

Engineering Technology

Improving Robot

Cory Rhodes, Darrick Elliott, Jeanie Hess

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Cait Cramer, Robert Parker

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1.0 Executive Summary

Our group was assigned with the task of repairing and improving the Ivy Tech robot provided by the robotics lab. This robot was created to launch basketballs at various events and returned damaged the last time it left Fort Wayne Ivy Tech. Our group responded to this assignment by first analyzing the robot for concerns by testing wiring and looking over the components. We found that there were design issues with the chassis, missing controller with VEXnet and damaged parts on the chassis. Then we reached out to Bob Parker to gather the equipment and materials required. Material that we accumulated were: axles, controller with VEXnet and a laptop with RobotC. We were able to redesign the chassis with the given axles to avoid future damages with regular use, because the previous design could not handle the pressure of the push down when loading the basketball. The new controller had to be paired the the VEX brain clearing any previous programming and there was no previously saved program for this bot. We used RobotC to research and created a basic program for the drive train and the launching mechanism built on basic sample programs. The program has been the biggest challenge during this project. It seemed the program that was created should run both the chassis and the wiring running to the upper system but is only working on the driving motors. Upon further analysis of the wiring, there is a portion of the wiring that has been damaged and may be causing the lack of communication between the brain and the upper portion. To fix this damage, there may need to be more wire testing because the wiring diagram is not specific enough. This damage includes a cable with small electrical board inside that will need soldering for repair, due to broken wires and solder.

2.0 Introduction/ Background

This robot was created by previous Ivy Tech students in the robotics lab with the purpose of launching a basketball at various events. Our groups assignment was to complete an engineering project for our Engineering concepts. Our group took this opportunity to improve and repair the defective robot. The problem defined is the robot was returned to the school without a controller and with damages to the robot. The tasks we needed to complete was to reprogram, get a controller that worked with the VEX brain, repair the broken parts on the robot and possibly redesign to avoid future damages. Our group was able to reprogram and get a controller for the brain, as well as redesign the robot to prevent further damages. This report will contain what we have learned and accomplished.

3.0 Design

3.1 Constraints

- a. Four weeks to complete repairs and redesign.
- b. Materials conflict between VEX and other hardware used together.
- c. Program needed research for understanding.
- d. Labor constraints due to having a small group.

3.2 Goals

- a. Learn the process of engineering for future engineering endeavors.
- b. Analyze the robot to determine the possible solutions.

- c. Establish understanding and utilize basic organizational and management concepts.
- d. Work in a collaborative group to solve engineering problems using various forms of communication.
- e. Resource to gain knowledge to implement the solution ideas.
- f. Repair and redesign problems within the robot.

3.3 Actual Project

- a. Our actual project was a basketball launcher that would launch a basketballs into the air at Mad Ants games and other school events.

- b. Our group planned to diagnose and solve wiring and hardware issues before making any changes. Starting with testing the battery voltage to find that they were fully charged.

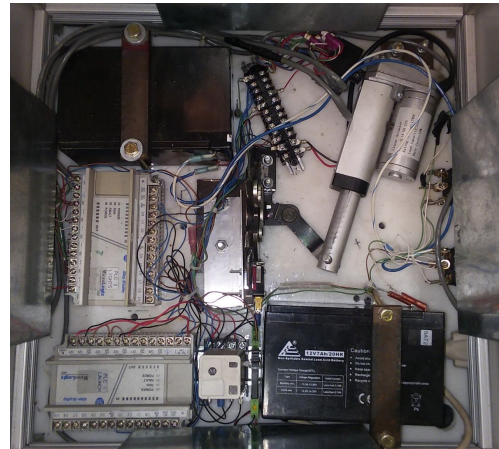


Figure 1

- c. Darrick was in charge of testing wiring within the main part of the robot which is displayed in Figure 1. He accomplished connections between the batteries the wiring distributors to the mechanisms. This figure shows the internal components which the bot: upper left corner and lower right corner are the 12 Volt batteries that control the internal components, the upper right corner is the actuator that controls the releasing mechanism for the basketball hopper, there is various wiring that controls the side lighting and and the actuator.

- d. Cory was in charge of the chassis system discovering there was damage to the axles due to poor supporting design of the heavy main

system which is displayed in Figure 2 and Figure 3. Figure 2 displays the previous chassis design including: a

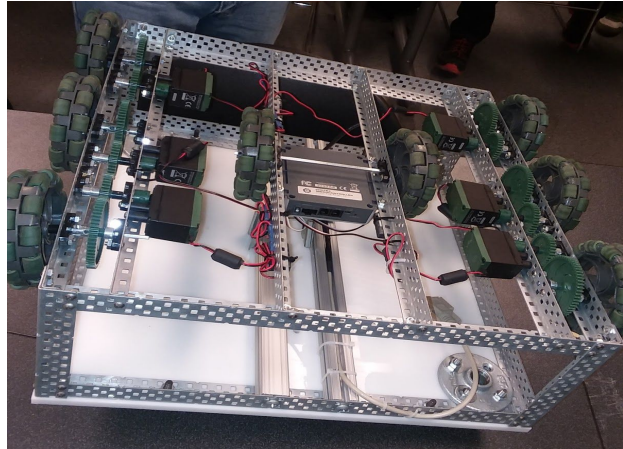


Figure 2

six motor system with six

functional omni wheels on the outside on the left and right, two omni wheels

below the VEX brain in the center for support. Figure 3 displays the wheel taken

off and the damage sustained from having a poor design: several axles were bent

in this way. The wheel location was

changed and assigned to inside the

two chassis rails for more support

on the axle during reloading of the

basketball hopper. For the new

design the gears were removed and

the wheels are now ran directly

from the motor from where the

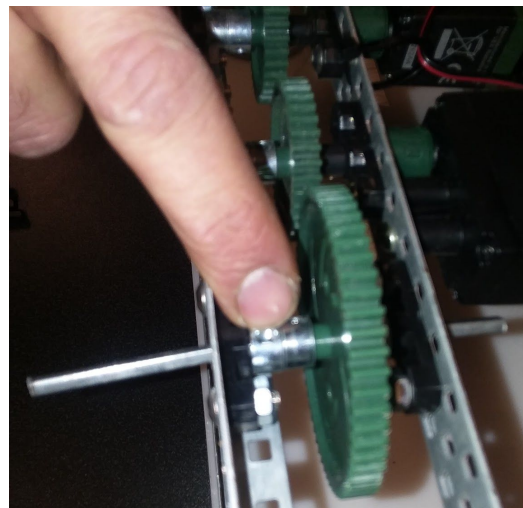


Figure 3

gears used to be, so that there is support on both sides of the axles.

- e. We received a new controller and VEXnet wireless connector. In order to connect the new controller to our VEX brain the previous program had to be

removed from the brain. This caused complications because no previous programming was saved for this robot. Jeanie researched the RobotC sample programs and RobotC website to create a program that would run six motor with the toggle switches on the controller and a button to run a five volt signal to the wire to the upper portion of the robot. This program ended up being useful for the six wheel motors but was not running any power to the actuator. This was initially thought to be a program problem but it was recently discovered the program may be correct but the wiring is damaged.

3.4 Goals Met

- a. Using the engineering process: Defined the problem given by reaching out to the robotics lab for a problem to solve, researched the background of the robot through personal references and online, identified constraints by realizing what material we could use and determining how much time we had to work on the project, brainstormed how the bot could be improved and functional, analyzed and selected the solutions need then implemented these ideas for evaluation.
- b. Organizing our work by dividing what needed to be done with the robot evenly once we discovered what needed to be done at the same time we collaborated to solve these problems.
- c. Successfully designed and repaired the robot to the best of our abilities during the time we had.

3.5 Drawbacks

- a. One of the biggest drawbacks for our group was time, we only had about four weeks to truly work on the basketball launching robot.
- b. Another that was a minor drawback was resources, we didn't get a good explanation of what had happen to the robot that we needed to repair. That being said we had to run test to properly diagnose the issues that the robot had.
- c. Another resource issue was not having anyone with the knowledge of the program that was used on this robot.
- d. Our group didn't figure out that the signal wire was damaged until after we presented our project.

4.0 Future Work/Alternatives

- a. If the programming is not correct, the next group would need to figure out how to send the 5V signal to the PLC that will activate the actuator to release the locking mechanism.
- b. The signal wire that connects to the VEX brain from the basketball launcher is damaged and will need to be resoldered to get the signal to send correctly.
- c. There could be improvements to the wiring diagram to better understand the layout of the wiring inside the basketball launcher component.
- d. Design a gear ratio that can replace the direct drive that may be a better solutions to our current design.

e. The plastic platform that holds the batteries and PLC's may need to be replaced to create a better stability for the batteries because the holes being damaged and allowing the nut that connects to the bolt to come through. In addition to other alternatives, you could possibly use a locking nut to replace a regular nut.

5.0 Learnings

We have gained an immense amount of team working skills during this project. We have also experienced the engineering problem solving process more than once, from recognizing the problem to evaluation. This was done with both phases of our project: the first phase we recognized that we needed a design that was unique and implemented new skills that could be gained through the process. For our first phase we learned how to dimension parts with given physical pieces to recreate these parts into a SolidWorks program. We learned conflict resolution by utilizing our instructor as a mediator to help resolve communication issues. As a part of phase two of our project, we learned more analytical skills by analyzing the Ivy Tech robot to determine what needed to be changed or repaired. We learned to work together to get things done, so that we were all working on something to accomplish similar goals. We learned from the original design of the robot chassis, that designs can be made better for future use. One of the last things we learned was sometimes you have to break something in order to really see what is wrong with something. This came in when Cory stripped the wiring from the ball hopper to the VEX brain. Although Jeanie did a large portion of the programming she shared her knowledge and requested assistance from her teammates to research for better understanding, therefore the team now knows more about RobotC programming did they did

before. Also doing research on the VEX products that were included in the, we know more about VEX products and they are capable of functioning with other materials.

6.0 Conclusion

The robot we worked on was created by previous Ivy Tech students in the robotics lab with the purpose of launching a basketball at various events. Our groups assignment was to complete an engineering project for our Engineering concepts. Our group took this opportunity to improve and repair the defective robot. First we started with testing the wiring and diagnosing any mechanical problems that were obvious, we then tested the batteries to make sure we were getting power to all the sources that needed power. Second we started to redesign the previous design by removing the wheels from the outside to inside of the chassis, as well as remove gears to create a direct drive design. Jeanie worked on programming the VEX brain to be compatible with the robot. Cory and Darrick worked on redesigning and testing the new design to make sure it worked as intended. Our group did achieve many goals when working on the robot, we made the program work with the VEX brain and was able to diagnose and repair many obstacles that we faced in the beginning. In conclusion the given drawbacks we accomplished a tremendous amount of goals but there is still work to be done to the robot.

7.0 References

- a. Robert Parker
- b. Cait Cramer
- c. RobotC Websites
- d. RobotC Sample Programs