CS2310
Final Project
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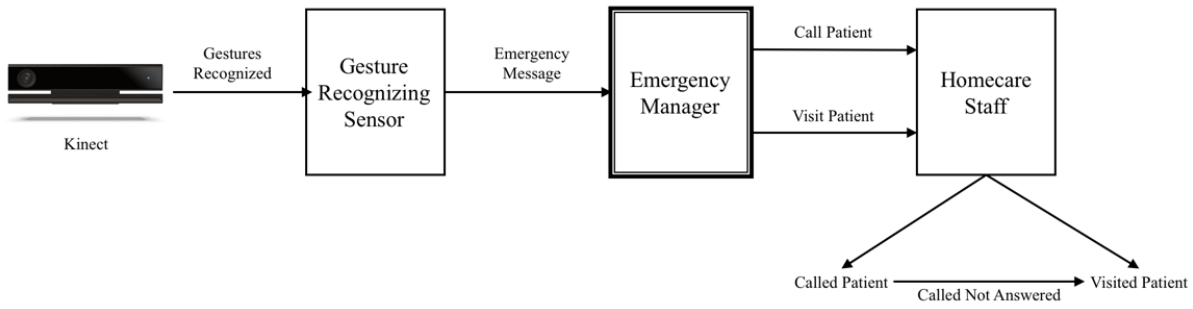
Term Project Report

Introduction

In this project, I worked on expanding exercise 4. What I focused on is making the real gesture recognizing sensor and design proper gestures and recognizing method that are optimal for patient in order to help them to report their emergency to the emergency manager.

System Design

The following graph illustrated the expanded system based on exercise 4. There are three components in the system: Gesture Recognizing Sensor, Emergency Manager and Homecare Staff. In Gesture Recognizing Sensor, there is a Kinect sensor involved for gesture recognizing. In the following section, there are more specific description about each component.



Components

Gesture Recognizing Sensor

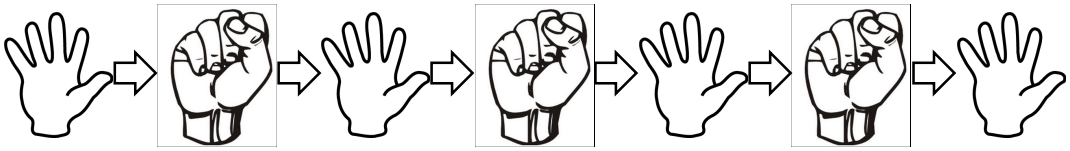
This component works to detect gesture from the patient as a sign of emergency message and send it to the emergency manager.

- Sensor (Kinect)

I used Kinect for gesture recognizing, since it can easily detect users' movement in a very big area and very specifically described the movement as data for developers to use. It can detect body movement described as movement of skeleton movement. It can even detect hand gesture, which give developers more possibilities.

- Gesture (Hand gesture)

  Based on my understanding and thinking in patients' prospective, I choose to use a series of hand gestures for emergency message. The series of hand gestures can be illustrated like following:

  Patients will need to use their right hand to do open hand, closed hand alternatively for seven times as a representation of emergency message. I only used right hand, it can definitely be expanded to recognizing either hand easily.

  Patients need to do these hand gestures continually, otherwise, if the patient stopped in the middle, it will not be recognized. A threshold of time interval between two different hand gestures is used to achieve this. I use 2 seconds as threshold. It can be changed to be optimized for patients.

  Also after patient successfully sent a message, there will be a very short time interval that patient cannot send message. It is design to avoid patient send extra message that not intended since it is not a good design for patients to count how many gestures they did. If patients are in a severe situation, they can keep doing the series of hand gestures that can across the time interval, since it is very short, in order to send more emergency message as a representation of severe situation.

  When a series of hand gestures is recognized as emergency message, a visual feedback will be displayed on screen. If they saw that, they can stop. This feedback can be replaced by any type of feedback that are optimal for patients.

  There are several reasons why I use this series of gesture:

  - It it easy to performed. When they are in emergency, they may not be able make a very big movement. This hand gesture didn't requirement patient to move a lot and it is simple enough to do.
  - Fault tolerant. Since it requires several repeats of hand gestures and using time threshold to control, it is hard to make a false alert from normal activities.

- Implementation

  - The Kinect program is written in C#. Parts of the program is inspired by an open source project provided by Vangos Pterneas (Pterneas, 2014). I implemented all the logical and control unit for gesture recognition and modified the display for visual feedback.
  - The Gesture Recognizing Sensor component is written in Java and followed the requirement of the SIS system.
  - The connection between Kinect program and Gesture Recognizing Sensor component is socket based. Kinect program will work as a client to send message to Gesture Recognizing Sensor component as server.

Emergency Manager

This component as a super component can generate different solutions after receiving Emergency message from Gesture recognizing sensor.

1. Message came as the first time

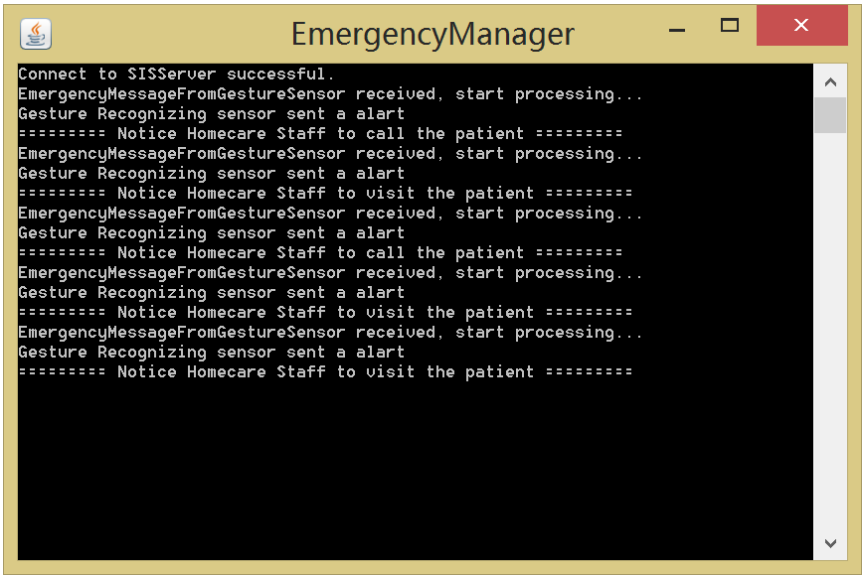
   The emergency manager will send a message to homecare staff to tell them to call the patient.

2. Message came not the first time

   The emergency manager will send a message to homecare staff to tell them to visit the patient

After a message is proceed, a timer will start a count down, if there is no message coming after previous message for certain amount of time, which is a threshold, the emergency manager will clean the history so that if a message coming, the message will be treated as the first time attempt.

Here is the screen shot to show how Emergency Manager process the emergency message.

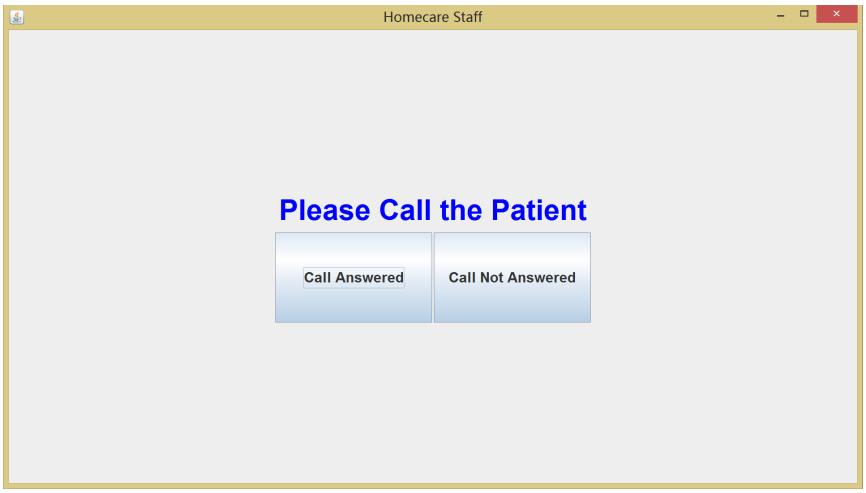


Homecare Staff

This component will work to do the job that emergency manager asked. When it received the message, it will display it in a pop up window.

1. Message: Call The Patient

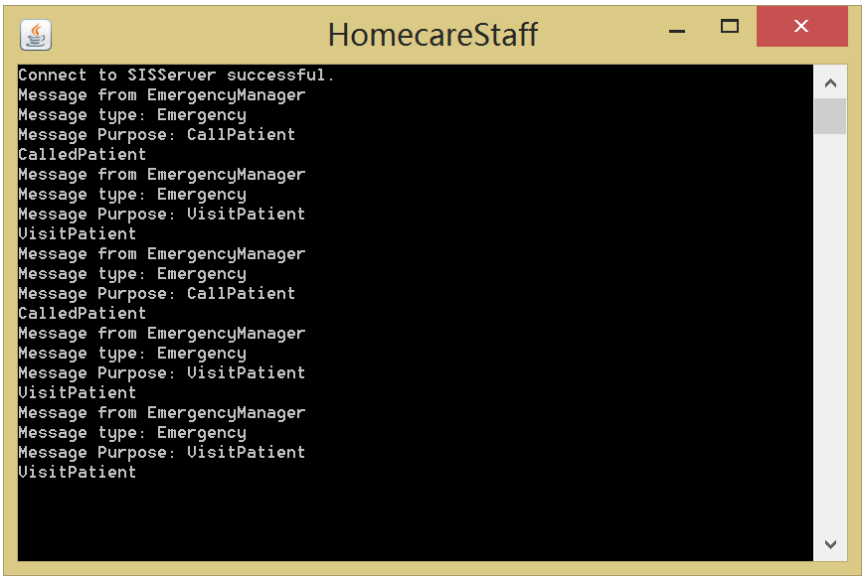
   It will display call patient information on screen to homecare staff and wait for the response from them to see if the patient picks up the phone. if the feedback is patient didn't pick up the phone, it will display visit patient information on screen to homecare staff.



2. Message: Visit The Patient

It will display visit patient information on screen to homecare staff.

Screen Shot to show how Homecare Staff component works



Demonstration

There is a Demo video on YouTube, which demonstrate how my program works:

https://youtu.be/kqB8UDE8gf8

Link to The Source Code

https://www.dropbox.com/s/ubntrquyl1457r3/CS2310TermProject.zip?dl=0

Passible gems

1. Link to YouTube live demo
2. Include the Kinect as a sensor for gesture recognizing
3. Come up an easy to use hand gesture for emergency message and recognizing algorithm
4. Graphical display of message in Homecare Staff component
5. Link to the source code for this project.

Reference

PternеasVangos. (March 21, 2014). Kinect for Windows version 2: Hand tracking. Source: Vangos Pterneas: http://pterneas.com/2014/03/21/kinect-for-windows-version-2-hand-tracking/