

SkyCare

Emergency Care Outside the Urban Core

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Executive summary

This project, initiated in collaboration with Region Östergötland and Norrköping Science Park, aimed to improve emergency medical care outside the urban core by harnessing the potential of drone technology. The overarching goal was to reduce response times and enhance patient outcomes in the remote areas.

Throughout the project, the team worked on establishing a proof of concept for the integration of drones into emergency response scenarios. The scope expanded to include varying surveillance capabilities, offering solutions for locating distressed individuals and managing several emergency situations. The established proof of concept involves an adaptable drone implementation, featuring pre-installed options that future customers can selectively activate. It also suggests documentation and analysis of the drone utilization during the initial year, facilitating ongoing improvement and strategic alterations based on real-world insights and user feedback.

Moving forward, the project emphasized the importance of ongoing research and risk assessment, particularly in addressing complications and ethical issues associated with the drone implementation. The report calls for iterative engagement with stakeholders to refine and tailor the solution even further to the stakeholders needs. With the proof of concept established, the next steps involve exploring potential collaborations and scaling the solution beyond the initial scope. This project can lay the foundation for a transformative approach to emergency medical care in remote areas, utilizing cutting-edge technology to save lives and improve overall response efficiency.

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1. Introduction

In this part of the report the background, external stakeholders and results of the presented challenge is addressed along with the purpose and description of the task at hand.

1.1 Background, purpose, and description of the challenge

The challenge presented was to bring emergency medical care quickly to remote areas using drones, and it was provided by Region Östergötland in collaboration with Norrköping Science Park. Originally the challenge had a broad scope, where the idea was to use drones to deliver defibrillators and provide some kind of media coverage, but all additional services were welcome and boundaries were scarce. Through communication with representatives from both Region Östergötland and Norrköping Science Park the challenge became clearly formulated.

The reason for the challenge being set and the importance of the solution lies in the current conditions of citizens currently outside of the urban core and their chances in a medical emergency. In many parts of Sweden it could take an ambulance more than ten minutes to reach a patient, with a median response time of 15,2 minutes (Åsheden, 2023), but within this timeframe many medical emergencies can go from severe to critical. This can be addressed by the use of drones and may become a critical part of the emergency services response, and their success rate.

Using drones for delivering medical supplies could save lives, but using them for surveillance may be just as important. When conversing with personnel at SOS Alarm (personal communication, November 21st, 2023) it was clear that finding the location of a person in distress can be a big challenge. Especially in areas without an abundance of cell towers, which are used in order to triangulate the position of a caller by SOS Alarm (personal communication, November 21st, 2023) using the Advanced Mobile Location technology (SOS Alarm, 2023), where the area to search for someone may be very large. Using a drone could vastly decrease the time it takes to find the caller. In relation to finding someone calling in to SOS Alarm, making the drone compatible with the SOS Alarm application which automatically sends the callers position when used was brought up as well. Furthermore they could be helpful in assessing the scope and severity of a situation as it develops and unfolds.

The purpose of the project is to create an innovative and adaptable solution for delivering emergency services outside of the urban core in order to save lives.

1.2 External stakeholders

Region Östergötland holds the role of challenge provider and is thereby the driving force behind this project. As the primary stakeholder, their opinions have a big influence on the direction of the project. Region Östergötland is interested in harnessing cutting-edge drone

technology to elevate healthcare services and enhance patient outcomes, thus the goals and scope of the project are significantly shaped by their insights and requirements.

Health care workers, such as ambulance paramedics, hold a crucial role in the utilization of the drone technology and are also considered as one of our main stakeholders. Their responsibility will involve giving feedback and a deeper understanding of how and when the drones can be used. The success of the project depends on a profound understanding of their needs and a seamless integration of their feedback into the implementation process.

SOS Alarm workers represent another crucial group of stakeholders. Given their anticipated interactions with the drone technology during emergencies, collaboration with SOS Alarm becomes paramount. Ensuring alignment with emergency response protocols is essential, contributing substantially to the reduction of response times and the overall effectiveness of the drones in critical situations.

The involvement of police and fire departments is also important. Beyond medical applications, the potential for drone technology in surveillance and broader emergency response scenarios necessitates a deep understanding of their perspectives and requirements. This collaborative approach ensures the creation of a versatile solution capable of addressing a variety of emergency situations.

At the core of the project's beneficiaries are the individuals who live outside the urban core. Tailoring the drone technology to meet their specific needs is one of the main priorities in the project. The project aspires to enhance emergency response times, thereby increasing the likelihood of survival rates in critical situations outside the urban core.

1.3 Results of the project

The primary objective of this project was to establish a proof of concept demonstrating the impactful role of drones in emergency response scenarios. The findings stem from extensive research and interviews conducted with experts in the field. Drones have exhibited remarkable efficacy in providing critical care during emergencies, notably in instances like cardiac arrests and the swift delivery of life-saving medications. Their unique capability to navigate past traffic congestions and geographical obstacles has been pivotal according to Baumgarten, Röper, Hahnenkamp & Thies (2022). For this project, the main concern was to enable medical assistants outside of the urban core.

In addition to its medical applications, another noteworthy aspect worth considering is the integration of drones in surveillance operations. Drones possess the ability to cover expansive areas, facilitating remote missions essential for surveillance needs. For instance, they can be instrumental in managing traffic accidents or locating missing individuals. The drones will offer customizable features catering to diverse customer needs. Options range from configuring drone settings to accommodating various medical tools such as defibrillators, epinephrine autoinjectors, or bleeding kits. Another part is built in cameras, both heat vision and regular ones. Moreover, customers have the flexibility to position the drones according to their specific

requirements. When the customer has bought the service, Skycare will analyze the drones during the initial year. This will include analyzing the needs that have to be met as well as what could be improved.

Introducing this initiative in Östergötland includes exploring its integration with SOS alarm services. Incorporating drones into their operations can significantly enhance response times and augment surveillance in the event of an emergency. Given the limited availability of ambulances, SOS alarm reserves their deployment for life-threatening situations. Supplementing ambulances with drones not only improves emergency aid but also empowers local individuals to provide immediate assistance before professional medical help arrives. Ultimately, this collaboration has the potential to enhance SOS Alarm's responsiveness, thereby reducing casualties in critical situations. Skycare will keep the drones strategically placed outside and will fly back accordingly to its station. If personnel is needed, it will be sent out from either the region or other cooperation partners.

2. The goal(s) of the project and its limitations

This part of the report describes the ways and results in which main and secondary goals were set. It also discusses limitations that needed to be considered during the process of accomplishing those goals.

2.1 Project goals

Before starting to work on a solution for the challenge, there have been a few different goals set that catered to both the team's expectations of the project, and ones that have been expected to be accomplished by the challenge providers. Those goals not only focus on solution related issues, but also on the team's communication and project management problems. Throughout the project the main focus was on designing a solution that would be able to bring care and save lives in a remote area.

Reaching the middle stage of the project, there was concern that an important part of the project was underprioritized - making the solution easy to integrate into the already existing systems. That goal has become one of the main priorities, rather than one that was considered as an afterthought. The most important ones, such as minimizing risks of casualties or being able to recommend a solution based on research, have been fulfilled within the scope of the project.

One of the main goals was to get clear results that would show whether it is recommended to use drones for this purpose. The results and the conclusion of the research were not as positive as it had been expected, as the drones seemed to be expending more costs than bringing benefits. Because of that, there was a need to further research and understand how many complications and contraindications there are in introducing drones into real-life usage. During the process, it has become clear that this was one of the most difficult challenges to overcome - making sure that introducing the drones brings more benefits than demerits and costs.

There was also the challenge of understanding customers and investors properly, while promoting the product in a way that would satisfy both those groups. The project progressed with the solution that would satisfy both those groups and reached the final solution of using drones to deliver emergency equipment to injured people outside the core and surveillance of the area of the accident.

Figuring out what exactly that emergency equipment consists of, how to position the drones, who would control them, and how to make sure that the drones are as fail-proof as possible has proved to be a very difficult topic to discuss and reach an agreement on. There have been changes made to the group's ideas and suggested solutions for this problem multiple times over the course of the project, which in turn required reevaluating the goals. There are still improvements and changes that can be made based on what the customer will need in the future and how the needs will change over time.

If this project was approached with the knowledge possessed currently, the focus on goals such as making the solution fit into the existing emergency systems would be prioritized earlier. It was clear during the process that this was one of the most important features of the solution that needs to be implemented. This could have also resulted in contacting relevant parties within the field earlier.

2.2 Project limitations

During this project, we were instructed by the challenge providers on what to put the focus on first and foremost and what should be ignored for the time being. Initially, it was noted that the desired solution would focus specifically on delivering medical equipment to patients outside the core in the region Östergötland. Currently the regulations around air-space do not allow the implementation of the project. However, when communicating with experts in the area a change in regulations appears to be close, and thus having a proof of concept ready for this eventuality is relevant.

After investigating the budget with the challenge providers, it was not specified whether there is a limit for the project, but that it could be implemented as a part of the proof of concept. The scope of the project should be applicable to the region that was suggested by the challenge providers, but creating a solution with consideration of being expanded into other areas and fields was encouraged within the course. Limiting the project to one region and one customer would significantly reduce the usability of the solution and its profit for a broader audience.

With consideration of how the solution can be utilized beyond the limitations set by the challenge providers, it would have been easier to reach the current conclusion at a much earlier stage of the project. Thanks to that, the group would have been able to research and provide additional considerations and answers regarding future improvements and long-term business perspectives.

3. The project process

This chapter explains how the team carried out the project, how stakeholders were involved, and how the project risks were evaluated.

3.1 The process

During the process of planning out the project the “iron triangle”, as described by Pollack et al. (2018) and visualized in figure 1, was implemented early on and its principles applied through all subsequent planning phases. For this project in particular the time and cost corners of the triangle represents the length of the course and the work hours of the group members. The third corner chosen as appropriate for this project was scope, and in this case it represents the requirements set by the challenge provider. Together they contribute to the quality of the project as a whole.

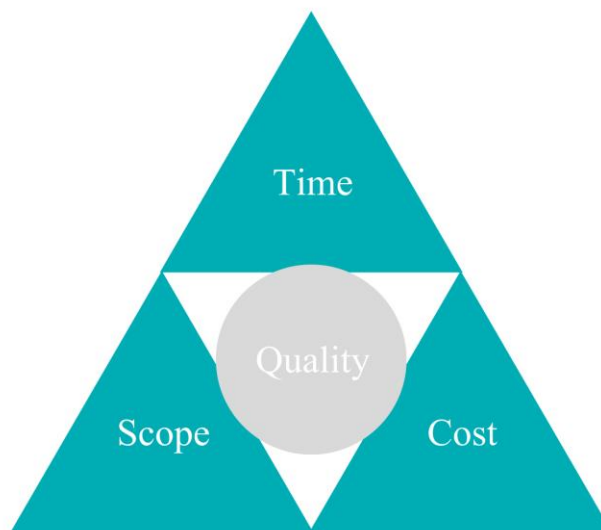


Figure 1, A figure of the iron triangle modeled after the definitions in Pollack et al. (2018). It shows the three corners applied: Time, scope and cost, along with the product of them; quality.

For the quality of the end product, which can be seen as a product of the three corners of the triangle in figure 1, there was some ambiguity at the very beginning of the project. First off, a decision had to be made for what the specifics of the project's product should be. The choice was between delivering a suggestion for a specific physical drone, a proof of concept for implementation only for Region Östergötland, or a more general proof of concept for broader implementation or combinations thereof, there was a lot of discussion. As the project could potentially help in issues pertaining to life and death, the motivation for delivering a solution of high quality was high from the start, regardless of which solution was chosen. The option of providing a proof of concept for a broader implementation was the solution deemed to be beneficial to the largest population and thus chosen.

Once a solution was chosen priorities had to be set as well. The scope of the project - as set by the challenge providers - was quite broad, where the only real borders were to include medical care, drones and to focus on areas outside of the urban core. This is the one corner of the triangle which could not be changed, however because of its broadness it was not an issue throughout the project. The time and cost corners were, on the other hand, more open to be changed as the project went on. This was taken into account when creating the original project plan as described above.

Within the project an agile approach was implemented according to the book *Agile Project Management* by Gustavsson (2019). Using weekly meetings with the entire group in order to assess progress and adjust the plan as needed. In the first stages of the course an overall plan for the work was made, where different periods of stress were noted and less work was allotted to the different members of the group in these periods. For example the group had members with two different exam periods, and thus the work was lessened and paced down somewhat during these weeks. This was done in order to ensure that both the members with exams could keep up with the project workload and their exams, and that the members working with the project more full time could meet the planned deadlines. This was also the stage where the decision of an agile approach was chosen and the weekly meetings were implemented.

It is worth noting that no project manager was chosen within this project, as it started off with a four member team. However, early on there was an addition of a group member to the group and some planning could be redone. The agile approach and weekly meetings stayed the same, but with an additional member bringing us to a group of five some deadlines were moved to an earlier date.

As in most projects, the original plan needed adjustment during the progression through the project. However, since an agile approach was implemented within the project this was somewhat accounted for and space was left in the original plan for changes. The changes needed within this particular project relate to both the set deadlines along with the functionality of the product chosen. As the project went on, it grew from a proof of concept to a business idea for creating a company to implement the solution in its entirety. This change naturally came with a lot of discussion within the group and some restructuring, which resulted in extra working hours and changed deadlines. It was a change which ultimately led to a product of higher functionality, and the hours spent in changing it meant some hours less in specializing the product, in this early stage, to one individual buyer.

The research portion of the project also pushed the limits of the allotted time within the project plan, but as less research would negatively affect the quality of the solution it was decided that the extra time needed was a reasonable trade-off for a better solution.

There were not only setbacks or an increase of time spent, but time was also saved in some avenues. In the middle of the project several interviews were carried out, all of which in turn generated more contacts and potential interviews, and initially all were to be followed up. However, after discussing where the process was at, what was actually needed for the next step and the time constraint of the course, several of these contacts were never interviewed. Though

it might be useful for developing the product further, or for specializing it for a specific use in a particular region, at this stage they were not necessary and a trade-off was made in order to focus on other parts of building the product.

3.2 The team

The team comprises five members: Carl, Jakub, Lisa, Nikita, and Sofia. Each member brings diverse experiences and pursues distinct programs at Linköping University. This diversity enriches our collective skill set, allowing us to contribute uniquely to our collaborative efforts. Our primary mode of communication revolves around a dedicated group chat on Facebook/Messenger. This platform facilitates swift and effective interaction among team members. Responses to queries or discussions are typically prompt, partly because there was a clause in the group contract ensuring answers within 24 hours, ensuring rapid and seamless communication. Determining our meeting schedule is done through discussions on Messenger or during our preceding gatherings, usually organized a week in advance. This approach affords the team ample time for individual research and thorough preparation for upcoming project tasks. This deliberate planning ensures that our meetings are productive and focused.

The communication during the meetings is also very efficient with a clear agenda. A few changes have been made during the course to become more structured. To start off the meeting one team member has prepared an agenda to initiate the meeting and another member takes notes during the discussions and uploads a summary for the team to refer back to. This will not only serve as a valuable resource, but also encourage active participation by keeping everyone informed. The team has committed to notifying the group in advance when a meeting room is booked and ensuring that everyone is aware of the meeting details. One team member has also taken the important role to keep mail contact with different interviewers and stakeholders.

Because of the different experiences within the group, it has occasionally given rise to some conflicts. However, it is reassuring to note that these conflicts have been managed effectively, showing an environment where open and respectful discussions can occur. It is recognized that being physically present at meetings often enhances the communication and collaboration within the group. That is why the group prefers those kinds of meetings. Nonetheless, it is also understood that this is not always feasible, which is why the group holds meetings on Teams when in-person attendance is not possible, in order to maintain consistency. When this is the case however, the meetings will be entirely on Teams and not as a combination of some group members on campus and some on Teams, which has sometimes been the case previously.

The project group maintains a commitment to discuss all decisions collectively within the group. This collaborative approach ensures that every member's input is considered, fostering a sense of ownership and unity within the group.

3.3 Stakeholder relations

Collaborating with different stakeholders was a dynamic process throughout the project. The relation with Region Östergötland, the challenge provider, proved to be a cornerstone of our efforts. The interaction included a proactive exchange of ideas, requirements as well as the limitations of the project. The partnership with Region Östergötland provided valuable insights that shaped the project's trajectory.

Engaging with healthcare workers, such as ambulance paramedics, was overall insightful. Opportunities to discuss and get feedback on the solution of the project were given, allowing us to gain an understanding of their needs and expectations. This approach facilitated their insights into the project, increasing the chances of seamlessly integrating the drone technology with their operational requirements. Looking back, more proactive communication with them could have clarified the project's potential and needs earlier in the project timeline.

Collaborating with SOS Alarm workers brought a unique perspective to the table, by offering valuable information and ideas that might have been overlooked otherwise. In hindsight however, visiting SOS Alarm earlier in the project could have further enhanced the collaborative process, ensuring a more comprehensive understanding of this stakeholder's perspectives and needs earlier on while working with the project.

Looking back at the project's entirety, if it were to start over, earlier engagement with stakeholders would be emphasized. Initiating dialogue in the beginning of the project could provide important insights that could have influenced the decision-making process. Having interviews with relevant companies even earlier into the project would also be beneficial as they provided input and information that was heavily influential and useful when coming up with the solution to the challenge. Additionally, a more iterative approach to stakeholder feedback, especially during the initial stages, might have enhanced the project's adaptability to evolving requirements. Regular check-ins and a more robust feedback mechanism could further optimize collaboration and ensure that the end product aligns seamlessly with the diverse needs of our stakeholders.

3.4 Risk management

During the project, several risks were discovered and discussed. Two categories of risks were considered: "risks in the group" and "risks in the project". The "risks in the group" were the problems that could occur inside the group and how communication and conflicts could change the outcome of the project, while the "risks for the project" were the risks with the idea itself.

To identify and assess the risks, two tables were made. In the tables, risks are first identified, then the probability and consequence are scored on a scale of one to five, these scores are then multiplied in order to get the Risk Value. The higher the risk value is, the more we need to be aware of the problem. A response to deal with the possible arising issues was then formulated to make sure the group was prepared if something happened.

<i>Risks in the group</i>	<i>Probability (P)</i> <i>1 to 5</i>	<i>Consequence (C)</i> <i>1 to 5</i>	<i>Risk value</i> <i>P*C</i>	<i>Risk Response</i>
<i>Poor communication within the group</i>	3	4	12	<i>Meetings every week where we continuously discuss the ideas and thoughts of the project.</i>
<i>Conflicts/Different opinions between group members</i>	5	2	10	<i>Conflicts are expected and encouraged. If the conflicts get out of hand, we sort it by voting.</i>
<i>Group member drop out</i>	2	2	4	<i>If a group member feels like this is not the course for them and drops out, we will redo the project plan and sort out the different responsibilities.</i>
<i>Documents get lost</i>	1	3	3	<i>The group will keep a backup folder with the text to keep the documents from getting lost.</i>
<i>Technical challenges</i>	3	2	6	<i>The group will be well prepared for different tasks and, if needed, take help from teachers and classmates.</i>
<i>Schedule delays</i>	3	4	12	<i>Make sure to go through emails and Lisam at every meeting.</i>

Table 1, presenting the identified risks for the group.

Between the stage of project planning and where the project is currently, a few additional risks have been identified and discussed. Risks correlated to the group were mostly poor communication and conflicts. The communication could have been handled in a better way when sometimes new information surfaced the day before meetings, which was rectified throughout the project's progression. There were both benefits and demerits to the conflicts within the group. On one hand, conflicts lead to breakthroughs and creative thinking and on the other they have also hindered the work process and made it slower.

While creating the project plan, some key risks were overseen, especially the risks for the project and the drone itself rather than risks within the group. During the project more potential risks started to emerge, indicating the difficulty with implementing the drones outside the urban core.

<i>Risks in the project</i>	<i>Probability (P)</i> <i>1 to 5</i>	<i>Consequence (C)</i> <i>1 to 5</i>	<i>Risk value</i> <i>P*C</i>	<i>Risk Response</i>
<i>The drone, equipment and stations needed is too expensive</i>	4	4	16	<i>Before implementing the drones, make sure to have proper information about the equipment and location.</i>
<i>Too low flight radius</i>	3	5	15	<i>The drone needs to be thoroughly chosen depending on location.</i>
<i>Technological problems with how to control it</i>	4	4	16	<i>The pilots need to have a correct education towards the drones incase of malfunction.</i>
<i>Regulations for the drone</i>	5	5	25	<i>The drones are only able to be implemented in places where there are no severe regulations.</i>
<i>People not using the equipment from the drone</i>	3	5	15	<i>Making the equipment easy to pick up and use.</i>

<i>People being scared of the drone</i>	2	4	8	<i>Coloring the drone like an ambulance as well as having the drone sound like it.</i>
<i>Too few people in need of the drone outside the urban core</i>	4	3	12	<i>Have different features for the drone depending on the location so it can cover a larger base of people.</i>

Table 2, presenting the identified risks for the project.

The risks for the project are potential risks that could occur while the drones are active, making it hard to know the outcome beforehand. The most critical risks are the regulations and how to address them for drones in certain areas. For the drone service to ever work, the regulations need to be changed. Regardless of the regulations, the technical issues such as who and how the control over the drone should be handled is also a major concern due to factors like collaborations with SOS-alarm, education and malfunctions. The risk considered the least important was the risk of people being scared of the drone, as this issue can be solved quite easily by for example painting the drone with the color of an ambulance and having it sound as one as well. Furthermore, a study by Baumgarten, M. C., et al.(2022) showed that this was not an issue within their trials. By doing this it makes the drones feel more user friendly for the population.

In conclusion, effective risk management strategies were implemented to address challenges within the group and potential project-related issues. This will help emphasize the importance of risk management and updating the risks throughout the project's course for a successful implementation of the drone service.

4. Evaluation of quality aspects

This chapter introduces the business potential of the project by using the NABC (Need, Approach, Benefit, Competition) model, and the responsible innovation.

4.1 Business potential and customer/user benefits

The need is evident in the challenge of bringing emergency medical care quickly to remote areas. If emergency medical care is not received within the crucial first minutes, the chance of survival drops drastically. With every minute, the survival rate falls 10% for cardiac arrest. This is only one of many emergencies that can occur (*Hjärtsäkrat Grannskap Med Hjärtstartare*, n.d).

Even though ambulances can be quick, the response time for traditional emergency services can be heavily extended in areas outside the urban core. Every second is important in a life threatening situation, and the possibility for a drone to arrive before the ambulance can make a substantial difference in the outcome (*Hjärtsäkrat Grannskap Med Hjärtstartare*, n.d).

The approach for this is to produce flexible drones with different kinds of equipment such as defibrillators, epi-pens or first aid kits along with surveillance. The drones are produced in the same way and then depending on what the different municipalities want to achieve, the drones equipment should be adjusted according to their needs. The option for surveillance can aid in quick and accurate location tracking, ensuring a faster and more precise emergency response. Collaborations between municipalities, SOS Alarm, hospitals and other potential actors are encouraged to make the rescue as swift and successful as possible.

The regions benefit from collaborative efforts from actors such as hospitals, private companies, SOS Alarm and municipalities. Bringing different parties together results in a more effective health system. For instance, by using surveillance, a drone could reach a car accident location, assess that fire trucks are not needed, and cancel them, optimizing resource utilization. This service enables individuals to avoid intensive care department visits, saving approximately 50,000 to 80,000 crowns for each person that does not have to stay overnight (*Svenska Intensivvårdsregistret*, n.d).

For now, there are not a lot of companies in this area. The competitors that are existing now are mostly located and active within the city center. Because of flight regulations for drones and getting airspace access, for now it is hard to have the drones fly beyond the city center. Keeping to the city center, and a more dense population, means a higher rate of usability of a drone delivering medical services. Still, the drones are not deployed enough to create an immediate profit for the company owning them. However, by expanding to include surveillance the drones could be used to a larger degree outside of the urban core, in this way the business would become more beneficial to both the region affected and the owner of the drones.

4.2 Responsible innovation

This part has been done according to a responsible innovation investigation template provided by course examiners of the InGenious course 799G52 held 2023 (see appendix 1). There have been multiple different important factors identified while considering how to be responsible while innovating and conceptualizing this solution. On the level of technology, there were a few possible impactful on the ethics issues that might arise with the solution, such as that having a high-tech surveillance flying above people's head might cause them to feel like their privacy is jeopardized, or that this kind of footage might get leaked or used for the wrong purposes. The group has come up with solutions for this and other technological issues and, as for this one, there could be special private servers created that would keep the footage only until the case is officially closed and are deleted afterwards.

On the artifact level, defined as “a physical configuration that, when operated in their proper manner and in the proper environment, produces a desired result” - Norrman (2023), there are a few different ethical problems anticipated. For example: if the drone has been used often, and started being relied upon, failure to reach the emergency zone in time could result in complete loss of trust in the product. This could lead to the drone being used less by the receivers and could cause more casualties. In general, most ethical issues on the level of artifacts and technology include over-reliance on technology, what that could cause - dependency on drones to deliver care perfectly and reducing responsibility on ambulances - and what it could cause afterwards - failure to realize issues with the drone performance and its care services.

Lastly, on the application level of ethical issues (Norrman, 2023), drones are not inherently fail-safe and are vulnerable to external influence, such as physical damage or a malicious take-over. In those cases, drones could cause physical harm to people by for example falling and dropping on someone, or they could be hacked and used to cause harm or violate people's privacy. The solution would be to create both fail-safes and safety nets in order to address these risks. One fail-safe could be a shut-down function in case of a hack, and then a safety net - so that the drone does not drop on someone - could be installing a small parachute that activates whenever the drone senses a heavy drop or one that could be launched manually.

As based on Stilgoe et al. (2013), there will be a need to engage with existing systems and integrate the solution with them by helping customers with the transitional period between their current system and the drone system. It also needs to be considered how plausible such integration is and at how deep of a level it will need to be integrated on. There will also be a need to reflect on how to connect the drone services through SOS Alarm, the solution's customers and the local government and who amongst them will take a role of responsibility for the solution and possible issues that arise with using it. It would be advisable to include an informative system that will notify all citizens in the area of the drone usage that such a service is being implemented, and to supply them with a contact for further information in case they are worried about f.e surveillance, and to suggest changes to the implementation of the system.

Lastly, the plan is to be responsive by using well-tested technology, delivering the highest quality care and making sure that the solution is both open and transparent.

To take responsibility, the project will anticipate possible issues with drone technology and assess it based on already existing similar systems. It will also be assessed whether its use is plausible in the long-term, make sure that there will not be any major issues arising during the further implementation of the solution, and deal with any that will not be possible to predict when they happen. It will also be important to create a trusting collaboration between participating institutions. If a need for an in-depth dialogue between the involved parties appears, Skycare will provide clear, legitimate answers to any questions. The project will ensure that the design of the solution is user-centered, previously interrogating both ethical and social stakes that are associated with such new technology and its application in real-world scenarios.

The most likely ethical technology issues, as presented by Brey (2012), are anticipated to be ones related to harms and risks of using unmanned automatic drone systems in delivering medical care to emergency cases. There is a possibility that a drone might fall from the sky or drop its equipment due to external or internal causes, which could cause risks for bodily harm if those were to fall on someone. Additionally, some people might not trust technology or drones which could cause further fear and distrust in this type of solution. As mentioned earlier, cameras being used without full control could be used for malicious purposes, something people could be scared of. To mitigate those risks, the solution will implement various technical fail-safes, such as previously mentioned installing a small parachute that would be deployed in case of a system crash. Additionally, to avoid a general mistrust of the flying drones, they would be painted in the colors of the local ambulances and emit the same or similar sound as them. The drones would only get permission to surveil the area near the accident, rather than record the whole way there. This would help avoid most privacy problems that the general reception could have with them, as their personal privacy wouldn't be invaded or jeopardized. Besides those issues, there is confidence that the solution contributes to the general well-being and the common good of the people in the area where the drones will be deployed.

The focus has been placed on three of the seventeen goals suggested by the UN Global (2023) - goal of good health and well-being, goal of reduced inequalities and goal of sustainable cities and communities. The first goal - good health and well-being - is a clear driving factor for us as a project group. The focus of this solution is on delivering medical equipment to injured and troubled people outside the city core, and helping them in their time of dire need. Even if some people won't be directly affected by the care delivered by the drones, the promise itself of receiving help and care quickly will hopefully decrease some of the worry and anxiety of people living outside the core.

In accordance with the second goal - reducing inequalities - SkyCare aims to make sure that everyone, regardless of their age, gender, money or location, can receive care as fast as possible and be safe and secure in their homes. With the focus placed on delivering medical equipment outside the city core, where people often find themselves in locations too far out for emergency

services to reach in time, the solution will be there to help amend this issue and reach them in an emergency, in time.

Lastly, there is the third goal - sustainable cities and communities. This is a goal that the solution aims to reach by supplying drones which abide by the environmental policy of the EU (Kurrer, Lipcaneanu, 2023). Furthermore the use of drones will hopefully help patients avoid unnecessary complications and the following medical care by receiving help before a medical emergency goes too far. And utilizing the drones' surveillance will help with lowering the amount of sent-out ambulances or fire trucks saving human and monetary resources. This would save energy and costs as the length and frequency of hospital stays could be decreased, as well as later hospital visits. On a larger scale it would also decrease medication production and other needed medical care. It would also improve the life of a survivor to avoid complications, letting them be a more productive and happy part of a community.

5. Recommendations and main lessons learned

In this chapter of the report the lessons learned throughout the project are evaluated, and the recommendations for similar future projects are presented.

5.1 Lessons learned

Throughout the progress of the project several takeaways in relation to the project planning, execution and group dynamics were made.

Firstly, in relation to the planning of the project, planning to execute all interviews early on could have helped in managing to execute more interviews and getting a stronger base and broader knowledge for the project. An important aspect in executing this is to be persistent; for example sending reminders when a contact is slow in replying.

Another part of the execution of the project which could have used some work is the annotation of decisions. In the beginning of the project note taking during meetings was not done thoroughly, though this was later remedied and added to the group contract after being identified as an issue. Because of this, discussions sometimes reappeared and played out again as no one in the group could show why exactly a decision had been made, until it had been argued for again. Had decisions made during every meeting - with motivation - been noted down clearly after each meeting those notes could have been referred back to and it would have saved the group time.

Furthermore, writing down limitations of the project early on in order to be able to refer back to them, and to ensure that everyone in the group has the same objective and expectations from the project. This includes writing down both the limitations in the goals of the project, for example using the SMART or MosCow principles, but also discussing the ambition level of all of the members to create proper expectations within the group. During this project the SMART and MoScow principles were both discussed and the MoScow principles were used when setting goals at the beginning of the project when making the project plan. However, as the project evolved the principles could have been kept in mind more as new goals and wants came to light. There were times when aspects of a solution which were simply not achievable within the course, or what was left of it, were discussed or entertained for longer than needed. A quick evaluation would have shown they were not appropriate at this time and they could have been discarded.

5.2 Recommendations

To achieve more efficiency, there are some recommendations that could be considered in the future. To begin with, setting a standard response time for all communications within the group and with stakeholders will help the group to get answers quickly and be able to continue with

the rest of the project. As a group it is important to prioritize collaborative decision-making, ensuring everyone's input is considered. Aiming for consensus whenever possible, and otherwise establishing a working system for resolutions.

Encouraging active engagement with stakeholders is also important since waiting for them to initiate contact can lead to delays, taking the initiative to reach out when necessary to keep things moving. Another recommendation is to, early on, focus on understanding the project's purpose and limitations thoroughly, and regularly reassess it to ensure alignment with the project goals.

Lastly, before any interviews or visits it is essential to ensure that the interview will be insightful through preparation of the questions. Schedule engagements early, gather relevant materials, and understand their specific purposes. Each interview or visit should serve a distinct purpose. Understanding these objectives beforehand is important to tailor the preparation and approach accordingly.

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