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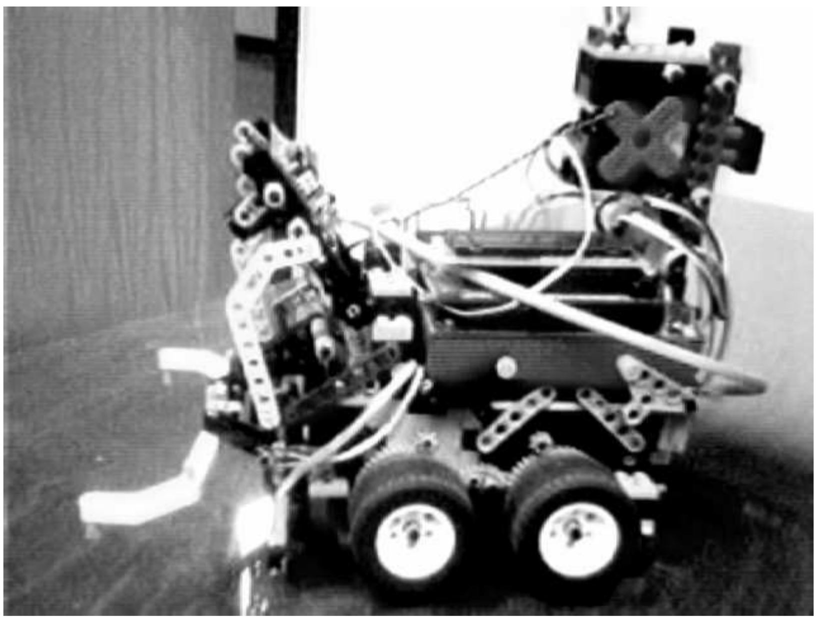
Group 7

Project 3



by

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1.1 Introduction

The basic idea behind the robot's design was to allow for gripping up and carrying one cube at a time from a nearest location to a closest target destination. This permitted for a reuse of the proven-to-be stable cassis from the project 2. Several major components were added in this design: a claw-grabber, CMU-CAM, shaft encoders and top-hat sensors.

1.2 Sensing Hardware Components

- CMU-CAM
- Shaft Encoders
- Switch (Bump) Sensor
- Top hat sensors

1.3 Sensing Hardware

CMU-CAM

The decision to install the CMU-Cam was essential for two reasons. Firstly, it was thought it would help find where the dynamic robot is and secondly it would be able to identify orange cubes. The camera was positioned in the front at an angle of about 60 degrees to the ground to help the robot recognize what it is around within several feet (see Figure 1.1). It was found during the testing phase that if the camera is pointed exactly straight it might see several cubes and will not be able to distinguish which one is closer. To avoid this problem the camera angle was fixed at the angle but at he same time allowing it to cover more distance.

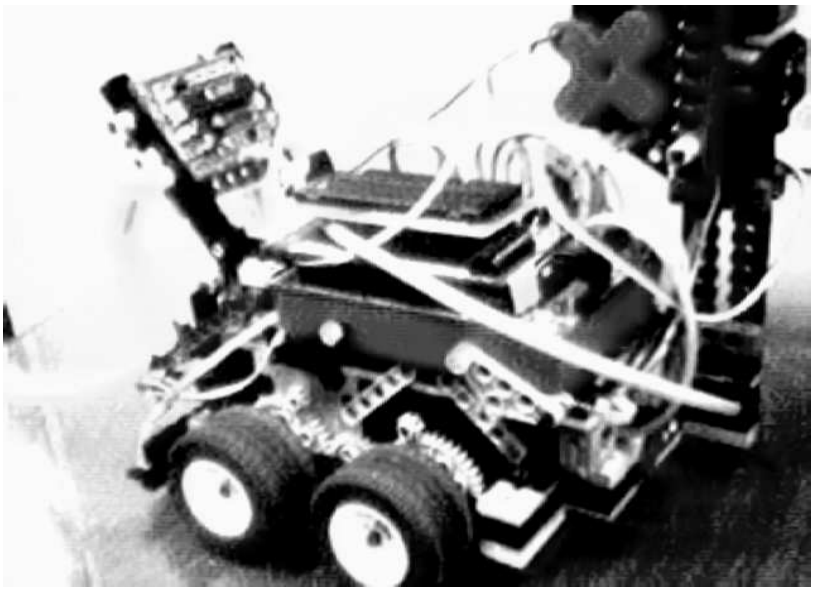

Figure 1.1 – left side view of robot (front to back) and CMU-CAM

Shaft Encoders

Two shaft encoders were placed on back wheels to accommodate software team with a measure of how far the robot has traveled during a particular time interval.

Bump Sensor

In our initial design a right bump sensor was incorporated to make sure that the robot will not get stuck in an infinite loop by bumping on one of the walls of the arena. The testing showed that it was not necessary to use the bumper as long as shaft encoders would give correct readings of where the robot and the walls are. So, it was rarely used.

Top-hat Sensors

Two top-hat sensors are arranged on the two sides of the robot in the front portion looking vertically down towards the floor. They are arranged very closer to the ground for accurate measurements. These top hat sensors were used to detect the black tape when the robot is heading towards the destination with an orange block in its claw.

1.4 Hardware System

Body

The HandyBoard is locked into the chassis using the holes provided in the side of the board and standard LEGO pegs. This combined with the use of locking pieces on the insides and outsides provide the stable construction to keep the HandyBoard in place at all times.

Motors and Gearing

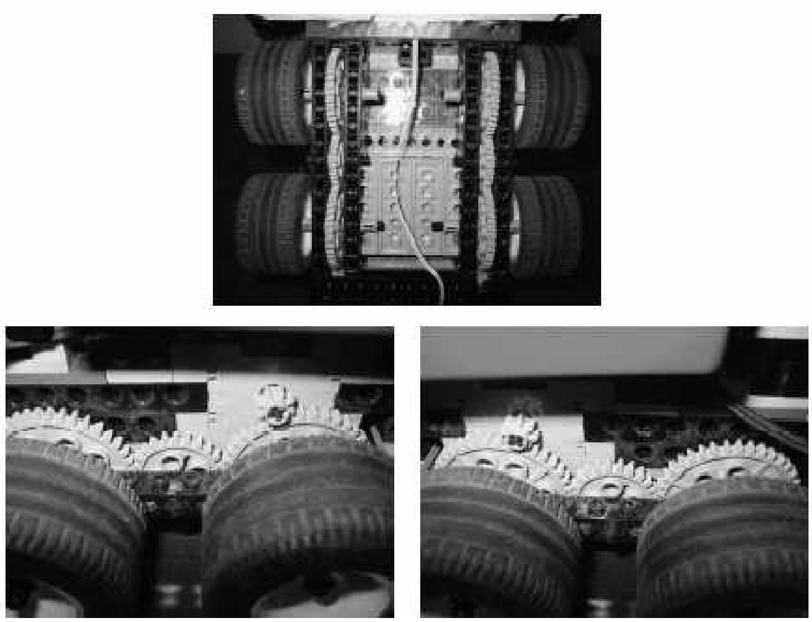

Figure 1.2 – Robot drive train (bottom, right, & left)

Because the hardware design in project 2 was proven to be successful it was important to keep the old chassis for the design of this robot. That way there was no need to change the 4-wheel-drive system. The old design was able to provide enough torque and low-speed drive system. It used a 5:1 gear ratio with an 8-tooth gear on the motor directly powering a 40 tooth gear (see Figure 1.2). And a 24-tooth gear was connecting the two 40-tooth gears connected to the front and rear wheels so as to power up the rear wheels. The same arrangement was made on both sides of the robot.

The Claw-Grabber

The most essential feature of this design is a mechanical claw that is housed on the front of the robot (see Figure 1.3). Its main function is to grab 2x2x2 inches cubes.

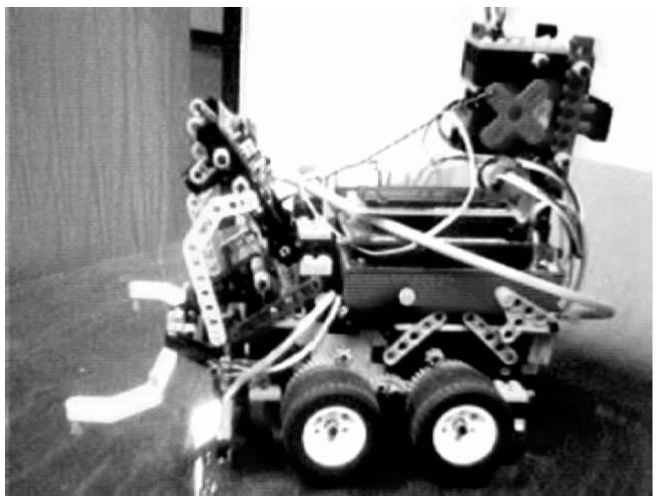

Figure 1.3 (front to back) yellow j-shape beams function as the claw-grabber

It is done by first opening, and then closing two j-shape beams with a cube inside. The grabber is powered by a servo mounted on the back. It takes only about a half of a servo's revolution to close the claw. So the claw responds instantaneously to a servo's movement. The actual grip is not hard enough to damage a cube, but strong enough to keep a cube inside the claw during the navigation to a target destination.