コインサイズのワイヤレスセンサを用いた Hands-Popie

Hands Popie using coin size wireless sensor

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Summary. Human gestures are typical examples of non-verbal communication, and help people communicate smoothly [1]. However, using camera to recognizing gesture needs high processing power and suffer from delays in recognition [2]. Popie [3] is a pen-based menu interface that facilitate the entering of Japanese text, but the user must be attached to screen in order to use this interface. So our main motivation is how we should design a user interface that use cookie wireless sensor [4] as an input device. In this paper we describe the interface setting, method of recognizing full hand gestures and direction from 3D-accelerometer data.

1 Background

Popie a menu-selection-based Japanese input method for a pen device. The system starts by allowing the user to select some characters constants then the system recommend the user a set of recommended words "Kanji" to select from. In some situations, consonant sequences can recommend a huge amount of kanji-form candidates. The user can input consonants, and select kanji-form candidates fluidly, using FlowMenu. [3].

In this research we attach a coin size wireless sensor to cone or sphere object [5] and in our primary experiments we put an assumption that the user not change the orientation of the sensor. If the user change the orientation of the nokia sensor then this will cause the gravity value of the accelerometer to be applied on the 3-axis accelerometer which at the end will cause a disruption for the accelerometer real values.

Nokia wireless coin size Sensors

Nokia cookie is an experimental device developed to test ubiquitous context aware applications. The chassis contains 6 sensors and sends data using Bluetooth. The device is about the size of 5 stacked quarter coins [4].

The sensor is composed of 2-axis linear accelerometer, Compass 3-axis sensor, Ambient light sensor, Galvanic skin response sensor, Heart rate sensor and Skin temperature sensor (see Fig.1 and Fig. 2). The sensor has two communication interfaces, Bluetooth and UART wired connection [4].

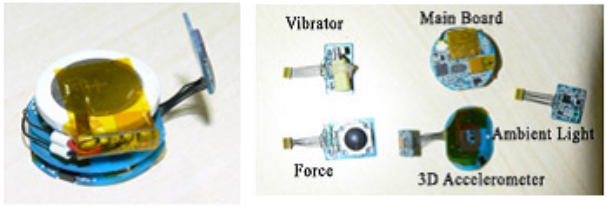

図 1. Nokia Sensor with 3D accelerometer(left) and Nokia Sensor Extension boards(right)

In order to allow users to define there own gestures we use a gesture recognition toolkit called GART [6] which depends on hidden markov model (HMM) for pattern recognition. GART has been tested using a regular mouse device to recognize users gestures.

2 Interface Overview

Popie composed of 24 basic patterns for example moving to north direction-northwest then returning back to initial state. We ask the user to define the 24 basic patterns for Popie usage see figure 2. Popie depends on basic 8 directions then each direction has 2 other directions one to the east and other to west that can be possible to moves towards. When reaching the initial state this means that the user has ended his pattern of motion and he will select one of the recommended words or enter another pattern of motion.

User has to train the Interface first by using

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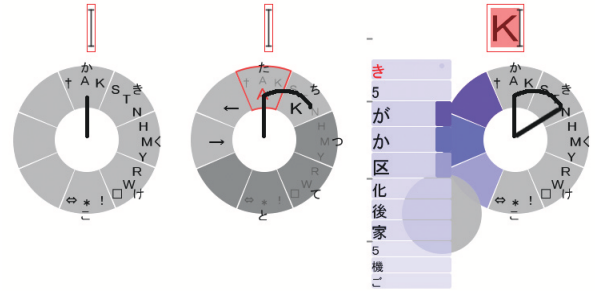

図 2. Pattern for selecting North, North east then back to start position.

the GART toolkit to define his own gestures for each Popie pattern, user has a complete freedom to determine his own hand gesture for each Popie pattern. For each pattern the user is asked to give at least five training sets. As much as the user trains the interface the more accuracy for detection the appropriate Popie pattern we can get.

3 Interface Architecture

In interface split the patterns by using the (Galvinic skin reaction) sensor so that whenever the user touch or release the GSR sensor the interface starts to record the pattern data. The interface captures and records a 3-d vector of the accelerometer readings for the three axis (x,y,z) respectively and calculates the angle between two successive 3-d vectors and record this as one sequence of pattern. Hence a pattern composed of three readings of the 3d accelerometer and angle between vectors. The interface passes this recorded data to GART to perform the training of the patterns, after this the interface will be ready to recognize the user 's gestures.

When the user performs a certain gesture the interface recognize the pattern and trigger this into a keyboard stroke. Popie application can be operated by pen with touch screen or by keyboard strokes, so it is listening to keyboard strokes and each keyboard stroke sequence can represent a pattern.

4 Primary evaluation

The primary evaluation shows that this interface can be useful to allow the user to freely customize his gestures and interact with Popie with his customized method of interaction. On the other hand the recognition of patterns still needs more enhancements in means of accuracy and minimizing the effect of gravity values that are applied on the 3-axis of accelerometer while changing the orientation of the sensor.

5 Conclusion

We developed an interface that allows using of Nokia sensors wireless device as a tool for entering Japanese words and sentences using the Popie interface. Users can customize there own gestures for each Popie pattern. so this can support the customization of the interface.

More study needed to evaluate this system in means of accuracy and time to enter text and compare the results to the usage of pen-based Popie interface. Also recognition accuracy could be enhanced during time of usage.

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