The Future Impacts of Autonomous Aid on Disaster Relief Efforts

Andrew Dodge  
*Fort Hays State University*, ajdodge@mail.fhsu.edu

Eric Deneault  
*Fort Hays State University*, eldeneault@fhsu.edu

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Abstract

Natural disasters and other catastrophes have significantly increased in recent years (Oishi & Komiya, 2017). Currently, resources available to succor in response to cataclysms are limited. Humans save lives, while ultimately risking their own. In order to bypass this risk, autonomous robot programming is essential. Research and advocacy regarding autonomous aid in the scientific community has yet to be fully addressed (Oishi & Komiya, 2017). Because of this, first responders, firefighters, and policemen are perpetually endangered. Furthermore, technological contributions would also eliminate human error, promote productivity, and stimulate collaboration on matters unable to be solved autonomously. A robot prototype, designed to retrieve 6x6x6 inch cubes, was programmed to a controller, but also operated autonomously. Despite the controller being beneficial for specific functions, autonomous programming proved to be advantageous when used applicable. While the initial task was direct, the knowledge acquired from the project possesses the potential to enhance future ventures seeking to aid disaster relief.

Introduction

On September 11, 2001, an Al Qaeda terrorist organization led a preemptive attack on the United States. The tragedy resulted in the loss of 344 firefighters, 60 police officers, and eight emergency medical technicians (Nation, 2008). Additionally, the 2010 Haiti earthquake took the lives of 300,000 individuals (Pallardy, 2020). Both adversities impacted millions of families and citizens worldwide. According to a study conducted by Shigehiro Oishi and Asuka Komiya, the frequency of natural disasters is steadily increasing (Oishi & Komiya, 2017). Despite seemingly inevitable losses in the future, a solution to the enigma could lie at the fingertips of researchers. A significant number of deaths could be prevented in catastrophes if autonomous robot relief was implemented. The introduction of abiotic advancements has the potential to reduce human error, decrease risk, and increase human collaboration amid disasters. Robots designed to pick up debris, drag victims from rubble, and extinguish fires will likely amount to disasters. Robots designed to pick up debris, drag victims of abiotic advancements has the potential to reduce human numbers of deaths could be prevented in catastrophes if autonomous aid was implemented. The introduction of abiotic advancements has the potential to reduce human error, decrease risk, and increase human collaboration amid disasters. Robots designed to pick up debris, drag victims from rubble, and extinguish fires will likely amount to disasters.

The robot was constructed using VEX Version 5 robotics kits. Vision and distance sensors were attached to the base. Wheels were also located on the base and they were spaced apart for stability. The lift was the primary mechanism for lifting the cubes, implementing the use of rollers, to deposit the cubes into towers. The rollers were attached to a motor and were utilized to pick up and store the cubes in the tray. The tipping mechanism was designed to stack the cubes. It possessed a gearbox to output torque on the gears.

VEX block coding was used to program the robot with autonomous and driver control modes. In all, there were over 120 lines of code. The autonomous period was programmed to operate for 60 seconds without a driver using a timing mechanism with rotations and sensors. The driver controls included basic functions as well as a toggle to stack and split cubes. “If, else” statements and boolean variables controlled the toggle to stack blocks. Splitting blocks involved holding the left trigger to remove blocks and place them on a tower. Changing the motor speed to pick the cubes up slower was vital in fixing the programming. Also, changing the motor cartridge on the tipping mechanism allowed for a critical torque improvement.

The completed trial robot was able to pick up 6x6x6 inch cubes using a vision sensor, and it successfully relocated the cubes to eliminate obstacles. Heat, vision, and light sensors all have the potential to be programmed to extinguish fires autonomously—eliminating the degree of risk involved. Similarly, heat, vision, and distance sensors bear the capacity to save individuals by detecting survivors and escorting them to safety. In the event of obstacles preventing a direct path to the victim, the robot can be programmed to move the barrier. The trial robot proved effective in accomplishing this objective. The testing field utilized for experimentation is shown in Figure 5. The net benefits allow for:

-Enhanced productivity due to minimal human error
-Increased human collaboration on non-automated tasks
-Reduction of human deaths resulting from disasters

Construction Methods

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Conclusion

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Kayla Brannick and Andrew Dodge
Fort Hays State University

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Figure 1: Demonstrates the implementation of the tipping mechanism to stack and transport cubes

Figure 2: Shows the design and building process of the railing used to stack and split cubes

Figure 3: Shows the use of block coding as well as “if, else” statements while programming the autonomous robot. (Illustration inspired by VEX robotics)

Figure 4: Image taken from the robot’s coding. This is a sample of VEX block coding. (Illustration inspired by VEX robotics)

Figure 5: Testing field for automated VEX robot. Equipped with 7 towers and 66 cubes. (Illustration by VEX robotics)

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References


