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Sociotechnical Synthesis

The capstone project and research project both involve robotics. The capstone project of building a checkers robot is the application of the research project about the safety of robotics. Methods and principles from the research can be implemented in the capstone project. In order to play checkers with the robot, the user will have to reach in into the same area as the robot. The capstone project has an emergency stop to deenergize the system, as well as warning lights to ensure safe operation. The inspiration for the projects was to create a device which can do something that a person can do, play checkers, without substantially modifying the action itself. We wanted to reduce any changes to the game of checkers and not add any barriers, while still maintaining a safe system which actual people would use on the demonstration day. Because children were present on demonstration day, we felt it important to make the system as robust as possible. Research on safety methods for robotics when dealing directly with people allowed us to reach an effective implementation.

For the capstone project we designed and built a checkers robot. The checkers robot utilized a motor-controlled gantry which could set up and play a physical game of checkers with a human opponent. It made moves in reaction to its opponent's moves and played a legal, complete game of checkers. The robot used a camera to locate pieces and was able to identify invalid or illegal moves and notify the user. It could also correct invalid moves to reset the board state to the last known legal move.

As automation extends outside of the industrial world and begins to interact directly with consumers, it will be important to reevaluate safety standards and consumer expectations of safety in this new environment. The research paper proposes to research existing safety implementations and ideas, and then evaluate how these implementations can be codified, who they would be codified by, as well as the implications these regulations would have on liability. To do this, the STS framework of the risk society will be used to analyze how society can treat the risk reward of direct human robot collaboration. The research will show how much thought engineers are responsible for putting into the safety of their designs. It will also shed light on how important it can be to design for a variety of shapes and sizes of people in order to ensure safety, as well as how important it is for an engineer to clearly communicate how technology should be safely used.

Working on both projects simultaneously allowed a closer look at designing safety into a system. It was possible to think about the safety of the device before and after doing research on the topic. The technical aspect also shed light on the limitations of certain safety methods. Understanding which methods are best for a certain system is much easier when there is an example system to analyze it with. When setting up the warning lights, seeing how people immediately responded to them showed the depth of thought that must go into a safety feature, and how simply having it does not necessarily make it effective. It illuminated the difference between theory and practice, which allowed me to more effectively choose sources and examples for the research paper.