Arts/Tech Collaboration with Embedded Systems and Kinetic Art

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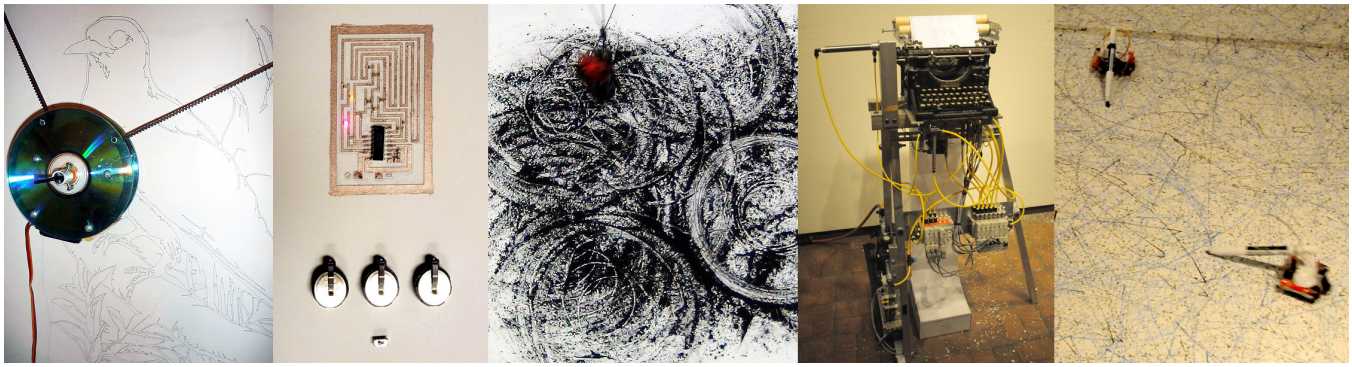

Figure 1: *Examples from the collaborative Embedded Systems and Kinetic Art class at the University of Utah. From the left they are:* Suspended Drawing Machine *(plastic, timing belt, pen, motors, computer control),* Homespun Technology *(conductive paint, LEDs, batteries, and IC),* Drawbot *(motor, battery, piano wire, graphite powder),*Underwood 1910 *(metal, typewriter, pneumatic actuators, computer control), and* Cars *(radio-controlled cars, white board, dry-erase markers, computer control)*

1 Abstract

The definition of "computer graphics" as used by artists in new media and kinetic areas of the arts is much more expansive than simply rendering to a screen. A visit to the SIGGRAPH art gallery, for example, will showcase a wide variety of uses of computing, embedded control, sensors, and actuators in the service of art. Kinetic art using embedded control is a marriage of art and technology. Artistic sensibility and creativity are required for concept and planning, and computer science and engineering skills are required to realize the artistic vision [Candy and Edmonds 2002]. However, these different skills are often taught in extremely different parts of a university campus.

As an attempt to bridge this gap, we describe a cross-disciplinary collaborative course that pairs computer science students with art students to engage in joint engineering design and creative studio projects. These projects combine embedded system design with sculpture to create kinetic art. We believe that this is a natural pairing of two disparate disciplines, and one that provides distinct educational benefits to both groups of students [Brunvand and Stout 2011].

Kinetic art contains moving parts or depends on motion, sound, or light for its effect. The kinetic aspect is often regulated using microcontrollers connected to motors, actuators, transducers, and sensors that enable the sculpture to move and react to its environment [Malina 1974]. But, distinct from other types of computer art, the computer itself is usually not visible in the artwork. It is a behind the scenes controller. An *embedded system* is a special-purpose computer system (microcontroller) designed to perform one or a few dedicated functions, often reacting to environmental sensors. It is embedded into a complete device including hardware and mechanical parts rather than being a separate computer system.

In the project-based semester-length class we describe in this talk computer science students work together with art students to build collaborative kinetic art pieces. Students explore interfacing of embedded systems with sensors and actuators of all sorts, along with real-time/interactive programming techniques and interrupt driven system design. By requiring that the project groups include both engineers and artists, the students contribute to their own learning and creative growth through peer teaching. Learning to communicate across disciplines, and perhaps just as importantly respect each other's skills and contributions, is vitally important for successful collaboration.The students also explore physical and conceptual aspects of machine-making as a fine-art sculpture process. The resulting artworks often make marks (produce physical "computer graphics") as a part of their artistic function.

Our collaborative course builds on the powerful connection between embedded control and kinetic art. This pairing seems like a natural fit, and one with high potential for intriguing results. Engineers are rarely taught to think about artistic, conceptual, and aesthetic outcomes, and artists are not usually taught to think about engineering issues in creating an artistic artifact. The studio model is an intriguing model for more general CS education [Barker et al. 2005], but it is perhaps best experienced in a true studio course. A focus on design thinking also seems to us to be a natural complement to computational thinking.

References

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