The Internet of Things in Agriculture

The Internet of Things (IoT) can be defined as the network of devices that are connected using the internet and have inbuilt sensors that can transmit data to other devices. This technology is becoming more widely used to solve problems in fields such as manufacturing, healthcare, city services, transport, and food production. In agriculture, the IoT is a relatively new technology that has been adopted to help with increasing demand. It allows farmers to increase their yields, decrease input costs and more reliably produce safe foods with consistent quality.

Managing resources such as water, feed, staff and equipment is very important in agriculture. For example, a lack of water can be the defining factor as to whether a crop will produce well or not. With IoT soil moisture sensors, farmers can easily and remotely monitor water content of the ground. This allows them to irrigate when and where it is most needed, and this precision prevents overwatering, reduces water wastage, and improves crop health. Furthermore, the soil moisture sensors could connect to the irrigation system and tell the irrigation when to run. What enables this is the fact that these devices are interconnected through the internet. The number of connections are effectively limitless, or, in other words, not just one connection is possible (i.e. the moisture sensors can also connect with a display in the farmers house, and the irrigation system is also connected to a weather station/sensor, flow-metre and various valves/pumps…). Overall, these embedded systems will allow farmers to direct their efforts towards more pressing issues while ensuring the safety and quality of their harvest.

Crop monitoring and management is also something that has been completely revolutionised by IoT technologies. Instead of farmers walking or driving around to check their crops, these days, drones equipped with cameras and sensors can survey big areas of farmland and take images. If the drones are very advanced, these images could even be transferred to another device or program to be analysed. This could potentially detect signs of pests, diseases, or nutrient deficiencies. This detection allows farmers to target areas that require specific intervention, ensuring healthier produce as well as allowing them to farm much larger areas more reliably.

A similar practice is employed on large cattle farms where livestock management has greatly benefited from IoT. Some devices like collars or ear tags allow farmers to monitor animals' health, location, and behaviour. This makes sure that the livestock are safe and helps farmers to optimise breeding and feeding. For example, IoT-enabled tracking systems help prevent theft and reduce the chances of animals straying away from designated areas because the location sensors can transfer data, over the internet (as they are connected this way) to a place convenient for the farmer, be that their phone or a website. Another use is when such sensors can identify sick animals so that farmers can separate them from the herd and avoid mass contamination.

Another critical aspect of the agricultural industry that has been transformed by IoT is supply chain optimisation. Throughout the journey from a crop being harvested to storage and distribution centres, IoT sensors can track temperature, humidity, and other conditions. This ensures quality and freshness and is useful in reducing spoilage, waste, and delivering

produce in optimal condition. For example, the company TempuTech uses IoT to provide grain storage monitoring systems which ensure optimal conditions. These sensors can connect to computer dashboards to show data concerning different grain bins, allowing conditions to be automatically adjusted accordingly.

Despite many advantages, the IoT is relatively new, especially in the agriculture sector. Therefore, it is not without challenge. Aspects such as data privacy and security concerns are crucial, as the information collected from farms could be sensitive and valuable. Furthermore, there's a digital divide that can prevent the more widespread use of IoT on farms. Access to the internet is still something not always possible in rural areas where farms are generally located, meaning they are not able to use the Internet of Things.

The integration of the Internet of Things into agriculture has enabled farmers to increase their food production and whilst minimising input costs and increasing the quality and safety of their products. It aids them in regard to livestock management, precision farming and optimisation of their crops, and in the future, technological advancements like the IoT may even become necessary to ensure food security.

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