RBE 1001 Final Report

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Introduction:

The main goal of the final project will be to demonstrate our knowledge by creating a robot with both autonomous and sensor-driven controls that can successfully lift an object (the pizza) to complete a portion of the final challenge. Our aim is to build a well-designed robot with interconnected electrical, physical, and coded systems. This should include efficient and readable code, a balanced bot with important forces understood, and a custom-built circuit to add functionality. Specifically, we are focusing on the HAPPY DORM challenge. To start off, we will autonomously deliver pizza to the second floor of the designed dorm building. Then, taking turns controlling, we will deliver more pizzas telescopically, filling the rest of the dorm.

Preliminary Discussion:

Throughout the brainstorming process, we came up with several unique approaches to accomplish the tasks presented to us. Our first design concept had the entire robot made out of metal. We soon realized that the idea came with many design flaws. Our modifications consisted of both the base and arm mechanism being made out of wood, allowing for a lighter weight robot and ultimately making it easier to control.

We also designed our scoop mechanism to be closed on the sides. However, we realized that we cannot control the angle at which we will have to pick up the pizza so we made the scoop open-sided to allow a pizza to enter off-center or crookedly.

Lastly, in our original design, we planned on ending the challenge by hooking onto the bar that is in between the dorms and with a pneumatic system, raising our robot off the ground.

After reevaluating the amount of points needed to officially complete the final, we realized that we did not need those points and eliminated the arm design completely.

Problem Statement:

In order to achieve the goal we sought out to accomplish, we need a maneuverable, stable drivetrain which can be controlled reliably both autonomously and by a human driver. As mentioned earlier, we decided to go with a light, wooden base that is 11" x 14.75". There will be six wheels attached within the base, not outside or inside, as shown in Figure 3. The idea behind having six wheels instead of four, was to again allow for more control and ease the robots movement throughout the course.

Our goal to deliver the pizzas requires a lifting mechanism that is able to deliver a pizza to all four floors of the dorm, lifting from ground level to about 38.5 cm. This lifting mechanism will also be made out of wood, making it lighter and easier to maneuver. Using a scoop with a spinning grip system attached, our robot will be able to pick up and release the pizzas. A bump switch will be attached inside our scoop mechanism to confirm that the robot has successfully picked up the pizza. Another bump switch, along with limit switches will be attached the the front end of the scoop. When the scoop reaches the wall of the dorm, the switches will signal to the robot to start turning the grip mechanism in the opposite direction, thus delivering the pizza to the dorm. Also included in the arm mechanism is a four bar linkage that will allow our scoop to rise/ lower to pick up the pizzas and deliver them to the respected floor level. This arm desing is represented in Figure 2.

Furthermore, it should have sensors which allow the robot to maneuver into place autonomously in under 20 seconds to deliver the first pizza on its own. The autonomous portion of our robot will be done by using a line following device. This will allowing the robot to follow the lines given on the course without our control. As mentioned in the previous paragraph, bump and limit switches will be used to detect where the robot is with regards to the dorm and whether or not the pizza it is holding has successfully been picked up and when it needs to be delivered.

Preliminary designs:

Our brainstorming process consisted of many different approaches to get the points needed for the final. Initially, we had several goals in mind: achieving a Happy Dorm, delivering a Golden Pizza to Gompei, and using and arm mechanism to raise the robot off the ground.

In the end, we decided to focus on just one of our original goals, getting a Happy Dorm.

Shown below are our sketches and CAD images of our finalized design.

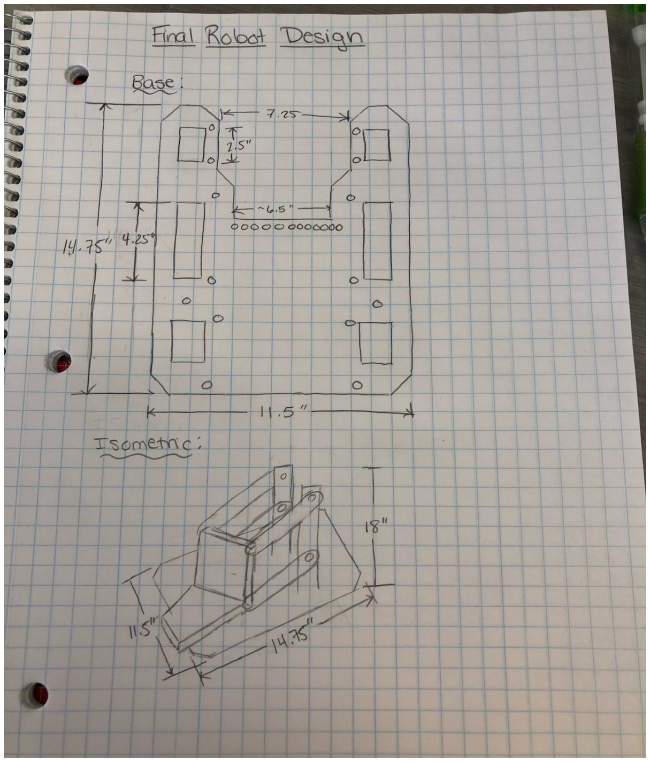

Fig 1. Top view of robot base and isometric view of 4-bar lifting mechanism on the scoop

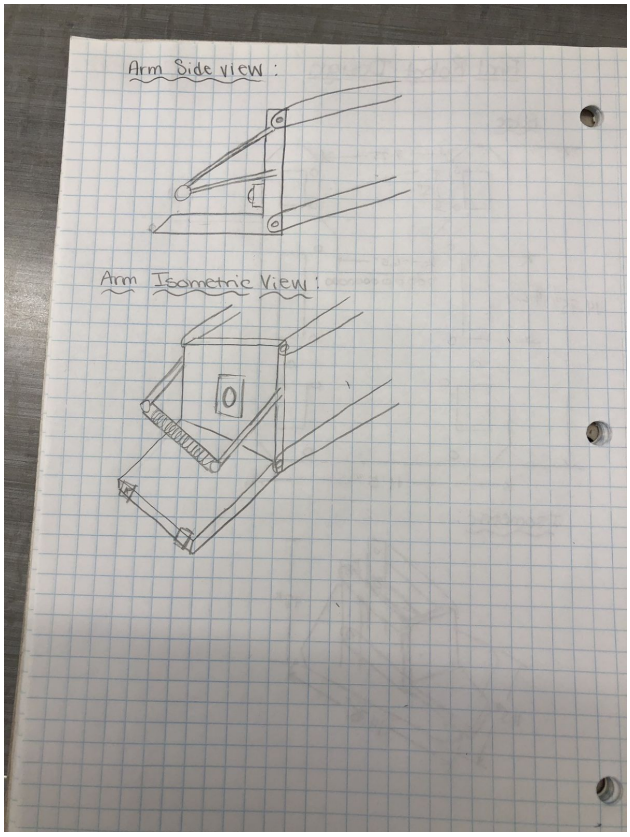

Fig 2. Side and Isometric view of robot arm/ scoop mechanism

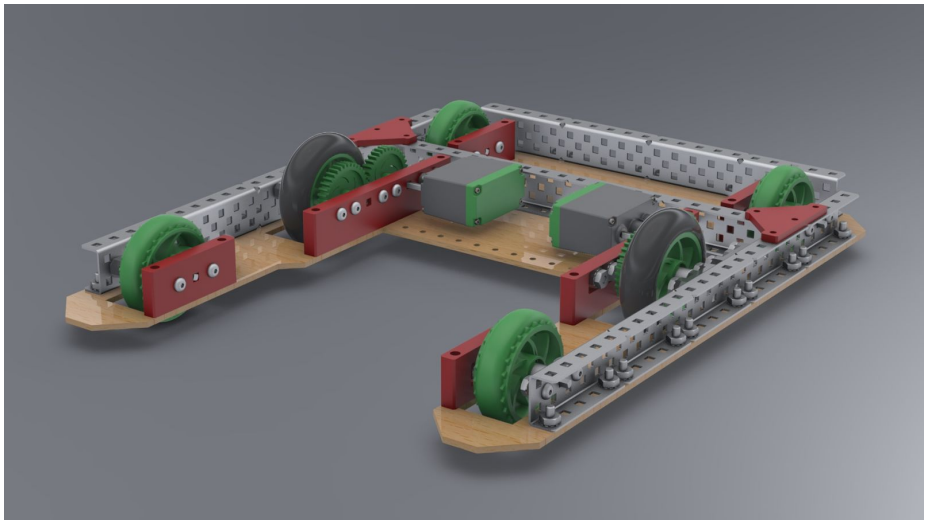

Fig 3. CAD of base and wheel assembly, including gear train