EU Horizon 2020 Research & Innovation Program
Advanced Robot Capabilities & Take-Up
ICT-25-2016-2017
Grant Agreement No. 779942

Safe Robot Navigation in Dense Crowds

http://www.crowdbot.org

Technical Report

D 7.2: Dissemination Plan

Work Package 7 (WP 7)
Exploitation, Dissemination & Communication

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Executive Summary

The main objective of the CROWDBOT project is to demonstrate safe navigation of mobile robots in dense human crowd environments. There are both technical challenges and ethical concerns that must be addressed during the execution of this goal. While the team is devising new technical solutions and engaging with stakeholders on ethical concerns, it is also of the team's interest and requirement to convey ongoing project activities and achievements to a larger outside community. This report provides a summary of various tools and methods we plan to use to communicate and exchange information with the larger audience. We call it *the Communication & Dissemination Plan*. Three main focus areas of communication and dissemination are 1) general public awareness of mobile robotics and artificial intelligence capabilities, 2) potential economic value and work productivity gains by using mobile robots, and 3) ongoing activities, resolutions and best practices that address ethical and safety concerns that arise when mobile robots co-exist in public spaces.

Beyond semantics, there is a difference in our usage of the term communication versus dissemination. The former covers the processes and tools used by the team for general information exchange with our targeted audiences while the latter term "dissemination" is a more focused delivery of information —usually derived from data collected via test events and research analysis by the team.

Communication is the team's outreach vehicle to interact and exchange information and ideas with external targeted audiences. This includes the team's public website, social media portals, in-person and teleconference meetings and interview sessions, robotic test events with human participants and promotional engagements at public social gatherings.

Via dissemination, the team plans to release technical findings and contributions via published articles in technical conferences and journals. Supporting technical data and software code used in robotic tests will also be shared as open-source material to facilitate knowledge transfer with external researchers and robotic developers. Since the project scope of CROWDBOT includes both technical solutions as well as social acceptance of mobile robots, the team will use various mainstream media sources to relay technical information at a level that can be understood by the general public. For peer-to-peer technical exchange and collaboration, the team will organize several workshops and seminars. Other dissemination activities include active participation in industry working groups and standardization bodies in the areas of artificial intelligence, automation and robotics. Since mobile robots are intelligent machines with features similar to those of driverless cars and unmanned aerial vehicles, technical, social and legal matters addressed in these adjacent fields may have relevance to robotics. The team will contribute our findings to this larger technical community. Finally, the team will provide essential technical information regarding the state-of-the-art in mobile robotics and artificial intelligence as well as future trends and market projections such that EU and national authorities can assess and plan for future regulation and legislative activities.

1. Communication & Dissemination Objectives

The main objective of the CROWDBOT project is to demonstrate safe navigation of mobile robots in dense human crowd environments. There are both technical challenges and ethical concerns that must be addressed during the execution of this goal. In a broader social context, robots are yet to be accepted by humans as our aids or work associates. It is true that robots —especially the industrial stationary types— play a significant role in manufacturing and logistics industries. There, they are used to carry out tasks that humans are less inclined to do, such as repetitive assembly and sorting of parts and lifting and delivery of heavy objects. The co-existence of moving robots among humans and the sharing of certain tasks with humans will obviously be a major shift in how we humans perceive our individual and collective roles in society as a whole. When taken to extreme, some humans may be outright hostile to the idea of robots and artificial intelligence machines taking over the world. This and other socially sensitive issues are very much relevant to CROWDBOT but beyond the scope of stated project goals. Instead, the team plans to step back and address more basic and pragmatic topics such as

- Awareness by the general public of robot capabilities and limitations: Examples are "How smart is a robot? Does it talk or understand speech?" and "How does it know where to go and how fast does it go?" The main objective is for a layperson to become comfortable or more accepting of a mobile robot's presence in daily living and working environments.
- Economic value and contribution to workplace productivity: A good example is the use of a mobile robot to deliver medicine from the pharmacy or hospital repository to a nurse or doctor at a ward in a different part of the hospital. This practice has multiple benefits: 1) it frees up time for caretakers (nurses and doctors) to dedicate to their patients, 2) increased accuracy and safety in medicine delivery since only the caretaker that placed the order can authenticate and access the compartment on the robot for medicine retrieval, and 3) no need by the worker at the pharmacy or repository to identify and authenticate the caretaker in person; the robot serves as a reliable and authenticated proxy.
- Ethical and safety concerns that arise when robots move among humans in crowded places: Examples are: "Who is liable if a robot injures a person?" Likewise, "if a person causes damage to a robot, what are legal repercussions, if any?" Since a robot is equipped with cameras, microphones and other sensors, "who maintains and has access to these data and how are they protected? Are they shared or sold to third parties?"

The scope of this report is to summarize various methods we plan to use to address the above three topics: public awareness, economic value and ethics/safety-aware practices to mobile robots. Section 3 gives a detailed outline of our "Communication" and "Dissemination" (D&C) plan.

As the project evolves, the team will have accumulated data from test results and research analyses. Furthermore, the team will benefit from interactions with targeted audiences and outside partners such as members from commercial industries and scientific/technical communities. Topics that are critical in the beginning of the project may need to be relaxed. Likewise, certain omitted or neglected topics may require revision or further scrutiny. Hence, the D&C plan will be reviewed periodically by the Executive Committee of the CROWDBOT team and necessary adjustments will

be made to tailor our themes, announcements and focus areas to those most relevant to our targeted audience. Details of this plan are discussed in Section 4.

2. Communication & Dissemination Plan

The CROWDBOT team will use a number of tools and resources for communication and dissemination. Beyond semantics, there is a difference in our usage of the term *communication* versus *dissemination*. The former covers the processes and tools used by the team for general information exchange with our targeted audiences. Examples are i) a public website for the CROWDBOT project that updates and highlights progress and latest achievements or ii) an interview session with a business owner discussing potential use of mobile robots on premises. The latter term "dissemination" is a more focused delivery of information, usually derived from data collected via research analysis and test activities by the team. Here, we address very specific topics such as "How fast can a robot move without forceful collision with humans in a crowded area?" or "Who is responsible when a robot injures a human?" Detailed plans are outlined below:

2.1 Communication Plan

Communication is the team's outreach vehicle to interact and exchange information and ideas with external targeted audiences. We plan to use the following tools and resources:

Team public website: All publicly releasable information is available on the team's public website. This includes detailed description of the CROWDBOT project and key objectives; team members, work packages and links to their individual sites; latest programmatic updates and technical achievements; publicly releasable European Commission Deliverables and technical data.

Social media portals: The team will use various online social media (Facebook, Twitter, Youtube, etc.) and conventional media outlets such as radio, television and print media to convey CROWDBOT project information that is of most interest to the general public.

Meetings & Interviews: The team will set up in-person and teleconference meetings with stakeholders, outside experts and advisers, and with external entities that have interest in advances and cutting-edge development of mobile robots. The team will hold regular meetings with the Science Advisory Board (SAC) and the Ethics and Safety Advisory Board (ESAB) to share our findings and solicit advice and guidance from board members. The team also plans to conduct interview meetings with potential customers of mobile robots (businesses, government agencies, etc.) to assess their desires, willingness as well as concerns and reservations in deploying them.

Robotic tests with Human Participants: As one of the main CROWDBOT objectives, the team will solicit participation of general public members in controlled robot-crowd tests. Such events will be used to introduce and educate CROWDBOT robots to the general public. Furthermore, they will allow interaction between team members, our robots and members of the general public in a friendly, face-to-face setting.

Promotional events: The team plans to promote CROWDBOT as part of social awareness at local community gatherings and social events. This involves poster and/or video displays of the

team's activities and achievements, display of CROWDBOT robots on premise and question-and-answer sessions with the general public —especially young adults and children. The team has plans to use Virtual Environment headsets to demonstrate immersive and interactive scenarios between humans and robots.

2.2 Dissemination Plan

Dissemination is the team's vehicle for information release of CROWDBOT R&D activities and generated data from test events. We plan to use the following tools and resources:

- *Scientific/Technical Conferences & Journals*: As part of the project's technical work product, the team plans to make available our technical findings and contributions in a number of technical conferences and journals. Since all conference and journal articles are peer-reviewed and judged by referees, they carry more weight and credibility in terms of technical quality and merit than self-published material on our website or other media outlets. In addition, the team will release supporting technical data and software code used in our robotic tests. This step allows independent validation of our work by external developers and it also facilitates knowledge transfer —further refinements and adaptation in future robotic projects.

- *Mainstream media sources*: Since the project scope of CROWDBOT includes both technical solutions as well as social acceptance of mobile robots, the team plans to use various mainstream media sources to relay technical information at a level that can be understood by laypersons. Since articles and materials in technical publications are mainly targeted at like-minded engineers and scientists in the robotics fields, the team perceives the need and urgency to convey both advancements and limitations of mobile robots (and the team's ongoing achievements) to the general public.

- *Workshops & Seminars*: These are outlets for peer-to-peer technical collaboration and information exchange between CROWDBOT team members and external experts and researchers. The team's coordinator and Executive Committee members will use such venues to introduce CROWDBOT details to the larger robotics community and solicit feedback and future collaborative opportunities. As part of ethics requirements, the team plans to hold two ethical and safety workshops to openly discuss and possibly reach resolutions for a number of outstanding safety and ethical issues. A number of keynote speaking engagements will be coordinated with conference and trade show organizing committees to further disseminate CROWDBOT technical material to a larger audience.

- *Industry & Standardization Bodies*: The team plans to actively participate in or maintain awareness of standardization bodies and industry working groups in the areas of artificial intelligence, automation and robotics. Since mobile robots are intelligent machines with features similar to those of driverless cars and unmanned aerial vehicles, technical, social and legal matters addressed in these adjacent fields may have relevance to robotics.

Therefore, the team will continuously interact with authorities and leaders in these bodies and share our findings from technical analysis and test events.

- *Inter-Governmental & National/Local Authorities*: The team plans to maintain regular engagements with European governing bodies (the European Commission and the EU Parliament) as well as national and local level government agencies and authorities. Here, the objective is two-fold: 1) the team will provide essential technical information regarding the state-of-the-art in mobile robotics and artificial intelligence as well as future trends and market projections. Authorities can then use this information as part of their assessment and planning purposes for future regulation and legislative activities; 2) the team will coordinate with authorities to understand and maintain compliance of current legal requirements and issued directives for safe operation of mobile robots in public spaces or whenever personally identifiable information is captured during test events.

3. Future Update Plan

As stated earlier, as the project evolves and matures, the team may change its scope and focus in the remainder of the project life. For example, after completing an initial set of mobile robotic tests, the team can assess which follow-on tests are most meaningful in addressing both technical limitations and ethical concerns. Re-scoping of future test events and research activities will shape the type communication and/or dissemination tools and resources the team uses afterwards. To facilitate such adjustments, the team's Executive Committee (ExComm) members will periodically revisit the D&C plan and make modifications as appropriate such that information exchange and outgoing messages are mutually beneficial to the team and targeted audiences. Since in-person ExComm meetings are held every four months during the project's lifespan, the D&C plan will be one action item that is reviewed and scrutinized at this meeting.

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