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5G Opens Up New Opportunities in Rural Areas

Trial shows 5G could enable "per plant" farming, potentially increasing yields by 200%

A public-private collaboration, the 5G RuralDorset project has tested how various 5G networks can increase the productivity of agriculture and aquaculture in the rural county of Dorset in southern England. The project also trialled the use of 5G to bring broadband to rural communities and to provide better facilities and increase safety for tourists and residents.

Dorset Council

FOOD PRODUCTION, CONSUMERS

5G Opens Up New Opportunities in Rural Areas

CASE STUDY LEAD: DORSET COUNCIL

CHALLENGE

The relatively poor connectivity in rural areas means it can be expensive and time consuming for food producers to collect the data they need to make better-informed decisions. For example, it can cost thousands of pounds for farmers to collect soil samples manually. At the same time, both residents and tourists in rural areas often struggle with relatively slow Internet connections.

SOLUTION

The partners in the 5G RuralDorset project tested various standalone 5G and non-standalone 5G networks in different parts of Dorset. Standalone 5G private networks were used to provide connectivity to clusters of agriculture and aquaculture farms and along Dorset's Jurassic Coast. The partners also provided non-standalone public 5G connectivity to the village of Worth Matravers, and both indoor and outdoor 5G standalone private networks at Dorset Innovation Park.

IMPACT & STATISTICS

In a trial on arable farms, it was proved how 5G mmWave connectivity can enable robots to identify and then destroy weeds with electricity, rather than harmful pesticides. With the help of Qualcomm® technology, the trial participants believe this approach could improve crop yields by 200%. In the trial, a non-standalone mmWave 5G network was able to deliver a threefold increase in data rates in the downlink and a fourfold increase in the uplink compared to non-standalone 5G deployments in the sub 6 GHz bands. These improvements translate into much higher network capacity.

WIDER IMPLICATIONS

The widespread use of 5G connectivity in agriculture and aquaculture could increase food producers' productivity and reduce their environmental impact. Furthermore, rural 5G networks could help local communities establish businesses and unlock various social and commercial benefits, while also enhancing public safety by bringing better connectivity to first responder organisations and emergency services.

STAKEHOLDERS

Dorset Council, Satellite Applications Catapult, Vodafone, Wessex Internet, AssetHUB, Bournemouth University, University of Strathclyde, Intrepid Minds, British Geological Survey, Neutral Networks, Excelerate, Kimcell, Telint, Qualcomm Technologies, Inc.

SOURCES & FURTHER INFORMATION

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Trial shows 5G could enable "per plant" farming, potentially increasing yields by 200%

The high cost of deploying infrastructure in rural areas means that farms and villages often lack the advanced connectivity found in urban areas. But a trial project in the county of Dorset in southern England has found that 5G networks could bring immense value to rural food producers and communities.

Led by Dorset Council and involving Qualcomm Technologies, Inc., the 5G RuralDorset project explored how next generation mobile connectivity can help people live better, safer, and more prosperous lives in rural communities. Running from March 2020 to September 2022, the £9 million project was funded by industry partners and the UK government's Department for Digital, Culture, Media & Sport, which funded 5G trials and testbeds across the UK.

The partners in the project tested various standalone 5G networks and non-standalone 5G networks in different parts of Dorset. The project explored multiple use cases, including an agriculture and aquaculture applications work-stream led by Dorset-based internet service provider Wessex Internet, and workstreams exploring coastal safety and Internet access for residents and tourists in Dorset's rural villages.

For example, Qualcomm Technologies explored how 5G mmWave connectivity could enable so-called "per plant farming" in which autonomous vehicles and robots capture data about individual plants. The project deployed 5G in the 26 GHz band, which is mmWave spectrum capable of transmitting huge amounts of data.

In the trial, the 5G mmWave connectivity enabled robots to identify weeds which could be destroyed with electricity, rather than harmful herbicides.
The trial participants believe this approach, aided by Qualcomm® technology, could improve crop yields by 200%.

"This work in Dorset is the latest demonstration of how we're inventing the technologies of an intelligently connected future, spearheading research efforts to scale mmWave 5G in 26GHz band across diverse use cases and collaborating with industry leaders to drive the commercial momentum," Ben Timmons, Senior Director, Business Development, Qualcomm Technologies International, Ltd.

Wessex Internet also worked with Hummingbird Technologies, an agricultural drone specialist, to explore how 5G could help reduce the time it takes for a drone to transfer images of a field back to the farmer. In a similar vein, at Kingston Maurward College, Wessex Internet partnered with software company CattleEye to test the use of 5G-connected cameras to quickly identify lame or unhealthy cattle so they can be treated immediately.

> This work in Dorset is the latest demonstration of how we're inventing the technologies of an intelligently connected future

Ben Timmons - Senior Director, Business Development, Qualcomm Technologies International, Ltd

The project participants say a non-standalone mmWave 5G network was able to provide an almost threefold increase in data rates in the downlink and a fourfold increase in the uplink compared to non-standalone deployments in the sub 6 GHz bands. These improvements translate into much higher network capacity.

Wessex Internet also deployed more than 40 different 5G-enabled sensors across three farms. Partnering with FMEC, a farm software developer, the internet service provider experimented with how best to collect and visualise data for farmers. The project used Vodafone's existing coverage to connect sensors across farms, as well as several private 5G networks.

Through a partnership with Vodafone, Wessex Internet and others including Bournemouth University helped develop a completely new connectivity sensor, designed to be reliable, useful and rugged.

The data captured by 5G-connected sensors, cameras, drones and robots will enable farmers to make more informed decisions about how they manage their farm. This could be data on the soil, the location of equipment or electricity usage. In the past, it has been very expensive and time consuming to collect data on farms – for example, it can cost thousands of pounds for farmers to collect soil samples.

"One of the biggest obstacles facing UK farmers in adopting new technologies is poor connectivity around the farm," concludes Hector Gibson Fleming, CEO of Wessex Internet. "Farmers rely heavily on remote sensing to monitor, detect and measure characteristics of their land. We have proven that that reliable 5G connectivity can help deliver affordable and reliable solutions that can work with existing machinery and equipment on the farm. In addition, 5G can enable exciting and innovative agricultural technology, such as drones and even robots."

Many of the networks deployed for the 5G RuralDorset project will remain in place to support further commercial, research and development and educational uses: the UK government has backed further research around the potential uses of mmWave spectrum in agriculture and the network serving Kingston Maurward Agricultural College will continue to train students in agricultural technology applications.

> One of the biggest obstacles facing UK farmers in adopting new technologies is poor connectivity around the farm

Hector Gibson Fleming - CEO of Wessex Internet

Better aquaculture and **safer coastlines**

The 5G RuralDorset project also tested the use of 5G to collect marine data that could be valuable for aquaculture. Collaborating with specialist tech company RS Aqua, Wessex Internet used 5G to provide suitable connectivity to Jurassic Sea Farms in Portland Port. 5G-connected rugged sensors collected information, such as oxygen levels and light levels in the water, which could be used by a seaweed farmer to manage their crop appropriately to minimise waste and maximise yields.

At the same time, the consortium integrated JET Connectivity's 5G-based solution that enables farmers to see what is going on under the water through live streamed 4K video feeds. The University of Exeter is now using artificial intelligence to measure biofouling levels on the seaweed crop.

The 5G RuralDorset project also explored how to improve public safety on the coast by increasing access to digital communication services for first responder organisations. For the coastal safety trials, Excelerate Technology deployed infrastructure along Dorset's world-famous Jurassic Coast to support a standalone 5G network operating in the 700 MHz band. The backhaul connectivity for the 5G network was provided by the Satellite Applications Catapult's 5G Centre in Westcott, Buckinghamshire.

A sea condition monitoring system was also deployed using a low-profile 5G-enabled buoy in Lulworth Cove. Supplied by Jet Connectivity, this buoy used 5G to transmit regular updates about sea conditions. The buoy had a sensor pack on board that collects real-time data on tidal height, wave height and frequency, and current strength and direction. This data was transferred to the onshore 5G network and displayed on digital signage deployed as part of the project.

Installed at Lulworth Cove, Durdle Door, Kimmeridge and Ringstead, the 5G-connected signs showed tide times, water conditions and water quality, plus information about currents. The signs also included safety information from the RNLI and local interest information from landowners and the tourist body Visit Dorset. The connected signage is also capable of displaying video content, such as safety videos or web cam feeds from the beach. That would allow tourists to make an informed decision about whether an area is too busy before leaving the car park.

At the same time, the digital signs can be used to count footfall by monitoring mobile phone signals. The signage can then use 5G to alert the council and emergency services to any overcrowding. These alerts can be used to implement crowd control measures in a more proactive way.

"With detailed and real-time sea condition information easily accessible to multiple users, the objective is to reduce risk to life – to stop people becoming involved in an unsafe situation in or near the sea, and to aid emergency services when performing any life-saving operations," says James Thomas, CEO of Jet Connectivity.

In the past, it has been very difficult to collect data and monitor stocks in the sea. The harsh conditions and general lack of connectivity mean that farmers and research organisations have little information about life beneath the waves.

Jet Connectivity, which designed and built the 5G connected buoys, has grown from a one-man-operation to employing 11 members of full-time staff. It has also secured millions of pounds in extra funding to develop 5G at sea.

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James Thomas - CEO of Jet Connectivity

Accelerating innovation

The 5G RuralDorset project also installed both indoor and outdoor 5G standalone networks at Dorset Innovation Park, which is designated as the national NSTIx Co-creation Space for Defence Innovation. Vodafone installed an indoor 5G standalone network in the defence innovation centre work-shop. The indoor network remained in place to support the British Army's research and development, as well as other Ministry of Defence and NATO projects.

In April 2022, the outdoor network was transferred to project partner Kimcell, who will be investing £1 million into expanding its capabilities. It will be used to support work involving government agencies and

suppliers concerned with public safety. Further R&D work, potentially harnessing 5G mmWave connectivity and artificial intelligence running at the edge of the network, is also being explored.

"Dorset now has the UK's largest expanse of 5G test infrastructure covering land, sea and air, rural and conurbation, as well as a private and secure technology park," notes Gordon Fong, Director of Kimcell Ltd. "This is a great place to do business and is already attracting visitors from around the world."

As the lead for the project's Rural Community Accelerator research, Vodafone deployed public 5G connectivity in the rural village of Worth Matravers. The site has become part of Vodafone's public network, bringing essential voice and data services to residents, businesses and visitors. It also provides connectivity in former dead zones for O2 customers

and 999 services in this popular tourist area. Vodafone has since decided to upgrade the capacity of the site from 1 Gbps to 10 Gbps.

"This project has had a profound impact on the county," says Councillor Jill Haynes, Cabinet Member for Corporate Development and Transforma-tion for Dorset Council. "From providing enhanced connectivity in remote areas to opening new avenues for employment and innovation, it really has put Dorset on the map as a forward-thinking region and I can't wait to see what we can achieve next."

Dorset Council aims to use the learning and the private 5G standalone networks from 5G RuralDorset to develop a nationally significant innovation

ecosystem says Project Lead Colin Wood.

"Digital innovation is a priority for the council. Further commercial private and public networks which will support those ambitions are being built in the county and we are clear that 5G is a key technology to help foster nationally significant innovation, drive our local economy, enable social opportunity and deliver better public services."

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GSMA 5G Transformation Hub

The GSMA 5G Transformation Hub is a source of information on some of the most innovative 5G solutions in the world. This portal contains case studies detailing design, benefits, key players, measured value and the future impact of scaling up these 5G solutions worldwide. The 5G Era is now firmly established and this family of standardised GSM technologies, including mmWave, are being rolled out successfully across the globe. The GSMA 5G Transformation Hub, launched at MWC Barcelona in 2022, provides details of how 5G is best placed to deliver real value for a range of key sectors including manufacturing, energy, transportation, media and live entertainment, smart cities and construction. Many more case studies will be added, in the coming months, covering even more industries and the GSMA is asking Members to nominate innovative 5G case studies to add to this global digital showcase. The 5G Transformation Hub is sponsored by Qualcomm.

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