APPLICATION OF ARTIFICIAL INTELLIGENCE (AI) IN AGRICULTURE BY IMPLEMENTING INTERNET OF THINGS (IOT) TECHNOLOGY AND UNMANNED AERIAL VEHICLE (UAV)

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Abstract: Smart farming is developing quite well, using Unmanned Aerial Vehicle (UAV) technology and the Internet of Things (IoT). UAVs are estimated to have ease of use, affordability so that farmers can use them. Most UAVs are controlled by remote controllers using radio waves, wireless, and bluetooth. The technology could transform traditional agricultural activities into modern activities, such as using drones for the agricultural sector. The application of this technology is done to improve the efficiency of products and the implementation of agricultural activities. Unmanned Aerial Vehicle is realized by applying artificial intelligence and human skills to precision farming.
Keywords: Artificial Intelligence, Internet of Things, Precision Farming, Smart Farming, Unmanned Aerial Vehicle

INTRODUCTION

Rapid and accurate technological developments play a crucial role in many areas such as the economy, farming, agriculture, and so on. To meet the huge demand for food for a growing population, agriculture must revolutionize using Information and Communication Technologies. (ICT). Smart farming is today's keyword that utilizes the latest information and communication technology techniques to grow food sustainably and cleanly. Over the past few years, agriculture has been undergoing a fourth revolution by integrating information and technology [1]. Technologies such as Remote Sensing, Internet of Things (IoT), Unmanned Aerial Vehicle (UAV), Big Data Analytics (BDA), and Machine Learning (ML) specifically can provide new breakthroughs in agricultural practice [2, 3]. IoT and UAV are two major supporting technologies in smart farming. Without a doubt, IoT and UAVs will be the fourth revolutionary leader in smart farming for years to come [4].

The Internet of Things (IoT) platform is rated to have a good level of efficiency and security, because autonomous vehicles and machines have sensors to collect, analyze, and act on data. By creating 3D digital models of farms, the system can drive farming vehicles, such as autonomous tractors, to move and hijack the gardens independently. The various parameters obtained in the application of smart farming are providing new breakthroughs in the field of agriculture such as informing the conditions of the agricultural environment, knowing the status of crop growth, irrigation water, soil, pests, fertilizer, greenhouse production, and weed control so that it can reduce production costs, optimize process input, and improve harvest yields. All the challenges in agriculture can be addressed by implementing and developing Artificial Intelligence (AI).

The human brain consists of billions of neurons that are connected to each other. AI implements neurons in digital format using complex algorithms. There are three methods that can be used, such as supervised learning, unsupervised learning, and reinforcement learning. (reinforcement learning). To improve precision

farming efficiency, AI has been widely used in recent years, such as computer vision, pattern recognition, artificial neural networks, robotics, machine learning, and autonomous vehicles. (Autonomous Driving). AI has become a major concern in creating technology that can run without a driver or drive autonomously. AI-based UAVs consist of innovative memory and storage systems to manage large amounts of data to make computers make the right decisions. AI is used to implement UAV to deal with traffic problems and complex situations. A UAV or drone is a kind of autonomous, remote-controlled aircraft equipped with cameras, sensors, and communication systems to enable vehicles to generate large amounts of data. Automated vehicles with AI empower vehicles to see, hear, think, and make decisions just like human drivers do.

STUDY OF LITERATURE
Internet of Things (IoT)

IoT is one of the modern technological revolutions in wireless communication. The basic concept is the interaction between different objects or physical objects using special remote surveillance schemes to connect to the Internet. IoT technology can be applied to a wide range of vertical markets including industry, transportation, health care, vehicles, smart homes, and agriculture [5]. In a farming environment, IoT devices provide useful information about various physical parameters to enhance the farming field. The role of Wireless Sensor Networks (WSNs) in IoT technology is crucial because most IoT applications in various markets are based on wireless data transmission in data exchange either directly or indirectly, then processing data and transmitting data.

IoT-based devices consist of I/O interface components for sensors, interfaces for connecting to the Internet, interface for memory and storage, and interface for audio/video [7]. IoT devices can be in a variety of forms such as wearables, smart watches, smart cities, home monitoring, smart transportation systems, smart health devices, and so on.

Artificial Intelligence (AI)

AI is artificial intelligence added to a system that can be regulated in a scientific context or defined as the intelligence of a scientific entity. Andreas Kaplan and Michael Haenlein defined artificial intelligence as the ability of systems to interpret external data correctly, to learn from it, and to use it to specific goals and tasks through flexible adaptation. Intelligence is created and put into a machine so that it can do the work that humans can do. Some fields that use artificial intelligence include specialized systems, computer games, fuzzy logic, artificial neural networks, and robotics.

Artificial Neural Networks (ANN) have more advantages than traditional systems. ANN can project and judge on the basis of parallel reasons. It predicts the level of nutrients in plants. A technique that proposes using simulated neural network calculations for plant prediction in smart phones has been successfully tested. The purpose of this system is to facilitate the cultivators. It was developed by a modern platform [8].

Unmanned Aerial Vehicle (UAV)

UAVs as sensing and/or communication platforms are also breakthrough technologies with tremendous potential in precision farming. UAVs have advantages such as low cost in environmental monitoring, high spatial and temporal resolution, and in image acquisition. Currently, the use of UAVs in agriculture is expanding to help farmers with monitoring and decision support in the farm [6]. UAVs are used in various agricultural practices, such as irrigation, fertilization, pesticides, weed management, and so on. In addition, the combination of UAV technology with new 3D reconstruction modeling techniques allows to monitor plant growth parameters at plant level.

RESULT AND DISCUSSION
Unmanned Aerial Vehicle (UAV) in Precision Planting

UAVs in agriculture have been used to address various problems in agricultural production. There are six basic parts in the UAV, namely:

- All the working factors are automated structural frameworks
- Intelligent and authentic controls
- Smart sensors and data retrievals

- Battery potential and energy accumulation
- Processing devices
- Access components

Rizki Ariyani

Intelligent route planning generates optional route broadlines and controls programmed vehicles. There are two divisions in the issue of route planning a) analytical modeling b) information guided modeling [8]. Intelligent route planning processes include: landmark drawings, data organization, optimum route formation, UAV control architecture, robust modeling and management, computational accuracy to performance in UAVs and more in the UAV.

The introduction of various UAV systems in smart farming can provide new breakthroughs in cultivation. While there are still a lot of technological problems to solve, there is a real improvement in multi-UAV systems in smart farming.

The authors at [9] developed a multi-UAV system for farmland using distributed herd algorithms. They analyzed the performance of the proposed system and compared the results obtained with a single UAV system. The researchers at [10] developed and presented an autonomous system for precision farming based on the use of several UAVs. In [11], the authors combined Particle Swarm Optimization (PSO) and Genetic Algorithm (GA) to address the mission planning problem of the multi-UAV system, which is actually a multi-purpose optimization problem. They proposed a precision farming system consisting of several components/agents/drones to complete joint farming missions cooperatively. The purpose of this job is to harness the limited resources of machinery equipment in smart farming. Finally, a combination of UAVs and unmanned ground vehicles or Unmanned Ground Vehicles (UGVs) has been tested in various fields of agriculture [12].

Platform UAV

There are basically two types of UAV stages, fixed and rotating. A permanent wingless aircraft is usually better than a rotating airfoil model used primarily for photography on a wide spectrum. Unmanned aircraft which rotates airfoils can be classified as helicopters and several rotors. It is commonly used for sparkling and flying photography. Multi-rotor stimulators are named depending on the number of rotors they hold, for example, 'quadcopter,' which means four rotors and hexa-copter and octocopter each have six and eight rotors respectively. The number of the rotors is related to the load contrast and size of the UAV. The rotor, type of helicopter, and type of wing still have the largest load limit and are mainly used for bathing. Quadcopters and hexacopters are generally smaller in size and carry smaller loads of about 3kg.

Figure 1. Types of UAV [8]

Applications In The Farm

The advent of robots, engines, and satellite-driven farming vehicles has made farmers consider that. In general, farmers accept that it encourages them to switch from traditional processing to modern processing by leveraging existing technology. This effectively provides a good collection, other powerful herbicides, pesticide/insect spraying, dirt details, water system framework (e.g., water ball rolling system), motorized

Rizki Ariyani

and computerized tractors and the consolidation of crops machinery, have led farmers to accept that they have achieved a mixture that solves problems related to crop production.
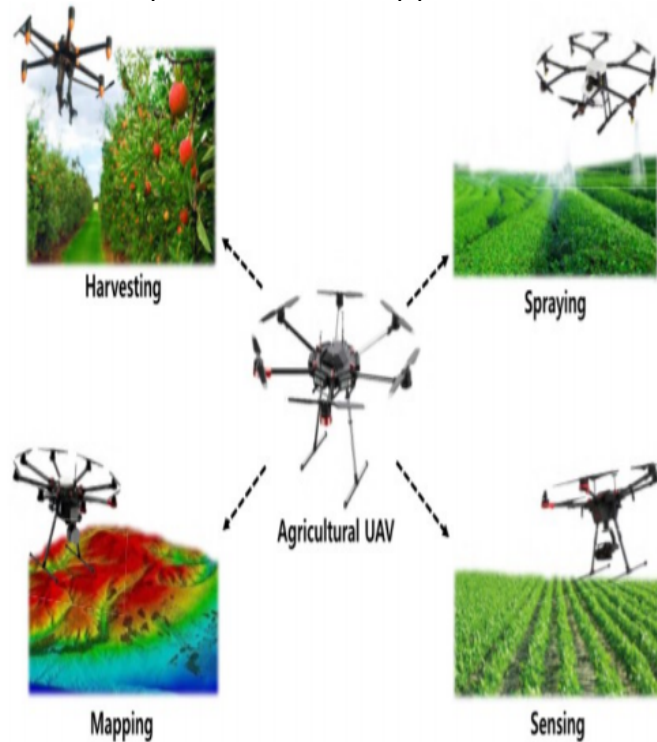

Figure 2. Agriculture Zone Application with UAV [8]

Agriculture zone applications with UAVs that can be done are:

1) Mapping: Two-dimensional and three-dimensional maps of farmland provide useful data for cultivation accuracy, soil condition, water access, crop status are some specific examples.
2) Spraying: Rapid spraying with UAVs reduces the use of pesticides and increases efficiency.
3) Harvesting: Before planting the climate conditions must be seen, and described in the specified zone. Once a month the UAV flies over that zone and sees the effect of planting.
4) Crop monitoring: Crop observation is important to produce an ideal crop. It reduces work and time.
5) Irrigation: In the future, intelligent cultivation with a computerized framework of water systems will be effectively implemented with UAVs. It uses heat sensors and several other world cameras to find water accessibility and water system control management.
6) Diagnosis of insect pests: Innovation in precision cultivation that supports crop yields in recent decades. The location of the bug in the previous spare time and the work backup fund. The carpenters review their property several times for each week.
7) Artificial pollinators: The number of inhabitants in the normal pollinator is decreasing step by step.
8) Each table must be given a caption under the table. Information on the table is given above the table. Information is written in lower case except for the first character in each sentence. All images must be numbered sequentially. Figures are placed in the middle of the page (center aligned), while tables begin at the left edge (left aligned) of the page. [8]

In China, some farmers have used a rice transplant or a fully autonomous peanut planting machine. The engine called FJ Dynamics uses the Microsoft Azure Intelligent Cloud Platform, building an efficient and secure Internet of Things (IoT) platform. Vehicles and autonomous machines that provide sensors collect, analyze, and act on data. By creating 3D digital models of farms, the system can drive farming vehicles, such as autonomous tractors, to move and hijack the gardens independently.First, the shelf is measured and digitally mapped. Then a path-planning process or planning of the planting path is carried out so that the optimal path is produced when the peanut planting machine sows the seed in the ground. Meanwhile, the

Rizki Ariyani

sensors on the peanut planting machine also measure the level of nutrients in the soil so that it can decide when fertilizer should be added. This will help prevent the waste of fertilizer but ensure the optimal nutrient composition for the growth of strawberries.

The technology developed by FJ Dynamics has spread throughout China, also in several countries, such as Japan, Indonesia, Zambia, Turkey, Argentina, Sweden, and Denmark. The FJ Dynamics plan will expand worldwide, backed by Microsoft. By placing the data in the Microsoft Azure cloud, farmers can easily retrieve and reuse the data over and over again. That data will always be available as long as the farmers are still working on the same land. All the farmers need to do is download maps from the Azure Cloud, and smart vehicles, like a peanut planting machine, can be operational immediately. Besides, it can manage risks and avoid dangerous jobs that cause work accidents. These smart machines can also do dangerous jobs for farmers. For example, spraying pesticides and poisonous herbicides can be done automatically. Even the results would be more accurate and could help reduce the amount of chemicals needed. It is expected that automation can reduce some of the exhausting physical jobs in the agricultural industry so that farming will be more attractive. The COVID-19 pandemic shows that food security is crucial. With smart technology to improve productivity and working conditions in the agricultural sector.

CONCLUSION

The application of Artificial Intelligence (AI) in agriculture is beginning to emerge. The application of AI in the agricultural sector is to develop a variety of smart machines or smart machines to improve production and sustainability by reducing risk and suppressing the need for farmers to engage in physical activity. Not just AI, this application also relies on the power of the cloud and the Internet of Things. (IoT). Using data has helped farmers decide when to start planting, when to harvest, what kinds of crops to plant, how much fertilizer and other chemicals to use, and how often to irrigate the fields. Yet agriculture is not an easy industry and loaded with heavy physical work for most of the world's farmers who work in the fields with equipment and machinery. That's why the Internet of Things (IoT) is also combined with Artificial Intelligence (AI), advanced manufacturing, and new energy to make it easier for farmers to do their jobs. These robotics companies use data, modeling, and automation to help farmers make decisions and work. These digital solutions can not only be used in large farms, even small farms can take advantage of this technology. With these centralized operational procedures, harvest yields can be improved while reducing waste. The result is farming becoming more efficient and sustainable.

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Rizki Ariyani

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Rizki Ariyani