Name(s)	Project Number
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Project Title

ResQ: A Low Cost Wearable Device that Automatically Detects Falls and Immediately Alerts Family Members Worldwide

Abstract

Objectives/Goals

Design and prototype a low cost wearable device for senior citizens that will automatically alert family members worldwide, in the event the senior falls down and loses consciousness. It is intended to be carried in a pocket or worn around the neck.

Methods/Materials

Hardware Components: Arduino microcontroller, IMU sensor (combination of accelerometer and gyroscope), wireless Bluetooth shield and 9V battery.

Software Components: 1) Fall detection algorithm was implemented in C, to control the Arduino & IMU sensor using open source Arduino software tools. 2) Modified existing open source iOS software to develop companion iOS app using Xcode tools.

The device ResQ was created by connecting the IMU and Bluetooth Shield to the Arduino. The IMU measures the angle of the device while the senior citizen is in motion. The Arduino reads the angle values every 50 milliseconds from the IMU and converts them into angular velocities. If the angular velocity exceeds a pre-determined "falling down" threshold, the Arduino instructs the Bluetooth module to send a signal to the senior citizen's mobile phone. The phone then automatically triggers an alert Notification containing GPS location data and also calls designated family members anywhere in the world.

Results

A prototype version of ResQ and its companion mobile app were successfully designed, built and programmed. The device and algorithm have been extensively tested using a crash test dummy to simulate various senior citizen activities like walking, lying down, sitting and falling down. Angular velocity threshold has been fine-tuned to reduce false positives. ResQ's ability to automatically call emergency contacts internationally, has also been successfully tested.

Conclusions/Discussion

ResQ has been demonstrated to geriatricians, senior citizens and administrators at three local elderly care centers. The feedback received indicates that this device is clearly superior to medical alert systems available in the market today. Current products cost approximately $500 annually and many require the senior citizen to manually press a help button, which is especially hard for Alzheimers patients. Additionally, none of these services work globally. A production version of ResQ, the size of a quarter, is estimated to cost less than $20. This affordable solution has significant application for over 13 million seniors living alone in the US.

Summary Statement

I have successfully designed, built and implemented a low cost, wearable, automatic fall detection device and its companion mobile app that alerts family members worldwide in the event of a Fall.

Help Received

With guidance from my robotics teacher Mr. Schaeffer, I have worked on several Arduino projects over the past 2 years and designed & programmed my own PID algorithm for a drone I built, using an IMU sensor. This helped me design and program ResQ's fall detection algorithm, myself.