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Humanitarian Impact of Drones in Healthcare and Disaster Management

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Abstract*:: *Unmanned Aerial Vehicles (UAVs) or Drones has been developing brilliantly in the last few decades and they show a remarkable progress in application where human reach is either difficult or hazardous especially in the grimy, dull, and risky activities with advance technology. The technology advancement is making the UAV much better in its specification with advances in computing innovation, programming improvement, light-weight materials, worldwide route, propelled information joins, refined sensors and so on, are reinforcing the abilities and fueling the interest for UAVs worldwide. UAV also colloquially known as Drone is a robot that has the ability to operate autonomously without direct control from a human operator. For nations, it is a surveillance tool, meant to watch over nations as Drones have been used in the past for warfare as such, and activities alike. Drones have been a handy gadget to get "Ariel photography" for many decades and used for intelligence and anti-terrorist outcomes. Today the drones are much more versatile and are moving the industry ahead in its reach for activities as monitoring, investigation, product deliveries, aerial photography, healthcare, disaster relief management, agriculture and even drone racing. There are other types of drones too such as boats, submarines, and ground-based robots. The primary purpose is to explore the usage of drones in Humanitarian causes such as disaster relief and social causes as health care.

Index Terms*: *Drones, Unmanned Ariel Vehicles, Geospatial mapping, Community and Social services, flying bots, Ariel view.

I. INTRODUCTION

Drones have been a handy gadget to get "Ariel photography" for many decades and used for intelligence and anti-terrorist outcomes. Today the drones are much more versatile and are moving the industry [8] ahead in its reach for activities as policing, peacekeeping, and surveillance, product deliveries, aerial photography, agriculture, Health care, Disaster management [1] and even drone racing! There are other types of drones too such as boats, submarines, and ground-based robots. There is also a controversy with the term Drone and the size it represents. Drone is a robot that has the ability to operate autonomously without direct control from a human operator. The primary commercial and business use possible today, for numerous activates as delivering packages, taking photographs [1] for say selling for real estate. For nations, it is a surveillance tool meant to watch over nations as Drones have been used in the past for warfare as such, and activities alike. The Drones industry is growing in sophistication in its hardware and with equally complex software in its strength in agility and adaptive character. Very small drones are, as small as, about a large insect. Very small drones can be usually found in two forms: Nano or Micro Drones and Mini drones. The Nano drones are mainly shaped and designed in the form of insects. These usually have a very small rotary or flapping wings and of course, the size limits the battery and distance it can cover in flights. The primary purpose of this paper is to explore the usage of drones in Health care and Disaster management while it is used in many other areas like Land survey, urban planning and development, construction and earthworks, Mining and Quarrying activities [1], archaeology, agriculture, Environment Protection, Humanitarian as disaster relief and social causes [8, 21]. Drones equipped with Geo spatial mapping for utilizing it in diverse kind of applications but it brings some challenges also. Geo spatial mapping facilitates a drone to collect, store and analyze the spatial or geographic data. Alternatively drones must be having geographic information system (GIS). GIS itself comprises with several functionality including technologies, processes and various methods [1]. Drones are enriched with latest GIS technology for visualization and capturing 3 dimension visuals in real time. We can say that the drones are time savers and drones can transmit GIS data in lower costs. The GIS mapping is identifying very fruitful in war zones, and battlefields. The other bright part of using drones is the green technology and does not make any impact on hazardous factors for the environment [19].

II. CATEGORIES OF DRONES

Unmanned aerial vehicle (UAV) or Flying bots or best known as Drones [12, 13]. These are aircraft without a human pilot aboard, UAVs are a component of an unmanned aircraft system (UAS); which include a UAV, a ground-based controller, and a system of communications between the two. The flight of UAVs may operate with various degrees of autonomy, where it can be either under remote control by a human operator or autonomously by on-board computers Drones can be categorized in two classes: Fixed Wing drones and Rotary Motor drones. Each of these drones has its own particular favorable circumstances and impediments.

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The fixed wing drones can fly at higher paces going from 25-45 mph and can cover the scope of 500 to 750 sections of land for each hour relying upon the battery Rotary Motor Helicopters then again can drift and spotlight on particular issue in genuine and can fly over consistent speed. They experience the ill effects of restricted battery life and can take off and arrive off securely in little limited regions and are totally best first of all to learn Drone Flying [9]. Fixed winged Drone are half breed plans which utilize two type of wing action where the steady wings are meant lift and fluttering wings for drive. The fluttering wing part builds proficiency, gives a mechanically and efficiently adjusted stage, and extinguishes slow down finished the settled wing by entraining stream This sort of drones likewise can be found in dragonfly with couple wings which depict the two sets of wings to expand for Drones lift and push. Rotary Motor Drones are tiny which enable them to fly in small spaces. This is especially valid for rotational wing drones that can float and have a high mobility. These drones having small turning radius [14] and are propelled frameworks they are called rotational wing drones. Not at all like the other drones, these drones can fly toward each path, on a level plane, vertically, and furthermore can drift in a settled position. These qualities make them the ideal drones for looking over difficult to-achieve zones, for example, pipelines, [2] spans, and so on. Revolving wing drones, like helicopters produce lift from the consistent turn of the rotor cutting edges. In this kind of UAVs, a few sharp edges might be utilized. Along these drones, these days, analysts planned and created distinctive kinds of drones running from one to twelve engines. As for Hybrid drones, efforts are made to plan and manufacture drones with various capacities that can be connected in varied conditions. Distinctive drones are tested fir ability to walk, plunge swim and leap. Moreover, the miniaturized scale air-arrive vehicle (MALV) is another drone which can fly and stroll over unpleasant territory utilizing inactively agreeable wheel-leg running gear. Parrot Hydrofoil is a drone that is considered as a striking half and half robot in both air and water [2]. There is a difference in remote controlled planes and drones. The rise in popularity of consumer drones has led to a considerable amount of confusion. The word drone has been misused by the media [15] and manufacturers attempting to capitalize on the excitement that surrounds everything “drone”. A drone is a robot that has the ability to operate autonomously without direct control from a human operator. “Drone” usually refers to unmanned aircraft which are also called UAVs. For an aircraft to be considered a drone it must have an autopilot and have the ability to fly without user input. Many of the “drones” on the market right now do not meet that criteria [20].

III. EVOLUTION OF DRONES

Early Developments for Unmanned Aerial Vehicles evolved back in 1849 when Austrians attacked in Venice with unmanned inflatables stacked with explosives. It was extensive progression in the kinds of UAV utilized amid early years, World War1 (WW1), World War2 (WW2), Korean War, Cold war, Vietnam war and later in inlet war. Those early UAVs were exceptionally untrustworthy and flawed, and around then, their helpfulness, their capacity to change the combat zone, and their general effect on military applications [2] were not perceived by most military and political pioneers. The market for nonmilitary personnel unmanned airborne vehicles, otherwise called drones [18]. As such, the acknowledgment of the possibility that intelligent machines [1] outfitted with infrared cameras and perhaps receivers are flying over our heads and inside our private airspace is totally subject to the trust we have in the administrator. If there are no legitimate controls, drones can be effortlessly utilized for unlawful purposes extending from reconnaissance and unapproved following to even criminal uses, for example, directed deaths and fear based oppressor attacks [6]. The primary unmanned elevated vehicle was the "Kettering Bug" created by US Airforce amid WW1. It was a self-flying torpedo. At the point when contrasted with the most recent UAVs it was a straightforward machine which could be aligned for exactness attacks against strengthened for protections up to 75 miles away. It is more a guided rocket than a drone [20]. The German V-1 buzz-bomb, a fly controlled voyage rocket, was WW2's most utilized automaton. The advancement of RADAR to supplant TV as the essential direction framework was a surprising change in the WW2 task. OQ2, OQ3 drones created had one-hour perseverance and a speed of 85mph. The thoughts were great, however the innovation was not progressed. In 1960's and 70's US created colossal number of UAVs for military purposes. All through the twentieth century, there has been a huge advancement in UAV innovation. Drones have done wonderful work amid against psychological militant activities performed by US. They have done it with little cost, and no hazard to military. Despite the fact that at first it was utilized for military purposes, later individuals began utilizing UAVs for nonmilitary personnel applications. Presently, numerous nations like US, UK, France, Iran, China, Israel, India, and Pakistan and so on are utilizing UAVs. Following up on misconception #1 there are a lot of confusing acronyms and terms for drones and drone-like aircraft. The “proper” name for drones is actually UAVs or unmanned aerial vehicles [12]. Some people will say UAS or unmanned aerial systems. These terms are a matter of debate in academic, military and regulatory circles. Drone, UAV and UAS essentially mean the same thing. The terminology gets a little foggy when you start talking about RPVs which stands for Remotely Piloted Vehicle. Many of the large military drones fall into the RPV class. The difference is that they are actively piloted by a human although the human can be hundreds or in some cases thousands of miles away. RPV’s are essentially big expensive R/C planes. As discussed in #1 R/C stands for radio control and refers to the hobby planes [2], helicopters and multirotor that are literally controlled by radio transmitters. Modern drones developed from R/C aircraft and have many of the same components. One more acronym that is related to drones is FPV which stands for First Person View. That is the technique used to fly R/C aircraft using a live video feed via radio link and video goggles [4].

IV. LEGAL ASPECTS OF USING DRONES

Presently FAA (Federal Aviation Administration) and most of the other countries regulatory authorities,

have limited the production of commercial drones but have allowed for a selected few industries and applications like aerial surveying in the agriculture, mining, and oil and gas sectors which bring in restrictions on the volumes for commercial use [8]. It is the military and intelligence operations that have continued to use drones for much more advanced activities and several countries' demands are on the rise for using drones for their security and surveillance activities which make it safe for humans as compared to earlier manned missions and aircraft. Commercial and other use of drones comes with regulations. Like most laws it is the responsibility of the operator to learn and obey the regulations. In Canada the regulations are in a state of flux so it is important to keep up to date with the changes. Likewise, in the United States new rules are currently being developed to register all recreational drones. At the present time both Canada and the United States do not have a licensing system for commercial drone operations. In both countries the existing laws consider commercial drone activity illegal and therefore an exemption or permit is required. In Canada this is called an SFOC or a "Section 333 Exemption" in the US. The Canadian laws are further ahead as there is somewhat of a streamlined system to apply with a clear set of criteria. Exemptions have been made for small drones provided that they have insurance and operate at a safe distance from airports, and buildings. The advance technologies as geo-ensure, highly capable machines which can have their geo-mapping and positions precisely tracked with other capabilities as collision avoidance which will make the traffic of drones safe but on the flip side the traffic density will be high in the automated drone/bot corridor [7].

As for the Indian Context a few guidelines that are given are under "Government of india Office of the director general of civil aviation Technical Centre, opp. Safdarjung airport, new delhi", Civil aviation requirements, Section 3 – Air TransportSeries 'X ', Part I, Issue I, Dated Dd Mmmm 2017 Effective: Forthwith F. No. 05-13/2014-AED Vol.VI, Subject: Requirements for Operation of Civil Remotely Piloted Aircraft, System (RPAS)Applications in Social services and community assistance deliveries [3]. Here the safety concerns is a major one. It has been illegal to fly drones in India without a permission from the authorities. The new rules aim to tap the myriad opportunities in the commercial and recreational space [16], while ensuring the safety of other vehicles in the airspace and people on the ground.

V. DRONES USAGE

The uses of drones cover an extensive variety of common and army applications. Drones can perform varied missions in extremely difficult situations. Drones are versatile in their use and application [3] so the advancement in technology will have similar approach to equip them. The major uses are for observation and surveillance missions [1]. The utilizations of drones can be arranged in various ways. It can be founded on the kind of missions (military/common), sort of the flight zones (open air/indoor), and kind of the situations (submerged/on the water/ground/air/space). Drones have an assortment of uses in our day by day life. These drones can be utilized for hunt and save missions, natural security, mailing and conveyance, performing missions in seas or different planets, and different incidental applications. These drones can give a fast review around the objective territory with no threat. Drones furnished with infrared cameras can give pictures even in the obscurity. Some of the application area of drones are described as under.

A. Drones in Healthcare

The healthcare industry can offer the best usage of drones for improving healthcare services [21]. Transportation is a major hurdle in delivering the medicines and vaccines in some areas [5]. Drones can be an alternative for transportation of medicines in such areas. It also reduces the cost of providing medical facilities. In case of any emergencies or natural disaster it may be a quick means of transportation of medicines and other facilities. It can act as time savior in critical situations and also achieve the affordable cost of transportation. Drones will contribute for caring of outpatient in the manner to provide immediate medications, blood and antibiotics [1]. In future it will be possible to deliver medications for life threatening communicable diseases through the small indoor drones. It also opens the door for more advanced drones which can helpful for senior population by introducing small arms to drones which can be used to give medication to them, to grab a glass of water also.

B. Drones in Disaster Management

Drones can be involved in survey and roam in the areas where natural calamity has struck with the capability of analyzing the data of the disaster affected area and converts it into intelligent insights of analyzing data for management capability and decision taking. In recent years, natural disasters, for example, flooding, fierce blaze, storm, tornadoes, and numerous others hit every now and again in various parts of the world and make critical harms to both economy and human life. One of the vital uses of drones is utilizing them in rescue missions. In search and protect activities, consistently is imperative. With a specific end goal to work as productively as could reasonably be expected, it is imperative to have the capacity to acquire a quick review of the circumstance [2]. While kept an eye on planes and helicopters require time to be prepared for doing the mission, drones can be put promptly with no loss of time. Due to the vital part of drones in pursuit and save missions, they pulled in the consideration of numerous analysts. Calamity influenced area where drones can be considered as a potential method of transportation in transport crisis. Drones can turn out to be extremely valuable as a method of transportation [5] in helpful coordination since they needn't bother with any prior way to fly.

Along these lines, if a cataclysmic event strikes and streets are blocked, drones can without much of a stretch be utilized to serve a fiasco influenced area. These days' drones are utilized as a part of a differing scope of regular citizen exercises, basically helpful guide and protect activities in different catastrophic events which incorporate seismic tremors, tropical storms, flooding, volcanic ejection, tidal waves [2], and numerous others.

The emergency administration of these cataclysmic events postures extremely basic choices identified with the prosperity of the influenced individuals.

VI. LIMITATIONS OF USAGE OF DRONES

It looks cool, even plausible, but there are several major road blocks that need to be dealt with before drones will be landing in back yard [9]. First the drones require a system called Sense and Avoid [2]. This is arguably the holy grail of modern drone development. Sense and avoid means that the drone can avoid collisions with unplanned obstacles, people and vehicles using onboard sensors and real time decision making. Great strides have been made in the last two years in this field but it will be a while before it is ready for the real world. In addition to sense and avoid systems delivery drones will also have to be reliable in all weather conditions. There are very few drones today that are capable of flying in rain, strong wind or at night. There are other reliability issues that need to be addressed such as battery life, and battery consistency. Not to mention dealing with militant anti-drone activists or simply kids that might throw plastic bags or rocks at delivery drones [10]. Apparently, it is legal to shoot down other people's drones in the United States. The last hurdle that needs to be cleared is regulation. Amazon, Google and Walmart have all been lobbying for a designated altitude to be used for delivery drones above cities. The proposal sounds like something out of a science fiction novel, and it may be part of the solution in future, but it will take a long time. Currently drones are not prohibited within 9km (Can) or 5 miles (US) from an airport which is where the majority of customers live. Drone delivery is not a new concept. In remote regions of Africa experiments are underway to deliver live organs and medicine between villages. In rural Africa there is virtually nothing for the drone to hit, no conflicting traffic and so on. In areas like that drone delivery can already take place. Drone delivery services will be available in major cities in future but with today's technology and regulatory climate it is nothing more than a publicity stunt. Most of the military drones are not killing machines. A widely held misconception about drones is that the US military drones are all weaponized killing machines. Coverage in the press gravitates towards the very controversial remote killing machines that the military certainly does possess [18]. They have several models of weaponized drone, the main drone strike tool is the General Atomics MQ-9 Reaper. The Reaper is a bigger, more powerful version of the Predator with the addition of weapons payloads. They also have F-16 fighter jets converted to drones and unmanned bombers. The Tomahawk cruise missiles which were made famous in Desert Storm are also basically kamikaze drones.

VII. PRACTICAL IMPLICATION

The advance technologies as geo-ensure, highly capable machines which can have their geo-mapping and positions precisely tracked with other capabilities as collision avoidance which will make the traffic of drones safe but on the flip side the traffic density will be high in the automated drone/bot corridor. Although the regulations hold it back, for now, and just matter of time with the pressures from the community before they will release the usage for the want to be justified and secure usages. The industry is opening up the high-end hardware and the state of art usage with a readiness that will change the ecosystems and that is on the horizon in the coming years. In the next few years or so usage will undergo massive change. The vendors for software and the hardware area already looking at the variety of usages and window of opportunity that has to be kept in readiness for deployment from very small niche companies to major conglomerates also in defense activities. I anticipate a big rush as the regulations relax even a little with initial teething problems and after the confusion settles down a new monitored rational should set in. The bottom line is that we will have another line of AI where we will depend on mundane tasks. Do look up the different drones on sale in various stores from very cost effective to expensive ones for restricted use. Drone use for commercial purposes at its rise with Amazon announcing its intent of use of drones to deliver packages to customers. It is a business under transformational stance as Amazon is a delivery company and aggregator and this idea with consequences. There are incident where a recreational drone interfered with a forest fire fighting operations. And this is dangerous. A disturbing number of drones have been spotted at airports interfering with commercial air traffic [7] as well.

VIII. CONCLUSION & FUTURE SCOPE

Another perspective that crops up is that of ethics in the use of Drones. It is a strong debate on the intent with humanitarian concerns and on the other, it is the bottom line for a business [22]. The nuclear bomb was not understood until the world witnessed the devastation and distressful effects and had generations to pay for. It matters as to who has the power to use the technology and what are the reasons for deployment. Drones can be used for many such activities which can create the divide between those in power and those who are not and it will not be about perspectives or being right. Drones and its use will be pushed ahead are to happen but the use will rationalize only as good as the governance will be. There are several hurdles to get to the greater use of these flying bots [1, 22], as for delivery where you imagine that they will land at your doorstep precisely just like humans can perceive, drones cannot do a good job yet. The drones have to have a precise sense of location and understanding of where it needs to go without colliding with moving objects ("Sense and avoid") like humans and vehicles and even animals. This is an advanced feature of AI for "sense and avoids" needs to be driven to perfection, is not still fully functional, before it is ready to take off into the real-commercial applications.

The variations are many for "sense and avoid" while working under different conditions as day and night, in darkness and the other similar situations. The technology may have the best of transmission, very good cameras but there are limitations like magnetic flux that can jam the operation, battery life, hail & storms and static storms. Major challenges remain [10] in the specifications of similar drones that will be deployed for activities under government, enterprise use, and personal usage. This will lead to specific and niche adoptions with gradation in usage by regulation and checks, which will be another set of policing activity parallel to the present system.

The manufacturers with this insight have already segregated the anticipated use and features. The biggest impact will be with the differentiated services for the prices and autonomous flight take off features [13].

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