IoT in smart agriculture: Revolutionising farm efficiency and profitability

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Key Points

- IoT in smart agriculture involves the integration of interconnected sensors, devices, and data analytics to enable precision monitoring and management of farm operations, optimising the resources used (e.g. water, land, labour), thereby enhancing overall productivity.
- The IoT in smart agriculture market is forecasted to grow from $11.5 billion in 2021 to $32.8 billion by 2032. Market growth is being driven by the increased affordability and subsequent adoption of IoT devices by farmers, a growing focus on livestock monitoring and disease prevention, high demand for fresh and traceable produce, world population growth and food scarcity concerns.
- Benefits include precision farming (minimises wastage, increases crop yield, reduces environmental impact), improved resource management, data-driven decision-making (enhances productivity and improves risk management), and remote monitoring and automation for faster response times for changing conditions.
- Leading innovators and startups are finding success in areas such as field mapping, crop management platforms, telematics systems, variable rate technology, disease scouting and pest control solutions, and integrated traceability.
- Emerging trends include AI and machine learning integration, edge computing, blockchain, autonomous tractors and drones.
- The cost, security, and energy consumption concerns of investing in agriculture IoT technologies (for both startup product developers and end-user farmers) may seem expensive and challenging.

- However, partnering with established product design consultancies with in-house capabilities – such as Ignitec – helps to find solutions to challenges (e.g. production costs, cybersecurity, product connectivity in rural areas, and energy consumption), thus making end products accessible to a broader consumer base.

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IoT in smart agriculture refers to using interconnected devices (e.g. sensors, machinery, and data analytics software) to increase farm efficiency. Future Market Insights describes it as being on the 'brink of explosive growth' with financial forecasts projecting a 10% compound annual growth rate (CAGR) from $11.5 billion in 2021 to $32.8 billion by 2032. New competitors offering a variety of farming technologies at reasonable prices are making agriculture IoT more accessible and a dominant motivating factor for widespread adoption – especially as a means to combat global threats of food scarcity by helping to solve problems of efficiency and labour shortages.

In 2022, we looked at how IoT in farming increases efficiency (i.e. lower costs, increased productivity and accuracy) but also how one of the perceived barriers to adoption was the training and investment needed to implement it. This, as highlighted by the projected growth rates, is no longer the case: Out-of-the-box, user-intuitive and cost-efficient solutions are changing traditional farming practices and creating conditions for IoT-enabled agri-tech solutions (i.e. the application of technology and digital tools to farming) to thrive.

Call us if you have an agricultural product idea and need help developing the technology to optimise it. Schedule a free and confidential consultation with an expert on our team to talk you through existing product design options – or help you innovate new ones!

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The Internet of Things (IoT) – the 'smart' technology that links devices together over a wireless network to enable seamless communication – has become so ubiquitous that most of us use it daily without realising it. IoT allows a thermostat to automatically adjust the temperature in your home based on the weather forecast or enables you to remotely check the contents of your fridge at the grocery store. It's wearable tech such as smart collars for pets that track their location and health or fitness watches that monitor heart rate and respiration – sending updates or alerts for anything out of the ordinary.

In this post, we provide a guide to help navigate the world of IoT in smart agriculture: the emerging trends and innovators influencing and shaping industry growth, the opportunities helping the market grow, and the challenges that are solutions waiting to be found!

Are you planning on developing an IoT product but concerned about getting a return on your investment? Call us for a quote for bespoke IoT solutions that will help you improve efficiency, reduce costs, and enable personalised services to enhance customers' user experience.

7 leading startups and innovators of IoT in agriculture worldwide

IoT in agriculture refers to a network in which physical components (e.g. plants and animals), environmental elements (e.g. sunlight, rainfall, pollution), production tools (e.g. fertiliser spreaders, irrigation systems), and 'virtual objects' in the agricultural system (e.g. virtual weather stations and sensor networks) that are connected over the internet. These connected devices collect and transmit data via a real-time mobile app (e.g., soil conditions, animal or crop health) for analysis, which facilitates quick and accurate decision-making.

Leading startups and innovators in this field have been able to leverage the capabilities of IoT in smart agriculture successfully and are opening up the market for others to do the same.

1. Field Margin:

A London-based agritech platform providing a wide range of digital farming solutions that farmers have adopted worldwide. Key aspects of their innovation tools include:

- **Field Mapping** allows farmers to create accurate and up-to-date maps of their fields. This includes features for drawing field boundaries, marking out specific areas, and annotating maps with important information.
- **Crop Management Platform** provides tools for monitoring and recording essential information, e.g. tracking planting and harvesting dates, monitoring crop health, and recording observations.
- **Collaboration** features allow users to share information and collaborate in real-time. This can be particularly useful for coordinating activities, sharing insights, and improving communication within the farming operation.

2. John Deere:

A leading American agricultural machinery manufacturer that actively incorporates IoT technologies into its equipment and offers innovative tools for precision agriculture.

- **Telematics Systems** utilise IoT technology to connect tractors, harvesters, and other farm equipment to the internet. This connectivity allows farmers to monitor their machinery's location, performance, and operational status remotely.
- **Precision Farming solutions** provide farmers with detailed insights into their fields. This includes sensors and GPS technology to collect data on soil conditions, crop health,

and weather patterns. Farmers can use this data to make informed decisions about planting, irrigation, fertilisation, and harvesting.

- **FarmSight Services:** Leverages IoT to offer a range of solutions for farmers, including remote machine monitoring, data analysis, and agronomic support.

3. Bayer AG:

This German life sciences company has a strong presence in agricultural sectors worldwide, providing innovative solutions that enhance agriculture productivity, sustainability, and crop protection.

- **Climate FieldView Platform:** A digital farming platform that integrates data-driven insights to help farmers make informed decisions. It utilises IoT technologies, including field sensors and satellite imagery, to collect data on various aspects of farming, such as soil conditions, crop health, and weather patterns. The platform offers features like field mapping, variable rate seeding, and crop health monitoring.
- **Data-Driven Decision Support:** Climate FieldView provides farmers with real-time data and analytics to support decision-making throughout the crop production cycle. This includes insights into planting, nitrogen management, and harvest optimisation.
- **Variable Rate Technology (VRT):** Allows farmers to customise inputs like seeds, fertilisers, and pesticides based on specific conditions within a field. This helps optimise resource usage and improve yield outcomes.
- **Integration with Farm Machinery:** Bayer's digital farming solutions aim to seamlessly integrate with farm machinery and equipment, enhancing the overall efficiency of farming operations. This integration often involves data exchange between the Climate FieldView platform and compatible agricultural machinery.

4. Lentera Africa:

A Kenyan agritech startup that develops ground-based sensors to measure temperature, humidity, and soil moisture to allow farmers to make decisions to adjust certain farm conditions. In addition to these sensors, they use satellite imagery and drones to detect and alert farmers about pests, offering pest and disease-scouting solutions for their fields.

5. Makabi:

A Croatian startup that developed a 3-in-1 encapsulation technology for plant protection, nutrition, and controlled release of bioactive components as an innovation of green chemistry for sustainable agricultural production. It reduces environmental pollution, mitigates climate change, and increases

the biopotential of produced food. With this trinity, it fulfils essential criteria of the EU Taxonomy and is poised to make impactful changes in the agricultural industry.

6. O4S (Original for sure):

An Indian startup that aims to solve agricultural product suppliers' problem of a high return rate from customers by developing a SaaS platform to trace products. It provides each product with a unique identification number and monitors it throughout manufacturing processes so that any defect can be detected beforehand. It also increases supply chain visibility for its customers.

7. AgUnity:

An award-winning Australian agritech company that connects organisations working to address United Nations Sustainable Development Goals (UN SDG) with smallholder farmers in emerging markets and empowers them with digital tools needed to navigate complex global supply chains:

- **Blockchain for Agriculture** creates transparent and secure systems for farmers. The blockchain records transactions, providing a reliable and traceable system for farmers to engage with markets and establish trust.
- **Mobile Applications** designed to be user-friendly for farmers. These applications often focus on record-keeping, market information, and financial transactions.
- **Empowering smallholder farmers** in developing regions with tools and technologies to improve their livelihoods. This includes facilitating fair and transparent transactions, enabling market access, and fostering financial inclusion.
- **Emphasis on social impact** helps to create positive change in the lives of smallholder farmers and rural communities. By leveraging technology, AgUnity seeks to address poverty, inequality, and lack of access to essential services.

Are you looking for ways to leverage IoT's capabilities in smart agriculture to innovate and create solutions that the agricultural sector is looking for? Call us for more info on how we can help you innovate on demand, explore emerging technologies, or conduct the research and development needed to ensure you develop a product that capitalises on a growing market demand.

What are the emerging trends in IoT for smart farming?

IoT technologies are stepping in to meet the urgent need to ensure food security and meet global sustainability goals – especially in light of World Bank estimations that place the global population at 10 billion people by 2050 and will require a 98% increase in food production. Existing technologies

(e.g. GPS, remote sensing devices, geospatial technologies, real-time data collection, and intra-field diagnostics) helping to meet this need primarily consist of IoT-enabled precision farming tools that streamline crop management services, increase production levels, and improve productivity.

Specific applications include:

- **Sensor-based farming:** A network of IoT sensors that monitor soil conditions, crop health, and environmental factors in real-time, enabling farmers to make data-driven decisions on irrigation, fertilisation, and pest control for optimised crop yields and resource efficiency.
- **Smart livestock management:** IoT devices such as wearable sensors to monitor animals' health, location, and behaviour. This technology helps farmers enhance animal welfare, detect illnesses early, and efficiently manage breeding programs for improved productivity.
- **Smart greenhouses:** Leveraging IoT sensors and automation to regulate environmental variables, such as temperature, humidity, and light levels, to create an optimal crop growth environment. This precision control enhances crop quality, accelerates growth cycles, and reduces resource consumption. For example, up to 60% decrease in pesticide usage.
- **Advanced weather prediction algorithms:** Integrates IoT data with meteorological information to provide accurate and localised weather forecasts. This enables farmers to plan their activities effectively, manage risks, and optimise crop management based on upcoming weather patterns.
- **End-to-end farm management:** Integrates various IoT technologies to offer comprehensive solutions, encompassing crop monitoring, equipment tracking, and supply chain management. This holistic approach improves operational efficiency, reduces waste, and enhances farm productivity.
- **Smart water management:** Employing IoT sensors to monitor soil moisture levels and weather conditions, enabling precise irrigation control. Farmers can conserve resources, reduce costs, and maintain sustainable agricultural practices by optimising water usage. According to a study by the Food and Agriculture Organisation (FAO), implementing precision irrigation can lead to water savings of up to 30% while improving crop yields.
- **Drones:** IoT technology to capture high-resolution aerial imagery and collect data on crop health, soil conditions, and field topography. Drones enable farmers to assess large areas quickly, identify potential issues, and make informed decisions to enhance crop yields and resource utilisation.

As we look to the future of IoT in smart agriculture specifically and how it relates to product design trends in 2024 as a whole, two clear-cut areas where the two intersect are sustainability and artificial intelligence in user interface and user experience (AI in UI/UX design). Let's look deeper into the emerging IoT trends for smart farming.

AI and machine learning (ML) integration

Integrating AI and ML with IoT agriculture technologies is ushering in a new era of smart and predictive systems. These systems analyse vast amounts of data to optimise productivity and resource usage, making farming operations more effective. Examples of emerging agritech trends include:

- **AI-powered decision support systems:** Leveraging machine learning algorithms to analyse data sources (e.g. weather forecasts, historical data, soil sensors). This results in personalised, real-time recommendations for farmers that guide planting, irrigation, fertilisation, and pest management decisions.
- **Edge computing for real-time analysis:** A distributed computing paradigm where data processing is performed closer to its source rather than relying solely on centralised cloud servers. Processing and analysing data occurs on or near the device or "edge" of the network, reducing latency and enhancing real-time decision-making.
- **Predictive analytics for market trends:** By analysing market data and trends, these models offer insights into optimal crop choices, timing of harvests, and even pricing strategies. This empowers farmers to align their agricultural decisions with market demands, resulting in more efficient production and distribution.
- **Autonomous farming:** Robotic vehicles equipped with sensors and AI are poised to perform tasks like planting, spraying, and harvesting with unprecedented precision. This advancement reduces labour costs, increases operational efficiency, and paves the way for a future where farming becomes increasingly automated.

Blockchain for traceability

The benefits of blockchain for product resilience and robust supply chain management aren't anything new. However, this technology is quickly gaining traction in agriculture for its ability to enhance traceability and supply chain transparency. This application ensures every step from farm to fork is recorded and verifiable, meeting the increasing consumer demand for transparency in food production.

Autonomous tractors and drones

The introduction of autonomous tractors and drones will result in the significant advancement of the agriculture industry. These technologies automate key processes like planting, monitoring, and harvesting, introducing a level of precision and efficiency previously unattainable in traditional farming practices.

- Drones can see what humans can't and make it possible to assess crop health assessment, monitor irrigation, and analyse soil—all without stepping foot in the field.
- Autonomous tractors such as the TYM TX76 are equipped with technology that boosts efficiency (e.g. accurate straight-line driving with tighter row spacing) and produces more crops.
- When integrated with AI and computer vision, autonomous vehicles provide advanced analytics, automation, and insights. Key applications include crop monitoring and health assessment, weed detection and management, precision irrigation, automated harvesting, predictive analytics for crop yield, and disease prediction.

Looking to get ahead of the curve with emerging technologies for IoT in agriculture? Call us for a free and confidential consultation with an expert on our team to talk you through the services we can provide for you.

The opportunities and challenges of IoT in smart agriculture

The first opportunity, which has already been seized by many, is for Original Equipment Manufacturers (OEMs) of sensor devices to introduce customised tracking tools and equipment able to fulfil various farm requirements. Examples of sensors with customised tracking solutions:

1. Precision agriculture sensors
2. IoT-enabled farm equipment such as tractors, harvesters, and implements.
3. Telematics systems
4. Variable Rate Technology (VRT)
5. Remote sensing technologies
6. Livestock monitoring devices
7. Weather stations
8. Data management platforms

Introducing customised tracking tools opens up another opportunity: collaboration with software developers. This is essential to creating applications that enable farmers to easily interpret data and translate it into actionable insights. These applications often feature user-friendly interfaces for easy decision-making that enhance user experience. This corresponds directly to the product design trends of 2024 we mentioned above, i.e. the increased use of AI and UX/UI in product design.

Ignitec's software design services are geared towards offering bespoke, end-to-end, and affordable solutions to companies aiming to introduce customised tracking tools and equipment to their product offerings. Call us for a quote!

Another opportunity is for product design companies to collaborate with corporations prepared to spend big to provide the agricultural industry with innovative technology in anticipation of a significant return on investment (ROI). The agriculture IoT market is currently dominated by a few established players such as Deere and Company (USA), Trimble Inc (USA), Raven Industries (USA), DeLaval (Sweden), and the AKVA Group (Norway). These companies adopt organic and inorganic growth strategies (e.g. product development, partnerships, acquisitions) to strengthen their position in the market. Examples of recent developments as a result of product development partnerships include:

- DeLaval introduced robots to its product portfolio to improve cow comfort and hoof condition.
- The AKVA group completed a prototype for a fully electric boat for the aquaculture industry.
- A partnership with IBM to develop software for agriculture that integrates AI to help evolve all phases of the farming cycle.
- Raven Industries introduced its first driverless agriculture technology for harvesting operations.

In addition, there is the funding opportunity provided by government grants aimed towards ensuring food security and sustainability. One example is the UK's Improving Farm Productivity grant that provides financial support of up to £500,000 for robotic and automated equipment and solar equipment for energy resilience. This type of governmental support is crucial in accelerating the sector's transformation towards tech-enabled practices but also helps small companies and startups with the financial capital needed to develop affordable products and compete against large corporations dominating the industry.

Challenges and restraints to the growth of the IoT agriculture industry

The biggest challenge to market growth is the high initial investment: agricultural IoT devices and tools are expensive and not easily affordable to small farmholders and farmers in emerging economies. In addition, there is the training that a workforce needs to operate these technologies and the setup costs required to implement them. For example, automated milking and feeding robots aren't an out-of-the-box solution that can be implemented without prior training and setup.

Another major concern is data management and security. With the influx of data generated by IoT in smart agriculture devices, effectively managing and securing this information is challenging. The vulnerabilities of farming devices with weak security protocols would need to be addressed, and creating cyber-secure products to safeguard against these vulnerabilities is essential.

In addition, there is the challenge of limited network coverage in rural areas as the app must transmit large volumes of data, requiring a stable internet connection.

Work around these challenges by consulting a multidisciplinary product design agency such as Ignitec. Our in-house capabilities help to lower overall costs, and our team are experts at finding solutions to problems such as network coverage, workforce training, and affordability. Contact an expert on our team to explain which solutions are available and how to lower production costs.

Lastly, and arguably most importantly, mitigating the high energy consumption of IoT-enabled devices while ensuring their effective operation poses a significant challenge in developing and deploying these technologies. This challenge arises due to several factors:

1. Limited power resources: Many IoT devices operate on battery power, especially those deployed in remote or inaccessible locations. The challenge is to balance the need for energy efficiency with the limited energy capacity of batteries. Prolonging battery life is crucial to avoid frequent replacements and maintenance.

2. Data transmission and connectivity: Data communication between IoT devices and central servers or cloud platforms consumes energy, especially in wireless communication. Balancing the frequency and volume of data transmission with the need for real-time or periodic updates is crucial to optimise energy consumption.

3. Complexity of sensing and processing: IoT devices often include sensors and processors for data collection and local processing. The challenge is implementing energy-efficient algorithms and sensor technologies to minimise power consumption during sensing, data processing, and decision-making.

4. Duty cycling and sleep modes: IoT devices often use duty cycling to conserve energy, where they alternate between active and sleep modes. Optimising the duration and frequency of these cycles while ensuring timely responsiveness to events is challenging for maintaining energy efficiency and effectiveness.

5. Energy-hungry components: Some IoT devices include high-resolution cameras, powerful processors, or long-range communication modules. Integrating these features while managing their energy consumption is a balancing act to avoid compromising the device's overall energy efficiency.

6. Harvesting renewable energy: In scenarios where traditional power sources are impractical, IoT devices may rely on energy harvesting methods, such as solar or kinetic energy. The challenge is to design systems that efficiently harvest and store renewable energy to meet the operational needs of the device.

7. Optimising edge and cloud computing: Balancing the computation load between edge devices and cloud servers is critical. Deciding what data should be processed locally versus offloaded to the cloud can impact energy consumption. Optimising algorithms for edge computing can help minimise the need for continuous data transmission to and from the cloud.

8. Lifecycle considerations: The overall lifecycle of an IoT device, from manufacturing to disposal,

contributes to its environmental impact. Designing devices with energy-efficient materials, considering end-of-life recycling, and minimising the ecological footprint are additional challenges in mitigating energy consumption.

Addressing these challenges requires a multidisciplinary approach involving advancements in hardware design, communication protocols, energy-efficient algorithms, and system optimisation. As IoT technologies evolve, ongoing research and innovation will be essential to balance energy efficiency and effective operation in diverse IoT applications.

However, finding solutions to multi-faceted challenges is manageable. Our experience in developing autonomous robotics for deep-sea exploration and environmental monitoring technologies to research glacial monitoring is living proof that the challenges of designing robust products adapted for remote and challenging environments but also affordable and with no extensive user training needed is possible – especially when collaborating with Ignitec's multidisciplinary team of experts. Call us to discuss how we can help with your challenges and bring your product to market faster.

A final word on the agriculture IoT market

As the agricultural sector evolves, integrating IoT-enabled agriculture devices will become essential to ensuring advanced efficiency, precision, and yield. Tailored solutions able to meet the unique and growing demands of the industry are necessary, as are product developers who can do so quickly and affordably without compromising on quality and accuracy.

If you're looking for ways to leverage IoT technology to make your existing or planned agriculture products more efficient and scale up your business, please get in touch!

And if you found our guide to IoT in smart agriculture informative, please share it.

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FAQ’s

Why is precision farming important in IoT in smart agriculture?

Precision farming in IoT-enabled agriculture is crucial because it allows farmers to optimise resource usage, reduce waste, and enhance overall crop yields by using data-driven insights from interconnected devices to make informed decisions on irrigation, fertilisation, and pest control.

How do IoT sensors benefit crop monitoring in smart agriculture?

IoT sensors in smart agriculture provide real-time data on soil conditions, crop health, and environmental factors, enabling farmers to monitor crops efficiently and identify issues such as diseases, pests, or nutrient deficiencies. This data-driven approach supports proactive decision-making for improved crop management.

What role do drones play in IoT-enabled smart agriculture?

Drones in smart agriculture equipped with IoT technology capture high-resolution aerial imagery and collect data on crop health, soil conditions, and field topography, allowing farmers to assess large areas quickly, identify potential issues, and make informed decisions to enhance crop yields and resource utilization.

When should farmers use variable rate technology in IoT-driven agriculture?

Farmers should use variable rate technology in IoT-driven agriculture when customising the application of inputs like seeds, fertilizers, and pesticides based on specific conditions within a field is

essential for optimizing resource utilization and improving overall yield outcomes.

Which IoT applications are most beneficial for livestock monitoring in smart agriculture?

IoT applications for livestock monitoring in smart agriculture include wearable sensors that track the health, location, and behaviour of animals, enabling farmers to optimize breeding programs, detect illnesses early, and improve overall herd management for enhanced productivity.

What are the advantages of using IoT-enabled weather stations in smart agriculture?

IoT-enabled weather stations in smart agriculture provide accurate, on-site weather data, supporting farmers in making timely decisions about planting, harvesting, and irrigation by analyzing temperature, humidity, wind speed, and precipitation.

How does IoT contribute to efficient water management in smart agriculture?

IoT in smart agriculture helps optimise water management by using sensors to monitor soil moisture levels and weather conditions, enabling precise irrigation control. This data-driven approach ensures efficient water usage, conserves resources and promotes sustainable agricultural practices.

Why is edge computing considered essential for IoT in smart agriculture?

Edge computing is essential for IoT in smart agriculture because it reduces latency by processing data closer to the source, enabling quick analysis of information from sensors on the farm. This low-latency approach supports real-time decision-making for enhanced responsiveness in agricultural operations.

How do IoT devices assist in efficient resource management in

smart agriculture?

IoT devices in smart agriculture assist in efficient resource management by providing real-time data on soil conditions, crop health, and environmental factors. Farmers can use this data to optimise the usage of resources such as water, energy, and fertilizers, reducing waste and operational costs.

What is the significance of remote monitoring in IoT-driven smart agriculture?

Remote monitoring in IoT-driven smart agriculture allows farmers to monitor and control various aspects of farm operations from a distance. This includes the ability to remotely control irrigation systems, machinery, and other equipment, improving operational efficiency and responsiveness to changing conditions.

How does precision farming contribute to sustainability in smart agriculture?

Precision farming in smart agriculture contributes to sustainability by minimising resource wastage, optimising crop yields, and reducing environmental impact through data-driven insights. This approach promotes efficient and environmentally friendly farming practices.

Which renewable energy sources can be used to power IoT devices in smart agriculture?

Renewable energy sources such as solar or kinetic energy can be used to power IoT devices in smart agriculture, especially in remote or off-grid locations. Energy harvesting methods help ensure a sustainable and continuous power supply for these devices.

Why are IoT-enabled solutions essential for data-driven decision-making in smart agriculture?

IoT-enabled solutions are essential for data-driven decision-making in smart agriculture as they generate real-time data on soil conditions, crop health, and environmental factors. This data empowers farmers to make informed decisions, optimize farm management, and enhance overall

productivity.

How does IoT contribute to the automation of farm equipment in smart agriculture?

IoT contributes to the automation of farm equipment in smart agriculture by enabling remote monitoring and control of machinery. This includes features such as automated harvesting, precision planting, and the ability to control equipment based on real-time data, improving operational efficiency.

What are the benefits of implementing IoT in smart greenhouses?

Implementing IoT in smart greenhouses offers benefits such as precise control over environmental variables like temperature and humidity, creating optimal conditions for crop growth. IoT enables automation and remote monitoring, enhancing the efficiency and productivity of greenhouse farming.

Why is predictive analytics valuable for crop yield optimization in smart agriculture?

Predictive analytics in smart agriculture, enabled by IoT, utilises historical data, weather patterns, and environmental factors to predict crop yields. This valuable information helps farmers plan effectively, allocate resources optimally, and make informed decisions for improved crop management.

How do IoT sensors contribute to disease detection in smart agriculture?

IoT sensors contribute to disease detection in smart agriculture by monitoring crop health and identifying anomalies that may indicate diseases. Early detection through sensor data allows farmers to implement timely interventions, reducing the impact of diseases on crop yields.

When is the use of IoT-enabled virtual fencing recommended in

smart agriculture?

The use of IoT-enabled virtual fencing in smart agriculture is recommended when farmers need to monitor and control the movement of livestock without physical barriers. This technology uses GPS and sensors to create virtual boundaries, optimising grazing patterns and herd management.

What advantages do farmers gain from using end-to-end farm management solutions in smart agriculture?

Farmers gain advantages from using end-to-end farm management solutions in smart agriculture, as these solutions integrate various IoT technologies for comprehensive farm monitoring. This includes features like field mapping, variable rate applications, and crop health monitoring, streamlining farm operations and decision-making.

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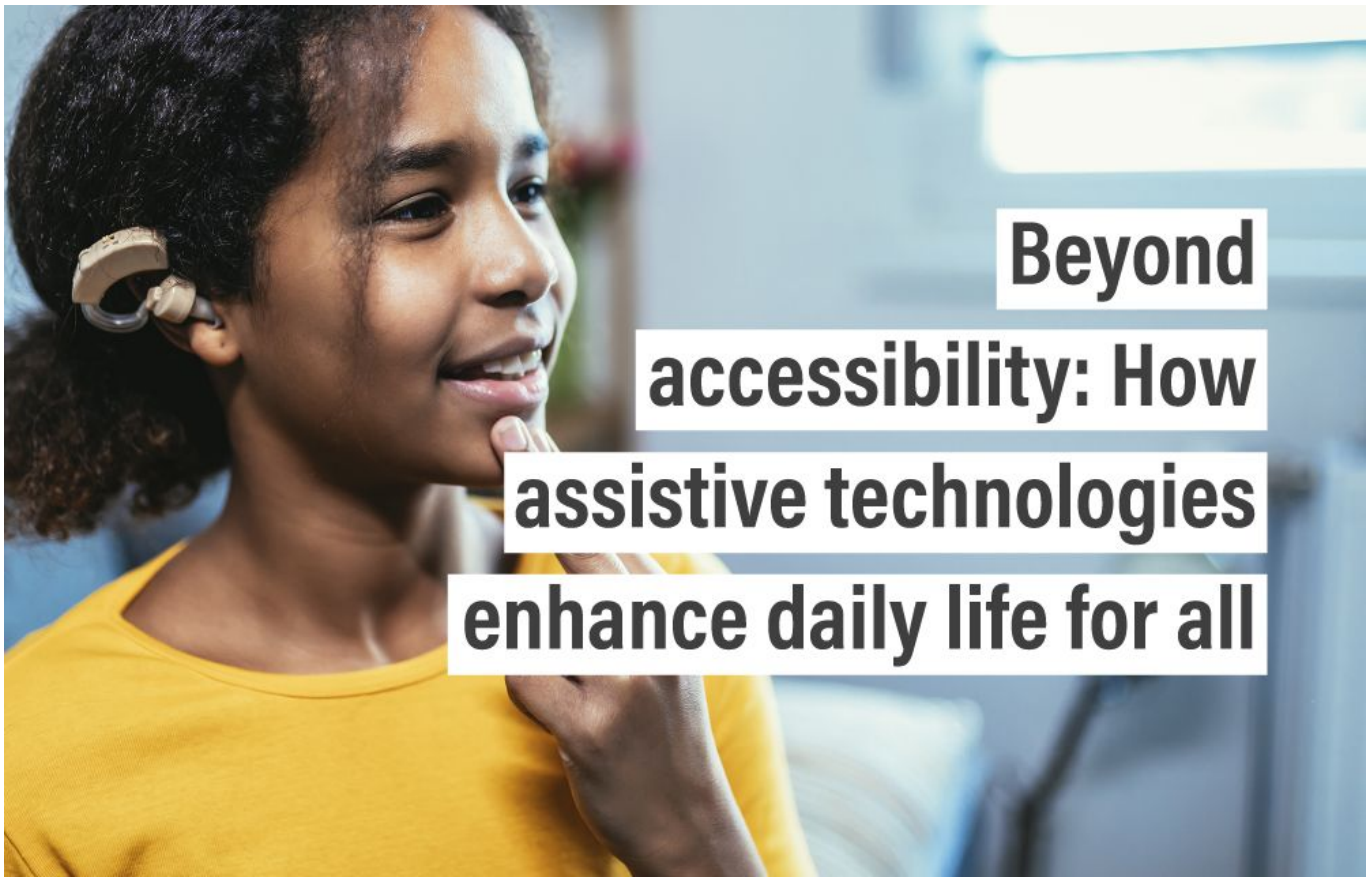

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