Artbotics: Challenges and Opportunities for Multi-Disciplinary, Community-Based Learning in Computer Science, Robotics, and Art

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University + art gallery + HS collab

CS + art + social sci fac

A university course

A high school after-school program
University course structure

✓ U-grad course first offered spring 2007
✓ Gen-ed credit in Technology (for art students)
or Studio Art (for tech students)
✓ Two 75-min lectures + one 75-min lab per week (2 sections offered)
✓ Three fac + museum educator co-teaching all classes and labs
A project-driven course

- Super Cricket as core technology
- Warm-up labs
- “Electrifying!” gallery opening March 3, 2007
- In-class artist presentations & reflection papers
- Lab co-located with HS program
- 2nd, final project at end of semester
Challenges & successes

✓ Diverse student population — major, year
✓ Large time commitment req’d from all
✓ 2nd project — why?
✓ Best results: students who liked taking risks, able to self-manage a large project, enjoyed group work
Computer science content goals

- Imperative programming: functions, args, return values
- Real time systems: sensors, actuators, control loops
- Agent-based models of computing
- Computing in a variety of fields
Analyzing student project work

- ✔ Simple control of 2-wheel robot
- ✔ 6-sensor interactive desk lamp
- ✔ Multi-cricket musical band
Simple: Procedures only

to main
note 79 6
note 79 2
note 119 2
note 79 2
note 79 10
a, thisway setpower 8 onfor 55
wait 2

etc. ... more of the same for a total of 52 lines
wait 1
note 54 2
note 54 10
a, thisway setpower 8 onfor 55
end
whadyalookinat interactive lamp

Lamp head follows the viewer using an array of 6 distance sensors; when viewer gets close, bulb turns on
6-sensor decision loop

```plaintext
loop
[
  setmaxi 10
  getaves
  if aave > (maxi + pad)
    [setmaxi aave setposloc posa ]
  if bave > (maxi + pad)
    [setmaxi bave setposloc posb ]
  if cave > (maxi + pad)
    [setmaxi cave setposloc posc ]
  if dave > (maxi + pad)
    [setmaxi dave setposloc posd ]
  if eave > (maxi + pad)
    [setmaxi eave setposloc pose ]
  if fave > (maxi + pad)
    [setmaxi fave setposloc posf ]
  ifelse (aave < 15) and (bave < 15) and (cave < 15) and (dave < 15) and (eave < 15) and (fave < 15) [ a, off ] [a, setpower 8 on ]

  servo 7 posloc
]
```
MUSIC project with xylophone
Xylophone’s state machine

```
; to main
setnextnote 1 ; start with first note of song
loop [
  if sensora < 24 [song]
]
end

to song
; song plays the current note, adds 1 to the note var
; when looped plays the entire song and restarts
  if nextnote = 1  [lo_a setnextnote nextnote + 1 stop]
  if nextnote = 2  [lo_e setnextnote nextnote + 1 stop]
  if nextnote = 3  [lo_c setnextnote nextnote + 1 stop]
  if nextnote = 4  [lo_b setnextnote nextnote + 1 stop]
  ...
  if nextnote = 29 [hi_c setnextnote nextnote + 1 stop]
  if nextnote = 30 [lo_a setnextnote 1 stop]
  setnextnote 1 ; shouldn't get here
end
```
Concluding remarks

✓ Challenge to teach to curriculum & do projects
✓ Projects take lots of time from students & fac
✓ Good students thrive in open-ended, project-based learning environments
✓ First entry-level project class in our CS dept
✓ There is real CS content in the better projects, but it’s hard to predict how it will emerge