

## Problem: Computer Science not Taught in Most Alabama High Schools

- According to the Alabama Learning Exchange (ALEX)<sup>1</sup>, computing is equated to learning Microsoft Word and various mechanical tasks; this is not Computer Science!
- Within Jefferson county, less than a handful of high schools teach Computer Science in a manner that would prepare students to take the Advanced Placement exam
  - From contacts initiated while recruiting for our state-wide programming contest, we have observed the situation is the same or worse in the rest of the state.

<sup>1</sup> <http://alex.state.al.us/standardAll.php?grade=9&subject=TC&summary=2>

## Ubiquity of Computing



>10Mb embedded software



15-20Kb



1-1.5Mb



- 98% of all microprocessors control devices *other* than desktop computers
  - Automobiles, airplanes, televisions, medical devices, PDAs/cell phones, video games
- These devices also need software and often require strong technical skills to develop
- Entertaining and challenging projects can be constructed to teach Computer Science principles
  - Video games, robotics, mobile devices
- Teaching true Computer Science offers much deeper insight into mathematical and scientific discovery.

## Opportunities for Alabama Youth

- Computing will continue to be a dominant science on which every other science, engineering, and business discipline will increasingly rely. Almost all major technology breakthroughs in the future will involve computing.
- High school graduates in the 21<sup>st</sup> century cannot afford to be ignorant of Computer Science principles. This is important for Alabama, which is one of the major developing technology centers in our nation. Having a technology literate workforce will be necessary for continued economic growth.
- *Offshore hysteria*: Many companies with high paying jobs are unable to fill positions with computer scientists (e.g., Local: SunGard, CTS; National: Microsoft, Google).
  - \$50,046 is the expected starting salary for computer science degrees in the class of 2006 (4<sup>th</sup> highest starting salary)
- Alabama has an opportunity to be a leader in the area of high school computer science if we grab the opportunity now.

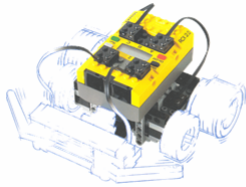
# Increasing Awareness of Computing in Alabama High Schools: Introducing High School Students to Java through Lego Robot Experiments

<http://www.cis.uab.edu/heritage>

## Project Motivation

Encourage bright high school students from economically disadvantaged school districts to learn about computer science. Students were mentored in a 7-week internship, in collaboration with the Heritage Center, which matches UAB mentors with students. Students were given their own office, computer, and robot – they were treated like a PhD student at UAB.

Each student had never programmed before entering the internship – the goal was to have them writing Java code in Eclipse by motivating them with fun projects! Students were “forced” to learn Java to accomplish robot tasks.



## Pedagogical Approach

Students begin the 7-week internship by first learning to program the robots using the LEGO Robotics Invention Systems Graphical Interface in order to become acquainted with the basic functions of the robots. After becoming familiar with the robots, they began to study Java through a series of small exercises. Students were able to apply their new knowledge of Java to program the LEGO RCX using Lejos within Eclipse.



## Sample Projects



- **Sumo Wrestler:**  
This project simulates a Sumo wrestling event. The student must write code that keeps the robot within a circle, but pushes the other robot out of the circle.
- **Simon Says**  
This is a project that is similar to synchronized swimming, where one robot controls the movement of another robot through infrared communication.
- **Balloon Buster**  
A set of balloons will be placed in a circle with the robot starting in the middle. The winner is the robot that can burst the most balloons. Each robot has a needle attached to its front to pop the balloons..
- **Kick the Can**  
Seven 12 oz. Cans of soda are placed in marked positions, arranged radially from the center. The goal is to remove soda cans from inside the rink as quickly as possible.
- **Homing Pigeon**  
The robot must drive forward 10 feet and return as close as possible to the original starting position.

## Lessons Learned

- **Involve students in the research process**
  - Interact with undergrad and grad students
  - Attend research meetings
  - Talk to counselors and encourage exploration of a career in science
  - Accommodate the students as if they were doctoral students, and expect the same level of responsibility
- **Grad Student volunteers were essential**
  - 9am-3pm, 5 days a week for 7 weeks involves a lot of mentoring

## Future Plans

- **Weekend robot workshops in community centers for middle schools in economically disadvantaged school districts**
- **Track the progress of past participants**
  - Attend and graduate from college?
  - Major in CS? Major in another science?

# Alabama High School Programming Contest

<http://www.cis.uab.edu/programs/hspc>

- Students from Alabama high schools compete by solving 6 programming problems within a 3 hour period

- Representation across entire state:

- |                                  |                              |
|----------------------------------|------------------------------|
| - Alabama School of Fine Arts    | - JCIB                       |
| - Alabama School of Math/Science | - Mountain Brook High School |
| - Altamont School                | - New Century Technology     |
| - Auburn High School             | - Oak Mountain High School   |
| - Demopolis High School          | - Thompson High School       |
| - Grissom High School            | - Tuscaloosa Academy         |
| - Heritage Family Academy        | - Vestavia Hills High School |

- Next event: May 13<sup>th</sup>, 2006

- Corporate sponsors:

**Microsoft** **CTS**



## UAB Summer Graphics Camp

<http://www.cis.uab.edu/cscamp>



- Since 1999, the UAB CIS department has offered a week-long computer graphics camp for high school students.
- The camp is designed to introduce students to computer science at a deeper level to prepare them for potential study at the university level.
- Students attend daily lectures and work on several fun graphics projects that help to teach geometric modeling and algorithm visualization.
- Over the past 7 years, students from 11 different high schools have participated.

## Other Mentoring Opportunities

- Throughout the academic year, several UAB-CIS professors are involved in mentoring local high school students in order to prepare the students for regional science fair competitions. An example of a recent high school research project is a robot that recognizes written characters.
- During the summer school session, a special section of the CIS department's introductory computer science course is open to high school students. Many robotics and graphics camp students enroll in this course.