

SonarWatch: Appropriating the Forearm as a Slider Bar

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1 introduction

Human bodies become an emerging type of human-computer interfaces recently. Not only because our skin is a surface that is always available and highly accessible, but also the sense of how our body is configured in space allows us to accurately interact with our bodies in an eye-free manner. Hence, this input method is suitable to be applied on extending the interaction space of mobile devices [Harrison et al. 2010] or providing more degrees-of-freedom for enhancing gaming experiences such as Kinect¹. Nevertheless, since the additional gesture detector may be obtrusive or not so portable for users, this approach can hardly be applied in everyday life.

This work presents *SonarWatch*, a less-obtrusive, wearable gesture detector. Unlike the device introduced by Nakatsuma et al. [2011], we equipped an ultrasonic rangefinder and a capacitive touch sensor on a wristwatch (Figure 1), thus a user’s forearm can be appropriated as a readily available input surface for interacting with computers. Several click and slide gestures are allowed to be performed by the user. To demonstrate the possible applications and the effectiveness of this implicit design, three applications are provided: photo browsing, music playlist controlling and augmenting Kinect for gaming.

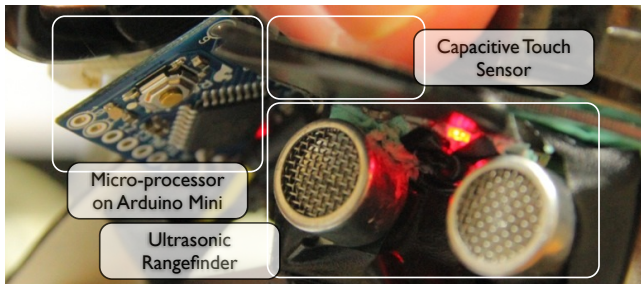


Figure 1: *SonarWatch*, a wristwatch equipped with an ultrasonic rangefinder and a capacitive touch sensor. Sensor outputs are retrieved by the Arduino Mini platform

2 SonarWatch

Our device consists of a low-power consumption Devantech SRF10 ultrasonic rangefinder, which provides distance readings from 6cm to 6m, and a capacitive touch sensor mounted for detecting user events. The user can touch the sensor to initiate the detection (Figure 2(a)(b)). Once releasing the finger from the sensor, the rangefinder starts detecting the gesture between the following 0.3s to 1s at 30Hz sampling rate. Noisy outputs would be classified as outliers. All sensor data is retrieved by the microprocessor and transferred to the server running on a PC for analysis.

Two types of gestures are developed for users to interact with *SonarWatch*: *Click* and *Slide*. A *Click* gesture (Figure 2(a)) is recognized if there is no finger detected within 20cm in the first three samplings. Once detecting a click, the sampling session would be immediately terminated for listening a Double-Click. A *Slide* gesture is recognized if fingers are detected within the range such like

(Figure 2(b)). In this case, the sampling session would be continued, and the maximum distance M and the final position P would be obtained. If $M \leq 20cm$, Slide-to-Select (Figure 2(c)) is determined with regarding selection at P ; if $M > 20cm$, it is determined as either Slide-Up ($P > 20cm$, Figure 2(d)) or Slide-Down ($P \leq 20cm$, Figure 2(e)).

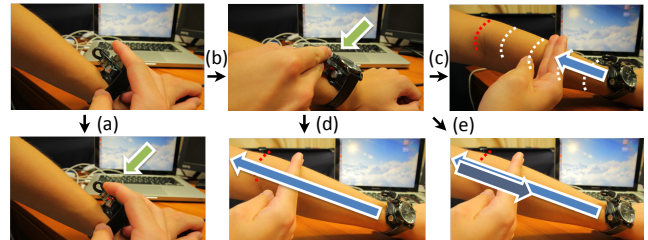


Figure 2: Available gestures. (a) Posture for a click. (b) Posture for a slide. (c) Slide-to-Select. (d) Slide-Up. (e) Slide-Down.

3 Applications

We have implemented three different applications for demonstrating the effectiveness of our approaches: photo browsing, playlist controlling, and augmenting Kinect for gaming.

Photo browsing: Gestures can help users browsing photos more efficiently. In the photo browser, the users can Slide-Up/Down for turning pages, Slide-to-Select thumbnails for browsing photos, Single-click to select an album, and Double-click to return.

Playlist controlling: While working with listening to the music, users may want to control the playlist in an eyes-free manner. Hence, the users can Single-Click to play/pause, Slide-to-Select to adjust volume, and Slide-Up/Down to switch to another song.

Augmenting Kinect for gaming: Utilizing body as controller may somehow lacking haptic sensation, but we can use our proprioception as a complement. We illustrate this idea by the Angry Birds² game. Since a user’s arm position can be captured by Kinect, she can perform a shot by moving her arm up and down to adjust the angle of slingshot, sliding the fingers on the arm to select the desired intensity, and removing the fingers to launch the Angry Birds.

References

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- NAKATSUMA, K., SHINODA, H., MAKINO, Y., SATO, K., AND MAENO, T. 2011. Touch interface on back of the hand. In *ACM SIGGRAPH 2011 E-Tech.*, 39.

¹<http://www.xbox.com/kinect/>

²<http://www.angrybirds.com/>