Autonomous Surface Disinfection Robot to Combat SARS-CoV-2 Grant Proposal

IEEE REGION 3
ORLANDO SECTION

Project Description

Since the COVID-19 pandemic began, countless people have raised concerns about the safety of public spaces. The SARS-CoV-2 (the virus which causes COVID-19) can spread through person-to-person contact, from droplets in the air, and from contact with surfaces. Many measures have been taken to mitigate the spread of the virus, now including several teams across the world creating robots as disinfection tools. Our team proposes to implement one of these robots.

Ultraviolet C (UVC) radiation has been shown to kill bacteria and inactivate viruses, and low-profile UVC lamps have long been sold as “germicidal” products for consumers. Research on the effects of UVC radiation on the SARS-CoV-2 is limited, but it is highly probable that exposure to UVC radiation does inactivate the virus. As such, our team proposes to use a UVC lamp as the disinfection implement on our disinfection robot.

The robot itself will contain a mobile base which can navigate inside a building, sensing equipment to help it avoid collisions, and a UVC lamp mounted several feet in the air. The lamp must be at least above the height of a typical desk/table in order to properly disinfect surfaces. A lamp mounted lower could potentially be effective in disinfecting the air, but the purpose of this project is to create a robot that can disinfect surfaces specifically.

UVC radiation is dangerous for humans, so the robot will need to operate only in rooms where no people are present, such as in a building after it has already closed at night. Necessary precaution would also dictate that the robot have a mechanism in place to detect the presence of humans. At any point during runtime, if the robot senses a living creature, it must be able to automatically shut off the UVC lamp.

Expected Outcome

The approximate timeline of the project is as follows. In November and December, the team will conduct research on the various mechanisms that the robot will need in order to function. During this time, decisions will be made about the specific parts that will need to be bought for the final product.

Beginning in January, two sub-teams will work in parallel on the robot's navigation system and the UVC system. Between January and April, the team will prepare a sensing system to ensure that the robot can detect humans and avoid collisions. During this same time, the team will prepare a circuit design to connect the robot's controls to the lamp, the drive system, the lamp, and power. Meanwhile, the UVC sub-team will be testing the efficacy of the UVC lamp.

Between May and November, the robot will be gradually assembled, with testing of the various mechanisms occurring at every stage of assembly. First, the collision avoidance will be tested, then the human detection, then the entire system with the UVC lamp implemented.

It is anticipated that the robot will be fully functional by November 2021. At this time, we intend to donate the robot to one of several potential places. Since this project will be associated with the University of Central Florida, we could donate the robot to be implemented inside a university building. Alternatively, in order to best serve the relief of the pandemic, we could donate the robot for use in a local hospital.

Tentative Budget

3D Printing	$50
Battery/Charging Equipment	$150
Motor Shield	$25
Motors	$80
Navigation Sensors	$225
PCB Printing	$33
Raspberry Pi 4 (4 GB)	$55
Robot Base Materials	$200
UVC Lamp	$250
Wheels	$30
	$1,098

Safety Information

In order to ensure that our members can participate in this project safely, large team meetings will take place virtually over Zoom. The team will be split into smaller subgroups that can meet in person to assemble components of the robot. For in-person meetings, face coverings will be required for participants at all times, meetings will be restricted to a small number of participants, and social distancing guidelines will be followed. Before each meeting, the participants will be required to check themselves for symptoms, and symptomatic persons will not be permitted to attend in-person meetings.

Further Reading

For more information on the technology and research that inspired this project, visit the following resources:

- https://new.engineering.com/story/robot-fights-covid-19-with-uv-c-light
- https://www.lighting.philips.com/main/products/uv-disinfection
- https://media.ies.org/docs/standards/IES-CR-2-20-V1-6d.pdf
- https://www.fda.gov/medical-devices/coronavirus-covid-19-and-medical-devices/uv-lights-and-lamps-ultraviolet-c-radiation-disinfection-and-coronavirus

Team/Contact Information

The Autonomous Surface Disinfection Robot to Combat SARS-CoV-2 project will be comprised of members from the IEEE UCF chapter under the Orlando Section of Region 3. The primary contact for the project will be Taylor Barnes, who can be reached by email at ieee.ucf@gmail.com or taylordanielbarnes@ieee.org.

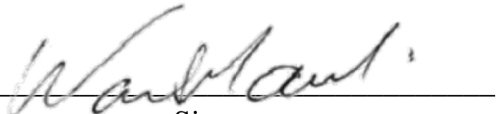
The following are IEEE member numbers for members of the project team:

- Taylor Barnes: 95165538
- Alex Parady: 96882266
- Juan Battaglia: 96243729

Endorsement

I, Warren Macchi, IEEE Orlando Section Chair, approve of this proposal for the Region 3 pandemic project grant.

12/10/2020
Date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