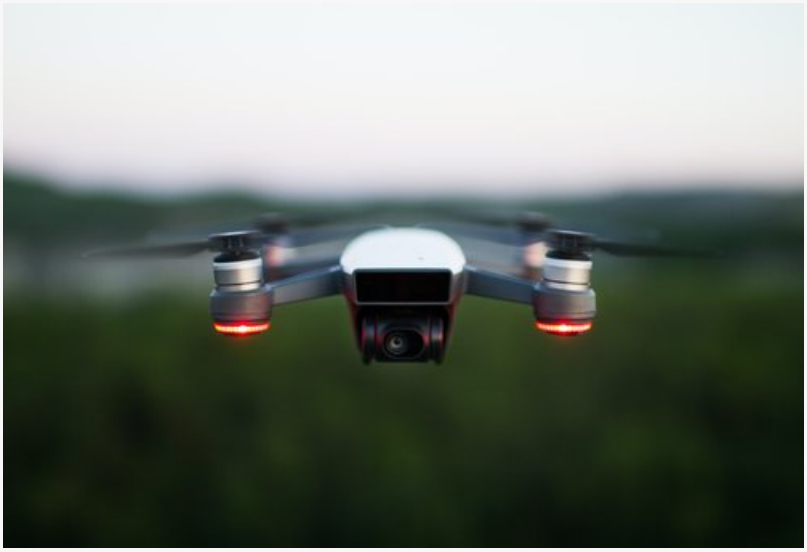
Digital Twin Technology for Connected Agriculture

Digital Twin Technology is Enabling Smarter, Safer, More Sustainable Farming



CONDON, OREGON, UNITED STATES OF AMERICA, October 15, 2022 /EINPresswire.com/ -- Wouldn't it be handy if everyone had a virtual representation of themself that lived in the cloud? There would be less of a need to go to the doctor because healthcare providers could just examine our vital signs online. Buying clothing would be a lot easier too. Shoppers could virtually try things on their online copy to see how they look and fit. A digital double would also make collecting valuable personal data a routine practice.

Digital twins for individuals may not be widely available yet, but in a wide range of industries they are a force for positive disruption.

The digital twin concept was first dreamt up by science fiction authors in the 1990s but became a reality in 2010 when NASA developed a complete physical-model simulation of one of its spacecraft. The goal of that project was to create a virtual representation of a physical object that received real-time input from sensors and other data sources so that the digital version changes in lockstep with the original (the physical twin).

Enhancing Physical Things With Digital Skills
The rationale for that first experiment was to be able to monitor the physical object around the clock, simulate changes and test new integrations (without the cost in time, money, and humanpower of attempting the real thing), and to develop a robust dataset that informs predictive maintenance (forecasting faults so that remediation can occur before they happen).

In the decade plus since that early experiment, digital twin technology has grown and adapted to

a variety of applications as far ranging as automotive manufacturing, healthcare, supply chain management, and even agriculture. Gartner estimates that fully half of all large industrial companies use some form of digital twin in their workflow — and that the companies that do generate a 10-percent improvement in operational effectiveness over their rivals that don't.

The implementations differ greatly, but generally they all operate by outfitting a physical twin with sensors that observe key functional factors like temperature, humidity, and energy usage. That sensor data is transmitted to a cloud-based processing model that interprets it and applies it to a digital twin.

Recent advancements in IoT (Internet of Things) technologies have driven down the cost of internet-connected sensors, expanding the opportunities to take information out of factories and fields and move it into the cloud where it's far easier to access and analyze it. That means not just foremen and farmers can get a close-up, real-time look at how things are progressing, but also data analysts, stakeholders, partners, customers, and anyone along the supply chain with a reason to stay in the loop.

Cloud Farming
One of the major benefits of deploying a digital twin system particularly for farmers is that the timeframes in agricultural settings are often measured in long increments like months and seasons. Testing a change in soil inputs on the physical field is never instantaneous. It can take weeks before meaningful results emerge. On a digital system, that same test can be run in minutes.

The Benefits of Digital Twins in Agriculture
-Greater yields on the same acreage
-Profitability maximization
-More resilience to weather
-More sustainable operations
-Faster time to market

With a digital twin to analyze, agricultural operations can simulate how changes in weather patterns will affect their yields, whether they can save money and do less harm to the ecosystem by reducing their agricultural inputs (without negatively impacting the quality of their crops), and spot warning signs like discolored foliage, the presence of blight or pests, over-irrigation, or falling carbon in the soil. And they can do it fast enough to respond before too much damage is done. Even better, they can use predictive modeling based on their past and current data to make guesses with a high degree of probability that a problem will occur in the near-term and head it off.

The data that powers digital twins is already proving invaluable for agricultural operations around the globe. Belgian agricultural technology company 2Grow, for example, helps its partners measure things like stem width with unique sensors. Stem thickness is a good proxy for

the flow of water within a plant and 2Grow claims its sensors enable tomato farmers to reduce the surface area and water needs for a plot of tomato plants by as much as 20-percent.

Leveraging Remote Sensing in Agricultural Settings
Though the benefits are many, the process of implementing a digital twin system in agriculture can be burdensome, requiring a large number and wide variety of IoT sensors deployed across an entire farm. Farmers have discovered some smart shortcuts, however, like mounting imaging sensors on their irrigation hubs. Irrigation systems necessarily already run throughout most farms and hence provide a practical existing platform to piggyback on.

Agricultural Data Sources
-Expected Yields
-Inputs (e.g. Fertilizer, Water, Sunlight)
-Soil Carbon Levels
-Field Imaging
-Weather History and Forecast

The digital revolution in farming came at just the right time. For generations, institutional knowledge was siloed in individual farmers. These new digital systems are democratizing access and accelerating the advancement of the sciences behind growing great crops — which is vital because there is still a lot left to learn.

“Light, plant nutrition, air, build-up of gasses, water recycling, weather conditions and rain – the combinations are endless and every stage of growth is different,” explains Dave Scott of Intelligent Growth Solutions, an agricultural IoT firm. “Plant science is massively misunderstood. We understand more about how a fish works than a plant.”

Furthermore, despite the advent of high tech tools like GPS monitoring, drone flyovers, satellite imaging, and laser land surveying, the goal of true precision agriculture and digital farm management is still out of reach for many. “Precision agriculture is not that precise,” says Soumik Sarkar of the Artificial Intelligence Institute for Resilient Agriculture at Iowa State University.
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