



Capra Robotics

Citizen Survey Results



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Introduction

This report presents the results of a collaboration between Capra (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.

Capra Robotics

Capra Robotics have created a mobile robot for collecting cigarette butts, primarily for urban areas. Keeping our cities clean is a needed but costly affair. Therefore, municipalities are looking for solutions that are neither too time-consuming, labour-intensive, expensive nor environmentally damaging.

Fundamentally, robots have the benefit that they tirelessly continue to solve routine tasks. As the world looks today, it also becomes increasingly difficult to get the needed staff for monotonous jobs. Robots could be the next-generation tool for relieving and upgrading the skills of municipal service employees to foremen of robots, while still giving them the ability to solve creative and complex tasks.



The robot is equipped with a camera to find the cigarettes and a vacuum cleaner to remove them. The robot is controlled by an operator, who gives it commands from a provided app. It is estimated that the operator can oversee about 5 robots at any given time. The main goal of this solution is to minimise the amount of microplastics and toxins in urban areas by removing discarded cigarettes from the ground.

Demographics

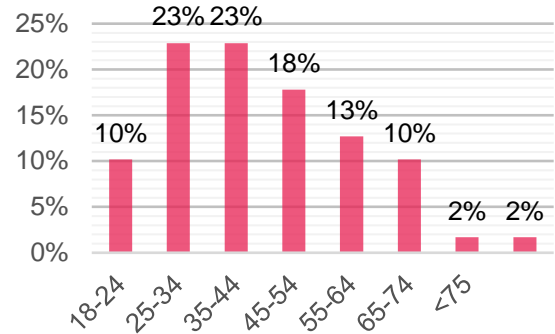
The survey received a total of 118 responses. The respondents were mainly citizens in the age groups 25-34 and 35-44, each group representing 23% of the total responses. These were followed by the age group of 45-54, accounting for 18% of the total responses, and age groups 18-24 and 65-74, each accounting for 10%. Less than 2% of the respondents were aged 75 years or above.

Gender distribution was relatively even, with 53% of the respondents being male and 46% being female – the remaining 1% being unspecified.

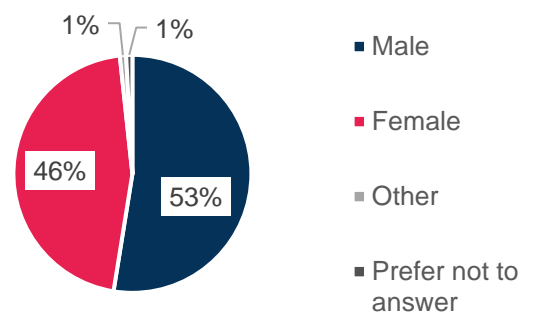
Almost half of the respondents said they live in a large city, followed by 25% who said they live in a small town. 16% of the respondents live in a suburban area, while 10% answered that they live in a rural area.

Respondents were generally highly educated. As many as 23% said they hold a doctoral degree, 35% a master's degree or equivalent, and 25% a bachelor's degree or equivalent. This distribution may partly reflect the age distribution, although obviously age does not directly correspond to educational level. In any case, there is a clear predominance of respondents holding degrees.

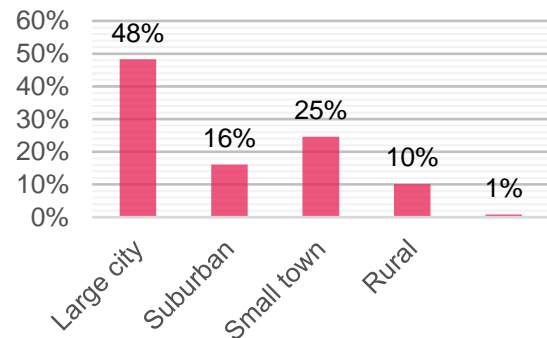
Age group



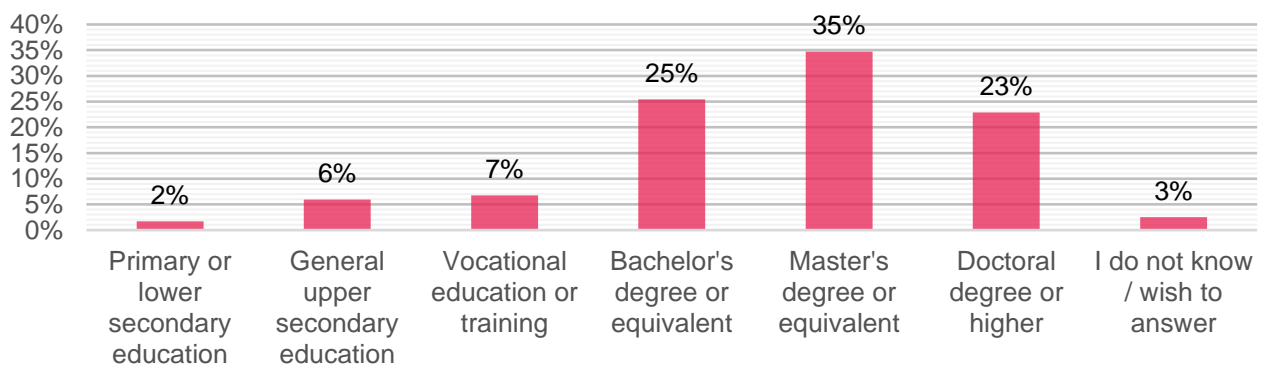
Gender



Area of residence



Education



The survey responses were distributed across 16 countries, of which 15 were European, accounting for 79% of the total responses. The remaining country was the United States, which however accounted for just below 2% of the total responses. The remaining 19% of the responses were of unknown origin. Citizens from both Central and Eastern Europe, Northern Europe, Southern Europe, and Western Europe have answered the survey indicating a diversity across Europe. A particularly large number of responses came from France and Denmark, each accounting for 14% of the total responses, followed by Portugal with 13% and Norway with 11%.

To briefly sum up, most of the respondents for this online consultation were younger or middle-aged, highly educated 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.

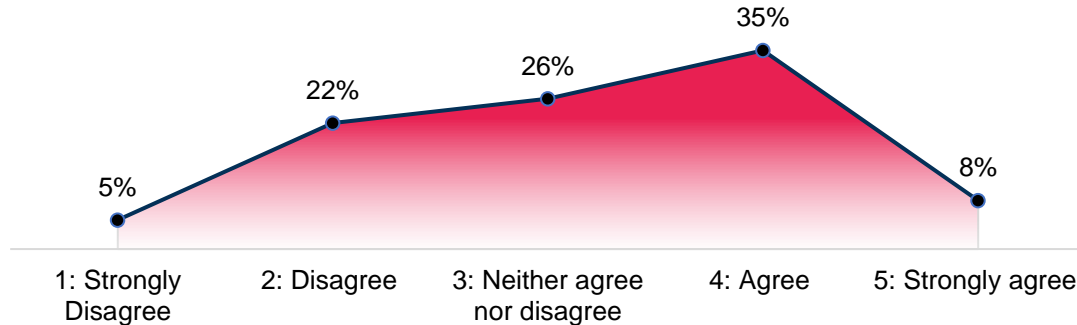
Survey results

The online consultation consisted of 8 questions and the respondents were asked about the robot's appearance, functionality, and safety. The results will not be presented in a chronological order to how they were asked but by compiling questions relating to the same topic.

Question 1: I like the appearance of the robot & Question 3: This robot seems intimidating

The following results are a combination of questions addressing the robot's appearance. Several answers from the survey circled around the appearance of the robot. When asked about the robot's appearance more than a third of the respondents either agreed or strongly agreed to liking the appearance of the robot. On the opposite side a little less than 30% answered they did not like the appearance of the robot. Most of the comments on the robot's appearance focused on the aesthetic and functionality of the robot. Different comments suggested a change of colours, so the robot would look more: "(...) *eye-catching*". Other suggestions were to make the robot seem more familiar and have a friendlier look. These types of comments can reflect how changes in our environment might be easier adapting to when the changes replicate some sort of familiarity. One respondent suggested that it could look like the noo noo vacuum from Teletubbies, a friendly looking vacuum from a children's television program. These statements were supported by comments about having the robot look more like a vacuum than it already does, as this would also help accentuate the functionality of the robot. So, when introducing a robot to an environment where it will engage with people, an appearance that both displays the functionality of the robot and has a familiar look can help increase the acceptance of its presence.

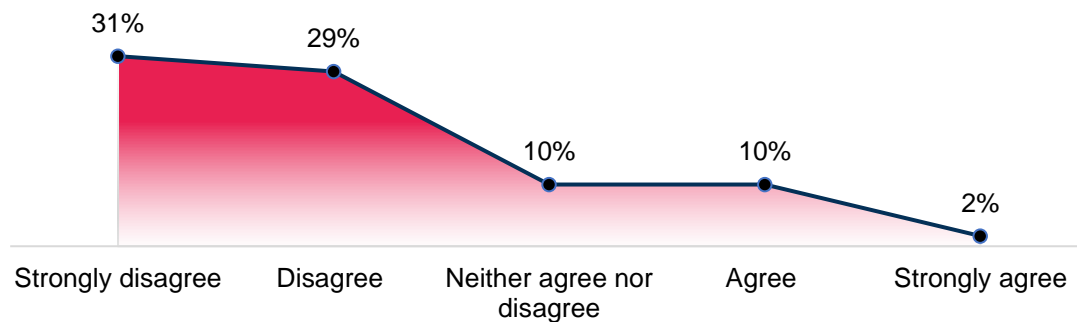
I like the appearance of the robot.



Whether the respondents perceived the robot as intimidating is also part of the perception of the robot’s appearance. Question 1 focusing on the robot’s appearance didn’t receive a lot of elaborated answers to why people liked the appearance of the robot. But with question 3, when the respondents were asked if they found the robot intimidating several elaborations on why respondents do not find the robot intimidating were received. These comments can support why respondents might like the appearance of the robot. More than half of the answers to whether respondents found the robot intimidating answered they disagreed or strongly disagreed and did not find the robot intimidating. Respondents have used these adjectives to describe the robot: **‘harmless’, ‘small’, and ‘not dangerous’**. These attributes can be supported by another comment: *“The robot has a noble purpose, and when you see its content, you can understand what kind of work it is doing”*. This comment helps understand why the appearance of the robot might seem appealing to the respondent, when the physical appearance of a robot clearly displays its functionality. Some of the comments on why respondents are not attracted to the look of the robot are more connected to subjective opinions towards the look of the robot, while they do not find the robot intimidating.

Some of the respondents found the robot intimidating. These concerns were mostly explained with a connection towards the maturity of the robot’s functionality rather than the look and appearance of it. One respondent experienced the robot as scary, but at the same time the look of it was familiar: *“looks like wall-E”* (, a friendly robot from a children’s movie). The comment emphasises why the appearance and look of a robot is important for the societal acceptance of the robot. Several comments focus on the aesthetics and how it’s important for the approval of a robot.

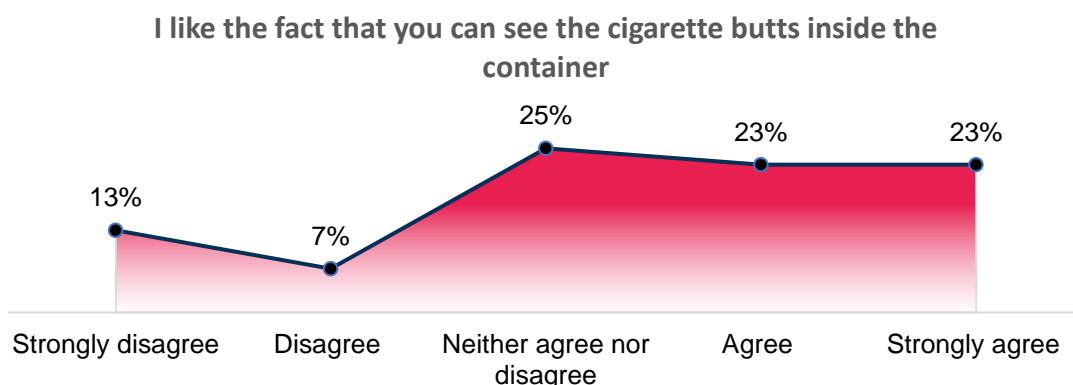
This robot seems intimidating.



During the focus group interviews conducted at the Robotex Festival in Tallinn, the participants discussed the robot's appearance for a long time. In the case of robots moving around streets, the importance of appearance was pointed out. One participant mentioned: *"Such a very nice little cute robot. In my opinion, this cute look could be emphasised somehow. Right now, he looks like a doer of dirty work and could be a little nicer."* The participants pointed out that in the case of robots operating in urban spaces, more attention should be paid to what emotions the robots evoke in people. One of the participants said: *"If we think that it is something that is on the street and in the urban space and is always active there, then it can also create a positive mood for people. For example, if you are smiled at, you smile back. It could do several jobs at the same time."*

Question 6: I like the fact that you can see the cigarette butts inside the container

When asked if respondents liked seeing the collected cigarette butts inside of the robot a little less than half of the respondents agreed or strongly agreed to the statement, but several elaborated their answers with comments such as: *"...it is good to see how much the robot has picked up, the cigarette waste is an unpleasant sight"* and: *"(...) not necessary, the proof of work is that streets are clean"*. While most of the respondents liked seeing the robot's function displayed, some of the respondents do not wish to see the cigarette waste. One respondent suggested: *"Use an LED panel instead. You can show number of cigarette butts and friendly emoji icons. Cigarette butts inside a transparent box isn't visually appealing"*. There are many ways to display the functionality of the robot which are more discreet than a clear look at the actual waste being collected. To this question more than a fourth of the respondents neither agree nor disagree with the statement of like seeing the cigarette waste. The answers support how the perception of the robot's appearance is very subjective and that many respondents do not have a strong opinion of it. Some respondents suggest enhancing the aesthetics and appearance of the robot by making it look more familiar and by aiming for a look supporting the functionality of the robot, when using a display that showcases the effectiveness of the robot is welcomed by respondents.

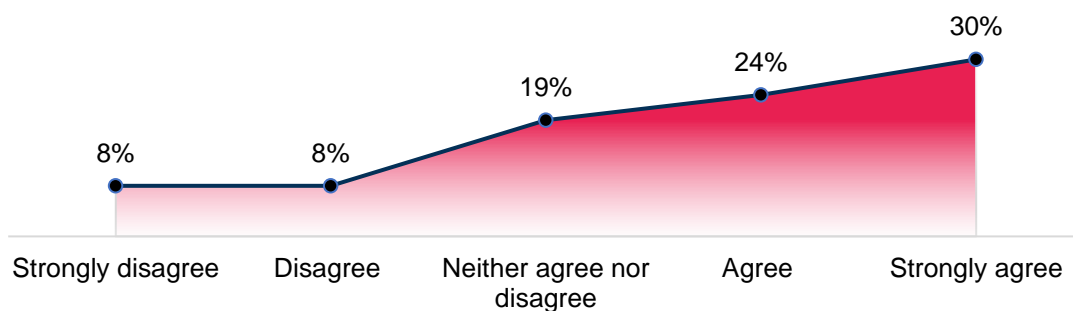


7: I would like to have this robot in my neighbourhood

Respondents were generally very positive toward the robot’s functional purpose and welcomed the aid it would be able to provide. Most respondents agreed or strongly agreed that the robot seems helpful, and those who elaborated on their answer emphasised the benefit of relieving humans of a generally unwanted and repetitive job: *“People don’t want to walk around cleaning cigarette butts. This thing does. Therefore, it is useful”*. For some respondents, the robot also appeals to the concern of available labour force. One respondent elaborated by noting: *“with an aging population and lack in human workforce for monotonous jobs, this robot is just what we need in cities, as pollution have increased dramatically the last 100 years.”*

Only 3% of the respondents strongly disagreed that the robot seems helpful, while 11% disagreed and 13% neither agreed nor disagreed. These responses may be due to doubts about the robot’s effectiveness in practice since this hasn’t been demonstrated to the respondents, or respondents can’t identify an immediate need for it in a personal context. For instance, when asked to consider the statement: *“I would like to have this robot in my neighbourhood”*, several respondents pointed out that they don’t notice a lot of cigarette butts in their neighbourhood and that this particular type of litter isn’t much of a problem. This, of course, points to the fact that there are many different types of neighbourhoods, and the prevalence of cigarette butts (and litter in general) may depend on the country and whether the neighbourhood is in a rural or metropolitan area, its socioeconomic status, and so on. However, most respondents still either agreed or strongly agreed that they would like to have the robot in their neighbourhood, while 19% neither agree nor disagree – the latter of which might be explained by the same reasons as above.

I would like to have this robot in my neighbourhood.



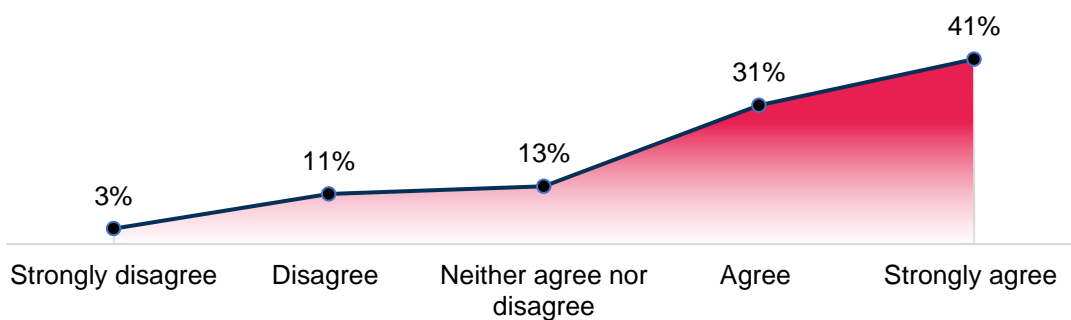
Although the majority of the respondents seemed to like the idea of a robot that picks up cigarette butts, there were also a significant number of respondents who felt its scope is somewhat limited. As mentioned above, the robot might be perceived as being redundant in areas that are less plagued by cigarette butts, and some respondents even pointed to the fact that they experience: *“smoking is on the way out”*, which of course alludes to a declining need for technology specialising in picking up cigarette butts in their opinion. As several respondents suggested, this presents an opportunity to better leverage the robot’s potential by making it capable of picking up other types of litter in addition to cigarette butts.

One respondent noted that, *“A human being would probably collect all garbage and not just cigarette butts.”* This comment brings up the classic distinction between robotic efficiency and human judgment and emphasizes the fact that if the latter is superior in order to perform a task adequately, then it is difficult to justify the employment of a robot. However, if the robot is capable of recognizing and picking up several types of litter, it will likely be perceived as more useful by society. For instance, one respondent said that they live in the countryside and while cigarette butts are not much of a problem in their neighbourhood, other trash such as fast-food wrappers and empty cans are. Another respondent found other types of litter related to their specific neighbourhood to be bothersome and expressed a need for a robot that could take care of that: *“I never see cigarette butts in my neighbourhood. I live in front of an elementary school. Kids lose homework, articles of clothing, and discard snack wrappers and containers in front of my house. I could use a robot for picking up after them.”* Others requested a robot that can pick up dog poop, and some suggested the possibility of using a robot to remove hazardous litter such as syringes or glass shards.

Question 2: This robot seems helpful.

When asked if the robot seems helpful almost two thirds of the respondents replied they agree or strongly agree. A respondent emphasises why the robot could be perceived as helpful: *“It is helpful, given the trends of cigarettes does not decline”*. Even though many of the respondents see the robot as helpful, there are still some reservations within the elaborated answers in the survey. These reservations are expressed as the responsibility of littering is moved from people themselves to the robot instead. One respondent expressed: *“it [the robot] could make people not care where they drop their cigarette butts”*. Many of the respondents who were hesitant towards the robot and its function prefer to either educate people not to throw cigarette butts or limit the spaces to smoke. Respondents’ elaborated answers indicated a wish for preventive actions towards smoking and cigarette waste and demonstrated a challenge for the acceptance of the robot, even though most of the respondents supported the statement of the robot being helpful. The perception of how helpful the robot is are limited by which other behaviours are being accentuated according to both littering and smoking. The effectiveness of the robot could be supported by a nudging functionality informing people to use the trash can for their cigarette butts. At the same time the robot’s function is limited to the extent a robot can affect human behaviours according to smoking and littering.

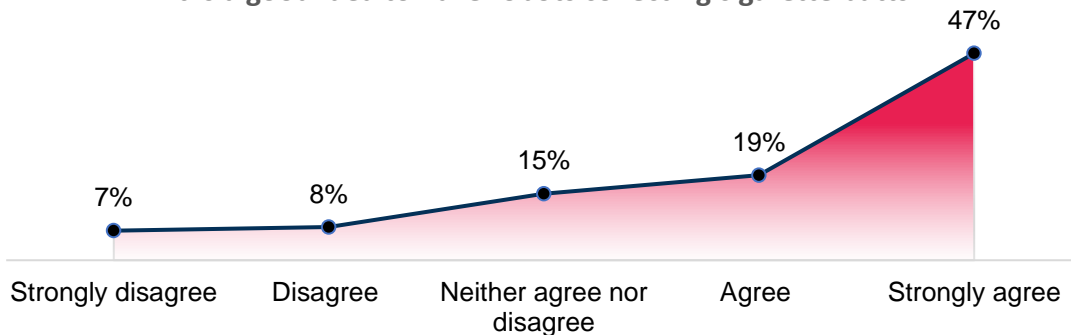
This robot seems helpful.



Question 5: It's a good idea to have robots collecting cigarette butts

Another question in the online consultation asked if the function of collecting cigarette butts is a good idea, a large percentage of the respondents agreed or strongly agreed. In the consultation some of the answers are supporting how the robot's functionality of collecting cigarette butts is helpful. These respondents have a special focus on how the robot can help fight pollution: *"One thing is that strong winds will bring cigarette butts to the sea, causing more ocean pollution. A different matter is that both pets and small kids are not careful about what they eat, so it is important to collect"*. Other respondents focus on how the task the robot is performing can be more suited for a robot since the task isn't very appealing for humans. This is being supported by comments like: *"Most people would not want to do such a thing"* and *"(...) lack in human workforce for monotonous jobs, this robot is just what we need in cities, as pollution have increased (...)"*.

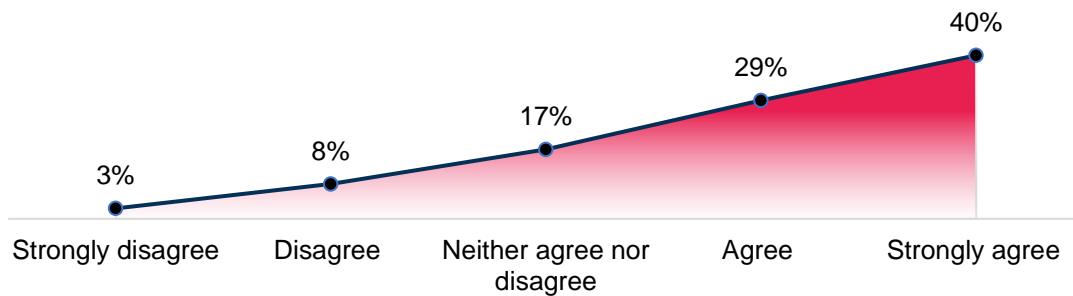
It is a good idea to have robots collecting cigarette butts.



Question 4: I would feel safe passing this robot on the street

As previously mentioned, respondents seem to generally be in favour of this type of robot, especially if it was capable of handling other types of trash besides cigarette butts. Also, despite the potential to increase acceptance by targeting familiarity in the robot's appearance, it generally seems like people would feel comfortable around it: 40% of the respondents strongly agreed that they would feel safe passing the robot on the street, while 29% agreed to the statement. 17% answered that they neither agree nor disagree, for which there could be many reasons; however, it's important to keep in mind that the questions and statements presented in the survey are hypothetical in nature, since they ask respondents to *imagine* scenarios in which they encounter the robot. Since they have no actual experience to base their answers on, it may be difficult to provide an answer with enough confidence, and so some respondents might prefer to 'play safe' by remaining neutral or at least undetermined in their response. This might be the case even more so for respondents who are particularly opinionated about this type of robot, or robots in general, because they may feel like they need more information in order to give a qualified answer.

I would feel safe passing this robot on the street.



Nevertheless, the responses reflect a generally positive attitude, which also resonates with the overall impression that the robot seems harmless. Most respondents either disagreed or strongly disagreed that the robot seems intimidating, indicating that although people might prefer a robot with more familiar-looking features, its appearance and behaviour as people imagine them from the information available in the consultation do not appear to be threatening on an individual level. As is evident from the elaborations, this partly has to do with the robot's size, since it is small enough for humans to maintain a feeling of superiority over it. As one respondent put it, *"If it attacks me, I am able to kick it over and throw it into a canal. So yes, I feel safe"*. However, a few respondents felt that it might depend on the situation and recipient whether the robot feels intimidating. One respondent noted that, *"On narrow sidewalks it could be intimidating,"* while another respondent pointed out that *"It might appear intimidating to small children, senior citizens or pets"*.

In general, the willingness to trust the robot and its intentions seems to rely on the extent to which people feel like they have more power than the robot does, and whether the robot is capable of adequately communicating its presence and intentions. In commenting on whether they would feel safe passing the robot, one respondent said: *"No problem. If I move, I would avoid it. If I was standing or sitting, then I would expect the robot to show that it has seen me, and make me feel certain that it will not run over my feet"*. Rather than displaying suspicion or scepticism, this respondent simply expects the robot to be built and programmed in such a way that it puts human needs and safety before anything else. Indeed, while few respondents find the robot to be intimidating, some did raise concerns about safety risks. These concerns were mostly related to whether the robot is heavy and could drive into people, or whether you might risk falling over it. Because of this, several respondents stressed the importance of building safety measures into the robot that would mitigate these types of risks, including visual and auditory indicators. One respondent said that: *"with enough sensors the robot should be safe,"* and, in a similar vein, another respondent suggested that *"It would need a tall flag so that it can be seen from automobile drivers, persons in electric wheel chairs, bicyclists, others"*. Thus, even if the robot is relatively small and slow, it is still important to design it in such a way that it will be able to reliably make people in its vicinity aware of its presence.

Besides concerns about safety, some respondents were slightly sceptical about the viability of the robot in terms of logistics and flexibility. Doubt was raised about whether the robot would be useful in large cities and crowded areas. To the statement “*This robot seems helpful*”, one respondent commented, “*I am not convinced of his ability to move in real urban areas,*” and this sentiment was echoed by another respondent who thought that the robot was “*[n]ot very helpful. Try to use that in Rome city center*”. Still others even expressed concern for the robot’s safety, pointing out the risk of vandalism that could end up destroying it. One respondent expressed these points as a question, asking, “*Would it survive operating in a tough neighbourhood? Can it operate on around cars parked on sidewalks?*”

While these insights are more doubts based on assumptions about the robot’s capabilities and ability to be integrated into various environments than they are concerns about impact, they are important for understanding the expectations the respondents have toward robots and what it takes for them to be accepted as meaningful additions to society. Additionally, a final but important concern raised by a handful of respondents was related to a well-known topic within the robot and automation debate: namely, replacing humans with robots. This concern did not only regard robots’ limited perception of reality and context in terms of what counts as litter – as we discussed earlier – but just as much the social implications. To the statement “*I would feel safe passing this robot on the street*”, one respondent commented, “*Yes, but it does not provoke a positive feeling, subjectively. If a human were out cleaning, they’d probably give a friendly nod.*” Another respondent said that they “*would rather pass a human being*”, alluding to the value of the subtle social interactions of everyday life.

If a robot takes over a job that is normally performed by a human, it will be at the cost of any potential social interaction between that human and whomever they might meet while working, even if the interaction is merely a nod or a smile. And, as these consultation responses suggest, it is a shift in everyday structures that will likely not go unnoticed. The robot may, of course, simply be intended as an addition to existing efforts at reducing pollution locally and not as a replacement for human labour. In this case, it is possible that respondents worried about social disruption would be more inclined to accept the employment of the robot.

Participants in the focus group interviews conducted during the Robotex festival pointed out that in the case of robots operating in urban spaces, more attention should be paid to whether they also stand out in traffic. “*He could be brighter somehow. That if he is moving in traffic, he should of course catch the eye.*”

Conclusion

In conclusion, the results of the robot Butty, a robot designed to pick up cigarette butts show that many respondents generally support the idea of the robot and its function. The appearance of the robot is important for its acceptance by society, with suggestions for changes in color making the functionality of picking up cigarette butts more visual noticeable as well as making the robot more familiar and friendly looking to increase acceptance. Respondents also agreed that the robot seems helpful in relieving humans of a generally unwanted and repetitive job and in filling the gap in the lack of human workforce for monotonous jobs. However, some respondents noted that cigarette butt litter is not prevalent in their neighborhood and that smoking is on the decline, indicating a potential declining need for the technology, however many agreed that the overall function of the robot could be applied in many additional areas. Some respondents raised concerns about the robot's safety and the potential for it to make people not care about littering, with some suggesting that the robot should be designed with safety measures such as sensors and visual indicators. Additionally, it was noted that the acceptance of the robot depends on the context and the need for it in a specific area.

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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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