

FOGCELL: FOG IN THE TUBE

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ABSTRACT

Fogcell is a fog-based display system based on adiabatic process happen in a bottle. To create fog in a bottle rapidly, we employed the adiabatic process in a bottle by inflating and exhausting high pressured air. High pressure in a bottle makes high temperature, and low pressure in a bottle makes low temperature causing vaporization and condensation of water molecules in the air. Our prototype consists of a tube and special exhaust valve created by 3D printing. Unlike existing fog machines, our prototype makes fog appear and disappear in a bottle rapidly and continuously.

1. INTRODUCTION

Fog is a natural phenomenon that occurs when the water vapor in the air is saturated. The fog machine is used as a system to generate fog for the use of performances or entertainment parks. In previous researches, they are used as a media of computer screen such as 3D screen[1] and fog in a bubble as a tangible display[2].

An 'Ephemeral User Interfaces' [3] is a concept of a user interface with the ephemerality of materials. However, the computer media by which to purposely control the appearance and disappearance of the fog itself is not implemented yet. In this research, the appearance and disappearance of fog in a tube occur rapidly in an intended manner. This system realizes a basic concept of the ephemerality of materials.

2. FOGCELL: FOG IN A TUBE

A fog machine is one of the most popular ways to create artificial fog. It makes fog by using special fog liquid and slowly creates robust fog in the air which stays for few minutes. This characteristic of fog machine means it is hard to control appearance and disappearance of fog when needed. In our installation, fog in a tube appears and disappears instantly. High pressure in a tube makes high temperature, and low pressure in a tube makes low temperature. These differences of temperature cause the water vapor to condense or vaporize into the water in the air.

Figure1 and 2 show disappearance and appearance of fog in the tube. Each cell has each valve to control its internal

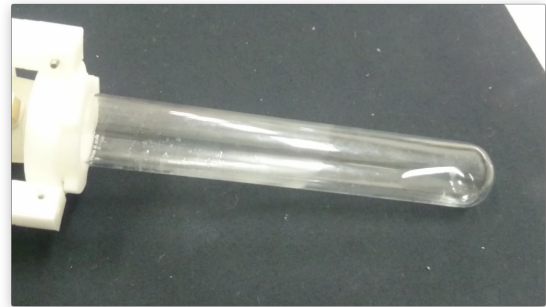


Figure 1: Tube of Default State

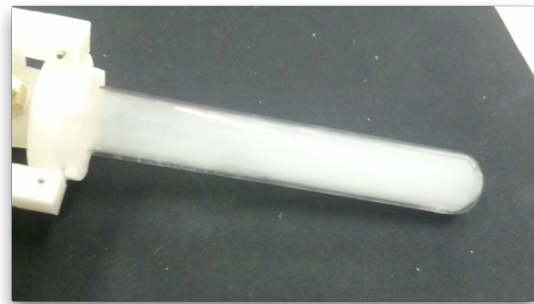


Figure 2: Appearance of Fog in tube

pressure by a program. Each cell changes its status from fogged and unfogged rapidly along with internal pressure change.

At this time, the fog spread instantly, and disappear after a while. Also, it is hard to keep fog status because a temperature of cell changes due to a temperature outside. This characteristic means that fogcell shows a natural ephemeral phenomenon.

3. SYSTEM IMPLEMENTATION

Fogcell system consists of a test tube, valves for inhaling and exhaust and a controller board. Figure 3 shows one cell of our implemented system. An air compressor for airbrush drawing is employed to charge air pressure. A test tube is a chemical experiment equipment that made of fused quartz.

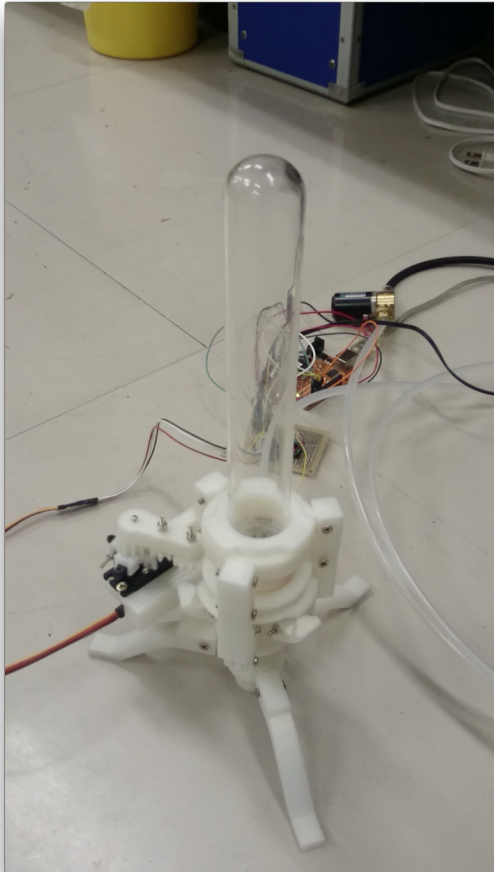


Figure 3: System of One Cell

Each tube has a valve in the exhaust and intake. We employ a solenoid valve to the air intake and 3D printed mechanism with servomotor for a rapidly exhaust system. Below explains cycle of fog appearance associated with diagrams on Figure4.

- (1) At first, an exhaust system is closed by rack and pinion mechanism with stepping motor.
- (2) After closing an exhaust system, a solenoid valve that is connected to air compressor inflates air in the tube to increase air pressure for 0.1Mpa.
- (3) The exhaust system is created by a 3D printer and attached to the tube mouth. A gear attached to a servomotor is used to open the valve rapidly for exhaustion. The exhaust valve can reduce air pressure instantaneously.

Motors and solenoid valves are connected to the PC via a driver circuit with Arduino. Our system can make fog appear in same cell 3 or 4 times in short minutes. Therefore,

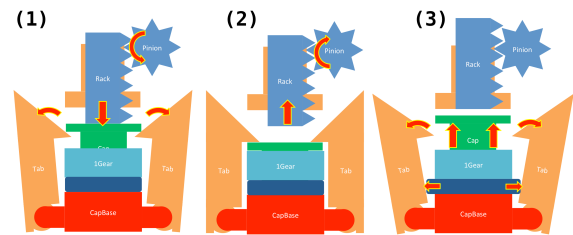


Figure 4: Moving cycle of system

fogcell has enough potential to be applied as an installation. It takes 1 second to charge air and exhaust valve takes 1/30 seconds or less to exhaust and let fog appear rapidly. Therefore fog would seem to appear instantly. We are also working to ventilate the tube by air after fog appears to fasten disappearance of fog in a cell.

4. CONCLUSION

This paper describes 'Fogcell' that is physical cell filled by fog. Fogcell is a fog based programmable hard pixel in a real world. Fog in a test tube is controlled by an adiabatic process by intake and exhaust valve mechanism and air compressor. It takes very short time(1/30 second or less) to appear fog and few second to disappear fog by ventilation mechanism. In our experiment, this system could create fog continuously 3 or 4 times in few minutes.

Differ from existing fog-machine based research; our prototype could purposely make fog appear and disappear in a tube rapidly, and continuously that extends the usability of fog as media, display, and various method of expressions.

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