Project 1 : Final Report

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CS 4023—Introduction to Robotics
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Robot Design

Overview

The design of the robot is a simple dual-motor approach. The robot rests on two wheels and a single low-friction point at the back end of the device. The two motors connect to the two wheels. The pair of motors are responsible for the forward, backward, and rotational movement of the robot. The motors are connected to the wheels via a LEGO differential piece. The method is described in the article at (http://www.oreillynet.com/pub/a/network/2000/05/22/LegoMindstorms.html)

Steering

The amount of rotation that the robot needed to achieve were 90° turns to the right, 90° turns to the left, and 180° turns. The robot used a LEGO encoder piece to detect the amount of wheel rotation. Through experimentation the wheel rotation constants were discovered and recorded in the program code. We incorrectly assumed that the number of wheel rotations for a 180° is exactly double that of a 90° turn. After some additional research we discovered that the wheels have some additional movement immediately after the motors are no longer receiving power. This accounted for the discrepancy.

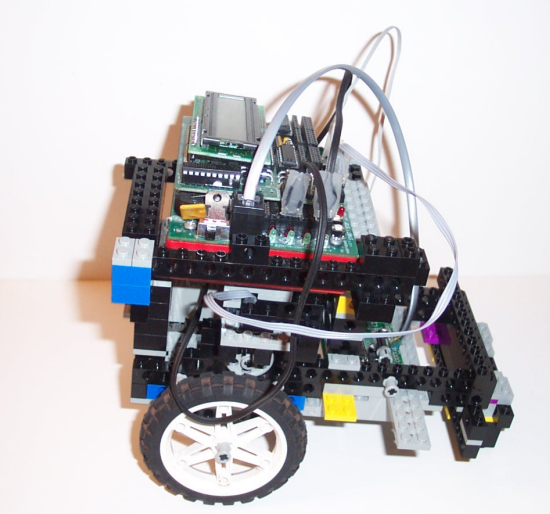


Figure 1—Robot Profile

Friction and Weight Distribution

The first design of the robot had placed the Handy Board component directly above the camera. This added more weight toward the back end of the robot. After several test runs we discovered that the weight near the back added additional friction to the balance post at the back of the robot. This made turning the robot very difficult. As a result the Handy Board component was relocated to a position that places it directly above the wheels. This decreased the friction at the back of the robot, and made turning the robot easier.

Robot Algorithms

Camera

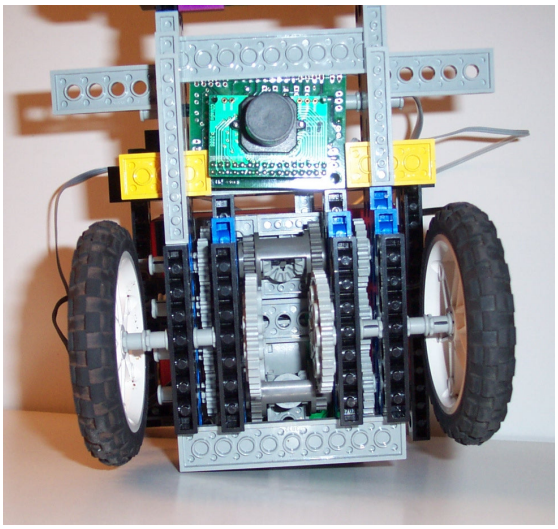
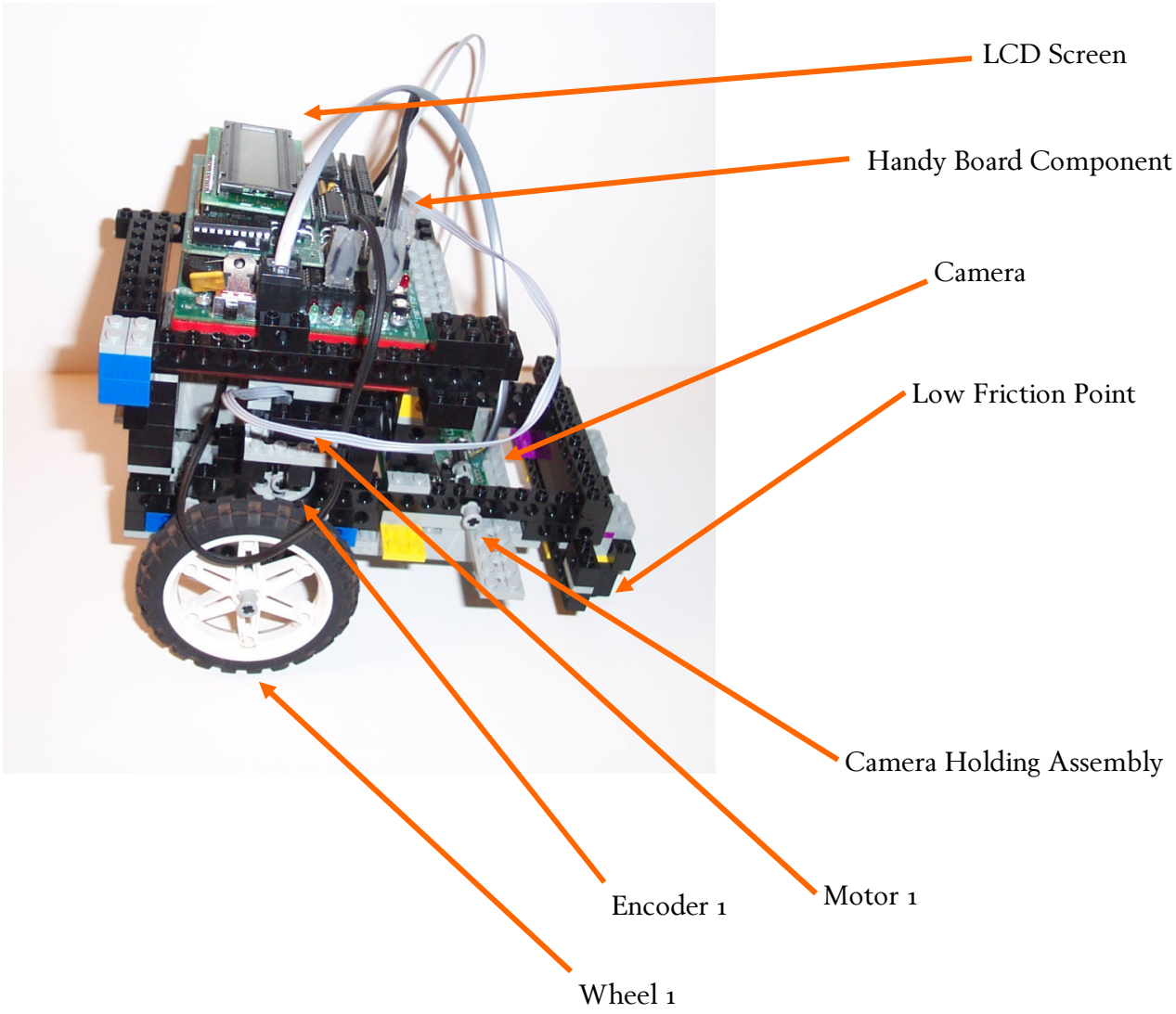


Figure 2—Camera

The camera was mounted underneath the center of the robot to achieve an accurate idea of where the robot was in relation to the squares on the floor. The code used for the camera was split into two parts: square identification and color identification. The robot would first detect the presence of a square by searching for a black color on the floor. This algorithm worked efficiently because the program only had to compare the input data colors to one color. As soon as a black color was detected, it was assumed that the robot was within a square. At this point the robot's motors are slowed down and the camera input data is compared against the five possible colors. When a color is detected the action is carried out. As the robot is leaving the square the black color is detected again, and the robot resumes its initial state of searching only for black colors.

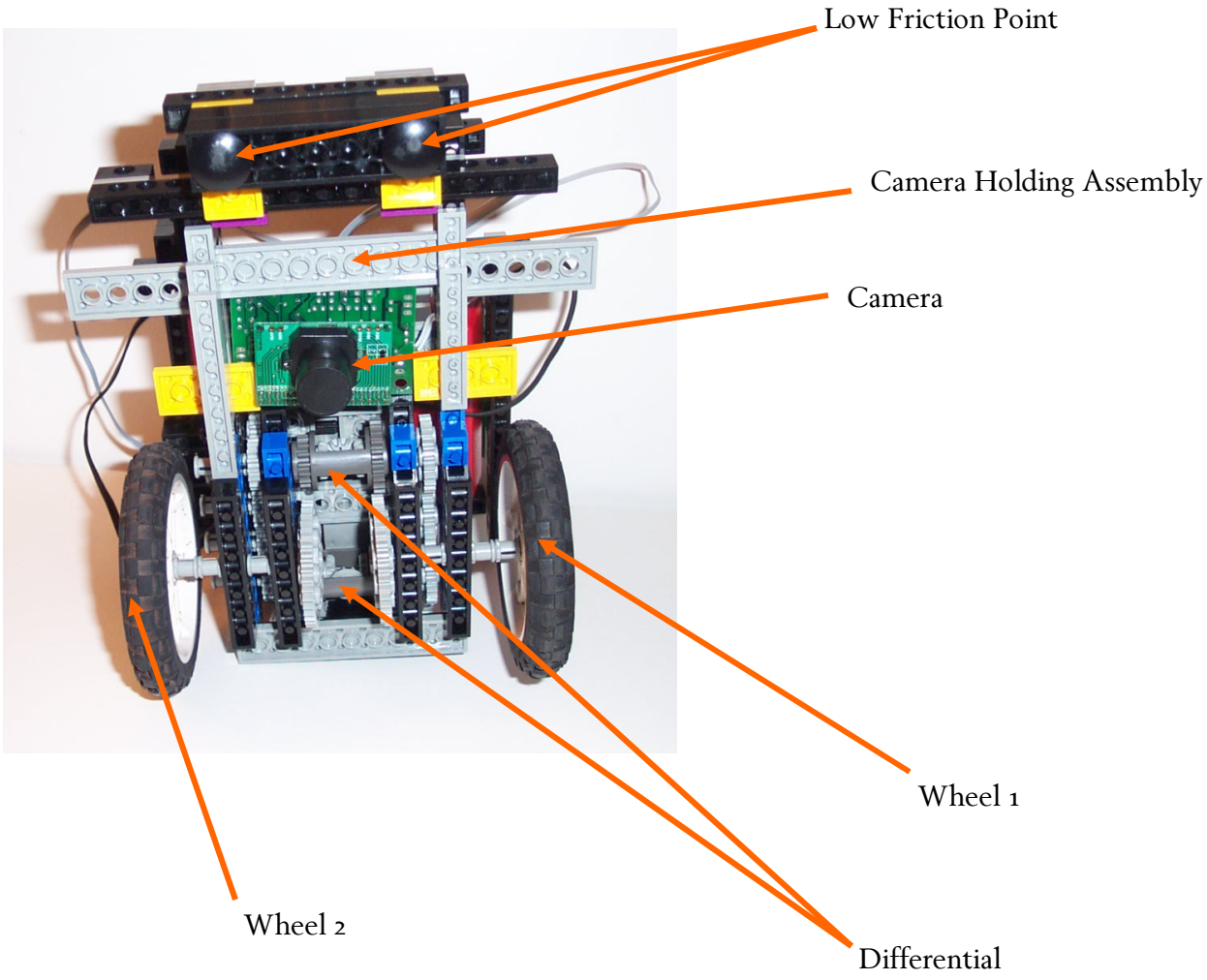
Robot Diagram

Profile



Robot Diagram

Below



Team Organization and Task Allocation

Team Organization

For this first project we will have a team composed of three members. Each member will be responsible for completing their assigned task. We have elected a project leader to coordinate the logistics of the project. The project leader will organize and keep track of approaching deadlines as well as serve as the communications center for all team members. It is the responsibility of the project leader to e-mail all team members periodically to provide a team status update. All team members will give input to other members yet the final decision will be up to the team member completing the task. The tasks of each team member are listed below. The tasks assigned are evenly distributed between all team members.

Task Allocation

Lego Building	*Moshe Gutman*
Robot Documentation	*Zachariah Ross*
Color Recognition Code	*Nicolas Grounds*
Movement Code	*Nicolas Grounds*
Testing	*Zachariah Ross*
Finalizing Robot Design	*All team members*
Final Report	*Moshe Gutman*
Presentation	*All team members*

Conclusion

Overall the first project was a success. The project leader hierarchy ensured that every member was doing their job and keeping everything ahead of schedule. All the scheduled tasks were completed on time and the robot performed as expected. In this project the team was split into tasks. This made each member responsible for completing a certain job. We feel that more collaboration between members would make this project easier. For example, all members should be involved with testing and writing code.