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THE USE OF DRONE TECHNOLOGY AS AN EFFECTIVE TOOL IN PROVIDING INFORMATION SERVICES IN NIGERIA

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Abstract

Diverse research investigations and observations have revealed that majority of Nigerian university libraries do not have adequate information delivery tools. This seems to be characterized by the failure of these various higher institutions to acquire and utilize same for information delivery.The study gave brief introduction and definition of drone and delve into the history on the evolution of drone technology down to its present stage. It went further to categorize the different types of drones/UAVs. This study revealed the use of drone technology as an information delivery tool in the library and also showcase the benefits of its applicability to the agricultural sector in rendering services which before now tend to be very tedious in executing.

Keywords: *Drones technology, multirotor, fixed wing, single rotor and fixed wing hybrid VTOL.*

Introduction

Technological advancement in this 21st century have made the world to become a small global village. This technological development have continue to change things around for good, which has simplified the day-to-day human activities,inspite of diverse criticisms and sometimes wrong applications of these technological tools or equipment.Various digital information dissemination tools have over the years been introduced which change the concept of architecture and operations in acquiring, organizing,processing and administering of services in the library and agricultural settings. Among these devices is the drone technology.

What is a drone device/technology

The word 'drone' originated from its initial use in a play called "Queen Bee" in 1935 when the Prime Minister Winston Churchill and Captain David Margession, Secretary of State for War were watching preparations being made for the launch of a De Havilland Queen Bee seaplane

L5984 from its ramp, which was a pilotless target drone with a radio-controlled version of the Tiger Moth trainer. (Staff, 2018).

Drone is regarded as one of the 192 major upcoming technologies which find tremendous applications in almost all areas like defense, urban planning, disaster management, healthcare, agriculture, weather forecasting, waste management, mining and telecommunications etc. (Frey, 2014) & (Mahashreveta, 2018).

John (2010), define drone as an Unmanned Aircraft System (UAS) which is controlled remotely either by a human operator or by an onboard computer (Rouse, 2018). It can be referred to as Unmanned Aerial Vehicle (UAV),Remote Pilot Vehicle (RPV), Uninhabited Combat Aerial Vehicle (UCAV), Organic Aerial Vehicle (OAV), Remote Pilot Aircraft (RPA), Remote Piloted Helicopter (RPH), which are able to fly without a pilot and passengers on board. Its control is performed remotely by radio waves or autonomously (with predetermined route)

The evolution of Drone Technology

The history of drone can be dated back to the era of when men were always on the battleground, fighting wars with guns, long spears, amoured on horses, covered from the tips of their toes to their heads, all in a bit not to be vulnerable to the adversaries of wars. The quest to enable man not to be exposed to danger of casualty in war situation has been at the front burner of thought, letting their weapons do the battle on their own and retaining man alive.

The original reason for building drone was for a military purpose, especially as weapons in the form of aerial missiles guided by remote control through radio waves, but today, drone have found wide range of applications for civil use in the form of small quad-copters, and octo-copters, which are used for numerous functions such as monitoring climate change and delivering goods to carry out search operations after natural disasters, for filming and photography.

Prisacariu (2018), stated that various online search have it recorded that drone can be dated back to August 22, 1847, when Austrian soldiers attacked the Italian city of Venice with hot-air hydrogen or helium fitted with 200 balloons, equipped with explosives when Venice was fighting for her independence. As at this time it was referred to as Unmanned Aerial Vehicle (UAV). This technology further metamorphoses in its technical advancement in 1915, when the British military used aerial imagery to capture more than 1500 sky maps of the German trench fortification in the region, during the Battle of Neuve Chapelle from 10 Mar 1915 – 13 Mar 1915 in the Artois region of France. Thomas, (2020).

In 1916, America develop the first pilotless aircraft during the World War I (WW1), a small Biplane called the Kettering Bug which was intended to be used as an “aerial torpedoes” using gyroscopic control. The first Kettering Bug flew in 1918, but the war ended before it could be launched. (Wikipedia, 2001).

During the 1930s, the US Navy continue in her technological quest, by experimenting with the radio-controlled pilotless aircraft, which resulted in the development of Curtiss N2C-2 Drone in 1937. Simultaneously, in 1935, the British develop the "Queen Bee", the radio-controlled target, which also believed to have led to the use of the term "drone" for Unmanned Aircraft. (Consortiq, 2010)

In 1941, the early stage of WWII, the US created the first remote controlled aircraft called radioplane OQ2. This product was the first large purpose built drone of over 15,000 by Reginald Denny. Actually, the kudos of discovering remote controlled aircraft that can hover out of sight can be ascribed to Edward M. Sorenson who patented his invention that know what the airplane is doing from the ground terminal. Without this patent early remote controlled aircraft could only operate within the visual sights of the controlling pilot Vyas, (2018).

In 1973, Israel developed the Mastiff UAV and IAA Scout, both unpiloted surveillance machine. Even though the U.S. was able to achieve a breakthrough in mass-manufacturing and supply drones for the military, UAV were often considered unreliable and expensive.

In 1982, this perspective towards UAVs which were seen often as an unreliable and expensive toy changed dramatically when Israel forces used UAV to gain victory over Syrian Air-forces with minimal losses of battle soldiers. With this development the U.S. military in Grenada, Lebanon and Libya began the Pioneered UAV program, to build an inexpensive drone over the horizon targeting, reconnaissance and Battle Damage Assessment (BDA) capability for local commanders.

In 1986 there was a joint project by U.S. and Israel, which led to the developments of RQ2 Pioneer, a modern medium sized reconnaissance aircraft.

1990 – 2010 saw the era of Miniature and Micro versions of UAVs and the famous Predator was introduced in 2000, which was used in Afghanistan for the search of Osama Bin Ladin. The next year further gave rise to the numbers of small-sized, fixed-wing surveillance drones such as Raven, Wasp, and Puma by an American technology company Aero Vironment Inc. Raven is currently used by many countries, with over 20,000 units already deployed.

2010 – 2017, while most of the drone flights were for military purposes, in 2014, Amazon proposed the use of UAVs to deliver goods. Drones also became a popular component for filming and photography. However, these consumer drones have seen increasing interest not because of military influence. It is actually as a result of the merger of two completely different technologies: radio-controlled (RC) aircrafts and smartphones.The rapid growth in the usage of smartphones reduced the prices of microcontrollers, accelerometers and camera sensors, which for fixed-wing hobbyist aircraft became ideal to be used. The future of drones over the years have been highly promising, and its usage has been on the increase on daily bases as it cut across all facet of life.

Types of Drone Technology

Different opinion writers and different school of thoughts have come out over the years to emphasize that there are too many types of drone technologies across the world, each type varies as it depends on the purpose which it is produce. Other school of thoughts went further to state that since the use of drone technology has gone beyond it use to fight wars and conquer territories, it is therefore difficult to say that there are specific types of drone technology. This was well spelt out in an article published in USAID (2018),where it was stated that the most suitable drone type depends on the application, environmental conditions, regulatory framework, organizational needs, associated cost, and supporting infrastructure, among other considerations as factors that determine a drone technology type.

In this article, we will explore the categorization and classification of drones which will determine the type of drone technology to be discuss as it relate and enhancein providing services to agricultural professionals and library users.

There is no single dimension through which drones can be classified. Several school of thoughts have classified drones according to their sizes, ranges which they cover and the duration of its sustainability in the airspace. According to Qassin (2012), stated that in the US Department of Defense, Unmanned Aerial Systems are classified into 5 categories, which was classified into group 1 to group 5 as discussed below:

GROUPS

Group1: This comprises of small drones, with a maximum gross takeoff weight of 0-20 (lbs), it has a normal operating altitude (ft) of less than 1,200 above ground level (AGL) and an airspeed of less than 100 (knots).Group 2: This comprises of medium drones, with a maximum gross takeoff weight of 21-55 (lbs), it has a normal operating altitude (ft) of less than 3,500 above ground level (AGL) and an airspeed of less than 250 (knots).Group 3: This comprises of large drones, with a maximum gross takeoff weight ofless than 1320 (lbs), it has a normal operating altitude of less than 18,000 mean sea level (MSL) and an airspeed of less than 250 (knots).Group 4: This comprises of larger drones, with a maximum gross takeoff weight of 1320 (lbs), it has a normal operating altitude of less than 18,000 mean sea level (MSL) but it has no limit airspeed.Group 5: This comprises of the largest drones, with a maximum gross takeoff weight greater than 1320 (lbs), it has a normal operating altitude greater than 18,000 mean sea level (MSL) and has no limit airspeed.

However, for the purpose of this article, drones shall be classified as small and large. These can further be sub-classified into types for ease of analysis and performances.

Basically, there are 4 major types of drones, based on their aerial platforms, they are: Multi Rotor Drones, Fixed Wing Drones, Single Rotor Helicopter, and Fixed Wing Hybrid VTOL.

Multi Rotor Drones: Simply defined, they are drones that have more than 2 lift generating rotors. Unmanned Systems Technology (2018), defines Multirotorsdrones as UAVs that use more than two rotors with fixed-pitch spinning blades that generate a lift, and by changing the speed of the

rotors, the thrust generated is greater than equal to or less than the forces of gravity and drag acting on the aircraft, the drone can be made to ascend, hover or descend, and by varying the speeds of particular rotors, it is also possible to make the drone turn or move in a horizontal direction. These drones are used for the most common applications like aerial photography, aerial video surveillance etc. These drones can further be classified based on the number of rotors on the platform into Tricopter, (3 rotors), Quadrotors (4 rotors), Hexacopte (6 rotors), and Octocopter (8 rotors).The more rotors a multirotor drone has, the more thrust it can generate and thus the greater a payload it can lift.

Fixed Wing Drones: As the name connotes, it's a fixed wing flying machine such as airplane that is able to fly by using wings that generates lift. According to Circuits Today (2018), They use a 'wing' like the normal airplanes out there. Unlike multi-rotor drones, fixed wing type models never utilize energy to stay afloat on air (fixed wing types can't stand still on the air) fighting gravity. Instead, they move forward on their set course or as set by the guide control (possibly a remote unit operated by a human) as long as their energy source permits.Most fixed wing drones have an average flying time of a couple of hours. Gas engine powered drones can fly up to 16 hours or higher. Owing to their higher flying time and fuel efficiency, fixed wing drones are ideal for long distance operations (be it mapping or surveillance). However, fixed wing drones have some short comings bedeviling its acquisition and these includes high cost of its purchase, professional skill required for its operations, special runway or landing strip required for its takeoff and parachute or net necessary to land them back on the ground.

Single Rotor Drones: This drone looks more like an helicopter. It has one big sized rotor plus a small sized one on the tail of the drone to control its heading. These drones are more efficient than the multi rotor drones, because they have higher flying times. They are perfect for heavy payload, since they allows for very long blades which are morelike a spinning wing than a propeller, giving them great efficiency.

Hybrid Drone VTOL: These are hybrid version of drones. They have the ability to vertically take-off and land (VTOL) without any specific runway or landing strip like the single rotor drones, indicating that it can be launched from any location. They also have the ability to fly longer distances, faster and cover more ground when compared to a multi-rotor UAV. Haowei, G., et al (2017), stated that this device has a designed flight, the VTOL UAV can achieve full autonomous flight in a real outdoor environment, and serves a good platform for future research, such as vision-based precise landing, motion planning, and quick 3-D mapping, as well as service application, such as medicine delivery.However, based on the combined functionalities of this device, it can provide highly efficient coverage and data collection for large agricultural farms, academic libraries, thus allowing farmers and academic researchers to quickly gain insights into crop health

The applications and benefits of drone technology in an academic setting

Recognizing the numerous evolution and application of drone technology for the advancement of humanity, one can say that drone technology has come to stay with man. On daily bases drone application continues to cut across all spheres of human endevours and existence, especially in this era of insecurity in Nigeria, where this technology can be used to provide information to surveillance operators in forest such as the Sambisa forest and other hide outs

where Boko Haram is operating. Furthermore the relevance of Dronescannot be underestimated in thisCorona Virus Disease (COVID 19) pandemic, where information resources and other medical items were to be delivered to sick patients. Theimperativeness of drone technology has continue to be on the increase, irrespective of the subject area, this concept of drone have rendered series of assistance to students to learn abstract in off-the-ground ways doing things.

However, some of the benefits derived from the use of drone technology for information deliveryare discuss herewith.

Tasevski, (2018) substantiated in an online blog that the use of drone have reduces the accidents in libraries as staff don't want to climb on stairs to take books and it reduces the delay in reaching the books to the patron's hand. Application of this technology to librarianship will go a long way to reduce hazards and sustaining high degree of injuries. Nath, (2018) emphasized that drone technology can help to convey book materials to densely populated area, where people find difficult to reach the library and even when library is said to be in central position due to rapid expansion of cities.In the same vain,Chim, (2017), revealed UNICEF innovation team that tested an Unmanned Aerial Vehicle (UAV), also known as a drone, carrying a cargo payload box, which can potentially carry humanitarian supplies at Kasungu Aerodrome in central Malawi. This goes a long way to state that these drone can also deliver books and other information resource materials to their users at specific points of request.We can safely say that drones have a rapid way of delivering information to users with little or no stress of physically moving from one location to another with the hardcopy of the information resource materials.The process starts with requesting for a book by the patron through the dedicated library app and the request is received and processed by the concerned section in the library. The ordered book being taken and further hand over to the drone section where the experienced pilot attaches the book with the drone and let it flies to the patron's hand. After the delivery it automatically flies back to the origin and all the major processes and progresses are updated to both sender and receiver. (Kolakowski, 2018). See fig.3 on image of drone use for book delivery. This drone can also be used to deliver farm produce or livestock feed to specific areas where needed without the sender physically been present

In addition, Lynch, (2015) stated that drone facilities were offered to students of Tampabased University of South Florida library to enable them capture high-resolution aerial video and photos for their project work. This university makes use of drone for mapping out the campus to see energy usage. Accordingly, Bogusława and Jerzy (2017), stated that drone technology can also be used as a security tool within and outside library which are far better than fixed cameras as it moves and covers the entire place and offering 24 hours surveillance. In this regard, library porters need not engage in the traditional movement from one place to another, as this device is capable of surveying the entire library even at odd hours with the aid of the cameras entrenched in them. The porters can manipulate the device from his control station to do the survey around and within the library. Mitch (2020) displayed a drone prototype which can be used for total surveillance within and outside the library and even in the agricultural farm setting, during the day and also in the night.

In Africa, drone technology is receiving tremendous impact and boost in its utilization especially also in the agricultural sector.

As earlier stated, technological advancement has virtually transformed every activities in human existence. It has enhance proficiency by reducing work pressure and time in achieving set targets between short-space of time. The agricultural sector is not left lagging behind.

The application of drone technology to agriculture has significantly enhanced productivity, it has since shifted labourers into other productive industrial areas. According to FAO of the United Nation as edited by Sylvester, (2018), stated that drone technology and advanced image data analysis with capabilities it provided, have the potentials to become important parts of the technology mix that could fill the gap, between the current agricultural production and the needs of the future. He went further to state that drones can be equipped with a range of image data sensor, which includes, the ability to access the health of crop vegetation.

This technology of equipping drones with accessories used for surveillance and monitoring, can essentially be controlled through software controlled flight plans in their embedded system, working in conjunction with on board sensors and GPS. With these features, the mapping capabilities of Normalized Difference Vegetation Index (NDVI) has been brought to a new level of accuracy, making it possible to monitor the status of not only plants in farms, but also specific parts of plants health in the farms, which enhance the identification of pest and diseases, andhaving identified the lapses in these areas, specific solutions can be proffer on either application of fertilizers, pesticides or herbicides to the plant as the case may be. See fig. 4 on sample image for drone used in spraying pesticides on farms.

Another area wherein drone technology enhances agricultural sector, is on the area of surveillance andsecurity on the theft to farm produce or on livestock. Drone technology can be used to monitor the activities in the farm without physically been present at thecite. From the ground control station and with the aid of the image data sensor configured into the device, the drone operator can visibly monitor every activities going onaround and within the farm, either in the night or noon as the case may apply. The operator can also monitor the movement of library users and can also use it to monitor the movement of livestock within the farm from the aerial, and when there are any variations in the activities expected, the operator can quickly raise alarm and address the issue. See fig. 1 &2 on sample image of drone use for surveillance either in the library or infarm.

(!)  (2) 
Mitch, S. (2020) drone for surveillanceiStock. (2018). Proper for aerial surveillance

(3)  (4) 
Chim, C. (2017). Cargo drone for infor deliveryStaff, W. (2019). Drone spraying pesticides

Conclusion

As the relevance of the various drone technology activities have been exposed, the need to take advantages of its acquisition and implementation in our academic setting will improve all round general services rendered by the university.

The acquisition of a multirotor drone for a start will go a long way in enhancing surveillance and putting security on top check. It will also enhance the library activities on information delivery and also proffer tremendous success in agricultural programmes. The cost of acquiring the multirotor device is very minimal and little or no skill is required for its operations, but its beneficial impact are too numerous to mention especially in this era of information communication technology.

References:

Bogusława, B. and Jerzy, C (2017*) Farm machinery and processes management in sustainable agriculture*. Use of drones in crop protection. Available at https://www.researchgate.net/publication/321708513_USE_OF_DRONES_IN_CROP_PROTECTION/citation/download. Accessed on 29/07/2020

Chim, C. (2017). *UN News*. FEATURE: Does drone technology hold promise for the UN? Available at https://news.un.org/en/story/2017/09/564452-feature-does-drone-technology-hold-promise-un. 06/08/2017. Accessed on 31/07/2020.

CircuitsToday (2018). Types of Drones – Explore the Different Models of UAV's. Retrieved from https://www.circuitstoday.com/types-of-drones

Consortiq, (2010).A short history of unmanned aerial vehicles (UAV). Available at https://consortiq.com/short-history-unmanned-aerial-vehicles-uavs. Retrieved June 5, 2020.

Frey, T. (2014). 192 Future Uses for Flying Drones. Retrieved March 27, 2013, from https://futuristspeaker.com/business-trends/192-future-uses-for-flying-drones/

Haowei, G., (2017). Development and Experimental Verification of a Hybrid Vertical Take-Off and Landing (VTOL) Unmanned Aerial Vehicle(UAV). A paper presented at the International Conference on Unmanned Aircraft Systems, ICUAS, At Miami in June (2017). retrieved from https://www.researchgate.net/publication/317933218_Development_and_Experimental_Verification_of_a_Hybrid_Vertical_Takeoff_and_Landing_VTOL_Unmanned_Aerial_VehicleUAV#pf

IStock.(2018). Getty images. Retrieved from https://www.istockphoto.com/photo/white-drone-with-digital-camera-filming-from-above-clear-blue-sky-background-gm1033275072-276715858

Kolakowski, N. (2018). Five Years Later, Where are the Amazon Delivery Drones?
Retrieved March 26, 2019, from https://insights.dice.com/2018/12/05/where-amazon-delivery-drones/

Lynch, J. (2015). What Are the Strangest Things Libraries Lend? Drones? Retrieved March 30, 2019, from http://www.techsoupforlibraries.org/blog/what-are-the-strangest-things-libraries-lend-drones

Mahashreveta, C. (2018). 10 Major Application Areas of Drone. Retrieved March 29, 2019, from https://www.geospatialworld.net/blogs/10-major-application-areas-of-drone

Mitch, S. (2020). *The New York Time.* 'It's Creepy': Unexplained Drones Are Swarming by Night Over Colorado. Available at https://static01.nyt.com/images/2020/01/01/us/01drones/01drones-jumbo.jpg?quality=90&auto=webp. Jan 1, 2020. Accessed, 31/07/2020

Nath, F. (2018). Library Drone Delivery Programme : A Study, 38(5), 349–353.

Prisacariu, V. (2018). The history and the evolution of UAVs from the beginning till the 70s. *Journal of Defense Resources Management Vol.8,Issue1(14) 2017.* Available at https://www.journaldresmara.ro/issues/volume8_issues/15_vasilePRISACARIU pdf. Retrieved March26, 2020.

Qassim A. A. (2012) Pennstate College of Earth and Mineral Sciences. Geospatial Application of Unmanned Aerial systems (UAS). Retrieved from https://www.e-education.psu.edu/geog892/node/5

Rouse, M. (n.d.). Drone (unmanned aerial vehicle, UAV). Retrieved March 24, 2019, from https://internetofthingsagenda.techtarget.com/definition/drone.

Staff, IWM (2018). A brief history of drones. https://www.iwm.org.uk/history/a-brief-history-of-drones). Retrieved April 20, 2020

Staff, W. (2019). *Technology.* Drone Use in Agriculture Soaring to New Heights. Available at https://www.thomasnet.com/insights/drone-use-in-agriculture-is-soaring-to-new-heights/. Aug 14, 2019. Accessed 31/07/2020

Sylvester, G. (2018). E-Agriculture in action: drones for agriculture. Food and Agriculture Organization and International telecommunication Union. Available at

Tasevski, S. (2018). Book-Carrying Drones in Libraries: Are They Real (Yet)? Retrieved March 29, 2019, from https://dronebelow.com/2018/09/24/book-carrying-drones-in-libraries-are-they-real-yet/

Thomas, R. B. (2020). Airspacemag.com. Neuve-Chapelle, France Was the First Town Ever Mapped From Aerial Photos. https://www.airspacemag.com/daily-planet/first-map-compiled-aerial-photographs-180973929/

Unmanned System Technology (2018), What is a Multirotor Drones?retrieved from https://www.unmannedsystemstechnology.com/category/supplier-directory/platforms/multirotor-drones/

Wikipedia (2001). History of Unmanned aerial vehicles.Available at https://en.wikipedia.org/wiki/History_of_unmanned_aerial_vehicles. Accessed July 10, 2020.