Non-Sequential Behaviors

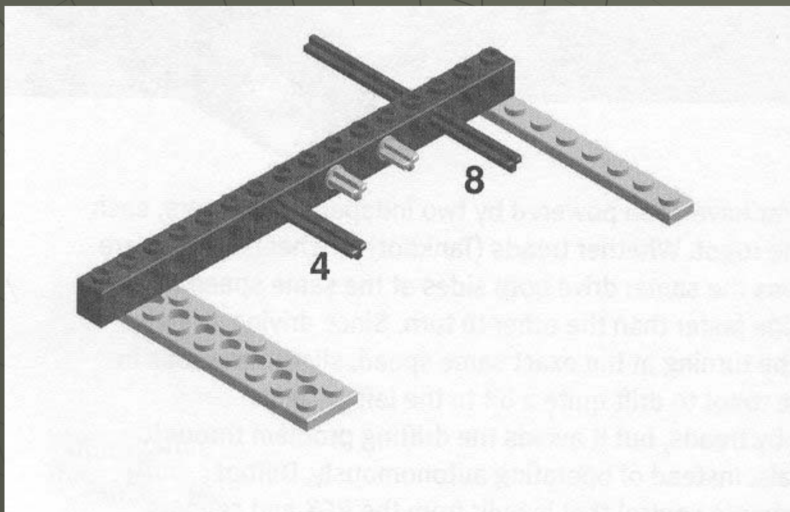
Group 9

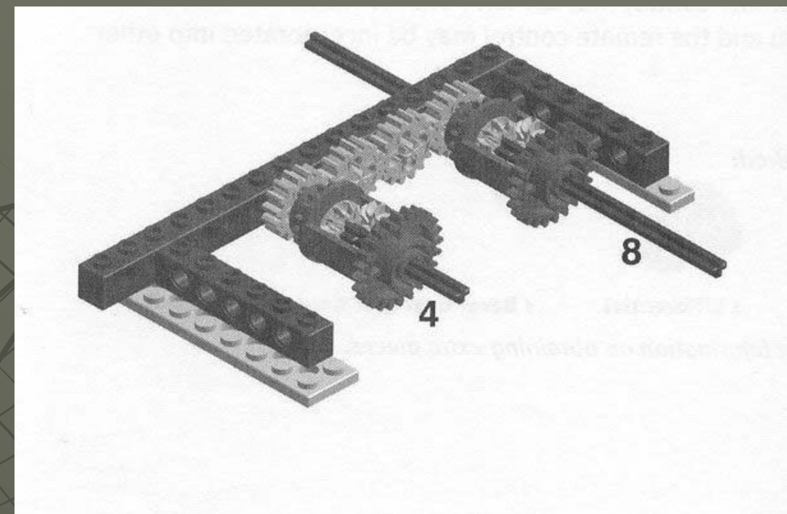
31 MARCH 2003

OVERVIEW:

- Hardware Design
- Software Design
- Successes
- Improvements
- Conclusion

Hardware Design





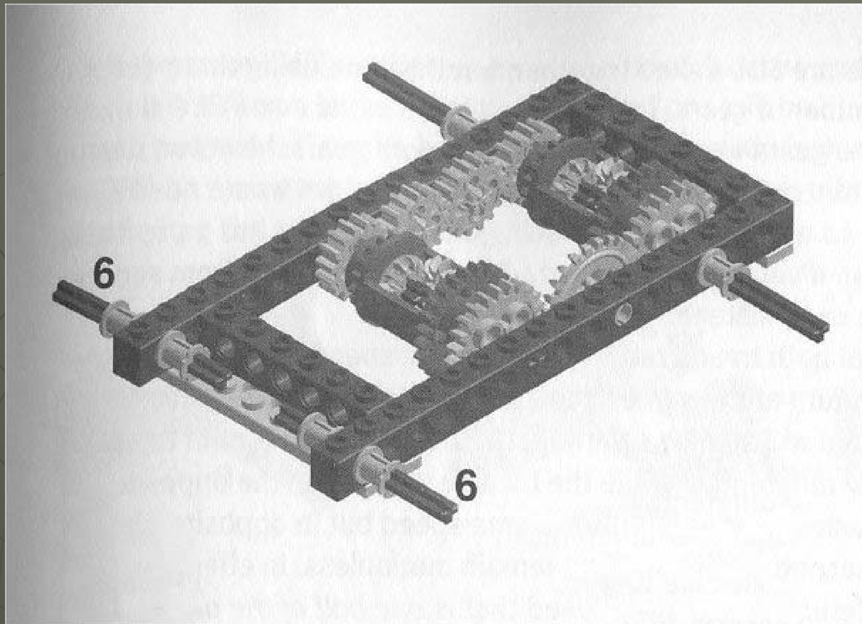
Design for the Chassis was found in

Dave Baum's

"*Definitive Guide to Lego Mindstorms*" 2nd Ed

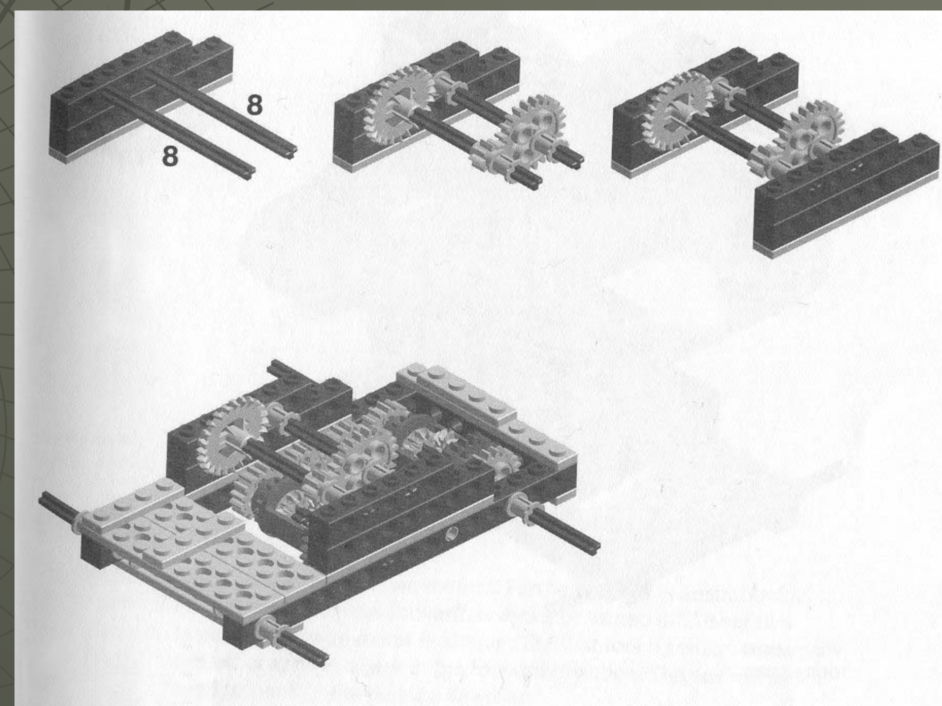
Chapter 14 – <u>*Diffbot*</u>

Apress Books, Berkley CA 2003



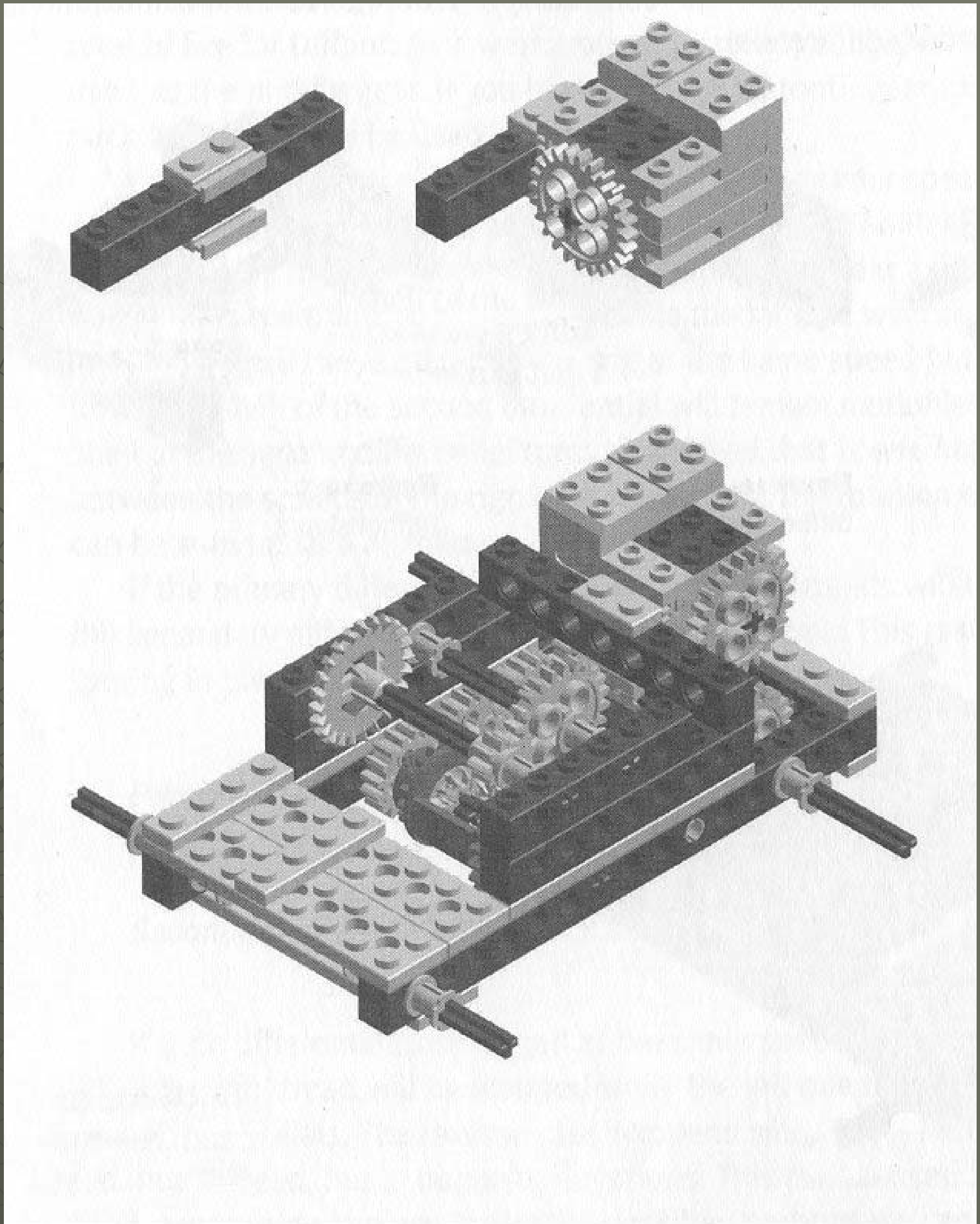
The "Diffbot" uses a double differential design, with 18 gears and two differentials.

The chassis box is extremely small, measuring 2.5 inches wide x 5 inches long

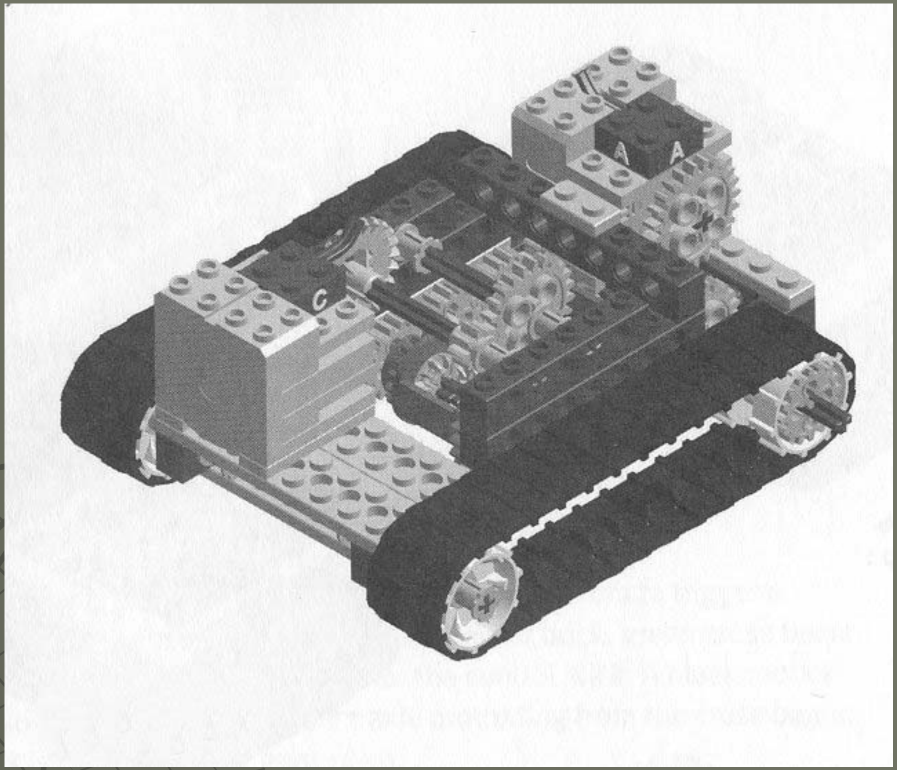


The drive motor is mounted to a cross bar in the rear, directly above the primary differential.

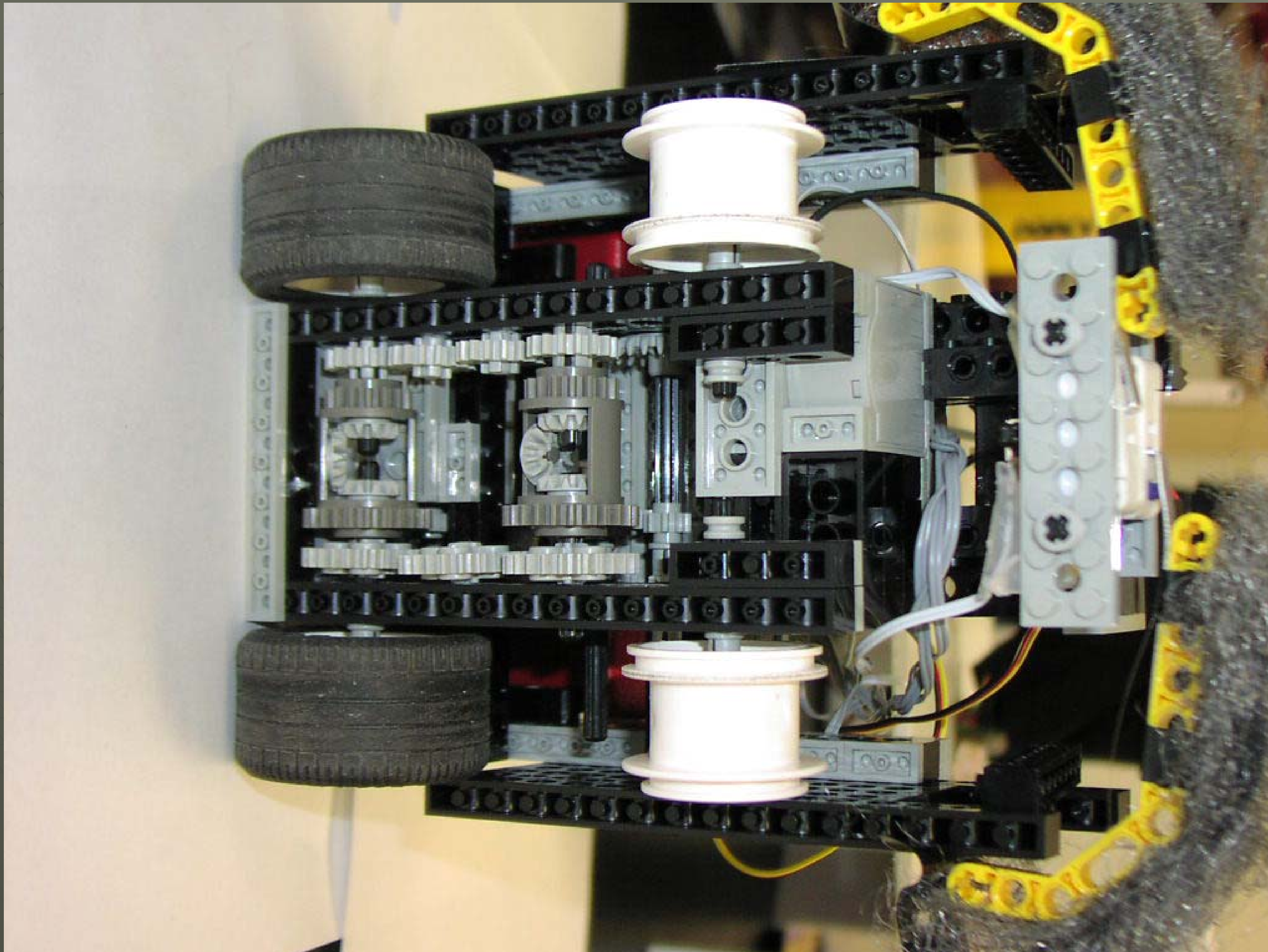
The second level of gears seen in the center are for the second motor, the turning motor.



Here you can see the turning motor mounted to the front of the chassis, it connects to the large beveled gear using the small 8 tooth gear at a 90 degree angle.



The original design specs called for a treaded vehicle, though we changed that to the large, fat “racing” tires in the rear, and two of the “racing” rims in the front without tread.



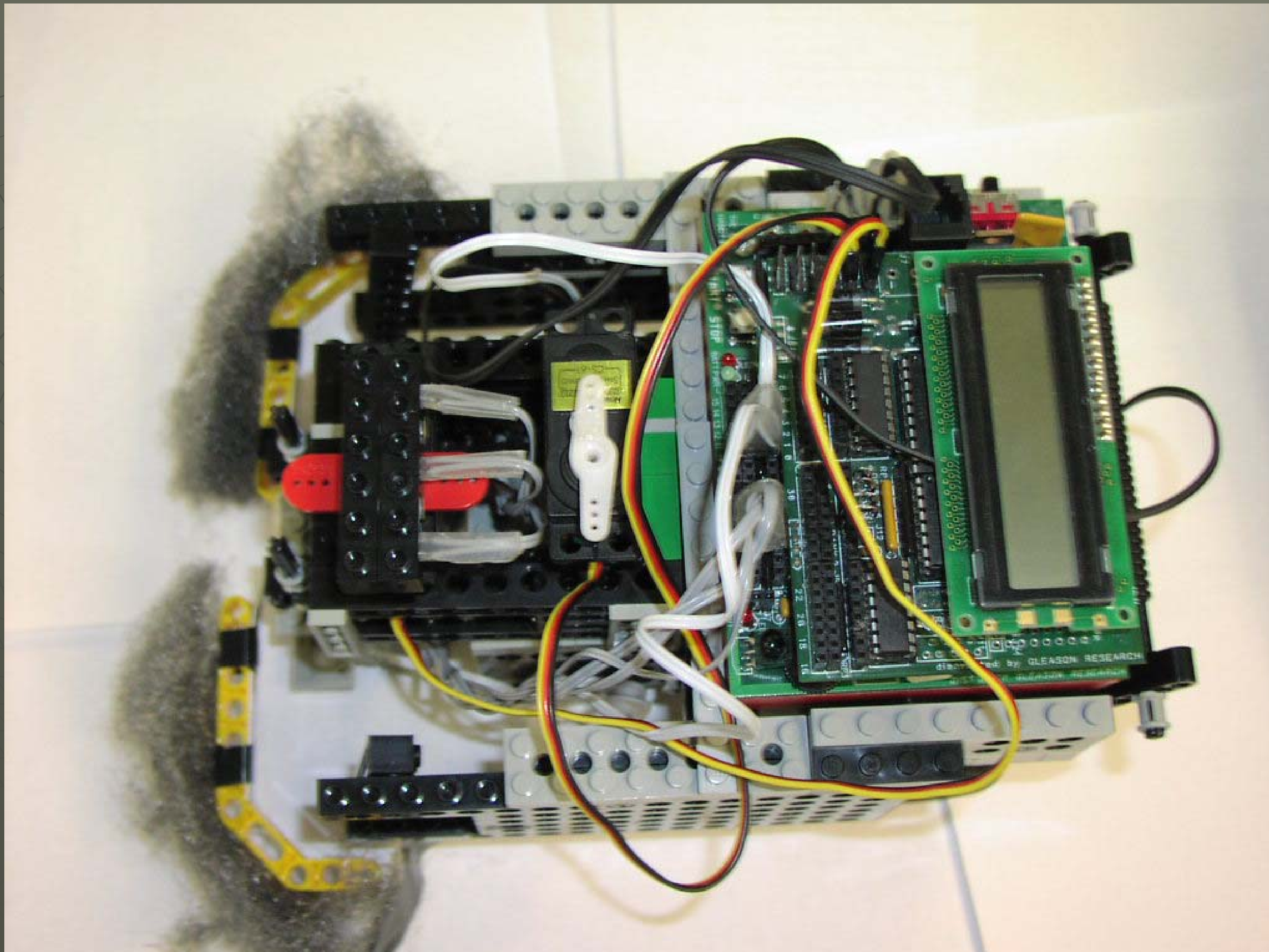
SENSOR CONFIGURATION

Our Robot Design uses the following sensor inputs:

- 1 Range Finder
- 2 Touch Sensors
- 3 Light Sensors

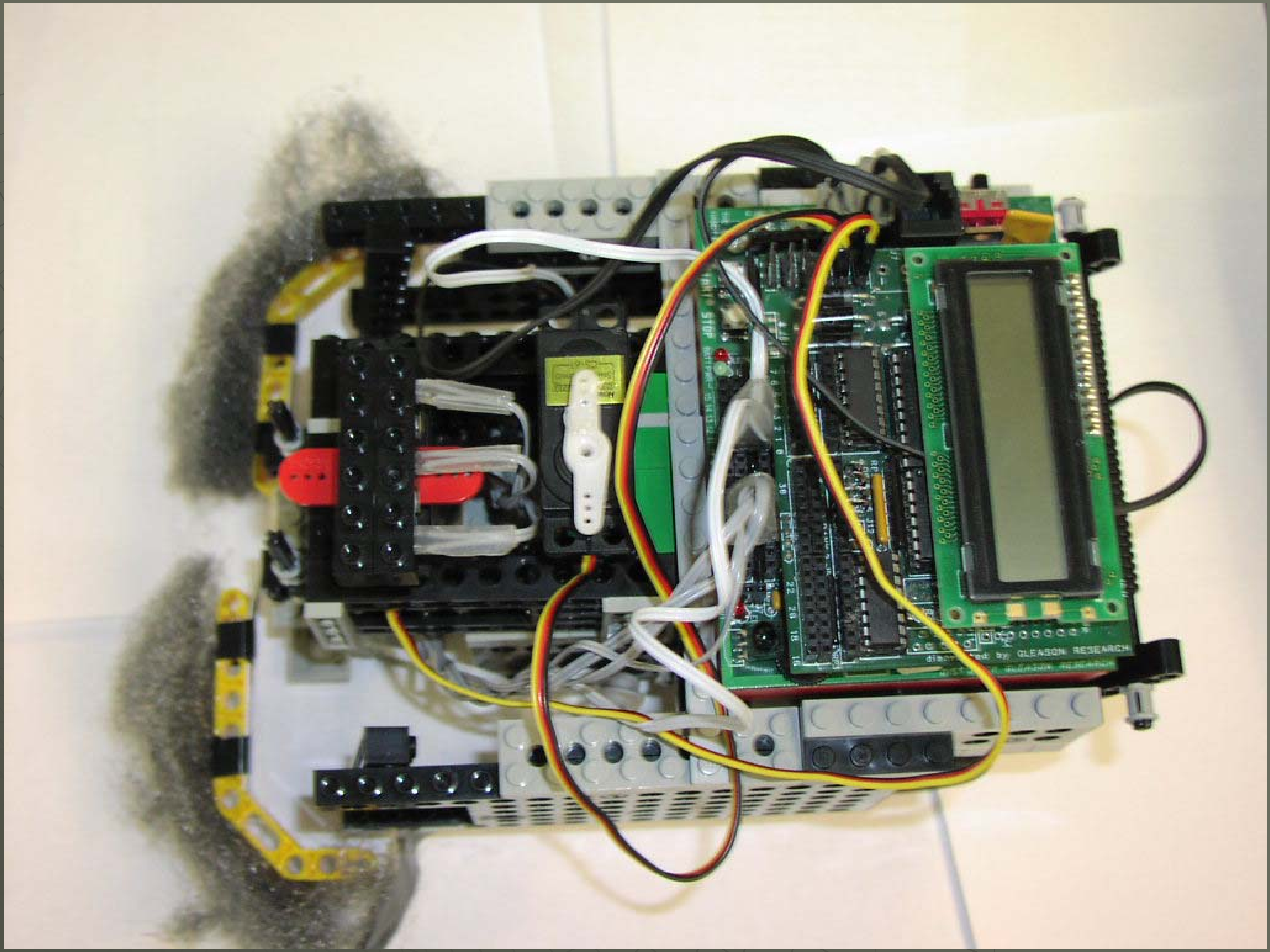
And the following motors:

- 2 Drive motors
- 2 Servos


by GLEASON RESEARCH

Sensor Placement

- The touch sensors were mounted in front of the chassis, low to the ground.
- The light sensors were mounted atop a servo in the front-center of the robot.
- The rangefinder was mounted atop the second servo on a mast that brought the rangefinder ~9 inches off the ground.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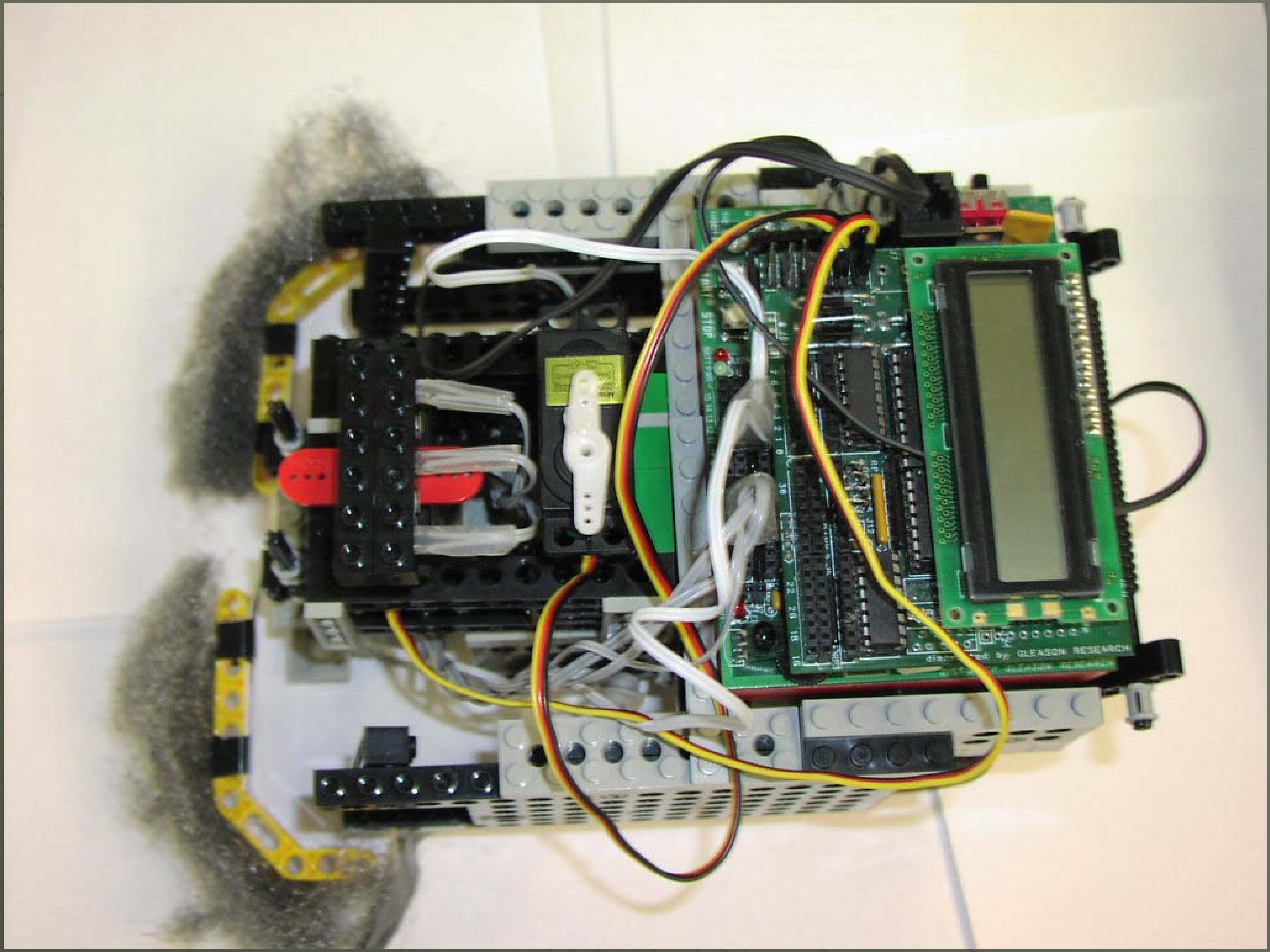
Additional Features

Our design also utilized the following features:

- Wheel Guard on the sides to protect wheels from getting hung on rocks.
- Steel Wool mesh on the touch sensors for light contact.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Software Design

The software consisted of 4 processes:

- One thread handled continual readings from the light sensor.
- Another thread handled reading from the RangeFinder.
- A third thread handled the touch sensors.
- The main thread processed information from the other threads and determined the proper responses.

Light Sensor Process

The light sensor process is a very simple process. It is actually just a few lines that input data from the three sensors, average them, and update that value to a global variable. This process executes all the time.

Large Obstacle Avoidance Process

This process is responsible for the rangefinder and the servo that the rangefinder sits atop of. This process causes the rangefinder to sweep back and forth. Upon detection of an obstacle, obstacle avoidance procedures are immediately implemented. This thread also executed at all times.

Bump Sensor Process

This process handled the two touch sensors mounted on the front of the robot. When the touch sensors were triggered, this process would initiate lesser obstacle avoidance procedures. This process had a lower priority than the rangefinder obstacle avoidance, and was terminated when in "turn of light" mode.

Main Process

This process is the main thread of the program. It starts the other processes, and makes necessary motor movements based on the input from the other processes.

Successes

- Hardware Design was small and compact.
- Software Design was simple, not unnecessarily complex.
- Light-Seeking algorithm was effective and successfully detected the light.
- Rangefinder successfully detected the large obstacles in all demonstrations.

Improvements

- The curved part of the touch sensors sometimes became hung up on the rocks.
- The integrated movement scheme for avoiding obstacles and maneuvering to the light was not very effective.
- The chassis configuration had high speed, but very low torque. Needed more power, less finesse.
- The robot was very light, and therefore had large traction issues. Weighting the robot down helped with traction, but then it would grind gears because of its low torque and complex gear assembly.

Conclusion

Our robot met the minimum requirements of Project 2. It could find the light, maneuver towards the light, and turn the light off. Light-detection and Large Obstacle Avoidance work very well. Improvement is needed in the light-detection and obstacle avoidance integration, especially in the software movement schema, the touch sensors need to be reconfigured, and a chassis with more torque needs to be adopted. But overall, the robot did fairly well.