Undergraduate Thesis Prospectus

Indoor Mapping and Navigation for an Autonomous 3D Printed Robot
(technical research project in Systems Engineering)

Automation and Employment: Transportation in the United States
(STS research project)

by

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October 31, 2019

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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General Research Problem

How is automation transforming human occupations?

Automation can augment human occupations, improving workplace efficiency and relieving human workers of tedious on dangerous work (Manyika, 2017). But automation also threatens livelihoods, and can cause undesirable economic disruptions (Arntz et al., 2017). An optimal automation development path would balance automation's safety and efficiency benefits against its disruptive effects.

Indoor Mapping and Navigation for an Autonomous 3D Printed Robot

How can a robot autonomously navigate and map an indoor space?

Prof. Madhur Behl of the CS and ESE departments is the advisor of this capstone team made of Gabe Argush, Jess Krynitsky, Brian McGuire, Dax Scott, and Charlie Tolleson. Company sponsor MITRE supplies the robot hardware and the team implements software to enable the robot to seek targets in an indoor setting.

Soldiers and rescue crews need to be fast in their searches in order to be effective. Individuals scanning buildings requires time and manpower in order to fully analyze the spaces near them. Robots could scan rooms faster than people and easily at scale. Designing a robot to be useful towards this goal is difficult. The team will implement a combination of mapping algorithms to allow a human operator to teleoperate the robot as it forms a visual map of the space. Autonomous navigation systems will allow the robot to form these maps with limited human operation. The robot will also have visual recognition to identify specific objects, like people, and mark their position on the map it has built.

Robots are used for many search and rescue tasks, like the Little Sunfish that was able to locate fuel rods in Fukushima in 2011 (Beiser, 2018). The functionality in this project already exists in the world and the team is looking to bring that functionality to the specific robotThe team will use Robotic Operating Software (ROS) as the environment where these algorithms will run. Short of verifying that code compiles, the nature of the robot means most runtime testing must occur on the robot itself. The team will first assure that the robot can make a map that accurately represents the room to the point that a driver could drive anywhere in the room using only the map. Then autonomous navigation systems will be built in such that the robot can autonomously fill out a map of the room. As an additional goal, visual object identification could be added. A finished project would be a robot that could form a map of a room and highlight the locations of target objects, all without a human operator.

Automation and Employment in the United States

How are employees, companies, and regulatory bodies responding to the automation of labor in the United States?

As robots and AI become more potent at falling cost, utility grows. Some employees are will lose their jobs to automation and the rest will have to work with new automated systems.

Total automation of an enterprise is rare (Gittleman, 2019). Automation is controversial; some fear losing their jobs to robots (Nam, 2019). McKinsey Global Institute predicts that about 15% of all work hours globally will be automated by 2030 (Manyika, n.d.). Transportation and accountancy may serve as representative fields in which automation is developing.

The core participants are workers susceptible to automation, companies that automate their workflow, contractors that implement automation, and the U.S. Department of Labor.

Unions organized in AFL-CIO's Transportation Trades Department (TTD) argue for regulation to protect jobs from displacement by autonomous vehicles (TTD, 2019). Many workers fear job loss or fear poor integration. Since 2012, approval of robots has decreased across Europe. Countries with many elderly citizens and white-collar jobs saw rising approval, suggesting blue-collar workers perceive a greater threat of displacement through automation.

The International Federation of Accountants (IFAC) a professional society, recognizes automation's little threat to accountants' jobs (Thompson, 2016). Nevertheless, there is little resistance to automation from accountants and other organized white-collar workers. Both types of workers acknowledge automation, but only blue-collar groups act to protect their jobs.

Companies automate primarily to increase profits and shareholder value. McDonald's is automating customer interaction, first with in-store kiosks and soon in the drive-through (McDonald's 2019). The trend is in response to movements to raise the minimum wage and to efforts by automation contractors.

Trade associations such as the Association for Unmanned Vehicle Systems (AUVSI) represent companies engaged in transportation automation. They lobby for industry regulations them expand their markets (AUVSI, 2019)

Vendors and contractors of automation systems promote them by convincing companies that automation is profitable and augments jobs rather than displace them (UiPath, 2019).

The U.S. Department of Labor has funded efforts to mitigate the burdens of automation for workers, targeting three groups of employees: those directly impacted by automation, employees in industries impacted by automation, and destabilized mature workers (DOL, 2018)

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