



NAUST Robotics

Citizen Survey Results



www.robotics4eu.eu

info@robotics4eu.eu

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Introduction

This report presents the results of a collaboration between NAUST (DK) and the EU-funded project Robotics4EU under grant agreement No 101017283. The collaboration is part of a European wide citizen consultation on validating different robotics business ideas from a societal perspective. In total 11 robotics applications participated in the activity and took part in exploring how citizens can be engaged and give input to the development of new robotic applications.

The assessment of each of the 11 robotic solutions was performed in an online, informed survey style consultation. Here respondents were guided through the survey via an online platform providing them with informative text, pictures or video material and questions about the specific robotic solution. The platform then collected the answers from each of the individual respondents which were further analysed by the Robotics4EU project.

What is the Robotics4EU project?

The citizen consultation presented in this report is part of Robotics4EU, a 3-year project funded under the European Union's Horizon 2020 research and innovation program. The project aims to ensure a more widespread adoption of robots within the areas of healthcare, inspection and maintenance of infrastructure, agri-food, and agile production. To achieve this, the project is advocating for implementation of responsible robotics principles and raising awareness about non-technological aspects of robotics by organising community building and co-creation events bringing together the robotics community and citizens.

Why involve citizens' perspectives in the development of robots?

The collaboration between robotics developers and citizens rests on the core democratic notion that technology with the potential to have a significant impact on how we shape our future society, should not only be discussed by stakeholders, policy makers, experts, or businesses, it should also include opinions of the broader public who most likely will be directly or indirectly impacted by the changes the technology may impose over time.

There are several ways in which robot manufacturers can benefit from engaging citizens in their development processes. While citizens may not possess the technical knowledge required to build a robot, they are experts of the social worlds that new technologies will inhabit, change, or at the very least affect in some way or another. This type of expertise is equally important as professional expertise because it is what ultimately decides whether or not society will accept a new technology. Inviting citizens 'behind the stage' can help make sure that the manufacturers' solutions are aligned with society's expectations and needs. The citizens bring an 'outsider' perspective that can be an effective tool to detect and identify concerns and potential problems that would perhaps otherwise emerge only when the robot is fully developed and on the market. Thus, by adopting inclusive approaches from early in the development process, robot manufacturers will be better equipped to make informed decisions about their products and avoid costly mistakes that may ultimately render their solutions(s) unfit for society.

NAUST Robotics

NAUST Robotics are developing an autonomous drone (i.e., a drone able to fly and move around on its own) equipped with speakers to protect the agricultural fields from birds and wild animals' attacks. The drone will fly over the fields playing deterring noises with the purpose of moving the animals back to natural areas and keep the crops safe.



A landing platform for the drone (drone-in-a-box), that will be initially set in the field, will shelter, and recharge the drone itself. It will also detect the presence of animals either by sound or images, triggering the deployment of the drone to the area affected. The whole system will work autonomously.

The solution aims to increase the agricultural yield in agriculture, while avoiding the use of more harming techniques for scaring the fauna and the human-time used to check the status of the fields. The robot is limited to playing bird sounds, and in no way aims to harm the animals. Research shows that bird sounds are the most effective, but least stressful method to lead them back to natural areas. Current techniques include hunting, poisoning or using disturbing noises, whereas NAUST Robotics wants to offer a more humane solution for bird control. The robot also reduces food lost while bringing increased revenue for the farmer and it will result in a lower CO2 footprint and chemical input usage per unit of food.

Demographics

A total of 105 respondents were engaged in the activity answering questions about the robot.

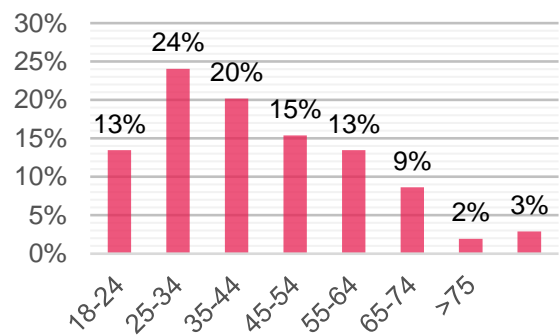
Respondents for this survey consisted mainly of citizens in the age group 25-34, accounting for 24% and ages 35-44 accounting for 20%. Following these ages 45-54 accounted for 15%. These were followed by ages 18-24 and 55-64 with both groups accounting for 13% each.

The gender distribution of respondents was adequately equal, with male participants accounting for 51% and female participants accounting for 47%. The remaining either answered 'other' or did not specify their gender.

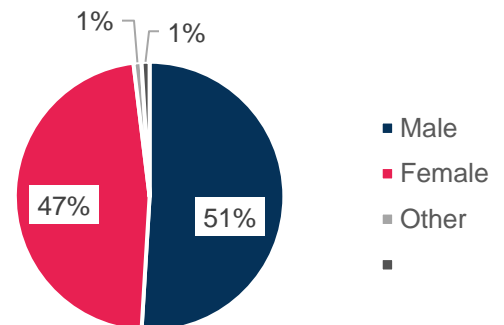
Looking at distribution of areas of residence, a total of 48% of the respondents answered that they lived in a large city. The second most chosen option was small town with a total of 25%, followed by suburban with 18% and rural with 8%.

Respondents were generally highly educated with 35% answering that they held either a master's degree or equivalent and 26% answering that they held a bachelor's degree or equivalent. Following this the third most chosen option was doctoral degree or higher with 18%.

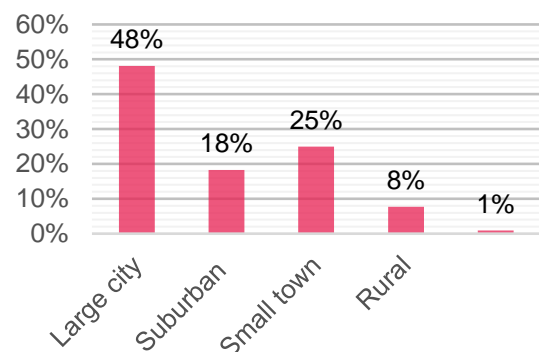
Age group



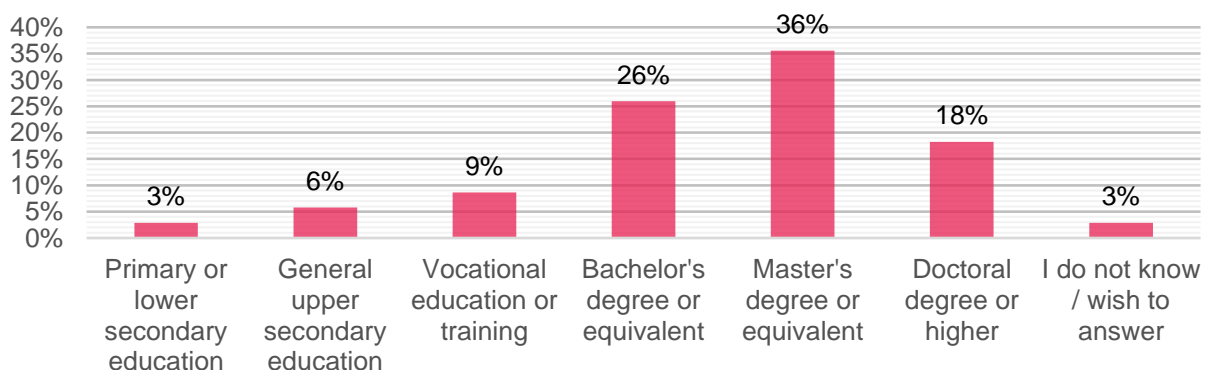
Gender



Area of residence



Education



The survey received answers from respondents from 17 different countries in total. 18% chose not to disclose their country of origin. Apart from this, Denmark and France took the top spots with the former accounting for 17% and the latter for 15% of the total answers. Following this Portugal was with 9%, Lithuania and Estonia with 8% each and Norway with 7%.

As is evident from the above, most respondents answering the survey were younger people holding degrees and living in larger metropolitan areas. These specific demographics may influence the answers and tendencies described in the report. However, when reading through the responses on the following pages, it is important to be aware that these results are not statistically representative, but indications of people's individual opinions which can be used as valuable input to the further work of the company's robot solution.

Survey Results

The online consultation consisted of 7 questions focusing on citizens general view on drone technology.

Question 1: What is your perception of drones and what uses are you aware of?

Firstly, respondents were asked to write briefly about their perception of drone technology and what uses they knew of. Here, respondents generally mentioned a few clusters of categories with quite a few overlaps between them. Respondents highlighted drones used for video and photography in a variety of different situations, and one citizen mentioned how:

"Drones can do surveillance; search and rescue; traffic monitoring; weather monitoring; personal use; videography and photography; agriculture; delivery services"

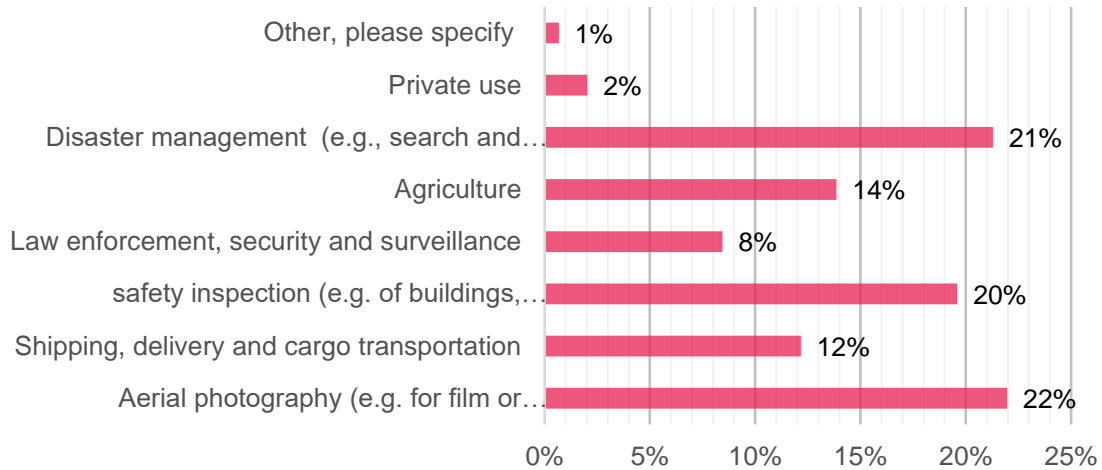
This answer encompasses many of the topics highlighted by the respondents throughout the activity. Furthermore, drones used for aerial photo and videography were also mentioned by participants at this point of the survey. Another important area that attracted a lot of attention was the potential use of drones for military operations and considerations about drones being used for military purposes made up a substantial portion of the answers.

Respondents were also quite positive towards drone technology and mentioned several uses of drones that are greatly beneficial as a technology and a tool that can be used for multiple purposes.

The participants in the focus group interviews conducted during the Robotex Festival did not feel intimidated by this robot. Rather, it was pointed out that since drone technology is already quite well known, it has become a safe technology that is destined to fulfil its role and do the job. *"I can't say either bad or good. It's like simple worker, I would say."*

Question 2: What potential do you see in drone technology (choose up to 3)?

What potential do you see in drone technology?



**Data is showed as a percentage of total answers in this question, not total of respondents*

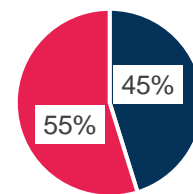
When asked about the potential of drone technology the respondents engaged in the activity mostly favoured 3 areas, namely ‘Aerial photography (e.g., for film or journalism)’ with 22%, ‘Disaster management (e.g., search and rescue, weather monitoring etc.)’ with 21% and ‘safety inspection (e.g., of buildings, infrastructure, industrial areas etc.)’ with 20% of the answers. Interestingly, agriculture was not among the top choices indicating that despite drones being fairly well known among citizens it is not for agricultural purposes they relate the technology or see most potential. This does of course not mean that drones shouldn’t be used for agricultural purposes but is rather an indication that when having to choose among three options agriculture is not the prioritized area from a citizen perspective. In fact multiple citizens elaborated that they would like to choose all the options.

Question 3: Are you generally worried about the increasing implementation of drone technology? Please elaborate on your answer in your own words.

When asked whether participants were worried about the increasing implementation of drone technology 55% answered ‘No’, while 45% answered ‘Yes’. Even though more than half answered that they were not worried about increasing implementation of drone technology, several concerns were raised in the elaborative section of the question.

Here respondents highlighted the need for regulatory measures to create a society in which drones are accepted.

Are you generally worried about the increasing implementation of drone technology?



■ Yes ■ No

Several of the answers concerned the fear of drones being used to increase surveillance in society at the cost of privacy. Answers such as:

“Mainly worried that they will be used for surveillance on civilians”

Along with statements such as:

“I’m a little worried - but not much. I am worried about whether they are safe enough - and whether they are used for dystopian control surveillance”

Were quite prominent as elaborative answers to the question. Furthermore, respondents mention how legal concerns can be a considerable cause for worry. They highlight the need for regulation and legislation to ensure that drones are beneficial and helpful to society and not just as tools that might be misused and abused. A consensus was that with the proper regulation and legislation, drones will be a beneficial technological addition to society – and one capable of bringing about a large positive outcome.

While answers relating to legislative and regulatory action were by far the most common, worries relating to military use were also highlighted at this part of the survey. Here participants highlighted how drones are capable tools for performing bombing assaults or other military operations but also the fear that they might be used in terrorist acts. Interestingly, several mentions highlight the noise made by drones as being a problem and a cause for worry, a general sentiment being that their noise will be a nuisance and affect both wildlife and people and that increasing use of drones might make cities even more noisy.

Many also highlighted the positive aspects of drones and the potential of the technology, mentioning:

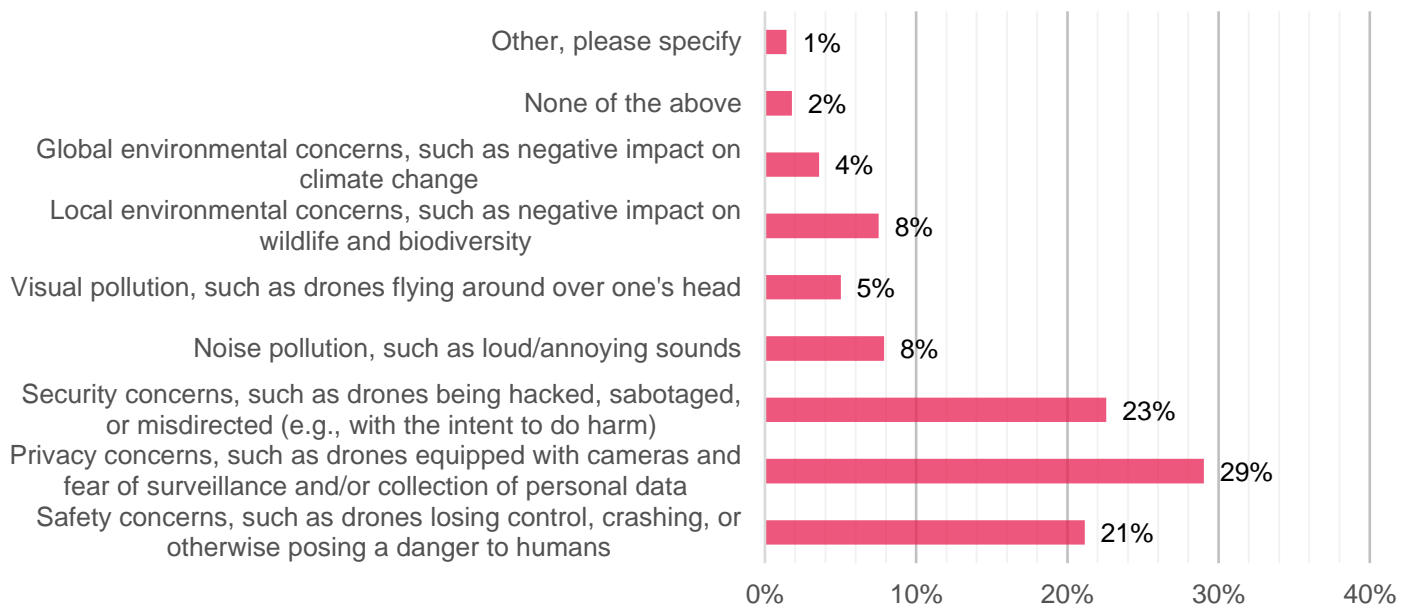
“[...] the value outweighing the big brother or voyeuristic negatives.”

And if respect for privacy is upheld and regulation and legislation are implemented, usage of drones is seen as being highly beneficial.

Question 4: Which of the following areas are you most concerned about regarding the future uses of drone technology?

As responses to this question were limited to participants choosing only 3 of the answers it is to be expected that, had participants been able to choose more than 3, they would have highlighted the other areas as being important as well. Limiting the number of options to 3 was done with the intention of getting participants to be more critical with their answers.

Which of the following areas are you most concerned about regarding the future uses of drone technology? (choose up to 3)



**Data is showed as a percentage of total answers in this question, not total of respondents*

However, when asked to pick out the 3 areas that respondents felt most worried about, some tendencies reveal themselves. When asked about the areas that worried the participants the most, it was evident that *‘Privacy concerns, such as drones equipped with cameras and fear of surveillance and/or collection of personal data’* was the most concerning option answer. This answer received 29% of the total votes. The second most chosen answer was *‘Security concerns, such as drones being hacked, sabotaged, or misdirected (e.g., with the intent to do harm)’* with 23% of the total votes. Following closely was the answer *‘Safety concerns, such as drones losing control, crashing, or otherwise posing a danger to humans’* with 21% of the total votes. As is evident from the distribution of answers to this question, the areas causing the most concern for participants are privacy, security, and safety, with privacy ranking just higher than the other two areas.

Looking at the answers to this question, it was also evident that environmental concerns did not rank high among the participants, neither locally nor globally. The answer *‘Local environmental concerns, such as negative impact on wildlife and biodiversity’* received 8% of the answers, while *‘Global environmental concerns, such as negative impact on climate change’* received 4% of the answers.

A similar tendency can be seen when looking at the areas regarding the participants' attitudes towards drones and the way they occupy the spaces around us. Here, neither visual nor noise pollution were ranked particularly high with '*Visual pollution, such as drones flying around over one's head*' accounting for 5% of the total votes and '*Noise pollution, such as loud/annoying sounds*' for 8%. Once again, this distribution of answers shows that when obligated to choose only 3 options there are some areas that respondents saw as being more pressing than others, for example in terms of environmental concerns being less worrying than privacy and safety concerns.

Question 5: What can designers and developers do to make drones look safer and more reliable?

Here, several respondents mentioned that equipping drones with redundancy features and failsafe mechanisms could help create a better attitude towards drones. Mentions of adding elements such as parachutes preventing the drone from crashing into people, animals, or property in case of a crash or an accident. Another respondent noted that it might be useful to:

"Provide designated drone spaces and safe areas, implement fail-safes for automatic drone landing in case of damage or other problems."

Other suggestions include ensuring that the software has been developed with focus on safeguarding it against cyber threats and hacking. Considering the design itself, many argued that safeguarding the helices of the drone would make them look considerably safer.

Perhaps not surprisingly, this was one of the questions that received the highest number of answers claiming that they did not know or had no opinion.

Q6: Soon drones may operate completely autonomous. What, in your opinion, should be done to ensure that society will accept and trust autonomous drones?

When asked about the increasing autonomy of drones and how the future of drones might look, the worry about legislation once again came up as one of the most pressing matters. Here, calls for very strict safety procedures, legislation and regulation were central for the participants of the survey. Respondents mentioned permits, authorization, and security approval by aviation authorities or other third parties along with restrictions on private use as some of the main pathways towards a more widespread societal acceptance of drone technology.

However, there were also a substantial number of respondents that were completely against the use of automated drones, one participant stating that:

"[...] There will always be a risk of breakdown, malicious hacking. Any absence of human control of an autonomous machine in a free field environment leads to a significant and unacceptable risk"

Further, respondents note that they would simply not trust them to operate automatically and that there should be a person controlling the drone in case of malfunctions and that:

“[...] Total autonomy is much harder to achieve than partial and so this will need a lot of work!”

Those who did not oppose a shift towards increasing autonomy highlighted the need for communication, information, and transparency. Here, raising awareness was seen as a way towards achieving acceptance and trust and multiple participants mentioned that communicating and involving citizens could be beneficial as a means towards broader acceptance for example by involving citizens in the development process.

As with many AI-driven applications, there is often a call for transparency towards the systems utilised, and the case for drones is no different. One respondent mentioned that making the software used open-source and showcasing code audits could be a way of gaining trust, while others argued that more transparent development of drones and their software could improve public trust.

Question 7: Drones are increasingly performing activities that involve the use of cameras. How can developers ensure that citizens do not feel that they are being watched or that their personal data is being collected and/or misused?

Concerning the use of drones equipped with cameras, respondents were generally somewhat more negative. Several answers here entertained the notion that it would be extremely difficult or simply not be possible to change the perspective of citizens when it comes to the way they feel about their data. Several respondents argue that this is one of the biggest issues to tackle when it comes to creating and ensuring trustworthy drone technology while maintaining that they do not know or have suggestions as to what could be done, and as one respondent mentions:

“People still have the fear that their personal information is collected and abused, it is in our nature and does not think it can be so easily changed”

For this question respondents also focused heavily on data and how to make sure that citizens can know how data is being processed and stored.

Several respondents mention that equipping drones with software that blurs or obscures could help trustworthiness, such an approach would need to be combined with information and communication to citizens about what data is being processed or stored by the drones. Once again, transparency is mentioned as a key component of societal acceptance and one way towards this could be to:

“Clarify what the cameras are used for. Have routines in place, like safe storage of data, and deletion of said data”

Another suggestion mentioned by respondents was to limit the movement space of drones to selected areas, for example by prohibiting the use of drones in public areas, near private properties and areas with people. Furthermore, they should only be allowed to operate with proper authorization. However, they once again highlight communication and information as a way forward.

The participants in the focus group interviews conducted during the Robotex Festival also pointed out that since this drone makes a sound, it is difficult to assess how disturbing or scary the drone could be, because it is difficult to tell from the picture whether the sound it makes could be somehow scary or unpleasant. "When it's coming towards a person, it can be maybe kind of startling."

Conclusion

In conclusion, the online consultation revealed that citizens have a positive perception of drones and recognize its versatility as a tool for various purposes such as aerial photography, disaster management, and safety inspection among others. Respondents also highlighted the need for regulation and legislation to ensure that drones are used for beneficial purposes and not misused or abused. Concerns about privacy, security, and safety were identified as the areas that participants were most concerned about regarding the future uses of drone technology. Respondents suggested that designers and developers can make drones look safer and more reliable by equipping them with redundancy features and failsafe mechanisms, providing designated drone spaces and safe areas, and also by implementing software safeguards against cyber threats and hacking. Respondents also emphasized the need for strict safety procedures, legislation, and regulation, communication and transparency, and involving citizens in the development process to ensure societal acceptance and trust of autonomous drones.

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