National College of Ireland

Requirements Specification Document

HelpCopter

drone volunteer services

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13/05/2018

Declaration Cover Sheet for Project Submission

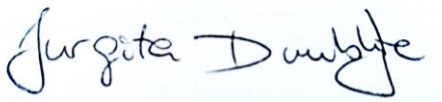
SECTION 1 *Student to complete*

Name: **Jurgita Dumblyte**
Student ID: **14110644**
Supervisor: **Patrick Delaney**

SECTION 2 Confirmation of Authorship

The acceptance of your work is subject to your signature on the following declaration:

I confirm that I have read the College statement on plagiarism (summarised overleaf and printed in full in the Student Handbook) and that the work I have submitted for assessment is entirely my own work.

Signature: 

Date: 13-05-2018

NB. If it is suspected that your assignment contains the work of others falsely represented as your own, it will be referred to the College's Disciplinary Committee. Should the Committee be satisfied that plagiarism has occurred this is likely to lead to your failing the module and possibly to your being suspended or expelled from college.

Complete the sections above and attach it to the front of one of the copies of your assignment.

What constitutes plagiarism or cheating?

The following is extracted from the college's formal statement on plagiarism as quoted in the Student Handbooks. References to "assignments" should be taken to include any piece of work submitted for assessment.

Paraphrasing refers to taking the ideas, words or work of another, putting it into your own words and crediting the source. This is acceptable academic practice provided you ensure that credit is given to the author. Plagiarism refers to copying the ideas and work of another and misrepresenting it as your own. This is completely unacceptable and is prohibited in all academic institutions. It is a serious offence and may result in a fail grade and/or disciplinary action. All sources that you use in your writing must be acknowledged and included in the reference or bibliography section. If a particular piece of writing proves difficult to paraphrase, or you want to include it in its original form, it must be enclosed in quotation marks and credit given to the author.

When referring to the work of another author within the text of your project you must give the author's surname and the date the work was published. Full details for each source must then be given in the bibliography at the end of the project.

Penalties for Plagiarism

If it is suspected that your assignment contains the work of others falsely represented as your own, it will be referred to the college's Disciplinary Committee. Where the Disciplinary Committee makes a finding that there has been plagiarism, the Disciplinary Committee may recommend:

- that a student's marks shall be reduced
- that the student be deemed not to have passed the assignment
- that other forms of assessment undertaken in that academic year by the same student be declared void
- that other examinations sat by the same student at the same sitting be declared void

Further penalties are also possible including:

- suspending a student college for a specified time,
- expelling a student from college,
- prohibiting a student from sitting any examination or assessment.,
- the imposition of a fine and
- the requirement that a student to attend additional or other lectures or courses or undertake additional academic work.

Contents

Section 1 – Executive Summary

Definitions and Abbreviations

CASA – Civil Aviation Safety Authority (Australia)

EASA – European Aviation Safety Agency

FAA – Federal Aviation Administration (USA)

FPV – First Person View (Video Piloting)

IAA – Irish Aviation Authority

NOTAM – Notice to Airmen: a notice issued by Aviation Authority with an aim to warn aircraft pilots and drone flyers about potential hazards and no-fly zones (appendix 1).

PCC – Pilot Competence Certificate

RPAS – Remotely Piloted Aircraft Systems

Quadcopter – remotely controlled aircraft (drone) with four identical propellers

SAR – Search and Rescue

SOP – Specific Operating Permission, issued by The Irish Aviation Authority to an organization that wishes to operate SUA or drone to less restrictive limits than those described in The Irish Aviation Authority Small Unmanned Aircraft and Rockets Order (IAA, 2016).

UAV – Unmanned Aerial Vehicle

UAS – Unmanned Aircraft Systems

1.1. Introduction

I got the project idea during the author's Business Analyst internship in a Dublin-based drone marketplace Skytango, a small start-up that connects commercial drone operators (aerial photographers and video-makers) with aerial content buyers. I felt that there is

much more to drones than exploring landscapes from 400 feet above the ground for recreational or commercial use.

Drone industry, although fast growing, is still an emerging market. Regulatory frameworks in most countries across the world are still in different development stages, with FAA regulations in United States being the most advanced to date.

I became extremely interested in innovative companies that invest their talent, creativity and resources into developing drones with a higher purpose: making the work across the different industries (agriculture, mining, mapping, etc) easier, and ultimately, saving lives.

Drones can provide network connectivity in disaster areas, observe the damage done by the chemical spill, look for survivors after the natural disasters or terror attacks, use the thermal imaging cameras in search and rescue operations, detect and detonate landmines (Dumblyte, 2017), assist firefighters by locating people in a building on fire.

That was when the HelpCopter idea was born. HelpCopter is a digital platform, dedicated to assist first response teams in their emergency missions by providing timely and reliable help from above,- connecting them with qualified, licensed and responsible drone pilots. It consists of a website and a mobile app, available on both IOS and Android operating systems. First response teams will be able to use interactive map to see which volunteers are available and in what proximity they currently are from the particular area where the assistance is required. HelpCopter is a global platform, therefore registered volunteers that are travelling to different countries during their holidays, might be called for help by local first response teams, unless they choose to change their privacy settings accordingly (possible variations: “Available 24/7”, “Unavailable dd/mm to dd/mm”, etc).

The very idea of drone volunteer services is not completely novel. However, analysis and evaluation of companies already providing these services shows the lack of emphasis in providing a reliable and professional service, allowing this initial noble idea to become rather a hobbyist activity,- unqualified, undocumented, unreliable, and quite possibly dangerous.

Prior to commencing work on this project, I have received Small Unmanned Aircraft Systems certificate for completing a beginners SUAS course at Embry-Riddle Aeronautical University, and kept my knowledge about drone technology up to date by following leading drone manufacturing companies, attending commercial drone events and communicating with drone subject matter experts. All of this greatly assisted me at gaining a better insight to the possible opportunities and pitfalls in such project’s realization.

Figure 1.: Embry-Riddle Aeronautical University SUAS certificate

1.2. Business Need

Time-efficiency and capability to accurately evaluate the situation are crucial success factors in emergency operations, be it assessing landslides and flood damage, terrorist attacks, or trying to locate missing people.

HelpCopter drone volunteer services will assist rescue and first response teams to overcome practical difficulties during their emergency operations, in terms of significant time saving, increased operation effectiveness due to broad spectrum of beneficial features implemented in unmanned aerial systems. enabling to locate stranded victims, assess the emergency area without risking first-responders' safety, observe large crowds and areas that are manually difficult/ dangerous to access.

HelpCopter provides more than just an eye in the sky: volunteering drone pilots are experienced, certified UAV operators, complying with regulations, knowing the rules and constraints (regulatory, environmental, etc.), capabilities and limitations of their UAVs.

1.3. Scope

According to EASA, drone operations can be separated into three categories:

- ✓ Open (ones that does not carry risk and thus does not require prior authorisation from regulatory authorities);
- ✓ Specific (unmanned aerial vehicle falls into a weight category that must be registered with the aviation authority, operator must be a holder of light UAS operator certificate (in Ireland – standard licence for a drone weighting 1kg or over);
- ✓ Certified: to ensure a sufficient level of safety, drone operator must be a holder of Pilot Competency Certificate or Specific Operating Permission (EASA, 2014).

This project is concerned with operations falling under the "Certified" operation category due to the risk involved and experience required.

For the first year, Helpcopter will focus exclusively on Republic of Ireland for two reasons: the initiative will have to be refined to suit the local market and tested in local environments to prove itself sufficiently effective and efficient; also, currently different drone regulations in each state of European Union makes it rather complex as there is no general standards and licences that would be recognized in all countries. The relationships with authorities of each county will have to be established. Few levels of iterations will be developed, getting users' feedback after each one, this way enhancing the system in terms of functionality, security and usability.

Jay Bregman – founder of Hailo and newly launched drone technology company CARA, sees Ireland as a future Europe capital of drones. According to Bregman, "Ireland is (...) aggressively focused on making these technologies prosper" (Weckler, 2014). He closely collaborates with Irish government, legislative bodies and aeronautical executives to make it happen. For HelpCopter it means an opportunity to have better educated, responsible and compliant drone operators.

The timeframe for establishing HelpCopter initiative in the Republic of Ireland is one year. Given that the EU drone regulations under European Aviation Safety Agency (EASA), that are now in development stage and are due to be released in fall of 2018, come to the effect meeting the deadlines, the goal at the end of the first year is to extend HelpCopter services across the Europe. When initiative proves itself successful, United States market

to be included for the reasons like high interest level in RPAS and advanced development level of drone flying regulations and governance.

HelpCopter partners Dublin-based software development company Stack Shuttle will be responsible for technical development and maintenance of the systems.

Administrative and coordinating body for HelpCopter initiative will be drone software development company for search and rescue operations DroneSAR. The founders of the DroneSAR are also the owners of a well-known Irish drone flying academy FlyRyte. They are Specific Operating Permission (SOP) holders, thus making them an ideal choice for rigorously following compliance and managing HelpCopter system. SOP enables holders to fly their aerial vehicles where the ordinary commercial licence holders would not be allowed, and is issued to the company rather than an individual, and is granted only to the most competent pilots, their knowledge and competency level is being assessed at regular intervals by Irish Aviation Authority approved examiners.

External funding is expected from Enterprise Ireland and private sector companies.

1.3.1. Project Charter

Project Charter is ultimately a statement of goals and objectives, participating people, and the scope of the undertaken project. In other words, a roadmap for all involved people throughout the project lifecycle. This is one of the most important documents in the project, typically developed during project planning. While there is no strict rules that have to be followed creating a project charter, and its template is usually subject to a requirements of a particular initiative, some good practice guidelines of what could or should be included in a project charter, are outlined below:

- ✓ Business Need: everyone involved in the undertaken project has to understand why they are doing it.
- ✓ Project Objectives: the goal of the undertaken project must be clear to all project team members.
- ✓ Scope: all deliverables that are in scope and out of scope. It is imperative to create the scope baseline at this stage, as the further progress will be measured against it. The boundaries of the project must be clear and understood.
- ✓ Stakeholders: all key stakeholders have to be identified in order to enable a better stakeholder management and collaboration throughout the project; authoritative bodies of the project have to be identified as project manager will have to report project development progress to them.

- ✓ Roles and responsibilities: outlined responsibilities of everyone involved in project delivery. Brief definitions can be added after each record.
- ✓ Potential risks and benefits: Risks have to be evaluated and list of proposed strategies created along with the impact of those strategies on the risks that might arise. Project benefits, ideally, should also be briefly outlined in the project charter.
- ✓ Milestones: milestones outlined in the project charter with due-dates and actual dates help to stay on track. Alternatively, for visible representation of tasks to be done, tasks in progress, and tasks that are finished project team can use Kanban boards, or project time management software Trello.
- ✓ Financial: it is important to know financial resources for the project and who has an authority to manage that budget (Ray, 2017).

PROJECT CHARTER

Project title: HelpCopter – Drone Volunteer Emergency Services	**Project manager:** Jurgita Dumblyte
Project start date: 01-10-2017 Project end date: 30-05-2018	**Project supervisor:** Patrick Delaney

BUSINESS NEED

Time-efficiency and capability to accurately evaluate the situation are crucial success factors in emergency operations, be it assessing landslides and flood damage, terrorist attacks, or trying to locate missing people.
HelpCopter drone volunteer services will assist rescue and first response teams to overcome practical difficulties during their emergency operations, in terms of significant time saving, increased operation effectiveness due to broad spectrum of beneficial features implemented in unmanned aerial systems. enabling to locate stranded victims, assess the emergency area without risking first-responders' safety, observe large crowds and areas that are manually difficult/ dangerous to access.

PROJECT GOAL

Project objective is to create a comprehensive project requirements document.

Business Scope: To leverage the effectiveness of first-response teams' work in emergency operations by utilizing innovative drone technology.	**Project Financials:** ✓ All projects needs for the timeframe October 2017 to May 2018 are covered by Project Manager. ✓ Actual application development budget to be established as soon as the opportunity for a practical project realization arises.

In Scope:	**Out of Scope:**	**Project Team:**
Requirements Specification Document; Project Poster; WordPress Website	Application Development	Project Manager, Business Analyst, Technical Lead - - - - - - - - - - - **Approval Committee:** Project Sponsor, Finance Manager, Business Division Head

Milestones:	**Target Date:**	**Actual Date:**	**Current Status:**
Options Considerations	01-10-2017	01-10-2017	
Project Pitch	05-10-2017	05-10-2017	
Supervisor Consultation	Throughout the project		
Brainstorming completed	20-11-2017	20-11-2017	

Initial requirements specification	24-11-2017	24-11-2017	
Survey completed	21-12-2017	20-12-2017	
WordPress training	14-02-2018	14-02-2017	
Interviews completed	20-03-2018	20-03-2018	
Survey results evaluated	27-03-2018	26-03-2018	
Interview results evaluated	29-03-2018	29-03-2018	
Requirements elicited	10-05-2018	10-05-2018	
Literature Review completed	12-05-2018	11-05-2018	
Project poster printed	16-05-2018	xx-xx-xxxx	
Closing activities (Showcase)	30-05-2018	xx-xx-xxxx	
	Completed	On Schedule	t Risk nding

Project Constrains:

Time: any factors that have or can have a negative effect on a project's timeframe.
Scope: project management approach, awareness of Scope Creep possibility, stakeholders' requirements change approval guidelines.
Cost: restriction of financial resources, affecting the quality or timeframe of final deliverables/ product.

PROJECT RESOURCES AND RISKS

Internal Resources:
Research and development
IEEE Guidelines

External Services:
DroneSAR software for search and rescue
First response training
SOP Training
Software development

Project Risks:

Establishing partnerships	**medium**/ ~~high~~
Project Timeframe	**medium**/ ~~high~~
Scope Creep	**medium**/ ~~high~~
Legal/ regulatory constraints	**medium**/ ~~high~~

1.4. SWOT Analysis

SWOT analysis consolidates the key issues in organization's internal (strengths, weaknesses) and external (opportunities, threats) environments, helping to evaluate current situations and develop strategies for the future improvements (Cadle, Paul and Turner 2014).

STRENGTHS	OPPORTUNITIES
• Only qualified, licenced and insured drone pilots • Worldwide network • Track record of volunteers • Volunteer training provided by partners • Mobile application • Interactive map • Timely response • Growing industry	• Possibility to incentivize best / most active volunteers with a monetary reward and an official acknowledgement from the local government • Expanding the range of different purpose drones available • Broad range of first response operations • Possible future business opportunities collaborating with private sector firms
WEAKNESSES	**THREATS**
• Unregulated industry • Unpaid work • Coordinatory hub • Funding • Lack of training • Expensive equipment and insurance • System maintenance costs	• Network security • Personal data protection • Unreliable volunteers • Issues in software system

Figure 2: SWOT analysis

1.5. Business Opportunities

While HelpCopter aims to reward the best and most active volunteers at the end of each year with monetary prizes from our sponsors, as well as boost their social media exposure via our media partners' channels, it is also feasible to take this initiative to the next level by encouraging private sector companies to use our reliable and professional drone pilot services for their short term needs, this way allowing us to reward our hard working pilots with recommendations for well-paid half/full-day jobs in various industries.

For instance, in agriculture industry drones with multispectral sensors can help farmers to assess soil and crop health, spot various infections in plants, and spray fertilizers only the specific areas that need extra help, this way saving resources, time, and reducing negative impact to the environment. PwC estimates that market for drone-powered solutions in agriculture industry alone exceeds $32 billion (Mazur, 2016).

Drone use for good does not stop here, but extends to construction, aerial survey, weather forecasting, law enforcement and many other areas, with new innovative ideas being realized into technologies.

1.6. Research

1.6.1. Stakeholders

There is a rather broad array of interested or to a different degree involved parties in HelpCopter project. Stakeholders, currently identified but not limited, are following:

- Drone pilots
- Business Analyst (author of this paper)
- IT team
- Data protection officer
- Project manager
- Coordinator hub administration
- Partners
- Government
- Local police forces
- First response teams: firefighters, search and rescue teams, etc
- Sponsors

- Local aviation authorities (IAA in Ireland, FAA in United States, CASA in Australia, etc.)
- Domain SME (subject matter experts)
- Implementation SME

All key stakeholders, listed above, can be categorized taking into consideration their level of power and influence, which helps us in making an effective communication plan for interaction with specific stakeholders throughout the project. To better assess stakeholders' roles and responsibilities in relation to specific business processes or tasks, Cadle, Paul and Turner (Cadle et al., 2014) advise using the RACI/ RASCI matrix, as outlined in figure3.:

	Document reqs.	Plan Stage	Communicate	Conduct req. elic.	Approve change	Implement	Document outcome
Drone pilots	**C**						**I**
Business Analyst	**R**	**I**	**R**	**A/R**	**R**	**C**	**R**
Technical lead			**C/I**		**C/I**	**R**	**R/I**
Data protection officer	**C**		**R/C**				**I**
Project manager		**A/R**	**A**	**A**	**A/R**	**A**	**I**
Coordinator hub			**C**	**C**		**A/R**	**I**
Partners	**C**		**C**				**I**
Government			**A/C**		**A**		**I**
Local police forces	**C**		**A/C**		**A/C**		**I**
First response teams			**C**		**C**		**I**
Sponsors	**A**		**C**		**A**		**I**
Local aviation authorities	**C**				**A**		**I**
DBA	**C**		**C/I**			**R**	**I**

Figure 3.: RACI Matrix

A specific letter is assigned to a corresponding stakeholder, identifying their relationship with a business process or task in question:

R (Responsible): identifies people directly responsible for completion of a task.
A (Accountable): key influencers the project. Often - authoritative bodies and/ or governing bodies.
C (Consulted): experts in specific field, that project manager consults with to achieve a better project outcome.
I (Informed): everyone that do not have responsibility for any part of the project, but must be kept up to date with the project progress and informed about the final outcome.

1.6.2. Competitors

S.W.A.R.M. Search with Aerial RC Multirotor

Based in United States, S.W.A.R.M. aerial search and rescue network has over one thousand volunteers (SAR Drones, 2017). However, not only professional drone pilots, but also hobbyists are able to apply, and over a half of volunteers rely on FPV (First Person View) unmanned aerial vehicles, which are small, have only up to 20 minutes of battery life, and are primarily designed for new and quickly gaining popularity sport - drone racing.

S.W.A.R.M. does not have a mobile application for their network, either, and this can be considered as a serious downside in regards to timely access to the system, and timely response.
The list of volunteer names and their hometowns is available to public.

Air Bears

Another company based in United States, with primary focus on training and equipment lease.
Supported by Amazon, where online shoppers can choose them as their favourite charity and donate a part of their purchase price towards Air Bears' mission.

Claiming to be an "elite community of volunteers" (Air Bears, 2016), Air Bears, however, do accept people as young as sixteen. There is no requirement to have an Unmanned Aerial Vehicle license or insurance in company's online application form, but there is a request to state the T-Shirt size, as illustrated in an image below. Volunteer drone pilots have to pay registration fee.

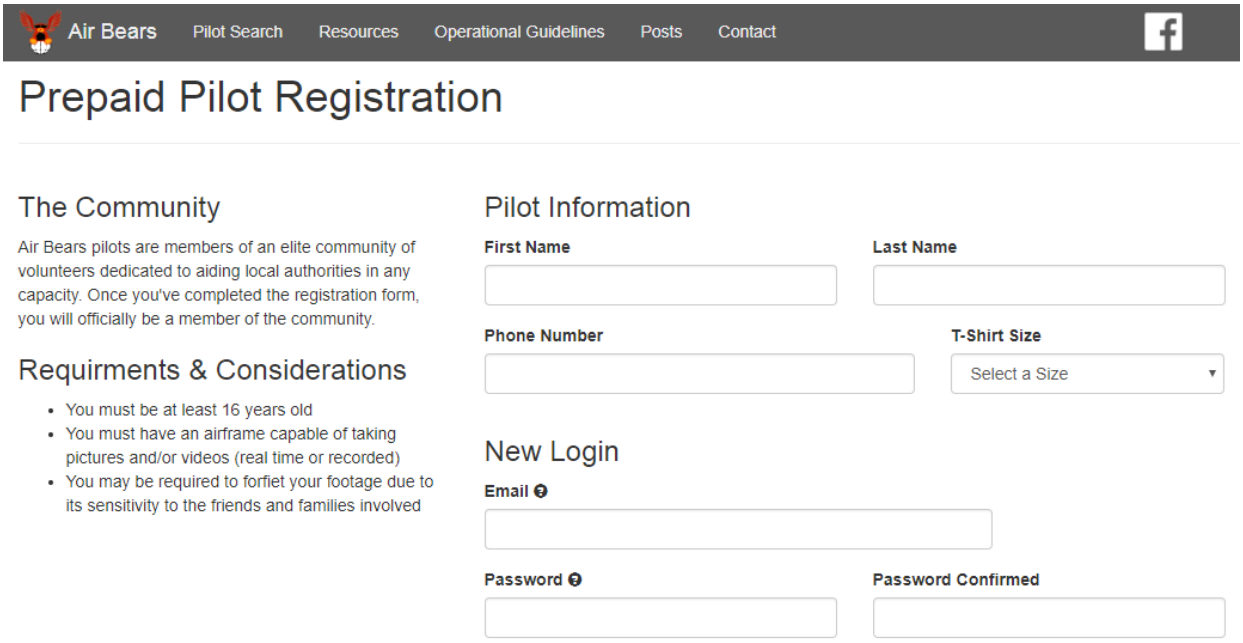


Figure 4.: Air Bears registration page (Air Bears, 2016)

1.6.3. Partners

Networking and collaboration help companies grow stronger. HelpCopter is starting off on the right foot by using existing connections to develop a robust, adaptive and sustainable digital ecosystem with a strong sense of social responsibility.

FlyRyte Drone Academy

FlyRyte Drone Academy is the first drone flying school in Ireland, founded by two former Irish Air Corps pilots Gearóid O'Briain and Oisín McGrath.

FlyRyte Drone Academy is an anticipated partner of HelpCopter, responsible for the drone pilots training regarding first response and emergency situation coaching.

Training is to be provided either online, or in FlyRyte Academy's facilities. Training course length and place is subject to further negotiations.

This partnership is expected to be mutually beneficial, as FlyRyte Drone Academy will get more exposure, brand recognition, and promotion via various Social Media Channels.

Both Gearóid O'Briain and Oisín McGrath are founders of another innovative company DroneSAR, where they develop drone search and rescue mapping software, comparing such powerful aerial SAR tool with incorporated safety checklists, generated flight plans

DroneSAR, 2016) and other useful features, to another team member in search and rescue operations.

According to Oisín McGrath, “technology is designed to augment rescue work, not to replace it” (Hilliard, 2016). In the fall of 2016 tests were successfully conducted in Donegal Mountains, assisting local mountain rescue crew.

Skytango

Skytango were among very first licenced drone operators, and pay great deal of attention to compliance and educating the public. In summer 2017 Skytango CEO Steven Flynn was recognized as one of the most influential people in drone industry (Antunes, 2017). We trust their expertise, and believe that this collaboration will be mutually beneficial.

Aerovista Innovations

Aerovista Innovations is a renowned aerial solutions company. It builds scalable and effective drone operations programs, including professional training and consulting services, educating about safety and compliance, operating guidelines and equipment standards (Aerovista Innovations, 2017).

The person I intend to reach out to regarding the partnership, is Aerovista Innovations Chief Operating Officer and founder of world’s best online magazine “Women and Drones” Sharon Rossmark. I was both humbled and delighted to interview Sharon during my work placement in Skytango (the link to the interview can be found here).

We both share the passion for innovative technologies, helping others and advocating for girls in STEM. We quickly found a common ground, and this good start led to collaborations on other digital content projects. I feel quite confident that HelpCopter will have support from Aerovista Innovations in regards of pilot training in United States, and will have “Women and Drones” initiative as media partner.

1.7. Technical Details

Website for the final projects showcase purposes was created using **WordPress** website development platform. WordPress is open source software, allowing to use any template from their vast website template collection. Templates are easily customizable, and not too complex to use with relatively small amount of prior knowledge. WordPress allows the user to install plugins for enhanced functionality, e.g. Woo Commerce plug-in integrates website with PayPal for easy and secure transactions, bbPress enables user to create simple yet robust multi-layered forum, Yoast SEO – for search engine optimisation on the website. I found NextGEN Gallery plugin especially useful in terms of adding beautiful features like photo galleries with just a simple chunk of code.

The purpose of this website is to visualize the most important parts of the projects to the audience during the showcase.

HelpCopter project is hosted on the 000webhost.com platform 000webhost is one of the most reliable web hosting providers that provides free services, offering free website and domain name hosting, thus is an ideal choice for students and anyone who requires good quality on budget.

Microsoft Excel software was used to aid in sorting some non-numerical data gathered from survey and constructing a histogram.

Project poster was created using a lightweight open source image optimization software **RIOT (version 0.6)** and Adobe Creative Suite 6 application (**Photoshop CS6**). Photoshop SC6, while is not the most recent version of the application, is full of extremely useful features and image manipulation tools.

Images used in the poster are royalty-free images from Unsplash website – global photography movement community, gifting free high-resolution photos for the free use in any projects (Unsplash, 2018).

The project poster can be found in the Appendix 5.

1.7.1. Project Website Link

The link to the HelpCopter project website can be found here:

https://helpcopter.000webhostapp.com/

Section 2 - Requirements Elicitation

2.1. Requirement elicitation techniques

2.1.1. Brainstorming

Brainstorming is a generally accepted elicitation technique, fostering creative thinking and allowing for a broad array of new, spontaneous ideas. BABOK® Guide outlines the importance of proper facilitation and certain guidelines that should be followed:

- Clearly identified topic/ area of consideration
- Whiteboard, paper, markers and other tools available
- Appropriate timeframe has to be determined, considering the size of the group
- Timekeeper and coordinator have to be appointed
- Merit needs to be set for evaluating and rating all elicited ideas (might be a subject to a separate discussion)
- All participants have to be encouraged to actively participate, even if they are not sure of the value weight of their particular ideas
- Shared ideas have to be recorded
- No criticism is accepted during the session
- Elicited ideas to be evaluated, discussed, condensed and combined where appropriate in a wrap-up session
- Final list of refined ideas rated according to the predetermined criteria (BABOK®, 2015).

Brainstorming will be done in few separate rounds. First of all, the draft is made to map out initial thoughts what would be required for HelpCopter platform, as shown in figure 5.

Initial brainstorming session is a great fundament for further requirements elicitation in a second, more focused brainstorming session or sessions, which will be performed during the focus groups meetings involving different groups of stakeholders, considering the area of stakeholders interest.

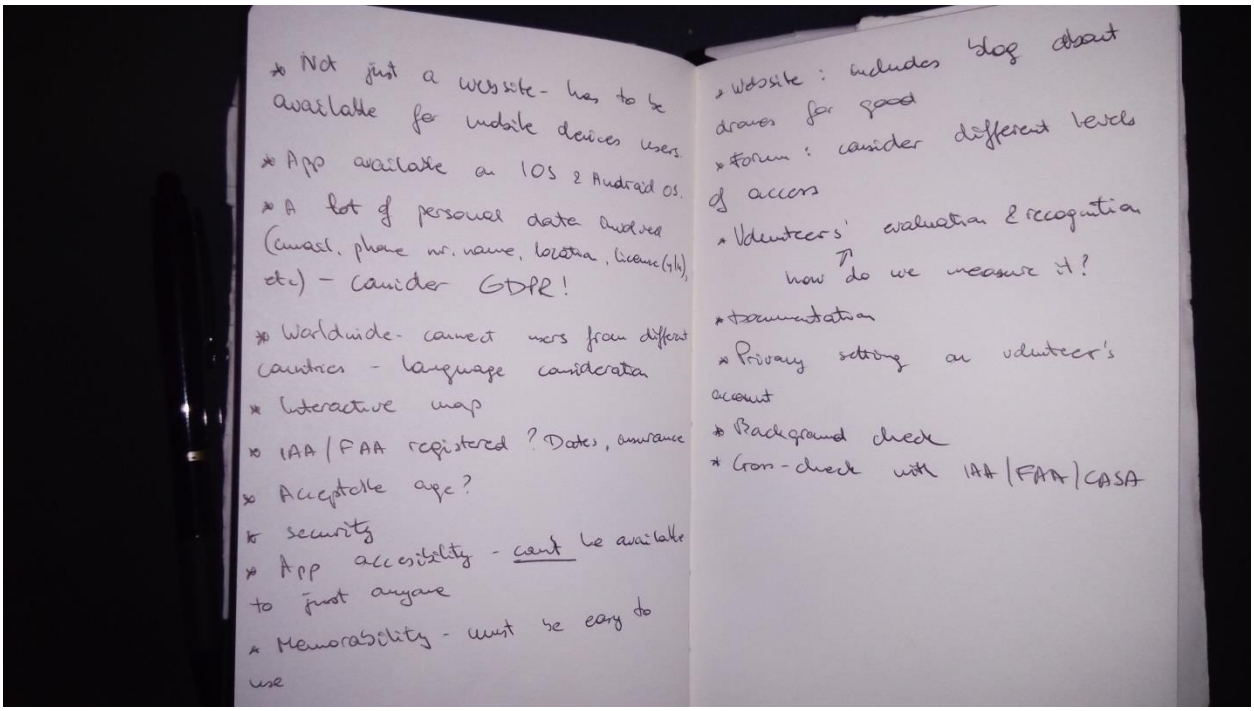


Figure 5.: Brainstorming, session 1

2.1.2. Surveys

2.1.2.1. Overview

Surveys is a great preliminary requirements technique for meaningful quantitative (measurable) investigation. Cadle, Paul and Turner call it a “primary fact-finding technique”, as it allows the gathering information from big, wide dispersed population groups (Cadle et al, 2014). In order for survey to be successful, few key aspects have to be considered:

- Clearly defined purpose
- Limited choice questions – helps to gather meaningful and measurable information. Few closed questions at the start of the survey questionnaire to be included for general understanding of survey demographic.
- Allow for 1-2 open questions in form of a “short answer” or “paragraph”. It could be beneficial to know responders’ views and thoughts, and let them to qualify the answers, however, free-format questions are more difficult to analyse.

- Easy completion (surveys usually consist of 17-20 questions, therefore they should not be too difficult to answer)
- Realistic scope (surveys tend to have relatively low response rate, hence the question design and scope should be well thought through and focused)
- Some sort of incentive could be considered to encourage the responders to participate (Cadle et al, 2014).

Online surveys are more effective than paper ones, as they can reach wider population much easier. HelpCopter project survey will reach out to responders primarily via Twitter, also using other Social Media platforms. Responders in this requirements elicitation technique are drone operators.

2.1.2.2. Pilot Survey

Two small Pilot survey sessions have been conducted.

Pilot survey session No.1:
Date: 29th of November, 2017.
Place: Cafeteria at National College of Ireland.
Participants: four final year B.Sc. in Technology Management students.
Outcome: New ideas how to rephrase some of the questions so they would be easier understood by the responders, therefore diminishing the risk of survey questionnaire being abandoned halfway and not submitted.

Pilot survey session No.2:
Date: 03rd of December, 2017.
Place: Project manager's residence at Davis Court, Inchicore, Dublin.
Participants: group of two family members and two friends.
Outcome: A small error fixed in one of the survey questionnaire questions in Google forms, which initially did not allow the responders to answer the multiple choice grid format question the way it was expected.

2.1.2.3. Google Forms

Google Forms is used for conducting and analysing the survey, as it is simple to use, full of useful functions open source tool, available from Google, and does not require any additional software for analysis, summary of results and visual representation via graphs and charts (G Suite, 2017).

Google Forms allows the author of a survey questionnaire to customize the colour palette and the layout of a survey page, allowing to choose between checkboxes, dropdown, linear scale, multiple choice grid, checkbox grid, short answer and paragraph. I did not find linear scale very useful, as it is only gives an option to choose a certain numeric value (e.g. 1-10) between the most negative and the most positive option, leaving the points in-between unidentified and left entirely to a survey participant's interpretation.

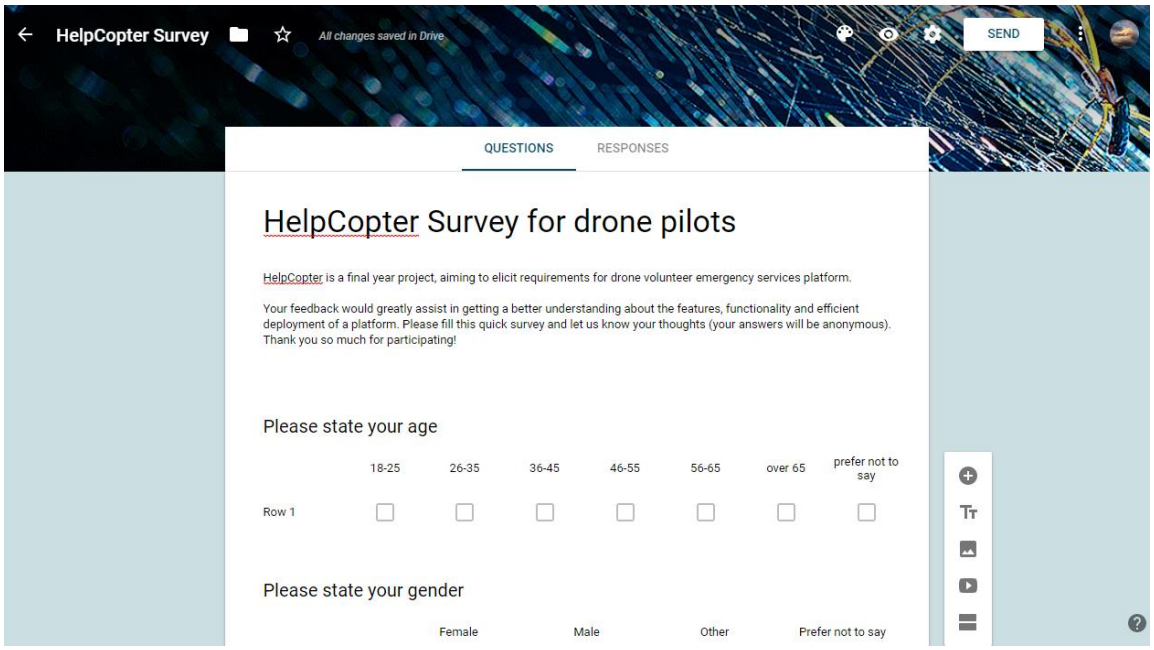


Figure 6.: Google Forms, Editing mode

Checkboxes and checkbox grid are sufficient for simple demographic questions. For the further questions, I find that the multi-choice grid option is the most appropriate, as it allows to create a set of rows (questions) and columns (evaluation of each question) for each topic, this way enabling us to get a clearer view.

Some useful General and Presentation settings:

- allow us to show the progress bar to a participant,
- shuffle the order of the questions (I do not find this feature useful, as I think the questionnaire should start with demographic questions),
- collect email addresses (to provide responders with a copy of their responses),
- enable / disable option allowing to edit the submitted responses and to see summary charts.

For the full set of survey questions, please see the Appendix 3.

2.1.2.4. Twitter

Twitter in an online social networking and news platform, accessible through both desktop and mobile user interfaces. It was created only in 2006, but according Amazon Analytics company, Alexa (2018), is the 13th most

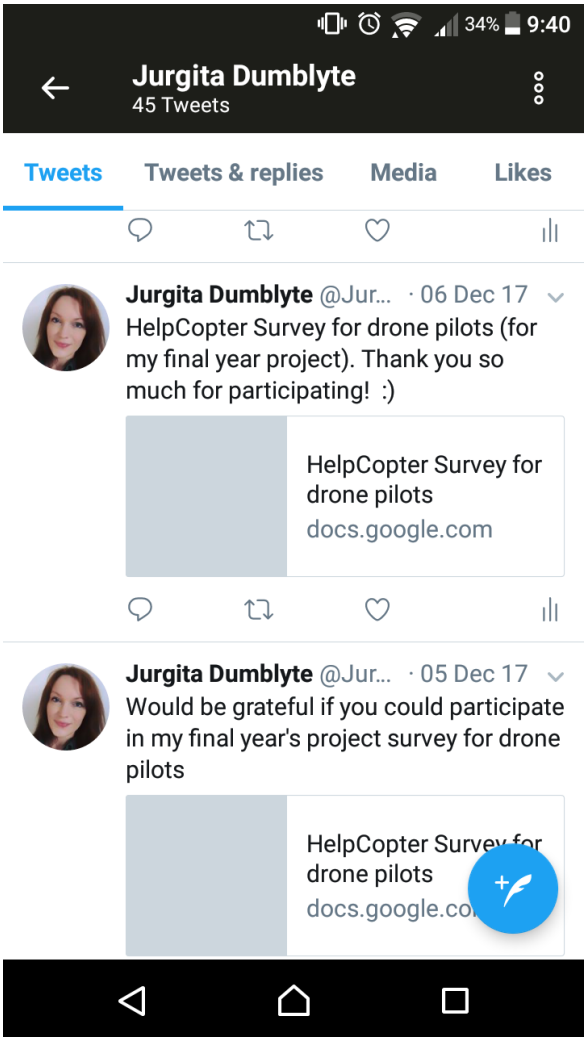


Figure 7.: Twitter screenshot

2.1.3. Interviews

Interviews are used to gather information from a small target sample group. This elicitation technique, according to Dr. E.O'Loughlin, allows to "gather experiential, technical, (…) and specialised information by asking relevant questions" (O'Loughlin, 2009).

Both structured and unstructured types of interviews will be used when eliciting the selected stakeholders requirements in HelpCopter project. Structured type is deemed to be the most appropriate where the stakeholder is not available for face-to-face meeting with a Business Analyst, and uses predefined set of questions, with possibility to follow

up the interview with some additional questions to clarify the stakeholder's views on a discussed topic. The main advantage of face-to-face interview is that it's a two-way communication, allowing both – interviewer and interviewee to clarify and explain their questions and answers, as well as to elaborate to a greater level where it is necessary. However, O'Loughlin points out few drawbacks, like interviewer bias, lack of experience ("ask the right question"), inefficient follow-up, lack of anonymity and leading questions that might hint an answer the interviewer is expecting (OLoughlin, 2009).

Interviewee name/title	Company	Type
Founder	Aerial.ie	Commercial Drone Pilots
COO	Aerovista Innovations	Media Partners, Drone school
Founder	Skytango	Partners
Founder	Stack Shuttle	Technical lead
	Garda Síochána	
Mountain Ranger	EY	Mountain ranger volunteer
Founder	FlyRyte Drone Academy	Drone school
	IAA	Governing body

Figure 8.: list of potential interviewees

The plan for conducting an interview:

- Set interview objectives and structure
- Identify potential interviewees (figure 5.)
- Conduct background research to better understand how the particular interviewee could best contribute to the requirements elicitation
- Create the set of open-ended questions
- Get the set of questions approved by the Project Supervisor (Patrick Delaney)
- Select appropriate recording technique (taking notes, digital voice recording, video recording, etc.)
- Familiarize the interviewee with the interview purpose, format and address any concerns
- Conduct the interview
- Summarize gathered information
- Check for any overlooked aspects, and anything that interviewee might want to add

- Analyse interview data
- Follow up (O'Loughlin, 2009)

2.1.3.1. INTERVIEW No. 1: Drone operators

Interviewee: CEO of professional drone photography company based in Dublin, Ireland.
Interview date: 22-03-2018
Interview place: via email, with follow-up questions.

Question 1. What details should be displayed in your personal profile?

A.: How long a licence is held, drone type, assistance that they can provide, additional qualifications (first responder, etc), whether it is a one person or a bigger team, conditions that they can fly in, location.

Question 2. What additional features would you consider important in your personal profile: consider "member since …", experience as a drone pilot, available gear, insurance/ licence,
additional training, etc.?

A.: All of these are very important.

Question 3. What details you feel you would like to be in control of:
*availability calendar,
*volunteer missions participated in,
*temporary visibility switch on/off,
*ways of contacting you, etc.?

A.: Yes, all of the above mentioned features, the ability to turn your visibility on and off is the key.

Question 3.1. How would you prefer to be contacted? Would you be ok with simultaneous notifications by phone and email?

A.: yes, it's fine. It's bigger chance to reach the person.

Question 4. As possible users of the platform, what functionalities would you like to see implemented to give you a sense of account security?

A.: I think a two side process would be good, where only emergency services can see my details and pilots can only see emergency services. I can't browse other users details as it is sensitive to the user.

Question 5. Consider the nature of this application, do you think the two-step verification is
important?

A.: Not particularly, although hoax calls to the pilots is a threat.

Question 6. What would you think about the personal rating displayed on your profile page, which changes according to previous participation and reliability?

A.: If I'm volunteering I think that a star rating would be a poor way to go about it, If I'm qualified,- I'm qualified. If I do not show up to events I say I will, there should be a strike system.

Question 7. What would be your preferred way to give feedback: one-way feedback board,
interactive forum on the website, etc.?

A: Both

Question 8. One of the few aspects differentiating this application from competitors is that
HelpCopter does not accept teenagers/ unlicensed drone enthusiasts, but rather focuses
on experienced, reliable pilots. Therefore, we need to know about our volunteers. Considering the pilots will work hand in hand with emergency teams, to what extend is the background check you think is necessary in order to keep everyone safe: drone licence and few years of experience, past criminal records, etc.?

A: I think that sounds right once you're qualified.

Question 9. Any additional thoughts of what you would expect from the platform would be greatly appreciated!

A.: I would question the amount of pilots that you will get on board, this is a work for professional pilots. Volunteering is important but it needs to be incentivised, e.g. They can market that they help out on their websites. I think thinking through the amount

of people out there who would sign up is the key. Additionally you need permission to fly in so many places that would need to be granted by Irish Authority Aviation in Ireland, or other regulatory bodies in other countries, this would need to be coordinated on the emergency services side or app side to make it easy for the pilots. I think a way to commercialise this is essential from a pilot point of view. They are constantly being tapped for their resources, they pay the insurance and conduct the training. Having a market view I think is key to success.

2.1.3.2. INTERVIEW No. 2.: Technical Lead

Interviewee: Founder of rapidly growing software development start-up Stack Shuttle Ltd. based in Dublin, Ireland.
Interview date: 26-03-2018
Interview place: via email, with follow-up questions.

Question 1. While both – a website and the mobile app are mentioned in a project brief, how sensible is it to develop it separately? Could a responsive website be a possibly better option, considering the development cost and time, as well as maintainability of the software?

A: Yes. It depends on the time and budget. If the UI/UX (User Interface Design/ User Experience) of the website is not too complex, a responsive mobile web site is definitely a better option. Developing a responsive would take longer time than just a normal website, but it'll take shorter time than developing a separate mobile app. But when leveraging the technology like React Native (created by Facebook), we can develop native mobile applications for both IOS and Android quite fast. Nowadays, most software development companies would develop both mobile web application (responsive site) and native mobile applications.

Question 2.: You mentioned it depends on a time and budget. Could i ask you to state just approximate timeframe of developing a responsive website versus separate site & app, and even if vague touch up on cost difference (3-fold, etc.)

A: oh, I would really need to see the specs first, to be able to tell that!

Question 3. According to our survey questionnaire, majority of the drone operators want to be able to change availability (e.g., to have different settings like "available Sat/Sunday only", or "available 24/7 except first weekend of each month"). How feasible it is to see those requirements fulfilled?

A: It’s feasible.

Question 4. Considering the high priority of secure access, would you think a combination of capital letters, numbers and symbols is enough, or would you recommend two-step verification, or perhaps some other ways to ensure the user’s account is safe?

A: Strong passwords and two-step verification should both be implemented if the security is the main concern.

Question 5. What are your thoughts about other security requirements for such application?

A: Data encryption. User data should be encrypted, only can be unencrypted by the correct user password. There’s also an option to allow only limited (for example, 3 times) amount of times to input incorrect password before the account locks you out. Simple and effective.

Question 6. Highly accurate interactive map is very important. How difficult / easy it is to implement, and what are the risks associated?

A: It is difficult. It depends on the technology being used. Google map or Open Street map. For accurate interactive map, detailed geolocation data is required.

Question 7. During the brainstorm session some participants raised a question about selection of volunteers for a particular job. That would include not just proximity and availability, but also a personal rating which changes according to past participation, reliability and user’s activity. How feasible it is to implement such features?

A: Personal rating system is feasible.

Question 8. Would you think a forum would be a good way to gather the users’ feedback? What kind of forum would you suggest, and what features do you think should be incorporated into it?

A: Unless you want to encourage discussions between users, forum is not really a good way to gather feedback. Adding intercom like customer support portal would be better. And sending out timely user surveys would be a good option too.

Question 9. If you have any additional thoughts what must/should or could be implemented for the main, ease of use, reliability, scalability and performance of the software, please share it, it will be highly appreciated!

A: I like the idea of only allowing mobile app access to people who's profiles have been verified. It's slick.

2.1.3.3. INTERVIEW No. 3: Irish Aviation Authority

Interviewee: Representative of Irish Aviation Authority
Interview date: 17-04-2018
Interview place: Irish Aviation Authority Headquarters, The Times Building, 11-12 D'Olier Street, Dublin 2.
Interview duration: 1 hour 45 min.

Question 1: Please tell us about current drone regulations in Ireland

A: When working on the project like this, you have to understand that not aspects to be considered are necessarily aviation related,- we don't set the rules for privacy, or trespassing. We've no power regarding this, and there's a bit of a grey area regarding to what we do and what does police do. Regulation in Ireland that deals with small unmanned aircraft (drones and rockets) is S.I.563 (2015). There is a similar document in every state in Europe, it is only a national law at the moment, not a European law. Where we're going is that European Union under EASA (European Aviation Safety Agency) is developing European law, which will come into effect possibly in the end of this year, and will take over all the existing national small unmanned aircraft laws that are so fragmented at the moment. The new regulation was to be published earlier this year, but because it is so complicated and has so many variations and variables, at the moment representatives of all states are looking into situation and debating in Brussels, aiming to decide what can be regulated and what cannot be regulated. Regulation has to be simplified, and easy for ordinary people to understand. This regulation will be the one to use as a guidance when developing an application relative to drones. Our current Irish regulation states that for anything from 1kg to 150Kg these rules apply. It was developed thinking anything smaller than 1kg is a toy, and we won't be regulating toys, but looking at how technology has developed, all of sudden we have these sophisticated drones coming in that are less than 1kg. It could take a year to get a new piece of law reissued, and by the time that happens, European law will come in. Aircraft has to be registered in a manner subject to the authority, so it's a first time that we ever require small aircrafts to be registered. Person in charge of a small unmanned aircraft should not operate a drone in a way so it would cause any hazard to another aircraft,- so that is our main responsibility

to make sure that they don't interfere with the aircraft at the airports; also it shouldn't be operated in a negligent or reckless manner, which means endangering life or causing damage to the property. So that would be our responsibility if somebody was doing any of those things.

Question 2: what about the wavers to fly in the restricted areas?

A: each company is issued with a permission, and the permissions that they get depend on their operations manual and the risk assessments that they have done. So it is no unusual that some Irish or foreign companies are coming to do survey at the airport, and they might get permissions for a day or for a week.
The main thing in the regulation is Article 5. It sets out all of the things that you cannot do, describing in detail all restrictions. The main is the distance of less than 30 metres of a person, distance less than a hundred metres from an assembly of 12 people, beyond the line of sight, height of more than 120 metres (400 feet).

Question 3: Is the standard licence enough to be participating in drone volunteer operations?

A: The first thing to understand is that the regulations concerning drones here is based on risk, not based on commercial activity. The regulation thinks about the risks involved, so, for instance, a drone operator does not need a permission if the drone operations are flown at least 120 metres away from people. However, when it comes to doing aerial survey work or the type of operations you describe in your project, the required distances from people in the regulation may make this work impossible. Operators generally need to get much closer than these distances. And that's when you need an "SOP" or – "Specific Operating Permission" for small unmanned aircraft. An SOP can be issued to a person or to a company. You could be sole trader, just one person, but you would have to have an operations manual, setting out standard procedures. AN SOP holder may have multiple drones and so will need to have several pilots to fly them. Each drone pilot is required to hold a valid pilot competency certificate or 'PCC'. To get a PCC, the drone pilot will need to attend a course at one of the registered drone training facilities, where they will learn all about the local airspace rules and how to do the required risk assessments before flying their drones.

Question 4: And what kind of activities can you do when you are an SOP holder? Can you go to an airport, or not really?

A: It's easy – it is all described in your manuals. You can do all what they have approved in your manuals to do. In the future you will have a piece of paper with your permission number, so when the police come up and ask you if you are authorized to be there, you

can be confident that you have a permission number and procedures, and can carry on with your work. The SOP permission allows you to get closer than the distances in the regulation. Doesn't mean that you can go and snoop on somebody, and break privacy laws,- all those rules are still applicable to you, but that's kind of a basic idea how it works, so no matter what you want to do, you must have an Special Operating Permission, and your pilot must have a Pilot Competency Certificate. Also, in your operations manual you must have details of what kind of activities you're trying to carry out.

Question 5: Considering the nature of this project, I think it would be important for the volunteering pilots to undergo additional training (either online or on-site) that would prepare them for possible health & safety, as well as other issues that might arise during the first response operations. Do you think it might be a good idea, or would you say that drone licence and some years of experience flying a drone is sufficient?

A: That might be one of the problems that you will have with your proposal to call up drone pilots to operate drones for a strange operation. Even if the pilot holds a valid PCC, you need to consider, how that PCC holder will be trained in the new activities and possibly new drones with no time available. They might be very experienced drone operators, but it's possible that they have only been taking pictures of the country and the rooftops, and now all of sudden you want to get them into emergency situations where they have no experience at all. So the amount of training and the timeframe has to be carefully considered.

Question 6: So how does it work in built-up areas?

A: There are built-up areas around every airport, and everybody wants to use their drones in the population centres, so air traffic control normally object that, and this issue was causing a lot of difficulty for us in Dublin and Shannon, so we put in procedure in place with Dublin Air Traffic Control and Cork Air Traffic Control: if someone had a valid SOP, that they would supply their SOP number when doing operation in a city, inform what time they want to go up at, and IAA would allow that operation to happen. It is like a flight plan. We have about 50-60 operations per week in Dublin area, close to the airport, in a controlled air space, but with the cooperation of the Dublin Air Traffic Control. And it is exclusively SOP holders. Now sometimes we do get people who are not SOP holders and it's usually licenced operators that call us and report somebody flying their drone without Specific Operating Permission.

Question 7: How would the potential volunteers be assessed?
A: Some standard procedure has to be worked out in order for an SOP holder to bring in an unknown quantity licenced pilots. And everybody must be trained in these operating procedures. You cannot have two operators doing things different ways, because then

the pilots wouldn't know which way is a correct way. Pilots must not be asked to do anything that they were not trained for. It's especially complicated with the fire involved. Dublin fire brigade is using drones now, but they are learning all the time, working on their special techniques, because of the heat, and all drafts, and how you approach the fire, and what kind of equipment do you use, etc. Those techniques are completely different from the ones used in the mountains or coastal regions. There's a sufficient amount of training to be done to make operation effective and not miss anything during the drone survey. And that training has to encompass all the different environments. So it's a little bit like pilots in an aeroplane: every time you move to work for a different airline, you can't just jump into another airplane, - you have to go through a whole different training course, get familiar, know their new procedures. So that is something that you will have to find a solution for, some standard operating procedure that enables all volunteers to be on the exactly same page. You might have to work out what the possible scenarios are: what techniques you are going to use, what is the battery life of the available drones and how do you optimize that, where do you start, where do you stop, how do you set a search pattern so that you do not miss anything and avoid the blind-spots. When you run out of battery and have to continue with another drone, how do you identify those exact points. It is very important that when you call something "Clear", it actually is clear, and you can move on. These are all things you need to consider if you are putting together likeminded people with similar training for a volunteer program.

Question 8: So, where would I, or a coordinating hub, start with this program?

A: What you would be looking at doing is developing a small centre, where you have one SOP holder, and you get some PCC guys who are all trained, so you have to come up with a training standard. Then you widen the circle, bringing in another SOP holder, and they can deal with several new people. The most important thing is developing the standard that everyone would follow, and make the system work. You would need help of subject matter experts like [interviewee 4], who are in that space. In a long sight it has to grow into some industry standard, so that eventually somebody has a qualification with which they can go, let's say, to Portugal, and their qualification would be recognized.

Question 9: The long sight plan is to make this application cover not just Ireland, but Europe. Would you think that would work?

A: We have done this with pilots: pilots are trained on European system, so I can go to Portugal with my licence and understand their procedures. The licences are interchangeable, all the training on the aircraft is interchangeable, but it took a long time. The drone world, because it is kind of plugged into aviation, a lot of aviation authorities would understand this, and they would recognize it. The problem that we have is that a lot of drone users don't use it, they are not aviation trained. The training for, let's say, a

light aircraft, can be done anywhere in Europe. You can go to a flight school in Lithuania, it takes about 50 hours of training, do some exams, and your licence would be also recognized and accepted here in Ireland, because the licence is up to European standard. But we are not there yet with drones.
Regarding to doing some volunteering while on holidays, currently all countries have different regulations, So things that they can do while abroad would be quite limited. Pilots would have to do some complimentary training to be familiar with the local rules and regulations.
In most countries pilots are trained to local conditions, or somewhere there is no training at all. So we want to have that universal standard, thus it would be a difficulty in your project to coordinate the standard throughout Europe, you would have to wait for a common standard across Europe to be applied. What you are doing is really important in a sense, just need to understand and emphasise what EASA is doing and where all the regulations are going to come from.

Question 10: One of the few aspects differentiating this application from competitors is that HelpCopter does not accept teenagers/ unlicensed drone enthusiasts, but rather focuses on experienced, reliable pilots. Therefore, we need to know about our volunteers. Considering the pilots will work hand in hand with emergency teams, to what extend the background check you think is necessary in order to keep everyone safe: drone licence and few years of experience, past criminal records, etc.?

A: Gardai vetting is critical, yes.

Question 11: There was a question raised regarding drone insurance and reimbursement of some sort if something happens to volunteer's drone during an operation. How would a coordinating hub go about that?

A: When we issue an SOP to the company, we require them to have a third party insurance, in other words,- if the drone causes damage to somebody else (somebody on the ground, an innocent passer-by, somebody who is not connected to the operation), we require to have insurance as part of the mitigations to be allowed to be operating closer to people. They are allowed to operate closer to people because they have shown that they have expertise and procedures. However, there is always a risk that something will happen. We do not require you to have insurance to cover a value of your own drone, or damage that might happen to the operator himself. It is a little bit like driving a car – you have to have a third party insurance, but you are not required to have a comprehensive insurance; but most people will get it. I can only suspect that volunteers would say "I am happy to help, but I am not taking liability for your € 10.000 drone", but it is not regulated, and it wouldn't be regulated from our point of view.

Question 12: So it's more likely that the volunteer pilots would be using drones provided by coordinating hub, not their own equipment?

A: Well, it is only more difficult for an SOP holder. Generally, it's an operator of few specific drones, for example DJI Phantom, and they nominate those aircrafts for volunteer operations. So if somebody turns up with a whole other drone, let's say a homemade drone, that would introduce a significant risk, because you are facing something that is not up to specifications. You do not know what that aircraft is capable of doing and not capable of doing, particularly if it is something that might look really good but is built at home, may not have any geo-fencing on it, could have any kind of anomalies that you don't know about. So besides the insurance question, I would suspect that how the Aviation Authority and how the operator could possibly accept an unknown drone coming into operation, under their responsibility. Definitely the insurance in this case would be an issue for both – the SOP holder, and for volunteer. At the moment we wouldn't allow an SOP holder to use an unknown PCC holder and an unknown drone. That is not to say it would be impossible, - the SOP holder would have right down procedure, do the risk assessment, demonstrate how it can be pushed into less risky or no-risk situations, but it is a quite complex issue. It is easier when you have a short list of what kind of personal drones are accepted, with conducted risk assessment for those particular models, maintenance procedure that says that all those drones have to be part of such and such maintenance program. Then you can guarantee the quality of the aircraft. Also, you might require all volunteers to do a specific training in one of three drone training centres, that has been already done and approved by an SOP holder. So now, it starts to make sense, because those volunteers and their equipment is checked and evaluated, their aircraft is documented and meets minimum requirements. It's crucial to bring the risk down and make sure everybody knows what they're doing. There is quite a level of organization and understanding required.
While at the moment a lot of drone population are not aviation trained, they are becoming aviation trained. Referring to flying actual manned aircraft like we were discussing earlier, you going into highly structured system, and you going to learn lots of language that is heavily aviation related, and know lots of disciplines, rules and behaviours. If you apply aviation architecture to your application, you could find that there's lots of solutions in there. In HelpCopter project, it would be important to collaborate with experts in this area, who can help you to clarify how to do risk assessment, what equipment to use, and what training would be required. Because you need a common source of training, common certification for your aircraft, you need to be able to demonstrate all this if somebody asks you, provide evidence how did you ensure that some particular person or their aircraft was ok.

Question 13: Can the data that a pilot inputs in their profile be verified? E.g.:

a. Drones owned
b. Licence (number, issue date)
c. Insurance (issued/ renewed)
d. Personal details

A: Yes, absolutely. IAA has a list of licenced drone pilots, which is about six thousands at the moment. Sales of drones last year were much higher than that, so we can assume that there are plenty more unlicensed drone users.

Question 14: Do you approve the idea of a forum on HelpCopter website, where the pilots can share their experiences and communicate with other pilots/web admin (if yes – where do we draw a line of topics allowed to be displayed for public, topics be accessible only to registered members, and the ones that would be flagged straight away), or would you think it should be confidential email/phone communication if they want to express any thoughts or concerns?

A: We regulate only the operation of the drone. But how you bring people together, or how you share information, is not regulated. It is up to you if you want to connect people on the forum. Pilots would probably have some sort of WhatsApp groups anyway.

Question 15: What would you think about the personal rating displayed on pilot's profile page, which changes according to previous participation and reliability?

A: You are in a situation here, where you try to control human behaviour. Thing is, most people turn up to work because they get paid; they don't get paid – they won't turn up. So it's a risk and reward system. Volunteers do not get paid, and you could get a really good drone pilot, who is just unreliable, but when he does turn up, he is really good. In aviation, we would rate people on their performance. Let's say, when someone has all the training, and proficiency, and then they fall below that level of proficiency, it should really go back down to whoever issued that certificate, and they, in turn, would recommend re-testing the pilot, send them back for some additional training, before putting back on the system. It is all done with Just Culture concept, which serves as a foundation of balanced accountability.

Question 16: ..which means, there must be some system in place to monitor that, just not on pilot's personal profile?

A: That is why you normally have an organization structure. Let's say, you have an SOP holder that's operating ten drones. There should be somebody in charge, or responsible person, possibly head of training, or a chief pilot. When somebody comes along and they fly a drone, not demonstrating the standard, the person in charge should take them aside,

and say “look, I’ve observed you, you are not doing this correctly. I think there’s a problem in your training, there’s a problem in some knowledge that you don’t have, so I’m going to recommend that you get that knowledge before you go back and fly again”. The number of options can follow that, for example, you can write to the Aviation Authority recommending to suspend that pilot’s certificate until they get re-tested.
As long as everybody buys into that and everybody knows that that is the situation, then it is generally ok, and people generally accept that. It is for safety reasons, so it is really important. But we would never publicise it. If the system works correctly, pilot should get his licence back after re-training, and should come out clean, without the past following him around, because then system collapses, people start to hide and lose the trust in the system. You have to have standards and you have to have trust. In aviation these days it would be much more likely that if somebody makes a mistake, they would tell about that as quickly as possible, before an accident happens, and be sure that nobody will blame them for that, - rather the opposite, they would be thanked and respected for doing a right thing and not trying to hide the problem. This culture is developed for the engineers and pilots, and it’s taken years to develop that, but at the end, Just Culture benefits everybody in the system, and that’s why the system works so safely. We have to do the same in the drone world, even though majority of drone pilots are not aviation trained. We need to cultivate and develop it, so it becomes a part of a mind-set.

2.1.3.4. INTERVIEW No. 4.: Drone Flying Academy

Interviewee: Founder Irish drone flying academy FlyRyte and co-founder of drone software development company for search and rescue operations DroneSAR.
Interview date: 20-04-2018
Interview place: via email, with follow-up questions.

Question 1: Considering the nature of this project (close collaboration with first response teams), I think it would be important for the volunteering pilots to undergo additional training (either online or on-site) that would prepare them for possible health & safety, as well as other issues that might arise during the first response operations. What is your opinion about that?

A: Sounds like a good idea. I would recommend that pilots attain ‘badges’ based on their qualification. Agencies looking for help could then filter by qualification. In some scenarios qualification requirements would be low but in others it would be quite high, and generally pilots may need certain training for insurance requirements.

Question 2: Do you think it’s necessary for a coordinating hub to be an SOP holder?

A: Not necessary. I would recommend a special agreement is put in place with the IAA which may require a SOP.

Question 3: One of the few aspects differentiating this application from competitors is that HelpCopter does not accept teenagers/ unlicensed drone enthusiasts, but rather focuses on experienced, reliable pilots. Therefore, we need to know about our volunteers. Considering the pilots will work hand in hand with emergency teams, to what extend is the background check you think is necessary in order to keep everyone safe: drone licence and few years of experience, past criminal records, etc.?

A: Difficult to answer. I like your approach of requiring licensed personnel so checking their licences would be good here. After that it will be difficult to decide what the requirement would be. Background checks are very slow and are likely to put people off. I would be more inclined to use a peer review process like that at Airbnb or Uber. You could then filter by experience on the app rather than in general, further encouraging people to volunteer through the app.

Question 4: Please tell us about your SAR software. How does it work?

A: Pilots pay an annual subscription and download the dronesar app through the app store (works on iOS only). This enables their DJI drone with a range of autonomous functions. The information can be streamed out to the cloud and accessed through the web live.

Question 5: How easy/ complicated it is to use it for a person who has never seen it before?

A: Very easy, especially for someone who has flown a DJI drone.

Question 6: What kind of personal data is required to use this software? How is it stored?

A: Organization name (or person), email address and password. Stored on the cloud.

Question 7: Can location data of the drone be accessed by the coordinating hub (for real-time coordination between drones, and for retrospective)? What security measures are taken so the location data could not be accessed by any unauthorized bodies?

A: This could be arranged if the pilots agrees in advance and provides log in details. The info will only be transmitted if the pilot selects on each flight. A better option would be for the coordinating hub to give the pilot their login and assign a name to the pilot, which would then appear on the coordinating hub side (looks like air traffic control screen with an aircraft and a tag with track and live video)

Question 8: As possible users of HelpCopter app, what functionalities would you like to see implemented alongside DroneSAR software, to get the most of technology, and to enhance effectiveness and efficiency of first response operations?

A: Ability to see pilots available and filter by skill level, organisation they belong to, and whether they require payment etc

Question 9: What would you think about the personal rating displayed on pilot's profile page, which changes according to previous participation and reliability?
A: I think this is a great idea, as suggested above

Question 10: Do you approve the idea of a forum on HelpCopter website, where the pilots can share their experiences and communicate with other pilots/ web admin (if yes – where do we draw a line of topics allowed to be displayed for public, topics be accessible only to registered members, and the ones that would be flagged straight away), or would you think it should be confidential email/phone communication if they want to express any thoughts or concerns?

A: I think hosted webinars would be more appropriate.

Question 11: Any additional thoughts of what you would expect from the platform would be greatly appreciated!

A: Sounds like a great idea. Something that DroneSAR and FlyRyte Drone Academy would be willing to consider partnering with if implemented well. We could assist with some development aspects too (administrative rather than technical).

2.1.4. Prototyping: Balsamiq Wireframes

Prototype enables the key stakeholders have a visual representation of what a website or mobile application might look like. An iterative approach encourages us not to assume that all requirements can be accurately gathered at the very start of the project and does not imply an assumption that the stakeholders requirements will not change during the later stages, as it is the case with a traditional Waterfall approach to the project management.

HelpCopter project follows good practices of Agile philosophy, which state that the less functional initial prototype/ demo, and more frequent communication with stakeholders

throughout the course of the project, presenting them chunks of deliverables with each iteration, directly correlates with the higher quality of the final product. Reason behind that is that project team receives stakeholders feedback, both positive and negative, on regular basis, enabling the team to implement feasible changes to better reflect the desired outcome of the project. And that is ultimately what we want, as the final product should be exactly what the customers want, not what we assume they should want.

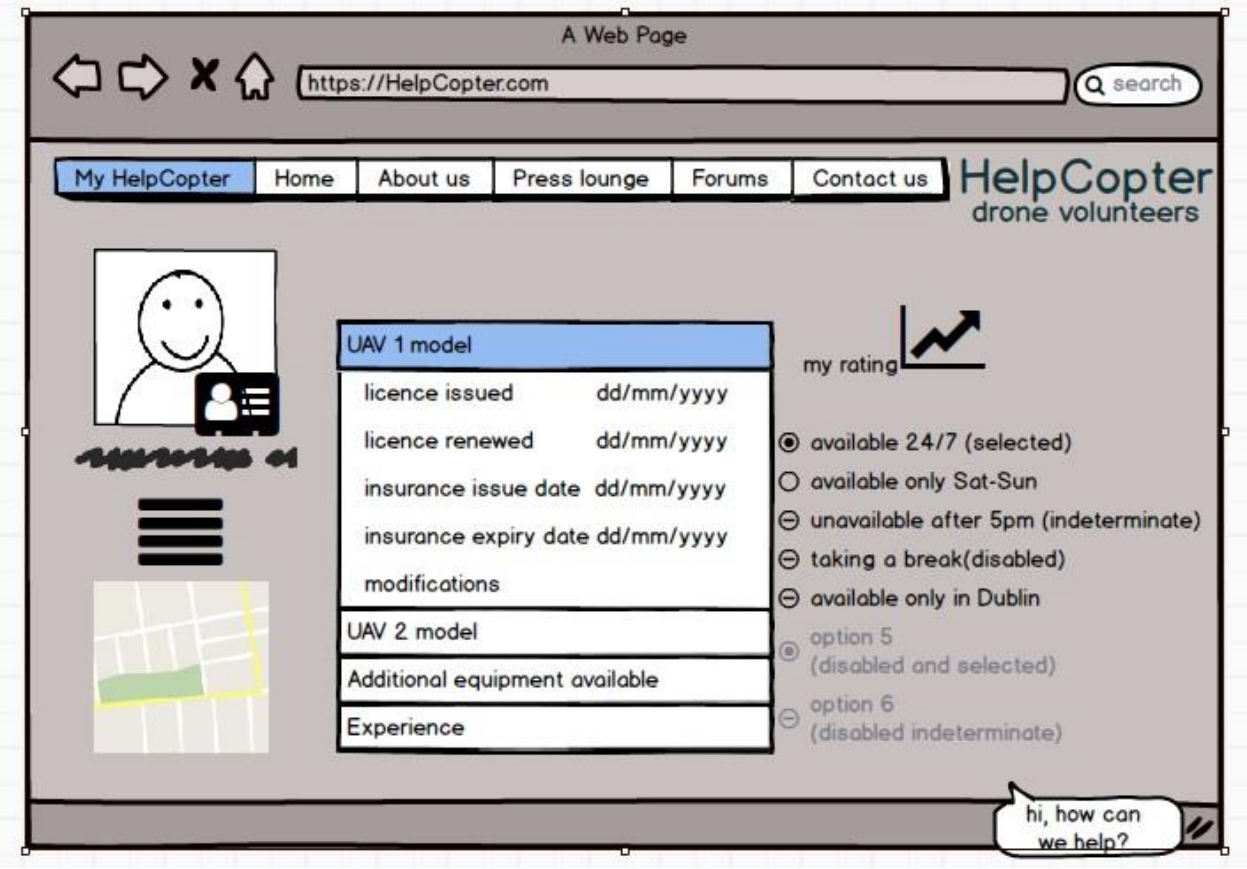


Figure 9: volunteer's personal page

Balsamiq Wireframes is an online rapid wire-framing tool that allows the users to perform quick sketches, generate ideas, explore different design options, enhance their work integration, focus on the content (Atlassian, 2018) and encouraging an interactive environment where the project team can evaluate whether it is a right way forward towards achieving the project goals.

Prototype for drone volunteer's personal page, shown in figure 9, was created after brainstorming sessions and conducting the survey, but before the interviews with the key stakeholders.

Considering there is a sufficient amount of information to fill in, in order to activate the profile, there is always a risk of misunderstanding some requirements, the format that the information has to be put in, or any other queries that might arise, interactive Intercom window in the bottom right corner is very helpful. The average or maximum query response time, as well as working hours of the customer support centre should be displayed just beside it to keep the users more informed.

Volunteer's profile picture is displayed at the left side of the profile page, with an indication whether the user profile is verified, contact details, and an interactive map (requires network connection) right below it.

Centre of the profile page is dedicated to all information about the user/ drone pilot that might be useful to the coordination hub in their decision making during the emergency operations. That includes equipment, information about the insurance and licence of an aerial vehicle available, pilot's experience, additional qualifications, etc.

Finally, on the right side of the personal profile page we see availability and profile visibility settings, and a personal rating graph. Personal rating graph is not visible to the other drone volunteers, and automatically changes according to the previous participation and reliability.

While stakeholders that reviewed the prototype agreed with the importance of majority of features present in the prototype, few adjustments have been requested to be made:

1. Considering sensitive nature of the collaboration in emergency operations, modifications of the existing equipment should not be allowed, as it might not only make an aerial vehicle "not up to specs", but does not facilitate transparency, increasing the risk of data leaked to the unauthorised bodies, and increasing the possible risk of physical injury to any participants.
2. There should be an option not only to outline the equipment owned by the volunteer, but also equipment that a volunteer does not possess but is confident of using. In certain occasions, volunteer might prefer to use the equipment supplied by the coordinating hub, rather than bring their own.
3. Personal rating graph: while it is important for the administrative body to keep track of performance and efficiency in order to minimize possible risks in the future first response operations, personal rating graph should not be displayed in the profile page. Just Culture attitude should be promoted instead of demotivating volunteers from future participation by displaying the personal rating graph that might not move up as rapidly as the volunteer expected.

2.1.5. Document Analysis

Document Analysis is one of the core requirements elicitation techniques. It is extremely useful in trying to understand the business need and the environments of the certain industry. Document Analysis does not involve direct human participants, but rather encompasses a systematic study of various documentation such as publications, textbooks, reports, good practices, industry regulations, and other. The Guide to The Business Analysis Body of Knowledge emphasises the Document Analysis capability to address possible information gaps, - data that could not be obtained through other elicitation techniques (e.g., survey or interviews), and highlights the importance of considering publication release date (whether the document under review is still relevant or not) and source credibility (BABOK, 2015). Throughout HelpCopter project, background information was gathered from BABOK version 3, IEEE publications, Irish Aviation Authority, European Aviation safety Agency, among others.

One of the few Document Analysis drawbacks outlined in BABOK Guide (2015) that business analyst conducting the research should be aware of, is the risk of information overload, which enhances possibility of confusion.

2.2. Requirements Elicitation Results

2.2.1. Brainstorming results and evaluation

Preliminary requirements were derived from brainstorming sessions, giving us a rough understanding how the system should work and what inputs are required from the users of this system. Purpose of brainstorming was not to come up with ideas that would be necessarily final and set in stone. Rather the opposite,- its goal was to gather as many ideas as possible in order to make a foundation for the elaboration and development of those initial ideas.

Given the HelpCopter online platform consists of a website and a mobile app, not just a responsive website alone, preliminary requirements gathered from the brainstorming sessions are following:

<u>Preliminary requirements for the website:</u>

- Detailed information about HelpCopter has to be available to the website visitors, along with a statement in regards of volunteer background check and information about GDPR
- Volunteers have to be able to sign up/ sign-in

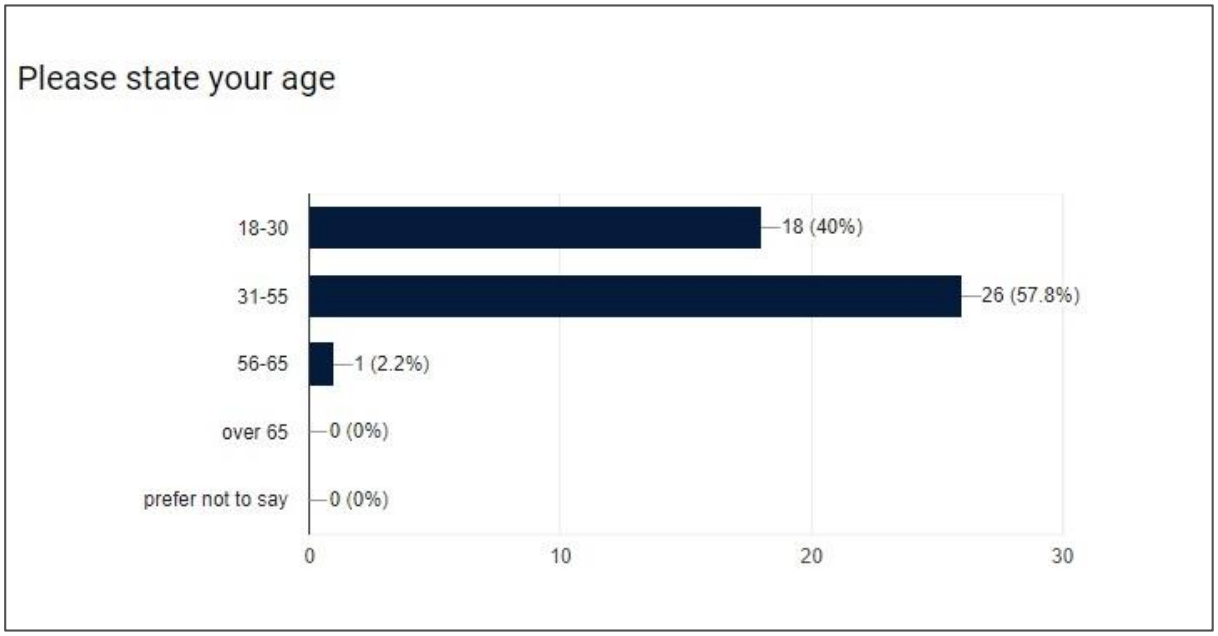
- Volunteers must complete an online application form (contact details, experience, equipment, licence number, insurance number and issue date, etc) before being accepted
- After the background check, registered volunteers receive a passcode enabling them to use a mobile app
- Website will use Intercom services for time-efficient response to website user queries

Preliminary requirements for the mobile app:

- Has to be available for both IOS and Android platforms
- Only volunteers that have signed up on the website and received their passcode, are able to use the app
- No option to remember the password on the phone for security reasons
- Mobile app has to provide an accurate Interactive map
- Mobile app has to allow real-time communication with the first response teams

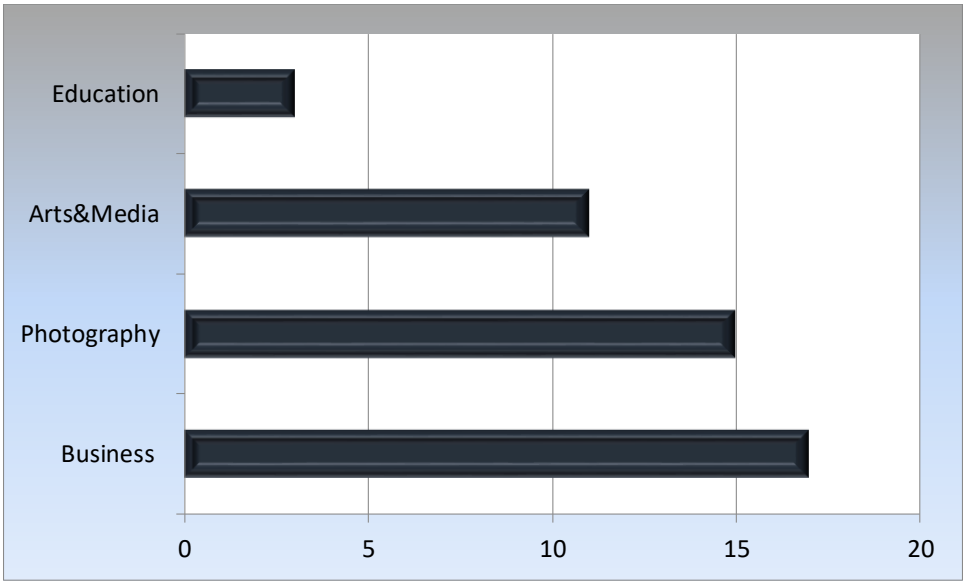
2.2.2. Survey results and evaluation

Please state your age



I started the survey with couple demographic questions. Age-related question was included not just out of sheer curiosity regarding the average age of the people flying drones, but also to amplify that people under 18 are not suitable for this particular survey.

Please state your occupation



This histogram shows us that only three users out of 46 are students, using drones mainly for explorign from above, great Instagram images and drone racing. The rest are either professional photgraphers, bloggers/ journalists or people in private sector that are keen and licenced drone users. Considering the factor that all responders were outreached through my Twitter network cosisting of about 90 percent of connections some way involved in drone industry, we can assume that while earning money by utilising unmanned aerial technology might not be the case to all of these responders, majority of the responders are rather passionate about drone industry.

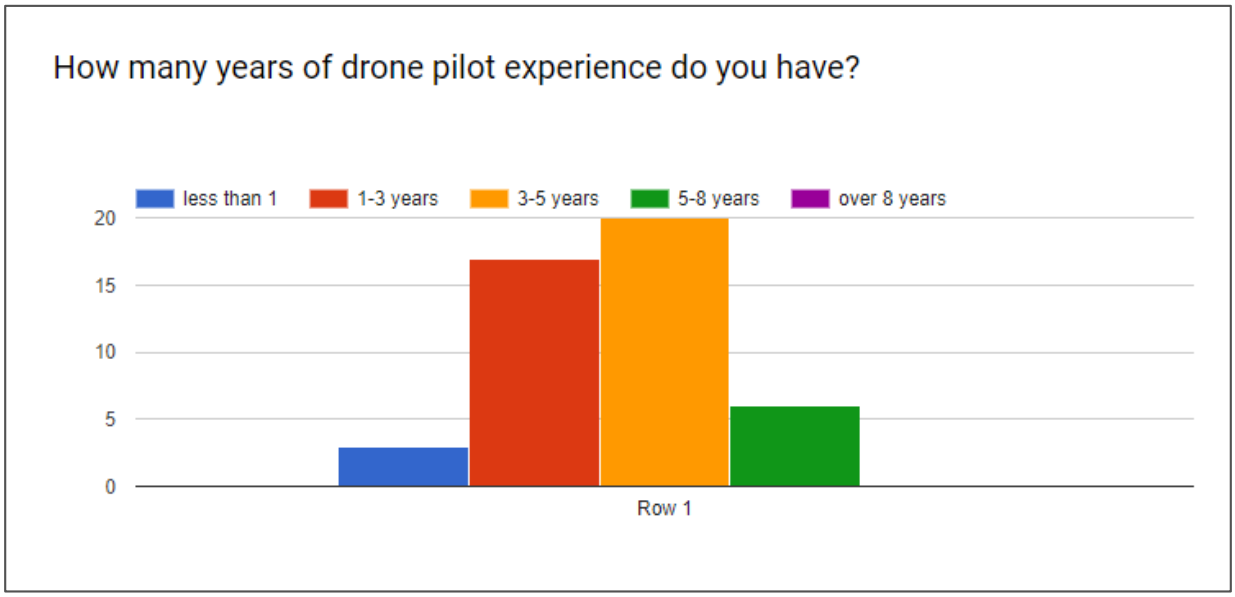
Note: This question was not thought through quite well. The big list all different occupations is hard to make sense of. To try and quantify it, I assigned them into four separate groups of different areas:

1)Business: co-founder, COO, business owner, team lead, accountant, winemaker, etc.
2)Photography: aerial artist, photographer, professional photographer, etc.
3)Arts and Media: Creative director, author, blogger, freelance journalist, etc.
4)Education: student, Film student (GMIT), etc.

The following step is to create a frequency table for non-numerical data. For that I used knowledge acquired in Business Analysis module, with a help of Microsoft Excel program, using the advanced filter to create the unique record of each data, and using formula

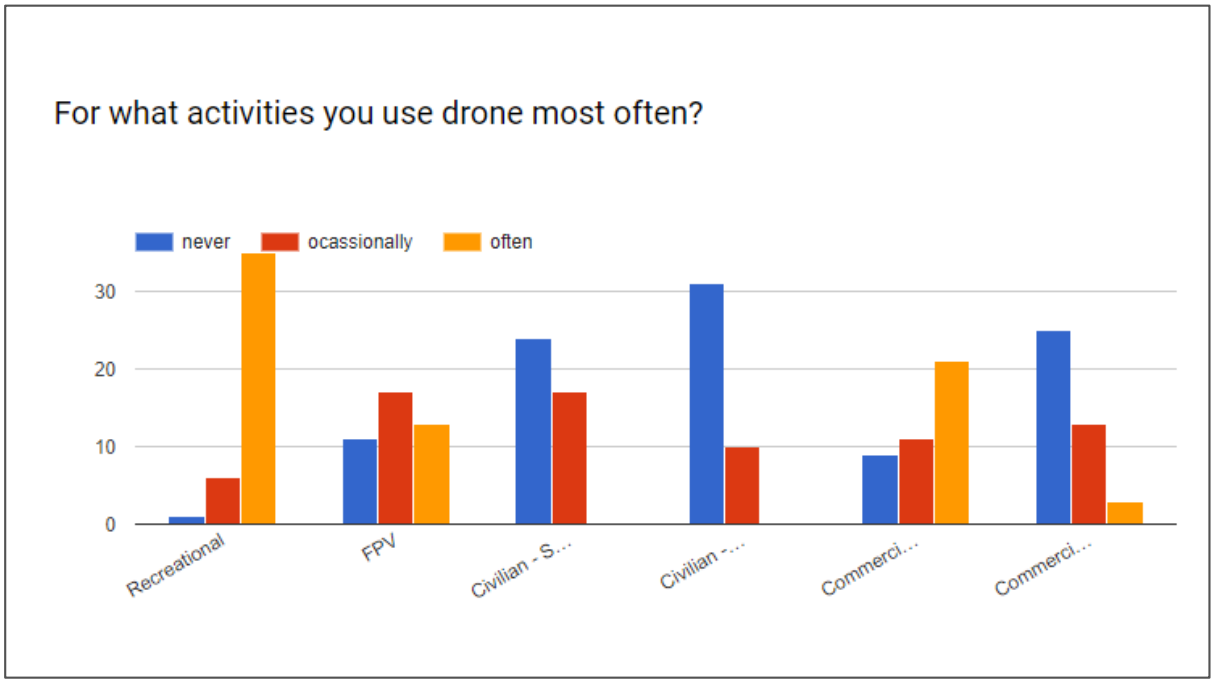
=COUNTIF(B2:B48,E3:E7) quantifying each category of data: Business 17, Photography 15, Arts and Media 11, Education 3.
The histogram above was created from summarized quantitative data.

How many years of drone pilot experience you have?



There were no expectations to see many pilots with more than five years of drone pilot experience, as the civilian drones industry is quite new. However, looking at the results of our population sample survey, we can see that nearly half of survey responders indicated three to five years experience, and about 12% of users have more than five years of experience. This allows us to assume that about 60% of drone pilots are significantly adept to operating the aerial unmanned vehicles, and are most likely familiar with possible weather conditions, restricted areas, and other aspects, which is a very positive result since HelpCopter focuses on experienced users.

For what activities you use the drone most often?



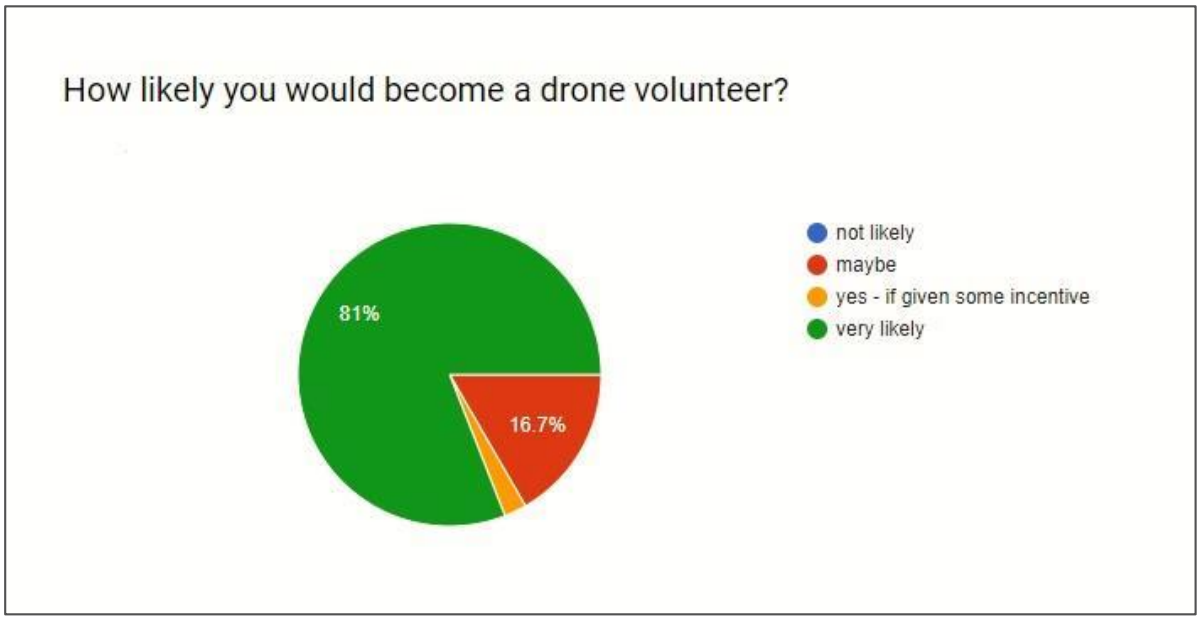
Possible options to choose from:

Recreational;
FPV (first person view, - drone racing);
Civilian – Search and Rescue;
Civilian – Other: Agriculture, Forestry, etc.;
Commercial – Aerial Photography;
Commercial – Other: Insurance, Aerial mapping, etc.

About 40% of responders operate drones commercially, - which gives us a clear indication that this percentage of responders are really adept in drone technology.

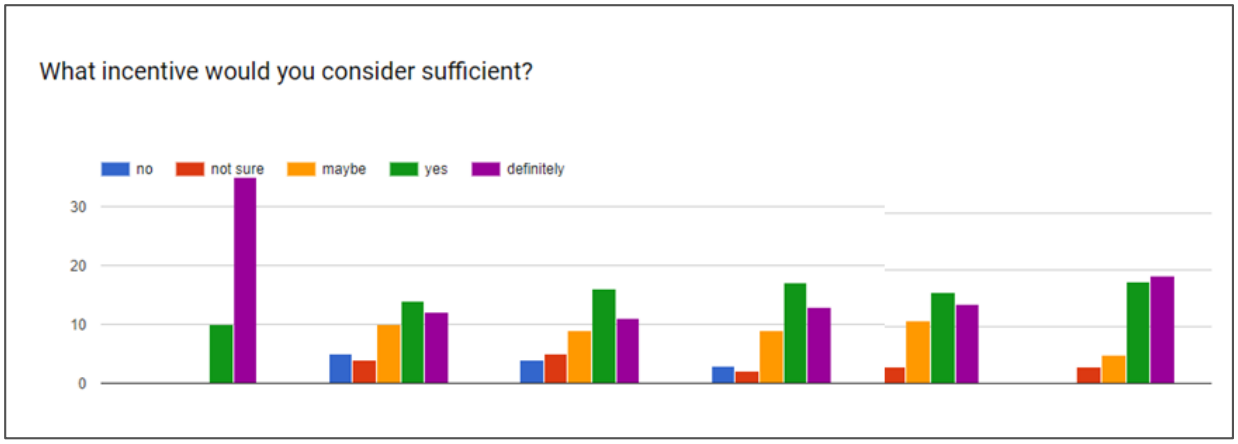
Absence of “Often” choice in civilian drone use is not exactly surprising, as the industry is still evolving, and only in recent years drone users started utilising their aerial vehicles for more diverse purposes than just aerial photography and general exploration from above.

How likely you would become a drone volunteer?



According to 81% of responders, they would very likely become drone volunteers. The sense of social responsibility is significant, which leads to the assumption that when HelpCopter platform becomes reality, it is quite possible that it will have a significant number of pilots ready to help.

What incentive would you consider sufficient?

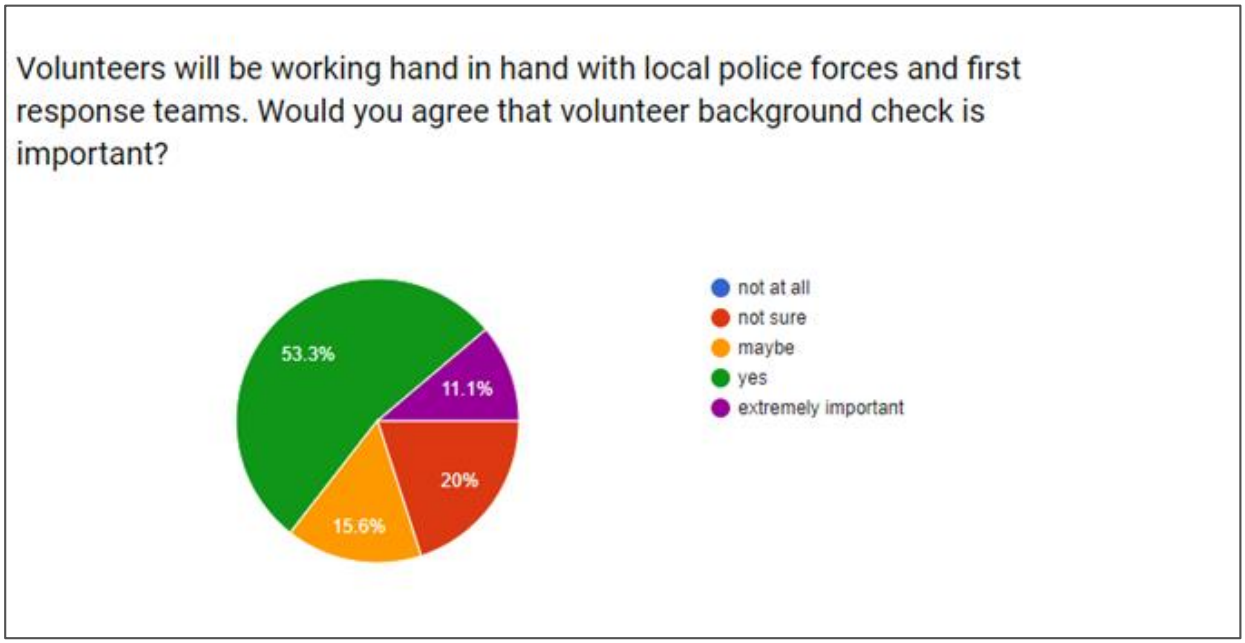


Options to choose from:

Knowing that I can help
Peer recognition
Social Media exposure
Official acknowledgement & reward of some sort
Monetary reward
Possibility of getting paid short-term contracts in the future

It is great to see that the sense of social responsibility is so strong and people want to help purely for the sake of doing a good thing. However, we cannot disregard other factors that might influence/ motivate people go get up and go out when needed, nevermind the weather or time of the day. Interestingly, possibility to book short-term paid jobs in the future (18 responders answered "Yes", 19 answered "Definitely", combined: 37) looks more appealing to people than, for example, monetary reward ("Yes" and "Definitely" combined: 30), or Social Media exposure ("Yes" and "Definitely" combined: 27).
Note: while options to choose from are indeed showing in a survey itself, in the results they only appear when hovered over. Another weakness in Google Forms.

Would you agree that volunteer background check is important?

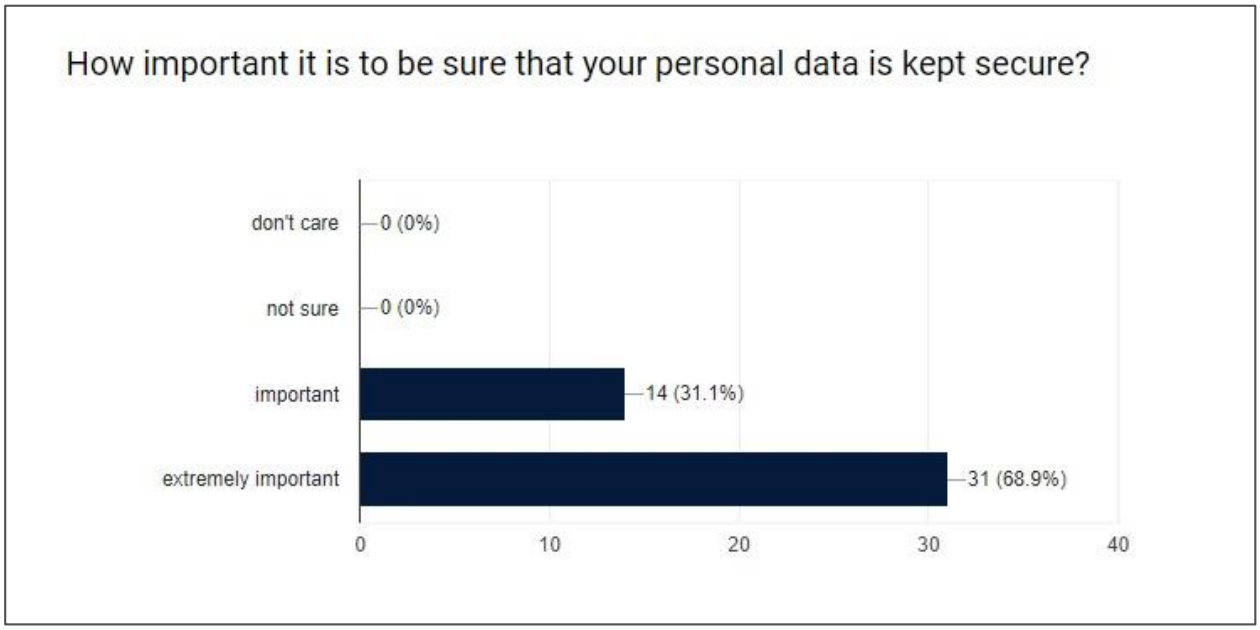


Only 64% of survey responders think that volunteer's background check is important.

According to regulatory body (interview 3), it is critically important to be ensure that all volunteers' background is checked. Garda vetting is required when working with any vulnerable groups. HelpCopter operations might potentially include vulnerable groups, and more often than not,- sensitive data. Possibly we need to try and investigate this deeper, to get to the roots of the issue and figure out which aspects exactly make users

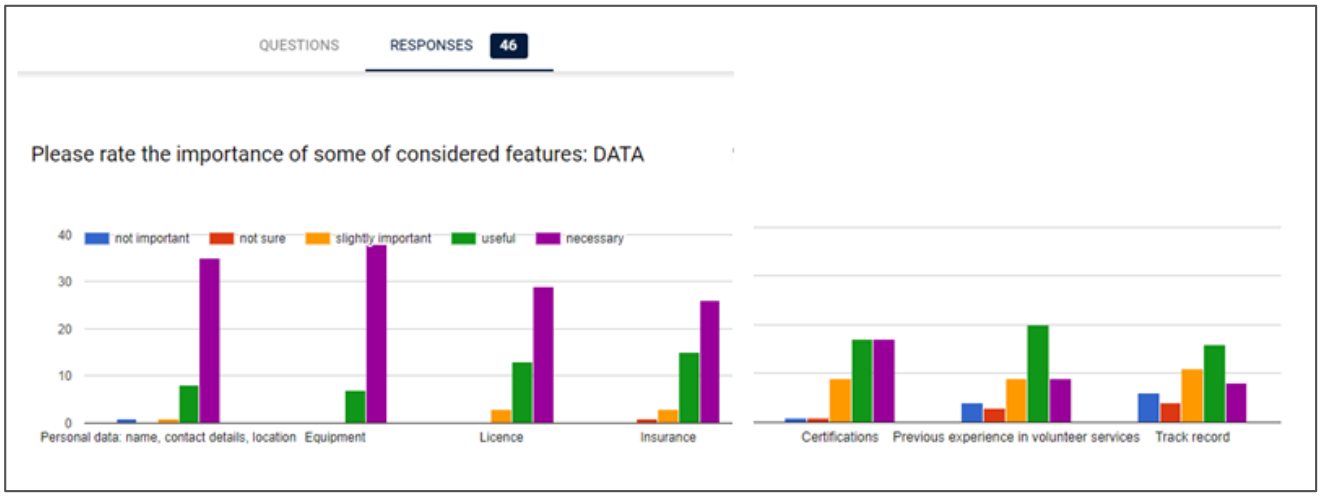
concerned. People that are well informed, are more likely to accept change, because they understand the need for it, and the benefits of that change.

How important it is to be sure that your personal data is kept secure?



Unlike the previous question, this one seems to be very clear to the survey responders. Absolute majority thinks that secure personal data is important.

Please rate the importance of some considered features: DATA



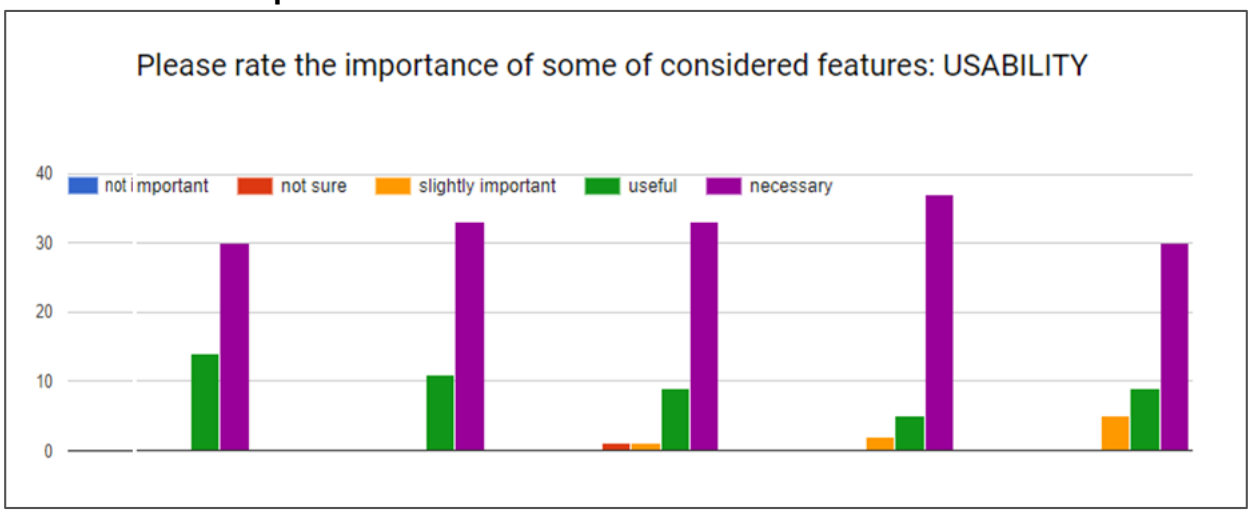
Options to choose from:

Personal data: name, contact details, location
Equipment
Licence
Insurance
Certification
Previous experience in volunteer services
Track record

While majority of responders think that HelpCopter should require certain personal and equipment data (35 and 38 responders respectively; the rest choosing “Useful” option), opinions become slightly more dispersed when we talk about licence and insurance (assumption: almost half of responders consider unlicenced and uninsured pilots to be a better help in emergency situations, than no help at all), and even more broadly divided regarding the rest three factors.

Dispersed “Track record” result (6 responders stated that it is “not important”, 4 responders were “not sure”) reflects the result of an earlier question regarding the background check (20% of responders were “not sure” if the background check is important).

Please rate the importance of some considered features: USABILITY

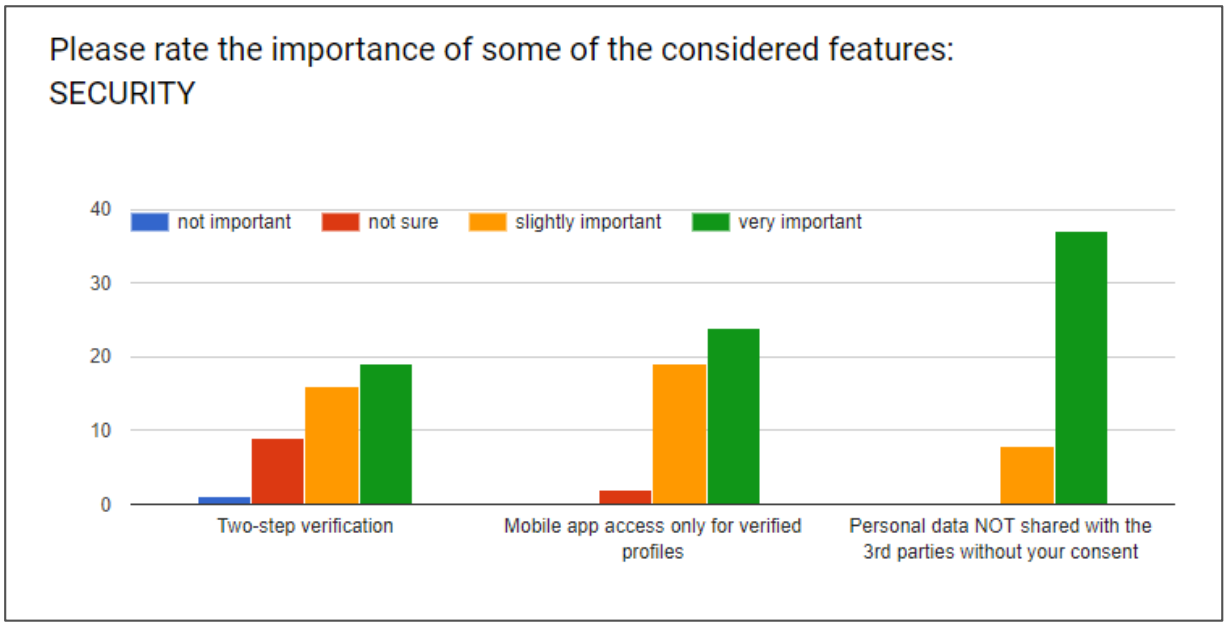


Options to choose from:

Simple navigation
Interactive map
Clear interface
Ability to adjust privacy settings
Ability to edit availability calendar

No surprises in this part of the survey. It was rather expected that the results would be somewhat similar. It is slightly disappointing that I did not come up with some more interesting factors that would be harder to predict. Although, that one person that was “not sure” about importance of clear interface raises my curiosity. “Not sure” because that particular responder have not yet seen a user interface that would be even slightly challenging, or “not sure” because the responder is not sure what the interface is about?

Please rate the importance of some of the considered features: SECURITY



In this instance we see quite different responses, “personal data not shared with 3rd parties” statement being agreed with very enthusiastically (37 responders stated that it is “very important”), “access for verified profiles” responses are slightly more scattered, and the question regarding two-step verification has responders’ opinions all over the place (only 19 responders stated that it is “very important”). Considering all three factors mentioned in this part are all really about the same thing- security of the personal data, I can only speculate that reluctance to recognize importance of two-step verification is caused by unfamiliarity with this feature and not knowing what it does and how it works. Which makes me stress the same point already highlighted earlier: we need to educate the public about the new things and new terms, about the sequence of steps needed to take us where we want to be, and the benefits of the final outcome, because well informed people make better choices and better decisions.

Conclusion

Conducting a survey was a great learning curve, allowing me to get a better insight into what features drone pilots consider useful, and which ones they tend to steer away from. In the future projects, I would dedicate an extra effort and time to craft more effective survey questions, possibly conducting survey pilot sessions with colleagues/ acquaintances rather than family and friends in order to avoid possible bias.

As noticed during this survey, people can be quite reluctant to answer open questions in survey questionnaire. That could have been a reason for a low responsiveness at the launch of the survey, 03 December 2017. Responsiveness improved when the open questions (paragraph format) were changed into “non-compulsory”. However, the responses to the open questions were not meaningful enough to be useful in requirements elicitation. Few open questions were not considered to be an issue at the start of the survey, and did not flag during survey pilot sessions. However, as noted for the future projects, it is significantly more effective to list simple questions with limited answer options in the survey, very carefully considering adding any open questions, yet the best - leaving open questions for the interviews.

I would not recommend using Google Forms for surveys in a corporate environment, as there are quite a few weaknesses, and would not look sufficient enough in a professional setting.

2.2.3. Interview results and evaluation

Interviews were the most effective requirements elicitation technique in this particular project: majority of requirements were derived using this particular elicitation technique, uncovering the best quality information on what would be the most useful features on this platform, evaluating the ones gathered during survey, and adding the new ones. I found the interview with IAA representative the most valuable, as it helped uncover some crucially important details that I did not consider before.

Through the course of this project requirements elicitation it has been noted that no matter how helpful the interview responders aim to be, the series of emails with questions and answers are no match to the face to face interaction. One of the drawbacks regarding the email interviews is that when interviewer feels that the answer could have been more elaborate, they can send another email to the responder with few follow-up questions, and hopefully get response in another few days. While in the responder’s mind, all the information they have shared during the first round of questions and answers might not be that fresh anymore, and sitting down again and thinking how to answer yet another few questions can sometimes be a nuisance. Situations like this are lose-lose for everyone involved. Initially, email interviews might look more suitable for the responders, as everyone is so busy with their day-to-day work. Initially, this kind of interview might

seem like an easy and time-efficient task. However, at the end of the day it often turns out rather the opposite, as all that time spent figuring out the most appropriate answers and not being able to ask interviewer to clarify certain details straight away, accumulates into a much bigger chunk of time than the actual face-to-face interview. To summarize that, it is strongly advisable to invest some extra effort and time into negotiating the personal meeting with the potential interviewee.

2.3. IEEE Requirements Specification

2.3.1. Purpose

IEEE (Institute of Electrical and Electronics Engineers) is one of the world's leading organizations in technology standards development, and having expertise in virtually all existing technology areas from computing to medical electronics (IEEE, 2018).

> As the project's objective is to prepare software requirement specification that is required and will be used by a customer, customer focus is critical, thus the customer (general/power user of the HelpCopter platform) perspective should be given primary emphasis, incorporating corresponding functional and non-functional requirements alongside. This kind of requirements arrangement will provide a better insight in system integration and corresponding relationships between requirements.

The key objective of using IEEE guidelines in Requirements Specification document for Helpcopter drone volunteer project is to create a formalized framework of requirements and sequential steps from where, given the opportunity of practical realization of the project, software development team could follow the requirements outlined in this document for successful HelpCopter platform implementation.

Both functional and non-functional requirements are the subtypes of ultimate solution requirements, and will be listed and described further in this section (2.3), while being separated, as per Software Requirements Specifications (SRS) good practice guidelines, into different user classes: User Class 1 - general user (in this case, drone volunteer), User Class 2 – power user (in this case, administrative body/ coordinating hub).

2.3.2. Scope

IEEE recommends that specification for a system or product would be created by collaborative efforts of representatives of both customer and supplier. It is taken into consideration in HelpCopter project, in terms of gathering requirements from all key stakeholders. Requirements to be addressed in this software specification document are functional (behavioural: what system shall do) and non-functional (addressing performance and quality issues).

IEEE defines requirement as an “externally visible function or attribute to the system” (UTDallas, 1993), that should not be confused with detailed sub-components of a system or its design.

Software requirements specification will serve as a roadmap for developers, and consider special characteristics of the HelpCopter project, but shall not impose or describe software constraints, implementation details.

HelpCopter software requirements specification will be ranked for importance, applying MoSCoW (Must, Should, Could, Won’t) framework. It will be modifiable to the sensible extend, considering both – possibility of the need for change in certain stakeholder requirements, and the possible risk of a scope creep if those changes are unauthorized and undocumented. Each requirement in this document will be traceable,- that is crucially important if during later stages of implementation it turns out that a certain requirement cannot be delivered or cannot be delivered on time, stakeholder that is a source of that requirement should be contacted and negotiated with.

List of requirements deliverables is outlined in a table below:

Requirement Type	Requirement Group	Rationale
Preliminary	Brainstorming	Gathering initial ideas
	Survey	Quantitative data gathered from survey responders
	Interviews	Qualitative data gathered from key stakeholders
	Prototyping	Rough sketch of how the website could look like
Functional	Authentication	Access is granted only to the user who authenticated correctly (Ping Identity, 2018)

	Authorization levels	Different levels of access to various functions
	Reporting requirements	Reporting to the authoritative bodies, Reflecting standards
	Work-flow	Clear semantics of the flow
	Legal/ regulatory	Health and safety, copyright
Non Functional	Performance	Response times, utilization
	Availability	Offline mode of work
	Usability	Ease of use and interaction with the system
	Integration	Standards compliance, GDPR compliance
	Security	Data encryption, Privilege based access to the system
	Configurability	Personalization
	Portability	Hassle-free transfer of a system to one software or hardware environment to another
	Reliability	Performance without failure under specific conditions, probability of failure

2.3.3. Requirements prioritization

MoSCoW prioritization technique was used in HelpCopter project to rate the gathered requirements on their importance.

MoSCoW technique helps to control the scope, and is a part of Dynamic Systems Development Method, widely used in Agile approach to project management (BABOK, 2015). It defines and specifies the priorities, separating them into following categories:

Must have: not negotiable, critical for project success;

Should have: important, but the final solution is still considered viable without them;

Could have: desirable; could be implemented having sufficient resources, but do not have significant impact;

Won't have: requirements that will not be delivered.

However, according to Agile Business Consortium, a specified timeframe can heavily influence the priority of the same requirement (Agile Business Consortium, 2018). Full list of derived requirements from a user's perspective is listed in a table below.

Abbreviations used in the table:
AB – Administrative Body
BR – Brainstorming
DP – Drone Pilots
DA – Document Analysis
Int1 – interview 1 (int2, int3, int4)
RB – Regulatory Body
SV - Survey
TL – Technical Lead

Req ID	Requirement	Priority: MoSCoW	Source
User Class 1: General User			
01	User can sign up to the application	MUST	BR
02	User can sign in to the application	MUST	BR
03	User can create the personal profile	MUST	BR
04	User can upload the picture	SHOULD	BR
05	User can input their equipment information	MUST	DP int1
06	User can input their UAV licence number information	MUST	SV
07	User can input their UAV licence Date Issued information	MUST	TL int2
08	User can input their UAV Insurance number information	MUST	SV
09	User can input their UAV Insurance Date Issued/ Renewed information	MUST	TL int2
10	User can input their additional qualification information	COULD	AB int4
11	User can input their experience information	COULD	AB int4
12	User can indicate whether it is a one person or a bigger team	COULD	DP int1
13	User can input the conditions they are confident flying at	SHOULD	DP int1
	User can indicate what equipment they are confident using	MUST	RB int3
14	User can input their contact details: phone number, email, city	MUST	DP int1
15	User can indicate the ways they prefer to be contacted (phone, push notification, email, all of above)	MUST	DP int1
16	User can delete their personal profile	MUST	BR
17	User can adjust privacy settings	MUST	TL int2
18	User can temporarily set their profile visibility ON / OFF	MUST	SV

19	User can access interactive map	MUST	SV
20	User can access the calendar for inputting days available/ unavailable	MUST	TL int2
21	User can access the system on both desktop and mobile devices	MUST	TL int2
22	User can adjust availability settings by certain week days (input <string> e.g, Not Available Saturdays, Sundays)	MUST	DP int1
23	User cannot browse other users' profiles	MUST	TL int2
24	User can contact coordination hub by phone and email	MUST	DP int1
25	User can participate in HelpCopter forum	SHOULD	DP int1
26	User can see their personal rating graph	WON'T	RB int3
27	User can electronically sign a Non Disclosure Agreement	MUST	DA
28	User can express their thoughts on a feedback board	COULD	RB Int3
29	User can save the password so application opens with one click	WON'T	RB int3
30	User can receive automatic updates on flying conditions	COULD	DA
31	User can receive a push notification when somebody comments in a forum	COULD	DA
32	User can download the complementary SAR software on their device	SHOULD	AB int4
33	User can input their SOP training information (Yes/No)	SHOULD	AB int4
34	User can track PCC/ SOP training dates <valid until>	SHOULD	RB int3
35	User can change the background colour on the application	WON'T	DA
36	User can have their personal data safely stored by coordinating hub	MUST	AB int4
37	User can receive push notifications about new posts on the website	COULD	DA
User Class 2: Power User			
38	Power user can log into the system	MUST	BR
39	Power user can alter access level to the system	MUST	DA
40	Power user can verify general user's profile	MUST	RB int3
41	Power user can register new general users	MUST	DA
42	Power user can browse general users' profiles	MUST	BR

2.3.4. High Priority Functional and Non-Functional Requirements, User Class 1

Requirement ID	01 User Class 1
User Requirement Definition	User can sign up to the application
Rationale	User must be able to sign up to the system, performing the inputs in all required fields.
Corresponding Functional Requirement	**Authentication:** The system shall prompt the user to input an email address, security question and a password. Security question must be one of the suggestions in a drop-down list, such as: primary school name, grandmother's name, first pet, etc. Password must contain
Corresponding Non Functional Requirement	**Access Security:** The system is safeguarded against unauthorised access from any external or internal sources. Email address must be input (typing) twice, not allowing copy-and-paste. Password must be case sensitive, at least eight characters length, and contain at least one capital letter, one number and one special character.
Importance / Priority	Must Have / High Priority
Traceability	BR

Requirement ID	02 User Class 1
User Requirement Definition	User can sign in to the application
Rationale	User must be able to log into the system in a safe manner. Due to security reasons only limited number of incorrect attempts to log in are accepted.
Corresponding Functional Requirement	**Authentication:** System shall prompt the user to input his login and password details. If the details entered are incorrect, system shall deny access. After multiple times (3) of incorrect details input in a row, system will not accept any more entries, and advice the user to contact the administrator.
Corresponding Non Functional Requirement	**Access Security:** System does not allow to save the password on the device. Password is not visible on the screen during password input.
Importance / Priority	Must Have / High Priority
Traceability	BR

Requirement ID	03	User Class 1
User Requirement Definition	User can create the personal profile	
Rationale	User must be able to create personal profile with brief introduction, experience, profile photo (optional) and other information that could be useful to the administrative body (here: user class 2 - power user)	
Corresponding Functional Requirement	**Work-flow:** System shall prompt user to input relevant information in “required” fields, and shall allow the user to input information in “optional” fields.	
Corresponding Non Functional Requirement	**Configurability:** information entries can be updated if/ when such necessity or desire arises.	
Importance / Priority	Must Have / High Priority	
Traceability	BR	

Requirement ID	05	User Class 1
User Requirement Definition	User can input their equipment information	
Rationale	As there is an option to use their own equipment during emergency operations, user needs to be able to enter the brand and a model.	
Corresponding Functional Requirement	**Authentication:** System shall indicate whether specific item of equipment in the entry is permitted to use during emergency operation.	
Corresponding Non Functional Requirement	**Accuracy:** only short list of unmanned aerial vehicles and other equipment is permitted. The characteristics and maintainability specifications of the equipment must comply with company standards.	
Importance / Priority	Must Have / High Priority	
Traceability	DP int1	

Requirement ID	06	User Class 1

User Requirement Definition	User can input their UAV licence number information
Rationale	Only licenced drone pilots can be HelpCopter volunteers, thus valid licence is a MUST.
Corresponding Functional Requirement	**Authentication:** System shall allow user to input the licence number, and verify it against the records of IAA. System shall not allow the user to submit the application if the licence number is invalid.
Corresponding Non Functional Requirement	**Integration:** licence number should be correct length, and contain valid combination of numbers and letters. Licence number should be verified in a timely manner, that is outlined beside the entry field for the user to see.
Importance / Priority	Must Have / High Priority
Traceability	SV

Requirement ID	07 User Class 1
User Requirement Definition	User can input their UAV licence Date Issued information
Rationale	Only licenced drone pilots that have their licence up to date can be HelpCopter volunteers.
Corresponding Functional Requirement	**Authentication:** System shall allow user to input the “licence Issued” information. System shall specify the correct way of inputting information.
Corresponding Non Functional Requirement	**Accuracy:** ”Licence issued” date must be in the past. “Licence valid until” date must be in valid period of time from the issue date. “Licence valid until” must be in the future. All date entries in the system must follow the same format: DD/MM/YYYY.
Importance / Priority	Must Have / High Priority
Traceability	TL int2

Requirement ID	08 User Class 1
User Requirement Definition	User can input their UAV Insurance number information

Rationale	As the user has an option to use their own unmanned aerial vehicle, they need to be able to input insurance number information.
Corresponding Functional Requirement	**Authentication:** System shall allow user to input the third party insurance number, and verify it. System shall not allow the user to submit the application if the insurance number is invalid.
Corresponding Non Functional Requirement	**Integration:** insurance number should be correct length. Insurance number should be verified in a timely manner, that is outlined beside the entry field for the user to see.
Importance / Priority	Must Have / High Priority
Traceability	SV

Requirement ID	09 User Class 1
User Requirement Definition	User can input their UAV Insurance Date Issued/ Renewed information
Rationale	User must be able to enter their Third-party insurance (compulsory) and Comprehensive insurance (desirable) information into the system.
Corresponding Functional Requirement	**Authentication:** System shall allow user to input the “licence Issued” information. System shall specify the correct way of inputting information.
Corresponding Non Functional Requirement	**Accuracy:** ”Insurance issued” or “Insurance renewed“ date must be in the past. “Insurance valid until” date must be in valid period of time from the issue date. “Insurance valid until” must be in the future. All date entries must follow the same format: DD/MM/YYYY; different format entries will not be accepted. If user is tries to enter wrong format, system shall display a notification with brief guidelines.
Importance / Priority	Must Have / High Priority
Traceability	TL int2

Requirement ID	14 User Class 1
User Requirement Definition	User can input their contact details: phone number, email, city

Rationale	Power user must be able to see which general users are located the nearest to the emergency operation's location. Also, general user might have to be contacted via their chosen communication channels for various reasons that are relevant to the HelpCopter platform.
Corresponding Functional Requirement	**Work-flow**: System shall prompt user to enter the required information. If user is tries to enter a different format, system shall display a notification with brief guidelines. If a user still has difficulties, the system shall advise to use Intercom chat.
Corresponding Non Functional Requirement	**Integration:** Each of the entries, except of the phone number, is described as Varchar (60 characters). Phone number description: Integer, 12 numbers (e.g., 353857858667); different format entries are not accepted.
Importance / Priority	Must Have / High Priority
Traceability	DP int1

Requirement ID	15 User Class 1
User Requirement Definition	User can indicate the ways they prefer to be contacted (phone, push notification, email, all of above)
Rationale	User must be able to choose what is the most suitable way to be contacted.
Corresponding Functional Requirement	**Work-flow:** System shall prompt user to enter the required information, offering to indicate primary way of contact. System then shall display the pop up window asking the user if they wish to add another way of contacting. If the user clicks "Yes", system will display a field where user can input a new entry.
Corresponding Non Functional Requirement	**Usability**: interaction with the system must be simple, easy to understand, and unambiguous. System's response to the user's entry will not take longer than 2 seconds.
Importance / Priority	Must Have / High Priority
Traceability	DP int1

Requirement ID	16 User Class 1
User Requirement Definition	User can delete their personal profile

Rationale	User must be able to delete their profile if they do not wish to be HelpCopter volunteers anymore, and they must be able to do it themselves, without waiting for administrator's permission.
Corresponding Functional Requirement	**Work-flow:** System shall request a user to confirm that they want to delete their profile/ user account. System shall prompt user to enter their password to confirm the action.
Corresponding Non Functional Requirement	**Usability:** Deleting of a profile/ user account must be hassle-free and not require anyone's authorization to perform this action. Process of deleting the profile will not take longer than 5 minutes.
Importance / Priority	Must Have / High Priority
Traceability	BR

Requirement ID	17 User Class 1
User Requirement Definition	User can adjust privacy settings
Rationale	Ability to adjust privacy settings is imperative.
Corresponding Functional Requirement	System shall display a radio button with an option to make a certain feature visible/ private beside each statement in the privacy settings menu.
Corresponding Non Functional Requirement	**Usability/ Personalization:** navigating through settings in the system should be easy and time-efficient. System's response to user's requests must take less than 2 seconds.
Importance / Priority	Must Have / High Priority
Traceability	TL int2

Requirement ID	18 User Class 1
User Requirement Definition	User can temporarily set their profile visibility ON / OFF
Rationale	Would the user wish to temporarily turn their profile visibility On/ OFF, they should be able to do so.
Corresponding Functional Requirement	System shall display a radio button beside the relevant field, indicating whether the profile visibility is currently set on "On" or "OFF".

Corresponding Non Functional Requirement	**Usability/ Personalization:** a single click required for a radio button mentioned above, indication of current settings must be clear to the user.
Importance / Priority	Must Have / High Priority
Traceability	SV

Requirement ID	19 User Class 1
User Requirement Definition	User can access interactive map widget.
Rationale	Accurate interactive map widget is imperative in first response operations.
Corresponding Functional Requirement	System shall display an interactive map widget indicating the user's location, the operation's location, and the proximity between these two points, along with the regular geo-tagging.
Corresponding Non Functional Requirement	**Accuracy:** System must work effectively with only minimal network requirements.
Importance / Priority	Must Have / High Priority
Traceability	SV

Requirement ID	20 User Class 1
User Requirement Definition	User can access the calendar for inputting days available/ unavailable
Rationale	User must be able to schedule the days that they are busy with other important events and cannot be disturbed, hence a calendar widget is an important component of the user interface.
Corresponding Functional Requirement	The system shall display a calendar widget on the user's personal page, where the user can input days available/ not available.
Corresponding Non Functional Requirement	**Usability:** performing inputs like adjusting the calendar to suit users' needs must be hassle-free and easy to remember.
Importance / Priority	Must Have / High Priority

Traceability	TL int2

Requirement ID	21	User Class 1
User Requirement Definition	User can access the system on both desktop and mobile devices	
Rationale	Whether using a desktop computer at home, or mobile phone anywhere at all, use needs to be able to access the application	
Corresponding Functional Requirement	System shall allow general user perform the same operations using mobile application, as using a desktop device.	
Corresponding Non Functional Requirement	**Portability/ Performance:** System performance quality, response times, performing inputs must be same efficient on all devices.	
Importance / Priority	Must Have / High Priority	
Traceability	TL int2	

Requirement ID	22	User Class 1
User Requirement Definition	User can adjust availability settings by certain week days (input <string> e.g., Not Available Saturdays, Sundays)	
Rationale	Apart of the calendar option to mark certain events, user must be able to input specific days of the week.	
Corresponding Functional Requirement	The system shall display the field where general user can input specific days of the week, marking them as available/ unavailable. System then shall display a message asking a user if they wish to receive a reminded about the current settings in three weeks in case they want to change it.	
Corresponding Non Functional Requirement	**Usability/ Personalization:** User must be able to opt out of receiving a reminder. System response to user's entry cannot take longer than 2 seconds.	
Importance / Priority	Must Have / High Priority	
Traceability	DP int1	

Requirement ID	23	User Class 1

User Requirement Definition	User cannot browse other users' profiles
Rationale	There are several other applications for browsing other users' profiles. HelpCopter focuses users on what matters the most.
Corresponding Functional Requirement	**Authorization:** System shall only allow power user (administrator) with an appropriate level of authorization to access general users' profiles.
Corresponding Non Functional Requirement	**Security:** General user can only see other general users' names when using HelpCopter forum or feedback board.
Importance / Priority	Must Have / High Priority
Traceability	DP int1

Requirement ID	24 User Class 1
User Requirement Definition	User can contact coordination hub by phone and email
Rationale	User needs to be able to contact the coordinating hub if any questions or issues arise.
Corresponding Functional Requirement	System shall display Intercom window for customer assistance at the bottom of every page. System shall display the email address in the Contact Us page. System shall display the telephone number with working hours in the Contact Us page.
Corresponding Non Functional Requirement	**Accessibility:** Coordinating hub representative must be available and willing to address possible issues/ queries during hours displayed in the Contact Us page. System must display defined timeframe for responding to users' queries.
Importance / Priority	Must Have / High Priority
Traceability	DP int1

Requirement ID	27 User Class 1
User Requirement Definition	User can electronically sign a Non Disclosure Agreement

Rationale	User needs to be able to electronically sign the required documents, instead of printing the document out, scanning it and sending back to the coordinating hub.
Corresponding Functional Requirement	**Legal/ Regulatory:** System shall display a pop-up window containing a message to make user aware that “electronic signature carries the same weight as hand-written signature. Do you wish to proceed?” When the user clicks “OK” button, the system shall generate the message “thank you, your signature has been recorded DD/MM/YYYY SS/MM/HH”.
Corresponding Non Functional Requirement	**Integration/ Compliance:** only users that have signed Non-Disclosure agreement are approved by the power user (either director or administrator) to use the system.
Importance / Priority	Must Have / High Priority
Traceability	DA

Requirement ID	36 User Class 1
User Requirement Definition	User can have their personal data safely stored by coordinating hub
Rationale	Since the new General Data Protection Regulations are not just guidelines, but the law, all organizations must ensure that personal user’s data is stored safely.
Corresponding Functional Requirement	**Legal:** System shall only require data that is absolutely necessary. System shall send user’s data to the safe cloud server. System shall send the alert to both general and power users in case of data security breach.
Corresponding Non Functional Requirement	**Security:** Advanced antivirus software must be integrated into the system. If the security breach occurs, system shall send the security breach alert immediately.
Importance / Priority	Must Have / High Priority
Traceability	AR int4

2.3.5. High Priority Functional and Non-Functional Requirements, User Class 2

Requirement ID	38	User Class 2
User Requirement Definition	Power user can log into the system	
Rationale	Power users must have access to the system.	
Corresponding Functional Requirement	**Authentication:** System shall allow power user to input their unique login and password details. System will require user to answer security question if the details entered incorrectly.	
Corresponding Non Functional Requirement	**Security/ Usability:** Password must be case sensitive, and include at least one capital letter, one number and one special character. System shall alert the top tier power user (director) if another power user (administrator) inputs the login details incorrectly more than 3 times.	
Importance / Priority	Must Have / High Priority	
Traceability	BR	

Requirement ID	39	User Class 2
User Requirement Definition	Power user can alter access level to the system	
Rationale	Top tier (director) power user must be able to authorize or revoke other power users (administrator) access to the system.	
Corresponding Functional Requirement	**Authorisation:** System shall allow different levels of access to different tiers of power users: director and administrator.	
Corresponding Non Functional Requirement	**Security:** Only top tier (director) can register new power users onto the system, or terminate their access to the system in case of redundancy.	
Importance / Priority	Must Have / High Priority	
Traceability	DA	

Requirement ID	40	User Class 2
User Requirement Definition	Power user can verify general user's profile	

Rationale	Power user is an administrator of HelpCopter system, thus is responsible for verification of the profile, performing inquiry issue to Irish Aviation Authority and Garda Síochána.
Corresponding Functional Requirement	**Regulatory/ Reporting:** The system shall accept user's inputs and send an inquiry to the regulatory bodies.
Corresponding Non Functional Requirement	**Integration/ Compliance:** Profile verification should not take time longer than stated to the general user, unless under unforeseen special circumstances, in instances of which general user will be issued a notice of delay.
Importance / Priority	Must Have / High Priority
Traceability	RB int3

Requirement ID	41 User Class 2
User Requirement Definition	Power user can register new general users
Rationale	Power user (administrator) needs to be able to register new volunteers (general users) onto the system.
Corresponding Functional Requirement	**Performance:** The system shall prompt power user to enter their unique identifying code when the request to access new users' registration section is made. The system shall prompt power user to enter their unique identifying code again when the new user entry is made, to confirm the entry.
Corresponding Non Functional Requirement	**Security:** Only a power user with an adequate login criteria (privilege based access) can register new general users, e.g., such permission is not granted to customer support and technical support representatives. The system shall not allow any power user to modify any other user's profile.
Importance / Priority	Must Have / High Priority
Traceability	BR

Requirement ID	42 User Class 2
User Requirement Definition	Power user can browse general users' profiles

Rationale	Power user must be able to see all general users' profiles, including activity status, in efficient and effective manner.
Corresponding Functional Requirement	**Performance:** The system shall generate and sort general users' profiles according to chosen inputs/ variables: location/ proximity to first response operation, profile activity status (active/ inactive; last active DD/MM/YYYY), prior operations participated in, SOP holder (Y/N), etc.
Corresponding Non Functional Requirement	**Integration/ Reliability:** search request should be processed in less than 3 seconds. Power user should be able to rely on the system to be up at least 98% of the time.
Importance / Priority	Must Have / High Priority
Traceability	BR

Section 3 – Literature Review

3.1. Regulatory Framework Guidelines

Working on the project that involves innovative, -and still evolving,- drone technology, huge emphasis must be placed to exploration and analysis of relevant regulations and rules. Regulatory framework guidelines used in this document are following:

- ✓ European Aviation Safety Agency (EASA):
  - Civil Unmanned Aircraft: definition and characteristics of small unmanned aircraft, distinguishing the differences between Open, Specific, and Certified categories of drone operations (EASA, 2014).
  - Regulatory framework background: elaborates on safe operation framework guidelines based on risk assessment and performance, considers technical and operational requirements for unmanned aerial vehicles and other aspects of the upcoming new EU drone regulations (EASA, 2018).

- Perspective on Drones and Aviation Roadmap: on-air interview, outlining the reasons behind the drone regulations (EASA, 2016).
- Safe drone operations in Europe: a “Formal Opinion” publication, of a significant milestone in European Union drone flying regulations and drone design requirement regulations development (EASA, 2018).

✓ Irish Aviation Authority (IAA)
- Small Unmanned Aircraft and Rocket Order (2015): the order mentioned here came into effect in December 2015. It lists all current rules and regulations (distances, air conditions, restricted zones, training required, safety concerns, etc.), and outlines conditions for permissions and exemptions of the drone use. It is important to note that while at the moment Small unmanned Aircraft and Rocket Order is the central regulatory framework in Ireland, this particular document is due to become obsolete when EU drone regulations under European Aviation Safety Agency take over at the end of 2018.

✓ Data Protection Commissioner
- Guidance on the use of Drones: described rules of drone use in domestic (recreational) and commercial purposes, emphasising the importance of transparency and compliance with data captured by unmanned aerial vehicles, storage, security and access regulations (2015).

3.2. Requirements Elicitation Techniques

Overview

The goal of requirement elicitation is to “discover the real needs behind the project, not to gather as many elicitation techniques as possible, assuming the more- the better” (Brandenburg, 2011)

A Guide to the Business Analysis Body of Knowledge® (2015) identifies following steps for requirements elicitation:

✓ Preparation: definition of scope (allows to stay on track), and desired outcomes, identification of stakeholders Power/ influence matrix, RACI chart) and their engagement approach, selection of appropriate techniques, supporting material (regulations, historical data, business policies) and resource (human resources, material, financial and other resources) planning.

✓ Conducting elicitation: Collaborative elicitation is the most widely used. It involves active interaction with stakeholders and that have a high level of expertise in fields relevant to the project, hence it allows to rely on their experience (e.g., interviews,

requirements workshops). As there is often aspects that are unknown to the stakeholders, Research type of elicitation is commonly used for systematic study of information derived from secondary sources: historical data and publications, to identify good practices, trends and other variables needed for the project. In certain cases, the necessary information cannot be obtained from primary or secondary sources described above, but only by conducting specific tests, or, as defined in BABOK Guide, Experiments (e.g., active or passive observations, and prototypes).

- ✓ Confirming results: elicited information must be checked for consistency and possible errors by comparing it to other elicitations results and collaboration with stakeholders (e.g., some information gathered in survey can be incorporated into interviews with stakeholders, to get their expert opinion regarding the matter).
- ✓ Communicating Business Analysis data to stakeholders: all stakeholders need to have shared understanding of the information derived from elicitation, as it directly contributes to a decision making. They need to be engaged throughout the project lifecycle, choosing forms of communication that are easily understood and cannot be misinterpreted. It can include presentations, reviews, workshops, and either formal or informal documentation (text, diagrams, etc.).
- ✓ Managing stakeholder collaboration: We need to keep in mind that stakeholders' roles, power and influence levels, and most commonly, - attitudes, can change during the project lifecycle, and this must be addressed in terms of continuous monitoring and readiness to work on diminishing possible negative effects and emphasising strong positive relationship based on mutual trust (BABOK®, 2015).

Brainstorming

Brainstorming is the most common data gathering technique involving a group of participants, with a goal to produce a large set of diverse options, ideas, and solutions to the problem that the participants are introduced to prior the brainstorming session. Prior the session, the timeframe, way of recording ideas, the evaluation criteria have to be established, and the session facilitator to be appointed.

Brainstorming is usually divided into two main activities: performing brainstorming session, where the goal is to gather as many ideas as possible, encouraging everyone to participate (facilitating a non-judgemental environment) and writing the ideas down on the whiteboard or a sheet of paper; and the analysis of gathered information, sorting it into meaningful groups (Goldsmith, 2016). Wrap-up activity is very important as it's when the gathered ideas are rated and organized. BABOK Guide (2015) suggests several limitations to the brainstorming, such as organizational culture and politics, or individual characteristics (confidence, willingness to actively participate).

Interviews

Interview is one of the most fundamental requirement elicitation techniques, allowing the interviewer to gather the qualitative insight into the subject matter by asking well-formulated open-ended questions, and allowing the interviewee to express what they really think about the specific subject. According to Goldsmith (2016), four most important things to keep in mind before conducting the interview are:

1) Preparation is the key: investigate interviewee's background, area of expertise, how familiar they are with the nature of the project in question.
2) One person at a time: it is strongly advised against interviewing several people at once, as it reduces the level of attention to each interviewee as well as the overall interview effectiveness.
3) Asking open questions: let the interviewee set the direction of the topic, only lightly guiding it to stay in scope, rather that ask close-ended questions that would not allow for better insight into the matter. Open-ended questions give opportunity for the interviewee express what they really think, and might pivot the whole interviewer's understanding about the topic, setting the different direction for the further project development, as it happened in the interview 4, HelpCopter project.
4) Follow up: best information often comes from follow up questions to unexpected answers. Interviewer's listening skills and curiosity are crucially important for the quality of the interview (Goldsmith, 2016).

Ideally, interviewer should use a combination of predefined questions and impromptu (unscripted) questions. Interview success heavily depends not just on interviewer's experience and skill to ask right questions as well as document them, but also of responder's readiness to supply a sufficient amount of meaningful information that would enable the interviewer to form an opinion (BABOK, 2015).

Survey

Think about the ways the survey will be distributed: will the responders be approached in-person, outreached by mail/ email, phone, or online. The chosen mode can potentially to a degree influence the effectiveness of the questions, thus it is important to think how the questions will sound (in-person), or how they will look (online, mail). Whichever mode is chosen as the most appropriate, it is highly advisable to conduct a pilot survey session in a small group of colleagues or friends, to gather their feedback and possibly some ideas how specific questions in the survey could be improved. Survey focuses on gathering quantitative data, hence Chase Harrison of Harvard University (2007) suggests keeping survey questionnaire short and clear, with concise question response options (e.g., NOT AT ALL, MAYBE, PROBABLY, DEFINITELY). The filtering of population sample that we want to survey is absolutely imperative in terms of critical need to keep

the questions relevant and applicable to the responders. The nature of questions to be asked in survey questionnaire can influence the size of population sample, in example, if we are preparing survey for undergraduate students in Ireland, it is quite realistic to assume that receiving a 100-150 responses will be not just feasible, but relatively easy and time-efficient. However, if we are to survey licenced drone pilots, expecting the same amount of responses would be rather ambitious, considering that currently in Ireland, according to Irish Aviation Authority, are only about 6000 licenced pilots. Therefore, we need to know out target population and have realistic expectations.

The main rules for writing survey questions are:

- ✓ Write the questions that can be interpreted the same by all respondents: survey has to be relevant.
- ✓ Avoid complex wording and technical jargon.
- ✓ One question at the time: do not try to incorporate few questions into one, it is only confusing.
- ✓ Open questions are valuable during interviews, but need to be carefully considered for use in surveys, as they are difficult to analyse due to complexity of sentiment tone interpretation (Bernazzani, 2018), and could also enhance the risk of respondents not willing to spend too much time thinking what to answer and not finishing survey at all.
- ✓ Rating scales points (ideally, from 4 to 7) must be clearly labelled and each point should be evidently higher or lower than the other ones (for example, it is nearly impossible to distinguish the difference between “Little bit”, “barely”, “not really”, as they carry pretty much the same weight).
- ✓ Try to limit dichotomous questions that only allow responders to choose between two options (Bernazzani, 2018). While it is quick and easy to analyse, it only provides us with minimal amount of information.
- ✓ Carefully plan options of possible answers to the question so there is no missed responses (Harrison, 2007).

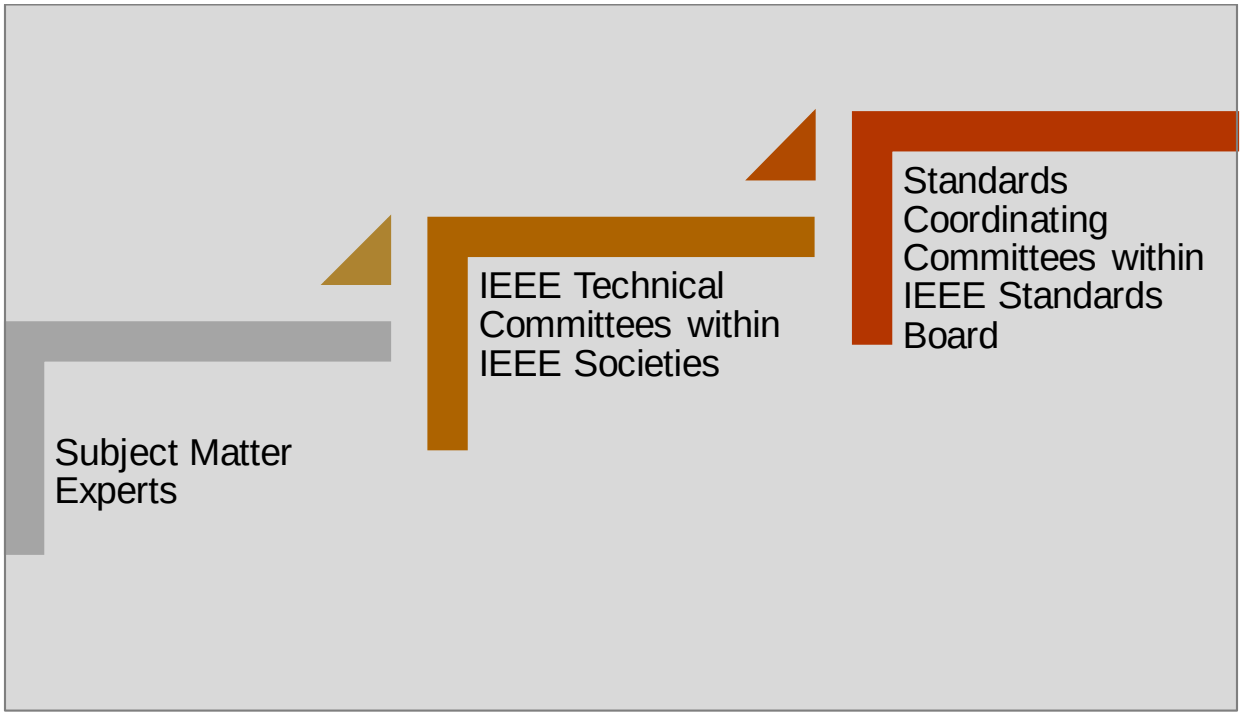
Harrison advises not to reinvent the wheel, but rather use an extensive existing survey questions resources, where the reliability of the concept that we want to measure, is most likely already tested.

3.3. IEEE Standards

IEEE standards are a result of a worldwide collaborative effort of subject matter experts in virtually any technology field, from Aerospace and Geoscience to Ferroelectrics and Frequency Control to Cybernetics and Solid State Circuits. Organization’s goal is to inspire innovation and educate tech community around the globe through conferences,

technical standards, and knowledge sharing through various cited publications (IEEE, 2018). While IEEE Standards Board clearly states that use of developed standards is voluntary, serves as a guidance and good practices, and does not imply that it is the only right way to test, measure, produce and perform any other activities relevant to IEEE scope, absolutely all IEEE standards are reviewed by experts every five years to reaffirm the relevance and accuracy of each standard, thus are widely trusted and recognized by academia as well as engineering and technology SMEs (UTDallas, 1993).

The contributors to research, projects and standards development are members of IEEE societies within IEEE Standards Board, sharing their knowledge and expertise voluntarily (without pay). The simple representation of IEEE structure is outlined in a figure below.



IEEE structure, source: The University of Texas and Dallas, 1993

According to IEEE rules, each developed technology standard has to go through several committees, where it is analysed, evaluated and finally approved, in order to be considered valid. As stated by The University of Texas and Dallas (1993), software requirement specification (SRS) standard was developed by Software Requirement Specification Working Group, as a result of consensus of fourteen SMEs, reviewed by forty-five members' balloting committee, which then presented SRS standard to the IEEE Standards Board for approval.

Recommended practice of IEEE software requirement specification standard stresses the importance of taking into account a broad spectrum of background information when writing any software requirement specification document, including nature and evolution of software requirement specification, applicable inputs, preparation required, SRS

environments, characteristics, and prototyping, as well as other aspects. Some of the core aspects is elaborated on as follows:

Nature of software requirements specifications: importance of addressing functionality, system performance (e.g., recovery and response time, availability, etc.), maintainability and security attributes, and possible design implementation constraints (that encompasses all possible issues such as resource limitations, General Data Protection Regulation effect on databases, operating environments, standards required for a particular project, etc.).

Environments of software requirements specification: As stated by IEEE, correctly written software requirement specification should limit the range of designs options, without specifying any particular design and implementation details (UTDallas, 1993).

Characteristics: According to IEEE guidelines, good, well written requirement specification document should reflect the customer's / user's needs. Ability to trace each requirement to its source diminishes the risk of committing inaccuracy and ambiguity errors. Standard definitions should be used to enhance the internal consistency of the document. Each requirement must be verifiable, in other words, either a person or a specific machinery needs to be able to test it.

Prototyping: Early and more frequent prototyping enables for a better understanding of stakeholder needs, provides feedback, and limits the need for change in the product development stages.

IEEE identifies a list of non-functional requirements: Reliability, Availability, Security, Maintainability, Portability, and others, however, it recommends the business analysts to pick the ones that are appropriate and most relevant for a specific project, instead of addressing all of them just because of assumption of a good practice.

3.4. Conclusion

The purpose of the literature review is to represent the background of the research study conducted for the project in question. How the review is organized, highly depends on the availability of historical and current data sources, and a nature of the project itself. Ultimately it is the nature of the particular project that dictates (or at least, heavily influences) the approaches to organizing the sources of literature review. University of West Florida (2018) suggests Chronological approach for the reviews that encompass a significant amount of historical data, - e.g., sorting literature sources by time of publication, or trends, would be examples of chronological method.

In the literature review of this document, the sources are organized using Thematic approach, as organizing the sources relevant to the specific topics rather than

progression of trends the author considers it to be the most sensible approach for this particular project (UWF Libraries, 2018).

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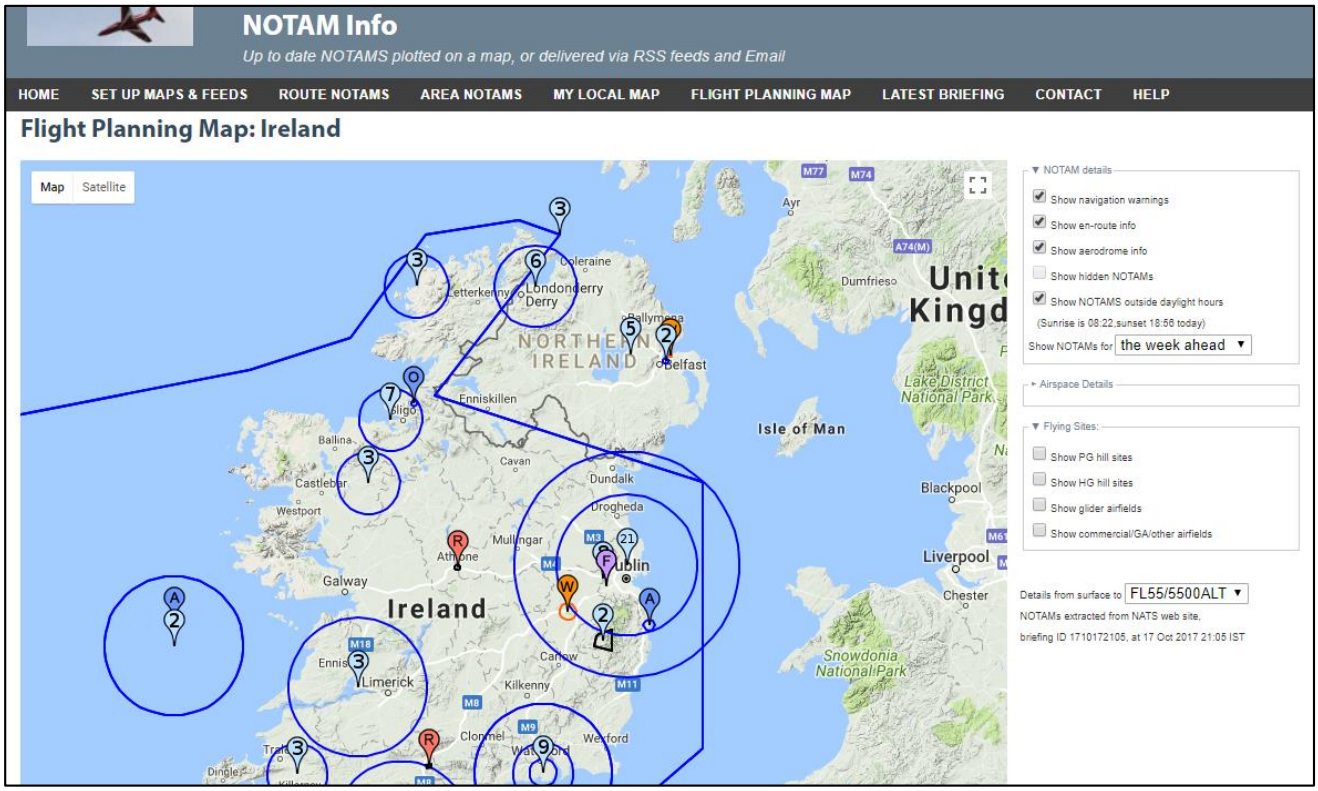
Appendices

Appendix 1.: NOTAM info



NOTAM Info (2017)

Appendix 2.: Reflective Journal

Reflective Journal

Jurgita Dumblyte 14110644

BSHTM4

X14110644@student.ncirl.ie

September 2017

During the second part of September 2017 I thought through the idea that was lingering since my work placement in Skytango in the first half of the year.

Skytango is an aerial content marketplace, helping people to make the money with their drones, and I thought that drones could be used for just for commercial purposes, but for volunteering in emergency situations.

Project supervisors are not assigned yet, will have to wait and see what my supervisor thinks about this idea.

October 2017

This month, I came up with the name for my project – HelpCopter (it is probably a bit too plain, but I think it describes the company profile perfectly, will have to check with my supervisor Pat Delaney after the reading week).

In between work, college, kids and assignments, I was not successful in completing the project proposal in time: some parts are still all over the place. Which is disappointing.
Did not add the project plan yet, as it did not look presentable enough. Will add it before the end of next week.

In the nearest couple weeks, I will elaborate on introduction, scope, SWOT analysis and, most importantly, focus on requirements. Looking forward to next Thursday's session with Dr. Eugene O'Loughlin.

The trickiest thing that I have to think through in the nearest weeks is Coordinatory Hub. It does make sense having it, I suppose. I was just not considering it at the start, I believe it will slightly change things.

Supervisor Meetings:
Had two very informative group meetings before the reading week. It was decided that from then on, there will be individual meetings, as all generic information was discussed and rules established. WhatsApp group has been created, in case there is any updates for the whole group, or somebody might ask questions that would be possibly interesting to other people, as well.

November 2017

Reading week:
Updated the project proposal. Initially felt bad about not doing it right the first time, but then thought, that well, it is a living document, after all. It supposed to change and evolve thorough the whole process.

Nov. 10:
Yesterday had an information session with Dr. Eugene O'Loughlin. Went through what is expected from us in mid-term presentation, and pin-pointed what has to be done until then. Very

little time, need to stay focused. Half of a class started making fuss about stuff not being put up on moodle (while it's definitely there since the start of semester)..typical.

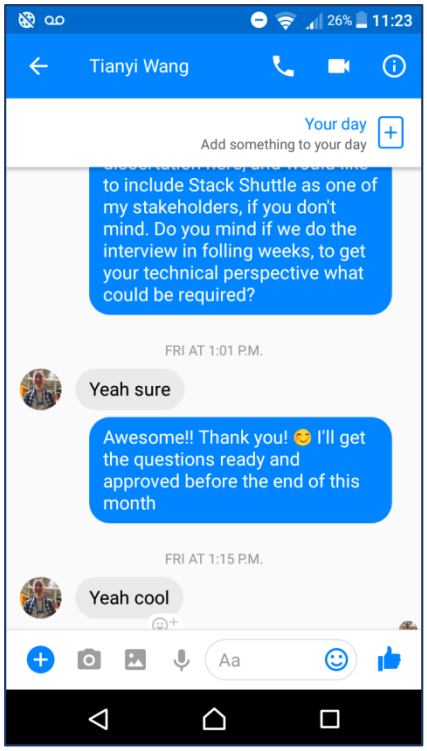
Nov. 16:
Great. Celebrating my birthday with cake in one hand, and BABOK in the other one. Fourth year though, should be used to it by now.

Nov. 17:
Had a meeting with our project supervisor Pat Delaney. It is odd, that it feels like more mess, and more clarity at the same time. There are certain aspects that I haven't considered at the start of the project, and I am dreading the headache trying to sort that out; but at the same time, I feel more informed and actually capable on getting it done.

Will have to upload preliminary requirements in a week. An example from last year looks pretty straightforward. Is that a trap?? Should I really keep it simple? It wouldn't hurt, of course- I am quite up to my eyelashes with lectures, work, assignments, kids and housework. But will it be enough to get me the marks I want?

I need more coffee.

Tianyi Wang, founder of software company Stack Shuttle, is on board! He is very interested in the project, agreed for the interview to get a technical perspective. Hopefully that also means that my coordinator hub issue is sorted? Will have to work on it.



(..cannot believe I made a typographical error. SHAME!!!)

Nov. 21:

Few days left until preliminary requirements document upload, and each day I get more and more ideas what to add to it, and what to research when I get any free minute. More and more layers to wrap on the initial document, I really start getting a buzz of it.

Have to finish the survey by the end of the month, and at least two sets of interview questions by the same time. Another couple sets might be left for the start of December.

December 2017

Presentation went alright..i guess. Not as good as I wanted at all, but then, it is all my own fault – trying to juggle too many things at the same time does not always work out and I have to make note for the future, to REALLY focus and invest adequate time into preparing something. This project is a priority number 1, and I should treat it like that.

January 2018

Had a meeting with a project supervisor Patrick Delaney yesterday.

Received some feedback, that I should try and look into this project from the project manager perspective. And yes, at this moment I already understand what he meant, - however, the project management module would have been really handy last semester, would have given me much better start with my project. I do not count the "Team Project" module that we had previously for obvious reasons, that were expressed in the module feedback. But the project management that we are having this semester, is really useful and I have a list of headings that I need to include to make the whole document more comprehensive.

February 2018

Had a session with Sam Cogan regarding our WordPress website. It looks quite straightforward, will just need to work on it from home, as computers just started freezing when whole class tried to log into that 000webhost website…At least have half a page of notes, so I won't forget what was said in class…

Another session with Sam, a week later. Not much new, was just shown few add-ons that would be good to install to give website more functionality.

Downloaded nice little voice recording application. Free version, but sound quality seems pretty decent. Will come in really handy doing the interviews (yes, I'm not giving up on trying to get people to actually talk to me, not just answer the interview questions by email).

March 2018

I'm just thinking that it would have been really really great if we had Agile Project Management module earlier in the course. Could've used Trello (the project planning and time management software) from the very start, it's so handy. Now there is not much point to start it half-way.

Our showcase photos, all – good ones and bad ones,- are available for public on Tumblr..?? yikes…Not sure I feel great about that. Not sure at all….

Okay. Minimum amount of interviews is two. Desirable – three. That means, I should get four if I want a good grade. That alone, of course, won't same me, but "whatever you do, do the best you can", so, heh, need to exceed expectations. Even a tiny bit.

Two sets of interview questions (for the Technical lead and professional drone pilots) are approved, will send them out asap. Now have to be a bit braver and approach somebody at Irish Aviation Authority. Cool face. Deep breaths. Be Professional.

Appendix 3.: Survey Questionnaire

> At the top of survey questionnaire include short introduction about HelpCopter platform, explain its purpose, mission, and why the drone pilots' opinion is important.
> Responders to be reached out to via Social Media channels.
> All questions to be marked as "mandatory".

Questions:

1. **Please state your age**
   Options: 18-25, 26-35, 36-45, 46-55, 56-65, over 65, prefer not to say.

2. **Please state your gender**
   Options: female, male, other, prefer not to say.

3. **Please state your occupation**
   (short answer)

4. **What purpose do you use your aerial equipment for, the most?**
   (multi-choice grid)

	Never	Occasionally	Often
Recreational			
FVP			
Civilian – Search and Rescue			
Civilian - Other (agriculture, forestry, etc.)			
Commercial – Aerial photography			
Commercial - Other (aerial mapping, insurance, etc)			

5. **How many years of drone pilot experience do you have?**
   Options: less than 1 year, 1-3 years, 3-5 years, 5-8 years, over 8 years.

6. **How likely you would become a drone emergency services volunteer?**
   Options: not likely, maybe, yes-if given some incentive, very likely.

7. **What incentive would you consider sufficient?**
   (multi-choice grid)

	No	Not sure	Maybe	Yes	Definitely
Knowing that I can help					
Peer Recognition					
Social Media exposure					
Official Acknowledgement & reward or some sort					
Monetary reward					
Possibility of getting paid short-term contracts in the future					

8. **Volunteers will be working hand to hand with local police forces and first-response teams. Would you agree to the background check when signing up?**
   Options: Not at all, not sure, maybe, yes, extremely important.

9. **How important it is to be sure that your personal data is kept secure?**
   Options: Don't care, not sure, important, extremely important.

10. **Please rate the importance of some of the considered features: data**
    (multi-choice grid)

	Not important	Not sure	Slightly important	Very important
Personal data: name, contact details, location				
Equipment				
Licence				
Insurance				
Certifications				
Previous experience in volunteer services				
Track record				

11. **Please feel free to add any thoughts in regards to the question 11**
    (paragraph)

12. **Please rate the importance of some of the considered features: usability**
    (multi-choice grid)

	Not important	Not sure	Slightly important	Very important

Simple navigation				
Interactive map				
Clear interface				
Ability to adjust privacy settings				
Ability to edit availability calendar				

13. **Please feel free to add any thoughts in regards to the question 12**
(paragraph)

14. **Please rate the importance of some of the considered features: security**
(multi-choice grid)

	Not important	Not sure	Slightly important	Very important
Two-step verification				
Mobile app access only for verified profiles				
Personal data NOT shared with the 3rd parties without your consent				

15. **Please feel free to add any thoughts in regards to the question 14**
(paragraph)

16. **Do you feel that something important is overlooked?**
(paragraph)

Appendix 4.: The Proof of Interview Participants

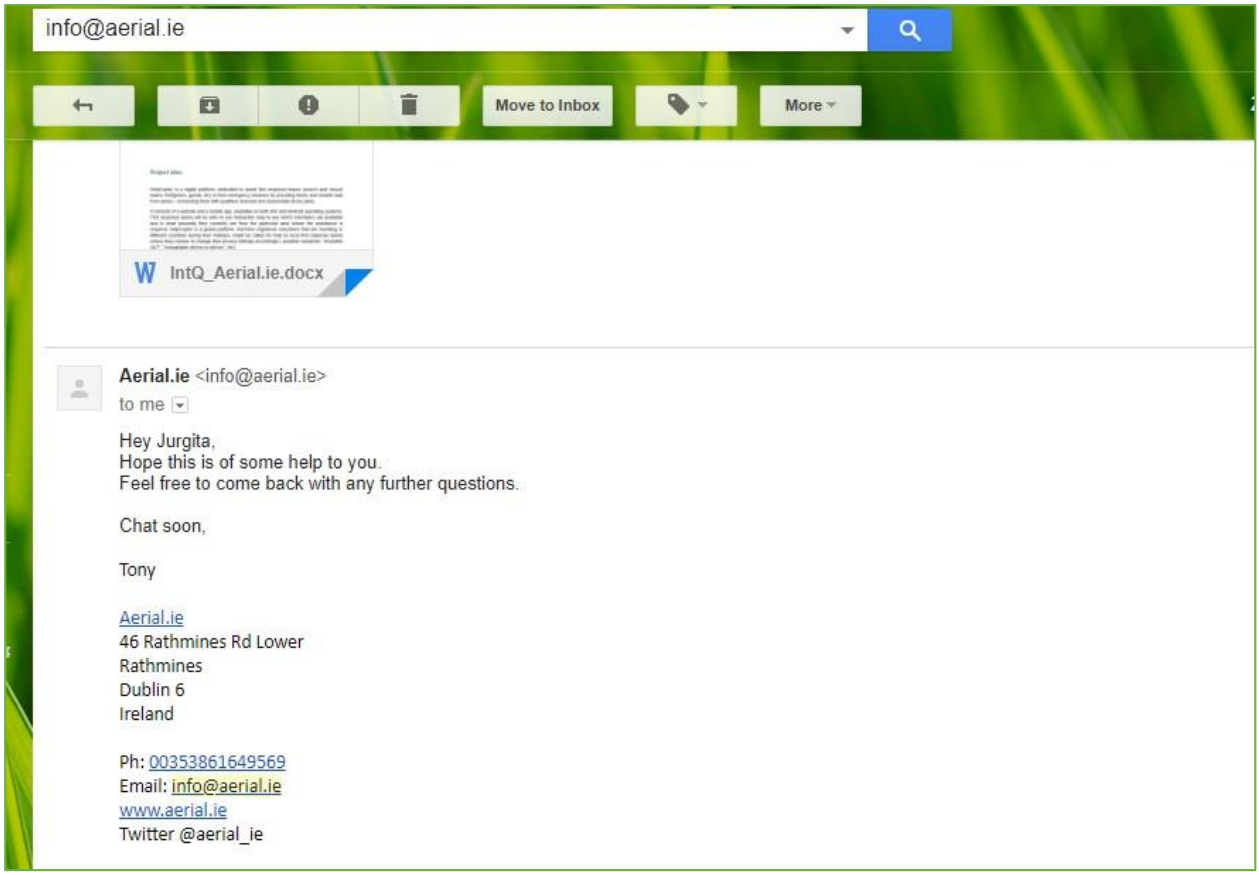
This section contains personal information of the interview participants, including names, email addresses, and copies of consent forms.

Examiners are very welcome to contact the participants with any questions regarding the Helpcopter project.

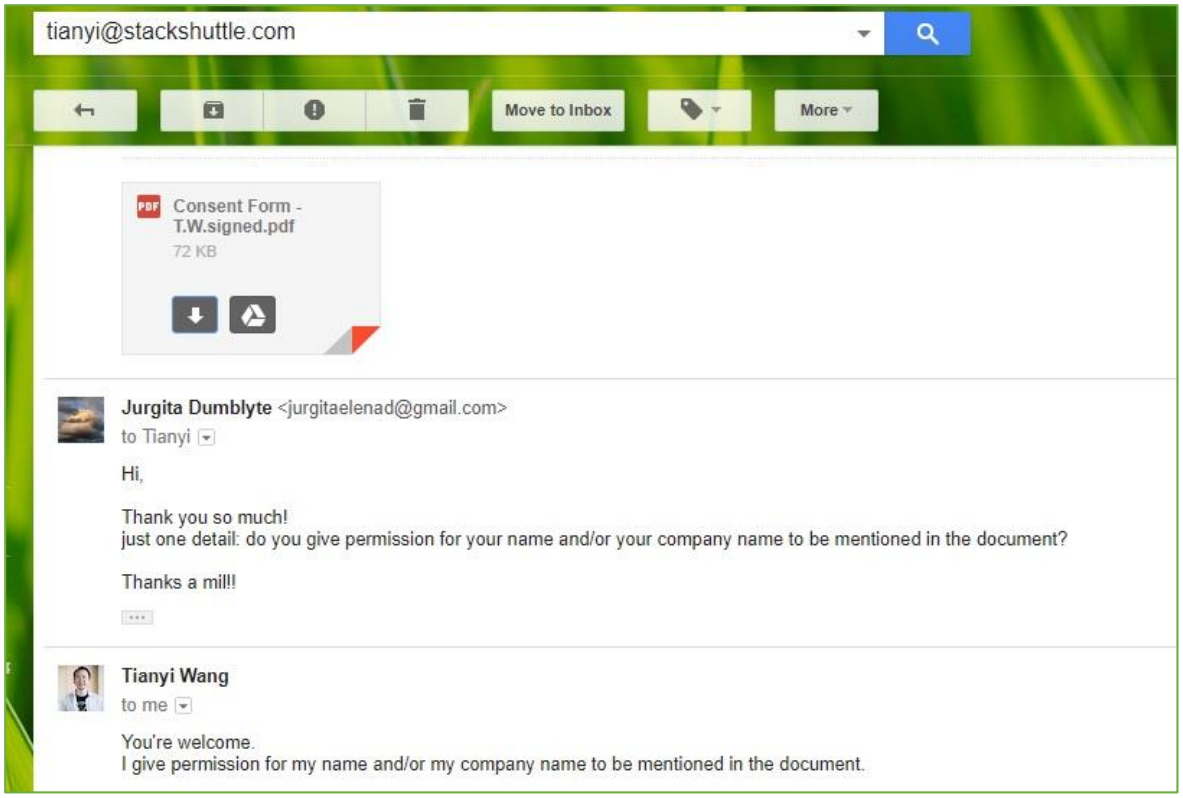
All information in this section should be treated as sensible and should not on any occasion be shared with the third parties (e.g., future students) without project author's consent.

Part A: Proof of email communication

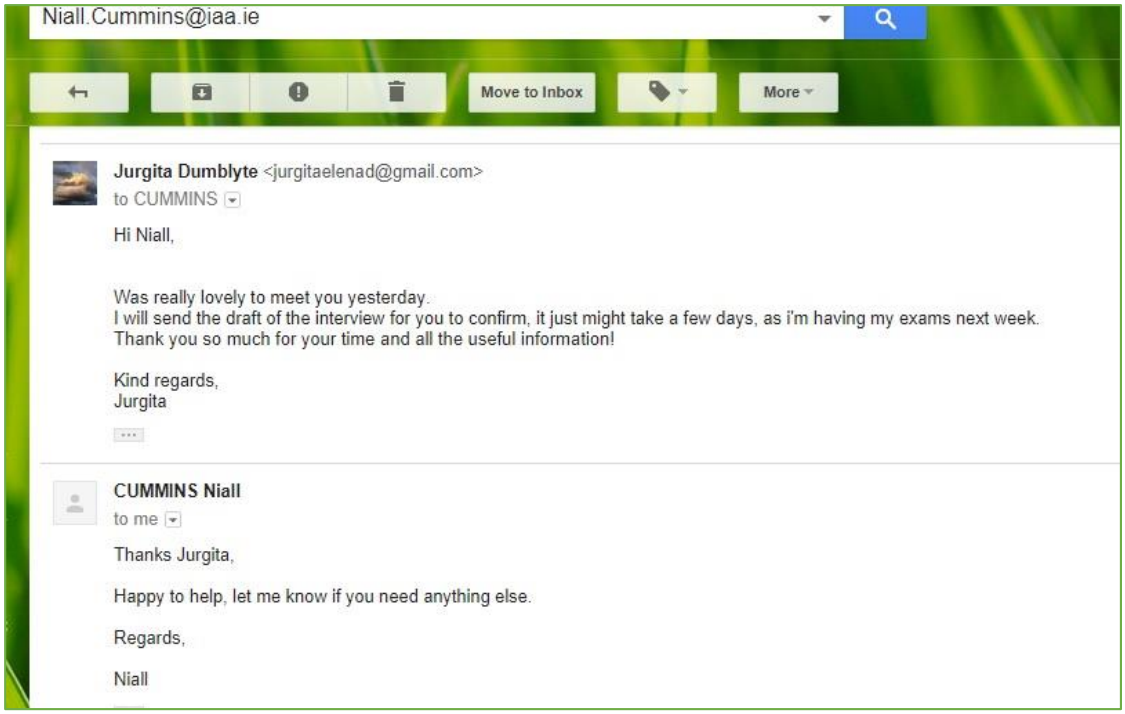
Interview 1: Tony Kinlan, Aerial.ie



Interview 2: Tianyi Wang, Stack Shuttle Ltd.



Interview 3: Niall Cummins, Irish Aviation Authority



Interview 4: Gearoid O'Briain, DroneSAR

Part B: Proof of signed consent forms

Interview 1: Tony Kinlan, Aerial.ie

HelpCopter

Participant Consent Form

This Consent Form is designed for qualitative interviews with adults from non-vulnerable populations and dealing with non–sensitive topics. The form would be different in the case of focus groups or quantitative research.

A consent form is an agreement between the researcher and the research participant outlining the roles and responsibilities they are taking towards one another throughout the whole of the research process.

The researcher should retain one copy of the consent form signed by both themselves and the participant. The participant should also be given a copy of the consent form as a record of what they have signed up to.

• I...Tony Kinlan..... voluntarily agree to participate in this research study.

• I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.

• I have had the purpose and nature of the study explained to me in writing and I have had the opportunity to ask questions about the study.

• I understand that I will not benefit directly from participating in this research.

• I understand that all information I provide for this study will be treated confidentially.

• I understand that disguised extracts from my interview may be quoted in J. Dumblyte's dissertation.

• I **give permission/ do not give permission** (please underline selected option) for my name to be used in the document outlined above.

• I **give permission/ do not give permission** (please underline selected option) for my Company name to be used in the document outlined above.

• I understand that in case of not giving permission, in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about.

Researcher:	**Interviewee:**
Jurgita Dumblyte	name ...Tony Kinlan.....
JurgitaElenaD@Gmail.com	email ...info@aerial.ie.....
NCI BSHTM4	company ...Aerial.....
Date: 15-04-18	**Date: 7 -5 -18**

Interview 2: Tianyi Wang, Stack Shuttle Ltd.

HelpCopter

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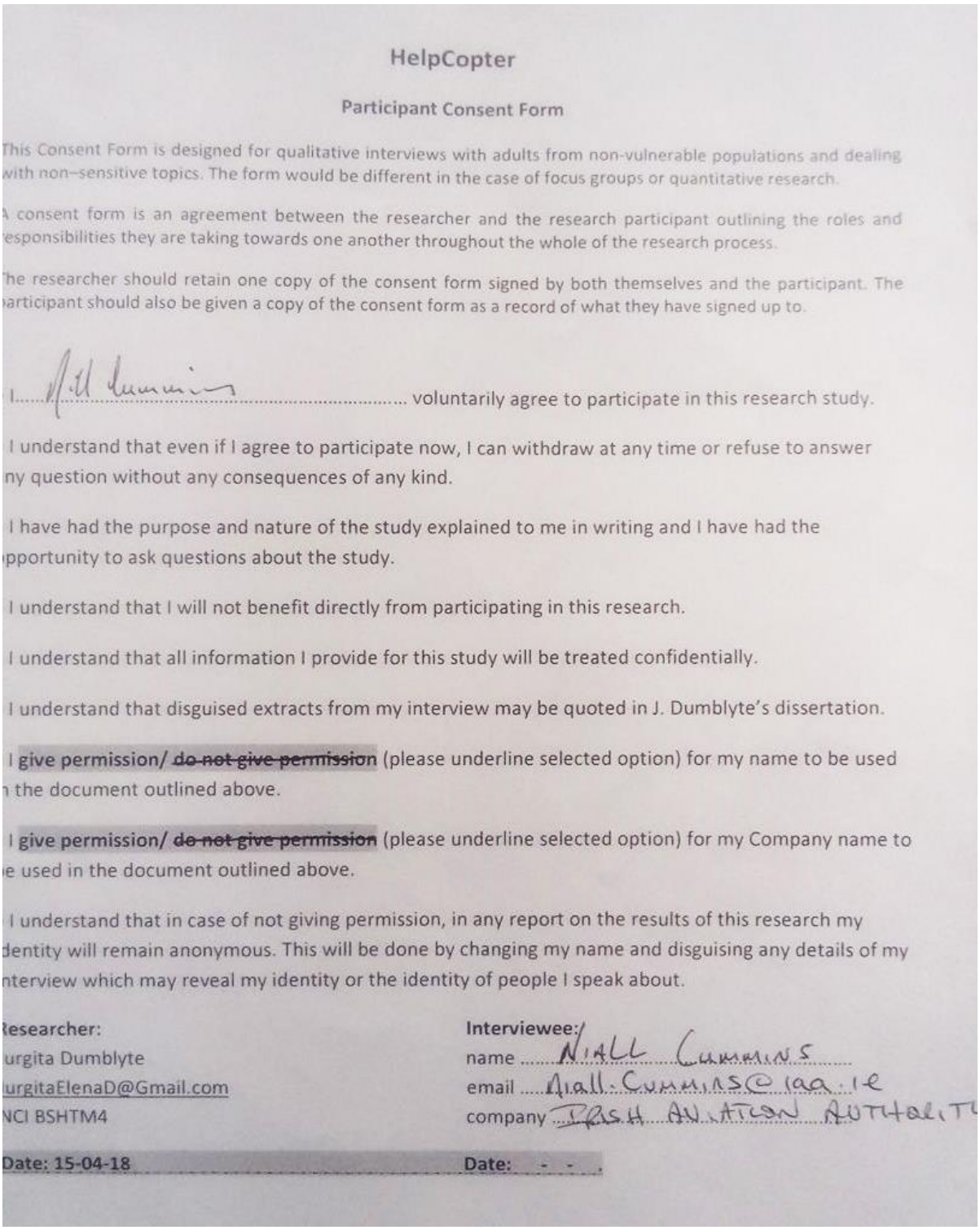
Researcher:	**Interviewee:**
Jurgita Dumblyte	Tianyi Wang
JurgitaElenaD@Gmail.com	tianyi@stackshuttle.com
NCI BSHTM4	Stack Shuttle Ltd
Date: 11-04-18	**Date: 12-04-2018**

Interview 3: Niall Cummins, Irish Aviation Authority



HelpCopter

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Researcher:
Jurgita Dumblyte
JurgitaElenaD@Gmail.com
NCI BSHTM4

Interviewee:
name ..... NIALL CUMMINS .....
email ..... Niall.Cummins@iaa.ie
company ..... IRISH AVIATION AUTHORITY

Date: 15-04-18

Date: - - .

Interview 4: Gearoid O'Briain, DroneSAR

HelpCopter

Participant Consent Form

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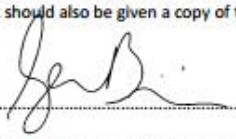

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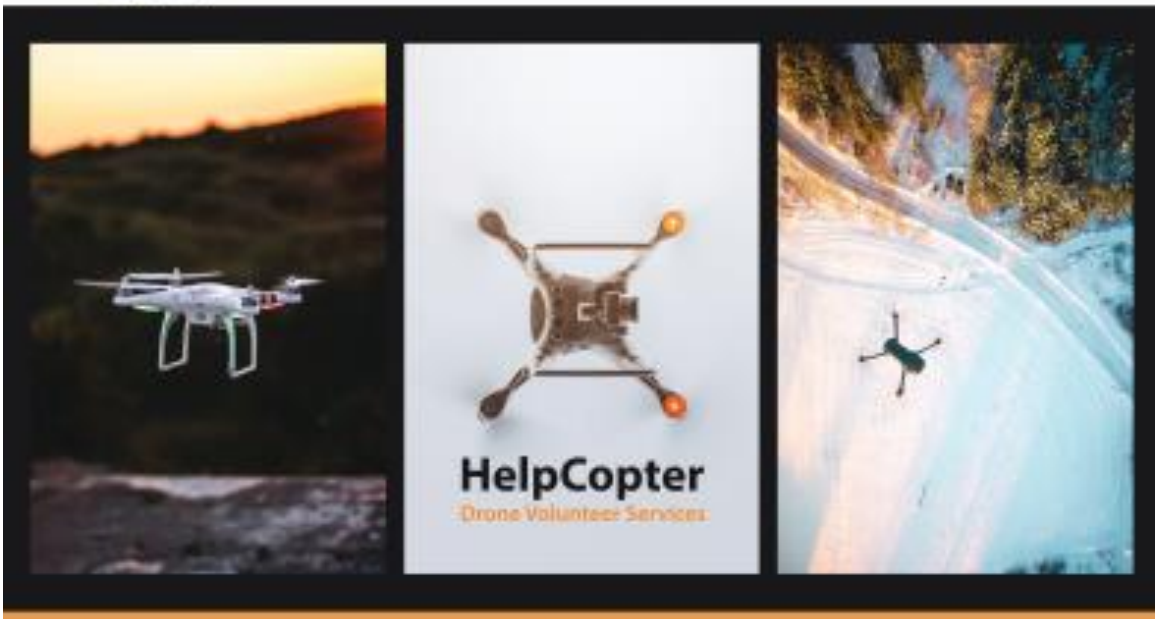
Researcher:
Jurgita Dumblyte
JurgitaElenaD@Gmail.com
NCI BSHTM4

Interviewee:
name Gearoid O Briain
email gearoid@flyryte.com
company FlyRyte Drone Academy/ DroneSAR Search & Rescue

Date: 15-04-18 **Date:** 23-04-18

Appendix 5.: Project Poster

National College of Ireland



HelpCopter is a digital platform, dedicated to assist first response teams in their emergency missions by providing timely and reliable help from above, connecting them with qualified, licensed and responsible drone pilots.

Jurgita Dumblytė,
BSc. Technology Management

HelpCopter drone volunteer services will assist rescue and first response teams to overcome practical difficulties during their emergency operations in terms of significant time saving, increased operation effectiveness due to broad spectrum of beneficial features implemented in unmanned aerial systems, enabling to locate stranded victims, assess the emergency area without risking first-responders' safety, observe large crowds and areas that are manually difficult/ dangerous to access.

HelpCopter provides more than just an eye in the sky: volunteering drone pilots are experienced, certified UAV operators, complying with regulations, knowing the rules and constraints (regulatory, environmental, etc.), capabilities and limitations of their UAVs.

"Sounds like a great idea. Something that DroneSAR and FlyRyte Drone Academy would be willing to consider partnering with if implemented well. We could assist with some development aspects, too!"

-Gearoid O'Briain, DroneSAR

Appendix 6.: Full Survey Results

Timestamp	Please s	Please state you	[Recreatio	[FPV]	[Civilian	[Civilian	[Comment	[Comment	How many	How likel	What inco	What ince	What inco	What inco	What inco	What inco	Volunteer	How impo	Please rat	Please rat	Please rat	Please rat	Please rat	Please rat	Please rat	Please fe	Please rat	Please rat	Please rat	Please fe	Do you fe
########	31-55	Drone Pilot/aud	often	never	never	never	ocassiona	never	3-5 years	maybe	yes	no	not sure	no	not sure	not sure	not sure	extremely	not impo	necessary	necessary	necessary	necessary	useful	useful	none	useful	useful	useful	useful	slightly important	not sure	not sure	slightly im	none	
########	31-55	Drone Operator	often	ocassiona	ocassiona	never	often	never	3-5 years	maybe	definitely	no	no	no	not sure	not sure	not sure	extremely	useful	useful	useful	necessary	necessary	useful	useful	n/a	none	necessary	useful	necessary	useful	slightly im	none	slightly im	slightly im	very impo	none	no
########	31-55	aerial artist	often	ocassiona	ocassiona	never	often	never	3-5 years	very likely	definitely	maybe	maybe	yes	yes	yes	yes	extremely	useful	necessary	necessary	necessary	necessary	useful	useful	n/a	useful	necessary	useful	necessary	necessary	n/a	slightly im	very impo	very impo	n/a	no
########	31-55	aerial artist	never	never	never	never	often	never	1-3 years	maybe	definitely	maybe	maybe	yes	definitely	definitely	maybe	extremely	slightly im	necessary	necessary	useful	slightly im	useful	useful	n/a	necessary	necessary	necessary	necessary	necessary	n/a	slightly im	slightly im	very impo	n/a	no
########	18-30		ocassiona	never	never	never	often	never	1-3 years	very likely	yes	maybe	maybe	maybe	maybe	not sure	important	necessary	necessary	useful	useful	slightly im	slightly im	slightly important	useful	useful	useful	useful	necessary	slightly im	slightly im	slightly important					
########	56-65	photographer	often	never	never	ocassiona	never	never	1-3 years	very likely	definitely	definitely	no	maybe	maybe	maybe	not sure	important	necessary	necessary	slightly im	slightly im	slightly im	useful	not impor	if people	necessary	necessary	slightly im	slightly im	slightly important	not sure	slightly im	slightly im	important	no	
########	31-55	entrepreneur	ocassiona	ocassiona	ocassiona	never	never	never	3-5 years	very likely	yes	no	no	maybe	yes	yes	maybe	extremely	necessary	useful	useful	useful	useful	useful	useful		necessary	useful	necessary	necessary	useful		slightly im	very impo	very impo	important		
########	18-30	student	often	never	never	never	ocassiona	never	1-3 years	maybe	yes	no	no	yes	yes	yes	yes	extremely	necessary	necessary	necessary	useful	useful	useful	not sure		necessary	necessary	necessary	necessary	necessary		not sure	very impo	very impo	important		
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########	18-30	TEAM LEAD	often	ocassiona	ocassiona	never	ocassiona	never	1-3 years	very likely	yes	yes	maybe	yes	yes	yes	yes	extremely	necessary	necessary	necessary	necessary	necessary	useful	useful	slightly important	useful	useful	useful	useful	useful		not sure	not sure	slightly important	NOT REAL	
12/28/201	18-30	Photographer,	often	often	never	often	never	never	1-3 years	very likely	definitely	not sure	not sure	not sure	not sure	maybe	definitely	yes	extremely	necessary	necessary	necessary	necessary	slightly im	slightly important	necessary	necessary	necessary	necessary	necessary		slightly im	slightly im	very impo	very important		
########	18-30	Film student (Gr	ocassiona	never	never	ocassiona	ocassiona	never	less than	very likely	yes	yes	yes	maybe	maybe	yes	maybe	important	necessary	necessary	useful	useful	useful	slightly im	slightly important	useful	useful	not sure	necessary	slightly important		slightly im	slightly im	slightly im	slightly important	n/a	
1/13/2018	31-55	Professional ph	often	ocassiona	never	ocassiona	often	ocassiona	1-3 years	very likely	definitely	maybe	yes	yes	definitely	yes	extremely	necessary	useful	useful	useful	slightly im	useful	slightly important	useful	useful	useful	necessary	useful		slightly im	slightly im	very impo	very important		
1/13/2018	31-55	developer	often	often	ocassiona	ocassiona	ocassiona	ocassiona	5-8 years	very likely	definitely	yes	yes	yes	yes	yes	yes	important	necessary	necessary	necessary	necessary	useful	useful	slightly important	useful	necessary	necessary	necessary	useful		slightly im	slightly im	slightly im	slightly important		
1/14/2018	31-55	Creative directo	often	never	never	ocassiona	often	often	5-8 years	very likely	definitely	definitely	definitely	yes	yes	yes	yes	extremely	necessary	useful	useful	useful	useful	useful	useful		necessary	necessary	necessary	necessary	necessary		very impo	very impo	very impo	important		
1/17/2018	31-55	marketing mana	often	ocassiona	never	never	ocassiona	ocassiona	3-5 years	maybe	yes	yes	yes	yes	yes	yes	yes	important	necessary	necessary	slightly im	slightly im	not impor	not impor	not important		necessary	necessary	necessary	necessary	necessary		very impo	very impo	very impo	important		
1/17/2018	31-55	sales rep	ocassiona	never	never	never	ocassiona	never	1-3 years	very likely	definitely	not sure	not sure	not sure	not sure	not sure	extremely	extremely	necessary	necessary	necessary	necessary	necessary	necessary	necessary	necessary		necessary	necessary	necessary	necessary	necessary		very impo	very impo	very impo	important		
1/17/2018	31-55	co-founder	often	ocassiona	never	never	ocassiona	never	1-3 years	very likely	yes	maybe	maybe	maybe	maybe	yes	yes	extremely	necessary	useful	slightly im	slightly im	slightly im	slightly im	slightly important	useful	necessary	useful	slightly im	slightly important		slightly im	slightly im	very impo	important		
1/17/2018	31-55	Technician	often	never	never	never	ocassiona	ocassiona	1-3 years	maybe	definitely	definitely	definitely	definitely	definitely	definitely	definitely	maybe	important	necessary	necessary	necessary	necessary	necessary	useful	not sure	not sure		necessary	necessary	necessary	necessary	necessary		slightly im	slightly im	slightly im	slightly important		
1/17/2018	31-55	business owner	often	ocassiona	ocassiona	ocassiona	often	ocassiona	3-5 years	very likely	definitely	maybe	yes	yes	maybe	maybe	yes	extremely	necessary	necessary	necessary	necessary	necessary	necessary	necessary	necessary	who will o	necessary	necessary	necessary	necessary	necessary		very impo	very impo	very impo	important	no	
1/17/2018	31-55	COO	often	ocassiona	never	never	often	never	5-8 years	very likely	definitely	yes	yes	yes	yes	yes	yes	extremely	necessary	necessary	necessary	necessary	necessary	useful	previous	useful	useful	necessary	necessary	necessary	necessary	avail. call	very impo	very impo	very impo	important	no	
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1/18/2018	31-55	employed	often	never	never	never	ocassiona	never	1-3 years	very likely	definitely	definitely	definitely	definitely	definitely	definitely	definitely	yes	extremely	necessary	necessary	necessary	necessary	necessary	necessary	necessary	necessary		necessary	necessary	necessary	necessary	necessary		very impo	very impo	very impo	important		
1/18/2018	31-55	winemaker	often	ocassiona	never	never	ocassiona	never	1-3 years	very likely	definitely	not sure	not sure	maybe	maybe	maybe	yes	important	necessary	necessary	necessary	useful	useful	useful	necessary		necessary	necessary	necessary	necessary	necessary		very impo	very impo	very impo	important	No, dont t	
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1/18/2018	18-30	managing direct	often	often	ocassiona	never	often	never	1-3 years	very likely	yes	maybe	maybe	maybe	maybe	yes	yes	important	useful	necessary	necessary	necessary	necessary	useful	useful		useful	necessary	necessary	useful	useful		slightly im	slightly im	slightly im	slightly important		
1/18/2018	18-30	Artist	often	never	never	never	never	never	1-3 years	very likely	definitely	yes	yes	definitely	definitely	definitely	definitely	yes	extremely	necessary	necessary	necessary	necessary	necessary	necessary	necessary		necessary	necessary	necessary	necessary	necessary		very impo	very impo	very impo	important		
1/22/2018	18-30	Teacher	ocasiona	ocasiona	never	never	never	never	1-3 years	very likely	definitely	definitely	definitely	definitely	definitely	definitely	definitely	yes	extremely	necessary	necessary	useful	useful	useful	useful	useful		necessary	necessary	necessary	necessary	necessary		very impo	very impo	very impo	important	No	
1/22/2018	18-30	Accountant	often	ocassiona	never	never	ocassiona	never	1-3 years	very likely	definitely	definitely	definitely	definitely	definitely	definitely	definitely	maybe	extremely	necessary	necessary	necessary	necessary	necessary	necessary	necessary	do i need	necessary	necessary	necessary	necessary	necessary		very impo	very impo	very impo	important		
1/22/2018	18-30	artist	often	never	ocassiona	never	often	never	3-5 years	very likely	definitely	yes	yes	definitely	definitely	definitely	definitely	yes	extremely	useful	useful	useful	useful	useful	useful	slightly im	slightly important	necessary	necessary	necessary	necessary	necessary	ease of us	slightly im	very impo	very impo	very important	nope	
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1/23/2018	31-55	Photographer	often	ocasiona	ocasiona	never	often	ocasiona	5-8 years	very likely	definitely	maybe	maybe	maybe	maybe	yes	extremely	useful	necessary	necessary	necessary	useful	useful	useful	necessary	necessary	necessary	necessary	necessary	necessary		not sure	slightly im	very impo	very important		
1/23/2018	31-55	photographer	often	never	ocasiona	ocasiona	never	often	ocasiona	3-5 years	very likely	definitely	maybe	maybe	yes	yes	yes	not sure	important	necessary	necessary	necessary	necessary	slightly im	slightly im	slightly important	necessary	necessary	necessary	necessary	necessary	necessary		very impo	very impo	very important	No	
1/25/2018	31-55	photographer	often	often	ocasiona	ocasiona	ocasiona	often	ocasiona	5-8 years	very likely	definitely	yes	yes	maybe	maybe	yes	not sure	extremely	useful	necessary	necessary	necessary	useful	not sure	not sure		necessary	necessary	necessary	necessary	necessary		very impo	very impo	very impo	important		
1/25/2018	31-55	Operations Mar	often	ocasiona	never	never	ocasiona	never	3-5 years	very likely	definitely	yes	yes	yes	yes	yes	yes	extremely	necessary	necessary	necessary	necessary	necessary	useful	not sure		necessary	necessary	necessary	necessary	necessary		not sure	slightly im	very impo	important		
1/28/2018	31-55	Film Crew	often	often	ocasiona	never	often	never	3-5 years	very likely	yes	yes	yes	yes	yes	yes	yes	important	useful	useful	useful	useful	useful	useful	useful		useful	necessary	useful	necessary	useful		slightly im	slightly im	very impo	important	not really,	
########	31-55	aerial photogra	often	often	ocasiona	ocasiona	often	ocasiona	5-8 years	very likely	definitely	no	maybe	yes	yes	yes	yes	extremely	necessary	necessary	necessary	necessary	necessary	useful	useful		useful	useful	useful	necessary	useful		very impo	very impo	very impo	important		
########	31-55	Traveller, beat r	often	often	ocasiona	ocasiona	never	never	3-5 years	maybe	yes	yes	yes	yes	yes	definitely	not sure	important	necessary	necessary	useful	useful	useful	not impor	not important		necessary	useful	necessary	necessary	useful		not sure	slightly im	very impo	important		
########	31-55	Freelance journ	often	often	ocasiona	never	often	ocasiona	3-5 years	very likely	definitely	definitely	definitely	definitely	definitely	definitely	extremely	extremely	necessary	necessary	necessary	necessary	necessary	necessary	necessary		necessary	necessary	necessary	necessary	necessary		very impo	very impo	very impo	important	not at all,	
########	18-30	Author	often	ocasiona	never	never	often	never	3-5 years	very likely	definitely	yes	yes	yes	yes	definitely	extremely	extremely	necessary	necessary	necessary	necessary	necessary	useful	useful		necessary	necessary	necessary	necessary	necessary		very impo	very impo	very impo	important	no.	
2/16/2018	18-30	Blogger, photog	often	often	ocasiona	ocasiona	often	often	1-3 years	very likely	definitely	definitely	definitely	definitely	definitely	definitely	definitely	not sure	extremely	useful	necessary	necessary	necessary	necessary	not impo	not important		necessary	necessary	necessary	necessary	necessary		very impo	very impo	very impo	important		
2/16/2018	18-30	journalist	often	often	ocasiona	never	often	ocasiona	3-5 years	very likely	definitely	definitely	definitely	definitely	definitely	definitely	definitely	maybe	extremely	necessary	necessary	necessary	necessary	slightly im	slightly im	slightly important	useful	useful	necessary	necessary	useful		not sure	very impo	very impo	important	no survey	
2/16/2018	31-55	PHOTOGRAPHE	often	ocasiona	ocasiona	never	often	often	3-5 years	very likely	definitely	yes	yes	definitely	definitely	definitely	extremely	important	necessary	necessary	necessary	necessary	slightly im	slightly im	slightly im	NO.	necessary	necessary	necessary	necessary	necessary	NO.	very impo	very impo	very impo	NO.	NO.	
2/17/2018	31-55	freelance artist	often	often	ocasiona	never	often	never	3-5 years	very likely	definitely	maybe	yes	yes	yes	yes	not sure	extremely	necessary	necessary	necessary	necessary	useful	slightly im	not sure	not important		necessary	necessary	necessary	necessary	necessary		not impor	slightly im	very impo	important		
2/19/2018	18-30	Journalist	often	ocasiona	never	never	often	ocasiona	3-5 years	very likely	definitely	definitely	definitely	definitely	definitely	definitely	definitely	yes	extremely	necessary	necessary	necessary	necessary	necessary	necessary	necessary	useful		necessary	necessary	necessary	necessary	necessary		slightly im	slightly im	very impo	important		

Appendix 7.: Project Proposal

National College of Ireland

Project Proposal

HelpCopter

drone volunteer services

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x14110644@student.ncirl.ie

27/10/2017

Definitions and Abbreviations

CASA – Civil Aviation Safety Authority (Australia)

FAA – Federal Aviation Administration (USA)

FPV – First Person View (Video Piloting)

IAA – Irish Aviation Authority

NOTAM – Notice to Airmen: a notice issued by Aviation Authority with an aim to warn aircraft pilots and drone flyers about potential hazards and no-fly zones (appendix 1).

Quadcopter – remotely controlled aircraft (drone) with four identical propellers

SAR – Search and Rescue

UAV – Unmanned Aerial Vehicle

UAS – Unmanned Aircraft Systems

Introduction

I got the project idea during my Business Analyst internship in a Dublin-based drone marketplace Skytango,- a small start-up that connects commercial drone operators (aerial photographers and video-makers) with aerial content buyers. I felt that there is much more to drones than exploring landscapes from 400 feet above the ground for recreational or commercial use. Drone industry, although fast growing, is still an emerging market. Regulatory frameworks in most countries across the world are still in different development stages, with FAA regulations in United States being the most advanced to date. I became extremely interested in innovative companies that invest their talent, creativity and resources into developing drones with a higher purpose: making the work across the different industries (agriculture, mining, mapping, etc) easier, and ultimately, saving lives.

Drones can provide network connectivity in disaster areas, observe the damage done by the chemical spill, look for survivors after the natural disasters or terror attacks, use the thermal imaging cameras in search and rescue operations, detect and detonate landmines (Dumblyte, 2017), assist firefighters by locating people in a building on fire. That was when the HelpCopter idea was born. HelpCopter is a digital platform, dedicated to assist first response teams in their emergency missions by providing timely and reliable help from above,- connecting them with professional, licenced and responsible drone pilots. It consists of a website and a mobile app, available on both IOS and Android operating systems. First response teams will be able to use interactive map to see which volunteers are available and in what proximity they currently are from the particular area where the assistance is required. HelpCopter is a global platform, therefore registered volunteers that are travelling to different countries during their holidays, might be called for help by local first response teams, unless they choose to change their privacy settings accordingly (possible variations: “Available 24/7”, “Unavailable dd/mm to dd/mm”, etc). The very idea of drone volunteer services is not completely novel. However, analysis and

evaluation of companies already providing these services shows the lack of emphasis in providing a reliable and professional service, allowing this initial noble idea to become rather a hobbyist activity,- unqualified, undocumented, unreliable, and quite possibly dangerous.

Project Plan

“Fail to prepare - prepare to fail” as Benjamin Franklin once said. Careful planning is crucial for any project. It is important to identify necessary tasks, decide on sequence of tasks, estimate how long it will take to perform each of them, and not to underestimate unpredictable events, as they can have push back the schedules, which can result in failing to deliver. Project plan shown In Figure 1 is created in Microsoft Excel, and represents the tasks and dates due throughout the first part of the Project (end of September 2017 to mid-December 2017). Simple colour coding helps to differentiate completed tasks (or tasks in progress) from tasks that are not currently started. For example, “Preliminary Requirements Document” is started during the week that ends on 12th of November 2017, and is due to be finished on the week that ends 26th of November 2017. As work on this task has already started, the start of the task bar is coloured green. However, at the current time we still have two weeks to complete it, hence the red exclamation mark at the end of the task bar, representing the date of the deadline.

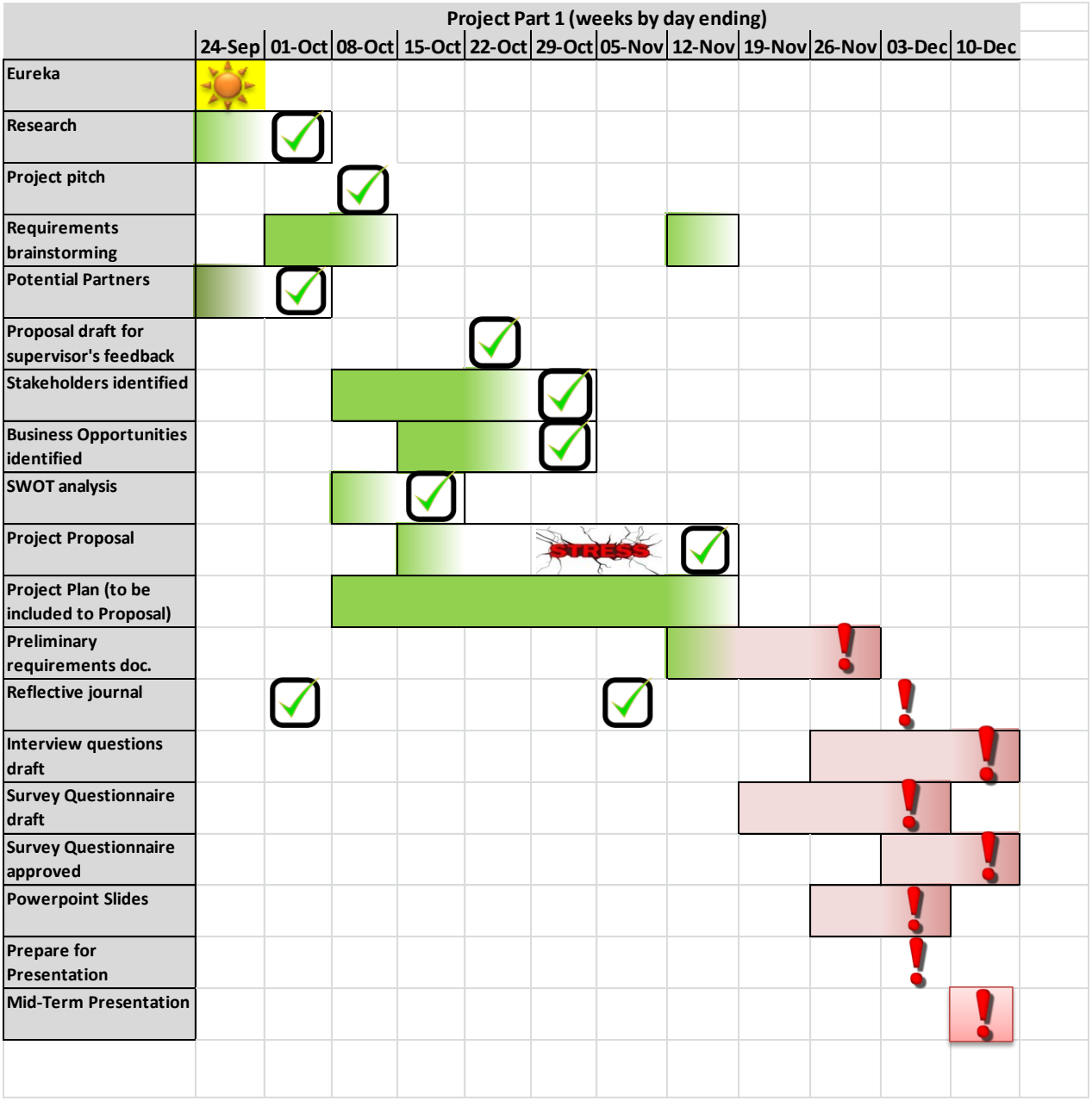


Figure 1.: Project Plan

Stakeholders

There is a rather broad array of interested or to a different degree involved parties in HelpCopter project. Stakeholders, currently identified but not limited, are following:

- Drone pilots

- Business Analyst (author of this paper)
- IT team
- Data protection officer
- Project manager
- Coordinatory hub administration
- Partners
- Government
- Local police forces
- First response teams: firefighters, search and rescue teams, etc
- Sponsors
- Local aviation authorities (IAA in Ireland, FAA in United States, CASA in Australia, etc.)

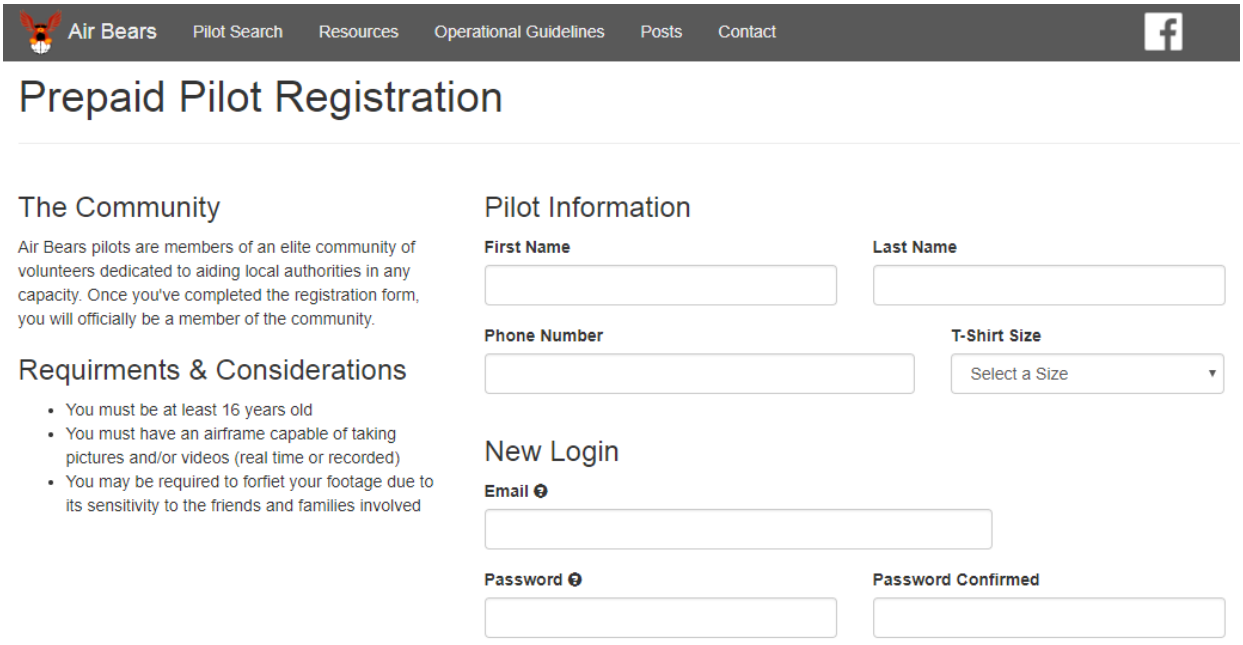
Competitors

S.W.A.R.M. Search with Aerial RC Multirotor

Based in United States, S.W.A.R.M. aerial search and rescue network has over one thousand volunteers (SAR Drones, 2017). However, not only professional drone pilots, but also hobbyists are able to apply, and over a half of volunteers rely on FPV (First Person View) unmanned aerial vehicles, which are small, have only up to 20 minutes of battery life, and are primarily designed for new and quickly gaining popularity sport - drone racing. S.W.A.R.M. does not have a mobile application for their network, either, and this can be considered as a serious downside in regards to timely access to the system, and timely response. The list of volunteer names and their hometowns is available to public.

Air Bears

Another company based in United States, with primary focus on training and equipment lease. Supported by Amazon, where online shoppers can choose them as their favourite charity and donate a part of their purchase price towards Air Bears' mission. Claiming to be an "elite community of volunteers" (Air Bears, 2016), Air Bears, however, do accept people as young as sixteen. There is no requirement to have an Unmanned Aerial Vehicle license or insurance in company's online application form, but there is a request to state the T-Shirt size, as illustrated in an image below. Volunteer drone pilots have to pay registration fee.



Air Bears (2016)

Partners

Networking and collaboration help companies grow stronger. HelpCopter is starting off on the right foot by using existing connections to develop a robust, adaptive and sustainable digital ecosystem with a strong sense of social responsibility.

FlyRyte Drone Academy

FlyRyte Drone Academy is the first drone flying school in Ireland, founded by two former Irish Air Corps pilots Gearóid O'Briain and Oisín McGrath. FlyRyte Drone Academy is an anticipated partner of HelpCopter, responsible for the drone pilots training regarding first response and emergency situation coaching. Training is to be provided either online, or in FlyRyte Academy's facilities. Training course length and place is subject to further negotiations. This partnership is expected to be mutually beneficial, as FlyRyte Drone Academy will get more exposure, brand recognition, and promotion via various Social Media and Channels.

Both Gearóid O'Briain and Oisín McGrath are founders of another innovative company DroneSAR, where they develop drone search and rescue mapping software, comparing such powerful aerial SAR tool with incorporated safety checklists, generated flight plans DroneSAR, 2016) and other useful features, to another team member in search and

rescue operations. According to Oisín McGrath, “technology is designed to augment rescue work, not to replace it” (Hilliard, 2016). In the fall of 2016 tests were successfully conducted in Donegal Mountains, assisting local mountain rescue crew.

Aerovista Innovations

Aerovista Innovations is a renowned aerial solutions company. It builds scalable and effective drone operations programs, including professional training and consulting services, educating about safety and compliance, operating guidelines and equipment standards (Aerovista Innovations, 2017). The person I intend to reach out to regarding the partnership, is Aerovista Innovations Chief Operating Officer and founder of world’s best online magazine “Women and Drones” Sharon Rossmark. I was both humbled and delighted to interview Sharon during my work placement in Skytango (the link to the interview can be found here).

We both share the passion for innovative technologies, helping others and advocating for girls in STEM. We quickly found a common ground, and this good start led to collaborations on other digital content projects. I feel quite confident that HelpCopter will have support from Aerovista Innovations in regards of pilot training in United States, and will have “Women and Drones” initiative as media partner.

Skytango

Skytango were among very first licenced drone operators, and pay great deal of attention to compliance and educating the public. In summer 2017 Skytango CEO Steven Flynn was recognized as one of the most influential people in drone industry (Antunes, 2017). We trust their expertise, and believe that this collaboration will be mutually beneficial.

SWOT Analysis

STRENGTHS	OPPORTUNITIES

• Only professional, licenced and insured drone pilots • Worldwide network • Track record of volunteers • Volunteer training provided by partners • Mobile application • Interactive map • Timely response • Growing industry	• Possibility to incentivize best / most active volunteers with a monetary reward and an official acknowledgement from the local government • Expanding the range of different purpose drones available • Broad range of first response operations • Possible future business opportunities collaborating with private sector firms
WEAKNESSES	**THREATS**
• Unregulated industry • Unpaid work • Coordinatory hub • Funding • Lack of training • Expensive equipment and insurance • System maintenance costs	• Network security • Personal data protection • Unreliable volunteers • Issues in software system

Business Opportunities

While HelpCopter aims to reward the best and most active volunteers at the end of each year with monetary prizes from our sponsors, as well as boost their social media exposure via our media partners' channels, it is also feasible to take this initiative to the next level by encouraging private sector companies to use our reliable and professional drone pilot services for their short term needs, this way allowing us to reward our hard working pilots with recommendations for well-paid half/full-day jobs in various industries.

For instance, in agriculture industry drones with multispectral sensors can help farmers to assess soil and crop health, spot various infections in plants, and spray fertilizers only

the specific areas that need extra help, this way saving resources, time, and reducing negative impact to the environment. PwC estimates that market for drone-powered solutions in agriculture industry alone exceeds $32 billion (Mazur, 2016).

First Draft of Requirements

HelpCopter online platform consists of a website, built in WordPress, and a mobile app.

Preliminary requirements for the website:

- Detailed information about HelpCopter has to be available to the website visitors, along with a statement in regards of volunteer background check and information about GDPR
- Volunteers have to be able to sign up/ sign-in
- Volunteers must complete an online application form (contact details, experience, equipment, licence number, insurance number and issue date, etc) before being accepted
- After the background check, registered volunteers receive a passcode enabling them to use a mobile app
- Website will use Intercom services for time-efficient response to website users queries

Preliminary requirements for the mobile app:

- Has to be available for both IOS and Android platforms
- Only volunteers that have signed up on the website and received their passcode, are able to use the app
- No option to remember the password on the phone for security reasons
- Mobile app has to provide an accurate Interactive map
- Mobile app has to allow real-time communication with the first response teams

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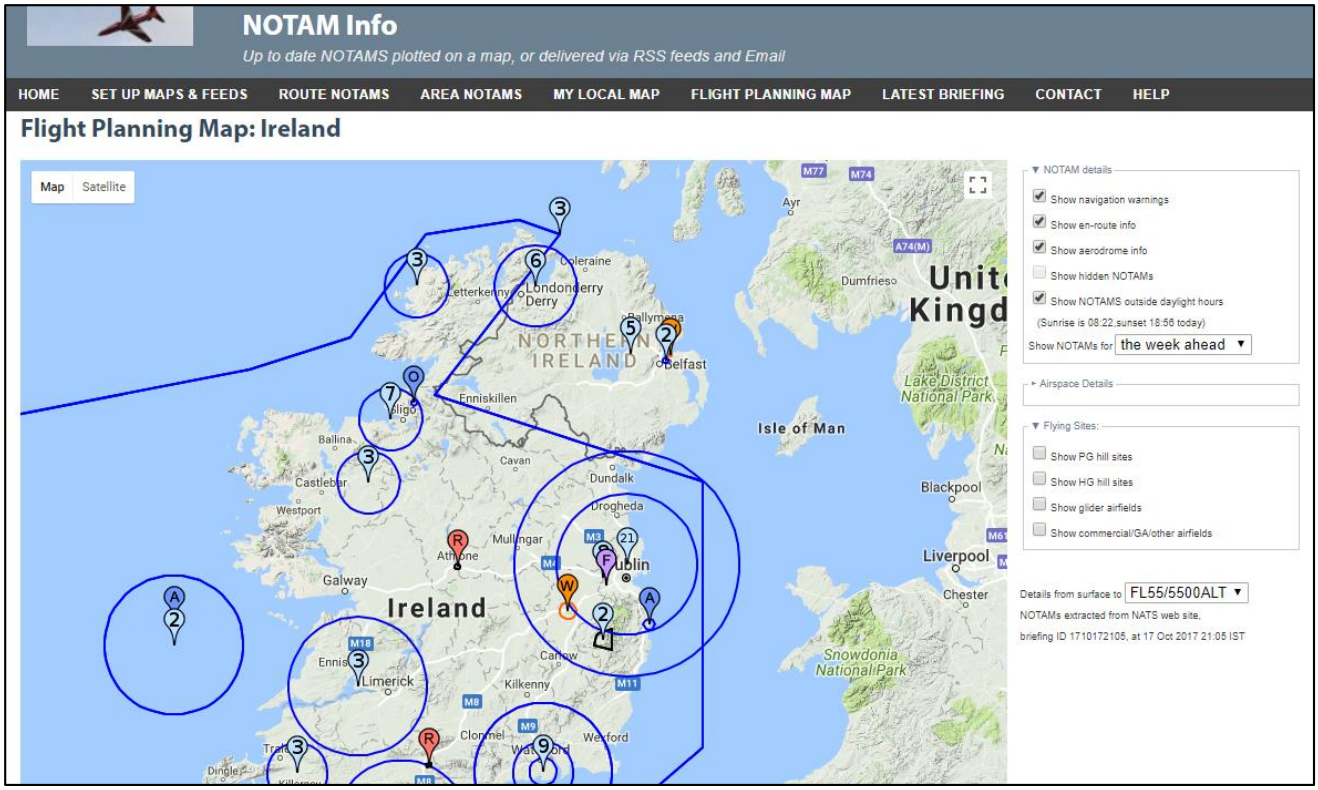
Appendices

Appendix 1.:



NOTAM Info (2017)