NeonDough: Crafting with Interactive Lighted Clay

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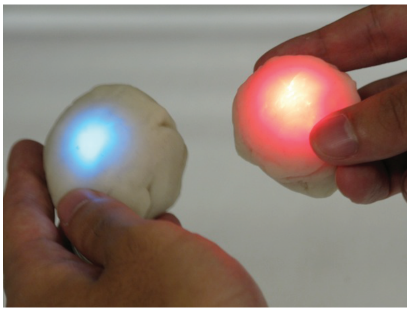

Figure 1: *NeonDough*

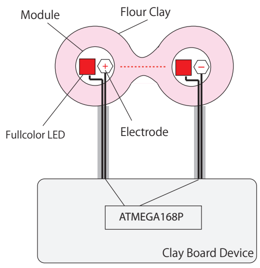

Figure 2: *System Design*

Figure 3: *Examples of Crafts*

1 Introduction

From childhood, we often play with clay to learn and enjoy formative design. In clay crafting, we believe that color arrangement on the clay is one of the important elements as well as forming shapes. However, since the colors of normal clay are static and it is not easy to change them in contrast to its flexible form. Toward a resolution of this issue, we propose a novel clay interface named NeonDough which is clay crafting with glowing clay. So far, there have been various studies aiming to support creative activities of children using educational toys that contain electronic circuits (e.g. [Raffle et al. 2004]). As one of typical interfaces which focused on clay material, Illuminating Clay [Piper et al. 2002] uses a laser scanner to detect the shape of the clay and projects images onto it according to the input. In this approach, sensors and display devices need to be located at the exterior of the clay. On the other hand, Squishy Circuits [Johnson and Thomas 2010] is a related work of our research that utilizes the electric character of conductive dough. While Squishy Circuits mainly utilized the conductive dough as alternated wires in electronic circuits, our NeonDough works as both input and output tools themselves.

2 NeonDough

NeonDough is conductive clay which contains a module that consists of electronic circuits and a full-color LED. As the clay material, we use flour clay that is made of salt and water and has high electro conductivity. In addition, the flour clay is also suitable for this interface since it diffuses the light of LEDs effectively. Each module is connected to a hub device in the shape of a clay board that can measure resistance values between every two modules.

By sensing the resistance values, this system can detect and estimate various states of clay with these modules. Firstly, as shown in Figure 2, when the user combines two pieces of clay, the system can detect the connection since an electric current initiates between these modules' electrodes. Secondly, according to the change of resistance, this system can estimate the distance between modules when they are pushed together. When the user stretches apart the clay, the resistance value gets higher gradually in proportion to the distance and thinness of the clay between these modules.

The LEDs installed in each module can change their brightness and colors dynamically and interactively according to these states information of the clay. In addition, note that cables are removable after the clay is formed since batteries are included in the modules.

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3 Applications and Future Works

As a typical application of NeonDough, we have developed an application that enables users program the light's glowing pattern and colors with simple ways such as combining different colored glowing pieces of clay or stretching them. More concretely, for instance, by pressing pieces of red and green clay together, it becomes an orange color; while stretching pieces apart changes the color gradually, eventually returning to their original color by separation. Furthermore, for supporting practical creations, we implemented a lock function which maintains the clay's blended color after separation, and a blinking function which adds a blinking pattern to the LEDs. Crafts made by participants of workshops using NeonDough.

As another approach, we developed several interactive applications by attaching various output devices to the module in addition to the LEDs. For example, by putting vibration speakers, users can play music with connecting, merging, stretching apart pieces of clay. By attaching a servo motor in the modules, users can partially move clay characters such as a hand or foot in the same way. We believe that these diverse outputs and inputs of NeonDough make much more novel representations achievable in the future.

References

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