



Rising to the Connectivity Challenge

Trial shows how 5G can enable autonomous drones to operate safely and efficiently

With the help of artificial intelligence (AI), drones could take on many manual and repetitive tasks.

Giving drones (and other robots) access to AI is getting easier thanks to 5G: By providing ultra-low latency and high-bandwidth connectivity, 5G enables much of the necessary computing to be performed in a nearby edge computing facility. That means the drone itself can be lightweight, compact and agile.

One potential indoor application being tested by multinational operator Telefónica and tech company Unmanned Life is automated inventory management. Designed to demonstrate the potential of 5G and edge compute, the trial suggests 5G autonomous drones could dramatically boost the efficiency and accuracy of stock taking.

Warehouses and depots have traditionally relied on staff to do manual stock checks that can involve climbing ladders and scanning the barcodes on boxes on racks. As well as being time-consuming and costly, this process is error prone – people doing repetitive tasks can lose concentration, which can lead to omissions, mistakes, delayed updates, and ultimately a loss of revenue from inefficiency. Depending on the context, inventory management can also involve potential risks also to physical safety – for instance where heavy containers or machinery are involved.

As they can easily travel anywhere inside a warehouse or depot, drones with cameras could automate stock takes. However, as they are flying inside, the drones need to be small, limiting the space for onboard computational power. “These devices don’t even have a GPU, so there’s no possibility of doing analytics, so you need more computational power, you need graphical power,” explains Kim Clement, CTO of Unmanned Life. “On small drones, battery life is also quite limited. Payload capacity is quite limited, and you want to reduce as much as possible the weight burden of a companion computer.”



Intelligence on the edge

One way to overcome these limitations is to connect the drones to computing power at the edge of the network using low latency 5G. As a result, the drones can harness image recognition software in real-time, and other advanced capabilities running in the edge facility.





Telefónica and Unmanned Life are developing 5G connected drones that can conduct automatic stock takes and perform other intricate tasks in a space-constrained indoor environment. Following a pre-planned route, these autonomous drones fly around the racks inside the warehouse or depot. As they do so, they use 5G to stream live video of the stock to an edge computing facility, which then uses image recognition software to update the inventory list in real-time. The drone also uses 5G to relay the precise location of each stock item. “This is where the low latency of the network comes into play,” says Kim Clement.

For the trials, Telefónica is using a hybrid-edge solution, combining on-site computing capacity with computing capacity at the edge of its public 5G network to deploy Unmanned Life’s platform. “As the complexity starts to get bigger and bigger, we need to upload capabilities from the drones to the platform,” explains David Moro, head of services platform in Telefónica CTIO. “Otherwise, it’s really difficult and expensive to have certain use cases where you need a big number of units.” Ultimately, Telefónica plans to move the platform solution entirely to the public 5G network edge, as that will give it greater scalability and flexibility.

The highly responsive 5G network can also be used to quickly abort a mission in the event of a problem. Unmanned Life combines the drones’ in-built safety systems, such as collision avoidance, with its own control and localisation software to

make autonomous drone flights safer. The solution has several integrated safety measures, including kill-switches in the event of a malfunction.

As a 5G network can provide ample bandwidth, multiple drones can be deployed at once, with the only constraint being the physical confines of the premises itself. Unmanned Life has developed a system that can orchestrate multiple drones or robots simultaneously to ensure a safe and efficient operation. “When we face use cases where we need to orchestrate two drones together, it’s critical to have low latency and that’s the role of 5G,” notes David Moro.

Telefónica and Unmanned Life are testing the solution at the operator’s demo centre in Madrid. Staff are protected by a physical security net and, even though the trial isn’t in a public environment, Telefónica doesn’t store the video footage to ensure that individuals’ privacy is preserved.

The trial, which began in October, involves several rounds, allowing for updates and amends to the software. As well as refining the image recognition system, Telefónica is checking the solution is robust enough to be used continuously. By early February 2022, the trial had conducted more than 100 test flights.





Moving forward on multiple fronts

Telefónica says the trial is demonstrating that 5G has the capacity to support video streaming from drones in a busy environment. Unmanned Life says the tests have also confirmed that the latency in the solution is minimal, giving it “confidence that the autonomous systems are fit for purpose, and the video feeds stream consistently.” The results to date suggest drones can provide cost-effective, scalable and traceable approaches to inventory management.

More broadly, the trial is showing that drones can operate effectively indoors if they are supported by 5G connectivity and edge infrastructure. “The target in this use case was to orchestrate robotics, in this case the drone mission, with a computer vision capability indoors,” says David Moro. “The challenge in this trial was to ensure that the peer-to-peer connectivity required by the application level is achieved when deploying the platform over a large-scale network, such as the public 5G network.”

In particular, the goal is to assess whether a 5G edge infrastructure is responsive enough to enable drones to benefit from real-time peer-to-peer communications. “The important aspect about the Unmanned Life platform, for us at Telefónica, is the real time orchestration,” adds David Moro. “It could be a situation where we have several drones doing a task, and the platform needs to coordinate the drone flights altogether, and change the mission steps accordingly to drone outputs. So, low latency here is critical.”

The trials have also given both Telefónica and Unmanned Life a much better understanding of the needs of the other partner. “We are really bringing two fields of expertise together,” says Kim Clement. “At Unmanned Life, we bring our field of expertise in autonomous robotics, robotics in general and sensors. We speak a certain language that we understand and know. And we bring that together with Telefónica, an expert in their field of wireless, communication, edge infrastructure and 5G. And they also speak their language. There is a gap between these two worlds. And we’re really closing that gap through these use cases.”

Unmanned Life is working to ensure its onboarding process is as smooth and seamless as possible for its partners. “This kind of collaboration really makes it very honestly clear to us that fundamentally it’s important that we are cloud and edge native,” Kim Clement says. “We need to be cloud native, not only for public infrastructures and public networks, but also for private networks. In some cases, you might have cloud applications that you need to communicate with, but your own application is running on a private infrastructure.”

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David Moro - head of services platform in Telefónica CTIO



The road to commercialisation

Telefónica is working with Unmanned Life to develop an end-to-end solution that will enable enterprises to employ drones indoors. In most cases, that solution will harness the operator's public 5G networks, but it will also offer a private 5G network option. "We need to be able to deploy these kinds of projects in different network environments," says David Moro. As well as offering private networks, Telefónica could provide dedicated APNs in the public network.

The operator plans to begin exploring potential solutions with a select group of customers this year, as a precursor to rolling out an actual commercial product.

Unmanned Life stresses that autonomous drones can be applied to all manner of application scenarios, opening up broad possibilities as industry looks to automate more processes. It intends its platform to be used to support the integration and orchestration of different types of robots, as well as drones. The goal is to support a broad set of use cases including logistics, industrial surveillance, smart factories, inspections, maintenance, surveillance, emergency response, infrastructure inspection, traffic management and crowd control. Unmanned Life is already developing an "outdoor drone swarm" solution.

"The real power is in the interaction between the different modules we deploy on the edge, and on the device," says Kim Clement. "We are paving the road towards even more exciting use cases in the future. And here we have done it in the ecosystem of an inventory management solution."



Standalone 5G networks and slicing

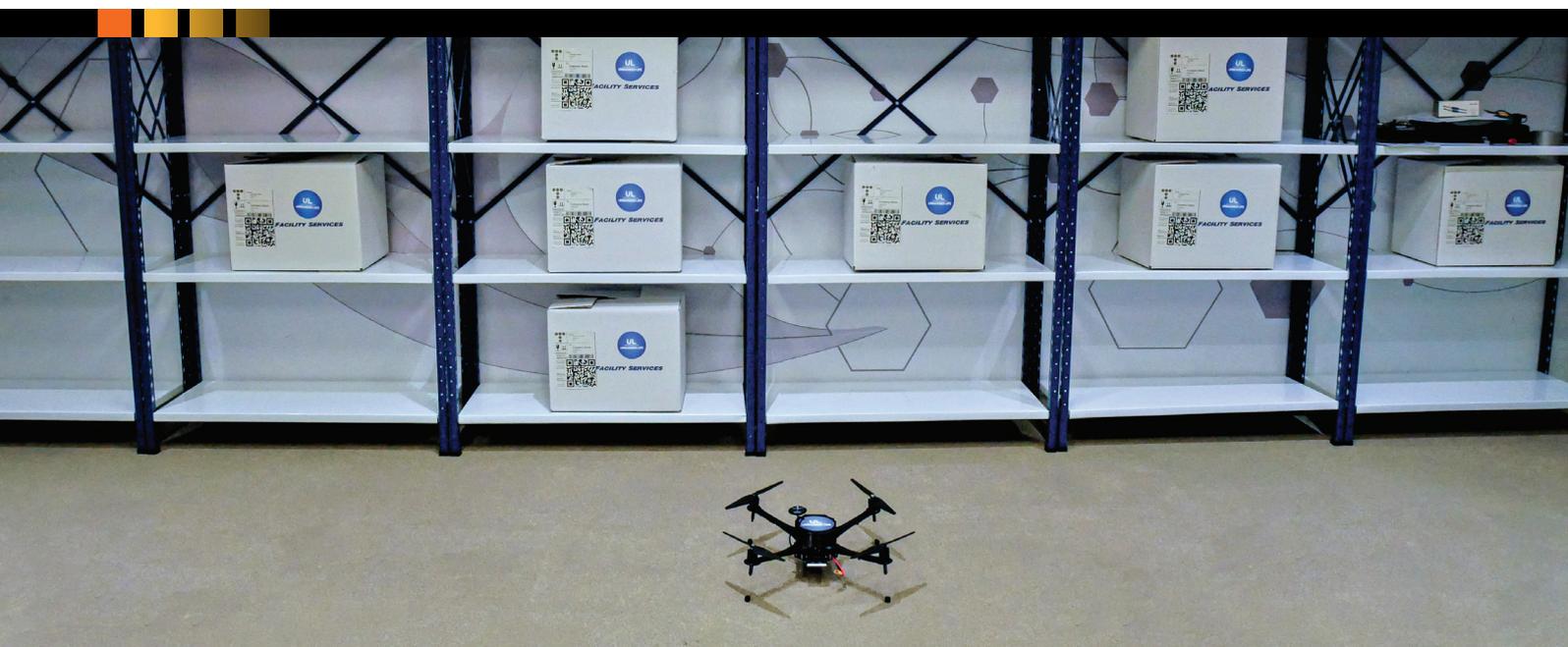
The advent of so-called standalone 5G networks could further improve the connectivity available to drones. As well as lowering latency further still, a 5G core network can be configured to provide a specific application, such as a swarm of drones, with a dedicated slice of connectivity.

Such a slice could offer a specific quality of service tailored to the use case. "We are working on the slicing," says David Moro. "It's going to be pretty much fundamental to separate traffic, I think. So, slicing definitely is going to be important for this kind of use case."

As operators deploy 5G core networks, they should also be able to expose further network capabilities via application programming interfaces (APIs). These APIs will support the concept of a network-as-a-service, which could enable an enterprise to quickly customise the connectivity for a specific use case. In future, that could mean harnessing 5G connectivity as simple and straightforward as running a software application in the cloud.

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About the GSMA



The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

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The GSMA Foundry is the go-to place for cross-industry collaboration and making positive change happen, supported by leading technology organisations and companies. By bringing together members and key industry players, engaging, and unifying the end-to-end connectivity ecosystem, the GSMA is solving real-world industry challenges.

Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. This enables the mobile industry's mission: to connect everyone and everything to a better future.

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About Telefónica



Telefónica is one of the world's leading telecommunications service providers. The company offers fixed and mobile connectivity, as well as a wide range of digital services for individuals and businesses. It is present in Europe and Latin America, where it has more than 365 million customers. Telefónica is a fully private company whose shares are listed on the Spanish stock exchanges and on the New York and Lima stock exchanges.

www.telefonica.com

About Unmanned Life



Unmanned Life is changing the way robots are being deployed by providing seamless orchestration of autonomous robotics with its Autonomy-as-a-Service software platform. Unmanned Life integrates different technologies, such as AI, 5G, and Edge computing with multiple robots, like drones and/or autonomous mobile robots (AMRs) and a variety of capabilities to enable autonomous robotics operations across multiple industries in particular, Industry 4.0 and Smart Cities.

<https://unmanned.life/>