Project Proposal
Lego Moving Robot

20 February 2007

Sue Vargo, thanyen87@comcast.net

Project Abstract

This Lego Robot will move forward, backward and can even follow a path. The Lego Robot senses the dark path on a white board and relay the sensor information to the motor driver. The motor driver will either continue what it is doing if it is on the path, or alter its course if it is sensing that the robot is deviating away from the path. The Zilog Z8 Microcontroller, instead of the Lego RCX brick, is used to run the Lego robot. By using the Z8 Microcontroller, the robot can be given more functionalities than the Lego RCX can offer.

Strategy

The Lego robot will be made of Lego parts and be large enough to cradle a Zilog Z8 Microcontroller, Z8F6403 series. The Z8 Microcontroller capabilities being used on the robot will be the UART, general purpose IOs, clock source and possibly interrupts as well. The external hardware used will be the Lego motors, the Lego light sensors, a Pololu micro dual serial motor controller, a battery pack, a solderless breadboard and some wires.

I want to use the Lego light sensors instead of any other sensors because I feel that, with the magnitude of the project, the light sensor will allow me to concentrate more on interfacing the sensors, rather than building a lot of Lego parts to accommodate the sensor and make it work.

I chose the Pololu motor controller because, based on the diagram on the Pololu website, the motor controller seems very easy to use. The Pololu website also offers extensive tutorials on how to interface the motor controller onto a microcontroller board to create your robot.

I would need to write software to drive the motor. The software would need to apply the power from the battery pack to the Lego robot's motor so that it can move. The software would need to relay program directions to the motor so that the motor can know to move forward, backward, turn left or turn right.

I would also need to write software to read the sensor input and then do something with that input. I still need to figure out what exactly does the light sensor sense. Does the light sensor reflect light and dark? If so, then the robot can follow the path of a dark line by sensing where the dark line and turning to follow the dark line. This could be more work.

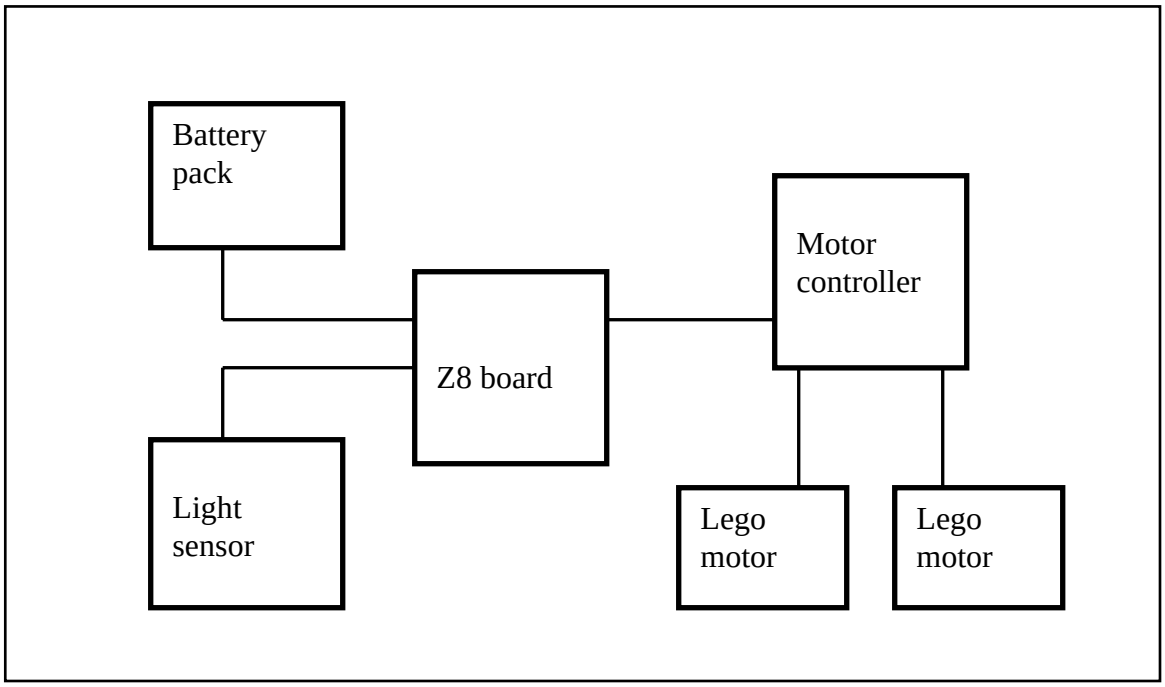

Figure 1: Preliminary hardware block diagram

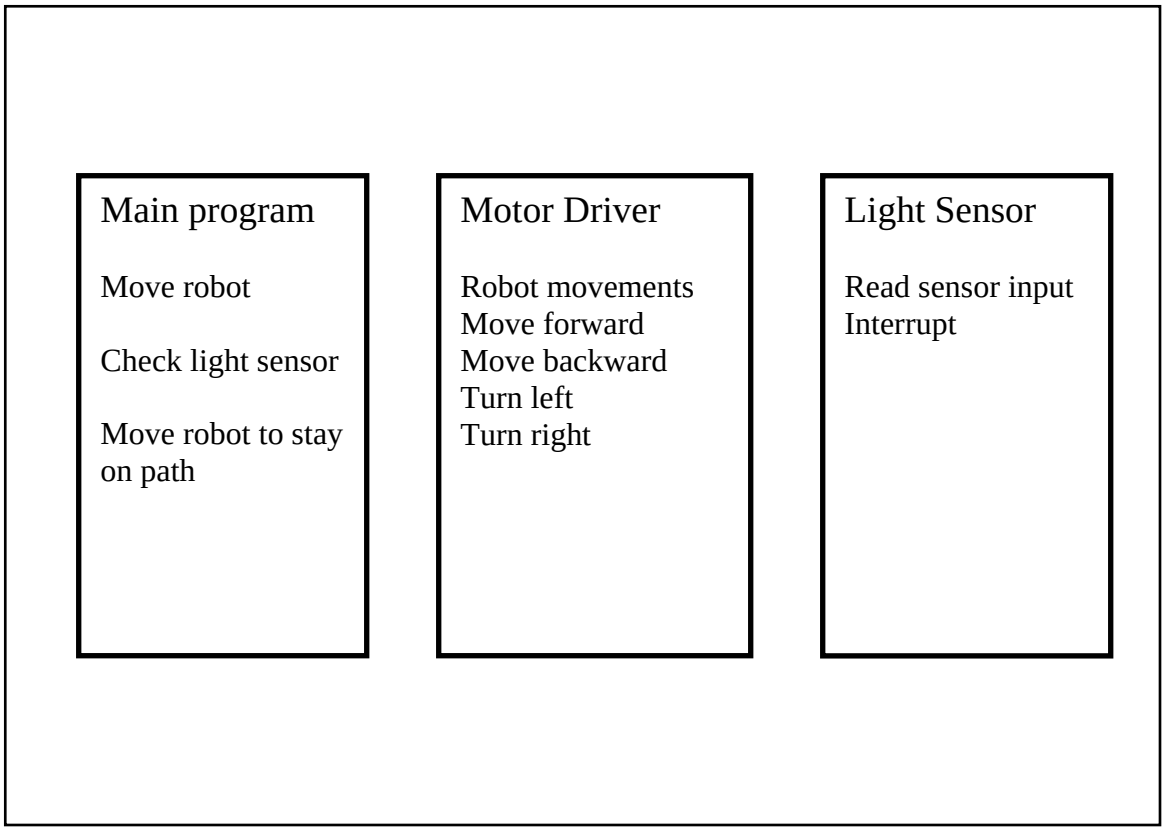

Figure 2: Preliminary software block diagram

Unknowns

I am still figuring out how the light sensor works. Is the light sensor sensing light, ei, light bouncing back? If so, then when the sensor sense light, the robot is not following the solid black path. If the robot is on the black path, no light will bounce back to the sensor and the robot knows it is on the right path.

Implementation Plan

Design a Lego robot to cradle the Z8 board. Hire Lego expert (my son) to help me with the design. Order Pololu motor controller and a switch, in case I decided to use the switch instead of the light sensor.

The first order of business is to make sure the robot can move. This is the most important part of the project. Once the robot can move then the other parts will follow. Follow the Pololu diagram to figure out how the motor controller works, how to attach the Lego motor to it and how to attach the battery pack to give the motor juice. Figure out how to interface the motor controller to the board. Read parts of the Z8 data manual about UART. Write simple driver program to test movements: forward, backward and turns.

The next part is to figure out how the light sensor works. Some of this can be done in parallel with figuring out how the lego motor works. What works for one may also works for the other since they are both lego parts. This is, after all, suppose to be a child's toy. Once that is determined, then I will need to figure out how to interface the light sensor's Lego wire to the Z8 board.

Write software to read the light sensor, by polling the IO pin that the sensor will be connected to. If everything is ok, then the robot just continues. If there is a deviation in the path then an interrupt will generate and the course of the robot will be altered so that the robot will stay on the path. This part is in theory since I am not sure this is how the light sensor works.

Resources

University hardware (borrowed):
Zilog z8 Microcontroller
Lego RCX Robot kit
Battery pack
Solderless breadboard
Wires

Bought hardware:
Pololu micro dual serial motor controller
RobotStore miniature basic lever switch (may not be used)

Software:
Zilog ZDS II Encore!, version 4.10

Robot design assistant:

son