LetterTwitter: Smart Mailbox for Spam-filtered Notification of Received Letters

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ABSTRACT

We propose a smart mailbox called "LetterTwitter" that can automatically capture dropped snail mail (s-mail), classify pictures into several categories (e.g., letters or flyers), and upload categorized pictures to the Web. Users can easily get spam-filtered notification of received letters using PCs or cellular phones equipped with common web browsers.

Author Keywords   Snail mail, mailbox, twitter, smart house, ubiquitous computing

ACM Classification Keywords H5.2 [Information interfaces and presentation]: User Interfaces.

General Terms   Design and Human Factors

INTRODUCTION

Although cellular phones and e-mail have become widely used, snail mail (s-mail) is a still valuable means of communication: official letters and packages can be only sent by s-mail, and many people feel greater warmth in handwritten letters than in e-mail. Meanwhile, people often have problems with s-mail for several reasons: people are not immediately aware of the arrival of s-mail and people often become irritated by s-mail spam (e.g., publicity flyers). To solve these problems, we propose a smart mailbox called "LetterTwitter" that can help users treat s-mail as easily as they do e-mail.

Figure 1. The concept of LetterTwitter: Spam-filtered notification of received letters appears on the Web.
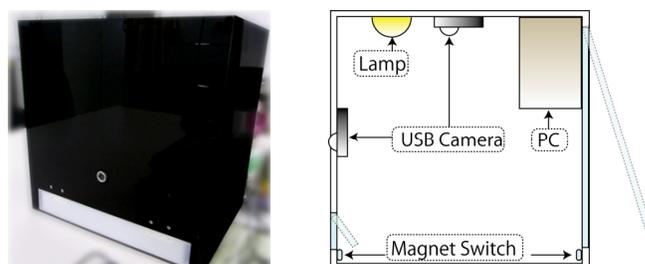
LETTERTWITTER

LetterTwitter is a smart mailbox that can detect the arrival of s-mail, distinguish letters from flyers, and notify users of their arrival. When s-mail is dropped into the mailbox, the system detects the state of the slot cover by a magnetic switch, and takes a picture of the s-mail with a camera. Next, the system classifies the pictures into several categories (e.g., letters or flyers) using an image analysis system, and uploads the pictures by category to the Web. In this way, users can easily check for the arrival of letters – not of flyers – using cell-phones or PCs equipped with common web browsers (Fig. 1).

IMPLEMENTATION

Before installing the system to an actual house, Ocha House[1], we developed a prototype of the same size (40 cm x 40 cm x 30 cm) as the mailbox in the house (Fig. 2, left). The prototype mailbox was assembled from acrylic boards.

We attached two magnetic switches to the front and back slot covers, two USB cameras (Logicool Qcam Pro for Notebooks) to the front/outside and top/inside of the mailbox, and a small fluorescent lamp to the top/inside (Fig. 2, right). We also attached a small PC inside the mailbox. The magnetic switches are used for detecting the opening and closing of the slot covers. Each magnetic switch is connected to the PC via a USB-Parallel converter (Akizuki FT245RL module), and controlled by the ParallelServer[2] running on the PC. The magnetic switches work as trigger mechanisms to control the lamp and USB cameras. The lamp is also connected to the PC via the USB-Parallel converter and a solid state relay, and controlled by the ParallelServer.

Figure 2. The prototype of LetterTwitter (left: front-side, right: device architecture).

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[1] Ocha House: experimental smart house for evaluating applications of ubiquitous computing in Ochanomizu University

[2] ParallelServer: middleware for easy control of the USB-Parallel converter.

Next, we explain the working procedure of LetterTwitter.

1. A postal worker drops the s-mail through the front slot.

2. The system captures a picture of the postal worker by the outside camera, in response to the opening of the slot cover detected by the magnetic switch.

3. When the front slot cover closes[3], the system turns the lamp on and takes a picture of the s-mail using the inside camera.

4. The system classifies the s-mail picture into several categories (e.g., letters or flyers) using the image analysis technique (discussed in the next section).

5. The system uploads these pictures to an online picture sharing service (e.g., Flickr).

6. The system posts the URL of the pictures with several comments –including the categories of the pictures – to a Social Network Service (e.g., Twitter).

We selected Twitter as the communication media for two reasons. First, since s-mail (especially flyers) tends to be dropped at random intervals, the push media like e-mail may bother users. Using Twitter, users can check for the arrival of s-mail quickly as convenient. Second, a mailbox is often shared with members of a home or an office. Using Twitter, users can easily share information only with their families or colleagues by adjusting their privacy settings.

In these ways, LetterTwitter helps users check for the arrival of letters as convenient, by integrating the smart mailbox and Twitter.

Classification of mail

As mentioned above, the system aims to classify s-mail into several categories. In the current prototype, we have implemented the function to distinguish flyers from letters. We focus on the difference in the color distribution between letters and flyers; that is, while most letters have low saturation (e.g., white), most flyers tend to have high saturation (e.g., primary colors) (Fig. 3). Therefore, we decided to classify s-mail by the ratio of high saturation pixels in each picture. The threshold of the high saturation pixels was set at 40%, based on the pilot study. When s-mail is posted continuously, the system calculates the difference in the number of the high saturation pixels between the prior picture and the subsequent picture. Moreover, when users open and close the back door of the mailbox, the system initializes the prior picture by assuming that all s-mail is removed from the mailbox.

RELATED WORK

Digital Decor [1] can take pictures inside a drawer to search for items or supporting communication. TagTansu [2] can easily capture pictures of clothes with several annotations

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[3] After the s-mail is dropped, the front slot cover is automatically closed by a spring.

and share them via Flickr. The Junk Mail to Spam Converter [3] can capture pictures of s-mail when users set the s-mail to the system, and send pictures to users by e-mail as well as shred the s-mail. Our research focuses on the mailbox to help users easily check for the arrival of letters – not of flyers – using common Web browsers.

Figure 3. Examples of captured pictures. While letters often have low saturation (top), flyers tend to have high saturation (bottom).
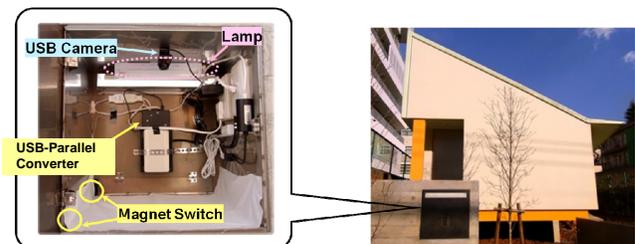

Figure 4. LetterTwitter installed in the Ocha House.

CONCLUSION

We proposed and developed a smart mailbox called LetterTwitter that can automatically capture dropped s-mail, distinguish letters from flyers, and notify users of them via Twitter. Users can easily get spam-filtered notification of received letters using PCs or cellular phones. After the prototyping, we have installed the system in Ocha House, as shown in Fig. 4. We are currently collecting data on the accuracy of classification, intervals of s-mail arrival, and feedback from users for further improvements.

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