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The Importance of Drone Technology in Nigerian's Construction Industry

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***Abstract*- Drone is also known as Unmanned Aerial Vehicles (UAVs) are aircrafts that fly without any humans being onboard. They are either remotely piloted, or piloted by an onboard computer. Drones are used for emergency response, inspection of damaged roofs, collapsed buildings, accessing difficult to reach places and many builders / engineers have come to rely on drones for their everyday operations in the developed countries. The advent of new construction technologies did not exterminate the job for construction workers, rather it created a room for workers to acquire skills of the modern technology for the new generation. Drones are not common in Africa and has been grounded in some countries because the governments do not have full understanding of the technology. The professionals in other related fields don't really have the knowledge of operating drones. The purpose of this paper is to create awareness of drone technology application in the Construction Industry of Nigeria, which the use of drones is not common in Nigeria. Oral interview with the construction workers in Abuja and the use of personal observation and open source materials were part of the methodology. The use of drones save time, reduces cost, allows remote monitoring of construction site, easy accessibility to difficult terrains or sites and reduces risk of human lives to dangerous sites. The Nigerian Construction Industry needs to embrace the use of drones in all project execution for effective job delivery, the Public and the Private sector can invest in the technology where Professions can be trained in drones operation, the engineers with interest in drone technology should establish a drone service / repair center as an avenue for job creation in Nigeria.**

***Keywords*- Construction Industry, Difficult sites, Professionals, Job creation.**

I. INTRODUCTION

The Construction industry is an important sector that contributes greatly in the economic growth of a nation. The Construction Industry is an investment-led sector where government shows high interest for National Development. Deficiencies in construction is lack of a proper skill training for workers and most industries have difficulties in procuring plants/equipment and inadequate capital to execute infrastructural projects. However, despite these constraints, the industry still has the potential of becoming the largest construction industry in the world (Thami, 2016).

The Nigeria's population is increasing every year and is over 170 million with the population growing faster than the rate of construction which is only 3.2 per cent of the Gross Domestic Product. Before the Industrial Revolution, construction work was strenuous and most labourers work without modern industrial equipments, laborers cleared sites and laid bricks by hand causing delay in job execution and delivery. The use of new construction technologies will enhance job delivery and it will not exterminate the manual job market, rather it will create opportunity for workers to acquire skills of the modern technology, for the new generation.

An unmanned aerial vehicle (UAV), commonly known as a Drone, is an aircraft without a human pilot on board (Maveba, 2017). UAVs can be remote controlled aircraft (e.g. flown by a pilot at a ground control-station). Drones represent the next revolution in industrial technology which can cover difficult areas over short time frames.

Drones are used for emergency response, inspection of damaged roofs, collapsed buildings, accessing difficult to reach places and many builders / engineers have come to rely on drones for their everyday operations in the developed Countries. Drones lower costs of construction and make work much easier for site managers, Engineers, Town Planners, Surveyors, Architects and Builders among others in the developed Countries.

The use of drone technology is a big opportunity for all developing countries, entrepreneurs and for those who want to solve social, economic and environmental issues across Africa.

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Across Africa, drones have been grounded because governments don't fully understand the technology, and amateur pilots don't understand how to fly them properly. When drone technology was introduced in Africa only Namibia allowed the use of drones without restriction. The Kenya n Government banned the use of commercial and recreational drones (Justin, 2015).

The Nigerian Construction Industry in Nigeria is yet to adopt the use of drones technology, probably due to unavailability and lack of skill in Drones operations. However, the use of drones in Construction will surely entice other professions and the Commercial Sector. Drones application is vast and can be used in Building and Road Constructions, Traffic Monitoring, Medicines, Agriculture, Geography, Fire/ Flood Rescue Operations, Disaster Management, Film shooting/Media, Security and other Commercial activities among others.

1. Aim:
The aimed at creating awareness for the use of drone technology in Nigeria's construction industry.

2. Methodology:
Oral interview with the construction workers in Abuja and the use of personal observation and open source materials were part of the methodology.

II. LITERATURE REVIEW

The predecessor of the drone, the remotely-controlled vehicle, was first patented in 1898, by none other than the genius Nicola Tesla. The United Nations calls drones used for environmental tasks 'eco-drones'. Personal drones are sometimes to referred to as 'civilian drones' and are smaller than those used by the military. The drone is a device that has a certain level of autonomy, meaning it can 'fly, hover, or navigate without input from a pilot. Drones are devices harbouring first-class technology in a compact, mobile platform and Equipped with cutting-edge technology.

Since drone technology and its applications are in ongoing rapid development, this article is an attempt to get a grip on its multiple and dynamic technological and social impacts. Filling the gap between satellites and ground surveying, drones enable fast, remote access to a particular area; the advantages of using drones for monitoring include their flexibility, their ability to fly under cloud cover, their high resolution cameras, and different camera systems. Cloudy skies and shadows from mountains can hinder satellite images but drones are so tiny and aerodynamic, they fly at much lower altitudes than satellites. They also have the ability to take pictures from other angles than merely from above. The use of drone technology has been steadily expanding across commercial, scientific and recreational fields in recent years, with the use of UAV ranging from surveillance and search & rescue operations through to aerial photography, surveying and digital communications.

Drones in construction have made surveying much easier by playing a huge role in making data collection simple. These small crafts are easily piloted by remote, and can transmit quickly the data they are gleaning to a live feed and data storage instantaneously.

This makes the task of creating very accurate maps and providing valuable data to numerous companies much easier. Information acquired can be uploaded right away to a server, where it can be accessed by individuals all over the globe. Drones can reach high-risk areas where is inaccessible by humans.

1. Types of Drones:
Small drones called quadcopters, are literally a helicopter with four propellers instead of one. There are other types of drones made by different manufacturers. The other types include Parrot AR drone, Sky Master Mini RC drone and DJI Phantom among others.

1.1 DJI Phantom 2: The DJI Phantom 2 is a remote control drone good for professionals in different field. The drone is an extremely impressive device with capability of flying for 3.1 miles and continuous autonomous flight capable of capturing clearer imagery more than the satellite imagery which makes good project and construction site monitoring.

Fig 1. The DJI Phantom.

1.2 Parrot AR Drone 2.0: The device is an impressive one that can hover freely in the sky and remotely controlled. The Parrot drone is affordable and is perfect drone for beginners which can be controlled remotely using smartphones. The construction engineers can use in different construction work, especially the types that has good camera.

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Fig 2. Parrot AR Drone 2.0

2. Drone Design / Operations:

In technical terms, a drone aircraft is an unmanned aerial vehicle, commonly referred to as a UAV. That means it's an aircraft, of any size or type, that flies by itself, without an onboard pilot or passengers. Think of it as a robot plane that is controlled either autonomously or via remote control. Drone is lifted by four propellers rotating at the same speed, the drone will hover. The speed of the propellers is related to the altitude of the drone: when the propellers rotate faster, the drone will go up and when they rotate slower, go down.

The drone moves from left to right due to a difference in speed-level between at least two propellers. When remotely piloted, drones require diverse means of communication with controllers. This includes radio waves, in the case of large vehicles, or WiFi, for those controlled by a smartphone, and many options in between. Depending on how advanced the drone is, a certain amount of applications are built in, such as a GPS chip, various sensors and infrared systems, measuring tools and most commonly, a camera, among others.

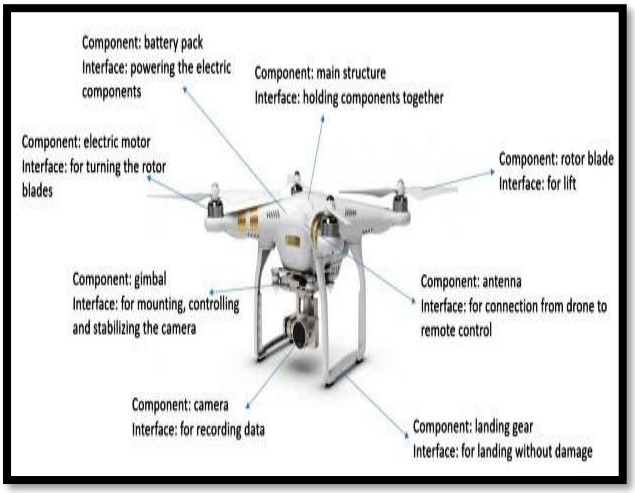

Fig 3. Drone Parts Source: Simon 2015.

3. General Use of Drones:

3.1 Aerial Mapping & Nature Monitoring: Drones are ideal for mapping - a 5kg drone can fly for several hours and send back pictures with a pixel resolution of up to one metre. Hovering at a height of only 200 metres, the potential issue of cloud cover obscuring the ground is virtually eliminated. A drone can provide crystal-clear images of any tropical rainforest or conserved wetland during any single day of the year. Often times, it only takes a drone 20 to 30 minutes to scan an area.

This allows project managers to always have up-to-date information, helping them to make better decisions and ultimately run their project more effectively. This data also makes it easy for project managers to communicate their progress to their clients and investors. The aerial view below was captured by remote control drone which allow the engineer to have a total view of the project site (Figure1).

Fig 4. Aerial view captured by Drone, Source: Bev Currie (2016).

3.2 Navigation and Ground Surveying: The use of drones is greatly an untapped area in Urban planning, which goes beyond a simple reliance on pre-existing GIS databases or a survey distribution to collect real-time, meaningful data. Engineers and planners could simply use small flying machines to conduct mapping procedures that is similar to balloon-based aerial photography. Real estate agencies are using simple quadcopters to take aerial photographs of properties for sale.

Drones have quickly become an essential tool for land surveyors, with a variety of surveying-specific UAVs now available. The UAV collects data and lands so that the information can then be uploaded. This data is then processed into the desired deliverable. Software suites such as Drone Deploy and Pix4D can create incredibly accurate 3D computer models.

These models allow land developers to tweak their ideas and make change- well before starting the construction (Figure 2).

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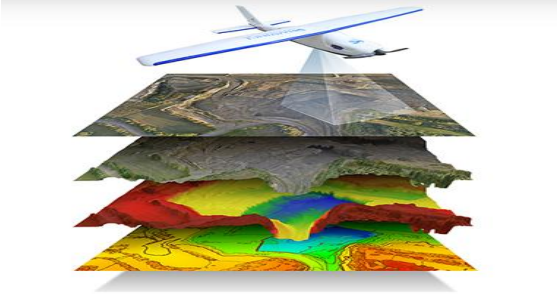

Fig 5. Use of Drone in GIS and Survey.

3.3 Agriculture: Drones can also be used agriculture in areas of farmland and crops inspection to know the status of crops remotely. Drones are good devices that are cheap workers and faster that are sometimes accurate in inspecting large pieces of agricultural land (Figure 3).

Fig 6. Monitoring farmland remotely.

3.4 Rescue Operation/Disaster Management: The developing Countries are using drones in rescue operation and saving lives of people in areas of high risks. There are special drone's designs for under water operations, which can submerged in water for a particular or a tasked assigned. Drones are used in areas of flood, where is sent remotely in search of people in flooding environment (Figure 4).

Fig 7. Monitoring Coastal Areas remotely.

3.5 Communications and Media: Recently a trend has emerged in journalism to collect information with readily available, consumer-market drones. There is an increased use of aerial video data collection by journalists and easily accessible with products such as the AR Parrot. Initially helicopters were the main source of overhead viewing during the earlier days of film making and construction: they were pretty risky to use, and resulted in quite a few tragedies along the way. Filmmakers are using drones to record footage for their films Phantom and Yuneec Typhoon are mostly used in Journalism and film making. (Figure 5).

Fig 8. Yuneec Typhoon, Source: Jim 2016.

3.6 Traffic Monitoring: Countries like Denmark used drones for traffic monitoring and it was successful, which has proven to be a valuable tool, especially finding solutions to alternative routes for motorist to ease the traffic congested roads with the help of drone technology. Drones are used in other Countries for traffic monitoring, at the same time collecting traditional traffic data such as traffic counts. (Rene, 2016). Below imagery shows view of traffic situation captured by a drone (Figure 6)

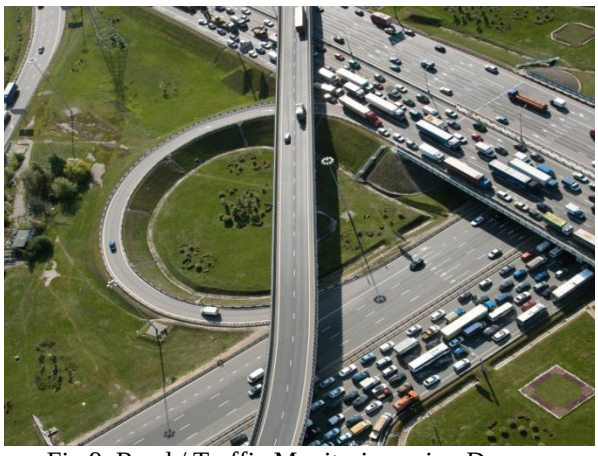

Fig 9. Road / Traffic Monitoring using Drones.

3.7 Construction Industry: Drones in construction can do a great job of hovering over a location that is too dangerous for a worker to get to, and can save lives by

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monitoring workplace conditions in areas that are very hard to reach. Operators can just send off a drone, stitch together the images into a map and analysis the results from the ground. The drones can go where humans cannot for a quick view of the exterior of the building. The camera and the quality of images mean that automated drones could increase security on some sites. A security guard can only cover so much ground, but a drone could keep watch over wider perimeters and stockpiles of materials. Below is an Engineer operating drone remotely at a construction site (Figure 7 and 8).

Fig 10. Drone operation at Construction Site, Source: Clay 2016.

Fig 11. Construction Site monitoring using DJI Phantom Drone Source: Clay 2016.

III. CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions:

The use of drones saves time, money and energy but the use of drones is not common in Nigerian construction industries and most engineers/professionals and construction company workers in Abuja complaint of unavailability of professional drones in the market.

Lack of drone's operation skills is another hindrance to drones application, which is due to lack drone operation training center in Nigeria.

The use of drones in construction will actually save time, money and will reduce the risk of human life in dangerous terrains and inaccessible areas.

Imageries captured by drones are sharper and better than the satellite imageries which are expensive and are mostly not real time data. The use of drones saves time, money and also reducing the risk for employees at construction sites. The construction industries of both building and road construction in Nigeria, should embrace the use of drone technology to enhance project delivery and effective job completion.

2. Recommendations:

- The construction Industry should embrace the use of drone technology which a modern innovation that enhances job delivery reducing cost and saves time.
- Both the Public and the Private can invest in drone technology where their staff in related Professions can be trained in the use of drones in different professions.
- Prospective investors can open a technological center where Professionals can a fee, to be trained on operating and navigating drones.
- The Drone Training Center should be attached with Center for Remote Sensing in Nigeria, where Professionals in the Built Environment can acquire skills in drone operations.
- The Engineers with interest in drone technology should establish a drone service / repair center as an avenue for job creation in Nigeria.
- Drones can also be used in Rescue operation such as fire and flood disaster where human lives can be saved, no necessarily areas of construction.

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