Group 2 - Robot Design - Project # 1

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This robot was initially designed with a two-wheel approach. This initial design consisted of two wheels roughly one inch wide and one and a half inches tall located on the center of the robot. These two wheels represented the robot's axis of symmetry with respect to the front and the rear of the robot. This wheel placement was proposed and used in order to minimize the amount of deviation from the axis of rotation in order to keep the robot from going off course. Motors supplied in the robotics kit drove the wheels. The gear ratio used in this design to drive the wheels was a one to one ratio. This design was accompanied by stabilizers, both to the front and to the rear of the robot in order to keep the robot relatively level with the surface it was placed on. The stabilizers consisted of extremely thin wheels with the tires removed. This was chosen to try to minimize the amount of friction that the floor would create with the stabilizers. One unforeseen advantage for the wheels that were chosen for the stability was that the wheels chosen actually aided the robot in achieving a straight path of travel for a relatively long period of time.

The placement of the CMUcam on the initial design of the robot was in the center of the robot between the two driving wheels. The CMUcam was positioned so that the axis of rotation was located in the center of the viewing window. This camera position was desired to eliminate the need to make a course correction after the sensing of the color and before the turning of the robot. It was theorized that minimizing the amount of course correction required would simplify the implementation of the Interactive C code that would be required to drive the robot.

The rest of the body of the robot consisted of a very simple support structure for the wheels, camera, and Handy Board. The support of the robot did not need to be very extensive because the robot was designed to minimize the amount of shearing force that was to be placed on the support of the wheels and motors. The Handy Board was mounted on the top of the robot in a very simple rectangular support structure. The vertical compression of the robot by the Handy Board was sufficient to keep the pieces of the robot from separating while the robot was moving.

This design was very good except for the problem of the wheels slipping. The tires used did not have sufficient traction, and this resulted in inconsistent turning. This design was thus altered by replacing the two wheels with two treads.

The two-tread design used the same housing for the Handy Board, but completely replaced the rest of the robot. In this new design, the motors were set more to the back of the robot and drove the treads using a one-to-one gear ratio. This ratio was used because the team wanted a moderate speed accompanied by enough torque to power the treads. The treads spanned most of the body of the robot, and actually maintained the ability of the robot to turn without significant, if any, deviation from the axis of rotation. The treads did, however, create a much greater shearing force on the structure of the robot and would cause the pieces to pull apart from one another. This resulted in a large problem with gear slipping, so more support had to be added. The supports used were attached to the sides of the pieces that were being separated, and bound them securely to one another. This addition solved the gear slipping issue that had arisen.

Another significant addition to the robot was the addition of optical encoders to make the turning problem a digital problem. These sensors were used in conjunction with wheels supplied in the robotics kit that had holes of uniform distance from the center of the wheel as well as uniform spacing around the wheel. This ensured that the reading of the optical encoders was consistent. These sensor units were placed on each tread to ensure the consistent turning of the robot. In order to improve the accuracy of the sensors, the wheels were connected via a four-to-one gear ratio with the speed of the treads. Maximizing the amount of revolutions of the sensor wheel over the treads will allow the sensor to take many more readings thus ensuring that the treads are moving correctly with respect to one another. The addition of these sensors almost trivialized the problem of turning the robot at consistent and accurate angles.

The last major design alteration involved the placement of the CMUcam. The original design was proposed and constructed before the camera was properly tested, and it was later discovered that the camera required a significant amount of light in order to read the colors effectively. Many different positions and alignments were proposed and considered, and the decision came to mount the camera a couple inches out from the front of the robot and align the camera so that it points straight down. This will ensure a consistent viewing window as well as allow enough light for the camera to operate satisfactorily. The issue of proper support for the camera was solved with a rubber band and a large garbage tie. This ensured that the camera would not move while operating the robot, ensuring a consistent viewing angle.

The major problem with the robot design is not so much a design problem, but a problem with the motors. The motors were found to be inconsistent, and completely dependent on the amount of battery power left in the Handy Board. This resulted in many inconsistent tests resulting in significant amounts of extra testing.