AwareHanger: Context-aware hanger for detecting the status of laundry

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Abstract. Many people hang their laundry outside on sunny days in Asian countries. However, they often need to go outside to check the status of the laundry. To solve this problem, we propose a context-aware hanger, "AwareHanger", which can automatically detect laundry status and inform users via multiple media (e.g., sounds, e-mail, or Twitter).

Keywords: Hanger, laundry, dry, sound, Twitter

1 Introduction

Most people hang their laundry outside on sunny days in Asian countries to take advantage of the sterilizing effects of UV rays, the psychological effects of sunlight, and the economic and ecological benefits over the use of dryers. Meanwhile, people need to bring in the laundry in a timely manner for following reasons: laundries may be damaged by excessive exposure to UV rays and laundry left outside until late evening may become wet again. People often face the problem of going outside numerous times to check on the status of the laundry, particularly when they hang the laundry away from their living space (e.g., a rooftop).

To solve this problem, we propose a context-aware hanger, "AwareHanger", which can detect laundry status automatically and inform users in a timely manner.

2 AwareHanger

The main concepts of the AwareHanger are as follows:

1. Detecting laundry status automatically
2. Informing users of the laundry status via multiple media
3. Integrating devices into a common hanger

First, AwareHanger can detect laundry status (dryness) automatically. We considered two detection methods: (1) electric resistance and (2) laundry weight. We applied the

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former method (electric resistance detection) since it is more cost efficient and requires less complex equipment than the latter method (weight detection).

Second, AwareHanger can inform a user of the laundry status using multiple media. For example, when the laundry becomes dry, the system informs the user by sound when he/she is at home or by Twitter when he/she is out (Fig. 1).

Third, we integrated the main devices into a common hanger so that users employ the AwareHanger system without the need for any special operation.

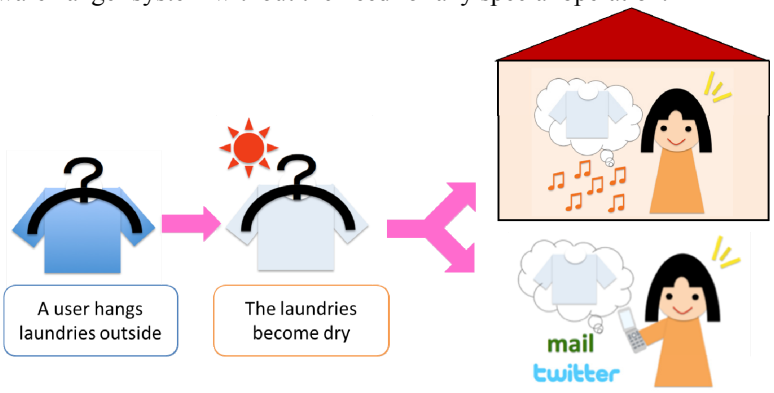

Fig. 1. The AwareHanger concept. When the laundry becomes dry, this system helps a user bring it in efficiently by informing him/her of its readiness via several media: by sound when at home or by Twitter when out.

3 Implementation

We developed AwareHanger prototypes as shown in Fig. 2. Each prototype consists of a hanger (for tops or bottoms), two electrodes, a wireless sensor (Digi XBee RF Module) and a battery. We attached the two electrodes separately on the hanger and adjusted the position for proper contact with the laundry. We connected each electrode to the XBee module as shown in Fig. 2 (right). Thus, the XBee module can detect laundry status (dryness) and transmit the data to a host PC via the XBee wireless network[1]. Figure 3 shows the system architecture of the AwareHanger system.

Next, we explain the working procedure of the AwareHanger.

1. When a user hangs an item of wet laundry on the hanger, the XBee client starts measuring the electrical resistance of the laundry and transmitting the data to the XBee host by wireless network at regular intervals (e.g., 10 seconds).
2. The data are automatically collected by the XBeeServer[2] on the host PC, and then passed to the main program.

[1] Since XBee modules can automatically configure mesh networks, users can use multiple hangers at the same time.

[2] XBeeServer: middleware for easy control of the XBee modules

3. When the main program detects a level of dryness above a pre-defined threshold, it informs the user of the status of the laundry by playing sound (e.g., wind bells) and uploading a message to Twitter (e.g., “Now, your shirt is dry!”).

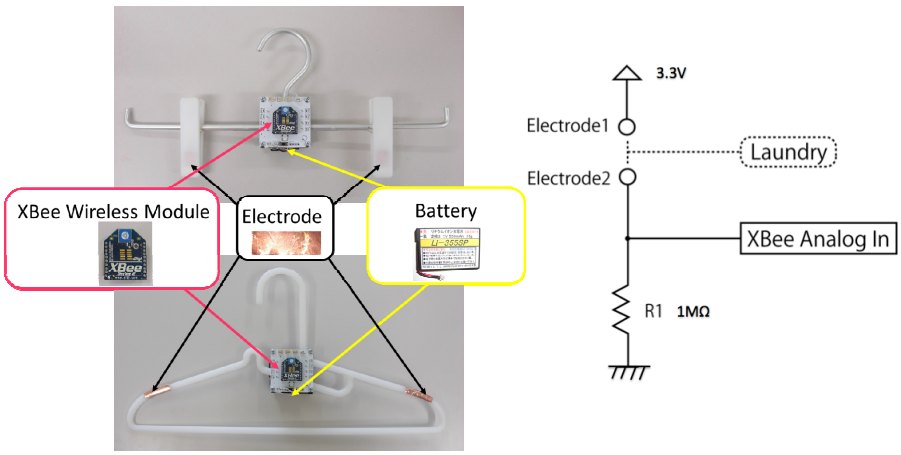

Fig. 2. The AwareHanger prototypes. Left: Prototype hangers for bottoms and tops, Right: Basic schematic diagram of the prototype

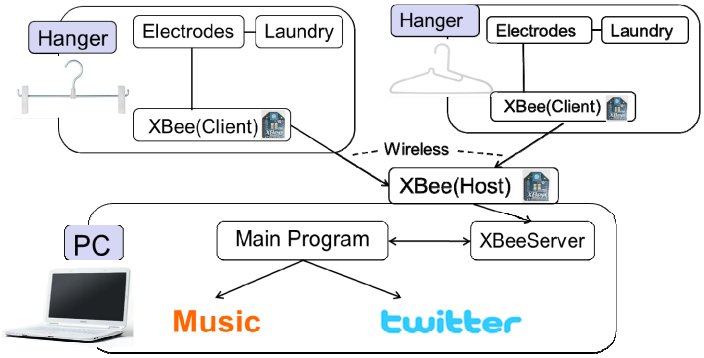

Fig. 3. System architecture of the AwareHanger

We performed a preliminary evaluation to confirm the basic performance of the AwareHanger prototypes. The experimenter hung an item of wet laundry on the hanger outside, and the system recorded a log of dryness levels (raw data from the 10bit A/D convertor of the XBee module). We tested 6 types of clothes under almost the same climate conditions (about 28°C temperature and about 70 % humidity). The results showed that our system could detect dryness levels in all types of clothes, as shown in Fig. 4. Moreover, since the transition characteristics change according to type of clothing, the system may automatically detect laundry type using machine learning techniques.

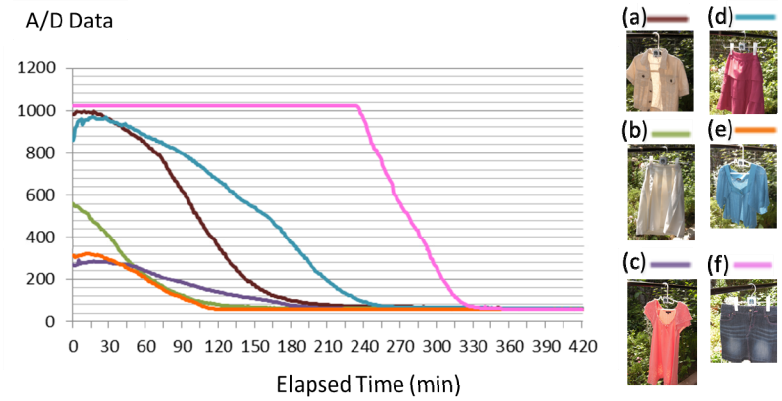

Fig. 4. Results of preliminary evaluation

4 Related work

There have been several research projects developed to support laundry tasks. Sugiura et al. [1] proposed a direct manipulation method to command a robot to fold laundry. Maitin-Shepard et al. [2] proposed image analysis techniques to detect the corners of a piece of cloth for folding it with a robot arm. Meanwhile, TagTansu [3] helps users take pictures of clothes with several tags just by hanging clothes on a hook.

Our approach is unique in that we focused on detecting/informing the status of laundry automatically using hanger-type devices.

Acknowledgements

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References

1. Yuta Sugiura, Takeo Igarashi, Hiroki Takahashi, Tabare Akim Gowon, Charith Lasantha Fernando, Maki Sugimoto and Masahiko Inami, Graphical Instruction for A Garment Folding Robot, ACM SIGGRAPH 2009,Emerging Technologies,1-1(2009).
2. Jeremy Maitin-Shepard, Marco Cusumano-Towner, Jinna Lei and Pieter Abbeel, Cloth grasp point detection based on multiple-view geometric cues with application to robotic towel folding, ICRA 2010,2308-2315 (2010).
3. Koji Tsukada, Hitomi Tsujita, Itiro Siio, TagTansu: A Wardrobe to Support Creating a Picture Database of Clothes, Adjunct Proceedings of Pervasive2008, pp. 49-52, (2008).