



Lifeline Robotics

Citizen Survey Results



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Introduction

This report presents the results of a collaboration between Lifeline Robotics (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.

Lifeline Robotics

Covid-19 came as a shock to many. Everything was turned upside down and everyone had to adjust to a new life filled with restrictions while trying their best to stay safe and healthy. A robotic solution like the Lifeline swab robot will enable organisations, companies and even nation states to be better prepared for the spread of future pathogens.

The purpose of the Lifeline swab robot is to conduct safe and gentle throat swabs with a high-quality to the sample collected. For example, in conducting a Covid-19 test. The solution works by combining artificial intelligence (AI), machine vision and sensitive robotics into a medical device.



The machine vision provides images to the AI which detects several human features ranging from a head to the back of the throat. The AI delivers specific swab target points to collect the best possible swab for that exact throat structure. Then, those points are transferred into gentle robotics movements.

The solution will be fully automatic, meaning that human personnel is not required to collect a sample from a citizen. This frees healthcare personnel to do more valuable human-centric work, as compared to a repetitive and monotonous swab sampling. It also shields workers from the danger of infection and minimizes the variety in quality between the samples.

Being a medical device means that the product must comply to strict regulations and are of the highest human safety standard.

Lifeline Robotics will not be able to stop a viral pathogen from forming. However, Lifeline Robotics will provide technology that can help nation states and organizations with being prepared to detect a viral threat before it evolves into a full blown, out of control pandemic – essentially, contributing to a so called early-warning system. Ultimately, the solution will improve health and save lives while securing the economy and minimizing the worry.

Demographics

Overall, a total of 116 respondents participated in this survey.

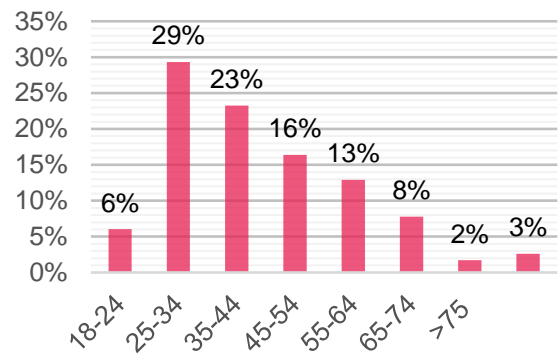
Responses consisted of high representation of citizens in the age group 25-34, accounting for 29% and ages 35-44 accounting for 23%. The age groups 45-54 and 55-64 were also adequately represented whereas the younger generation (18-24) and older generations from 64 years and up were not as well represented.

The gender distribution of citizens was relatively equal, with male participants accounting for 42% and female participants accounting for 54%. The remaining either answered 'other' or did not specify their gender.

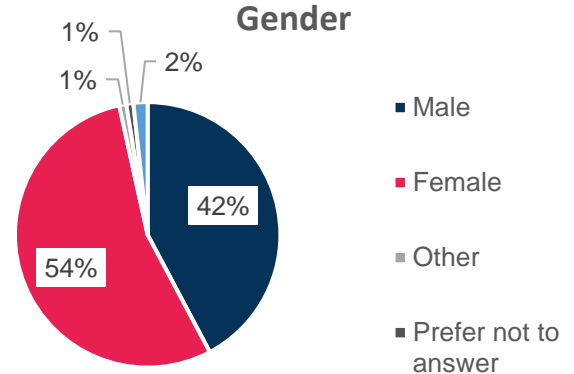
Looking at distribution of areas of residence, a total of 52% of the respondents answered that they lived in a large city. The second most chosen option was small town with a total of 23%, these were followed by suburban with 17% and rural with 6%.

Respondents were generally highly educated with 86% answering that they held either a bachelor, master's or higher degree, whereas only 12% held secondary education or vocational education.

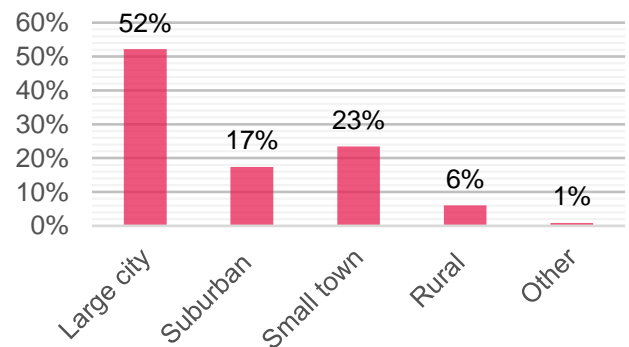
Age group



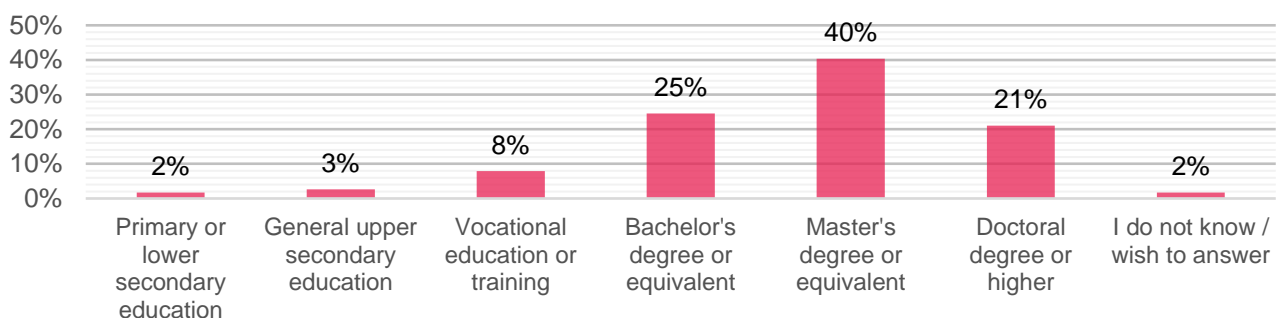
Gender



Area of residence



Education



The survey received answers from participants from at least 17 different countries in total. Citizens from both Central and Eastern Europe, Northern Europe, Southern Europe, and Western Europe have answered the survey indicating a diversity across Europe. Additionally, citizens from outside of Europe such as China and the USA have also been engaged. Especially people from Portugal and Denmark have been engaged, taking the top spots with the former accounting for 19% and the latter for 17% of the total answers.

As is evident from the above, most participants answering the survey were young and middle-aged 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 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

Citizens were asked eight questions regarding their perception of the robot and what barriers and opportunities they could imagine there might be if they were to use the robot.

First, respondents were presented with the following scenario and then asked four questions on how they imagined they would feel in the situation.

Imagine that you were about to be tested for COVID-19 as you have had a sore throat and been coughing for a while. You have chosen to go to your nearest testing centre as it is most convenient for you. At the testing centre, they have implemented swab robots and it will therefore be your first time being swabbed in your throat by a robot.

Question 1: How would you feel about the situation?

The respondents had divergent feelings towards having a robot swab them for Covid-19, which can be divided into positive and negative attitudes towards the robot.

Positive feelings towards the robot:

Approximately half of the respondents indicated positive feelings towards the robot. Around half of the positive respondents said they would feel fine or okay with the situation, some highlighting that it would perhaps be even more exciting or interesting than the normal procedure. Among these a good number of respondents also said that they would feel comfortable or safe in the situation without any major concerns or fear of risks holding them back to try it. Among this group there is a sense of trust towards the robot and an assumption that any implemented version of the robot would have gone through extensive testing to ensure safety. One respondent said, *"Being a new mechanism and trying it out for the first time, I would feel a little anxious but at the same time confident that it is a fast process that takes a few seconds and has been designed and tested by professionals"*. Furthermore, efficiency and hygiene were highlighted as some of the positive feelings towards the situation. A few mentioned that the robot would be more effective and protective towards both the citizen and medical staff as there

would be no risk of infecting another person with the virus. One respondent said: *"I am glad to have that, quite often robots perform better in terms of precision in operations, and I am also happy then I won't be exposing the medical workers there in danger, well, robots won't be infected by my virus"*. Some also saw it as a solution to overcome the lack of medical staff.

Negative feelings towards the robot:

Contradictory to the responses above, many of the other respondents highlighted feelings linked to them being doubtful about the situation. "Uncomfortable", "terrifying", "worried" "stressful" and "anxious" were some of the words used to describe their feelings among a large group of the citizens. One respondent said: *"[I would feel] Nervous. New technology for sticking something down my throat is not an appealing prospect"*. Safety and fear of pain or harm was also mentioned by a large group. There was a general fear towards the robot not being able to perform its task safely and precisely enough to avoid harming the patient. A considerable concern was centred around the force and sensitivity of the robot and a lack of trust that the robot would not go too far down the throat causing pain and discomfort. Respondents were also afraid of their own reactions causing the robot to make a more inaccurate and painful swap. Respondents questioned whether the robot would be able to respond accordingly to people accidentally coughing, moving their tongue/mouth or doing sudden head movements: *"[I would feel] A little insecure as the robot is not able to respond if I get the urge to cough, or vomit"* and *"[I would feel] Fascinated and curious but also nervous to keep still and not react too much in case my reaction would make the swab more painful"*. One person even said that: *"It would be important to me that I was stronger than the robotic arm so I could move it physically if I got scared."*

In the focus group interviews conducted during the Robotex festival, it is also confirmed that using a robot would make it safer to know that someone has already tried it beforehand. A participant said: "I might not really want to be the first, but what if another person has already had it, so I could try it."

Another considerable barrier towards the robot was the lack of professional human medical workers. Some would simply rather be tested by a human where others are open to the idea if human assistance such as a nurse or a doctor were present. One of the respondents that would rather be tested by human said: *"I would like to hear warmer voices from human beings rather than cold machines. If there are only machines placed, I would feel helpless"*. Among those who would like medical staff to be present, the reasons were to supervise the robot, ensure safety, make the patient feel more comfortable and to give explanations on how the machine works and what to do.

Question 2: What information would you like before being swabbed by a robot?

Communication on **Procedure** and **safety** are the two most important types of information the respondents would like to receive before being swapped by the robot. Respondents would like clear information on how the robot operates and a step-by-step instruction on what the patient should do, what the robot will do during the swab, what will happen after the swab, how the patient will receive their results and how their data will be handled.

Many would like to receive this information beforehand on their cell phone or while waiting to be fully prepared for the test. Others also indicate that the information could be given by the robot just before the swab or during the procedure.

In addition to information on the procedure it was also important that information on safety is given to the users of the robot. Respondents would especially like more information on the sensors in the robot and the safety measures to towards ensuring that the swab will go too far down the throat or push too hard causing injury: *“I would feel safer if the device made safety indications with a recorded voice. Like: There is no risk of touching any zone of the mouth, causing pain”*. Respondents also asked for information about emergency stop or procedures in case of a malfunction or if the patient wanted to stop the swab in case something was uncomfortable or hurt. In connection to this, information on certification, test protocol, success rate, and maintenance is mentioned as ways to show that the robot is safe. The respondents want to be assured that the robot is tested and follows EU liability regulations and is verified by a recognized organisation. Concerns regarding maintenance and hygiene were also mentioned. A few respondents would like information on how often the robot is sanitized and the safety measure towards not infecting the next person with potential virus through surface areas people might touch with their hands or head.

Many respondents mention videos or brochures as the best channel of communication. Some also mention that it would be nice to see examples of others being swabbed before trying it themselves: *“That would make me more comfortable and trust the robot more”*. This is proposed to either be though a live demonstration on a test person or though video testimonials: *“Ideally, I would like to see it 'live', but a video would be ok too.”* Some also asked to receive the information by a human rather than a video.

A significant group also asked for information regarding human medical staff. This varies from information on when a human last has checked the machine, how a human can be contacted if needed to information on *“Where I can get swabbed by a person instead?”*.

Question 3: What would be your biggest concern regarding being tested by a swab robot?

Many of the same barriers as previously described occurred again when asked what the respondents' biggest concern would be. The biggest concern is the fear of being hurt by the robot due to poor design and programming or technical errors in the system. This concern also relates to another big concern which is the mistrust in responsiveness towards human movement or human feedback. Many respondents once again highlight that they are concerned about their own reactions when being swabbed and therefore would need reassurance that the robot can react to discomfort, pain or unexpected movements. A specific suggestion to help this barrier was to design a function where the user can give feedback when feeling pain or discomfort and that the robot can communicate with the user throughout the swab to ensure that everything is going as planned. A couple of respondents also suggested to have a visible stop button: *“I think a visible stop-button would provide a sense of control and safety “*.

Lack of human support was also mentioned once again as one of the dominant concerns. Many suggested to have a human assistant on site to ensure trust both with the procedure but also to help assist if something goes wrong. It was mentioned that discomfort and nervousness cannot be dealt with by a robot and that especially for young children and older people human assistance would be necessary.

- Lastly accuracy, reliability in the sample collected and efficiency in it taking longer time than if performed by a human were also mentioned as concerns by a few respondents.

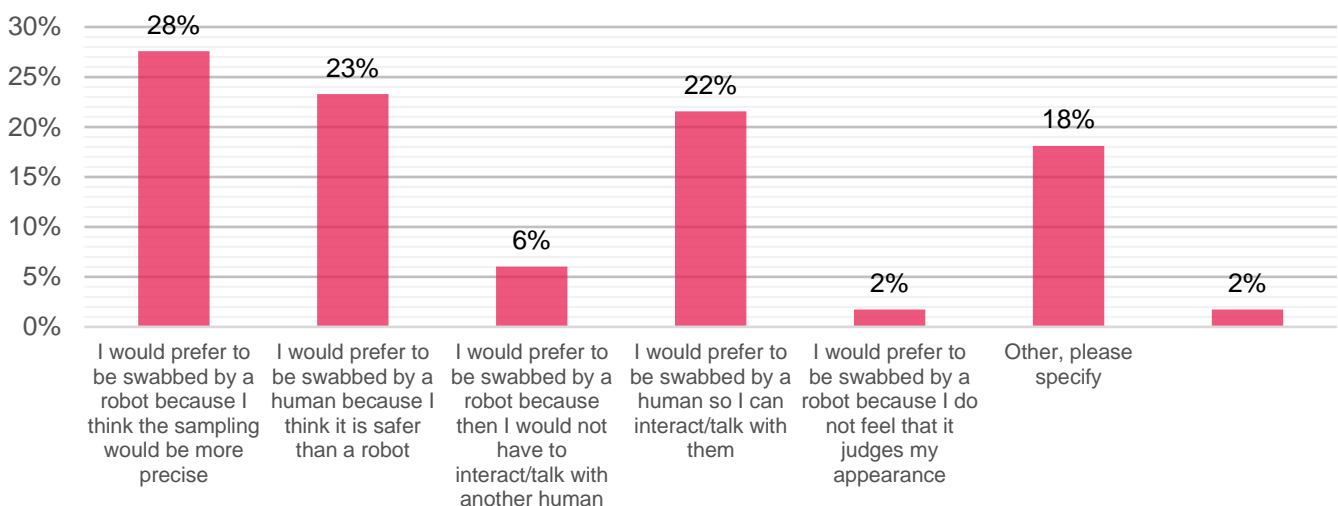
Only four respondents had no concerns towards the robot indicating that this type of robot has many barriers and challenges which should be designed for to ensure trust in the robot.

In the focus group interviews conducted during the Robotex festival, it is also confirmed that there is no great fear of this robot, but there is a small fear of mistakes made by robots. The interviewee points out that "If a person took a sample, it would still be safer."

Question 4: Which of the following statements do you agree with the most?

In the fourth question the respondents were presented with several statements that could be incentives for being tested by a robot or by a human. The respondents could only choose one option. About half (49%) of the respondents answered that they would prefer to be tested by a human, with 23% reasoning that they think it would be safer than a robot, 22% saying that they prefer a human so they can interact/talk with them and 4% had other reasons to why they preferred a human. 42% answered they would prefer to be tested by a robot with 28% saying they would prefer it because they think the sampling will be more precise, 6% preferring it because then they would not have to interact/talk with another human, 2% preferred it to not be judged on their appearance and 4% had other reasons for preferring a human. The remaining 9% were indifferent, did not know what they preferred or wanted to do the test themselves.

Which of the following statements do you agree with the most?



Question 5: When would it be a good idea to use a swab robot?

To get an idea of the business potential and where it would make sense to implement the robot the respondents were asked in which situations or places, they could imagine a swab robot being placed.

A large group responded that they could see potential in using the robot in pandemics/epidemics where infection rates are high and mass testing would be needed to test a concentrated group of people. Several mention that they see a benefit if it can free up medical workers for other tasks or when there's simply not enough medical staff to test many people in short periods of time. Among the places a robot like this would be useful many mention public institutions such as hospitals, test centres, pharmacies, retirement homes, universities, prisons, and other type of health centres.

In addition to the public institutions a large group of people could also imagine being tested at more public spaces or private institutions such as the workplace, shops, cafes, restaurant shopping malls, train stations, large events, and airports. Especially the airport was mentioned by many of the respondents: *"It can also be used at airports, to get out of the airport you must show a receipt for testing"*.

Question 6: When would it not be a good idea to use a swab robot?

As a follow up the previous question respondents were also asked when it would *not* be a good idea to use a swab robot and whether they could imagine the robot being misused or misplaced in certain situations.

The most recurring answer here was to not use this type of robot on certain groups of people such as children, elderly people, people that don't feel comfortable with the robot and in certain health treatment situations where the human factor is important. One respondent explained: *"I don't feel like a robot would fit as well if the work is around interaction with children, like a kindergarten or a primary school. As I feel it would be harder for the robot to understand the kids feelings"*.

Contradictory to some of the response in the previous question some do not think public spaces and places with crowds are a good place to implement the robot. Barriers and concerns towards public spaces include not being private enough, vandalism and risk of misuse, lack of hygiene, and lack of specialized assistance/supervision. There's also a concern that the robot will be less efficient than a human tester and thereby produce queues and crowds with high risks of getting contaminated by other people waiting.

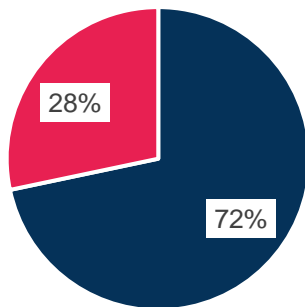
Another issue raised by multiple respondents is the concern of how the data is handled and stored after being swabbed. *"The robot should be implemented and operated by public health care institutions, not a private company outside regular healthcare. I would be nervous about others' use of the collected data (GDPR and commercial misuse)."* One respondent is also worried that this kind of robot will create an unwanted testing culture in the society.

There was also a group of seventeen respondents who couldn't think of any situations where the robot could be misused or misplaced indicating trust towards the robot.

Question 7: Would it be a good idea for travellers to be swabbed before entering a new country? And would you be willing to let yourself get tested before travelling to other countries? E.g., before travelling by plane.

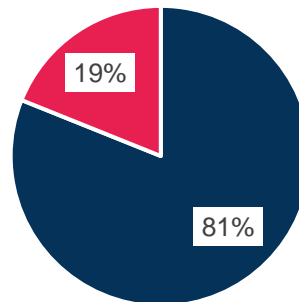
To test the business potential of testing people before entering a new country the respondents were asked directly what they thought of this idea. 72% thought it was a good idea to have testing procedures for people entering a country and 81% would be willing to let themselves get tested before travelling to another country. This indicates that there is a group of people who don't think testing is a good idea but who would be willing to take a test if necessary. Looking at the elaborations of to the answers it is important to note that many respondents indicate that it depends on the situation of the country and the stage of the given epidemic/pandemic. Many mention that they do not think it is necessary with the current stage of Covid-19 (fall 2022). Some also mention that they think it is good idea but that they would prefer to not have to wait in additional lines at the airport and would rather do the test beforehand.

Would it be a good idea for travelers to be swabbed before entering a new country?



■ Yes ■ No

Would you be willing to let yourself get tested before travelling to other countries? E.g., before travelling by plane.



■ Yes ■ No

Question 8: Imagine that you are the designer of a swab robot, what would the robot look like?

Lastly respondents had the chance to freely give any suggestions for the appearance of the robot. Here there were about as many different opinions and suggestions as respondents. The respondents were engaged in the robot and would like to give their suggestions for improvement.

Overall, the recurring responses can be divided into different themes. First, several respondents did not think the design is important or would rather focus on **function over design**. A robot that expresses safety and hygiene is important for them. Then there were two large groups with diverging opinions. One group thought it is important that the robot is **small, minimalistic**, and has a **simple design**. One respondent explains: *“I wanted to design it so that it was as minimalist as possible, as it may seem violent to have to interact with a machine full of buttons, wires, arms, etc”*.

On the other hand, a large group would rather like to see a more **human like design** as we see in anthropomorphic robots. Some mention that this could reduce concern and feel less intimidating. Some also responded that they were happy with the current design of the robot and one highlighted that human-like design would not help with acceptance in their point of view.

Lastly a few also mentioned that if they were to design the robot, they would include users in co-constructing the robot: *“I would include users from different backgrounds and ages to test and provide feedback to achieve a comforting environment and ensure a good user experience.”*

Conclusion

In conclusion, the responses from citizens regarding their perception of a robot swabbing them for COVID-19 were divided, with approximately half expressing positive feelings and the other half expressing negative feelings. Respondents generally agree that clear and comprehensive information on the procedure and safety measures are the most important types of information they would like to receive before being swabbed by a robot. Respondents also expressed concerns about the safety and precision of the robot, as well as mistrust in its responsiveness towards human movement or human feedback. However, many also see the potential for the robot to be useful in situations or places where mass testing is required, such as during pandemics or epidemics. Respondents generally prefer to be tested by a human for safety and ease of communication purposes, but it is also worth mentioning that a significant number also see the benefits of using a robot for testing for precision and efficiency. Overall, further testing and evaluation is needed to address the concerns and build trust among citizens to increase their acceptance and willingness to use the robot.

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017283

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Boosting Wider Adoption of Robotics in Europe

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