Can Service Robots Help Best Practices for COVID?

Yao-Lin Tsai
Oregon State University
Corvallis, OR
tsaiyao@oregonstate.edu

Parthasarathy Reddy Bana
Oregon State University
Corvallis, OR
banap@oregonstate.edu

Heather Knight
Oregon State University
Corvallis, OR
knighth@oregonstate.edu

ABSTRACT
We present the design of a mobile robot that delivers hand sanitizer on the Oregon State University campus. The goal is to encourage people to follow the best health practices under COVID-19. The current hardware involves a hands-free hand sanitizer dispenser mounted atop a TurtleBot base. A wizard teleoperates the robot to approach bystanders, communicating via its approach that it would like them to participate. Future work will evaluate what communication modes best serve this goal of distributing hand sanitizer in particular contexts, and consider distributing services to where there is the most human demand.

CCS CONCEPTS
• **Human-centered computing** → **Empirical studies in HCI**; • **Computer systems organization** → *External interfaces for robotics.*

KEYWORDS
Human Robot Interaction, Prosocial Behavior, Service Robots

ACM Reference Format:
Yao-Lin Tsai, Parthasarathy Reddy Bana, and Heather Knight. 2021. Can Service Robots Help Best Practices for COVID?. In *Companion of the 2021 ACM/IEEE International Conference on Human-Robot Interaction (HRI '21 Companion), March 8–11, 2021, Boulder, CO, USA.* ACM, New York, NY, USA, 3 pages. https://doi.org/10.1145/3434074.3446947

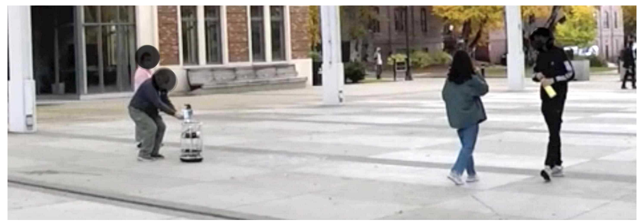

Figure 1: Robot dispensing hand sanitizer in a public outdoor space at Oregon State University.

1 INTRODUCTION
As robots become more pervasive in a post-COVID world, there are various novel opportunities for social robotics researchers to investigate new HRI applications. For example, various types of robots have been deployed during the COVID-19 pandemic to assist in COVID testing and measuring human body temperatures [4], disinfecting human spaces, enforcing rules for safety from COVID [7], and providing hand sanitizer [2] and masks that helped human reduce the risks of getting exposed to the virus during this pandemic. What few of these deployments have not explored, however, is the ways in which robot prosocial behaviors could increase people's compliance with behaviors that could limit the spread of disease, such as using hand sanitizer.

The concept of *Prosocial Behavior* was introduced in 1977 [6], and refers to the ways in which people voluntarily help or benefit others. Psychologists have used this concept to illustrate ways in which positive social influence can impact on social groups such as young peers and the family [1, 3]. Prosocial behaviors can also set social expectations for the group that individuals will seek to comply with. This concept has huge potential during COVID-times as fatigue over following particular health best-practices could be heavily influenced by the norms of one's peers.

Thus, this work seeks to use robot prosocial behaviors to encourage bystanders to use hand sanitizer more often. In this paper, we will introduce the robot hardware, interaction design, and future plans for experimentation.

2 TEAM
Mechanical Engineering Masters student Yao-Lin Tsai, and Robotics PhD student Parthasarathy Bana teamed up under their advisor's supervision to adapt a robot that had been used for a robot health coaching application to brainstorm how to meet the needs of the current pandemic.

3 HARDWARE DESIGN PROCESS
A simple and friendly looking exterior was our main focus while building the robot that can distribute hand sanitizer in the wild. Given our earlier work in developing a robot health coach [8], we were able to reuse much of the hardware and tele-present control for this current project. A Turtlebot2 was used as the mobile base (Fig. 2), with speakers and a servo-controlled webcam with microphone added to enable additional interactions. For the current implementation, we needed to source a good hand sanitizer dispenser and figure out the best location for its installation. Bovon Soap Dispenser was chosen due to its 500ml storage that is able to store large amount of hand sanitizer liquid, square base that provides a stable base, and flat platform on the top allowing the installation of the webcam. We further added three LED light-strips to augment the potential robot communications, controlled via an Arduino Uno. The goal was to get people's attention from a distance, which worked best in the evenings rather than the daytime. Beyond the physical robot, we developed a GUI for wizard-based control, added a router to

HRI '21 Companion, March 8–11, 2021, Boulder, CO, USA

ACM ISBN 978-1-4503-8290-8/21/03.
https://doi.org/10.1145/3434074.3446947

enable communication between the wizard and robot laptops, and utilized Robot Operating System (ROS) to interconnect all system functionalities. For example, custom ROS packages transmit a live camera feed from the robot to provide the operator with a first person view that enables to avoid imminent obstacles and turn left or right corresponding to robot's direction, control led light strips, robot gestures, and to enable text to speech conversion, to enhance the robot's interaction.

4 DEPLOYMENT INTERACTIONS

Consistent with the research resumption plan we submitted to the school administration, the student team developed and deployed this robot in two outdoor public spaces on campus: outside of our campus library and student experience center building.

The goal of the wizarded interaction is to distribute hand-sanitizer to people passing by. For example, would a robot that was staying in place be as effective as a robot that actively went up and approached people? When should we approach? How do different contexts impact people's likelihood of approach? In our deployments so far we have also come up with the idea of future potential research variables, e.g., the way groups might interact differently with the robots than individuals, or the impact of location on the likelihood of taking hand sanitizer. For example, people coming in and out of the library seemed to take hand sanitizer more often than those passing by the student center, perhaps the deployment location was by a door, and people like using hand sanitizer at transition points from one space to another.

In terms of typical deployment procedure, the wizard first teleoperates the robot towards individuals or groups it sees in the environment, seeking their attention. Variants the robot might try include signaling with LED lights, random gestures (moving back and forth, left and right, or increase the speed with a sudden stop) to attract the human, movement of the webcam "head," or even speech [5]. One illustrative interaction sequence is depicted in Fig. 3. During deployments, it was also essential to follow the safety protocols agreed upon with our university, such as cleaning the robot every 10 interactions or after observation of direct touch, consistent use of distancing, mask, and gloves by the robot operator,

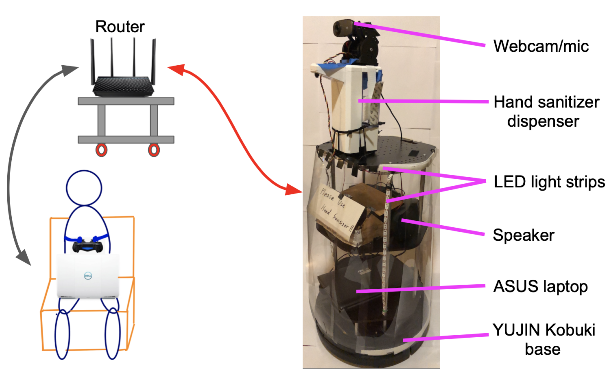

Figure 2: A wizard remotely operates the SantizerBot hardware. The robot's video and sensor data is transmitted back to the wizard for improved control/legibility.

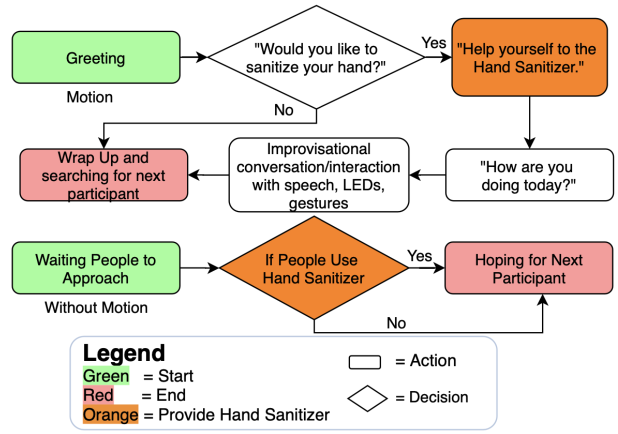

Figure 3: Sample interaction flow of how a wizard might decide who to approach and when to end an interaction. The detailing of which interaction flows would be most effective here is the subject of our future research.

and cessation of the deployment if bystander groups are not social distancing.

5 CONCLUSION

In this paper we discussed the initial design and deployments of a robot distributing hand-sanitizer in outdoor spaces on our university campus. Future work will explicitly explore what communication modes are most effective at promoting hand sanitizer use, helping us understand how robots might promote best health practices. At a time where opportunities to do in-person HRI studies are limited, this also offers a much needed opportunity to continue to run human-robot interaction experiments. We hope our participation in the HRI Student Design Competition will assist us in further specifying ways in which this deployment could promote best practices during the pandemic, and offer insights about the influence of prosocial robot behaviors on the choices people make. After approval from our university ethics research board, we will examine how different communication modes such as light signals, motion gestures, and speech signals can better influence interactions. We also hope this research concept will offer inspiration to other HRI researchers seeking to have a positive impact during the COVID pandemic and figure out creative ways to continue research efforts.

REFERENCES

[1] Carolyn McNamara Barry and Kathryn R Wentzel. 2006. Friend influence on prosocial behavior: The role of motivational factors and friendship characteristics. *Developmental psychology* 42, 1 (2006), 153.

[2] Yusuf Eddy et al. 2020. 2019 Novel Coronavirus Disease (Covid-19): Smart Contactless Hand Sanitizer-Dispensing System Using IoT Based Robotics Technology. *Revista Argentina de Clínica Psicológica* 29, 5 (2020), 215.

[3] Eva H. Telzer et .al. 2018. Chapter Seven - Social Influence on Positive Youth Development: A Developmental Neuroscience Perspective. Advances in Child Development and Behavior, Vol. 54. JAI, 215 – 258.

[4] Shao-Qiang Li et al. 2020. Clinical application of an intelligent oropharyngeal swab robot: implication for the COVID-19 pandemic. *European Respiratory Journal* 56, 2 (2020).

[5] Diana Löffler, Nina Schmidt, and Robert Tscharn. 2018. Multimodal expression of artificial emotion in social robots using color, motion and sound. In *Proceedings of the 2018 ACM/IEEE International Conference on Human-Robot Interaction*. 334–343.

[6] Paul Mussen and Nancy Eisenberg-Berg. 1977. *Roots of caring, sharing, and helping: The development of pro-social behavior in children.* WH Freeman.
[7] Adarsh Jagan Sathyamoorthy et al. 2020. COVID-Robot: Monitoring social distancing constraints in crowded scenarios. *arXiv preprint arXiv:2008.06585* (2020).
[8] Yao-Lin Tsai et al. 2020. How Service Robots Can Improve Workplace Experience. *International Journal of Social Robotics* (2020), under preparation.