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Introduction

Advertising is an area that benefits immensely from the use of computers to handle functions that would normally require many man hours to perform. From exchanging the content that's displayed, to collecting user metrics, to delivering targeted messages at locations spanning a country or even the world, computers help advertisers increase their return on investment in a much quicker and more efficient manner than people ever could. To promote their products nationally or even internationally, advertisers need to know what type of advertisement will attract their target audience at various times of the year and how to use that information to reach as many people as possible.

For the purpose of this paper, we'll assume that a retailer wishes to promote its products in malls in 50 different locations across North America. The retailer has 20 possible advertisements to display. He wants to know how many people will be attracted to each ad and whether particular ads are more effective at certain times of the year, to determine which ones to use.

If this problem was being handled solely by people, it would require that many employees be tasked with monitoring the displays; recording the season, the particular advertisement being monitored and the number of people who show interest in it. The data thus collected (at 50 different locations) would then have to be sent to a central location, where another employee would analyze it and generate a report. The decision-maker would use the report to decide which ads to keep and at what time of year they

should be displayed. More employees would be required to change the advertisements at each location several times a year, so that only the most effective ones are displayed.

Fortunately, all of these functions can be handled with minimum human involvement through the use of an interactive digital signage solution. Digital signage includes a variety of products that are networked for effective and efficient delivery of the appropriate message to the right audience at a given location.¹ Although there are many on the market, this paper will discuss digital signage developed by GestureTek® Inc., an Ottawa-based company that has invented camera-enabled gesture control. One of its products, ScreenXtreme®, is a good example of how computers make short work of an otherwise time-consuming and tedious task.

Overview of ScreenXtreme®

ScreenXtreme is an interactive display that uses data from a colour camera image to allow users to manipulate and interact with effects or advertisements.²

The components of this digital signage solution are the display (an LCD screen), a camera, a computer, a media player, a tracking application, a face detection application, and a content management server connected to the media player over a network.

The media player can run an unlimited number of advertisements (which for the scenario described in this paper would be interactive content created especially for use with this particular media player) on the display in sequence. The camera captures images of users as they approach the screen and the face detection application attaches a unique

¹ ABIresearch technology marketing intelligence

² GestureTek Inc. ScreenXtreme User Guide

user ID to each face. As the users gesture in front of the screen, their movement is tracked by the tracking application and the advertisement reacts to that movement in particular ways. Optionally, it can be configured so that the user can see their own image on-screen as they interact with the content. The media player then communicates the data (the name of the specific advertisement running, the date, the time and the user ID) to the content management server. The server collects and stores the data and is able to generate a report detailing this information for each location.³



A description of the software components follows:

Media Player

Dazzler is GestureTek's interactive media player. It utilizes GestureTek's motion tracking technology with modules, called 'Play Items', to create interactive and entertaining presentations. Dazzler plays content that is defined in an XML file called a .spark file. Content developers mix and match Play Items (preinstalled modules) and

³ Vahabzadeh, Faraz. Interview.

media to create unique custom effects. If the desired effect cannot be achieved using the provided play items, then developers may create custom Flash applications.⁴

Dazzler comes with many preinstalled Play Items, each of which have an extensive set of attributes that can be tweaked to change the look and interaction of the effect. Play Items are written in C++. One of the Play Items included with Dazzler is the AdTracker which tracks interactions with specific effects (or advertisements). It attaches the name of the ad to the face data received from the Face Detection Tracker and sends it to the Content Management Server.⁵

C++ is a general-purpose programming language that supports data abstraction, object-oriented programming and generic programming.⁶

ScreenXtreme Tracker

The ScreenXtreme tracker sends tracker outline data to Dazzler over AppComm. (AppComm is a proprietary library that provides one way communication of a tracking data outline from a tracker to Dazzler.) Usually, the tracker outline represents motion. For ScreenXtreme, a camera image is also sent to Dazzler. The ScreenXtreme camera image also contains motion data and a motion history that is embedded into the alpha channel of the image.⁷

⁴ GestureTek Inc. Dazzler User Guide. 1

⁵ Dazzler User Guide. 171

⁶ Bjarne Stroustrup. The C++ Programming Language. New Jersey. Addison-Wesley. 1997. 21.

⁷ Harbinja, Dinko. Interview.

Face Detection Tracker

The Face Detection Tracker is an application written in C++ that uses the camera to track faces frame-by-frame. A face is detected if it meets certain criteria and is assigned a unique identifying number. If those same criteria are met more than once within a set number of camera frames, then that face will be identified as the same person. When the set number of camera frames has elapsed and a face is detected, it is considered a different person. A log is kept of all the faces detected, indicating the date, time and status of the face (In, Ongoing or Out), along with the position of the face, expressed as a rectangle using x, y, width and height coordinates.⁸

A sample tracker log of a single person might look like this:

```
2009/01/28 14:08:30 1 IN      160 120 30 30
2009/01/28 14:08:31 1 ONGOING 170 110 30 28
2009/01/28 14:08:32 1 ONGOING 180 110 26 26
2009/01/28 14:08:33 1 OUT     0 0 0 0
```

A sample tracker log of a two person sequence might look like this:

```
2009/01/28 14:08:30 2 IN      160 120 30 30
2009/01/28 14:08:31 2 ONGOING 170 110 30 28
2009/01/28 14:08:31 3 IN      220 140 40 40
2009/01/28 14:08:32 2 ONGOING 180 110 26 26
2009/01/28 14:08:32 3 ONGOING 223 140 40 40
2009/01/28 14:08:33 2 OUT     0 0 0 0
2009/01/28 14:08:33 3 ONGOING 226 140 39 40
2009/01/28 14:08:34 3 ONGOING 228 142 41 41
2009/01/28 14:08:35 3 ONGOING 230 142 40 40
2009/01/28 14:08:36 3 OUT     0 0 0 0
```

Content Management Server

The GestureTek System Monitor is content management software that allows for adding, modifying and deleting content over a network and reporting user metrics. The

⁸ Harbinja, Dinko. Interview.

server is accessed through a Web interface, while the client application is installed along with GestureTek products. When running, the client continually listens for messages from the server that there is new content to be downloaded and also automatically sends user metrics to the server. The server stores the user metrics in its database and also generates various reports.⁹

The server uses Structured Query Language (SQL) to retrieve the specific information that's required from the database, in this case, the date and time frame during which the ad was running, the location of the ScreenXtreme installation, the name of the ad and the number of people who interacted with the ad.¹⁰ SQL is a database computer language designed for managing data and was originally based upon relational algebra.¹¹

The example below demonstrates a query of the database for the information in the previous paragraph:

```
select * from AdTrackerData
order by Number_of_Viewers desc
limit 5;12
```

⁹ GestureTek Inc.. ScreenXtreme User Guide. 67

¹⁰ Vahabzadeh, Faraz. Interview

¹¹ SQL. Wikipedia.

¹² Vahabzadeh, Faraz. Interview

This query would generate a table that looks something like this:

The screenshot shows the GestureTek Ad Tracker interface. On the left is a navigation menu with sections: User Administration (Add User, Find User, My Account), Corporate Administration (Add Corporation, Find Corporation), Client Administration (Add Client, Find Client), Screen Administration (Find Screen), and Content Management (Adhoc CM). The main area is titled 'Ad Tracker' and shows a search results table. The table has columns: Date, Time, Location, Spots, and Faces Detected. The data rows are as follows:

Date	Time	Location	Spots	Faces Detected
2009/12/02	09:00 - 21:00	New York	Ad_IceWithWater	203
2009/09/25	09:00 - 21:00	Montreal	Ad_RoselnWater	186
2009/05/22	09:00 - 18:00	Toronto	Ad_MartiniGlasses	180
2009/03/16	09:00 - 21:00	Miami	Ad_MeltingIce	138
2009/04/10	09:00 - 18:00	Tucson	Ad_DrinksWithIce	127

With the report on-screen showing the ads that were viewed by the most people, an administrator in a central location would be able to delete the ads that weren't effective at any particular time of year or at any particular location, leaving only those ads running that attracted the most people. A report showing just the results for one particular location could also be generated. Using the Adhoc CM (Content Management) function of the server, the administrator would locate an installation in a particular city, request the Spot List (list of ads) for that installation, select the ad or ads he wishes to delete and click Delete. New ads can also be assigned to the Spot List in a similar manner.¹³

Although collecting information, analyzing it and acting upon the analysis can certainly be done manually, it's clear that computers save a great deal of time and money for the advertiser.

¹³ ScreenXtreme User Guide. 88, 89

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