From Consumer to Producer: Ubiquitous Technologies for Outside Broadcast

Martin Flintham
Dominic Price
Duncan Rowland
Steve Benford
Mixed Reality Lab,
University of Nottingham
Nottingham NG8 1BB UK
+44 (0) 115 846 6780
{mdf, djp, dar, sdb}@cs.nott.ac.uk

Matt Adams
Ju Row Farr
Nick Tandavanitj
Blast Theory
Unit 5, 20 Wellington Road
Portslade
Brighton BN41 1DN
{matt,ju,nick}@blasttheory.co.uk

ABSTRACT
We present two experimental demonstrations of a lightweight platform for outside broadcasting using off-the-shelf low-end technologies. We describe a tool for planning and instrumenting an outside broadcast, and SNAP, a pervasive game that uses live video streaming. Finally, we consider a number of future opportunities for enabling traditional media consumers to engage with video production through crowdsourcing.

Keywords
Ubiquitous computing, mobile computing, outside broadcast, mobile television, video streaming

INTRODUCTION

Outside broadcasting is the term used to describe the production of television or radio programmes away from a purpose built studio. Typically, outside broadcasting is used to record and broadcast live events such as sports [1], festivals, major ceremonies and breaking news, or even virtual events [2]. This generally involves collaboration among a large team of highly trained professionals utilising a complex and expensive pool of equipment. However, the rise of ubiquitous devices capable of recording video (e.g., current generation of mobile phones) alongside avenues for the self-publishing of media content (e.g., Youtube), places the capability for home video authoring and publishing directly into the hands of end-users. To date, this has mostly been used for the offline creation and distribution of video, but there is also potential for everyday people to collaborate to create their own live broadcasts of a variety of outdoors events, either ones that are too small-scale and local to require professional broadcast, or perhaps when the public is first on the scene. In this paper we present a prototype digital economy service for lightweight outside broadcasting using affordable ubiquitous devices and freely-available distribution technologies. We present an initial demonstration of this through a pervasive game called SNAP and then discuss wider applications.

INSTRUMENTED LIVE STREAMING

In order to understand the issues involved in the live streaming of video, we created a test scenario which allowed us to experiment with streaming from a number of mobile cameras that were also instrumented with GPS.

Instrumentation Studio

We initially developed a service that enables us to track camera position and orientation from live instrumented cameras as well as the position of other instrumented objects. Camera instrumentation was provided by an application running on a Nokia Navigator phone that utilised its GPS and compass devices to provide position and direction information directly to the web application. This could either be a one off update (for fixed cameras) or a continuous update for mobile cameras. A simpler version was also developed for the Nokia N95 that only provided position information from the GPS. The live camera positions are distributed via a web-based application based that is implemented using the EQUIP-2 distributed platform. The service also allows the planning of broadcasts by experimenting with different camera placements in a virtual environment that is built as a layer on top of Google Earth, enabling virtual camera objects to be placed at chosen locations (Figure 1). The position and elevation of the virtual cameras can be altered and the resulting field of view is shown in the virtual world.

Initial tests

An initial test scenario involved filming a performer walking through an outdoor space from multiple cameras (Figure 2). The route chosen for the performer was preplanned, though they did have some freedom to add a degree of randomness by setting the pace, back-tracking

Digital Futures'10, October 11 – 12, 2010, Nottingham, UK.

and crossing roads. The performer was filmed from a number of different cameras distributed amongst fixed position cameras and mobile cameras with an operator. Several different models of camera were used, high-definition and standard definition camcorders, a virtual pan-tilt-zoom webcam and Nokia N95 and iPhone mobile phones. This initial test enabled us to compare the performance of the different cameras including image quality, average frame rates and battery life. A qualitative assessment of relative performance of the cameras was made to inform the next step of the project, SNAP.

SNAP

SNAP is a pervasive game that takes place both online and on the streets, and uses live media production and consumption as a central component of the game play itself. A demonstration of SNAP took place in Brighton in May 2010, to an invited audience of 10 online players.

The Game

Three professional performers roam the streets of an urban game area of around 1 square kilometer. Each performer is equipped with a handheld video camera and a mobile phone. During the game, the performers attempt to film one another, while trying to avoid being filmed themselves, combined with a constant vocal patter in order to make their video streams as engaging as possible.

Online, members of the public log into a website that shows a three-dimensional model of the physical area, with the positions of the three performers indicated by glowing dots that move as the performers move through the streets (Figure 3). Clicking on one of the dots zooms in to that performer's position, and the online player is now able to see the live feed from their chosen performer.

In SNAP online players compete against one another to gain the highest number of "snaps", while they lose a life if they are snapped themselves. A snap occurs when a player watching the live video stream from a performer sees that a rival performer is in shot, and clicks the "snap" button on their interface (Figure 4). Any players who happen to be watching the video stream of the rival performer when they are snapped lose a life. The performers are consequently notified that they have been involved in a successful snap. This simple game mechanic requires online players to selectively choose a video stream to follow, as they are limited to following one, but they may choose to change at any time. They can choose to follow and snap using a performer, although this puts them at risk of being snapped themselves. They may also use the 3d model to aid their decision. The game aims to create an engaging dynamic by causing online players to constantly reassess the value of the performers' video streams, in terms of where they are physically, what they are filming and who can be seen in the shot.

Technical Setup

The development of SNAP attempted to focus on creating a dynamic game using live video production, and as a result attempted to make use of off-the-shelf components where possible. Video from the performers' cameras was captured, encoded to h264 and streamed over 3G via a laptop hidden in each performer's backpack. Position and orientation instrumentation data were streamed from an Android phone attached to the camera, which also functioned as an interface for game messages, however future development would aim to provide all functionality for the performer using a single mobile phone.

CROWDSOURCING LIVE BROADCASTS

Looking to the future, we propose that simple outside broadcasting technologies could be used by groups who would traditionally be the consumers of live media to now also act as the producers. Using low-cost hardware such as a smartphone with video streaming software installed that would either be owned by or loaned to members of the public, live video content could be mass produced. Consumers could then act as the editors of the content, selecting the best live feeds and sharing them with other users. The following are some potential uses of such a platform for crowd-sourcing live broadcasts in this way.

A local marathon or festival

A marathon could be streamed live by both the participants and by spectators who are physically present at the event, while online consumers could then select what they want to see based on video instrumentation. Output can be displayed publicly on large screens, with suitable moderation, as well as watched over the Internet.

Remote visits to theme parks

Alternatively, an outside broadcast platform could be made available as a service, allowing members of the public to create their own, private live broadcast of a visit to a theme park or other cultural visit.

Local or breaking news

As above, crowd sourcing live production could enable people on the ground at a breaking news story to quickly organize a local OB network and begin transmitting.

Episodic Performance

Outside broadcast could be used alongside a long running drama, in which the consumer can also act as a participant and producer, by choosing to monitor one of multiple live feeds and editing highlights for their peers.

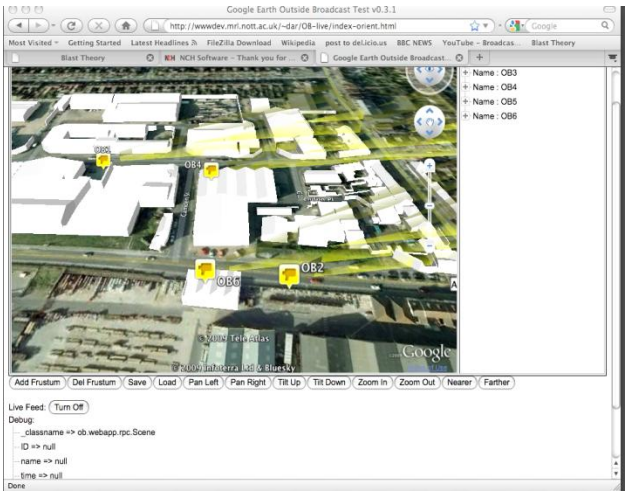
ACKNOWLEDGMENTS

We gratefully acknowledge the support of the RCUK through the Horizon Centre for Digital Economy research.

REFERENCES

Perry, M., et.al. 2009. Lean collaboration through video gestures: co-ordinating the production of live televised sport. In *Proceedings of the 27th international Conference on Human Factors in Computing Systems* (Boston, MA, USA, April 04 - 09, 2009). CHI '09. ACM, New York, NY, 2279-2288.

Benford, S., Greenhalgh, C., et.al (2000). "Inhabited television: broadcasting interaction from within collaborative virtual environments". *ACM Transactions on Computer-Human Interaction*, 7(4), 510-547.



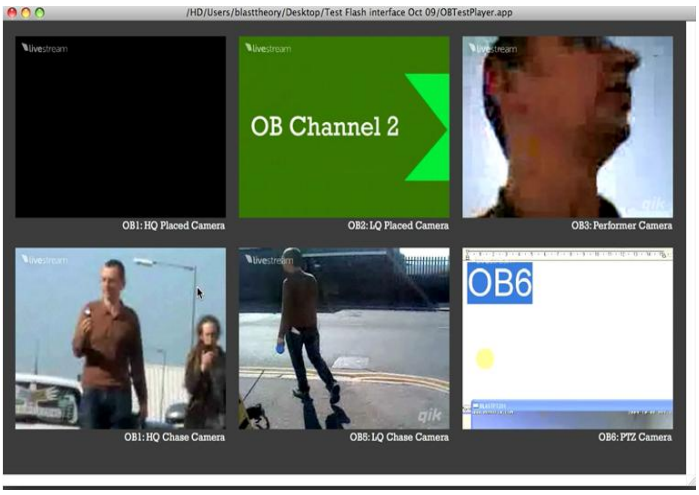


Figure 1: Instrumentation Studio

Figure 2: Outside broadcast of a performer using low-end hardware

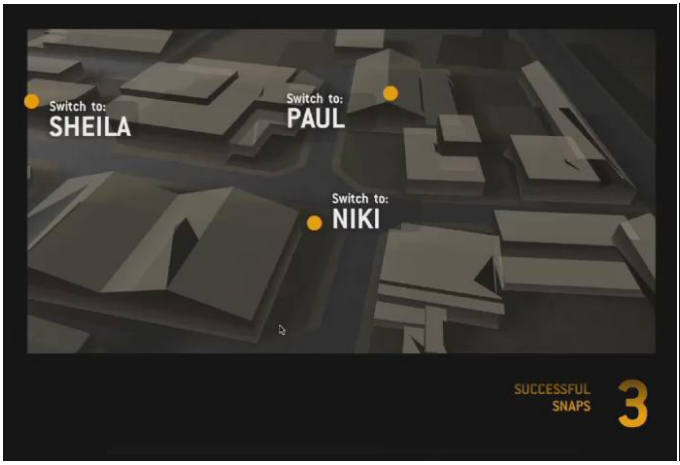


Figure 3: Browsing performer video streams by position in SNAP

Figure 4: Successfully "snapping" a performer