GSMA Internet of Things Case Study
Search and rescue supported by drones on a cellular network

INTRODUCTION

Unmanned Aerial Vehicles (UAVs) are already in use for a multitude of applications. The regulatory framework is presently still being shaped, and there remains some scepticism around their value and safety; however, use cases beyond the purely commercial, but which offer public value, can positively influence acceptance, and provide useful data for further development.

Deutsche Telekom and the German Air Navigation partner DFS recently led a broad collaboration to demonstrate how UAVs can conduct search and rescue missions in difficult terrain. The project brought together the German Lifeguard Association for logistics, UAV manufacturer Microdrones which provided LTE connectivity, and the Braunschweig University of Technology provided image processing.

Search and rescue missions along rivers and coastlines demands a great deal of manpower, with sometimes hundreds of professionals and volunteers being required to search quickly throughout an area. This is made still more resource-intensive where the area in question is difficult to traverse, which is regularly the case where people have gone missing.

How mobile networks can enable drones

A UAV equipped with a heat-sensitive infrared camera can provide real-time support in challenging environments, saving precious time and resources in the pursuit of saving lives. UAVs can be programmed to search a given search area and scan the location systematically - the images gathered are then processed, stitched together and provided to the search and rescue leader, showing an overview of the area in real-time. Once the search reveals an object which fits the outline of a human being, rescue forces can be sent directly to the location without losing time looking elsewhere.

While this method can provide significant support to rescue teams, and thereby help save lives, some challenges remain

a) The UAV operates beyond visual line of sight (BVLOS) – however, the operator still needs complete telemetry to monitor the operation, and must be able to send commands to the UAV whenever it needs to react to emerging new conditions.

LIFE IS FOR SHARING

b) The UAV operates in public airspace, with other aircraft such as police and rescue helicopters, or even potentially other UAVs. For this reason, the integration of the UAV into airspace surveillance represents an important contribution to the overall safety of flight operation. Accordingly, the position and identity of the UAV must be provided to the air traffic control tracking system.

c) Pictures or video from the UAV's camera must be processed to be provided in real time to the search and rescue leader who uses this information for their mission.

A great deal of communication is needed, with specific demands regarding availability of the data link, throughput, latency, and area coverage. But, although each transport stream may have a specific technical solution, overall the mobile communication network is generally able to cover all of these demands economically with quality and efficiency.

To realise this use case with all its components, an in-depth analysis with all involved partners was undertaken. All the communication streams were realised within Deutsche Telekom's existing mobile network. In order to make the use case work to its full extent, the network was used to establish the following communication channels in parallel:

Most essential for flying the UAV is the **Command and Control Channel** between the UAV and the ground station. Although the flight was completed autonomously, the transmission of telemetry data from the UAV to the operator (and potentially any new command to the UAV), and the ability to change the flight path after programming, must be ensured.

Since BVLOS operation was intended, the radio bearer needed to work even in mid- to long-distance, with high demands on availability and robustness. A second **Control Channel** with similar requirements on the radio bearer was established, to ensure transmission of the current position and identity data from the UAV to the tracking system of the **Air Traffic Management**, which was adapted to include this information on top of the general aviation traffic.

The Payload Communication consisted of pictures shot by the on-board infrared camera; the sequence of pictures was then forwarded to a server which processed and composed them into an overview covering the entire search area. This overview was directly forwarded to the workstation of the search and rescue leader, giving them a landscape overview based on infrared pictures in real time. The search and rescue leader was also able to provide the rescue team with the coordinates of any point of interest and guide them directly to those spots.

This established the base for UAV Traffic Management and could be integrated into the traffic of general aviation in the area. It is particularly relevant for when other aircrafts are operating in the lower airspace in the vicinity, and can now be coordinated with any UAV traffic.

Lessons learned

All this communication was completed successfully via Deutsche Telekom's LTE network. The specific challenges regarding demands of capacity and coverage for the different purposes could be met, which showed – impressively – that mobile networks can enable even sophisticated use cases with a number of parallel tasks.

The demonstration also provided an example of how use of UAVs could work in a wider context. A crucial element here are the truly BVLOS operations, which are far beyond the range of WiFi or remote control radio. This is a key enabler for professional use of UAVs, either for efficiency reasons or – as addressed in the search and rescue use case – to have operations in place as soon as possible, without first assembling and sending out a local team on the ground.

BVLOS operations are not only a technical, but an administrative and regulatory issue. For this reason, the collaborating partners invited representatives from both the rescue organisation and from air traffic regulators, to give perspectives on the realisation and opportunities for this technology. The partners are convinced that a good understanding by the authorities in charge of creating the framework for UAV operations is essential to make progress towards an open, regulatory friendly environment for UAV operations.

Realisation of this search and rescue case – and the positive effect for public safety – is regarded as an excellent start to work on commercial use cases with industry partners.

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 industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai, Mobile World Congress Americas and the Mobile 360 Series of conferences.

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

Follow the GSMA on Twitter: @GSMA.

Further reference materials:

www.gsma.com/drones
https://www.youtube.com/watch?v=Nt70mpXTik8
https://www.youtube.com/watch?v=YMg7CcMlJQY

About Deutsche Telekom

Deutsche Telekom is one of the world's leading integrated telecommunications companies, with some 165 million mobile customers, 28.5 million fixed-network lines, and 18.5 million broadband lines. Deutsche Telekom provides fixed-network/broadband, mobile communications, internet, and IPTV products and services for consumers, and ICT solutions for business and corporate customers. Deutsche Telekom is present in more than 50 countries, with a staff of some 218,300 employees throughout the world, and generated revenue of 73.1 billion Euros in the 2016 financial year, about 66 percent of which was outside Germany.

So that we can continue to be successful, we are already evolving from a traditional telephone company into an entirely new kind of service company. Our core business, i.e. the operation and sale of networks and connections, remains the basis; but, at the same time, we are proactively committing to business areas that open up new growth opportunities for us.

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