
Water Table - Utilizing Flowing Water as an Input Mechanism

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Abstract

In this paper, we describe our on-going work on using flowing water as an element in an interactive system. We present the Water Table, a table based installation where the user places their hand in flowing streams of coloured water to adjust the colour of a merged stream of water. The design of the piece has been modelled on a real river in northern Finland, and seeks to provide an environmental connection to the interaction.

Author Keywords

Water; design; tangible user interfaces.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

Tangible user interfaces provide designers new possibilities to experiment with different materials and emphasize holistic design and product aesthetics, when compared to conventional computing interfaces. These interfaces can use non-conventional material, for instance objects from nature, as part of their design and thus provide experience rich and thought provoking interactions.

In this workshop paper, we introduce our on-going work where flowing water is used as an active element in user interface design. Our design derives its inspiration from nature, more particularly from rivers and streams. In the current version (Figure 1), we present a tangible UI installation where the user manipulates water streams with their hands, to trigger lighting effects. Our future plan is to combine this interactive installation with environmental sensors, to collect contextual data in-the-wild. The target is to create an interactive, experiential information art for environmental awareness.



Figure 1: The Water Table installation

Related Work

Examples of using water as part of a user interface are quite scarce, but not unheard of. Raffe et al. have described a design space for bodily interaction with water [8], and in [4] a design space for different properties of liquid UIs and for manipulating liquid is introduced. Materiality and the tangible properties of user interfaces have lately gained an increasing amount of attention, and water has been described by earlier studies as creating rich sensory feelings, provoking emotions and associations, and facilitating playfulness [1, 6]. Focusing on its mercurial and vivid properties,

water can be used as part of ephemeral UIs that are formed for a short duration and do not last [2].

Examples where water has been used as part of a UI include Splash Controllers for gaming, where handling of the water in containers is detected as an input [3]. The AquaTop system introduces projection on a water container, where versatile effects are created by manipulating the water and pushing hands and fingers through the water surface [10]. Richter et al. shoot jets of water to the hand as UI feedback [9], and in Häkkinen et al., interaction is done by turning a wet stone ball resting on a water fountain [6].

Works demonstrating the use of (models of) natural 3D formations as part of an interactive system have earlier been demonstrated e.g. in IllumiClay [7], where sand is manipulated to create landscape forms. In comparison, our aim is being interact and augment models of water flow formations, with a rather more abstract visualisation output.

Water Table

Interaction

The Water Table installation consists of 2 source streams of flowing water, which merge together to form a single output stream. One of the source streams is illuminated with red light, whilst the other is illuminated with blue light. The combined output stream is illuminated with a colour depending on the amount of water flow from each of the source red/blue streams. Users of the installation can adjust the colour of the output stream by blocking the water flow from one of the source streams with their hand.



Figure 2: Interacting with the Water Table – restricting the flow of water from the red source stream, reduces the amount of red in the colour of the output stream.

Technical Set-up

The interactive Water Table installation consists of large table surface (150x80 cm) with a shaped acrylic water basin or trough embedded. To connect our design with nature, we aimed to create a water flow that would resemble the natural flow of a river. Thus, we utilized

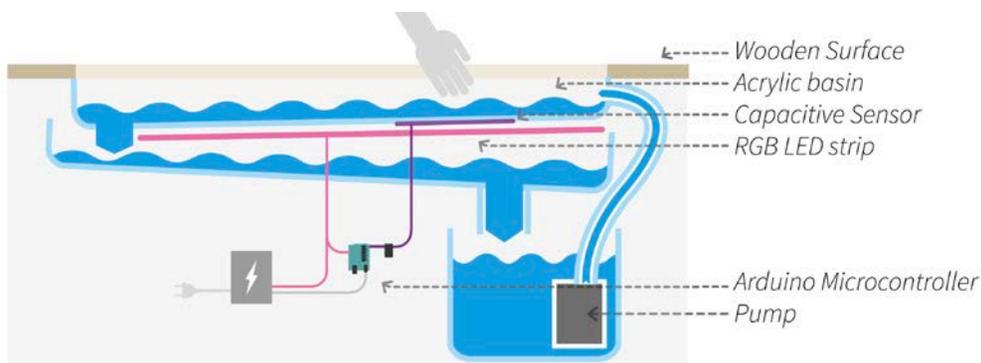


Figure 3: Functional elements of the Water Table (side view)

LIDAR data from the local Lemmenjoki river to create a natural river shape for the water trough. For the installation, the LIDAR data mesh count was reduced and scaled vertically to provide better and smoother flow of water on a smaller scale. The trough was then vacuum formed from 4mm opaque acrylic sheet.

All the electronics and functional components of the installation are hidden inside table structure (figure 3). An aquarium pump was used to provide a constant water stream to the "river", and water was circulated from a 20 litre tank placed underneath the table. The pump used (Eheim compact+ 3000) provided an adjustable pump output (up to 3000 litres/hour) and was very quiet in operation.

Capacitive sensing was used to measure the approximate amount of water flow restriction from each source stream. Two conductive ITO (Indium Tin Oxide) coated PET plastic sheets were attached to the underside of the acrylic bowl to detect the capacitance of the user(s) hand/fingers when touching the water. The ITO coated sheets were connected via a MPR121 Capacitive Touch Sensor board to an Arduino microcontroller. A five meter strip of addressable RGB LEDs was placed around the underside of the acrylic trough. The area surrounding each of the source streams was constantly illuminated (red or blue), whilst the colour around the output stream was adjusted depending on the approximate balance of red/blue flowing from the source streams. The light dispersion caused by the opaque acrylic water trough, created the effect that the flowing water itself was coloured and a colour blend could be created dynamically through the interaction.

Discussion

The Water Table was exhibited at Milan Design week 2017 as part of the University of Lapland *Vaana* exhibition. The piece drew much interest from visitors, who generally commented on the tangible aspects of placing their hand in water and feeling the water flowing through their fingers as positive aspects of the design. As future work we plan to extend the concept to enable the visualisation of and interaction with real-time environmental data.

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