ENSC 440 Progress Report
F.A.M. Inc.

March 19, 2012

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We are developing a small portable accelerometer-based device that will attach to an elderly person's belt and detect if they have fallen. Once a fall is detected the device will contact a central control unit which will then send a text message to a family member and notify the proper authorities. Development has been divided into two groups: portable unit/fall detection and central unit/text messaging.

The fall detection group has worked with the eZ430-RF2500 communications development kit from Texas Instruments. The kit includes two boards, each with an RF transceiver, a microcontroller, input pins, and a push button. One board is connected to a 3-axis accelerometer (the ADXL335 from Analog Devices). The second board is connected to the central unit or to a computer. Previously, we wrote software code to wirelessly transmit data between the boards.

More recently, we have done hardware work to connect the accelerometer to one board and power it via a 9V battery and 3.3V voltage regulator. Using relatively simple code, we can send accelerometer data to the second board (which is connected to a computer via USB port) and record it as a text file. In this way, we have begun collecting data of fall trials. We have also created a software framework for our fall detection code. The code monitors the accelerometer values and loops through a 'fall detection algorithm' to determine if a fall has occurred. The fall algorithm we are currently using is rudimentary, but will soon be replaced by a more sophisticated version. Finally, we have already integrated the second board with the central unit Arduino so that incoming RF message characters and digits can be easily shared.

There are several tasks remaining. Most importantly, we must develop a robust and reliable fall algorithm. We are currently analyzing our fall trial data and investigating several potential methods. We have contacted Dr. Steven Robinovitch, an SFU professor and expert in fall-related injuries, and hope to meet with him to discuss common fall types and our ideas for fall detection. Second, we need to create a plastic case for the portable device and have ordered materials for that purpose. The final task is testing the device to make sure that it reliably works for a variety of fall types and that it avoids false alarms as much as possible.

The central unit group has worked principally on getting our central device to send text messages when we receive a signal from the portable device. A lot of research was done to determine the best way to accomplish this task. We bought an Arduino Omega 2560 microcontroller, which gives us an easy to work with platform for the central unit. We also bought a GSM Shield (a device that can carry out a variety of communications, including telephone text messaging) which is compatible with the Arduino board and a small LCD display.

To date, we have connected the LCD screen to the Arduino and can print messages on it. Later when the fall alert system is operational, we will use the LCD to inform on-site help about a fall (if the system is being used in a nursing home, for instance). We have also soldered the GSM shield and the Arduino together. By inserting a cell phone SIM card into the GSM Shield, the Arduino can now command the shield to send simultaneous texts to several recorded phone numbers and we have successfully sent messages to all our group members.

The next task to be completed is to get the Arduino and GSM to be powered via AC wall-socket, instead of an electronics lab DC supply. After this is done, we will focus on fine tuning our texting code and the code that interfaces with the transceiver from the portable unit. We will also build a case for the central unit and, if there is time, implement a keyboard to type in the phone numbers to text when an alert occurs.