Autonomous Surface Disinfection Robot to Combat SARS-CoV-2

Monthly Report - May

IEEE REGION 3
ORLANDO SECTION

Overview

The IEEE Orlando Section's Autonomous Disinfection Robot is a project with the goal of creating a robot that can autonomously navigate a room and disinfect all of its surfaces using UVC radiation. The following is a summary of the progress made in the month of April:

- Thorough analysis was conducted on the robot's power requirements, and it was determined that a more powerful battery would be necessary.
- New ideas were implemented in the mechanical design of the robot.

According to the project timeline, the mechanical design and circuit design of the robot should be done at this point. Circuit design has been finished for practical purposes, although there are still minor tasks that will need to be addressed closer to the end of the project. The mechanical design is not complete yet, but significant progress is being made. The robot will not need to be assembled for several months, so there is still time for our mechanical team to continue making design decisions.

OVERALL PROJECT TIMELINE

2020

November - December

- Research UVC technology
- Divide subcomponent teams

January

- Select UVC lamps
- Begin electrical designs
- Research necessary sensors

February

- Prototype with sensors and lamps
- Continue circuit design
- Begin mechanical design

March - April

- Prototype with sensors and lamps
- Design complete circuit
- Design complete mechanical system

May - July

- Purchase mechanical components
- Prepare material for presentation (publication, donation, etc.)

August - September

- Assemble robot gradually
- Verify robot's performance at every stage of assembly
- Upgrade components if testing reveals necessary changes

October

- Purchase finalized PCBs
- Test robot in diverse environments

November

- Complete final testing
- Make final preparations for the project's real world implementation

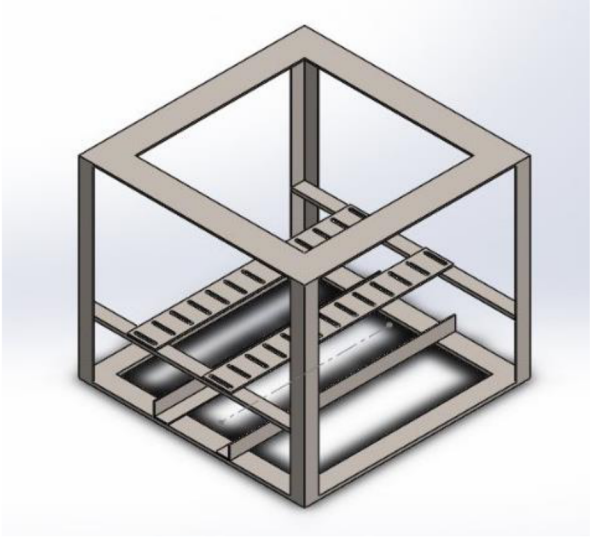
2022

Progress

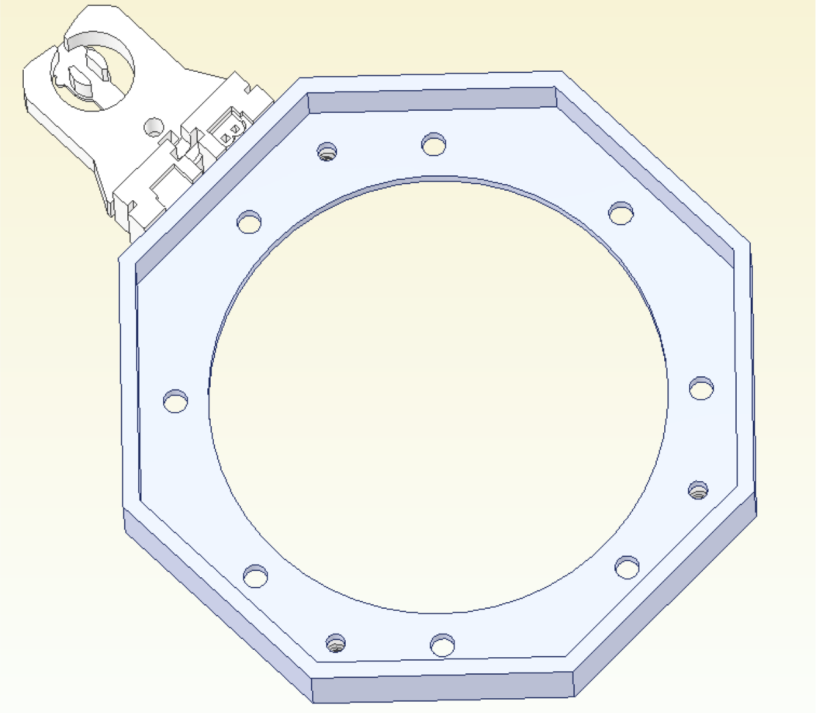
After initial calculations on the battery capacity, we determined that a 35 Ah battery would be sufficient to power the entire robot. These calculations were based on the idea that the robot would only need to be powered on for approximately one hour at a time, and the battery could safely be fully discharged during every use. After examining our calculations closely, it was determined that these assumptions were faulty. For practical purposes, the battery should only be discharged up to ~60-75% capacity at any given time, so as to not dramatically shorten the battery's lifetime. New calculations were conducted, taking into account more complete figures.

Comfortable discharge (%)	0.65
Number of lamps (#)	8
Motor Current (A)	1.7
Lamp On-time (%)	0.75
Motor on-time (%)	0.35
Number of rooms (#)	25
Time per room (h)	0.083333333
Battery current (Ah)	73.33333333
Battery wattage (W)	880

The above table shows the parameters used to calculate our new target battery capacity. The discharge rate of 65% denotes that the battery should never be used past 65% capacity. The lamp and motor "on-time" denotes the percentage of time that the lamps and motors will be consuming power while the robot is on (note that the robot should only be driving for short stretches of time). The "time per room" is our best estimate of how much time will elapse between the robot being turned on and completing its task within a room. As can be seen, the final result is that a ~75 Ah battery should be sufficient to meet our robot's requirements.



The robot base has been updated to the above model. The bars running across the middle of the base are set up to allow components to be screwed into place. Such components include the ballasts, power inverter, and computer equipment.



The above model has been added to the base to hold the lamp sockets in place. One screw holds the socket in its center, and the octagonal ring braces all eight sockets so they do not rotate.

Next Steps

Over the next several months, our team will be split up in many locations, so progress may be slowed significantly. In the coming weeks, we will attempt to finish the mechanical design so that its parts may be produced soon after. The ROS code for manipulating our depth camera sensor data will be written and tested using simulations and a prototype robot. According to the project timeline, our next benchmarks will be in August. We will have until then to have the design complete and ready for assembly.

Certification

I, Taylor Barnes, hereby approve of this documentation of the IEEE Orlando Section's pandemic project sponsored by IEEE Region 3, and I certify that the above information is a true and accurate depiction of the project's current progress through the month of May 2021.

5-1-21

Date

Signature