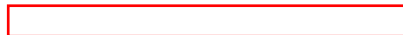


Project Proposal

LOGO-like 'Turtle' control with iRobot Create and ZNEO

March 7, 2011

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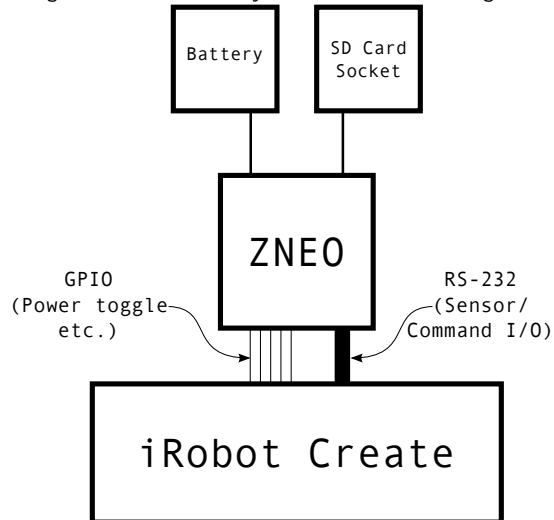
Project Abstract

LOGO is an educational programming language known for its Turtle Graphics system for imperative graphics drawing. Programs in LOGO for the Turtle contain statements such as `FORWARD 100` or `LEFT 90`, which the Turtle then interprets and follows, leaving a trail behind it. Students could use the trail and computer science concepts to create artwork and interesting patterns. Although drawing was generally done virtually with a virtual Turtle, physical Turtle robots were also made to illustrate the concept outside of the virtual world. My proposed project would implement such a Turtle robot with iRobot's Create robotics platform and the ZNEO contest board.

Strategy

The two primary components of the project will be the ZNEO contest board and the iRobot Create robotics platform. I'll be taking advantage of the contest board's built-in RS-232 UART and DE-9 connector. The Create is commanded via ASCII over RS-232, so communication shouldn't be a problem. The sensors in the Create include left and right bump sensors, drop sensors on each of the two drive wheels, and encoders on the wheels to measure rotation. All of these sensors are accessible over the serial link. It possible to request that the Create report sensor values every 15ms, so I'll use a timer on the contest board to keep data current. The encoders on the wheels of the Create will be of most use, as distance driven and angle will be necessary to follow the LOGO commands. If feasible, I'll also check for obstacles with the bump/drop sensors, although obstacle avoidance is not a primary goal of Turtle robots. To verify that everything works, I'll take interesting LOGO Turtle Graphics examples from the web and run them on my platform. The primary modules will be serial interaction, command translation/data interpretation and

Figure 1: Preliminary hardware block diagram



program logic. Additionally, if the primary goals don't prove too difficult, I'd like to add SD card and FAT32 support so programs can be edited on any SD/FAT32-supporting system and run on the Create/contest board platform.

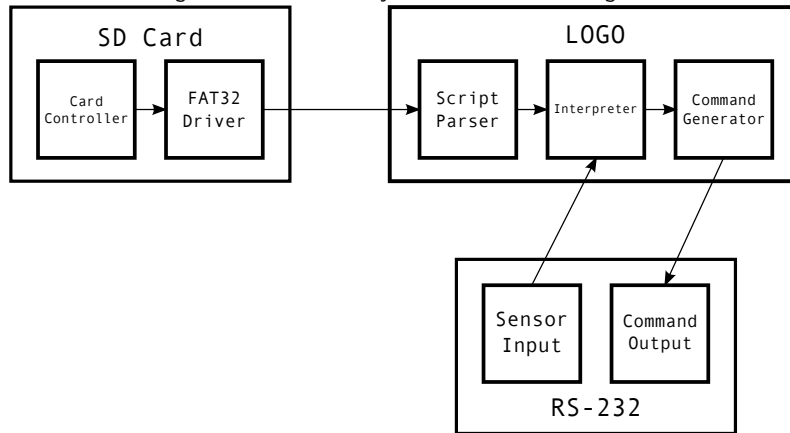
Unknowns

The area I am most unfamiliar with will be timing. I'm not sure how feasible it will be to simply have a timer interrupt check for sensor values every 15ms. It seems to me like any small offset between the interrupts and the reports from the Create will eventually cause packets to be dropped. Perhaps this packet dropping will be insignificant, or perhaps I'll need a more intelligent means of getting information from the Create's sensors. The Create also features a socket for a 'Command Module' produced by iRobot. This socket has several useful pins, including an alternative RS-232 connection and a pin that toggles power on a rising edge (pinout page 10 of the linked owner's manual). It would seem that with some tinkering, these pins could be highly useful.

Implementation Plan

- Gather materials
- Adapt serial console lab to communicate with Create
- Test basic commands to Create (drive forward etc.)

Figure 2: Preliminary software block diagram



- Read sensor data from Create
- Write simple API for commanding Create and reading sensor data
- Create parser for subset of LOGO
- Parse basic LOGO scripts
- Interpret basic (no flow control) LOGO scripts
- Add flow control
- [tentative] Connect SD card reader
- [tentative] Read raw data from SD
- [tentative] Implement FAT32 support
- [tentative] Read LOGO scripts from SD

Resources

Fortunately, I already have most of the necessary resources. The contest board is supplied for the class and I have an iRobot Create platform on loan from Dr. Parmer of the Computer Science Department. The only component missing is the SD card socket. I imagine I'll be able to wire up the socket pretty easily using the breadboard in the contest board kit. I won't need any software beyond the ZNEO IDE since the Create works entirely over serial communication. I may also need a battery pack to power the contest board if I don't want to tether the system to an outlet. Finding a pack with the appropriate voltage/ampereage shouldn't be difficult.

See Also

iRobot Create: <http://store.irobot.com/shop/index.jsp?categoryId=3311368>

via Wikipedia: http://en.wikipedia.org/wiki/IRobot_Create

Manual (PDF): http://www.irobot.com/filelibrary/create/Create%20Manual_Final.pdf

Serial API (PDF): http://www.irobot.com/filelibrary/pdfs/hrd/create/Create%20Open%20Interface_v2.pdf

LOGO: <http://el.media.mit.edu/logo-foundation/logo/turtle.html>

via Wikipedia: [http://en.wikipedia.org/wiki/Logo_\(programming_language\)](http://en.wikipedia.org/wiki/Logo_(programming_language))