SplashDisplay:
Volumetric Projection using Projectile Beads

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1. INTRODUCTION

The prime feature of the SplashDisplay is that it uses projectile beads as a display medium that are launched from the table; this means that the tangible medium can be removed from the surface and allowed free movement in air. In current research [1] [2], displays have tended toward fixed mediums and therefore defining and visualizing explosive activity on such displays has been difficult. However, the SplashDisplay is made for this particular purpose, and given the nature of the display medium it pulls away from conventional standard surfaces. Given this trade-off, it is possible for the SplashDisplay to launch projectile beads from millimeters to meters into the air freely making it possible to attain an image 'depth' much like the Z-axis in 3D. In the simulation of 'explosions', this system launches beads into the air much like the physical phenomenon, making the projected object 'feel' like it actually exploded (Figure 1). As the beads are white in color, it is possible for these beads to act as a display backing. When the system is still, then the beads play the role of a stationary screen; once the beads are in air, they can still be recognized as 'screen' material. If light is projected onto these airborne beads, they will illuminate as they fall, giving a 'fireworks' like effect in real time.

Figure 1: Splashed and illuminated beads in the air

2. CONFIGURATION

The SplashDisplay consists of a table that collects and holds beads, a projectile launching speaker, the speaker movement system, an IR LED and IR Camera system for input detection, and a visible light projector and two control computers (Figure 2).

The container table is 900mm by 600mm and built on top of a net with a lattice distance of 1mm. Settled on top of this net is a volume of projectile beads filled to a 70mm level, each at approximately 5mm in diameter. Below the net is a single speaker installed to use air vibrations to launch the projectile beads into the air, this speaker mounted on an X-Y table that can move the speaker freely under the container. The X-Y table consists of a stepping motor to pull a belt to shift the speaker mount. The bead surface projector is set 600mm above the container and is connected to a computer that allows for projection of images onto

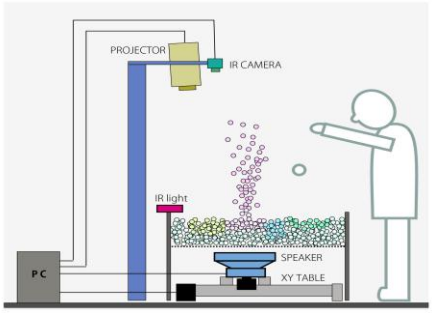

Figure 2: 'SplashDisplay' system overview

the bead's surface. In order to identify user interaction, there is an IR LED array set along the 900mm side with an IR Camera set on the top of the system.

The current system is divided into three software components. The Motor Control Program (MCP) controls the X-Y table's movements. The Image Processing Program (IPP) receives information from the IR cameras and detects an input object's position and thus can detect that object's movements. Within the Application Program (AP), the object information received from the Image Processing program and the speaker position information from the MCP is processed to activate the occurrence of an event. The event result is displayed through the connected projector and also sent through an audio cable to the mounted speaker below the net.

The speaker (260mm in diameter) is covered by a 5mm thick board with a 50mm diameter hole opening at its center to prevent sound leakage. This speaker is set to a frequency, 10Hz, which is undetectable by the human ear and blasted into the bead volume through the net through the hole opening by reverberation of the sound waves. When this occurs, the wind caused by this air pressure accumulation released out of the hole is of single vector nature. By using this wind blast, it is possible to freely create explosions. This method is preferred for the effect as opposed to a spinning fan. However, to obtain the effect to a substantial level the required components and construct becomes large and heavy.

Mounted on the top of the system, the USB Camera is set to receive scattered IR light. The IR light source is mounted directly opposite the user's position 50mm above the bead surface.

3. REFERENCES

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