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Interactive Digital Media Design for Active Communication in Public Spaces: Concept of BANDI

Abstract

'Interactivity' is all around us all around the world, with the rapid growth of new forms of media. The dictionary defines 'interactivity' as the extent that a computer program and a human being may a dialog with one another. [1] However, the meaning of interactivity is different depending on individual fields such as information science, communication and industrial design. This work defines the meaning of interactivity, as the communication between human and human, or human and artifacts. Based on this premise, this research attempts to understand interactivity and explore the possibility of applying interactivity into public space. Ultimately, this research proposes a unique concept which allows people to express their own emotions by LED lights while in a public space. This installation of light allows participants to change the atmosphere of space depending on the state of the participant's mind. The delivery of this work includes the final model image, the use scenario and operation movie by prototyping model. This research was conducted following the process which includes the understanding of interactive space and proposing a unique concept through development by ideation and prototyping.

1 Process

This research was obtained by employing the following procedures. A) We tried to understand the change of perspective on space and the investigation was carried out on influential artists, their works and their perspectives. B) The case studies were conducted to better understand and explore the possibility of applying interactivity into open spaces. C) The related studies inspired the generation of the final concept of our work. D) This study defined the final concept which is communication through interaction and we developed and formulated the possible situations while making a prototyping model. E) We developed the final model, scenario, applications and other applications of LED light installations around the world.

2 Concept

This study focused on interactivity which requires people to participate actively and we gauged the responses that lead them to create an atmosphere for active communication. To prepare out research goads we read the book "Public Space" by Stephen Carr [2] in which the author describes the needs that public spaces fulfill: (a) There is a passive engagement with the environment, when we simply observe the activities of others (b) There is an active engagement through intellectual challenges posed by the public space, or through interactivity with the people in it; and (c) There can be an excitement of novel discoveries within the space. It is this third need where LED lighting is often used to redefine both the space and the purpose of the space. An often underused resource in public spaces – LED lighting displays – can be used to stimulate these needs. [4]

The following paper argues for a new vision and explores how public LED displays can stimulate such essential needs in public spaces. We have included descriptions and the conceptualized processes that occur around public displays, based on observations of people interacting with a publicly fielded LED display application in a city center. Conceptualization is meant to lay the foundations for designing engaging public display systems that LED displays can and for supporting the analysis of existing deployments.

The aim of the final concept of 'BANDI' is communication with lights. The word BANDI means firefly in Korean. [3] People can set the color of lights depending on their mood, and the light remains. People leave a trace with lights, and the color of each light works as a medium for expressing people's emotion and feeling. Finally, the lights allow people to communicate with others indirectly.

BANDI has two meanings: A) The first meaning is that the lights created by individuals mingled with one another and together they work in a harmony. Each individual then becomes one with another as individuals express their own feelings. B) The second meaning is to change the atmosphere of installed space by participants. People have the control to change the atmosphere of space depending on their own emotion. This means that individuals and the surrounding space each have an influence on one another.

3 Scenario

BANDI is situated on a park or public space. It emits lights from an input point on the side as well as from the top where the lights slowly twinkle. When a person touches the input point, the small light changes color while the hand is on the point. Once the person moves their hand away, the light rises slowly toward the top. As the rising light ascends to the top, the light already on the top gradually changes its color to the color of the rising light as the person intended. The detailed scenario is as follows:
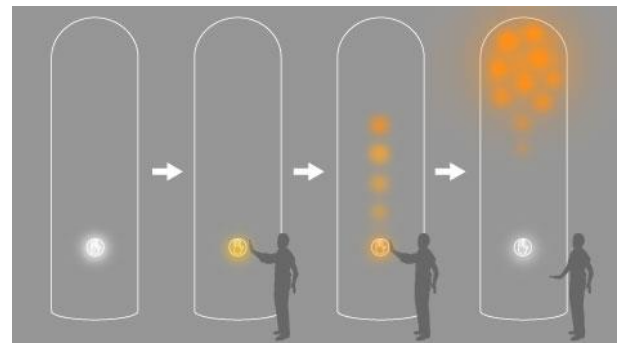
Figure 1 How to interact with BANDI

BANDI emits a small ambient light that twinkles very slowly and smoothly from the touch point on the side so as to draw the people's attention and stimulate their curiosity. The original white color can be modified by people. When a person approaches BANDI, he or she will see a life-size hand-shaped icon on the contact spot which could attract people to touch or place their hands on it. While the individual is touching the light, it becomes brighter than the default and begins to change its color. The color changes circularly from red to orange to yellow, to green, to blue, to purple respectively. The last color is determined as the participant leaves his or her hand. When meeting a favorite color from the circulation, a participant may take away his or her hand from BANDI and at the same time the light slowly rises toward the top of BANDI, shining with the favorite color. It moves smoothly and leaves short dimming traces. As the rising light arrives at the top, the color diffuses around the upper side and the small light becomes a bigger and brighter light that shines around BANDI. The light on the top would remain with the color that the last participant made until another light is made by the next participant. If there were another emitting color already at the top before the small light arrives, the small one would be gradually mixed with the previous one. People can see the harmony between those two colors and experience the smooth color replacement. After the replacement of color in upper light, a new small light emerges on the touch point, which is a starting point, and it twinkles again. In one BANDI, there can be more than 2 touch points on the body. People can create various situations with lighting; e.g. each light can start at the same time and more than 2 colors can be mixed at once.
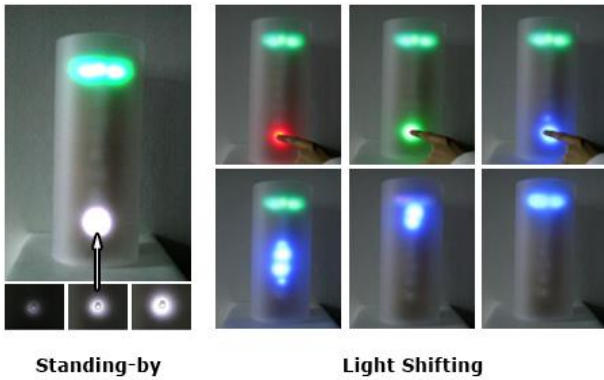
Figure 2 Prototype of BANDI

4 Components

BANDI is made 3 components: a lighting system, a control system and a frosted glass cover. The lighting system of BANDI is mainly composed of LED lights.[3] One LED bunch is made of 3 LEDs; red, green and blue. The combination of the 3 lights makes various colors and can also be divided into 3 factors: A) a touch place LED, B) a moving LED line and C) LED cluster. The touch place LED is a starting point of light and it can emit white color when BANDI stands by. The moving LED line is a row of the LED bunches and light shifts along the row. It works as a bridge between the touch place LED and LED cluster. The LED cluster is the destination of the shifting lights. It is at the top of the BANDI. Due to the amount of LEDs in the cluster, this part shines brighter than any other LEDs and that makes BANDI a public streetlight.
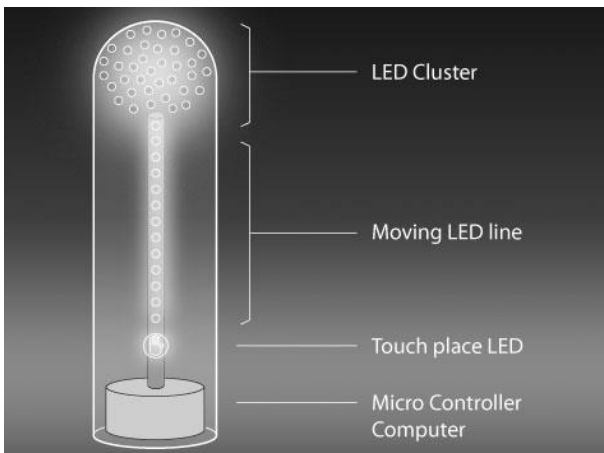

Figure 3 Lighting system of BANDI; there are 3 components

The control system of BANDI is composed with a touch sensor and a micro controller. The touch sensor detects people's hands and sends signals to the micro controller which controls LEDs whether turning on or off. The frosted glass cover shows the whole exterior of BANDI and it is because of this people cannot see the inside clearly but the light from the inside can be diffused dimly.

5 Technologies

BANDI is controlled by the Arduino [4] which is a micro controller board. This board senses electronic pulse from various sensors and controls electronic signals as outputs so that it can realize physical computing.
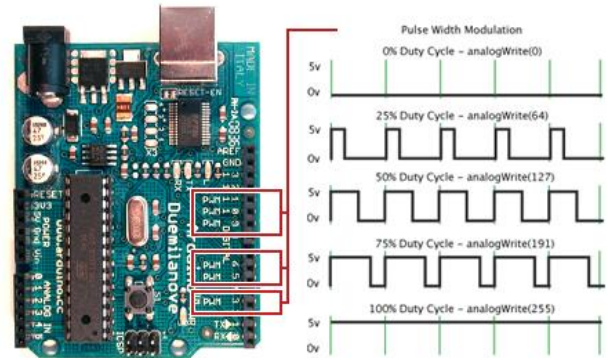

Figure 4 Arduino board and the principle of PWM.

To control the intensity of LED lights, we used analog signals. It can be controlled by 'Pulse Width Modulation' (PWM) pins on the Arduino. PWM pins are used for both mixing RGB colors and dimming lights. The compound of RGB light intensity, which is regulated by input voltages, makes color variations. The degree of voltage also decides the entire brightness of the LED bunch.
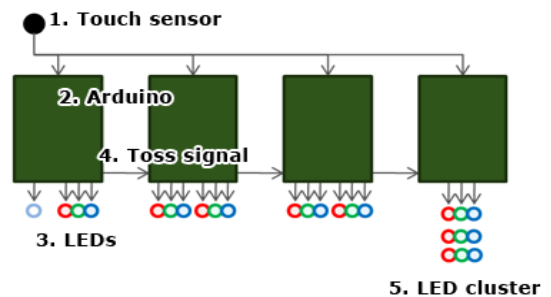

Figure 5 Working order in controller system

More than 2 Arduinos are connected to one another. To control the numerous LEDs, we had to use numerous PWM pins. A problem arose because there were 6 PWM pins in the Arduino. (Arduino Duemilanove/328) To address this problem, we made the Arduinos work by connecting them one after the other.[5] The Arduino controls the white LED under the touch sensor to twinkle slowly in a stand-by mode. When the touch sensor of BANDI detects the hand, an Arduino begins to change the LED color beneath the sensor. the same time, all Arduinos receive the signal and calculate the color of LED until people lift their hands off. Once the sensor's signal has cut, that means hands-off and the Arduino begins to brighten the LED bunch next to the one beneath the sensor. When a LED bunch has turned on completely, the Arduino begins to

Figure 6 BANDI installed at Public Square

brighten the next one in order. If the next one is controlled by the next Arduino, the previous Arduino tosses the signal that awakes the next Arduino. This process is repeated until the last Arduino gets the tossing signal. The last Arduino brightens the LED cluster on the top of BANDI and keeps the light up until a new light arrives. At the time, the RGB number codes would change toward the mean value between their RGB codes. To detect the hands touching BANDI, an infrared ray (IR) sensor (OSG-105LF) is used. It can detect objects within 0.8mm~1.2mm. An emitter and a receiver are attached side by side and the receiver detects IR which has reflected from an object in front of the emitter. The size of the sensor (2.7 mm x 3.2 mm x 1.4 mm) is small enough to bury.

6 Application
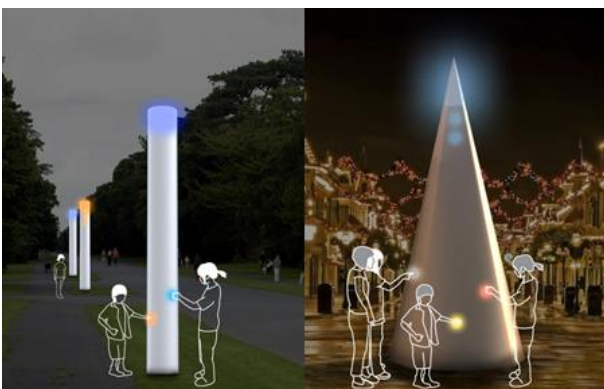
Figure 7 The images of BANDI installed as street lights

The BANDI can be changed depending on the space where it is going to be installed. The final model for our research is 4 meters high and cylindrical. The shape of BANDI can be other shapes in addition to cylindrical. It can be modified into various shapes such as corn, cube, pyramid and/or tube. The height of BANDI could be different depending on the space, from 4 meters or above. When many BANDIs are installed at regular intervals in a public park or on the side of the street, they can work as an interactive streetlight. In the case where BANDI is installed in a public square during the Christmas season, the corn shaped BANDI appears as an interactive Christmas tree.

7 Other Applications

I. A case study on voice-activated light show in NYC's Park Avenue tunnel:

Figure 8 Voice Tunnel

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As part of New York City's Summer Streets event series, artist Rafael Lozano-Hemmer has transformed New York City's Park Avenue Tunnel into "Voice Tunnel," a sound and light installation that is activated by the voices of participants. The installation consists of 300 lights and 180 loudspeakers which are placed throughout the 1,400-foot-long tunnel. Participants are invited to speak into an intercom placed at the tunnel's center—the participant's voice is then added to a sound loop that plays through the loudspeakers and is synced to the lights. "Voice Tunnel" is open during the remaining Summer Streets events, August 10 and 17, 2013. [5]

II. A case study of LED lights at Longwood Gardens in Pennsylvania:

Figure 9 Longwood Gardens

LED lights that respond to bodily movements and choreographed bursts of light emerging from a tree are but a few of the light installation exhibits on display at artist's Bruno Munro's light installation project at Longwood Gardens in Pennsylvania that debuted in the spring of 2012.[6]

III: A case study in Sydney Australia, Color the Bridge:

Figure 10 Color the Bridge

A project called "Vivid Sydney" is one in which the city's landmarks and cultural centers are awash with swathes of color. The Sydney Harbor Bridge has been turned into an interactive light sculpture. This has been a work in progress for the last two years. [7] Color The Bridge was created by production company 32 Hundred Lighting in partnership with Intel, and has turned the arching steel into a huge sculpture that can be seen from miles away. It covers western facade of the bridge with 2,000 LEDs and over half a mile of fiber optics. [7] The light display is controlled by the public who can choose from a palette of colors using a large touchscreen and a simple interface. It is open to the public to create their own unique "painting" and watch as it springs into life on arches of the bridge. [7]

IV: A case study of E-Static Shadows, Beijing:

Figure 11 E-Static Shadows

″E-Static Shadows" by Zane Berzina and Jackson Tan. The lights respond to viewers' static electricity by turning on and off as you wave your hand over them. This interactive installation explores the speculative arena of electrostatic: its possible readings in relation to human interactions within physical space and the poetic potential of static electricity surrounding our everyday lives. The project proposes a reflection on the energy resources of our planet and investigates the human body as a generator of energy. By doing so it also advances the potential for technology that allows us to interact with the omnipresent but hidden electrostatic forces. [8]

V: A case study of Dune, Rotterdam:
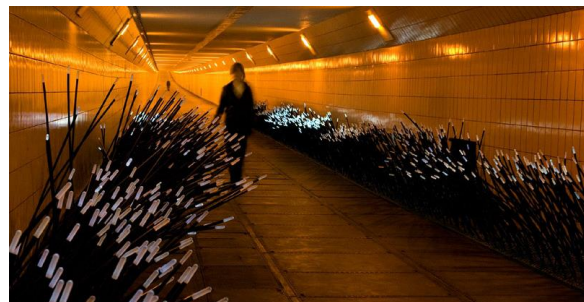
Figure 11 Dune 4.1

DUNE is the public interactive landscape that interacts with human behavior. This hybrid of nature and technology is composed of large amounts of fibers that brighten according to the sounds and motion of passing visitors. Evolving through several contexts DUNE 4.1 enhances social interactions in the public pedestrian Maastunnel, commissioned by the Rotterdam City of Architecture. The 60 meter permanent DUNE 4.2, situated alongside the Maas River in Rotterdam (Netherland), utilizes fewer than 60 watts of energy. Within this setting, Rotterdam citizens enjoy their daily "walk of light". DUNE X is the interactive landscape of light placed in the dark Dogleg tunnel at the 18th Art Biennale of Sydney. Filled with hundreds interactive lights and sounds DUNE investigates nature in a futuristic relation with urban space. [9]

7 Conclusion

There are many practical and artistic applications for LED light installations in projects all around the world. People are naturally attracted to beautiful lights and feel happy and pleased when they participate in something to make unforgettable memories along with others. BANDI satisfies that desire. An individual person's traces remain in BANDI and those come together later. To show the traces, we introduce a little light referring to a 'BANDI', the Korean word for firefly. A little twinkling light is on the surface and runs away when people touch it. It delivers the individual's trace with a color and diffuses it on the top. The traces of people brighten the space around BANDI. The color can be changed and mixed continuously by the people who are attracted to the BANDI.

Participation is the most important value in BANDI and interaction is a core activity amongst people. Since each person has a different taste in color and mood, he or she can change the space with BANDI and in other places around the world and enjoy the alteration. People might also feel another emotion, which is a harmony, because BANDI makes an intercession among people by combining their color traces.

The next step in researching the BANDI installation is giving individuals the chance to interact with the lights by manipulating them with their smartphones. When pedestrians scan a QR code on the Bandi, they are brought to a website that allows them to interact with the installation piece which uses interactivity by accessing the individual's smartphone in real time.

All in all, BANDI as well as other light installations in other parts of the world are a means of communication which is brightened by the participation of people. Their traces become a part of the BANDI's lights and illuminate smoothly. All of the people's minds get joined together as the light merging with other lights.

References

[1]http://dictionary.reference.com/browse/interactivity
Retrieved 11/14/14

[2] Carr, S., Public Spaces, Cambridge University Press: Cambridge January 29, 1993 pp: 2-12

[3]http://english.visitkorea.or.kr/enu/SI/SI_EN_3_
6.jsp?cid=1831483 Retrieved11/14/14

[4] http://www.arduino.cc/ Retrieved 11/14/14

[5]http://laughingsquid.com/voice-tunnel-new-york-citys-park
-avenue-tunnel-transformed-into-sound-light-installation/

[6] Murno, B., Experience Longwood Gardens in a whole new Light through the evocative and imaginative art of Bruce Munro, http://light.longwoodgardens.org Retrieved 11/25/14

[7]http://www.vividsydney.com/events/light-the-bridge
Retrieved 12/4/14

[8] http://www.zaneberzina.com/e-staticshadowsproject.htm
Retrieved 12/01/14

[9]https://www.studioroosegaarde.net/project/dune-x/
Retrieved 11/20/14