TEAM 8

PROJECT 1
SENSING AND MOVEMENT

ROBOT DESIGN.

Date: Feb 17, 2003.

Josh Guice
Neelam Chauhan
Ramakrishna.Pantangi
Vitaliy Marin

Foreword.

This robot is loosely based on the HandyBug (9719) design presented in Fred G. Martin book, Robotics Explorations. Though no longer very similar in appearance to the HandyBug, this robot is heavily inspired by many of the design ideas mentioned in the book.

Hardware Description.

Figure 1a.
¾ right front view of robot.

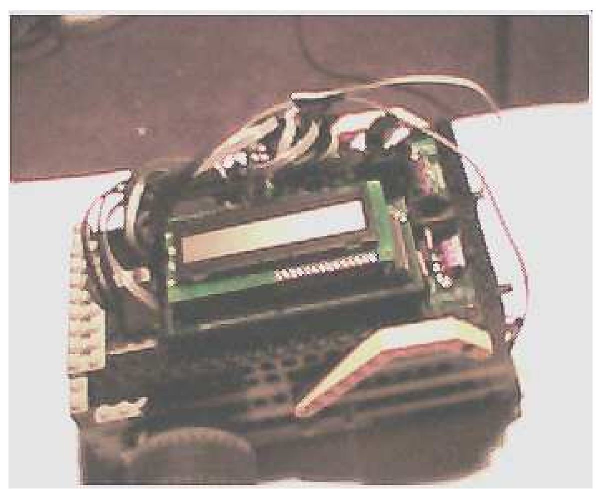


Figure 1b.
HandyBoard on top.

Figure 1 shows portions of robot. The front is noticeably lower than the rear to lower the center of gravity to provide a better balance. As it can be seen, the HandyBoard rests in a cradle on top of the robot and is easily lifted out for access to the inside portion of the robot. The standard LEGO™ Technic 9v gear reduction motors are used in pairs to give power at both front-end. We have used gears in 8:40 tooth ratio from the motor to wheel. The drive wheels (Figure 2) are of the extra wide "mag wheel" type to maximize traction on the tile floor surface that the robot will be operating on.

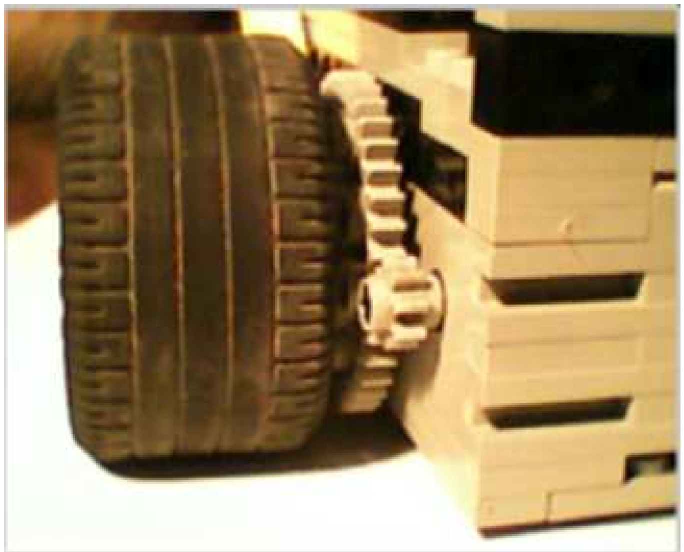


Figure 2.
Front wheel and the gears.

A u-shaped break beam sensor is mounted near each drive wheel axle on the inside of the robot as seen in Figure 3.

Figure 3.
Break beam sensors.

The sensor senses the breaks (holes) in two LEGO pulley wheels that turn individually with each axle and together the sensors and pulleys act as separate shaft encoders for the wheel axles. This allows us to ensure that the separate drive axles stays synchronized during the travel and that robot moves as precisely as possible.

A reflectivity sensor is mounted on the bottom back of the robot to determine the reflectivity of the surface over which the robot is traveling. This allows the robot to determine whether or not it has completely crosses the black tapeline and entered or exited the square. It is also possible to calculate the distance between squares using the shaft encoders; however, the reflectivity sensor will be used in conjunction with that calculation to provide a failsafe mechanism.

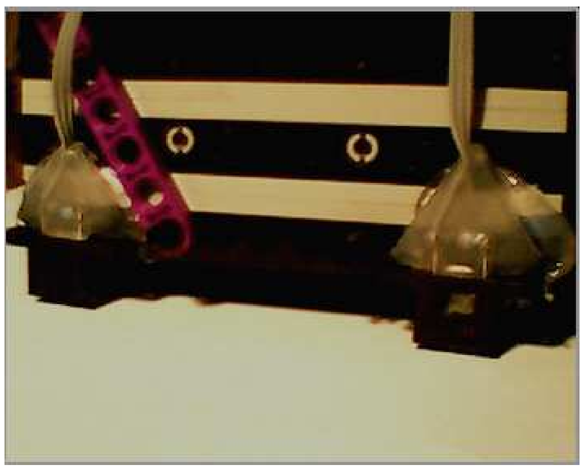


Figure 4.
Reflectivity sensors.

The third wheel of robot is positioned below the robot close to its rear end so as to have our reflectivity sensors very close to the ground for precise readings.

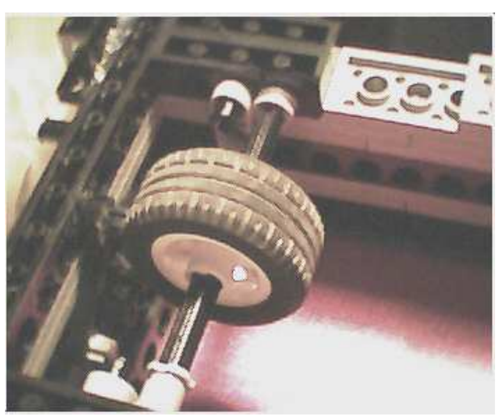
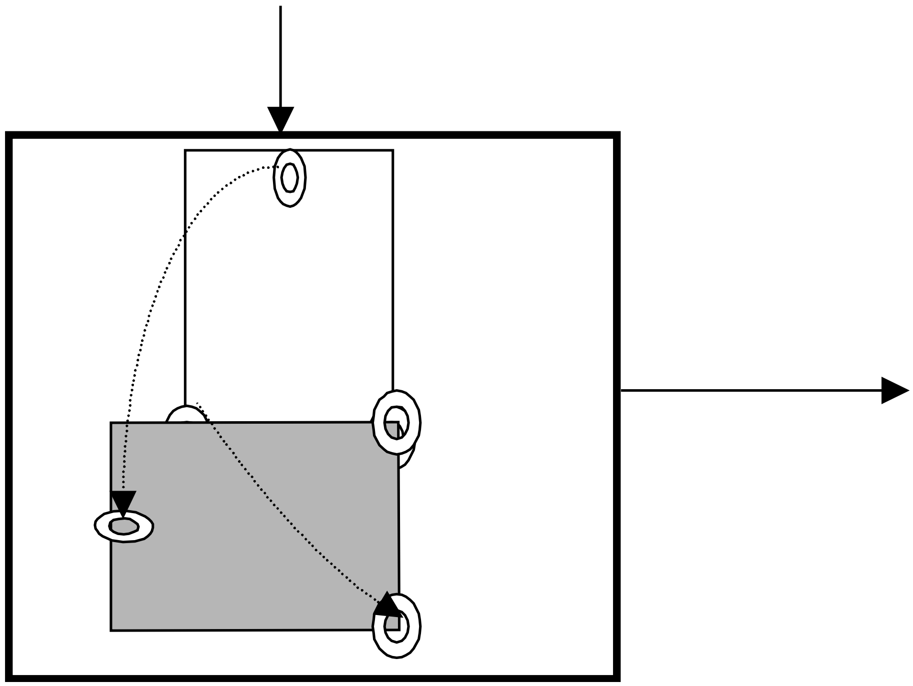


Figure 5.
Single rear wheel beneath the robot.

Once the black tape is detected, using the software code we can rotate the robot 90^o, keeping one front wheel stable and moving other front wheel. Then it backtracks and aligns itself to the tape while coming forward and starts all over again.

The following figure explains how the robot would turn 90^o once in the black square.



Final word.

We believe that this robot design is more than adequate to perform the task required in this project. It is possible, however, that slippage caused by debris or dust on the operating surface or improper initial alignment may cause the robot to veer off course. Given the limited directional guidance (black tapes) provided to the robot and possibility that stray marks on the tile might be interpreted as a black tapeline, we feel that the utilization of shaft encoders in directional control is the best design scheme. To that end, we have designed the robot with the primary objectives of stability, traction, ease of turning and smoothness of motion on a leveled surface.