PRESIDENT UNIVERSITY
Where tomorrow's leaders come together

Application of Drone Using Artificial Intelligence for Industry in Indonesia

Donny Marshal (023201905005)

Digital Literacy, MM Tech Batch 2

President University

2020

Abstract

Drones are a type of Unmanned Aerial Vehicle (UAV) that is controlled remotely by humans or autonomously by onboard computers. The development of drone technology in Indonesia from year to year is increasingly sophisticated. Drone applications from a design perspective are generally divided into three main groups: military, industry (corporate), and commercial. The development of technology has made drones widely used for civil needs, especially in business, industry and logistics. The application of drones can be used in a various of services, such as monitoring infrastructure, shipping goods, firefighting forest, mining material exploration, mapping of agricultural area, mapping of industrial area, fun toys and body temperature checking. The expansion of drones using artificial intelligence. Drones using artificial intelligence to detect and classify objects, by collecting data to make the drone's function more specific. The use of drones using artificial intelligence for industry can help people do difficult work and make it more effective and efficient.

Keywords: drone, unmanned aerial vehicle, artificial intelligence

Introduction

Drones are a type of Unmanned Aerial Vehicle (UAV) that is controlled remotely by humans or autonomously by computers in aircraft. UAV is how it works like an airplane that uses aerodynamic laws to lift itself and can carry loads such as cameras, weapons or other (Permenhub PM 180, 2015). Initially, drones were created and used by the military to attack enemies. Broadly speaking, the initial use of this drone is in the military field. But because there are changing times so that it can be used in other fields.

Drones are planes without a pilot or without humans in them. This aircraft is controlled through remote control from pilots located on land or in other places with coverage areas or automatically through computer programs that are designed. Initially the UAV was a remote controlled aircraft, but automated systems are now starting to be widely applied.

Based on the type of wings, there are two types of drones, namely fixed wings and rotary wings (helicopter) (Um, 2019). Fixed wings have the shape of an ordinary aircraft equipped with a wing system with a smaller size. This type of fixed wings requires aerodynamic design on the wings and body as shown in Figure 1. Rotary wings are a type of drone that utilizes a propeller spin to fly as shown in Figure 2. Rotary wings are divided into two namely single-rotor and multi-rotor. The single-rotor type is shaped like a helicopter using a single propeller, while the multi-rotor uses four, six or eight propellers.

Figure 1. Fixed Wings, Black Eagle Combat Drone, made in Indonesia (source: BPPT)

Figure 2. Rotary Wings (source: terradrone.com)

The development of artificial intelligence technology is growing rapidly, especially the era of the Internet of Things (IoT). Artificial intelligence and drones are a cool partner in technology. Artificial intelligence (AI) in drones is a computer program that can make machine functions such as human intelligence, for example making decisions, solving problems, and making predictions (Russel & Norvig, 2016). Adding artificial intelligence to the drone makes the drone's function more complex so that it can help humans do difficult work.

History of Drone

Initially drones were developed for military purposes as part of weapons to attack the enemy in the early 1900s. It turned out that the drone had been thought of before the Wright brothers succeeded in flying in 1903 (Um, 2019). At that time there was an electrician and scientist from Croatia, Nikola Tesla. He proposed the idea of combining radar (radio detection and distance) with wireless communication to develop a remote controlled drone with the aim of reducing the life threat of a pilot (Um, 2019). Furthermore, from Tesla's idea, at the end of the first world war, the US Government developed the first drone, Kettering Bug (aircraft without a pilot). This pilotless aircraft is a type of aircraft that drops torpedo bombs on a target after flying at certain times. But the accuracy rate is so low that it cannot be put into real battlefield operations. Nevertheless, the drone continues to be developed. Then, there was the development of UAVs in the military, where the United States and Israel developed other functions such as spying and surveillance.

This drone is expected by many military experts to be the core of military power in the future (Um, 2019). In recent years, unmanned aerial vehicle have been developed in various countries around the world including Indonesia, because they recognize the value and needs of unmanned aerial vehicle. In addition to military purposes, the last few drones have been expanded for civilian needs.

Since there is a civil need, there has been development of drone technology that is used for photography. Drone shooting can be considered an idea of playing into a toy, but because of the operation that is not easy and there is a shake of the photos. Since then, there has been an improvement with the rapid improvement of drone shooting technology such as video transmission / receiver devices and gimbal to compensate for shocks during shooting. Then the era of shooting is currently booming. In addition, improved technology has advanced software to control drones including the drone flying to the desired position and being able to fly stably. The use of professionally drone shooting is expanding its use in various fields, such as

broadcasting, increasing battery power and having a higher load. Indeed, now this shows that the market for hobby and aerial photography is exploding.

The development of Drone technology in Indonesia

The development of drone technology in Indonesia from year to year is increasingly sophisticated. Initial estimates of the development of drone technology in Indonesia since 2000, but the development is not as expected. Because it turns out the development is carried out only one body. Then over time, an association was formed involving PT Dirgantara Indonesia (DI), Lembaga Elektronik Nasional (LEN), Badan Pengkajian dan Penerapan Teknologi (BPPT) and Lembaga Penerbangan dan Antariksa Nasional (LAPAN) to develop drones that have their respective duties and functions. Besides being developed by the association, the development of drones was also developed and carried out by several universities, namely UGM, ITB and ITS.

After several years of development, 2015, BPPT succeeded in making drones "Alap-alap" and called the drones as Pesawat Udara Nir Awak (PUNA). The drone is capable of flying four hours nonstop and is capable of flying up to six thousand feet (BPPT, 2015). Then 2017, BPPT succeeded in developing a drone with the ability to fly increased to seven hours nonstop in a total cruising distance of 623 km. In addition, this drone is equipped with gimbal (camera housings) which can carry out visual monitoring of the air online (BPPT, 2017). Furthermore, so that the drones can be developed to be even more sophisticated to carry out air mapping missions and online surveillance missions from the air. Thus, the government needs to accelerate the development of the drone so that a consortium is formed in 2017. The consortium consists of the Ministry of Defense namely the Directorate General of Defense Potential and Defense Research and Development Agency, BPPT, TNI-AU (Dislitbangau), ITB (FTMD), BUMNs namely PT Dirgantara Indonesia and PT Len Industri. In 2019, LAPAN entered into a consortium member (BPPT, 2020).

The drone model that was developed was PUNA or the Black Eagle Combat Drone, the type of Medium Altitude Long Endurance (MALE) or called PUNA MALE. PUNA MALE is designed to be able to fly for 30 hours and be able to fly up to as high as 6 thousand meters with a maximum speed of 235 kilometers per hour. The president confirmed in 2020, PUNA MALE must be able to be tested and 2021 had received a certificate for mass production, said Hammam, Head of BPPT during a limited cabinet meeting in Surabaya on January, 27th 2020 (BPPT, 2020). This drone is needed to protect the sovereignty of the Republic of Indonesia

from military and non-military threats in the form of violations of border areas, terrorism and separatism. In addition, Indonesia can make locally made drones the pride of Indonesia.

Drone Classification

The application of drones from a design perspective is generally classified into three main groups: military, industry (corporate), and commercial (Singh, Muthukrishnan, & Sanpini, 2019).

Military

Early application of drones for military purposes. Usually the design of a drone resembles a fighter with a smaller size. Drone is also equipped with weapons. The drones are used to train anti-aircraft targets, reconnaissance, surveillance, and weapons of war to fight the enemy.

Industry (corporate)

The application of drones carried out and developed by the company. Development by integrating drone technology and the Internet of Things (IoT) and artificial intelligence, thus creating many benefits for industries and companies. With drones working with IoT sensor networks in the field can help several companies, such as agricultural companies to monitor land and plants, energy companies survey electrical cables and operational equipment, and insurance companies monitor property for claims or policies.

Commercial

After the development of industrial drones, it then moved to the commercial field. The application of drones in the commercial field is developing, where developed drones have the ability to be targeted according to market needs. Usually the use of drones is used for the film industry, commercial agents to examine infrastructure and for photography and is not infrequently used for hobbies and toys. Indeed, commercial drones are a small part of the overall drone market. But it is possible that commercial drone sales will increase.

Application of Drone for Industry in Indonesia

Indonesia has entered the category as an industrial country in 2017 (Kemenperin, 2017). As an industrial country, Indonesia certainly needs new technology that can help and develop the industry. With the emergence of industrial drone technology, it is expected that the application of drones can overcome competition with global industry. The Indonesian government supports the use of drones in several government agendas. In addition, the government also regulates the use of drones.

The government regulates the use of drones in Indonesia through the Minister of Transportation Regulation no. PM 180 (Permenhub PM 180, 2015). The regulation applies to the use of individuals, groups of people, organizations or companies, or government agencies. In the regulation there are some areas that are prohibited from flying drones, but do not mention the areas that are allowed to fly drones. The regulation further explained that drone operations at altitudes of more than 500 feet (150 m) must not be operated unless permission is granted by the Director General of Civil Aviation after receiving a recommendation from the competent institution in the area or airspace. Thus, the use of drones in Indonesia must follow and comply with applicable regulations.

The initial use of drones for industry in Indonesia began with the oil palm plantation industry (TerraDrone, 2020). The use of drones in the plantation industry is used to obtain real time information about the condition of oil palm plantations on a regular basis. The use of drones is done in daily operational activities by taking pictures of large plantations. Using these drones is considered practical and economical enough for the plantation industry and also to provide insight for management to be able to accurately assess the performance of plantation management.

The development of technology has made drones widely used for civil needs, especially in business, industry and logistics. Industries that began to look at drone technology as an option i.e. infrastructure, oil & gas, agriculture, and construction (TerraDrone, 2020). For the infrastructure and agriculture industries in Indonesia, they really need drone technology, because Indonesia has large agricultural land and doing infrastructure development in the territory of Indonesia. The choice of drone technology because it can improve industry performance, especially in terms of decision making. Furthermore, with the availability of drones with relatively affordable prices, the industry will open insight into the opportunities for drone applications in business.

The application of drones can be used in a various of services, such as monitoring infrastructure, shipping goods, firefighting forest, mining material exploration, mapping of agricultural area, mapping of industrial area, fun toys and body temperature checking. As a monitoring infrastructure, drones can fly very low and close to objects so that they can take pictures with high resolution, especially in locations that are difficult to reach without disrupting construction activities. As a shipping goods, drones can fly and then send goods more quickly and efficiently. As a firefighting forest, a drone can help extinguish burnt forests, especially hard-to-reach forest areas and provide safety for firefighters. As a mining material exploration, the drone captures images that monitor the development of the mining area to optimize monitoring efforts on mining activities. As a mapping of agricultural area, drones take pictures to be used as forecast data for agricultural production and the drones help the process of sprinkling liquid fertilizer and applying pesticides to plants. As a mapping of industrial areas, the use of drones is almost the same as mining material exploration, with monitoring of industrial areas for surveillance. As a fun toy, the drone is used as a fun toy and can be a hobby for its users. And lastly, as a body temperature checking, the development of the drone that is given a thermal sensor feature to detect a person's body temperature, so that officials check body temperature, as currently being pandemic Covid-19, this drone is needed. Furthermore, the drones can also be used for the calculation of the number of plant staples, identification of environmental changes due to oil spills, monitoring of transmission lines from third party activities, review of the planting phase of secondary crops, and documentation of development achievements. Those are some drone applications that can be realized as they develop.

The rapid development of drone technology demands the expansion of drones by using artificial intelligence for the future. Drones today are still controlled remotely by humans, later in the future drones will be controlled by Artificial Intelligence (Rajit, 2018). The application of drones using artificial intelligence allows drones and other machines to make decisions and operate on their own in flight. The application of Artificial Intelligence (AI) should help overcome complex challenges and solve problems for humans. It must be considered in the development of drones using AI, not to cause more harm than profit.

Basically, artificial intelligence describes the ability of machines that can perform sophisticated tasks that have the function of human intelligence and encompasses things such as reasoning, problem solving, planning, learning, and understanding and reading human language. The application of artificial intelligence in drones includes Machine Learning, Deep Learning, and Motion Planning as shown in Figure 3 (Schroth, 2018).
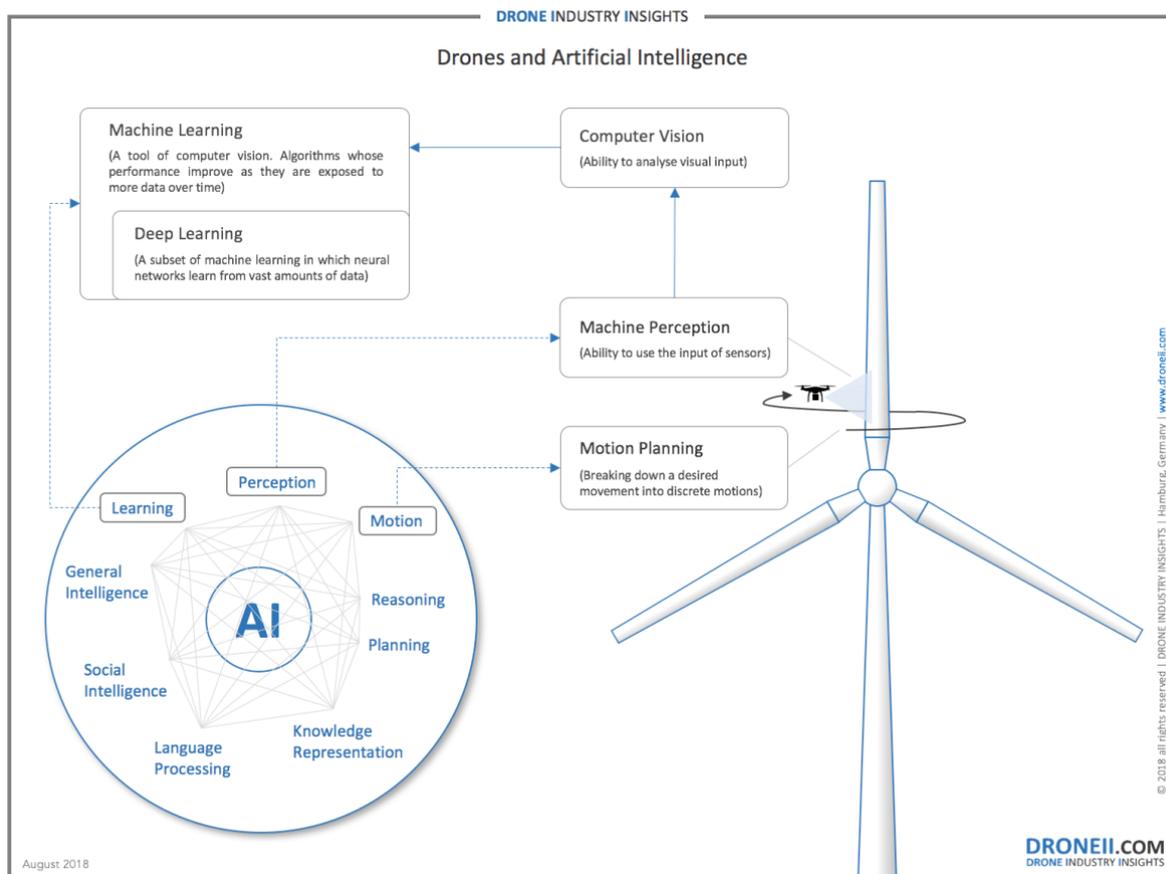
Figure 3. Drones and Artificial Intelligence (source: droneii.com)

Machine Learning

Machine Learning is used to optimize the parameters that can be distinguished. The Machine Learning algorithm is designed so that they can learn and improve over time when connected to new data. The form is not like software that has been programmed manually and performs tasks with specific commands (like Computer Vision software). Thus, machine learning will provide the ability of drones to access existing data with their own commands and also be able to study existing data and perform certain tasks such as when a drone can be asked to return to land with an auto pilot or without control to the starting point when first flying even though it has flown far away a destination.

Deep Learning

Deep Learning makes it possible to combine and expand what has been learned with new content. Deep Learning uses specific methods of information processing and machine learning core that uses neural networks and large amounts of data for decision making. This method of learning is based on the functioning of the human brain, which also consists of interconnected neurons. With the Artificial Neural Network consisting of several layers, each of which is

connected to the next layer and is responsible for certain tasks. Thus, deep learning becomes the continued development of machine learning carried out by drones in performing certain tasks.

Motion Planning

Motion Planning is used to detect and recognize objects such as humans, cyclists, or cars and to then make appropriate flight routes. This gives the drone the ability to map the distance to the destination and does not need to identify what exactly is in the environment. Thus, the drone can recognize objects in his view so that it can reduce the occurrence of collisions with drones or other objects. In addition, it can search for objects to be searched according to specific tasks.

In addition, to fulfill the application of artificial intelligence in drones, a system design is needed. System design is generally conducted by a group of experts who have the ability of hardware, software, and mechanical (Singh, Muthukrishnan, & Sanpini, 2019). Between hardware, software, and mechanical must support each other so that it can be good integrated and help process data become smoother and faster.

The application of drones using artificial intelligence can process data faster which will help in making decisions. Drones will often produce large amounts of data to collect data, with the existence of artificial intelligence to help process data faster, more accurate, good and easily evaluated results. The application of this technology is to support the industry in improving performance and making decisions and also providing new insights so that this technology provides more benefits. Because almost every industry deals with data processing and analysis, so the implementation of drones can help data processing according to the needs of industries in Indonesia.

With drones using artificial intelligence, it is faster and easier to detect the required objects using motion planning. Then to classify objects can use machine learning because drones will have data and classify themselves. Then the drone can collect data and process data with deep learning to connect the data to make decisions. So that it can make more specific drone functions that support human work.

The function of drones with artificial intelligence becomes more detailed. Drones not only record video but also process data that is seen and clarified based on objects, behavior, emotions, colors and sounds such as human intelligence. Drones will be able to perform such

automatic surveillance by supervising the programmed area, estimation of someone identified, reporting to someone entering a restricted area by sounding an alarm, etc.

The existence of artificial intelligence in drones, makes users who use drones easier. The drone can control the flight stably so it doesn't fall easily. The drone can return to its original location if you press the button to return. Drones can also provide information when the battery is used up and then return to the initial check point when you first fly.

The use of drones using artificial intelligence provides functions that are more specific and easier to use. Development of other industries besides infrastructure, oil & gas, agriculture, and construction should be applicable. For example, companies that have large warehouses can use drones to calculate warehouse and inventory stock. As entertainment, drones can be used to race drones in the entertainment industry. In the future, Indonesia can use drones as taxis which is a new thing in the transportation industry. That way, the use of drones using artificial intelligence can be used for various types of industries in Indonesia. This is because there are many benefits or advantage obtained.

The Indonesian government will develop drone technology because it is fully aware of the benefits of drones for various applications. There are several regulations and government policies that support the use of drones, such as the Ministry of Environment and Forestry, which requires companies to have early detection devices for forest fires, one of which is drone technology. Then the National Land Agency which explains drones must follow usage standards for making work maps in order to accelerate complete systematic land registration (TerraDrone, 2020).

The application of drones using artificial intelligence for industry in Indonesia has advantages and disadvantages. Some of the advantages are that there is a small drone form so it is easy to use in a narrow place, helps make decisions because it can be seen in real time, has many benefits to see large areas with shorter time, a sophisticated navigation system so that it can see a lot information, portable so that it can be used anywhere, and the last one does not require a pilot to fly a drone so it can provide safety for the user. While the disadvantages of using drones are the price of drones is relatively expensive, if done in public places can interfere with commercial and military aircraft flights, and the last risk of damage if used over the sea because of its small shape.

The development of drone technology for industries in Indonesia needs to be improved. So far, the drones used are still imported, even though we are able to make our own. Moreover, the development of drone technology using artificial intelligence is still rare. Because Indonesia has human resources, the existence of raw materials, can develop its own drone technology and is able to produce in large quantities. This is one way to make the price of drones relatively affordable and support industries that have not used drones to be able to use drones. This can provide even distribution of the use of drones in the industry.

It is necessary to support technology and education in the use of drones in the industry so that the development of drones reaches all regions in Indonesia. By reaching all regions in Indonesia, the use of drones will help the industry in the village. Industry performance will improve, productivity growth up, becoming more effective and efficient. Furthermore, it can have a positive impact on the local industry and increase national industry growth.

Conclusion

As an industrial country, Indonesia requires the application of drones for various industries in the country. So far, the use of drones in Indonesia is still not a lot of industries that use only a few industries even though there are opportunities for other industries. The application of industrial drones can help in making decisions, improve industry performance, can reduce operational costs, increase the speed of analysis, improve safety and provide new insights.

The development of drone technology has many advantages for various applications because it is economical and practical. Especially if in the future, Indonesia can make its own drones and develop more sophisticated uses of artificial intelligence will help the local industry. Indeed, the development of drones using artificial intelligence should not be misused by irresponsible parties. Because the development of drones with artificial intelligence can overcome complex challenges and solve problems that are difficult for humans. The use of drones using artificial intelligence for industry can help people do difficult work and make it more effective and efficient.

References

BPPT. (2015, October 02). *Di Puspiptek, Jokowi Nonton Drone 'Alap-alap' Terbang*. Retrieved from https://www.bppt.go.id/: https://www.bppt.go.id/component/content/article/108-kliping-2015/2386-di-puspiptek-jokowi-nonton-drone-alap-alap-terbang?Itemid=101

BPPT. (2017, May 21). *HARKITNAS 2017, BPPT Sukses uji Drone Alap-Alap, Berhasil Terbang non Stop 7 Jam*. Retrieved from https://www.bppt.go.id/: https://www.bppt.go.id/teknologi-hankam-transportasi-manufakturing/2894-harkitnas-2017-bppt-sukses-uji-drone-alap-alap-berhasil-terbang-non-stop-7-jam

BPPT. (2020, January 27). *Pemerintah Akselerasi Pengembangan Drone Elang Hitam, Siap Uji Terbang Tahun 2021*. Retrieved from https://www.bppt.go.id/: https://www.bppt.go.id/teknologi-hankam-transportasi-manufakturing/3851-pemerintah-akselerasi-pengembangan-drone-elang-hitam-siap-uji-terbang-tahun-2021

Kemenperin. (2017, November 25). *Indonesia Masuk Kategori Negara Industri*. Retrieved from https://kemenperin.go.id/: https://kemenperin.go.id/artikel/18473/Indonesia-Masuk-Kategori-Negara-Industri

Permenhub PM 180. (2015). *Pengendalian Pengoperasian Pesawat Udara Tanpa Awak di Ruang Udara yang Dilayani Indonesia.*

Rajit, K. (2018). *The Future of Drones in Artificial Intelligence*. Retrieved from dzone.com: https://dzone.com/articles/the-future-of-drones-in-artificial-intelligence

Russel, S. J., & Norvig, P. (2016). *Artificial Intelligence: A Modern Approach.* Malaysia: Pearson Education Limited.

Schroth, L. (2018, August 28). *Drones and Artificial Intelligence.* Retrieved from droneii.com: https://www.droneii.com/drones-and-artificial-intelligence

Singh, N. K., Muthukrishnan, P., & Sanpini, S. (2019). *Industrial System Engineering for Drones.* India: Apress.

TerraDrone. (2020, Maret 11). *Aplikasi Drone Industri pada Berbagai Sektor di Indonesia*. Retrieved from https://terra-drone.co.id/: https://terra-drone.co.id/2020/03/11/aplikasi-drone-pada-berbagai-sektor-industri-di-indonesia/

Um, J.-S. (2019). *Drones as Cyber-Physical Systems: Concepts and Applications for the Fourth Industrial Revolution.* Singapore: Springer Nature Singapore Pte Ltd.