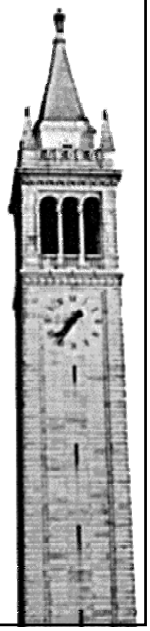
Outreach

Edited and Presented by
Jonathan Sprinkle
UC Berkeley



Chess Review
November 18, 2004
Berkeley, CA

Overview

- Undergraduate
  - Goals
  - SIPHER (Vanderbilt)
    - Students
    - Topics
  - SUPERB-IT (Berkeley)
    - Students
    - Topics
  - Aftermath & Analysis
- Education
  - Successes in course dissemination
- Industry
  - ESCHER

Goals

- Expose undergraduates to the life of a graduate student
  - Target underrepresented groups
- Get students interested in the research of hybrid and embedded systems and control
  - Hands-on approaches especially
- Contribute to the Chess main idea: an integrated systems science
  - Help students understand why traditional methods are inadequate

SIPHER

VANDERBILT UNIVERSITY

- Summer Internship Program in Hybrid and Embedded Software Research
- Specifically focused on participation from members of under-represented groups
- Program dates: May 31 - Aug 6, 2004

SIPHER—5 students

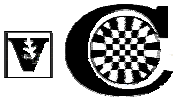
- Mary Hilliard
  - University of Tennessee Chattanooga
- Miguel Taveras
  - University of Florida
- Shirley (Xue) Li
  - Massachusetts Institute of Technology
- Praveen Mudindi
  - Alabama A&M University
- Trevor Brown
  - Middle Tennessee State University

Total applications: 24+
Stipend: $6000 (10-wks)

SIPHER—additional participants

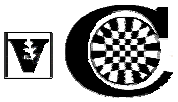
- Cohorts also included separately funded interns selected through different processes
  - James Porter (Tennessee Technological University)
  - Christopher Beers (Vanderbilt University)
  - Efosa Ojomo (Vanderbilt University)
  - John Williamson (North Carolina A&T State University)

SIPHER—Agenda



- Introductory Meeting
- Training with GME and MIC
- Industry/Application Trips
  - Saturn/GM Manufacturing Plant
  - NASA Huntsville Space Center
- Inspirational mentoring
  - Graduate mentors
  - Panel session with other graduate students
- Reviews
  - Project meetings
  - Mid-summer guidance/reviews
  - Final review and presentations/demonstrations

SIPHER—Projects

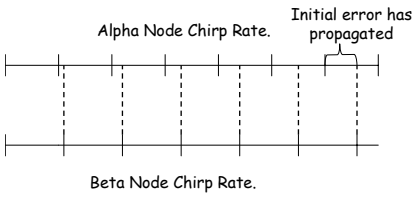


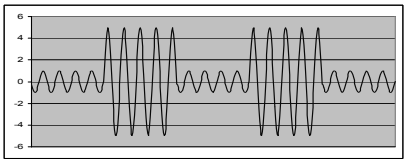
- Distributed System Implementation of the Kuvangu Running Frog's Calling Behavior
  - Praveen Mudindi (Alabama A&M University)
  - Efosa Ojomo (Vanderbilt University)
- Maze Discovery and Chutes & Ladders
  - Jameson Porter (Tennessee Technological University)
  - Mary Hilliard (UT Chattanooga)
- Embedded Systems Research with LEGO Mindstorm Robots
  - Miguel Taveras (University of Florida)
  - Shirley Li (Massachusetts Institute of Technology)
- Visual Tracking
  - Trevor Brown (Middle Tennessee State University)
  - John Williamson (North Carolina A&T State University)

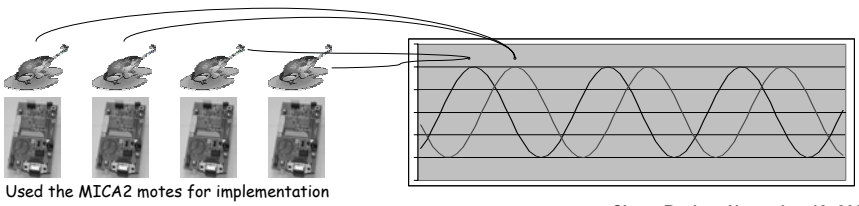
Distributed System Implementation of the Kuvangu Running Frog's Calling Behavior

Praveen Mudindi

- Program Alpha nodes, Beta nodes, and Omega nodes.
- An algorithm for determining the chirp rate
- Implementing the algorithm that determines the chirp rate
- An algorithm that will synchronize all the chirps.







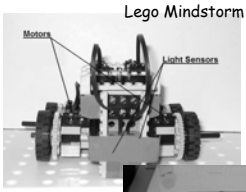
Used the MICA2 motes for implementation

Maze Discovery and Chutes & Ladders

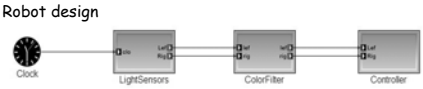
Mary Hilliard

- Explore a maze
- Map the results
- Transmit the data to the PC
- Provide a compatible data file for the Maze Navigation Team

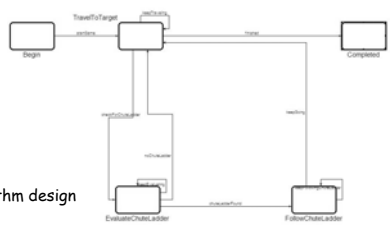
Lego Mindstorm Robot for Implementation



Robot design

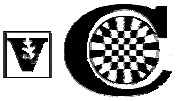


Test track/game board



Algorithm design

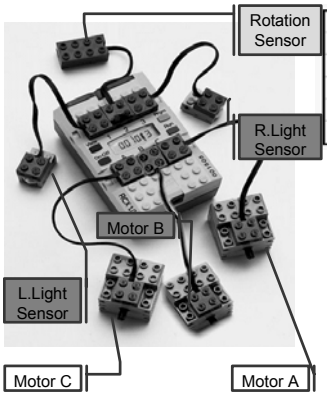
Embedded Systems Research with LEGO Mindstorm Robots

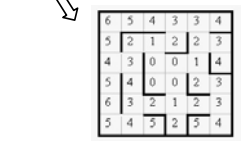


Miguel Taveras.

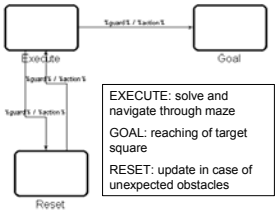
Shirley Li

- Phase I: known start and target, complete maze information
  - Shortest path calculation
  - Navigation through maze
  - Collision detection and resolution
- Phase II: known target, unknown start, complete maze information
  - Determination of current position





Each square is 26cm x 26cm.

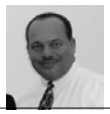


EXECUTE: solve and navigate through maze

GOAL: reaching of target square

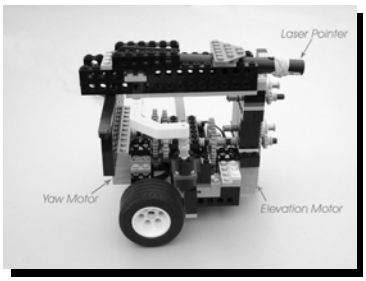
RESET: update in case of unexpected obstacles

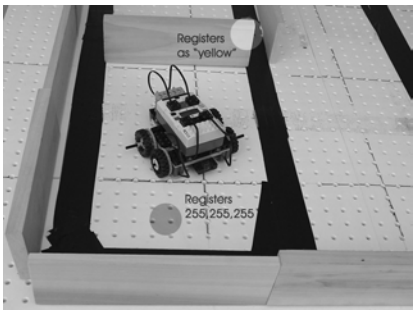
Visual Tracking



Trevor Brown

- Phase I
  - Visually track a moving target through a maze using a web camera and PC
- Phase II
  - Build and program a robot to hold a laser pointer, and track a moving robot using the camera from Phase I to do the image analysis





SUPERB—3 students

- Basil Etefia
  - Arizona State University
- Rafael Garcia
  - University of Puerto Rico, Mayaguez
- Elizabeth Fatusin
  - Ohlone College, transferred to Cornell

Total applications: 100+
Stipend: $3500 (8-wks[1.])

- These were the sponsored students who were a part of a 19 member group in the college of engineering.
- Additionally, "adopted" two other students for weekly lunches and research presentations

1. Note that housing and meals were provided.

SUPERB—*Agenda*

- Introductory meeting
- Industry/Application Trips
  - Lawrence Labs
  - Intel
- Inspirational mentoring
  - Graduate mentors
  - Weekly seminars with faculty/administration
- Reviews
  - Project meetings (weekly, with pizza!)
  - Mid-summer guidance/reviews
  - Final review and presentations/posters

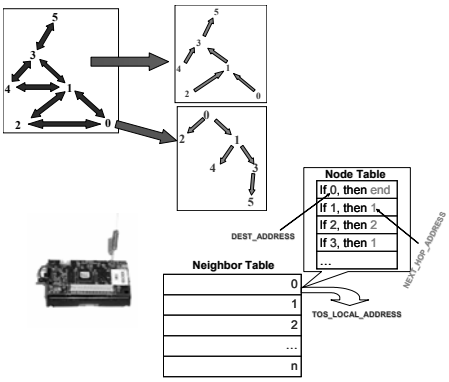
SUPERB—Projects

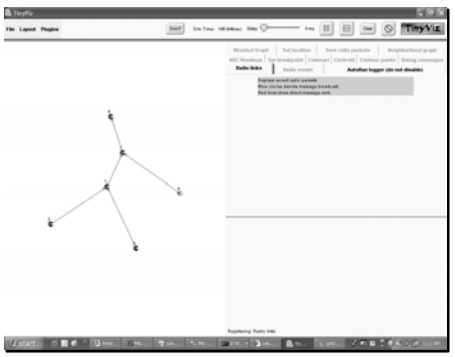
- Routing Protocols for Wireless Sensor Networks
  - Basil Etefia, Arizona State University
    - Tanya Roosta (Mentor)
- Multi-view Configuration of Flight Dynamic Playback
  - Elizabeth Fatusin, Ohlone College (now Cornell)
    - Jonathan Sprinkle (Mentor)
- Singular Event Detection
  - Rafael Garcia, University of Puerto Rico, Mayaguez
    - Aaron Ames (Mentor)

Routing Protocols for Wireless Sensor Networks

Basil Etefia

- Given a node structure, find a path from any one node to another using the least number of "hops" possible
  - Each node is organized in a table
  - Based on the destination address, each node is organized in another table.
  - Tree-like structure that describes its shortest path.
  - Each node maintains a table that lists the "next hop" address.

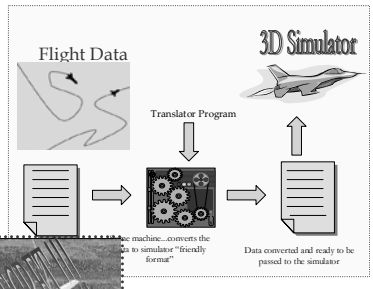


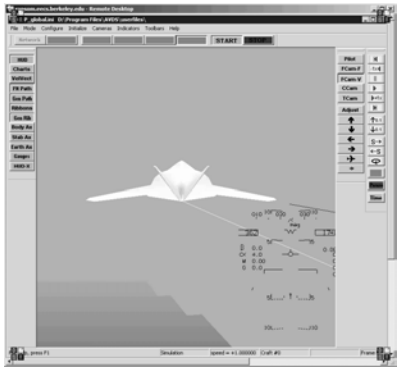


Multi-view Configuration of Flight Dynamic Playback

Beth Fatusin

- View sensitive data of a UAV's flight in an external package
- The converted data is saved and sent to the three-dimensional flight simulator system
- The flight simulator therefore responds to the retrieved data and displays the actual maneuvers of the aircraft.





Singular Event Detection

Rafael Garcia

- Propose a condition number for event detection—a number that gauges the qualitative similarity of the approximate solution to the actual solution

Proposed Condition Number

For a given set of functions similar to (1), i.e., $f = (f^*; f^!; g)$, the condition number of f is:

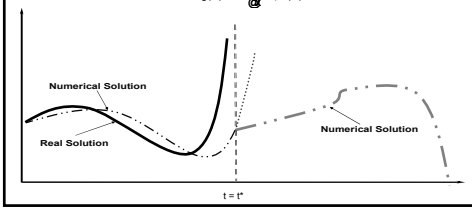
$$\text{cond\#}(f) = \frac{k f^*(\hat{x}(t^o))\,k\,k f^!(\hat{x}(t^o))\,k}{L_f \cdot g(\hat{x}(t^o))\,L_f \cdot g(\hat{x}(t^o))} \;\underset{t_p 2 P}{\Upsilon}\; \frac{\text{sign}(g(\hat{x}(t_p)))}{g(\hat{x}(t_p))} \;\underset{t_p 2 P}{\Upsilon}\; h k \hat{x}(t_p) \,¡\, \hat{x}(t^o) k$$

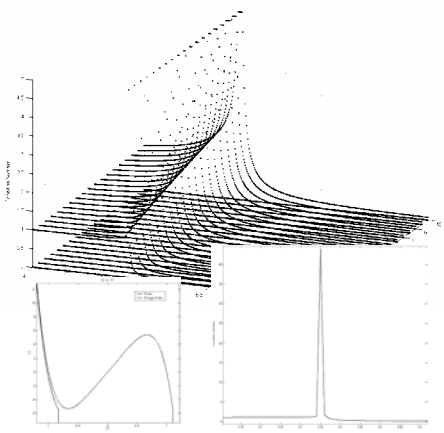
where h is the step size,

$$P = f t_p 2 R^n : \quad L_f \cdot g(\hat{x}(t_p)) = 0 \quad \frac{d}{dt} L_f \cdot g(\hat{x}(t_p)) > 0 g$$

and $L_f g(x)$ is the Lie derivative of f with respect to g, and is given by

$$L_f g(x) = \frac{@(x)}{@} ¢ f(x):$$





Aftermath and Analysis

- SIPHER
  - Several students expressed desire to continue into graduate school
  - One undergraduate from VU has continued on as an undergrad research asst.
- Summer 2003
  - Daniel Balasubramanian joined ISIS as a graduate student as a direct consequence of SIPHER 2003
    - Is now working on graph-rewriting technologies

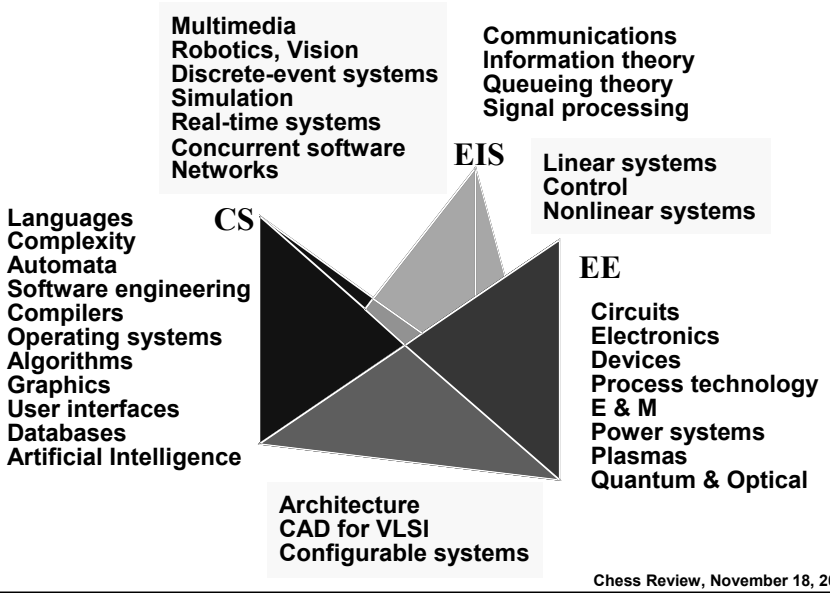
Aftermath and analysis

- SUPERB
  - Both graduating seniors are applying to graduate school
    - Recommendation letters forthcoming
  - 2/3 projects continuing to be investigated at Berkeley
  - Comments reflecting new respect for discipline, and appreciation in general

"I had no idea it was so important to be able to talk about my research on short notice..."

"Your jokes and easy to follow instructions made a huge difference in the whole process- thanks."

Education Outreach Efforts Centered on Bridging EE and CS



Progress/Success to Date

- Cal State Hayward has agreed to offer a pilot course.
  - Has taught the EECS 20 course (Introduction) and will teach it again this year, using the Lee & Varaiya book
- San Jose State
  - Ping Hsu – Senior-Level Embedded Control Class

Industry

- Organized training for industry
  - ESCHER consortium
  - Modeling and metamodeling technologies covered
  - Boeing is using GME tool
- Object Management Group (OMG) meeting
  - Software Industry exposure to MIC concepts
  - http://www.omg.org/news/meetings/mic2004/