind) deployed in Telefónica communications towers detect a potential fire
- 2 An **alarm** is sent to the control centre and to the drone
- 3 The drone-hangar opens automatically, the drone **flies autonomously** to the area and **captures information** with camera and sensors
- 4 The information is sent in real time thanks to **IoT** to the **Control Centre**
- 5 The drone flies autonomously **back to the hangar** where it is charged automatically

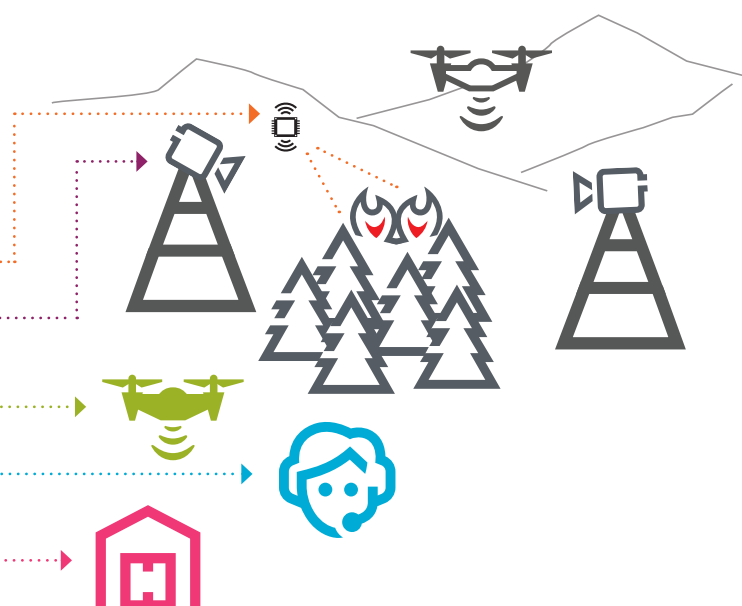


Figure 2: anti-fire UAV

The usage of 3G or 4G provides required coverage and bandwidth needed for this use case.

When the sensors detect a potential fire, an alarm is sent to the UAV indicating the coordinates of the potential fire. These coordinates are calculated based on the location of the towers where the sensors are deployed. The alarm will trigger both the UAV-hangar to open automatically, and in the planned future solution, the UAV will autonomously fly to the indicated fire area to survey the location and capture information. The gathered information is sent, in real time, through the Telefónica mobile network connectivity (3G or 4G depending on availability) to the emergency control centre.

Thanks to that real-time information, the emergency team has the relevant data and characteristics of the fire (whether it is an actual fire or a false alarm, whether there are people trapped by the fire, and the entry and exit routes that they can take, whether there are natural water sources that can be used to extinguish the fire, etc.). With that information, the emergency team can take better decisions and send the perfect team with the correct equipment to extinguish the fire in an effective way and also improving the safety of the team by reducing human risks. In addition, the emergency team can remotely control the UAV to survey other surrounding areas outside of the prefixed route or geofence area. Once the UAV has finished its task, it flies autonomously back to the hangar where is charged automatically, to get ready for the next mission.

LESSONS LEARNED

Although in the planned live solution the flight is completely autonomous, the communication offered by the mobile network ensures the transmission of telemetry data from the UAV to the emergency centre, and allows remote control of the UAV. The pilot demonstrated that mobile technology:

- Is offering the required capabilities for the emergency teams in regards to video streaming - even when only 3G coverage is available - good video streaming quality was achieved.
- Works perfectly in an outdoor environment with different weather conditions.
- Provides the appropriate security required by this critical use case. Mobile networks have inherent encryption and security mechanisms that protect communications.
- There are affordable and mature IoT modules and licensed spectrum for mobile connectivity.

Figure 3 provides an overview of the overall benefits of the mobile-enabled anti-fire UA solution. The demonstration also provides an example of the benefits of BVLOS operations, which are far beyond the range of WiFi or remote control radio.

SOLUTION BENEFITS

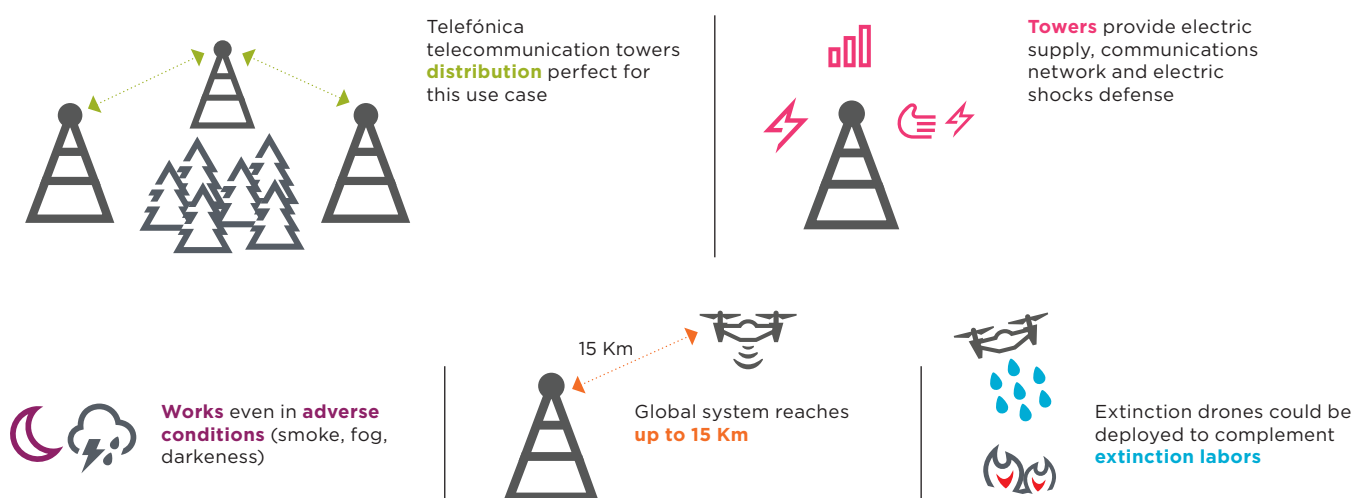


Figure 3: Benefits of the anti-fire mobile-enabled solution

This is a key enabler for similar use of UAVs, where relevant information is sent as soon as possible to an emergency response team for taking the best actions.

Implementation of this anti-fire solution – and the positive acceptance by the emergency teams and organisations – is regarded as an excellent start to the work on commercial UAV use cases with industry partners which help society and add value to customers.

Due to the positive results, Telefónica is working with all potential customers analysing the possibilities of deploying pilots in different geographies. In the planned live system it is hoped that BVLOS solution will be available to exploit the benefits of this great solution.

PARTNERS

- **Intelligent Systems Lab:** from Universidad Carlos III de Madrid. Developed the autonomous flight and interface for the emergency teams.



- **Dronitec:** Drones experts. Management of the testing drone flying permissions, drone insurance, etc.



- **Divisek:** Development and manufacturing of the drone-charging base system.



About the GSMA

The GSMA represents the interests of mobile operators worldwide, uniting more than 750 operators with over 350 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces the industry-leading MWC events held annually in Barcelona, Los Angeles and Shanghai, as well as the Mobile 360 Series of regional conferences.

For more information, please visit the GSMA corporate website at www.gsma.com.

Follow the GSMA on Twitter: [@GSMA](https://twitter.com/GSMA).

Further reference materials:

www.gsma.com/drones

About Telefónica

Telefónica is one of the largest telecommunications companies in the world by market capitalization and number of customers with a comprehensive offering and quality of connectivity that is delivered over world class fixed, mobile and broadband networks. As a growing company it prides itself on providing a differential experience based both on its corporate values and a public position that defends customer interests. The company has a significant presence in 17 countries and over 356 million accesses around the world. Telefónica has a strong presence in Spain, Europe and Latin America, where the company focuses an important part of its growth strategy.

The logo for Telefónica, featuring the word "Telefonica" in a stylized, cursive script font.

www.telefonica.com