Drone Utilization for Jakarta as a Smart City

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Abstract. Flood, land conversion, clean water, human development, traffic jam, and poverty are the Jakarta problematics. Even though, Jakarta city is implementing the smart city concept. Smart city is a dream for every city in the world because it makes the city more effective, efficient, and worth living by implementing technology. Therefore, Jakarta have to be able to pay attention with the problems that is arise along with the rapid of technology by changing dynamically. One of the technology development that can answer the challenges of Jakarta city is drone. Drone utilization has brings a lot of benefits to be implemented in smart city. However, it must be remain vigilant in smart cities that apply using drones.

1. Introduction
The influx of globalization is very rapid and easily shown in the field of Information Technology (IT). Entering an age which is sophisticated and modern, technology makes everything becomes possible. Disruption that caused by technological innovation is a pattern affects to people who prioritize practicality and active participation. In 2016, Amazon – US e-commerce giant, officially opened Amazon Go physical store in Seattle, USA [1]. Amazon Go comes without the cashier and customer do not have to queue. The concept of Amazon Go is able to describe the ease and modern life same as with the concept of smart city. The improvement in terms of information technology services and infrastructure creates a variety of lifestyle changes in the community. Nowadays citizen are transforming their lives by relying on technological development.

Jakarta as the capital city of Indonesia has experienced rapid growth and development from the metropolitan city to become a megapolitan. Based on [2], population at DKI Jakarta in 2017 reached 10,37 million. This development was followed by complexity and challenges such flood, land conversion, clean water, human development, bad traffic, poverty, etc [3]. Moreover, smart city concepts is expected to help solve urban obstacles such as transparency and public participation, public transportation, waste management, energy, security, data and information.

Basically, in the smart city has dynamic integration in its technology so that the city has good operational functions [4]. The integration of this technology has been seen in daily life on a large scale such as the emergence of online transportation in Jakarta. Autonomous vehicles that are being developed along with data processing will appear shortly, as well as drones to improve city life and quality of life for their citizens. Some use of drones can be seen on air traffic control, package delivery, military usage, monitoring construction sites, law enforcement, plantation, medical issues to remote area and photography/videography.
Figure 1. Projected commercial drone revenue in the Asia-Pacific region from 2015 to 2025 (in million U.S. dollars) [5].

Drone devices began to successfully win the hearts of customers in Indonesia since 2015. One of famous manufacturers in Indonesia, DJI is entering Indonesia market by opening their first store in 2016. Referring to Statista.com, revenue projection for commercial drone in Asia-Pacific region from 2015 to 2025 will hit 3.667 million USD (Figure 1).

Smart city technology often starts with the need to deliver services more rapidly and more efficiently to residents. One of those key technologies is drone utilization. In order to create Jakarta as smart city, the challenges of drone must be faced up precisely and wisely. The question can be stated into: What are the challenges of drone for Jakarta as a Smart City? This paper is aiming to understand what the challenges of utilizing drone for smart city. It is expected to deliver awareness the challenges of utilizing drone for Jakarta as a smart city that will help to increase the standard of living.

2. Literature Review
2.1. Smart City
So, what is smart city? A city can be called a smart city if it has integrated information and communication technology to a certain level in the daily governance and operational processes. The integration of technology is intended to improve efficiency, share information with the public, to improve services to the community or improve the welfare of citizens and standard of living [4]. Other than that, smart city is a highly developed and sustainable region economically, good and transparent communication, and has market viability [6]. [7] is consider smart city as an integration between technology and natural environment and the construction of smart city can be formulated by implementing smart city concept to transforms city into smart city.

Based on [8], there are factors that influence an initiative of smart city divided from layer to layer. (Figure 2).

- Technology. One of the most direct impact to the initiative is a technology. The city that want to be smart have to adopt technology. It has to be an advanced technology which is provides stakeholders integration with real time and best analytics to help people in decision making.
- Management and organization. It is very important for smart cities to align management and organizational goals to create effective and efficient.
- Policy. It is important to understand how to implement information system in order to create an urban development properly.
- Governance. Smart city concept is to create smart governance which is an effort to increase community participation and provide public services. Smart governance in this case is more emphasized to one of the development actors called the government.
Figure 2. Smart City Success Factors

- Economy. Economic is the countershaft of forefront function in smart city. A city with high economic competitiveness is considered to create a high productivity. Innovation and creativity competitiveness, entrepreneurship, and productivity are the digital economic factors.
- Built Infrastructure. The government is aggressively implementing built an infrastructure in Jakarta. ICT infrastructure plays an important role in making city to be smart city.
- Natural Environment. Environmental factors are considered as factors that influence the progress of smart city because in the future the environment of a city uses technology to lead the survival of its people.
- People Communication. People is an important role of the smart city creation because they can determine a successful implementation. In a smart city implementation, it will have an impact to the standard of living.

2.2. Drone

The use of unmanned aerial vehicle (UAV) in the military field is increasingly popular. Moreover, drone is an aircrafts without pilot and passenger on board [9]. In addition, [10] is defines drone as unmanned and remotely controlled flying devices. It will be able to transmit remote surveillance information, as well as carrying weapons. Generally, drones are UAV which can be able controlled by a pilot remotely or to control themselves by using program or applications. It can be shaped like an airplane, helicopter or multirotor design physically.

In Indonesia, drones have developed quite rapidly. Before Drone was widely known, actually aeromodelling activities or unmanned aircraft models were already pretty much done by young people and adults. In the recent developments recently pioneered, among others, by LAPAN and also BPPT, drones became more widespread and more popular. In addition, the private sector and several research and development institutions and a number of universities have also developed drones.

2.3. Drone Regulations in Indonesia

The increasing number of drone utilization is making the government to form regulations. Ministry of transportation has enacted Law No. 180/2015 and No. PM 47/2016 which have been legally replaced Law No. 90/2015 about controlling the operation of unmanned aircraft in the Indonesia air space [11]. This law was only inaugurated on May 12, 2015 which includes banning drone operation in restricted air areas, restricted air space, and in flight operation safety area of an airport.

3. Research Methodology

The research methodology using systematic literature review is the aim in order to acquire the goals. The results in this study is a drone recommendation framework that is integrated with the Jakarta Smart City and Qlue apps. The research boundary of this paper is drone challenges in Jakarta as a smart city.
4. Discussion

4.1. Jakarta as Smart City

Refer to [7], smart city is a capability of a city to utilize human resources, social education, and modern infrastructure to actualize the sustainable economic growth and high quality of life, with wise resource management through community/citizens participation based on governance. By learning from several cities in the world that respond to the complexity of the problem by optimizing the resources that are owned and supported by the use of technology to facilitate city residents enjoy public facilities, Jakarta has adopted the concept of smart city. Jakarta has unique characteristics; is a large and multi-ethnic city and has a high population density. In Indonesia, several big cities have begun to adopt the smart city concept besides Jakarta. Surabaya city also continues to implement innovations to become smart cities, for example by implementing an online ticketing system for motorized vehicle drivers who do traffic violations. Another city that implementing smart city concept is Bandung.

Jakarta has the Jakarta Smart City program since 2014 [12]. This has a practical impact and efficiency in managing the city. Its existence is claimed to ease DKI Provincial Government officials’ performance to quickly respond citizen complaints. Jakarta Smart City is the application of the concept of a smart city located in the city of Jakarta, optimizing the use of Information and Communication Technology (ICT) to understand and know various resources in the city of Jakarta more effectively and efficiently. The success and smoothness of Jakarta Smart City rely on the existence of two applications, named Qlue and Fast Public Opinion Response (CROP). Qlue is an application intended for residents, while CROP is an application that can only be downloaded by the Provincial Government of DKI Jakarta and the Indonesian Police. Reports from the public are then digitally mapped and integrated with the smartcity.jakarta.go.id and CROP pages.

4.2. The Opportunity for Drone in Jakarta as Smart City

Smart city development have some technological infrastructure to gather, accumulative and analyze real-time data so it can be worthwhile for the residents [4]. The development of drones is certainly expected to be able to provide benefits to the challenges faced by cities. Drones are considered to increase productivity, reduce operating costs, and minimize safety risks. It have the potential to utilize these data network sensors that can be accessed by other things. It began to be widely applied to civilian needs because of becomes faster, more practical, lacks of human error, and be able to reach remote locations. Here is the opportunity of utilizing drone especially in Jakarta to create smart city below [6].

- **Delivery Package.** Jakarta has its own interests besides the role of being the capital of country. City development will be followed with business development which is creating easiness in standard of living. Drone technology is being used by many people for various needs as delivery package. Drones are also being sought by foreign e-commerce and retailers to deliver goods. With drones, delivery or delivery of goods is considered to be faster, more accurate, and more cost effective.
- **Road Traffic and Crowd Monitoring and Control.** Traffic jams have become a common problem in big cities in the world, especially if the number of vehicles that are not balanced with existing roads, plus drivers who are not disciplined and cross traffic. INRIX – one of the practitioner of managing traffic – was releasing a scorecard of the worst traffic around the world in 2017.
INRIX was degraded Jakarta from ranked 22th to ranked 12th [13]. As this far, in Indonesia the use of drones in traffic management is a monitoring tool. In other smart city, drone is connected with RFID sensor to monitor and where is necessary to ensure safety for crowds by real time. Even more, in 2016, Europe is testing the area for UAV-based traffic management by collaborating with Nokia [14].

- Medical Transporter. As mention above, Jakarta has traffic jam issue when there are accidents or incidents that require quick handling, the issues become an obstacles in rescue missions. Rwanda in 2016 was implementing drone for delivering vaccines to the remote area and makes the shipping costs are cheaper than using helicopter [15]. On the other hand, in Netherland, Alec Momont is creating an ambulance drone [16].

- Rescue and Disaster Operations. The number of tall buildings in Jakarta certainly makes many people think to be alert to the risks that might occur like a fire. Drone utilization claimed to make possible for responding and rescuing emergency faster than before and working together with civilians and military forces to save lives in disaster [17],[18]. Refer to [19], drone utilization is proving the effectivity and efficiency for supporting emergency management in five disaster, flood, earthquake, nuclear accidents, dangerous material releases, and forest fires such as at New York [20].

4.3. The Challenges of Drone
Many opportunities created by drone utilization for Jakarta as smart city, but there are some challenges that must be considered seriously. There are business and technical challenges classified by [8]. In [6], there are three challenges (security, privacy, and safety) that can be addressed in the international level, so it can be formulated below.

- Safety and Security. Drone utilization in a highly dense cities will generates serious safety issue, such as technical malfunction, lack of maintenance, mid-air collisions, and operator manipulation. On the other hand, weather conditions can affect the crash of drone. Moreover, regardless of all, the biggest challenge is the technology inside the drone. Drone has become a target of hackers [21].

- Regulation. The main concerns of regulation is must be able to keep update with IT transformation and must be applied firmly. The regulations that have been made by the government are a step to minimize worst possibilities that can arise from the use of drones by collaborating with FAA (Federal Aviation Administration).

- Privacy and Technical. In a day to day, drones are easy to have by everyone. Drones assembling with high-definition cameras and sensors, recorder to perform surveillance tasks and turn into worst situation. Technical challenges on drone are coming from inside of its. It should be faced up on middleware services, communication system, engine platform, the wireless sensors, information systems, software and hardware architectures.

4.4. The Recommendation
Drones are using Remote Control Aircraft, controled by remoting on ground and using radio transmitter. Drone recommendation is adding better camera, deploy sensors and 4G LTE device on the drone body. The three devices are most known to develop drone functions. The first is camera, famous development in drone camera is using infrared camera. Even more, infrared camera combined with PC real-time processing image would be great to identify object. Second is sensor that will create more effective in agriculture and rescue benefits such as thermal and LiDAR sensors. The third is 4G LTE device. This will help drone to stay connect and eliminate distance. Then the drone systems is integrating with Qlue and Jakarta Smart City applications through the cloud server.
5. Conclusions
Jakarta is improving its efforts to implement government services towards a better and more integrated direction by implementing smart city concept. The various aspects in Jakarta Smart City should be integrated into a management system that will lead to service quality improvements. Now, the biggest challenge is to integrate the system that has been independently established, then integrate the results in one command. In the forthcoming year, Internet of Things (IoT) and cloud computing will be able to collaborate with drones technology in smart city. In no doubt, adoption of machine learning is aiming to sustain the environment through predictive analytics and big data which is beneficial to Jakarta Smart City by utilizing drone. The integration between drones technology and Jakarta Smart City is predicted bring more benefit in urban life to improve standard of living. The challenges have to be able to handle faster along with IT development.

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