Light Sensor Piano

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ABSTRACT
Generally speaking, there is only one way to play the piano, but musicians have more and more creative inspiration to present. So, how to change the way of playing the king of musical instrument - piano will be an issue. Now I try to use one Arduino board and photoresistor to get more gesture information from performer. Then we could add creative elements to music or control piano by light and shadow; and further, we could play the piano no need to touch. It will enhance musical performance.

1. INTRODUCTION
There are 52 photoresistors on the keyboard of light sensor piano. They generate data by changing brightness. And brightness changing is related to hand gesture. So we could wave a hand to show more detail of music. Light sensor piano can be played as a normal piano. It gives players not only a normal feeling, but also an extensive creative space.

2. RELATED WORK
Arduino boards are used to analyze the signals. They read the photoresistors value and send information to the computer. Then we can use software such as Max/MSP and Pure Data to do various applications.

3. DESIGN
It is not easy putting infrared sensor into any key. But we know inverse-square law that means brightness is inversely proportional to the square of the distance. So we could get distance information by simple calculation. Then, I used light sensor instead of distance sensor.

Inverse-square Law

\[
\text{Intensity} \propto \frac{1}{\text{distance}^2}
\]

In order to give players a nice feeling when playing a light sensor piano, I grinded key top. Put the photoresistors near key front for the best efficient. Make wires along natural to the bottom of piano.

4. IMPLEMENTATION
Light sensor piano could be divided into two main parts, keyboard and electric circuit.

4.1 Keyboard
Cut off every key top from standard piano natural.

Improving the transmission, I grind transparent acrylic to be new key top. Grinding arc is a strict work. It is hard to be accurate and precise. This is the key to getting nice touching feeling for players.

Cut off wood from natural to put light sensor into it.

Place wires and photoresistor in the natural.

Cut off wood by small circular saw for better quality.

Stick transparent key top on the natural by white glue, because it will be transparent, too.

Key top finished product. There are 7 types white keys.
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A space for a photoresistor.

There are 7 types white keys.

Key top finished product.

Stick transparent key top on the natural by white glue, because it will be transparent, too.
rate in it. Moreover, it can do simple calculation. But in general speaking, we would control data in application software such as Max/MSP for convenience. These are going to put into key bed.  

4.2 Electric circuit

Luminosity monitor windows in computer. Yellow bars are set as brightness. (A shadow on the fourth key)

5. Application

With brightness changing parameter, we can do more exciting performances just use a flashlight. Light sensor piano can detect approximate location of hand, so it could be used to make a dazzling show. And it might be a great tool in music education. More software for light sensor piano in the future, it will be a powerful music instrument.

6. REFERENCES


For the purpose of increasing input channels, I used expansion board and breadboard with Arduino. Made it into a parallel circuit let every key work independently. And the series resistors avoid damage.

Arduino sent value to software from USB serial port, so we could use data conveniently by only one A/B type USB cable.

Open-source Arduino environment is easy to write code. We could set up wiring plan, timing, and transmission

TEACHING COMPUTER SCIENCE TO DIGITAL ARTISTS THROUGH MUSIC AND SOUND

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Critical Studies

ABSTRACT

This paper describes the development of an introductory curriculum in computer science modeled on a traditional Applied Introduction to Programming and Algorithms course sequence, but designed specifically for artists as a means of furthering their creative work. Computer science theory is presented in lecture/demos, with weekly assignments that consist of making 30-second compositions incorporating the skills gathered from class. With this project, our goal is to improve the quality, breadth, and effectiveness of technology and computer learning for an entire undergraduate and graduate art school student body. A broader objective of the project is to develop an experimental, trans-disciplinary model for teaching computer science curriculum that can be replicated at other arts institutes, and extended to students in similar non-traditional computer science contexts.

1. INTRODUCTION

As artists of all disciplines increasingly use technology in their creative practice, it is essential that arts institutions provide foundational courses in STEM (Science Technology Engineering and Mathematics) disciplines so that students may conceive of and have the ability to generate new ideas, new artistic approaches, and new technologies. For contemporary artists, adequate knowledge of technological trends and hands-on experience with technology can be crucial for career success. This paper describes a curriculum that addresses this need and offers students more than basic computing literacy—that is, they learn algorithmic techniques, programming, and problem-solving in a student-friendly manner and within a context that inspires engagement, interactivity, and creativity.

The intellectual merit and broader impact of the project lies in the innovative approach to introducing students with little or no computing background to programming and computational thinking. While there has been significant work in developing CS curriculum for non-majors or novices, there have been fewer courses in the area of sound and music. Additionally, the proposed course features Chuck [1] as a primary teaching tool. Chuck is an open source programming language for real-time audio synthesis, composition and performance developed at Princeton by Ge Wang and Perry Cook. This project represents the first formal Chuck-based curriculum developed for undergraduate art students, and has potential to be applicable to and replicable within an array of contexts for teaching introductory computer science to undergraduates and even graduate students. Additionally, it could be appropriate for high-school students in certain contexts.

In creating this curriculum, our team seeks both to enrich the ability of our students to create technology-driven art and to develop new and engaging instructional approaches to the incorporation of STEM learning into arts education.

Heavily inspired by the curriculum designs of Plork[2] and SlorK[3] the goal of this project is to bring Chuck beyond the laptop orchestra and into a classroom for all digital artists who can use the strengths of the language to make art, and learn key computer science concepts. In this paper, Section 2 discusses related work on computer science education through the arts. Section 3 discusses syllabus and learning outcomes for our new course. Section 4 presents evaluation of the first implementation of our course in Fall 2012 at California Institute of the Arts. Section 5 presents discussions and future work.

2. RELATED WORK

There have been several successful curriculum designs at the intersection of computing and the arts for undergraduate students. The University of Massachusetts’ CPATH CP Performatics is an interdisciplinary project that developed a series of CS courses. Bringing together faculty and students from computer science, arts, and humanities departments to build connections and community between computing and the arts at the school.

Bryn Mawr College, in partnership with Southern Methodist University, developed a new visual Portfolio based CS1 course based on the programming environment Processing, with the goal of creating an inspiring and engaging CS course for novices and non-traditional programmers such as artists.

Both of these projects are related to and serve as inspiration for our project, with a primary distinction: the aforementioned projects use the Processing language to teach visual graphics integrated with computer science education, while our project is primarily based in audio and music. We endeavor to focus on sound and music teaching Chuck: student learning and assignments are sonically oriented.