Getting a Good Shot: Remote Picture Taking with Mobile Phones

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Abstract

We have prototyped a new consumer imaging device, a remote camera, that leverages the mobile phone and provides a key capability not found in today's digital still cameras and camera phones. Specifically our remote capture unit allows a user to capture images from a vantage point that would otherwise be impractical or socially unacceptable to use. We use a mobile phone as a view finder and a remote control. Possibilities exist for a new product, an accessory for an existing digital still camera (DSC), or integration into an existing DSC.

Introduction

In 2004, shipments of camera phones are expected to total 148 million units, comprising more than one quarter of all mobile phones shipped [1]. In North America, this year for the first time camera phones will outnumber digital still camera (DSC) sales [1]. The uptake of camera phones and photo messaging services by consumers is an important trend that bears study.

Market research [2] suggests that DSCs can and will coexist with camera phones in the near term, as each offers capabilities not found in the other. Camera phones are best for spontaneous image capture, often being at hand, and have integrated photo messaging services. Digital still cameras offer enhanced image quality and improved optics, including powerful telephoto capabilities; consumers will use these devices to capture important family memories and events. Both camera phones and DSCs will drive printing of images.

In this paper, we describe a new consumer imaging device that leverages the mobile phone and provides a key capability not found in today's digital still cameras and camera phones. This new device could serve as a new product for HP, extending our imaging franchise; or, alternatively, these concepts could be integrated into an HP DSC and/or DSC accessory.

Getting a Good Shot

Camera phones and digital still cameras, for the most part, require the photographer to operate the camera from his position. The photographer must remain "behind" the camera and must move to good vantage points to take a picture. The ideal or even a sufficiently good vantage point for a desired shot can be impractical to achieve or socially unacceptable in many situations.

To motivate our research, we examined three use cases where the difficulty of "getting a good shot" arises. These uses cases drove the requirements for our design.

The first use case is that of a typical wedding. Guests at a wedding are requested to sit quietly during the ceremony, yet they often wish to capture pictures of the bride and groom at important moments, such as during the exchange of rings. It would disturb the ceremony for several guests to rise or, worse, leave their seats in order to frame and capture photos at each important instance.

The second use case is similar to the first: a child's stage performance, such as band concert or play, at a school or church. Even more so than the wedding guests, parents desire to take pictures at moments that highlight their child. Getting close to the stage is impractical in many theaters and dangerous during a performance, and rude to other members of the audience.

The final use case is a sporting event. We considered a Little League baseball game. Parents wish to capture photos of their child at bat and in the field, without the obstruction of a fence. However, doing so would block the

view of other fans in the stands.

Our Solution: Separating Capture from Control

The use cases suggested to us a clear need to separate the capture mechanism from the view finder and control mechanisms.

Our solution is to "sever" a typical digital still camera in two. The first half we call the *remote capture unit* (RCU). Within the RCU, we place the familiar optics, imaging sensor, processing, storage and power supply found in a DSC in a small, ruggedized package. The only control that remains on the RCU is a power button. For the prototype, we chose a medium-resolution CCD image sensor and a powerful 10-x zoom lens. Table 1 gives additional specifications.

Figure 1: Remote Capture Unit, Prototype (1 of 2)

The remaining parts of the DSC are virtualized, becoming a software component that is installed into a user's mobile phone. The phone's screen becomes the viewfinder. The phone's buttons become camera controls. Using our software on the mobile phone, the user sees what the camera "sees" in real time, makes necessary adjustments such as zooming in or out, and snaps photos, from a convenient location.

The RCU and the mobile communicate over a secure radio link, passing control and data as needed. Bluetooth is used for the radio link, as it is found in a large fraction of today's mobile phone. We envision support for WiFi as it becomes available on mobile phones.

Figure 2: Our software running on Symbian phone emulator

The remote capture unit may be positioned *wherever* and *whenever* needed to obtain good photos without disruption. Deployment may occur prior to an event and retrieval afterwards. The position of the RCU may be at a considerable distance (roughly 40 m maximum) from the user.

Table 1: RCU Specifications	
Imaging	3.2 mpel 1/2.7-type primary-color CCD, passive auto-focus sensor
Lens	5.8 – 58.0 mm (10X optical zoom)
Mass	490 g, including batteries
Dimensions	116 mm x 117 mm x 63 mm (main body)
Storage	256MiB internal
Radio	Bluetooth, Class 1, 40 m effective range

Captured mages are stored initially within the RCU. The user can transfer stored pictures to the phone for photo messaging, printing, "beaming" to a Bluetooth-enabled digital photo frame [3] and upload.

Our use cases also suggested the need for flexible mounting and position of the RCU. In the ballgame scenario, we wanted to be able to hang the camera from inside a fence. In other use cases, we wished to be able to place the camera on a flat service. Working with an industrial designer and mechanical engineer, we devised a mounting bracket that we believe addresses these needs. We took special care to position the batteries within the RCU to maximize stability of the stand. A neoprene strap adds security, as well as style, and the bracket folds up when the RCU is being transported to protect the lens.

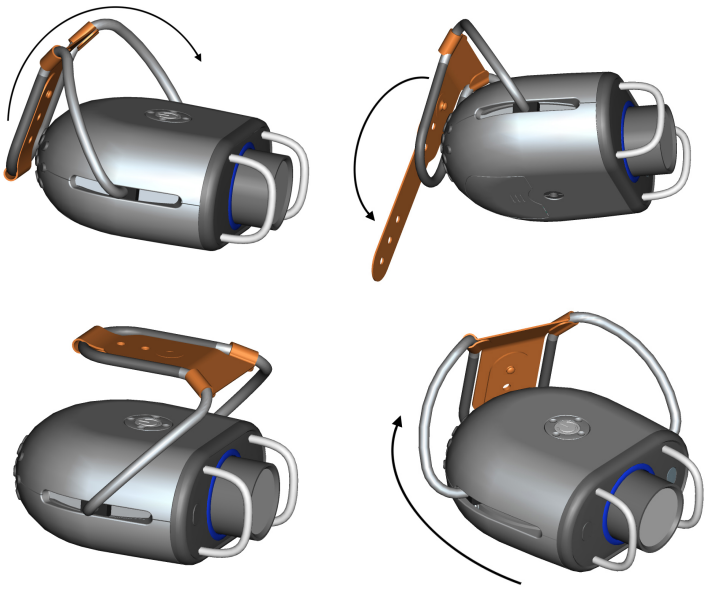

Figure 3: Stand Movements

Current Status

We are nearing completion of two prototypes. The industrial and mechanical design is complete. We have manufactured two working bodies, in different color styles. The circuit design is fully complete. We have nearly completed the final circuit layout and finalized the software for both the phone and the RCU.

Next Steps

We will be showing the prototype internally to gauge acceptance and attempt to develop a business case. We envision three possibilities:

- development of the remote capture unit concept as a separate product;
- development of an accessory that adds remote capture capabilities to an existing DSC; or
- integration of remote capture functionality into an existing DSC.

An alternative application of the remote capture concept is to have these cameras pre-installed at popular venues (ballpark, church, etc.) and allow people to "lease" the camera to take photos using their phones. This is an idea we will develop further.

We intend to investigate the integration of a next-generation wideband cellular radio (E-GPRS/EDGE, 1X) within the remote capture unit. This will allow control from great distance, and provide delivery of images via photo messaging services.

Finally, we are working on an accessory design that will provide an effective pan-and-tilt platform for the RCU. Performance and cost are key objectives. The software design already anticipates the existence of the pan-tilt accessory with the notion of “bookmarked” positions that the user may recall quickly from the user interface on his mobile phone. With a single key, the user can “point” and zoom the RCU to a preset location and snap a picture.

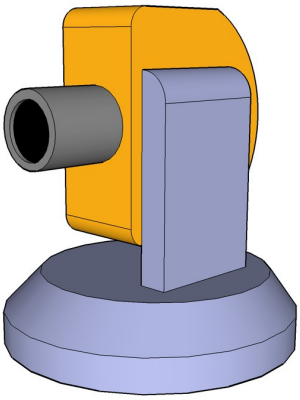

Figure 4: "Lefty" Pan Tilt Platform Concept

References

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[2] Worldwide Still Camera and Camera Phone 2004-2008 Forecast and Analysis, August 2004, IDC

[3] Hoover, Christopher. A Bluetooth-enabled Digital Picture Frame