Drones and Privacy

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ABSTRACT

Drones, also referred to as UAV's (Unmanned Aerial Vehicle), are an aircraft without a human pilot. Drones have been used by various military organisations for over a decade, but in recent years drones a have been emerging more and more in commercial and recreational capacity. The paper is aimed at drone and UAV technology capabilities and how they could and are currently effecting privacy laws globally in comparison to those currently in the Rep. of Ireland. Being investigated is the collection, retention and purpose of which civilian's information is being gathered. The authors also discuss the laws preventing the development and evolution of drone technology in the US in comparison to the Rep. of Ireland.

Keywords: Data, Drones, Law, Military, Privacy, Security, UAV

1. INTRODUCTION

In today's society the monitoring of flights has never been more regulated, and it would be difficult to argue the reasons why because in 2013 global terrorism rose by 43% alone (Ackerman, 2014). With terrorism on the rise and the use of drones in society, drones could become prime targets for terrorists and criminals, not necessarily to use the devices to crash into densely populated areas, injuring and potentially killing people, but to harvest the information on the drones to aid criminals and terrorists in cyber/digital crimes that could range from theft of personal bank details to the loss of highly sensitive military recon footage. With the FAA in the U.S. reporting that by 2020 there could be as many as 30,000 drones in the sky in the U.S. alone, concerns about privacy, security and safety could be justified (Waterman, 2012). If these projections are to be believed and drones are set to become a part of our everyday society then laws must be ratified for the use and policing of these machines specifically in civilian zones were human safety must be paramount.

Companies like Google and Facebook started acquiring drone companies such as Titan Aerospace, an American based drone maker which specializes in high altitude long endurance flights, and Ascenta, a British based drone maker that also specializes in high altitude long endurance flights, in 2014 respectively, acquiring them in order to research develop drones that could potentially stay in the air for years without landing. These giants of the tech world are essentially internet companies, entirely dependent on we the consumer having access to the internet, which

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Figure 1. Phantom advanced and pro-650-80 (TechRadar, 2015)

is the answer to the question. The more people they have using their systems, the more money they generate, as of the 2nd financial quarter in 2014 90% of Google's generated revenue came from Google websites or Google Member websites (invester.google.com, 2014), these companies are exploring the possibility of using these aforementioned drone companies to provide internet to regions in the world that currently have little to no access to the web. This could potentially be a great service even if it is just to increase profits for their companies, but the protection and confidentiality of customer information must be a priority for these projects, with drones from Titan Aerospace potentially having flight times as long as 5 years then user information privacy and security must take priority over even performance (Winter, 2014).

The track record of drones being hacked doesn't inspire confidence with Professor Todd Humphreys and his colleagues at the Radio Navigation Lab at the University of Texas demonstrated to the U.S. Department of Homeland Security how they could hack a drone, owned by the University, using a "spoofing" technique making the drone mistake their commands for those of the GPS satellite. Todd Humphreys and his colleagues were working off a budget of $1000, which is a nominal fee for something which could potentially cause catastrophic damage (BBC News, 2012). This same technique was used in late 2011 when a CIA guided recon drone had been hacked by enemy forces whilst flying over enemy territory in Iran. An engineer tasked with uncovering the drones stealth and security secrets claimed "The GPS navigation is the weakest point," when referring to the security of the drone (Peterson, 2011). The drone was hacked and landed by enemy forces with it containing very sensitive information. The DHS has since dismissed these accusations and claimed that it was a technical fault in the drone that forced it to crash land in enemy territory. If the accusations are true this would portray commercial drones in a bad light if state of the art military drones can be hacked so easily. Friday 26th of September 2014 is the first time that a drone has been given clearance to be used in Europe in a commercial capacity, the goods delivery company DHL are using the drone to deliver medical supplies in Germany to an island that is only accessible by road (DHL, 2014).

The drone sector in Ireland is legislated by the Irish Aviation Authority, this authority is responsible for laws in terms of who, where and what people can fly planes, helicopters, drones, etc. in Ireland. The IAA regulations of drones state that drones cannot fly no higher than 150m

or 500m from the drone control station, thus limiting the real application of long range drones in Ireland. In 2013 the IAA had issued 13 permits for the legal use of drones in Ireland, in total in as little as a seven month period this number almost doubled to 22 permits as of July 2014 highlighting the fact that the drone technology is becoming more and more apart of Irish society (McMahon, 2014). Currently in Europe the policing of drones is done by the state that the drone is present, but the European Aviation Safety Authority is in the process of drafting and introducing pan-European legislation for the legislating of drone use with a weight greater than 150kg with anything lower continuing to be legislated by individual states (McMahon, 2014). Depending on the type of drone, some drones must be compliant to the Irish Data Protection Act because of their data collection capabilities which include photography, video recording, thermal imaging etc. Table 1 endeavours to articulate some of the characteristics of drone technologies which must be considered by law makers:

The aim of this paper is to examine and research to what extent the Irish DPA act provides the right to privacy of Irish citizens in relation to the increasing introduction of drone technology into society. The Irish laws in relation to privacy will be examined in comparison to those currently in the United States of America and the United Kingdom. As the drone/UAV market rapidly expands and develops, many countries laws are out dated in relation to adequately protecting people's privacy in relation to the capabilities of these machines. As technologies advance, drones will become more and more part of everyday life and as this becomes the case, laws need to be ratified to prevent Ireland from gaining a big brother like society like the United States of America for example.

2. COLLECTION OF DATA

In the United States of America the drone market has expanded greatly in a military and a commercial capacity. Law enforcement agencies nationwide utilize drone technology to aid them in the prevention of crime and the apprehension of criminals. In the US state of Maryland traffic drones are in use to scan the licence plate number on vehicles travelling the major routes in the state. The information collected by these drones is used in relation to the apprehending of criminals possibly involved in crimes such as grand theft auto, but as this technology is being used for the benefit of the state and crime prevention, this technology also infringes on the privacy of innocents using those same routes as suspected criminals. With figures estimated that every 1,000,000 licence plates scanned in Maryland by a traffic drone, on average only 47 vehicles out of that 1,000,000 are suspected to be related to criminal activity. That makes the percentage of the data related to crime collected by the Maryland Police Department using traffic drones at an extreme low of 0.0047%, and those figures are reinforced with stats from Rhinebeck New York of 0.01% and 0.08 from High Point from North Carolina (Cushing, 2013). These figures would make this technology difficult to legally implement in the Rep. of Ireland because of the DPA, the stats from the use of this technology prove it to be excessive and that would infringe upon the Data Protection Act 1988 (amended 2014) Section 2(1)(c)(iii), this law dictates that the data being collected is "adequate, relevant and not excessive". The excessiveness does not relate to the scanning alone, the storing of the data collected is the most excessive part of the process. By the Irish Data Protection Act Section 2(5)(b) a data subject must be informed what s/he is being monitored for what purpose but when drones hover above highways recording video, collecting licence plate numbers etc. that no prompt is given to the data subjects they are not made aware as would be the requirement.

Table 1. Different categories of drones on the basis of weight (European Parliament, 2015)

Uses	Type of operator	Targets, examples
Infrastructure protection, monitoring and safety / security inspections	Commercial State	Objects: - Transport (rail tracks, highways, bridges, traffic) - Energy (nuclear plants, dams, dykes, power grids, wind turbines, pipeline and power lines inspection) - Communications (mobile phone towers) - Industry (industrial installations) People: - monitoring unauthorised entry
Geo-spatial mapping	Commercial State	Objects: Mapping and surveying exploration, planning and crisis management
Environment monitoring	Commercial State	Objects: Air, water and other natural resources: pollution monitoring, hazardous material sensing, air/water quality testing, weather monitoring
Precision agriculture	Commercial Private individuals	Crop, animals: Crop and herd inspection, crop spraying to apply pesticides
Law enforcement, surveillance and monitoring of individuals and of people and of electronic communications	State (law enforcement) Commercial (sub-contractors)	Persons: Infrastructure protection against threats and illegal actions, targeted criminal investigation, crowd and public event monitoring, border control/protection, anti-social behaviour, supporting police response Geo-location, interception of communications and of electronic devices, profiling
Civil protection	State (law enforcement, civil protection authorities)	Objects, persons: Infrastructure monitoring, disaster relief and response, search and rescue, firefighting, hazard detection, crisis response
Regulatory enforcement	State (law enforcement, other authorities)	Pollution monitoring, fisheries monitoring, monitoring for illegal logging, wildlife protection and hunting regulations, etc
Journalism, media, film-makers	Journalists, camera-crews, film-makers	People and objects: Live journalistic reporting, investigative reporting, documentary filmmaking, promotional videos, fictional filmmaking
Electronic communications providers	Commercial (service providers)	Objects: Telecommunication and computing devices
Hobby, leisure	Private individuals	Objects and persons

2.1. Retention of Data

The Minnesota State Police Department delete the data collected within 48 hours of collection which is reasonable, but this is an exception. The majority of other agencies delete dates generally range from 90 days to 5 years. The most alarming fact wasn't the possible 5 yearlong delete date but the response from 3 Texas law enforcement agencies that they have no specified delete date, it could be presumed that the retention of the data gained from traffic drones in Texas is being stored indefinite (Cushing, 2013). This raises greater questions regarding all these agen-

Table 2. Drones civil uses, operators, targets and examples of use (European Parliament, 2015)

Type on the basis of weight (MTOM)	Current uses and future potential uses	Description; Types; Price and diffusion	Regulation
Small (0-20 / 25 KG)	- Leisure use and commercial use (surveillance and inspection, photography)	- drones below 2 kg are also called micro-drones and are quickly developing - hundreds of different types; normally multi-rotor or fixed wing aircrafts, guided by GPS, live video streaming camera, - Price: 140 - 28.000 Euro Some available in shops (below 1 kg) - Take-up: those below 2 kg are very widespread	- Falls under MSs regulations
Light (20/25 - 150KG)	- geospatial surveying, wide-area surveillance - Potential to inspect pipelines/power cables, spray crops, search and rescue, border surveillance; forest fire monitoring	- Typically longer range, fixed-wing, B-VLOS, reaches altitudes of 3000 meters - ex: Luna, Hermes 90 - Price: 55.000 - 420.000 Euro	- Falls under MSs regulations
Large (>150KG)	- used by the military and defence - Potential for future cargo (and passenger) transport	NATO classifications: - Class II (150-600 kg): Sperwer, Hermes 450, Watchkeeper; - Class III (>600 KG): MALE - medium altitude, long endurance: Predator, Heron, Hermes 900[6] HALE - high altitude, long endurance: Global Hawk UACVs - strike or combat UAVs: MQ9-Reaper/Predator B Price: 670.000 Euro and above	- Falls under Regulation 216/2008/EC (EASA Regulation): EASA airworthiness certificate, unless operated by a State agency

cies affiliation to the US-EU Safe Harbour Framework, with law enforcement agencies in the US subject to the Framework (Export.gov, 2014). In November 2013 the European Commission issued a press statement regarding its stance on the large scale U.S. intelligence agencies collection programmes that were being used to collect citizen's data without their knowledge, with the statement also stating that government agencies have been "*spying"* on U.S. citizens, companies and leaders. The Edward Snowden case was a factor in what prompted the European Commission's statement, with the revelations of that particular case seriously damaging the trust between the E.U. and the U.S. in relation to data protection (European Commission, 2013). This is an example that could only enforce the argument that the data being collected by traffic drones is being stored indefinitely. The indefinite retention of the data generated by these traffic drones breaks the US-EU Safe Harbour principle Notice, that all individuals must be notified about the purpose for which the data is being collected. With traffic drones flying anonymously in the skies above highways, the Notice section in the US-EU Safe Harbour Principles not being adhered too. With the data being collected by drones being possibly stored indefinitely then the continuous monitoring of certain routes by drones or UAV's and the continuous use of similar

Table 3. EASA Concept of Operations for Drones (European Parliament, 2015)

Categories of operations / Regulatory regime	1st category: Open	2nd category: Specific	3rd category: Certified
Safety risks and risk level? taking "into account: mid-air collision with manned aircraft[15]; harm to people; and damage to property in particular critical and sensitive infrastructure"	Lower risk (Minimal aviation regulatory system, defining limits for operations, to be overseen by the police, "as for cars for instance")[16]	Medium risk	Higher risk (similar to normal manned aviation)
Operation authorisation by a Civil Aviation Authority for the flight?	No (Even commercial operations)	Yes - operator to perform a safety risk assessment with mitigation measures, addressing the airworthiness, operating procedures and environment, competence of personnel and organisations, airspace issues - to be reviewed and approved by the CAA through an "Operations Authorisation", with the support of the Qualified Entities as defined in the EASA	Yes - for the moment, for drones of 150 kg or more, but in the future kinetic energy, type of operation and complexity of the drone (notably autonomy), should be examined/defined - Certification required: Type Certificate (environmental, airworthiness, noise), design and production approvals,

routes by citizens then this could be used to track the location and travel habits of people without their consent or knowledge. The purpose of these traffic drones is to monitor traffic from above and process the data gained to aid law enforcement agencies with the locating and apprehension of people who have stolen cars, who have not paid there tax etc. but the continuous collection and retention of innocent citizens details, with the majority of them not aware that it is happening, may be legal in the USA but it would break Irish Data Protection laws should it be the implemented in Ireland. The purpose of this technology is to apprehend criminals, that is its purpose, meaning the retention of innocents details would infringe on the Data Protection Act 1988 (amended 2014) Section 2(1)(c)(i) "*the data shall have been obtained only for one or more specified, explicit and legitimate purposes*", this would make the technology being used difficult to implement in Ireland, the adjustment would need to be made that the only details being stored are the ones who are being flagged as crime related.

2.2. Privatized Collection of Data

In the USA a company called Vigilant has been collecting and retaining licence plate details. The company sells the data collected to over 2,200 law enforcement agencies in the country. The company has a shared database with another company called Digital Recognition Network, in this database there is estimated to be over 1.8 billion civilian records (Segar, 2014), one of the company's biggest contracts is with the Department of Homeland Security, providing citizens data straight to US government forces. The collection and distribution of this data in Ireland would break Irish Data Protection Laws, Data Protection Act 1988 (amended 2014) Section 2(1)(c)(i),

prohibits the processing of citizens data without the without his or her consent. But in the U.S this is occurring on a daily basis mostly without the data subject having knowledge that they are being monitored. With companies like Vigilant and Digital Recognition Network having such a vast database of vehicle registrations and car owner details being collected in there thousands per day then the data being recorded and archived from months ago in fact becomes out dated. With figures estimated to be over 250 million used cars in the USA as of February 2014 and with approximately over 40 million of these cars titles being transferred that would make the data being stored by these companies out dated and in relation to this in Ireland it would break the Irish Data Protection Act Section 2(1)(b) that the data collected *"shall be accurate and, where necessary, kept up to date"*. The data could be run in conjunction with the US's DMV to keep track of car transactions and keep the data up to date and current but access to DMV databases are so restricted that law enforcement agency employees must sign contracts before they are allowed access so private company access could be difficult.

2.3. Anonymous Collection of Data

Drones are a useful tool in terms of being implemented in situations where a human's life would be at risk. But as people are identifiable by their own set of unique characteristics such as height, weight, ethnic origin, hair colour etc. Drones on the other hand are not as easy to identify. Without company markings and patented designs drones are notoriously hard to identify the user/operator of the drone. In France a spy drone was spotted flying in a restricted fly zone, the no fly zone contained a nuclear power plant. Originally the drones appearing in the area where originally dismissed as drone enthusiasts in the area who had simply strayed into a restricted zone by accident and without any malice intent but as time as passed it became apparent that these drones where not being controlled by simple drone enthusiasts but people with an agenda with over 13 confirmed drone sightings by Electricite de France SA, which runs the nuclear power grid in France, around French nuclear power stations and over 30 unconfirmed over a 2 months period beginning in October (Patel, 2014). Since the revelation of these drones have been spotted the media has been speculating to what purpose are these drones being used, with some media outlets speculating but none have any foundation. France is the most nuclear power dependant developed country in the world with nuclear power providing over 80% of the countries power (Lichfield, 2014). Greenpeace has voiced its opinions that the French government is trying to play down the risk of these events, even speculating that the drones could be implemented to perform acts of terrorism, stating "*A medium-sized drone could carry an explosive charge big enough to damage the pools [of cold water] in which spent nuclear fuels are stocked*" a spokesman said (Lichfield, 2014). Regardless of who or what these drones are being used for they appear to be collecting data for some purpose without permission, a drone being used in this capacity in Ireland would infringe upon the Irish DPA Section 2 (a)(1)(a) and Section 2 (a)(1)(c)(iii). The example above is excessive but proves that the collection of data, video footage, photograph etc. by people implementing drone technology is extremely hard to prevent. Numerous drones have been flying around highly policed nuclear power plants in France but little can be done to prevent it, the plants have technology to detect UAV's in the plants airspace but beyond that there is little to nothing that law enforcement agencies can do without catching the pilots of the drones, which in the case of the drone power plant controversy has proofed difficult with three arrests made and zero convictions (Farivar, 2014).

2.4. Limitations

In terms of limitations to the research into how drone technology could potentially infringe on the Irish Data Protection Act there are many, globally drones are being implemented daily by companies and governments but outside of those organizations the exposure to what is being collected or generated by drone technology is very limited. If companies or governments are using drones in an unlawful or unconstitutional manner then these companies are not going to make the applications of these machines public knowledge in order to protect the interests, reputation and standing of an organization. These drones have the capabilities to collecting data from car speeds to human biometric data, but without the actual drone or control centre people have no way of knowing what is being collected.

Another limitation is that once the data has been collected that the user has no idea what is being there data is being used for ranging from the data being used to prevent crime to selling the data to companies to target people with advertising campaigns. The possibilities of what people's personal information and data is almost endless, but with the use of drone technology this data which can be so valuable can also be so accessed with such ease and anonymously. In terms of limitations of drone technology in Ireland, drones are still an emerging technology in Ireland. The drone sector is growing but in comparison to countries like the UK where as of October 2014 there was 359 drone permits issued up to that date (Quinn, 2014), when compared to the 22 that had been issued in Ireland as of July 2014, Ireland is lagging behind in terms of the use of drones with UK law enforcement agencies implementing drones and drones also being used more frequently in a recreational capacity. The population difference between the two countries has a factor but it also must be considered that in the UK drones are being used to their full potential of the technology using them in the police while in Ireland they are being implemented to make films and for enthusiasts flying them in a field. The industry in Ireland will grow, it will grow globally according to aerospace and defence research company Teal Group Corp. that the drone industry will become an $87 billion industry by 2023 (Chow, 2014) but currently Ireland which is regarded as the silicon valley of Europe, is lagging behind in one of the most emerging technologies in the world currently (Weckler, 2014).

As the field of drone technology continues to expand so does the accessibility and availability of drones. Drones can be purchased for as little as £25 making them affordable to the vast majority of the population. The majority of adults in the Rep. of Ireland could afford to purchase the £25 drone, a drone can be next day delivered to a customer's door. Such accessibility raises concerns in regards to that anyone can, using the proper drone, collect information on another person of their choosing at their will, they can do it anonymously without the person even being aware that they are being monitored. As companies can be audited and are by law supposed to adhere to Irish DPA laws they are bound and restricted to what they can do, collect, use and keep because there drone usage must be documented but with civilians having the access to the same technology and not being monitored under the same scope as companies it exposes a frightening fact that someone could spy on another person without their knowledge. People are subject to the Irish Data Protection Act the same as companies and governments but individuals are a lot more difficult to police. An example of this would be the drones spotted around the French nuclear power stations. The identity of the controller of these drones as of December 2014, almost 3 months from when they were first spotted, is still unknown as is for what purpose these drones being used at those plants. The data gained from these drones is an example of the one of the biggest limitations to drone technology and that is transparency. With independent people implementing drone technology creates the massive problem of people's personal data being collected without people's knowledge and without rules or laws being enforced because the law enforcement doesn't know who it may need to be enforce.

2.5. Privacy and Security

"It is now established by case law that the personal rights of the citizen guaranteed by Article 40.3.1{o} of the Constitution include a right of privacy" (Lawreform.ie, 1996). The right to privacy is a civic right which is applicable to all citizens. In the USA, the supreme court has made various rulings promoting the right to human privacy, an example is the recent ruling that cell phones cannot be searched without a warrant (Liptak, 2014), all enforcing the right to human privacy. But as the US Supreme Court ruled to promote human privacy another bill that was filed was not even given a committee hearing, that bill was drafted by Senator Jim Tomes, a Republican from Wadesville, Indiana. The bill was aimed at making it illegal to use a drone covertly. By not even hearing the proposal for this bill the US government are maintaining their ability to survey citizens without their knowledge. Whether the government is watching citizens or not there want to have the ability to do so is a great cause for alarm, it is a great invasion of personal privacy. The advancement in commercial drones has been rapid with companies like the aforementioned DHL putting their new delivery drones into practice, companies in the US have had the door firmly shut with the banning of drone use for commercial purposes in 2007. The U.S. government are doing some back tracking now with new legislation on the use of commercial drones in the U.S. with them being possibly granted legality as early as September 2015 (IBNLive, 2013). Amazon, like DHL, have been developing their own delivery drones, with Amazon talking about the ability to have delivered orders to customers within 30 minutes after purchase according to Amazon CEO Jeff Bezos (IBNLive, 2013). This would effectively change the world of retail shopping for good, but will face its own problems also. The U.S. is notorious for it's no fly zones (Mapbox, 2014), for example in Washington D.C. a large portions of the city are no fly zones, how could a company like Amazon operate or deliver to customers via drones who happen to live in these areas. There seems to be a lot hurdles for commercial drones before they can be made legal in the U.S. and there will have to be a lot legislation and laws for the use of these drones, there will be a lot of work to be done before they are legalized by the estimated time frame of September 2015. These drones being used for surveillance in a commercial capacity could become the next phone hacking scandal, these drones used for media purposes has limitless possibilities whether it be monitoring the situation in a war zone or stalking a celebrity, with the latter being very intrusive and potentially infringing on a person right to privacy. With drones likely to be put into commercial and more so in military use, all uses seem to infringe on all definitions of privacy whether that is with proper reasoning or justification and without.

3. THE FUTURE

Drones are here to stay in our society and are only going to become more involved with some countries around the world currently writing laws to legitimize the use of drones in society for example the aforementioned U.S expects legislation in place for September 2015 (IBNLive, 2013). According to British security technology company BAE Systems, drones may soon become invisible. BAE's project 'Taranis' is the development of a drone, which has been described as a 'Smart Multitasking Drone' that cannot be seen or tracked by radar thus making it invisible. Another feature of the drone being developed by the is the ability to develop its own flight patterns with the only human input being the destination, the drone then determines the how the drone flies, like speeds, routes and altitudes (BBC News, 2014). BAE has also made its concept of potential drone with a 3D printer in the drone. The 3D printer would be capable of producing parts, equipment and even mini drones as needed whilst on missions, the company predicts the

first time we may see this drone could be the 2040's (BBC News, 2014). Drones enable war to be fought with minimal risk to your countries soldiers by putting drones rather than soldiers in the danger zones, the US government has predicted that by 2030 that 1 in 4 combat soldiers for the US military will be drones/robotic soldiers (Atherton, 2014). According to aerospace and defence research company Teal Group Corp. that the drone industry will become an $87 billion industry by 2023 (Chow, 2014).

The following is a partial list of U.S. companies that have received venture funding (McNeil, 2014):

- Airware - $40.4 M
- 3D Robotics - $35M
- Skycatch - $19.7M
- Crescent Unmanned Systems $250,000

The following is a partial list of U.S. companies that have received crowd-funding (McNeil, 2014):

- Flexbot - $500,000 with 4,670 funders
- Airdroids - $929,212 in pledged money
- PowerUp - $1.23M

Drones are currently being developed to help people in disaster zones, Harvard-MIT Division of Health Sciences has recently been awarded a $100,000 grant for its drone development project that will be capable of delivering vaccines and other critical medical supplies (Chow, 2014). Around 60% of the world currently does not have access to the internet (Internetlivestats.com, 2014). As mentioned before Google and Facebook are currently developing drones to deliver internet access to those who currently have not. Inaccessible terrain and underdeveloped technological infrastructure are some of the problems that these drone projects being developed by these companies, these Google and Facebook projects could potentially solve the internet access problem on a global scale (DeBord, 2014). Another application of drones is in archaeology, in April 2014 a group of archaeologists in New Mexico, USA, used a drone equipped with a thermal image camera to monitor a site from above. The drone images produced enabled the archaeologists to view a thermal image of the desert floor and in turn revealing never-before-seen structures in an ancient Native American settlement (Gannon, 2014). Drones have been in use in the field of agriculture for over 20 years now in Japan for seeding and crop dusting, but with further advancements drones they are expected to be used to monitor livestock like cattle and sheep for example and crops, detect deficiencies and diseases, determine plant ripeness and schedule harvesting. They can also spread poisoned bait for vermin which may be interfering with or harming crops, such as fire ants, mice and rats with minimal environmental impact as well as little crop disturbance (Szondy, 2013). Drones could even be in line to replace waiters, Japanese food chain Yo Sushi have begun tests on their quad-copter drone. The drone simply flies from kitchen to table delivering customers' orders, they have dubbed the quad-copter the "iTray". Yo Sushi is currently testing its drone in its Soho location in London but plans to apply the iTray to all its restaurants by the end of next year (Fincher, 2014).

Ireland's future in drone technology development is estimated to be a country at the head of the technology. Ireland, in comparison to the stringent drone laws in the US, has relatively relaxed laws in regards to the policing of the use of drones and this is one reason why entrepre-

neurs in drone technology are targeting and setting up drone companies in Ireland. Jay Bergman, a co-founder of the taxi ordering app company Hailo, stepped down in September 2014 from the taxi company and has since started a company called Cara which will develop and test drone technology (Weckler, 2014). Bergman was an integral part of a meeting in November with representatives of law firm Mason, Hayes and Curran, former junior minister Ciaran Cannon, the manager of the IAA and representatives from the IDA and more, the agenda of the meeting was "*to make Ireland the drone capital of Europe"* (Weckler, 2014). Taoiseach Enda Kenny has enlisted expert in drone technology including Bergman to prepare a template that could be used to inform new legislation for the policing of drone's in the future in Ireland whilst making Ireland an attractive location for drone companies. The key for Ireland according to strategists is to gain first-mover advantage in making Ireland attractive to companies with drone projects (Weckler, 2014). Plans to make Ireland attractive to drone technology companies are at such an advanced stage that County Mayo in the West of Ireland has been earmarked as one possible area for test sites for drone companies while another possible location is Galway Airport (Weckler, 2014). A recent commission study predicted that in the next 2 and a half years that industrial development in drones will reach 14 billion and this in turn will create 70,000 jobs, this is why the Enda Kenny and the Irish Government are trying to make Ireland the most attractive place for drone companies to invest this 14 billion and take advantage of the vast amounts of IT qualified people in the country (Weckler, 2014). The government's eagerness to capitalise on the lack of freedom in competitor countries when it comes to drone development has both positive and negative aspects. One such positive is the possible creation of thousands of new jobs but one aspect that may be being over looked is that with the lax attitude being taken to the development of drones in Ireland that citizens privacy may be being compromised to enable the creation of jobs and the enhancement of the already strong IT sector currently in Ireland.

In terms of further work on the protection of citizen's privacy in the United States, the US Government are currently drafting laws to legislate the use of drones in the US. these laws are scheduled to be complete and proposed by September 2015 but there are some reports indicating that the draft of these laws are behind schedules and will not meet the set date of September 2015 with news reports suggesting that the laws may slip from the mandate deadline until 2017 or even later because of the agency also faces significant technological, regulatory, and management challenges and these problems are inhibiting the progression of the proposed bill (O'Kane, 2014). Currently companies waiting for these laws to be ratified are growing frustrated with the slow progress as the bill was originally put into motion in 2012 (O'Kane, 2014). Global tech giant Amazon has in December threatened to move its drone development research abroad because of the current restrictions, the company is already testing delivery drones in Cambridge, England because of even test flights of drones are illegal in the US (Vincent, 2014).

5. CONCLUSION

In conclusion all evidence points to the fact that drones are only going to become more and more part of everyday life as we know it (Market Research Media, 2013), in order for these machines to be successfully integrated into our society, the transition must be gradual and well marshalled, with laws yet to be drawn up yet. Drones have many strong points and improve many fields of profession, whether that be archaeology, agriculture, retail etc. the possibilities are endless for the progression of drones in society. But the advancements of drones also has its negative effects with drones potentially doing the work that humans have been previously used to perform these tasks, then you also have the moral dilemmas of drones being used by the military for the

assassination of terrorists. Also with drones possibly taking peoples jobs for cost and reliability reasons, drones may potentially be portrayed in a negative light but drones will work alongside people taking people out of harm's way whether that be in a military sense or a rescue sense. Drones doing the jobs we should not have to do, can only help society and lower job risks. As drones evolve and become an everyday part of our lives, drones will eventually greatly benefit the way we live and enhance our quality of life.

Technology never stands still, if you buy a laptop today in five years' time the odds are that the laptop's hardware and software would be out dated in comparison to the present times standards. Like technology the drone industry is and will continue to advance as it has done in the past. The drone industry has advanced in the past from military machine to commercial aid demonstrates the range of uses drones have and this expected to continue with drones now even being used to aid in the selling of homes and property in Canada (CBC News, 2014).

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