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CS 2310
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Project Report

This project contains two parts, the first part is the extended implementation of Project IV, in which a new super component named EmergencyManager is introduced in cooperation with the PrjRemote to simulate the gesture processing procedure in a health care system. The second part is to utilize the Sony Motion Controller for PlayStation 3 to gain actual gesture signals from users and generate corresponding health care reactions.

In the first part of the project, a super component named EmergencyManager is created under the SuperComponents folder. This super component will listen to the IP address 127.0.0.1 at port 53127 for generated gesture information from the PrjRemote. The EmergencyGestureAlert is a set of basic components with type alert that will be sent to from the PrjRemote to EmergencyManager. The EmergencyGestureAlert contains two key-value bindings named Intensity and Similarity, which will be processed by the EmergencyManager to generate corresponding health care reactions. The basic logics are shown in Table 1below:

	Patient is fine	Call for help	Start emergency ambulance
Intensity	<70	>=70	>=90
Similarity	<70	>=70	>=90

Table 1: EmergencyManager gesture signal processing logics

For part 1 demonstration, three basic EmergencyGestureAlert components are uploaded to PrjRemote, in which each of the basic components contains different value in Intensity and Similarity to simulate the three logic options of EmergencyManager super component.

In the second part of the project, a Sony Motion Controller designed for PlayStation 3 is used to detect user gestures instead of simulating gesture signals using EmergencyGestureAlert components through PrjRemote.

The Sony Motion Controller is a motion-sensing game controller platform by Sony Computer Entertainment. Unlike Kinect from Microsoft's XBOX 360 console which gesture detection is completely depended by the Kinect sensor, the Sony Motion Controller is based around a handheld motion controller wand. It uses inertial sensors in the wand to detect its motion, and the wand's position is tracked using a PlayStation webcam such as PlayStation Eye. Motion

Controller also has built in bluetooth that can pair with any device that also has a bluetooth as long as suitable drivers are available.

The design of the Sony Motion Controller provides three advantages compared to Microsoft's Kinect in this health care project. Firstly, No PlayStation webcams are needed for gesture detection as webcams only collect patient's position data. The gesture data, which is exactly all what EmergencyManager super component needs, can be sufficiently collected using only the Motion Controller (as per the device document, the Sony Motion Controller has built-in accelerometer, magnetometer, gyroscope and temperature sensor). This means as long as the patient is holding the Motion Controller and is within the bluetooth connection range (contemporary bluetooth connection radius can reach 100ft, which is large enough to cover normal houses), the gesture data can be collected by the Motion Controller and send wirelessly through the built in bluetooth to the host machine which runs EmergencyManager. In contrast, since Kinect needs to "see" the patient under its view in order to detect patient's gesture, for any normal house with several independent rooms, a number of Kinect sensors are required to be installed to cover the view of the whole house, which significantly increase the setup cost of this health care system.

Secondly, the Sony Motion Controller has built-in color LED light and vibration motor which is programmable for state indication. This also eliminate the need of monitor screen which whether patient's gesture request has been captured and sent out.

Thirdly, the Sony Motion Controller needs not to be alway turned on like Kinect, when the patient needs to send gesture request, one button click on the Motion Controller will have it connect to the host immediately, which will save considerable amount of energy cost in daily use.

So overall, the Sony Motion Controller is more useful and more practical to use in this health care system. It is not only more convenient to deploy, more convenient to use, but also much less expensive and much less energy consuming.

The Sony Motion Controller does not have official driver and development tools for PC, but fortunately, an open-source library called the PS Move API[1] is provided by the third party developer team which offers support for Windows, MacOS and Linux to access the Sony Move Motion Controller via Bluetooth and USB directly from PC without the need for a PS3. It contain some exciting core features listed below, some of which are exactly needed to make the gesture detection program.

- Pairing of Bluetooth controllers via USB
- Setting LEDs and rumble via USB and Bluetooth
- Reading inertial sensors and buttons via Bluetooth
- Tracking up to 5 controllers in 3D space via OpenCV
- 3D orientation tracking via an open source AHRS algorithm

- Sensor fusion for augmented and virtual reality applications[2]

For the demonstration, two programs are written in C using the PS Move API, the first program is called test.exe which implement all useful APIs we need in order to check whether those APIs and their corresponding built-in components are working properly. the second program is named gesture_detection.exe which is the main program used to detect user's gesture and send corresponding messages to the EmergencyManager super component. In this program, we set the trigger gesture to be circle wind. A horizontal circle wind represents calling for help, hence after a horizontal wind, the threshold variable will be set to 70 which means both Intensity and Similarity is over 70. If the user adds a vertical circle wind after the horizontal wind, the threshold variable will increase to 100, which triggers the "call for ambulance" emergency message. The LED light will gradually change color from green to red, indicating the value change of the threshold. After the threshold variable is over 70, a light rumble is activated indicating "call for help" alert messages has been generated and sent. After the threshold variable is over 90, a heavy rumble is activated indicating "call for ambulance" emergency message has been generated and sent.

The link to the demonstration to both parts is on ben072292.ddns.net/CS2310.

Reference

1. *PS Move API*. Dec 12, 2012. http://thp.io/2010/psmove/. Web.
2. PS Move API 3.0.0 API Documentation. Dec 12, 2012. https://code.google.com/p/moveonpc/downloads/detail?name=psmoveapi-3.0.0-docs.zip. Web.