Using Robotics to Release Life Buoys

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Introduction

It is difficult for ocean lifeguards to encounter tourists drowning in deeper waters or dangers for various reasons. Far away from the coast, the lifeguards cannot deliver the lifebuoy to the drowning person immediately. The lifeguard must rush to the accident site and rescue the drowning person. In this way, it takes time and misses the drowning person's best rescue time. An approach to solve this issue is by using robotics to release life buoys. The robot can accurately detect the drowning person through the camera sensor, quickly reach the trapped person, launch a lifebuoy immediately to the drowning person, and then rescue the drowning person with a rescue rope tied to a lifebuoy.

System Integration

This project will use a robotic arm to automate the process of releasing life buoyes. To identify objects, the robotic arm will use a fixed camera and object detection software called Limelight. The software will be trained to continuously pinpoint the lifebuoy landing position through the machine, to provide data to the transmitter. Polycarbonate materials and Falcon 500 motors will be used to operate the robotic arms and launchers. Both software and hardware are controlled by the Java Development Kit to automate this task and allow humans to perform other tasks.

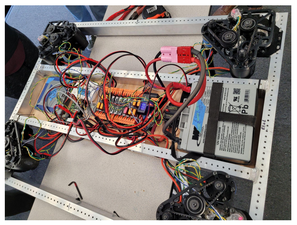


Figure 1a: *The base of the robot*

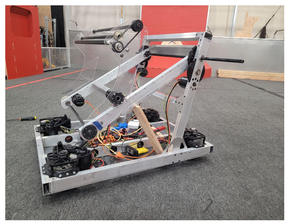


Figure 1b: *Completed robot*

Problem Statement

Problem 1: The launch distance of the robot's launcher is not far enough. No matter how much you increase the speed of the launcher, the lifebuoy will fall about the same distance. This is because the lifebuoy is already on the launcher when it is launched, so as soon as the launcher rotates, the lifebuoy will be launched. Therefore, every time launched, the speed of the launcher cannot be reached to the maximum.

Problem 2: There are many people swimming on the sea, and it is impossible to accurately scan the drowning person and launch a lifebuoy.

Methodology

Solution 1: Install two rollers in the launcher, and when the lifebuoy is ready to be launched, transport the lifebuoy to the launch area. When the rotation speed of the launcher roller reaches the maximum, transport the lifebuoy out and launch it from the launcher.

Solution 2: Place multiple cameras at a high place facing the sea, search the Internet for videos of drowning people, and let the program learn the movements and forms of drowning people when they are drowning. Make sure the program understands the difference in movement and form between a swimmer and a drowning person. When the program detects a drowning person, the computer will put real-time monitoring of the person whom the program thinks is drowning into the background computer, and the inspector can manually determine whether it is a real drowning person. If the detector does not respond for more than 4 seconds, the program will automatically launch. Another situation is that if the drowning person is not detected by the program, the detector can manually intervene and perform the launch. The cooperation of this kind of procedure and labor can play the role of double insurance and can greatly reduce the unnecessary sacrifices made by drowning people due to the negligence of lifeguards.

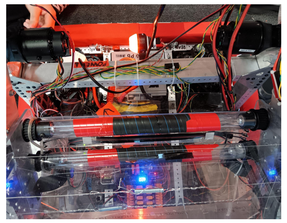


Figure 2a: *Robot waiting for launch area*

Figure 2b: *Motor that controls the shaft*

Robot Spare Part

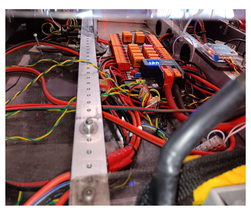


Figure 3a: *Robot basic circuit*

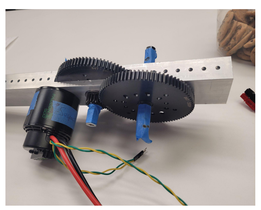


Figure 3b: *Gears for conversion*

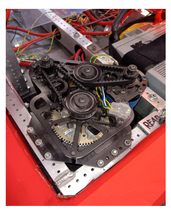
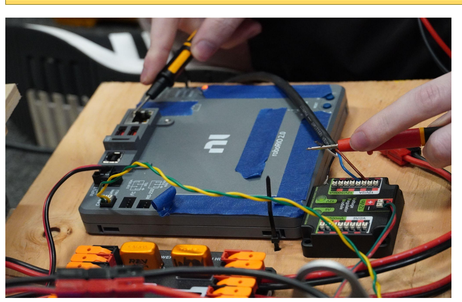


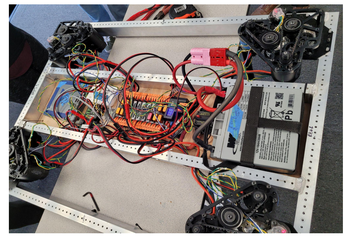
Figure 3c: *Robot wheel motor*

The Evolution of Robot

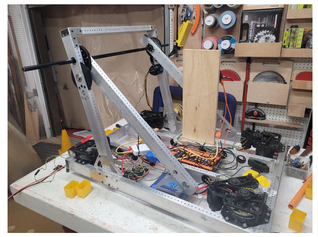


Step 1: The robot starts soldering and connecting the motherboard.

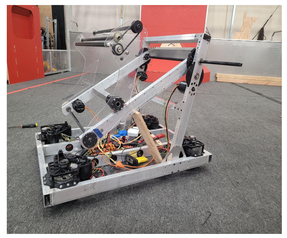
Step 2: Make the rough outline and parts of the robot out of wood. The advantage is that it can improve fault tolerance and reduce costs.



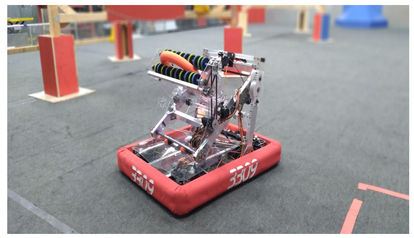
Step 3: Weld the bottom plate of the robot with aluminum strips, and install necessary components such as wheels, batteries, motherboards, and radios on the bottom plate. Then build the framework of the robot.



Step 4: Create the basic framework of the robot. The wooden board in the picture is to test the range of the robot's camera. The wooden board is used because the height and angle of the camera can be better adjusted.



Step 5: Install additional components such as robotic arms, transmitters and cameras on the robot.



Step 6: Install the anti-collision bar on the robot and test whether it is fully functional.

Stages of Operation

1. The robot starts immediately without waiting for human intervention. 2. Quickly locate the drowning person and accurately navigate to the target point. 3. Automatically launch a lifebuoy to ensure that drowning victims can receive support. 4. The real-time monitoring system tracks the robot's actions and provides rescuers with accurate information. 5. Intelligent operating procedures reduce human errors and improve rescue success rates. 6. The whole process is efficient and reliable, making drowning rescue faster and safer.

Conclusion

This robotic system utilizes six stages of operation to perform automatic release life buoys. The investment in robots will greatly improve the speed and efficiency of drowning rescue and reduce delays caused by human factors. It will reduce the risks for rescuers, especially during rescue work in bad weather or dangerous environments. Such innovations will stimulate the development of more technical fields, including robotics, artificial intelligence, positioning and navigation, etc. The intelligent operation of the robot can reduce human errors and improve the accuracy and success rate of rescue. The application of this technology will bring more security and trust to society, while also promoting people's awareness and acceptance of technological innovation.