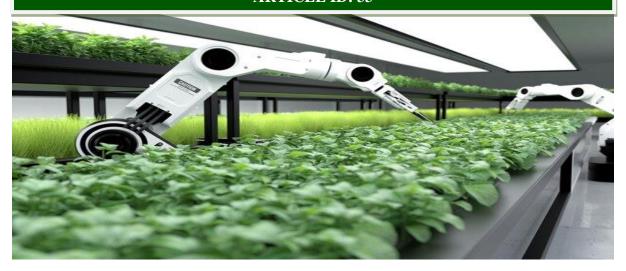# Just AGRICULTURE
multidisciplinary e-Newsletter

The Dawn of Agricultural Robots: Revolutionizing Farming Practice Worldwide

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Agricultural robots have emerged as a game-changing tool for farmers worldwide, offering a myriad of benefits from increased productivity and reduced labor costs to eco-friendly practices. The advent of AI and robotics has paved the way for 'precision agriculture', characterized by the targeted use of resources, thus reducing wastage and boosting yields.

The Market Landscape of Agricultural Robots

The agricultural robot market has experienced exponential growth in recent years. According to a Statista report, the global market for agricultural robots, valued at USD 24.5 billion in 2021, is projected to skyrocket to USD 74.5 billion by 2024.

The rapid expansion of the agricultural robot market can be attributed to the diverse range of robotic applications in agriculture, including:

1. Aerial Imaging Robots
2. Seeding and Spraying Robots
3. Fruit and Vegetable Harvesting Robots
4. Autonomous Mobile Robots for Nurseries, Orchards, and Greenhouses
5. Weeding Robots
6. Robotic Greenhouses

Aerial Imaging Robots: Eyes in the Sky

Aerial drones, armed with advanced imaging capabilities, have revolutionized crop inspection. By capturing valuable data on crop health and soil conditions from an aerial vantage point, farmers can make informed decisions on resource allocation, thereby enhancing yield and reducing wastage.

Types of Aerial Drones for Agriculture

There are primarily three types of drones utilized in agricultural operations:

Fixed-Wing Drones

These drones, resembling airplanes with one or two propellers, are known for their extended flight duration, making them ideal for large farms. However, they require smooth strips for takeoff and landing and are comparatively challenging to control.

Rotary Wing Drones

Characterized by multiple rotors akin to helicopters, these drones are easier to maneuver and do not require landing strips due to their vertical takeoff and landing capabilities. They are also generally more affordable than their fixed-wing counterparts.

Hybrid Drones

Fusing the benefits of both types, hybrid drones can take off vertically and switch to gliding mode mid-flight. Despite their advantages, these drones tend to be more complex, heavier, and pricier.

Types of Sensors Used in Agricultural Drones

The type of sensor a drone carries determines the kind of information it can gather. Here are some commonly used sensors in agricultural drones:

RGB Cameras

RGB sensors, or true-color cameras, detect light in red, green, and blue components, producing images similar to human vision.

Multispectral Cameras

These sensors detect light in multiple frequency bands, particularly useful in agriculture for assessing plant health.

Thermal Sensors

Thermal cameras aid in detecting plant stress, particularly water stress.

LiDAR Sensors

Used primarily for mapping terrain elevations, LiDAR sensors are typically heavier and more expensive than other types. Farmers can also avail of aerial imaging services through agencies, eliminating the need to invest in and learn to operate new technology.

Seeding and Spraying Robots: The Future of Crop Care

While drones for seeding and spraying are relatively new, they are commercially available and backed by prominent agricultural vehicle manufacturers. Seeding drones are primarily used for cover crops, aiding in soil health maintenance by curbing soil erosion and reducing water runoff pollution.

For spraying and seeding drones, payload capacity is a crucial factor. Advanced autonomous spraying drones employ radar and other sensors to avoid obstacles, ensuring efficient and safe operations. Most drones are battery-powered, but some use fuel to increase their payload capacity and flight time.

Fruit and Vegetables Harvesting Robots: Gently Does It

While most fruit and vegetable harvesting robots are still in the prototype stage, they show immense promise. The "End of Arm Tooling" (EoAT) of these robots varies depending on the type of crop. For instance, peppers can be gripped by suction cups, while tomatoes require a soft-fingered gripper that gently twists the fruit off the plant to avoid damage.

These robots typically feature an articulated arm mounted on a wheeled base, enabling them to move around the farm autonomously. However, several commercial options are also

available, such as an Israeli company offering harvesting robots as a service (RaaS), thus eliminating the need for farmers to make a significant initial investment.

Autonomous Mobile Robots (AMRs) for Nurseries, Orchards and Greenhouses

AMRs are robotic assistants that carry out mundane tasks, freeing up human resources for more complex tasks. In nurseries, AMRs can be used for spacing out potted plants. In orchards, they can transport harvested fruit from the picking location to a collection point, increasing productivity by allowing workers to continue picking while the robot carries the load.

Weeding Robots: An Environmentally Friendly Solution

Several vendors offer agricultural robots specifically designed to eliminate weeds. These robots can distinguish between crops and weeds and deposit tiny amounts of pesticide directly onto the weed, significantly reducing the amount of chemicals used. Alternatively, some robots use lasers to destroy weeds, a method that uses no chemicals and is certified as organic.

Robotics Greenhouses: The Future of Indoor Farming

The proliferation of indoor farming, facilitated by lower costs of LED lights and AI-controlled climate systems, is revolutionizing precision agriculture. Vendors offer equipment to set up automated greenhouses, which allows for the production of crops in a controlled environment with up to 90% less water than conventional methods. However, indoor farming is energy-intensive and is thus more suitable for high-value crops like fruits and vegetables.

The Agricultural Robots Market: A Growing Trend

The global agricultural robot market is growing at an impressive rate. According to research from AZO Robotics, the market was valued at over $43 billion in 2021 and is predicted to reach more than $81 billion by the end of 2028.

The SDGs and Agricultural Robots: A Perfect Match

Agricultural robots play a significant role in achieving the United Nations' Sustainable Development Goals (SDGs). By optimizing planting, irrigation, and harvesting processes, these robots promote responsible consumption and production (SDG 12). They also help combat hunger (SDG 2) by making food more affordable and accessible. Furthermore, by reducing labor costs and creating new job opportunities in the field of robotics, they contribute to decent work and economic growth (SDG 8).

Conclusion: The Dawn of a New Era in Agriculture

The future of agriculture is here, and it's robotic. From the Digital Farmhand and the AGRIM-X drone to the Vision RTK Fusion technology and the all-purpose Oz robot, agricultural robots are revolutionizing farming in unprecedented ways. With their ability to increase productivity, reduce labor costs, and minimize the use of harmful chemicals, these machines are paving the way for smarter, more sustainable farming. As technology continues

to evolve, so too will the capabilities of these agri-bots, ushering in a new era of agriculture that is not only more efficient and productive but also kinder to our planet.