

ROBOTICS IN AGRICULTURE

NEW ERA OF SMART FARMING

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Artificial intelligence is gaining traction in the agricultural industry and is steadily being integrated in robotics developed for this sector. The world needs more food. With the global population expected to reach nine billion by 2050, a 2020 report written for the World Resources Institute argued that agriculture will need to increase production by about 25 per cent to meet demand. You would expect farmers to prosper in this environment.

The shortage of workers willing to work the fields - and the need therefore to import them from other countries - is mirrored across the developed world. Automation through robotics provides farmers with a way to cope with a labour shortage that, in the case of a hard Brexit, could well arrive quickly.

Robotic seeding and weeding systems help farmers increase yields. Automated combine harvesters have been used in large-scale wheat farms for decades. Aerial drones can help farmers to herd sheep and

analyse soil conditions so fertiliser and water can be used precisely. From robot milkers to autonomous vehicles, automation is set to transform global agriculture over the next decade. Best of all, agribots can operate 24/7, 365 days a year and they do not need to be paid, just maintained.

Growers all over the world are typically conservative and quite sceptical about innovations and disruptive technologies, says Gad Kober, Co-founder and Vice President of business development at FFRobotics, an Israeli firm that developed the Fresh Fruit Robotic Harvester - a fruit-picking robot that the company plans to make commercially available in 2021.

Despite the investment challenges, the agribot has begun to take root. The unmanned aerial vehicle (UAV) and autonomous steering technologies have seen meaningful levels of market penetration in some regions. The market for agribots overall is set to grow from \$0.8bn in 2013 to \$16.3bn by 2020, according to market analyst Wintergreen Research.

A 2016 report from online VC middleman AgFunder found that investors poured \$4.6bn into food and farm technologies in 2015, up from \$2.3bn in 2014. Eight per cent of the total went to drones and agribots.



The AGRIBOTS are also used in horticulture industry, As agribots system's total picking capacity for apples is 10,000 fruits per hour, says Kober. The robot can work three shifts a day, is 10 times faster than human workers and is capable of picking apples and all kinds of citrus fruit, as well as peaches and pomegranates.

High-value crops make for better-value agribots. With six-figure price tags, machine harvesting tends to make more economic sense today in the wine industry because of the high value of some of the fruit. Mechanical harvesting in California costs somewhere between \$100 and \$300 per acre (0.4 hectare) of grapevines compared to a hand-harvesting cost of up to \$750 per acre.

The strawberry industry - worth \$2.9bn in the US alone in 2014 - is another target for agribot developers. One example is the Agribot - a \$100,000 robot, also with 12 arms - developed by Spanish engineer Juan Bravo. Equipped with several robotic manipulators, the Agribot analyses each strawberry individually, by looking at the shape and colour to identify which strawberries are ripe. Having judged the ripeness of the fruit, small metal baskets attached to the robot's arms collect the strawberries; they are then transported via a conveyor system to a packaging area.

In Japan, Panasonic plans to start selling a tomato-harvesting robot in 2021.

THREE AGRIBOTS REVOLUTIONISING THE FARMING INDUSTRY

Agricultural robots - or 'agribots', are being integrated across the world to assist farmers and improve productivity in every aspect of the industry; here are three of the most innovative robots available right now.

From weed-removing and fruit-picking to digitalising yields and soil monitoring; agribots could enhance farming processes in just about any area of the sector. Although they are likely to require a sizeable upfront investment, agribots have the ability to offer long-term returns by working 24/7, helping to reduce labour costs and increase productivity.



1) TOM, THE SOIL MONITOR



The Small Robot Company's – who are based in Portsmouth, UK – agribot Tom, lives onsite and monitors crop and soil consistency, digitalising the production. It collects data on a plant by plant basis, keeping track of the health and development of each biology.

The completely autonomous robot, returns to the 'kennel' when it is out of charge, and replaces its battery for a fully charged one. The robot then also downloads the gigabytes of data collected over the day for analysis. This agribot reportedly knows exactly where a farmer's plants are, whether they

are germinated and what they need. Robot Tom will even suggest what fertiliser and chemicals are needed to maximise crop yields. Agribots at Small Robot Company can take care of all the feeding, seeding, and weeding autonomously. They will reportedly only feed and spray the plants that need it, giving them the optimum levels of nutrients and support, with no waste. Current robots at Small Robot Company include: Tom (a crop and soil monitoring robot), Dick (a precision spraying and laser weeding robot), Harry (a precision drilling and planting robot), and Wilma (the operating system).

2) OZ, THE WEEDING ROBOT



French company, Naio Technologies' Oz agribot, removes weeds and is designed to improve working conditions and reduce daily workload. It is an entirely autonomous agribot, but it can be guided and

controlled to wherever it is needed. Oz needs to be informed of how many rows it needs to weed, the length of the rows and how far they are apart. When Oz has completed its weeding tasks, the operator will receive a text message directly to their smartphone.

The Oz robot (pictured above – courtesy of Naio Technologie) and the weed remover is completely autonomous and automated.

The agribot has five mechanical features which reportedly enables it to remove weeds effectively:

- The weeding brush: this covers up weeds in the crop row and deprives them of light and air
- The spiked harrow: this removes sprouting weeds from the crop row
- The five-teeth harrow: this loosens beaten and compacted soil
- The hoe share: a non-selective mechanical weeding tool, designed to remove weeds between the crop rows
- The torsion spring: this removes young weeds from the crop row

3) TERRASENTIA, THE DATA COLLECTOR



TerraSentia monitors crop's health including their colouration, physiology and stress response. The TerraSentia robot carries a variety of sensors to collect data on plant health, colouration, physiology and stress response. It then transmits this data in real time to an operator's phone or computer. At present, the four-wheeled, 24-pound, foot-wide robot can cover an 80-acre field a day, with the operation entirely automated.

The agribot autonomously measures complicated and intricate plant characteristics such as; stand-count (the number of plants or crops in a specific area), stem width, and stem angle – this is done using visual cameras – all vital to the health and growth of

crops. TerraSentia was developed at the University of Illinois with the support of ARPA-E (Advanced Research Project Agency-Energy) within the US Department of Energy.

The team behind the robot are engineering TerraSentia to further measure specific plant characteristics including; early vigor, plant height, corn ear height, leaf area index, biomass, and to detect and identify disease, in order to maximise its technological capacity.

TerraSentia is currently available for \$5,000, but the company is looking to scale the robot to fulfill the needs of bigger and small farms.

AGRICULTURAL ROBOTS MARKET IS EXPECTED TO GENERATE HUGE PROFITS BY 2025

The global agricultural robots market size is anticipated to reach USD 8.82 billion by 2025, expanding at a CAGR of 24.7%, according to a new report by Grand View Research, Inc. The agriculture industry is changing dramatically, across the globe. The growing technological advancements and

innovations in robotics have increased the sales of the agricultural robots. COVID-19 has increased the demands of robots in various sectors, due to the spread of contagion all around. Agriculture is also one of the sectors gradually increasing the usage of robots, leading to increased demand in the market.



An agricultural robot, also known as an agribot, is a robot designed for use in the agriculture industry. Agribots automate tasks for farmers, boosting the efficiency of production and reducing the industry's reliance on manual labor. Agribots have several benefits for the farmers, however, some of the most important ones are, its untiring nature of work and diminished expense on maintenance, as there is no need to incur expense on wages of human labor. There are different types of agricultural robots such as, UAV, driverless tractors, milking robots among others, working tirelessly and getting work done in several aspects of agriculture like:

- Field farming
- Dairy management
- Animal management
- Soil management
- Crop management

