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Project Name	Project – Smart Farmer-IoT Enabled smart Farming Application

SOLUTIONS FOR SMART FARMING:

AgriBot – Autonomous Tractor:

Tractors are essential agricultural equipment that is used right from preparing the soil for planting seeds all the way to harvesting crops. It can be used for hauling heavy materials or even as personal transportation. Farmers spend a lot of their time driving tractors to get work done. [Automation](#) in driving technologies has reached agriculture as well with autonomous tractors freeing up time for farmers to focus on other aspects of agriculture. Polish startup [Agribot](#) develops its eponymous autonomous tractor, the *Agribot*, offering several benefits for the farmer. Apart from saving time, their tractors are fitted with a range of sensors to significantly reduce human contact with chemicals and pesticides during weeding. It allows for increased capacity, working day and night along with the ability to carry out two agronomic tasks simultaneously.

One Water – Smart Irrigation:

The changing seasons have a great impact on agricultural activities. Prolonged drought conditions during the summer months and devastating floods during the rainy season affect crop yields all over the world. Some regions in the world are facing years-long drought conditions with minimal rainfall. It is no surprise then that innovations in irrigation are receiving a lot of attention. Smart irrigation provides optimal water delivery to crops while ensuring there is minimal to no wastage in water used for agriculture. Indian startup [One Water](#), guided by their parent company Nascent Info Technologies, develops [Internet of Things \(IoT\)](#) based smart irrigation systems for agriculture. Excess water can also cause the destruction of crops and spur the growth of weeds. One Water can sense soil moisture, humidity, and temperature to automatically execute drip irrigation on the farm, saving valuable resources.

Saga Robotics – Autonomous Harvesting

For farms with low mechanization, crop harvesting is the most labor-intensive activity of the season. Harvesting is not limited to just fields but includes orchards, vineyards, and plantations too. [Automation in harvest](#) technologies for agriculture ensures lower stress on labor and higher efficiency in gathering crops. It also protects the labor from potential accidents or snake-bites. Norwegian startup [Saga Robotics](#) develops a modular robotic platform called *Thorvald*, an autonomous farm robot capable of performing several tasks, including harvesting of fruits and vegetables. Farmers can choose from 4 different types of robots based on their specific needs. All their robots use the ROS software, an open-source meta-operating system for robots.

Desamis – Livestock Monitoring

Cattle, sheep, pigs, goats, and chicken contribute significantly to food and clothing for humans. Animal husbandry is an important branch of agriculture that deals with the day-to-day caring, breeding, raising, and [monitoring of livestock](#). Cattle, especially, are being provided with their own sensors that track their movement and activity, monitor heat in their stomach, check their breath to detect diseases, and more. Japanese startup [Desamis](#) develops *U-monitor*, an Artificial Intelligence (AI)-based [smart dairy](#) platform to monitor, detect, and analyze cattle behavior so that the farmer can make informed decisions. It records and monitors when cattle are feeding, drinking, moving, standing, lying and ruminating. It looks for dysstasia-related diseases using sensors in the stomach of cattle. Moreover, it provides the data in real-time, allowing for immediate analysis and decision-making.

Plastomics – Genetic Editing

It is believed that by 2050, there will be around 9 billion humans in the world. Today, almost all arable land in the world is being used for agriculture. This drives innovation in agriculture to significantly increase farm output or yields per acre/hectare. And one of the most powerful, but controversial, innovations is the [genetic manipulation](#) of crop seeds. Techniques like C4 photosynthesis, CRISPR/Cas9 or genomic selection are powerful because of their ability to make crops highly resistant in tough growing conditions. They are controversial because there is little control over the result of editing a gene of a crop, not to mention the high costs involved for such processes to eventually feed billions. The US-based

startup [Plastomics](#) is developing a new way to improve crops by making modifications to the plant's genetic traits using its chloroplast rather than its nucleus. They believe that chloroplast engineering is better because there are many chloroplasts in a cell, so the traits can be precisely introduced. The biological characteristics of the chloroplast translate into crop products that are better for the planet and more profitable for seed companies and farmers.

OTHER SOLUTIONS WITH DIAGRAMATIC VIEW:

IBM predicts, the use of IoT will enable farmers to increase production rates by 70% by the end of 2050, so, all in all, the future looks optimistic. One way or the other, IoT has a lot to offer in terms of alleviating the pains farmers regularly face.

AgriTech is a thriving industry, and, as of today, an extensive range of smart farming systems enables farmers to meet their daily challenges. Planting, watering, crop gathering and pest control – agriculture field monitoring collects a range of metrics farmers can act on to manage these tasks effectively.



Below are some examples of smart agriculture monitoring solutions and how they work.

Soil condition monitoring

Soil condition is an important indicator helping farmers decide on the optimal planting, and crop gathering time. With IoT sensors performing soil condition monitoring, farmers get instantly alerted of soil moisture and salinity. Other metrics include soil temperature and air temperature: estimating them correctly enables farmers to plan watering times and know when to expect pests.

Soil condition monitoring requires a combination of hardware and software systems to operate in real-time and alert users on any significant changes.

An example of such a solution is **CropX** – an ag-tech platform for agriculture remote monitoring. It uses smart agriculture sensors to collect data, and a cloud infrastructure for data processing and storage to deliver information in a readable format to a user's computer or smartphone screen.



Weather monitoring

Weather monitoring in agriculture is one of the most frequent application fields for IoT. In crop farming, yields are heavily dependent on the environment, which is inherently volatile. Weather monitoring solutions located directly in the field (such as the ones used by weather stations), alert farmers on changing weather conditions – temperature, precipitation, humidity, sun radiation, and wind speed.

Weather monitoring platforms like [Pycno](#), [allMETEO](#), and [Smart Element](#) are vivid examples of how the application of smart sensing technology in agriculture helps deliver effective weather notifications directly to farmers' laptops and smartphones, enabling them to immediately take action.



Greenhouse automation systems

A fragile and sensitive greenhouse ecosystem requires incessant maintenance and control. Smart agriculture solutions for greenhouse automation like [Growlink](#), [Farmapp](#), and [GreenIQ](#) illustrate the application of remote sensing in agriculture. They help maintain optimal microclimate conditions and manage lighting, humidity, CO₂ and temperature levels. Instant alerts and increased management capabilities maximize the efficiency of greenhouse farming.



Crop monitoring systems

As crops grow and ripen, so many things can go wrong: diseases, infestations with pests, or adverse environmental conditions can potentially cause irrevocable harm before farmers even notice. Applied in crop monitoring, smart sensing technology collects metrics about the state of the crops (temperature, humidity, health indicators) and enables farmers take timely measures should anything go wrong.

Moreover, systems like [Semios](#) and [Arable](#) help detect when the crop is ripe, enabling farmers to plan exact harvesting times.



Digital pest management

Pest infestations are some of the pains crop farmers face on a regular basis. Knowing when pests arrive can be challenging, but also pinpointing their activity and location is normally impossible without making frequent trips to the field. Smart agriculture monitoring systems tackle these problems; moreover, they also help allocate the exact amount of chemicals needed to eliminate pests in each particular case.

IoT pest detection systems like Strider count insects and determine their locations in real-time using an insect camera and sensors for crop pest detection placed directly in the field. Ag-tech companies like [Fieldin](#) and [DTN](#) offer similar solutions for IoT-based pest control.

Livestock monitoring systems

Apart from crop and weather monitoring, agriculture monitoring solutions are also gaining wider application in livestock farming. By combining sophisticated IoT hardware such as wearables based on smart-sensing technology with state-of-the art IoT software, ag-tech solutions like [Cowlar](#) help guard and protect livestock.

[SCR](#) is another company specializing in agriculture remote monitoring using cow neck collars to track cow health, location, and activity. Remote sensing in agriculture, combined with advanced analytical software delivers insights on cow nutrition and on the health of the entire herd.

