FINAL DEMO HARDWARE SPECIFICATIONS

GROUP 4

30th November 2016
Version 2

Abstract

The final demo hardware was simply hardware version 3.03. This document expands on the version's documentation in the hardware document by including a complete set of pictures of the final version instead of the simple pictures of improvements in the hardware document, more fully explaining the functionality that the hardware provides, and expanding upon the possible improvements by utilizing observations made during the final demo, and days leading up to it.

Contents

1 BACKGROUND

1.1 Edit History

Benjamin Willms: 2016-11-29, Initial set up

Benjamin Willms: 2016-11-29, Completed all sections but Model

Benjamin Willms: 2016-11-30, Added documentation for the model

2 HARDWARE VERSION 3.03

Main Builders: Ben, Quentin **Completion Date:** 2016-11-22

Lanky

2.1 NOTABLE PIECES

- 4 EV3 large regulated motors
- 2 ultrasonic sensors
- 2 colour sensors
- 4 wheels (2 with tires)
- 1 spoon caster
- 4 four pronged gears
- 1 EV3 brick

2.2 FUNCTIONALITY

2.2.1 Localization

The final design has a bumper that can be used to help with localization. It also has a front facing ultrasonic sensor, and an ultrasonic sensor facing the left, which can both be used for detecting the walls for localization.

2.2.2 Navigation

The final design utilizes a rear-wheel drive construction, allowing the robot's center of rotation to be closer to the actual center of the robot than a front-wheel drive design would allow. This means that when turning, there is a small length of the robot that swings and must be kept track of, whereas a front-wheel drive design would have a large swinging section.

2.2.3 Odometry Correction

The final design includes a downward facing colour sensor at the front of the robot, and offset to the right side. This can be used for detecting grid-lines, which can be used for many different odometry correction techniques.

2.2.4 Object Identification

Included in the design is a forward facing colour sensor, which allows the robot to identify objects in front of it.

2.2.5 Object Avoidance

The two ultrasonic sensors mentioned for localization can also be used to detect objects in front, and beside the robot, allowing the use of a P or bang-ang controller for object avoidance.

2.2.6 Collection

The bumper that can be used for localization can also be used to orient blocks to the correct angle for grabbing. This would simply require the robot to push a block for sufficient distance.

2.2.7 Grabbing

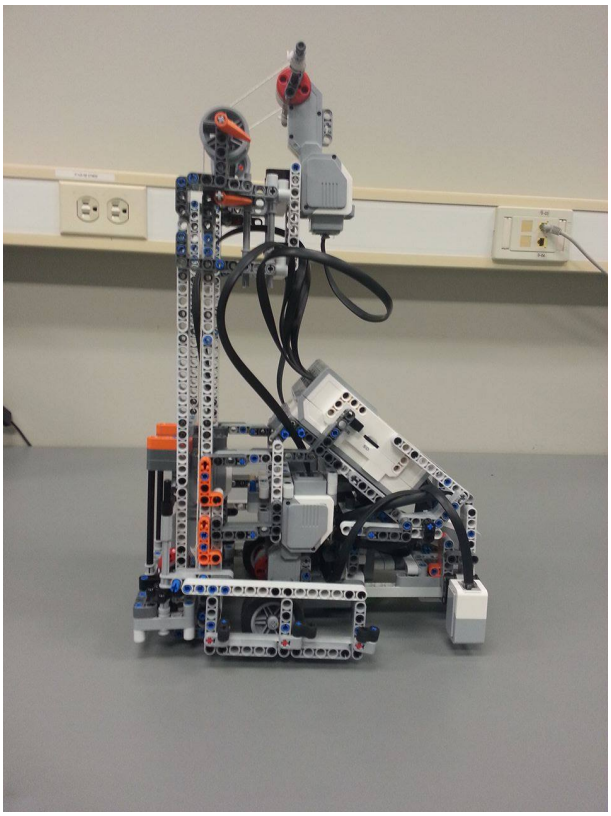
The final design incorporates a swinging arm grabber. It has some rubber teeth on the insides of the arms, which improve grip, and uses four-pronged gears instead of regular gears to ensure that if the arms make contact with an obstacle while swinging, they gears will not skip rungs, and offset the arms' orientations.

2.2.8 Lifting

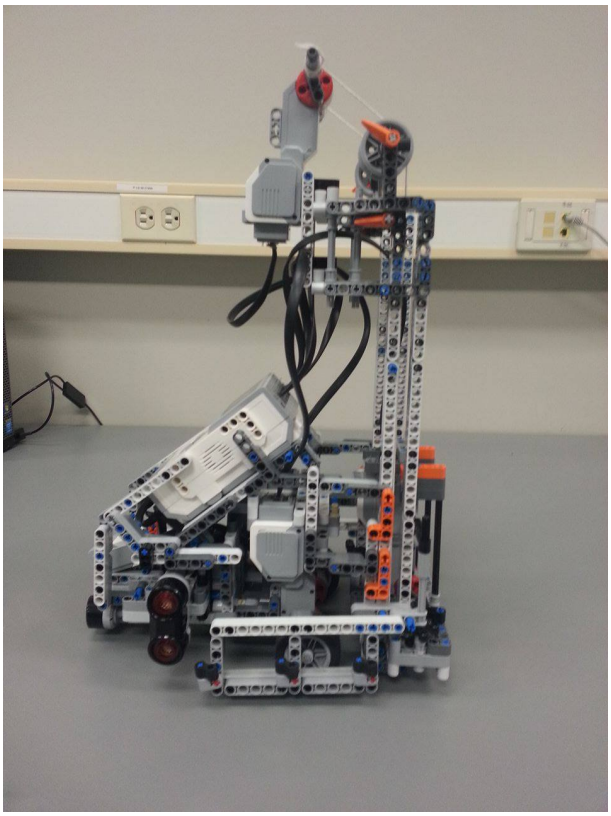
The tower is tall enough to stack 4 blocks. Its motor is located on top of the tower itself to avoid bending the tower back during lifting, and also to allow the tower to be placed as

close to the main chassis as possible (if it wasn't on top of the tower, room would need to be found for the motor either on top of the brick, or between the brick and the tower).

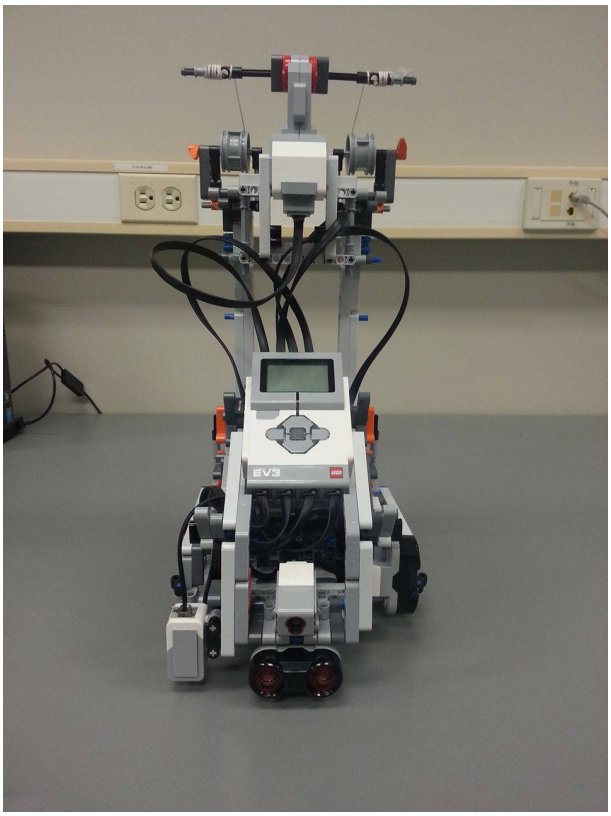
2.3 MODEL



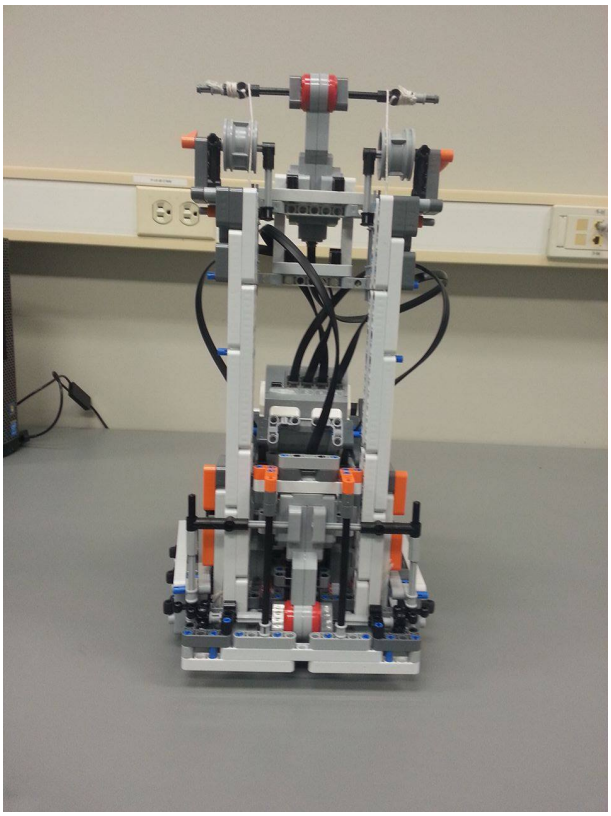
Right



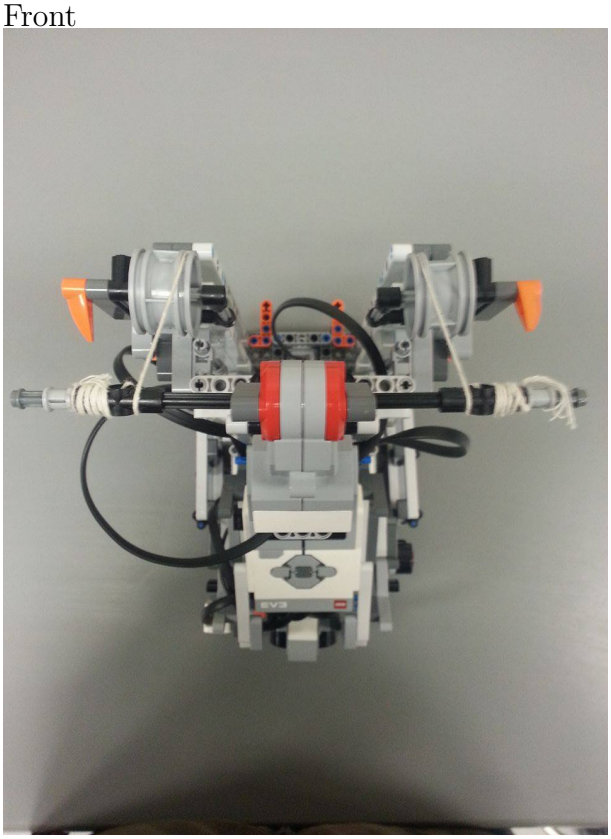
Left



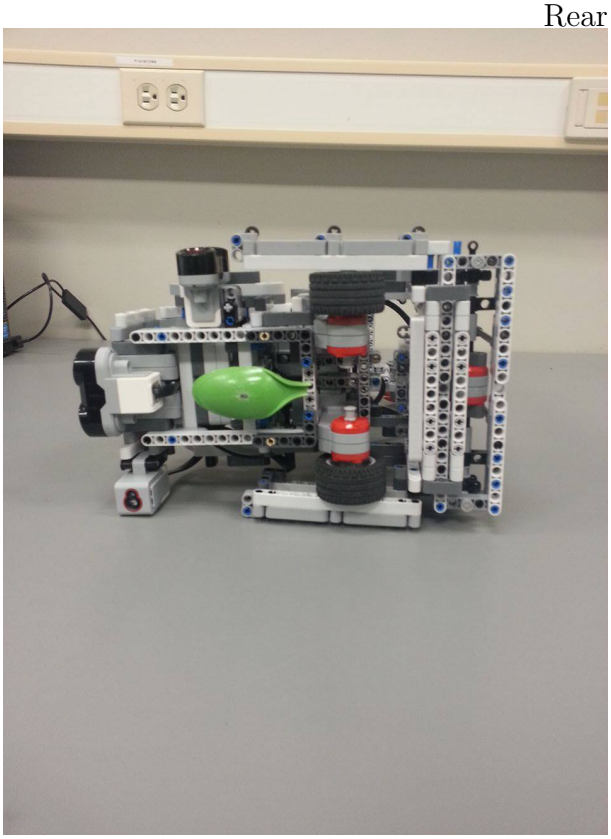
Front



Rear



Top



Bottom

2.4 POSSIBLE IMPROVEMENTS

- The center of mass could be lowered.
- The charging port could be made easier to access.
- Wire management could be improved.
- The tires could be made more solid to avoid squishing, which changes the wheel radius.
- A blocker could be added to the top of the tower to avoid the grabbing device falling out of the tower when it is raised to the top.
- The tower arms wrap the string around a lego bar connector until the grabber is nearly to the top of the tower. At that point, the string slips off onto the main lego bar, which changes the raising rate, and can offset the two sides of the grabber. For this reason, pieces of the same width as the connector could be added to keep the raising rate the same throughout the entire lift.
- The rubber teeth could be better anchored in the desired locations, so as to avoid them swinging into a position that renders them useless for grabbing.