LSP 150: Computers & Society

Lecture Notes
2 September 2004
Prof. Katherine St. John
Lehman College & the Graduate Center
City Universtity of New York

Overview

- First Day Details (web pages)
- Opportunities
- Introduction to Computers
- Checking out & Building Robots

First Day Details

See course webpages.

Opportunities for Students in Technology-Related Majors

- Computer Science & Mathematics Mentorship & Scholarship Program
- Internships (On-Campus & Industry)
- Research Assistantships

Computer Science & Mathematics Mentorship & Scholarship Program

- Provides scholarships, a laptop mentoring and career planning
- Majoring in technology-related field
- Good grades in first year courses
- US Citizen or permanent resident

Funded by the National Science Foundation.

Internships (On-Campus & Industry)

Some recent internships:

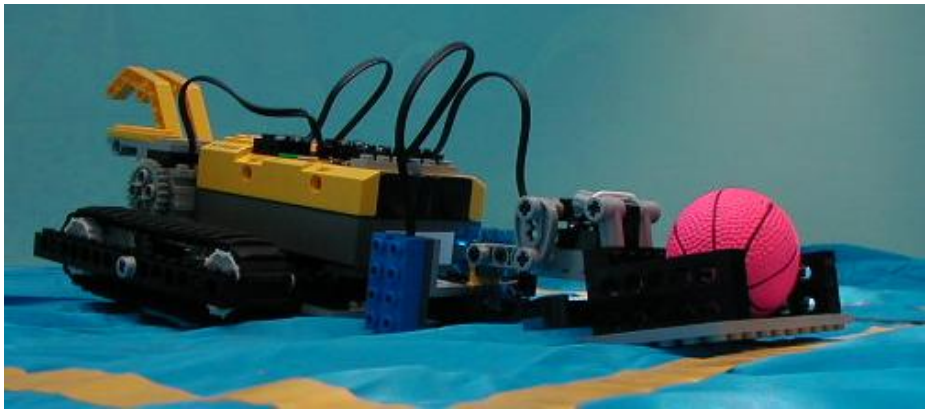
- ABC Television
- Einstein School of Medicine
- FAA– La Guardia
- IBM Research
- NYC MTA
- National Medical Library
- New York Public Library

Research Assistantships

A few examples:

		
Computational Biology: Tree of Life Project	Wildebeest Cluster (132 processors)	Morphometrics with AMNH

Introduction to Computers & Robots



- What is a computer?
- What is a program?
- Compiling Programs

What is a computer?

A basic computer has a

- central processing unit (CPU) or "brain",
- registers to keep track of next instruction & where data is stored
- Two kinds of memory:
  - Read Only Memory (ROM): Often contains directions that programs the CPU and can't be erased,
  - Random Access Memory (RAM): Used to store firmware and programs the computer runs.

What is a computer?

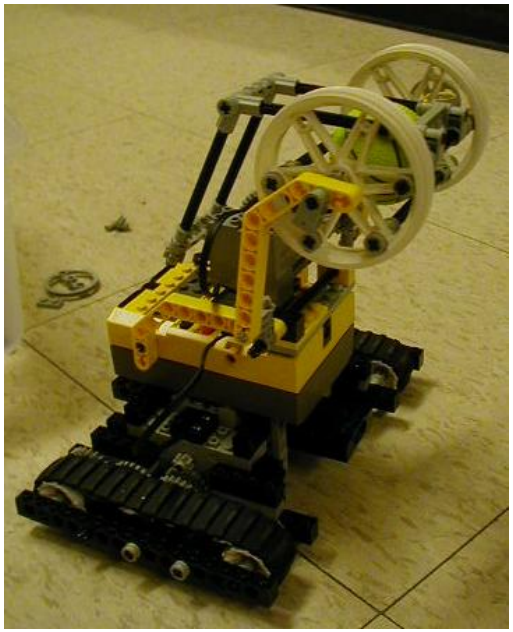
There's also input devices:

- keyboard, mouse, scanner,...

and output devices:

- screen, printer, speaker,...

Lego Mindstorm Robot



The lego robot has:

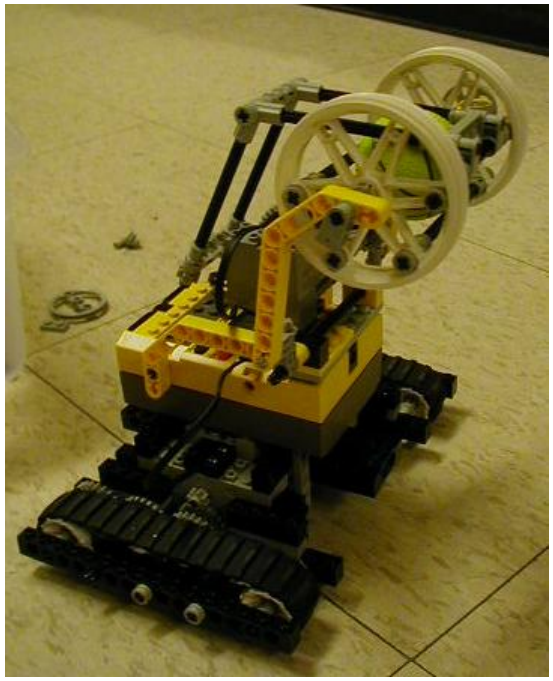
• 8-bit CPU (in bulkly lego block, called the RCX)

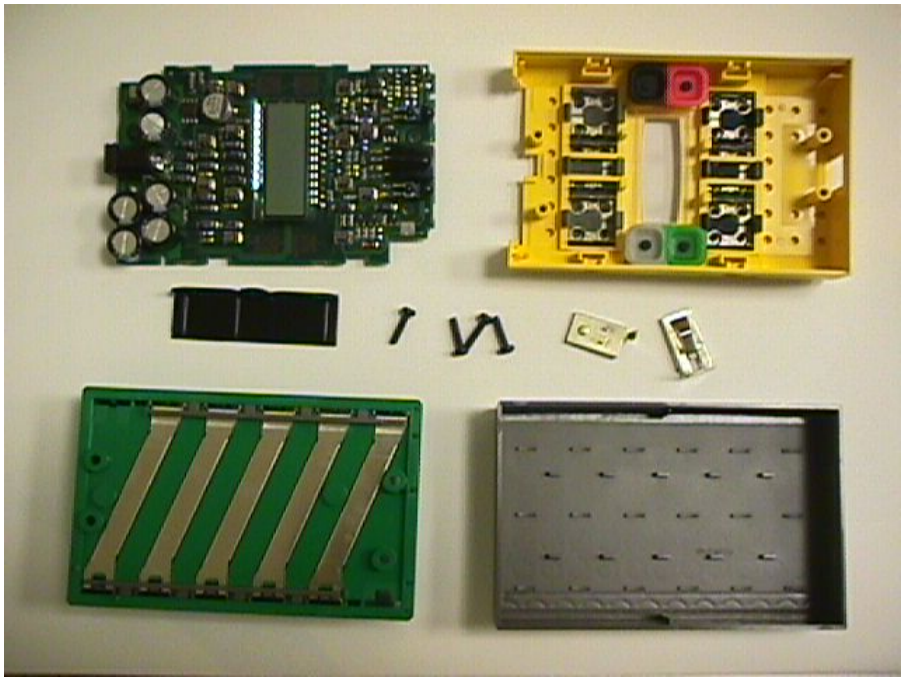
• 16K Internal ROM & 32K static RAM (6K for programs)

• Input Devices: 2 touch sensors, 1 light sensor, I/R port

• Output Devices: 2 motors, screen, speaker, I/R port

Lego Mindstorm Internals





(Pictures of RCX internals from: `http://graphics.stanford.edu/ kekoa/rcx/`)

CPU Directions

- Most CPUs understand directions written in machine language– strings of 0's and 1's
- Each instruction corresponds to an "operation code" or opcode that consists of commands like:
  ``Increment value in register AX''
- Very hard to write program in machine language.
- Most programs are written in a high level language, like Java, Visual Basic, C or C++.

Programming

- The general process is:

You write a program that looks like English (with lots of rules)	$\Rightarrow$	"compiling"	Gives a binary file the computer can understand	$\Rightarrow$	You "run" the binary to execute the program

- A program is a set of instructions for the computer to follow.
- Programs implement algorithms– step-by-step directions for performing a task (ex: a recipe to make cookies, directions to make the robot turn 360°).

Not Quite C

- For the robot, we're going to write programs in a variant of C, called Not Quite C (NQC).
- Legos come with a language called RCX– it's very simple, but doesn't allow you to do a lot.
- By using NQC, you can do more sophisticated programs and it will help you learn C/C++ and Java.

A Simple Program

```
// tankbot1.nqc - drive straight ahead

#define LEFT OUT_A
#define RIGHT OUT_C

task main()
{
    On(LEFT+RIGHT);
    until(false);
}
```

Some Useful NQC Commands

Command	Definition	Example
`On(`*outputs*`)`	turn on outputs	`On(LEFT+RIGHT);`
`Off(`*outputs*`)`	turn off outputs	`Off(LEFT+RIGHT);`
`Fwd(`*outputs*`)`	sets to foward direction	`Fwd(LEFT);`
`Rev(`*outputs*`)`	sets to reverse direction	`Rev(RIGHT);`
`Wait(`*time*`)`	wait for time $\frac{\text{time}}{100}$ seconds	`Wait(100);`

(Much more on this in the next two lectures.)

Checking Out & Building Robots



- Robots are stored in Gillet 137.
- After a short break, need a few volunteers to help transport them to our classroom.

Checking Out & Building Robots

Each student will get:

-  Large blue box of Lego pieces
-  Small plastic shoebox to store assembled robot
- Labels to place on the robot RCX, the blue box, and the shoebox.

Checking Out & Building Robots

- Everyone will put a robot together and test the 5 built-in programs, described in the Lego instruction manual.
- The easiest robot (tankbot) to build is described in Chapter 5 of Dave Baum's book. Subsequent chapters describe an easy bumper (bumpbot) and light sensor mount (linebot).
- We will begin cleaning up at 11:30am and must be completely out of the room by 11:50am.
- If you do not finish today, you may come during my office hours (T 3-5, Th 12-1) or when Gillet 137 suite is open (most T,W,Th 2-5).