Sajid Sadi

Project Proposal - Initial
Overview

In thinking of a project for this class, I have chosen to combine inspiration from a number of sources. Primary among them has been the description of the class (and group) at the beginning of the first set of slides. In particular, I would like to mention that I hoped to include personalization as a tenet of my design originally. However, I found that the project would then overlap greatly with the UBERBadge personalization project. Therefore, I instead concentrated on embedding an ambient interface within an everyday object that can produce a response that is both minimal and interesting, thus conveying information without further loading the mind of the user.

Recently, I was speaking to a friend from the Opera of the Future group, and heard of an installation being done by Tod Machover at a Macy's in Minneapolis. The installation is composed of a number of pinwheels physically separated from some wind chimes, which will ring when people blow on the pinwheels. This inspired me to think of a project involving wind chimes that take a different spin on the matter. I have also worked into this project my interest in digital persistence of physical phenomenon: the ability to leave a digital imprint of day-to-day life, however ephemeral, in a digital media.

Essentially, in my project the wind chimes will still be computer controlled. However, they will the controlled by the flow of people, instead of simply the movement of air. A camera will view the flow of traffic at some location, and the tones produced will depend on how fast the individuals within view move, and in what direction. In essence, this will be wind chime sensitive to the slight breeze of a person's passing. I believe that this is a very natural and intuitive mapping, without depending on overly complex coding of remote motion to chime motion. At the same time, the system can produce an interesting (and hopefully audibly pleasing) ambient display of activity visible from the camera's vantage.

I hope to have the system intelligently capture the fact that it is not the normal things that are most interesting in reality, but the abrupt and unusual things. The system will respond only minimally to the milling of people (unless they arrive or depart en masse), but more sensitively to the passing of individuals, and will ring "naturally" after being excited by the passage, thus retaining the qualities that make chimes so endearing in the first place. I believe that this embodies the ubiquitous computing aspects of Ambient Intelligence, in that the real-world relic is invisible enhanced, but retains the original functionality. In fact, I hope to make the changes subtle enough so that the chime would still function perfectly as a normal wind chime with the modifications in place.

Implementation

I will attempt to design this around a small wind chime, not more than a foot tall. While expense and complexity of the drive system is a consideration, a more important consideration is the amount of noise produced. I want the system to produce quiet, tinkling sounds, not loud gonglike ones, and to that end, it is necessary to have narrow

diameter elements for the chime. The video will be captured via a standard webcam. The images will be compared with the previous few images to detect baseline conditions, and when these conditions are detected, a snapshot will be stored which will allow the background "noise" to be removed from active frames.

When motion is detected (difference from the background frames), the frame will be subtracted from the background, and the motion compensation vectors will be extracted ala MPEG video encoding. Since the camera will be at an angle, scaling vectors will also be extracted to get 2 degrees of freedom in the data. The approximate directional vectors will activate a set of electromagnets which will pull or push the central member of the chime to some initial velocity, and the chime with operate normally from that point. I have not yet decided on a way to stiffen the center thread so it will resist deformation by the magnetic forces, and that remains an open issue that will probably require hands-on experimentation with a few solutions.

The method of image analysis and driving outlined above will ignore small motions, but will also tend to ignore large masses of people milling around (since the vectors will either cancel, or the camera will enter background acquisition mode under such conditions). However, when a single motion vector is found (or a few… this is an open question in part due to aesthetics), those vectors will be amplified so that a clear tone is produced where the initial ring (unless the chime is already ringing) will be indicative of the direction of motion. Additionally, this method of driving will tend to manifest the level of activity by the level of atonality (essentially, musical chaos) of the tone produced. A single person will tend to produce a pure tone, which a muddle of motion will either suppress the tone or play a cacophony of notes.

In addition to the above, a number of other modifications are also possible to the design. For example, the user may optionally choose to suppress chaotic melodies using the drive system. By monitoring the pattern of activation, the system can guess when the melody has lost its purity, and below a threshold, act to suppress it. Additionally, with some simple personalization information, it can automatically suppress playback when certain conditions are present. These conditions again can fall into either visual conditions at the camera, or other conditions (perhaps a meeting nearby) set by the user.

What do I Hope to Learn?

In doing this project, I hope to get a better understanding of vision-based scene analysis. I am, in general, interested more in the affect of a scene than the effective content of it, and believe that it may be possible to extract and convey this information with far less "intelligence" than would be required to fully understand a scene and extract the affect from it in a bottom-up fashion. Additionally, it would be interesting to consider how the driving interacts with the melody itself, especially given that the motion of the chime is quite non-deterministic over time.

What Will be Completed?

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I hope to finish the video acquisition, drive system, and some of the personalization interface within the duration of the class. Unfortunately, time will be at a premium due to the timeline of the badge project, and may not leave enough time for some of the personalization extensions.