

**MAE 4620 FINAL REPORT AUTONOMOUS ROBOT TEAM**

**THE INTEGRATION OF ROBOTICS IN SOCIETY, STARTING WITH  
HEALTHCARE**

An Undergraduate Thesis Portfolio  
Presented to the Faculty of the  
School of Engineering and Applied Science  
In Partial Fulfillment of the Requirements for the Degree  
Bachelor of Science in Mechanical Engineering

By

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## **SOCIOTECHNICAL SYNTHESIS**

As the COVID-19 pandemic grips the United States, healthcare systems across the country have been stressed immensely. Any technology that aims to reduce the transmission of COVID-19, with tangential improvements in improving patient outcomes and reducing the load on healthcare workers has a chance to see widespread adoption. The technical and STS research in this report seek to deliver a greater understanding of the difficulties, benefits, and drawbacks to implementing robotics in healthcare with regards to the coronavirus pandemic. The technical research involves the design and creation of a remote-controlled robot that will use ultraviolet-C (UVC) light to disinfect high-occupancy rooms and remove SARS-CoV-2 from surfaces. Customer-focused design allowed for an examination of the factors that could influence further development and adoption of this technology. Tightly coupled to this project, the STS research for this report will investigate what social groups shape the technology now, and how they may affect further development of healthcare robotics.

The technical research in this project was specifically created to reduce transmission of COVID-19. Many disinfection processes involve human workers, and any method to reduce the exposure of workers, doctors, and patients to COVID-19 could help strained and stressed health systems. A robotic disinfection solution that could be operated remotely with an arm-mounted lamp that can disinfect horizontal surfaces (as well as vertical ones) would be a substantial improvement over current commercial design. The robot's subsystems were validated using several different methods as will be described in the technical report, but due to time and resource constraints, the robot was not tested in the field substantially.

Similar to the technical project, the STS research in this report analyzes the impact of relevant social groups and actors on the development of robotic healthcare technology, and the

reciprocating effects robotics in healthcare may have on those social groups. A Social Construction of Technology (SCOT) model should be adopted as described by Pinch and Bijker. The key relationships within this SCOT model of healthcare robotics are patients, manufacturers, hospital administrations, regulatory agencies, healthcare providers, and users of robotic disinfection outside of healthcare. The framework was developed using a large combination of research studies, market analyses, legislation, and newspaper articles, provided to show how each social group fits into the model.

Healthcare robotics must be complicated machines in order to perform their jobs correctly and with enough benefit to be considered worthwhile, and should have new regulation to more carefully develop this technology as well as ensure that they can be available in new emergencies. Each group that interacts with the robotics, from nurses to administrators, have different requirements for robotics, and they all will shape future designs in different ways. The current use of healthcare robotics with proven effectiveness as well as market analysis leads many experts to believe that healthcare robotics will grow to be a large industry in the future, with far-ranging impacts for our economy and society. Overall, this research attempted to provide an understanding for the social groups that interpret robotic disinfection and robotic technology and shape it in different ways.

The actors described in the STS have affected the development of this technology, and will continue to in the future. Considering the actions and influence of each social group, economic factors, current events, political legislation, and regulation has allowed some insight into the future of robotics in our society, and the design, manufacturing, and operation of a novel robotic disinfection solution shows what design factors each social group may influence. As the world contends with the COVID-19 pandemic, robotics have become more common in our world and

they are likely here to stay. It is possible that robotics performing tasks such as cleaning and disinfection in locations as varied as hospitals, train stations, malls, airports, and hotels may be a common sight in the future.

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#### **THE INTEGRATION OF ROBOTICS IN SOCIETY, STARTING WITH HEALTHCARE**

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#### **PROSPECTUS**

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