Suit Up!: Inconspicuous Interactions on Jacket Buttons

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Abstract
We present a new interaction space for wearables by inlaying interactive elements, in the form of buttons, into outdoor clothing, specifically jackets and coats. Interactive buttons, or *iButtons*, allow users to perform specific tasks using *inconspicuous gestures*—subtle actions which are not easily perceived by others. They are intended for outdoor settings, where reaching for a mobile phone or other devices may not be very convenient or appropriate. Different types of buttons serve dedicated functions, and appropriate placement of these buttons make them easily accessible, without requiring visual contact. By adding context sensitivity, buttons can also be repurposed to fit other functions. By linking multiple buttons, it is possible to create workflows for specific tasks. We provide a description of an initial iButton design space and highlight some scenarios to illustrate the envisioned usage of interactive buttons.

Author Keywords
Wearable Computing, Eyes-free, Inconspicuous Interactions.

ACM Classification Keywords
H.5.2 [**Information interfaces and presentation**]: Input devices and strategies.

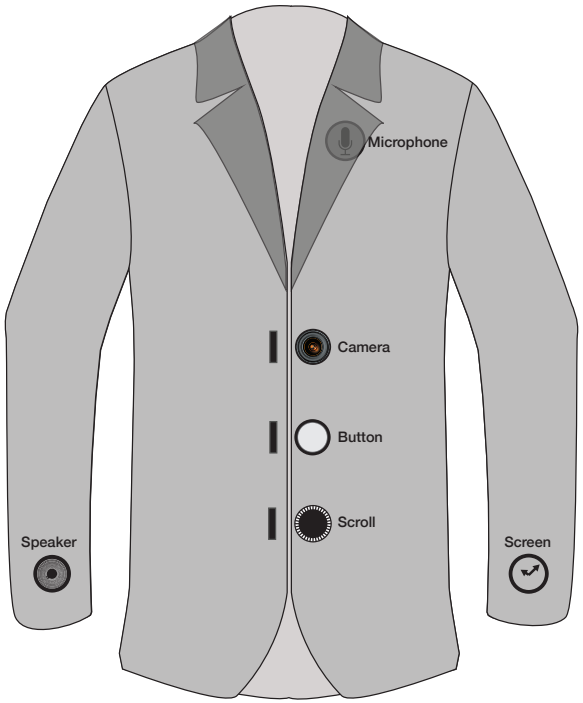

Figure 1: A jacket with interactive buttons. Different sensors are integrated, providing input and output. The buttons on the sleeves are located towards the inside of the wrist.

Introduction

We often use mobile devices such as smartphones in public settings for various tasks. In certain situations, we wish to refrain from taking the device out of our pocket and explicitly interacting with it. Wearable computing leverages these situations by providing users with a range of embodied interactions to achieve specific goals. An increasing number of wearable devices are entering the consumer market—smart watches, bracelets, pendants, glasses and headgear to name a few. Further, accessories such as rings have also been explored in the wearables research domain [7]. However, these devices are usually add-on accessories and require very explicit interactions, which might draw attention of other onlookers. There have been research works based on embedding interactions into the fabric of clothing items [5, 6]. The interaction space of such integrated wearables is limited to touch input. Also, since the technology is embedded into the fabric, the lack of physical cues makes it necessary for the users to remember the location of the interaction region. This could increase cognitive load and makes such devices harder to use in an eyes-free context.

We present a new interaction space for wearables in the form of interactive buttons, attached into clothing such as jackets and coats. Since these are rigid, physical components, users can easily locate them. Also, such buttons are inherently located at places which are easily reachable. We believe the physical location of these buttons plays an important role for performing subtle, inconspicuous interactions—gestures which do not attract attention from the surroundings. In [4], the regions around the collar, ribcage and waist are noted for being unobtrusive for wearable objects. These are the same regions where such interactive buttons are intended to be located. Our current research is limited to buttons that are of a size suitable for jackets (rather than shirts). Although this limits the utility to when one is wearing the jacket, our focus is on interactions in an outdoor urban environment, where this could be feasible.

In this paper, we explore several opportunities for using buttons to perform various functions that would otherwise require direct interaction with a mobile device. We have designed a set of buttons that support different types of

subtle interactions (both input and output).

Design Goals

To design for effective wearable interactions, we outline some desirable goals, which take into consideration factors such as aesthetics, form factor and function of the physical elements.

1. The wearable device can be *integrated into existing clothing*. This prevents users from having to wear additional accessories to achieve the desired interactions.

2. The technology is *not readily visible* to the naked eye. This allows for inconspicuous interactions and does not compromise the aesthetics of the clothing.

3. Interactive elements are *easily reachable*, and *allow for eyes-free interactions*.

4. To avoid mode-switching, each entity has its *own dedicated function*s.

5. Individual elements *can be linked together* to form automated workflows.

Interactive Button Space

A wide variety of iButtons can be created using different sensing techniques. Depending on the technology used, iButtons can also combine input and output into one button. We provide an overview of the different iButtons, along with their functions and required components. Although we do not consider this to be an exhaustive enumeration of all possible buttons, we believe this covers some of the most important ones.

Input Buttons: Push button, Radial dial, Four-way control (D-pad), Capacitive touch and proximity, microphone.

Output Buttons: Camera, OLED and 8-segment displays, Speaker, Dual-state LEDs.

Types of Interactions

We have classified the inconspicuous interactions supported by iButtons into four categories and provide some use scenarios:

Secretive interactions: Tasks which users might want to perform inconspicuously, because there is a need to hide them for privacy reasons or avoiding social awkwardness.

Unlocking a mobile phone: Current methods typically use four-digit passcodes or a unique sweeping pattern. These can be easily discerned by a person casually glancing at the screen, hence compromising security. Instead, by simply tapping on an iButton, one could unlock their mobile phone. Since buttons are embedded onto the user's clothing, it would be unlikely that an unauthorised person could gain access without the owner's approval.

Embodied interactions: Tasks that are specific to the social settings of the user and performed by using the tangible interaction techniques and sensing embedded in an everyday object such as a jacket.

Foursquare Check-Ins: We try to shift focus away from mobile phone-based interactions by using embodied interactions, which provide tangible interactions in a social context [3]. The popularity of location-based social media platforms like FourSquare inspires these interactions. As a use scenario, through a simple push of a button on the jacket, a user could check-in and simultaneously trigger

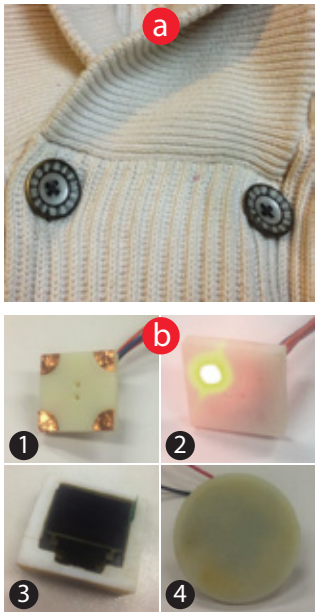

Figure 2: Prototyping interactive buttons. (a) A jacket with buttons of suitable size. (b) Some working prototypes: 1. Four-way control 2. Status LEDs 3. OLED Display 4. Piezo-electric Speaker.

the camera to capture a snapshot of the location.

Contextual interactions: Tasks dependent on the context of usage and the environment, including situated tasks that are specific to the location of the user.

Life-logging: The environment around the user is taken into consideration for these interactions. For example, a life-logging system similar to Autographer [1] can be realised using a combination of iButtons. Proximity sensors can detect if a person is interacting with the user, which can trigger the camera to log such a meeting. Other monitors, such as ambient light sensors, can be used to detect various different contexts and trigger new logs.

Glance Interactions: Simple tasks which require only momentary visual focus.

Activity Monitoring: The Fitbit bracelet [2] uses a series of five LEDs to show daily progress. This can be easily realised by integrating an iButton with LEDs and placing it on the sleeve (wrist) of the jacket.

Future Work

The presented work on interactive buttons is still in its initial stage. Although part of the design space is presented in this paper, we still need to explore how different ensembles of buttons work and which configurations lead to usable interactions. We plan to iterate over and extend this design space and perform a set of studies to chart preferred interactions and usages.

Our future research directions and goals for interactive buttons also include studies to analyse the ability of users to locate iButtons and remember their specific functions, gathering qualitative feedback and studying acceptance of such a technology. We also aim to identify the most desirable workflows, which can be developed using iButtons, and to design efficient arrays of buttons, allowing them to be repurposed for multiple workflows. Finally, we intend to prototype a fully-functional interactive jacket to conduct studies in the wild and to validate the enlisted design goals.

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