Institute for Systems Research

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Ethics Assignment

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Project Overview

The purpose of the project is to create a blueprint and standardized solution for an Automated Container Shipping System (ACSS) in a cargo ship port. We focused on implementing the ACSS to a specific port. We analyzed how the ACSS would increase revenue and decrease cost for the port through different measures of effectiveness. First, we considered the overall cost a cargo ship port with the ACSS would spend. Cargo ship ports with the ACSS would have lower costs due to replacing the cost of labor from workers for the cost of the electricity to run the ACSS, lower failure rates of automated machines compared to machines exposed to human errors, and lower rates of worker injury lawsuits. Secondly, we measured the scan, load, and unload time efficiency of containers from and to shipping vehicles, the port storage, and cargo ships. Finally, we measured the average container time in system discounting manufacturer request times. Automated vehicles move containers on optimized paths, work longer hours compared to vehicles operated by humans, and place containers in optimized locations.

The system shall provide different requirements. First, the system shall provide an operator interface machine for an ACSS operator, a maintainer interface machine for an ACSS maintainer, and automated vehicles for the port. These actors shall be able to operate automated stacker vehicles and automated gantry cranes, which shall scan, unload, and load containers to and from cargo ships, shipping vehicles, and the port storage area with an efficiency rate of no less than 90% through the use of machine learning. The system shall have a control element compromised of AWS processing servers, AWS database servers, AWS secure network, and appropriate computers on the interface machines and automated vehicles. The system shall be standardized, can be implemented in any port, by using micro-services on cloud computing. The system shall decrease overall cost of for the port by at least 20%. The system shall decrease average container time in system, discounting manufacturer request times, by at least 15%.

Ethical Implications Inherent in the Design

The main purpose of the project is to increase the time and cost efficiency of the scan, load, and unload of containers to and from shipping vehicles, the port storage, and cargo ships in a cargo ship port. There are two ethical dilemmas that can arise. **First, what happens if an automated machine receives instructions to optimally move or operate but injures shipping vehicle or cargo ship personnel?** When the system instructs an automated machine to move on an optimized route or to operate in a specific way, it should not result in injuring port personnel. For example, if an automated stacker vehicle receives instructions to move on an optimized route to a shipping vehicle, but it runs over shipping vehicle personnel while moving on its optimized route. Or if an automated gantry crane gets instructions to unload a container from a cargo ship, but it accidentally hits and injures cargo ship personnel.

Secondly, what happens if an automated machine severely malfunctions and injures the ACSS maintainer and his maintenance crew who attempt to repair it? When an automated machine malfunctions, the ACSS interface flags the machine and its location to the ACSS maintainer. The ACSS maintainer and his maintenance crew go to the described machine and conduct the appropriate repair. But if a automated machine is severely malfunctioning, it can harm the ACSS maintainer and the maintenance personnel when attempting to conduct the appropriate repair on the vehicle. This severe malfunction could originate from an error from the automated machine's computer or controls systems, improper instructions sent from the processing servers, or even improper data transmitted from the instructions of the ACSS operator interface machine. Furthermore, the system heavily relies on the network to connect all of the components of the system. If the network is hacked, the automated machine can be comprised and sent very malicious instructions. One or multiple of these errors can result in the sever malfunctioning that injures the ACSS maintainer and his crew when conducting the repair.

Optimization of Design

A number of steps can be taken to prevent the above ethical dilemmas from occurring. The first step is to create **safe areas** for all port personnel, where automated machines are restricted. By creating safe areas, workers can operate with the peace of mind that automated machines will not enter the area. These safe spaces will limit the ability for automated machines to move on optimal routes, as they are restricted from entering these areas. This creates a trade-off in the efficiency of the system and the safety of workers. The second step is to implement sensors on the automated machines that can identify humans and automatically shut down if it predicts a dangerous situation. This increase the safety of workers, but implementing these **sensors that automatically shut down the machine when it identifies a human** would increase the cost of the ACSS. This creates a trade-off between the cost of the ACSS and the safety of workers.

The issue with the malfunction of automated machines can be handled separately. The safe areas and human identifying sensors can help. But it doesn't prevent the injury of maintenance personal conducting repairs on the malfunctioning vehicle. First, the ACSS maintainer operator shall be provided a **feature to manually shut down any automated machine** in the event of a malfunctioning automated machine. This results in a trade-off between system cost and the safety of workers. Finally, our engineering team plans to **conduct several rigorous tests** on the reliability of these safety criteria, as well as **contract reputable and independent third parties to also conduct these tests**. This will be done through different simulated scenarios as well as real world scenarios with dummy workers. We plan to dramatically increase the reliability of the safety criterions of our system from these tests. This does create a trade-off between system cost and the reliability of the safety criteria to increase the safety of workers.

Embedded Values and Ethical Responsibility

The IEEE Code of Ethics claims an engineer shall “avoid real or perceived conflicts of interest”. Our team’s criteria for safety make the ACSS more expensive and less efficient. We do want to make a successful product, but we strive to **avoid conflict of interest** and prioritize safety. In addition, an engineer shall “accept responsibility in making decisions consistent with the safety…of the public”, according to the IEEE Code of Ethics. The design criterion to implement safety areas, human identifying sensors, shut down features on automated machines, and the conduct of tests to increase reliability demonstrates our team **accepts responsibility in making decisions consistent with the safety** of the people in the port.

An important responsibility of an engineer is the “acceptance of honest and concrete criticism of technical work” (IEEE Code of Ethics). Our team will contract reputable and independent third party engineering teams to conduct their own tests. **By not only accepting but also promoting honest and concrete criticism of our work**, we further our goal to create a reliably safe system. Finally, the IEEE Code of Ethics emphasizes, “to be honest and realistic in stating claims or estimates based on available data” is another responsibility of an engineer. Our engineering team strives to fulfill this aspect of the IEEE code of ethics by first requiring the collection of a large and accurate data set from conducting multiple rigorous tests on our system’s safety features. Secondly, by contracting reputable third parties to conduct separate tests on our system, increase data collected, and check our work. By heavily investing on collecting a large and accurate data set, and on contracting reputable third parties to check our work, we strive to be **honest and realistic in stating claims and estimates on the safety and reliability of our system**. Fulfilling these ethical aspects will result in a delayed system completion date, decrease in efficiency, and an increase in cost. But our engineering team believes ensuring the safety of workers is an important reflection of our team’s values that we consider as a necessity in our ACSS solution.

The Design Process and Ethical Responsibility

A professional engineer might find different aspects of the design process of the ACSS of concern. The IEEE Code of Ethics emphasizes an engineer must "accept responsibility in making decisions consistent with the safety…of the public". One of the greatest concerns a professional engineer would have about the ACSS is ensuring the safety of the port personnel from the automated machines. A professional engineer would first be required to guarantee a very high reliability rate of the safety features of the system through a large amount of rigorous tests. A professional engineer shall also "be honest and realistic in stating claims or estimates based on available data" (IEEE Code of Ethics). He is required to be honest and realistic with the reliability rates from these tests.

Once a suitable reliability rate is reached, a professional engineer would still only start implementing the system minimally, with just one automated vehicle. This is because a professional engineer shall "avoid real or perceived conflicts of interest" (IEEE Code of Ethics). A professional engineer prioritizes safety over profit. He would only slowly increase the number of automated machines in the port if they consistently showed to be safe and they had no incidents harming people. Finally, A professional engineer shall "accept responsibility in making decisions consistent with the…welfare of the public" (IEEE Code of Conduct). To go full circle, a professional engineer would only fully implement the system after considering the negative societal and welfare affect the ACSS can have on the port workers, such as the dramatic job loss of hundreds of workers at the port. In all the steps above, a professional engineer is required to follow the IEEE Code of Ethics in order to uphold the ethical standards. This would not only just maintain the healthy effects of the ACSS on the port and the workers, but also promote a more ethical and healthier engineering culture for the world.

References

[1] "IEEE Code of Ethics." IEEE -. Institute of Electrical and Electronics Engineers, n.d. Web. 16 May 2018.