Prediction of Fall Detection using Mixed Approach of wavelet Transformation and Classification in Smart Devices

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Abstract: **Ubiquitous computing is latest trend in computer science and information technology to compete with the human challenges. Wearable computing is one of the most predominant technology to accomplish small tasks using sensors. To implement fall detection algorithm in smart devices we propose a novel algorithm with classification technology to predict the falls accurately and send information based on GPS positions and activate emergency mode with information transmission to all predefined contact lists. In addition to that it sends the geographical information through GPS to local Hospital service. Detecting human activities is calculated using wavelet transforms based on time frequency transformations. It can implement in any smart device like phones or watches or tablets but the only criteria is to carry the device along with the person.**

Keywords : ,GPS , , Classification , wavelet transform , smart phone ,accelerometer

INTRODUCTION

Smart phone usage in everyday life grows enormously. A smart phone is a mobile with additional features like camera, GPS navigation system and media players etc., it built high computing power and which runs on operating system. The first smart phone device introduced was iPhone in 2007 with multi touch interface. In 2008 android mobile was introduced. In below figure the rapid growth of smart devices in millions over year by year is displayed
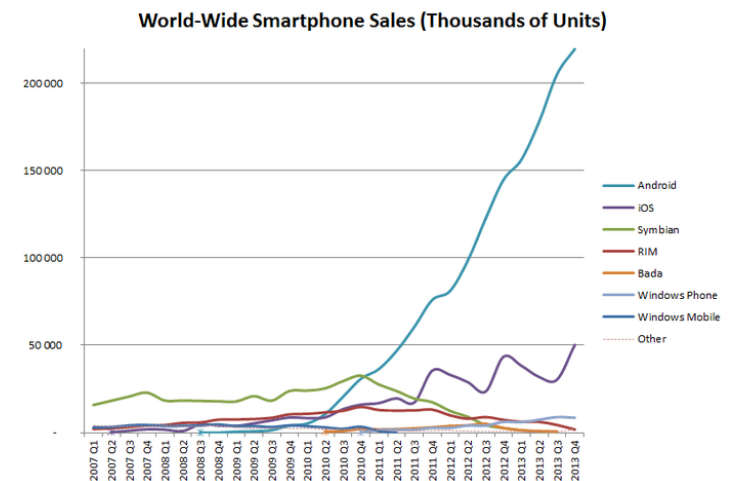

Fig.1 smart phone sales

To utilize the features in smart devices for the public, we proposed a novel framework for fall detection which helps the elder people in various ways. As we know it contains GPS System whenever the fall occurs system will detect the current coordinates of the present location and send the information to their contact lists. Automatic fall detection methods can be categorized into three:

I)   Video based Methods

II)   Acoustic Methods

III)   Wearable based sensor Methods

Video based methods are depends on images and its orientation .Acoustic based methods detect falls based on vibrations reached to the ground.it used microphone to detect vibrations.   Wearable based methods are more suitable for fall detection because the device was worn on human. In this paper, we prefer wearable methods to detect falls. In this approach GPS positions were used to pass the information. Detecting the fall by frequency using Fourier transforms.

We use android location manager to get location values by using GPS. These services will give periodical updates over geographical regions

2. Related Work

Fall detection method is challenging approach. el[6] bark proposed that after fallen the message will be send via email or twitter about the location was given a basic idea . It could be achieved by analyzing accelerometer data. Location details could be achieved using GPS navigator system. Yavuz [6] propose fall detection algorithm using discrete wavelet transformations as future extraction method and falls will be identified based on the frequency functions. [1] Pressure sensors and accelerometers for vibration detection are placed in predefined space to monitor activities. In[1] work it detects the wavelet frequency to determine the fall. We have a coordinator to monitor the services. In our work we propose an automated detection algorithm and send the emergency service

3. Working Model

In this model whenever the fall occurs, information from the smart device is transferred in two modes, it contacts the friend list via SMS alert and also it sends the GPS values to the nearest hospital services, so the emergency mode will be activated. Fall detections are observed based on the training samples present in the smart device .Here we follow the mixed approach one from the acoustic and other from sensor detector. In earlier one it uses wavelet transforms to compare with the trained samples. These samples are already incurred in the mobile while the app was installed. Whereas sensor approach detects the signal when it touches the ground.

In classical Fourier transform f(k) tells us the size of component of frequency k, we do not know when the signal is sounded. When we use wavelet transforms, each wavelet tells us to define temporal extent of signal and also frequency spectrum of signal. We need to find directions of x, y, z axis using accelerometer
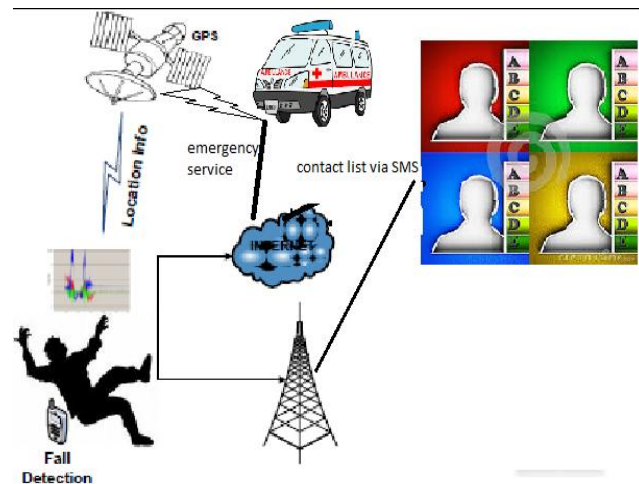

Fig. 2 : Architecture

Here whenever the device touches the surface it senses with a high frequency signal compared with classifier and generate the alert messages. In our system the message was trasferred to the contact list and emergency service with 15 seconds delay .because there might be a change to getting down the phone on surface if so we have an option to stop through alert message dialog box button

3. Accelerometer

Accelerometer are used to detect the vibrations over natural signals. Single and multiple axis modes are available to detect direction and magnitude of G-Force. Smart devices are made of accelerometer which changes the screen upright. The main challenging aspect in accelerometer is to detect the dynamic loads of human activities like running, skipping and dancing (mostly in iPhone). In this paper, we use accelerometer with compass magnitude to detect the multi axis rotations for fall detections. Hall Effect sensors are used for proximity switching because it measures wide range of magnetic fields.[1] we can consider triaxial accelerometer which uses only signal magnitude vector s[n]

$$S[n]= \text{Sqrt } (a_x^2[n] + a_y^2[n] + a_z^2[n])$$

4. Compass Navigator

A compass navigator is used to shows the directions .The magnetized needle automatically attracts horizontal component of earths magnitude.

5. Classifier builder

The most useful algorithmic model used in this project was to build the classifier model which consists of set of samples of predefined fall detection waves. In our project we store all such signals and the classifier work is to match the exact criteria of particular fall detection. We have an option to set several other samples to match using acoustic methodologies. Classifier builder having all trained samples of fall signals.

5. Wavelet transformation

Analysis of sinusoidal signals can be done using the below Fourier series .whenever the frequency changes over time

$$y(t) = \sin(2\pi f_0 t) + \sin(4\pi f_0 t) + \sin(8\pi f_0 t).$$

Wavelet transform

$$X(a,b) = \frac{1}{\sqrt{a}} \int_{-\infty}^{\infty} \overline{\Psi\left(\frac{t-b}{a}\right)} x(t)\, dt$$

In our paper, we use the predefined samples (training) for all observational falls. Whenever it gives the equivalent wavelet it compares with the existing db samples and generate the alert to send information to the contacts list with emergency service

6. Future work

In future, we can extend the services in all wearable computing devices with respect to threshold values. We can extend the project to give support to the people based on pulse rate issues and also generate the hints to health disease. All these are predefined in the app with existing samples .we can use correlation analysis to detect the patterns.

7. Conclusion

In this paper, we propose a novel approach to detect fall detection algorithm. Here we follow a mixed approach

which uses both wavelet transforms and Fourier transforms with respect to frequency. In our paper, we use a traditional technique called classification to maintain samples in the database. Samples are represented in vectors to compare with newly generated frequency signal

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