GSMA Internet of Things Case Study
AI-enabled Drones for Object Recognition in Multiple Settings

INTRODUCTION

Drones are in a unique position. With an airborne, compact, and nimble nature, they can access many locations, which would otherwise be difficult and costly to reach. As a result, they are ideally suited to perform object recognition tasks which can be connected to search, rescue and recovery missions.

One of the essential elements of successful rescue mission is the ability to make good decisions quickly. However, to make good decisions, reliable and precise information is needed. For example, updated and relevant information about surroundings in natural environments can be difficult to obtain because of a terrain that is difficult to map. AI-powered drones may provide the solution.

AI software can be trained to recognise a variety of objects and environments. Such as:

→ Forest fires
→ Humans
→ Pollution in water

As a result, the empowered drones are able to give rapid information on time-sensitive topics, which can then alleviate a variety of search, rescue and recovery missions.

How mobile networks support AI-enabled recognition drones

The application of recognition services is made possible due to the computational power which enables the drone via the mobile network. The local base stations are able to provide the network coverage, while mobile edge computing makes it possible to quickly process and deliver meaningful information to the drone operators and mission.

Onboard mobile edge computing using the mobile network is only the first step. The next step would be to place the drone management on the mobile network itself which would allow for flying beyond the visual line of sight (BVLOS), thereby extending drone functionality.

Currently, for the sake of speed, data analysis happens onboard the aircraft using mobile edge technology. On the 5G network the data collected by sensors will be sent directly to more powerful data processing centres, which in turn will allow for reducing the load that must be carried by the drone, and lead to longer possible flight times.

The solution

LMT (Latvian Mobile Telephone) is working in collaboration with Riga Technical University to develop AI solutions that provide fast and reliable information from the site to the search, rescue and recovery teams. With the help of several sensors, drones are able to efficiently collect a large amount of data, process it quickly with the help of edge computing on the mobile network and deliver the information to the rescue service.

Drones are equipped with a camera with infrared, RGB and 360° audio sensors. The system includes a processing unit with integrated computer vision and object recognition technology, edge computing for real-time data processing and analysis, machine learning and neural network for precise system calibration, and an encrypted data transfer and cloud communication platform.

EDGE computing for real-time data processing & analysis

Encrypted data transfer & cloud communication platform

Camera with infrared, RGB & 360° audio sensors

Processing unit with integrated computer vision & object recognition technology

Machine learning & neural network for precise system calibration
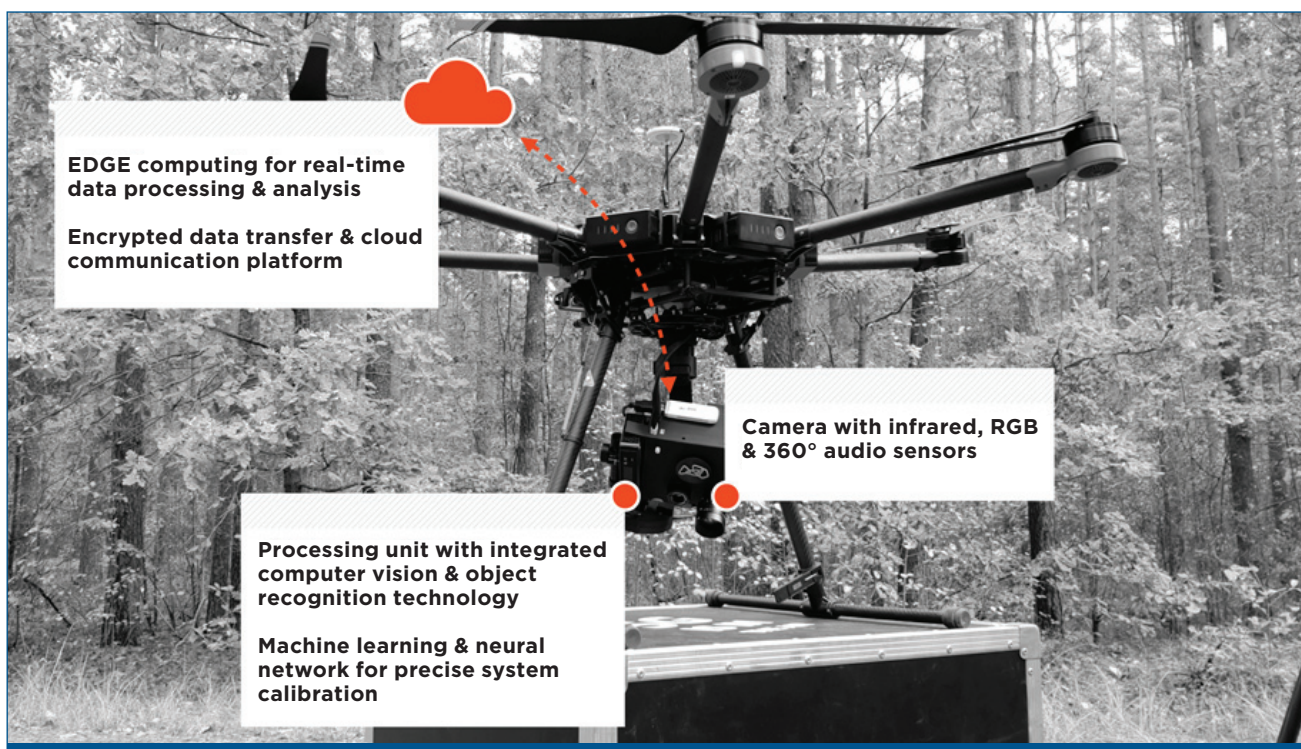
USE CASES

Forest fires

The global threat of climate change has led to a tragic increase in forest fires. Early warnings about forest fire development and monitoring, as well as surrounding infrastructure such as road access and available water sources, can help with combating them - and significantly reducing the amount of damage done. Here, the drone equipped with an infrared camera can quickly provide critical information to the first responders.

The system has been tested in various missions with first responders and has yielded positive results. One of which

was in the Valdgale district of Latvia, where the system collected and analysed data in real-time and identified areas with the highest risk of fire re-ignition. This allowed the first responders to prepare for activities in that area to minimise damage.

STAGE: In development

BENEFITS:

→ Faster information collection and analysis
→ Safer access points identified
→ Increased success rate of forest fire suppression

Search and rescue

Searches for missing persons often lead to locations that are difficult to access - both with limited lines of visibility, such as expansive forests, or locations where it's difficult for rescue service equipment to gain access or extremely expensive. In such situations, a drone equipped with an infrared camera and trained with AI to recognise humans can be an enormous support.

The drone with ISOR (Intelligent System for Object Recognition) has been tested with Latvian authorities in defense and public safety reconnaissance exercises, where the LMT-developed search and rescue drones were used for finding individuals in the forest. The drones were also equipped with sound sensors in order to define the distance and direction of, for example, a shot. Testing began in April 2018, and four Latvian National Guard exercises have since been conducted, including one at night, where the drone was able to successfully identify individuals.

STAGE: In use

BENEFITS:

→ Reduced costs for search and rescue missions
→ Faster missing person recovery time
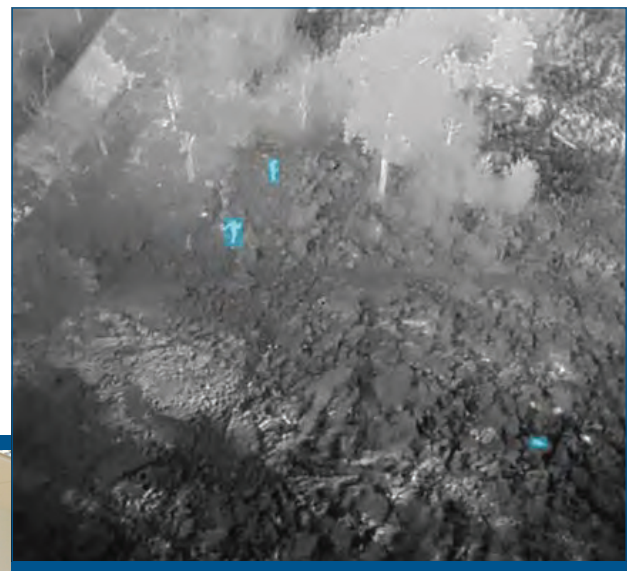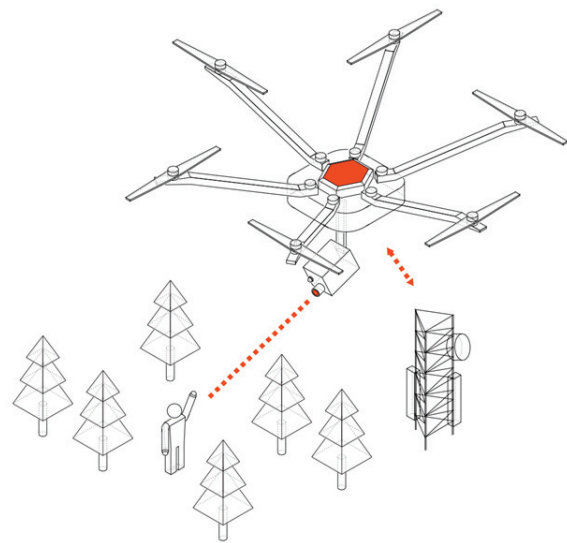
Pollution monitoring

Drones performing observational duties are able to periodically observe, collect data on, and report about changes in water pollution in high-risk areas. This allows for leaks to be managed and collected faster, which leads to less damage to marine life and to water quality.

LMT, together with academic partners and in cooperation with natural resource researchers, are developing a research project which considers the possibility to implement automatic pollution monitoring.

The current use case is being tested in the Riga Free Port Territory to identify oil spills from boating traffic. The solution is intended to reduce human involvement and ease the burden of manual monitoring. They will make use of their developed AI in combination with their object recognition system and pollution detection sensors.

STAGE: In development

BENEFITS:

→ Faster pollution identification
→ Lower costs for monitoring solutions
→ Improved marine life and water quality

LESSONS LEARNED

The use of the mobile network has in these cases demonstrated improvements on previously unsurmountable or difficult obstacles.

→ **Computational capacity**

With the help of mobile edge computing, high-definition video solutions can be implemented and connected, combined with the benefits of wireless, untethered solutions that allow for performing tasks in a variety of unlimited settings (such as over water, in deep forests, etc.)

→ **Provides collaboration opportunities**

The mobile network makes it possible to deliver collected data from the drones to a wider range of participants in recovery missions. The data is delivered to not only the drone pilot, but can be relayed to mission controls, commanders, etc. The mobile network makes it possible to relay commands to the drone remotely. Though not a feature currently in use, this will be developed in future iterations.

The experiments conducted within the project framework of AI-powered drone recognition has provided the team with valuable insight that will lay the foundation for continued work in developing the product:

→ **Possibilities and Future Prospects**

The project results have proven the possibility to ensure information transfer online over the mobile network as well as outlining future prospects that will become available as mobile network technologies develop.

→ **Versatility**

The AI-enabled recognition drone solution has successfully proven itself in a variety of environments. It has also allowed us to define unlimited new applications with this technology.

As a result of our experiments, we have concluded that AI in combination with telecommunications infrastructure and drone technologies offers limitless solutions. In the future, it will work to the benefit of society by completing tasks with increased speed, optimisation, and precision.

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 or the GSMA Internet of Things programme at www.gsma.com/IoT.

Follow the GSMA on Twitter: @GSMA.

Further reference materials:

www.gsma.com/drones

About LMT

LMT is a leading mobile operator in the Baltics with over 25 years' experience in delivering top quality telecommunications services, as well as pushing the industry towards development. Through persistently developing the 4G network, LMT has reached record-low latency levels, while simultaneously being the most efficiently loaded Nokia network in the world. This strong backbone will make it possible to efficiently implement 5G.

The network operator is actively working on developing technologies that could be advanced by 5G technology such as a smart cities, mobility and connected cars, drone technologies, public safety and even innovations in space exploration, etc.

www.lmt.lv/innovations

About Riga Technical University

Riga Technical University (RTU) is the only internationally renowned and modern multidisciplinary technical university in Latvia. It offers not only high-quality education and research but also brings scientific achievements to live through the technology transfer of innovations created within the university. RTU works closely together with companies, helping them create competitive products that until now do not exist. This expands companies' research and development capacity and strengthens the innovation environment in Latvia.

https://www.rtu.lv/en