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A Posture Recognition-Based Fall Detection System for Monitoring an Elderly Person in a Smart Home Environment

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Abstract

The mobile application is capable of detecting possible falls for elderly, through the use of special sensors. The alert messages contain useful information about the people in danger, such as his/her geo location and also corresponding directions on a map. In occasions of false alerts, the supervised person is given the ability to estimate the value of importance of a possible alert and to stop it before being transmitted. This paper describes system for monitoring and fall detection of ELDERLY PEOPLE using triaxial accelerometer together with ZigBee transceiver to detect fall of ELDERLY PEOPLE. The Accidental Fall Detection System will be able to assist careers as well as the elderly, as the careers will be notified immediately to the intended person. This fall detection system is designed to detect the accidental fall of the elderly and alert the careers or their loved ones via Smart-Messaging Services (SMS) immediately. This fall detection is created using microcontroller technology as the heart of the system, the accelerometer as to detect the sudden movement or fall and the Global System for Mobile (GSM) modem, to send out SMS to the receiver

***Keywords**: Activity classification, embedded, fall detection, histogram of oriented gradients, optical flow, smart cameras.*

1. INTRODUCTION

The leading health problems in the elderly community. They can occur in home as well as in hospitals or in the long-term care institutions Falls increase risk for serious injuries, chronic pain, long-term disability, and loss of independent A fall can cause psychological damage even if the person did not suffer a physical injury. Those who fall often experience decrease activities of daily living and self-care due to fear of falling again. This behavior decreases their mobility, balance and fitness and leads to reduced social interactions and increased depression. The mortality rate for falls increases progressively with age. Falls caused 57% of deaths due to injuries among females and 36% of deaths among males, age 65 and older Majority of falls result from an interaction between multiple long-term and short-term factors in person's environment Common risk factors include problems with balance and stability, arthritis, muscle weakness, multiple medications therapy, depressive symptoms, cardiac disorders, stroke, impairment in cognition and vision Detection of a fall possibly leading to injury in timely manner is crucial for providing adequate medical response and care. Present fall detection systems can be categorized under one of the following groups: User activated alarm systems (wireless tags), Floor vibration-based fall detection, Wearable sensors (contact sensors and switches, sensors for heart rate. The most common method for fall detection is using a triaxial accelerometers or bi-axial gyroscopes. Accelerometer is a device for measuring acceleration, but is also used to detect free fall and shock, movement, speed and vibration. Using the threshold algorithms while measuring changes in acceleration in each direction.

2. METHODOLOGY

2.1 Systems Using Non vision Sensor

Accelerometer-based systems use wearable devices containing an accelerometer, the output of which is used to detect a fall. Using accelerometers has been one

of the most popular approaches. Initial prototypes were designed for detecting falls in the elderly and were based on autonomous belt devices which detected impact of shock on the ground along with mercury tilt switches to detect a person lying on the floor. Since then, a lot of work has been done in the area of accelerometry tri-axial accelerometry posture based and many other techniques based on the fusion of the above systems.

Accelerometer-based systems are simple and cost effective.However, robustness and accuracy of such a system demand multiple sensors being placed at strategic positions on the body which can be inconvenient.

2.2 Systems Using Vision Based Sensors

Recent advances in camera technology together with efficient image processing algorithms have enabled researchers to consider vision-based systems as a viable option in activity monitoring. Vision-based methods involve processing images from one or more cameras monitoring a subject . Most approaches use raw video data,while others address the concerns of privacy by using infrared or contrast-detection cameras ..

2.3 HOG (Histogram of Oriented Gradients) Algorithm

HOGs are used as image feature descriptors in the proposed algorithm. According to the HOG algorithm , the image is divided into blocks and then each block is divided into cells. The magnitude and orientation of the gradient foreach pixel are calculated for generating histograms of strength and orientation. Different from the original HOG algorithm, for every cell, two separate -bin histograms are built for the edge strength and orientation. The combination of histograms forms the HOG descriptor, with the size of entries.I build two separate histograms, and thus build descriptors in a different way compared to the original HOG algorithm . The advantage of this approach over the original HOG, where the dissimilarity distances, between the current and previous frames, obtained with the original HOG and the separate EO.

2.4 Route Map Integration

The integration of spatial maps in mobile was investigated using a spatial analog to sensory preconditioning. The GPS chip outputs the positioning information which is transferred over a GPRS link to the mobile operator's GGSN (Gateway GPRS Support Node) and then to a remote server over a TCP connection. The TCP server stores the incoming positional data in a mySQL database. When a user clicks on the tracking page, Zope, which is an open source web application server, serves up an HTML page with an embedded javascript code. The javascript would run in the user's browser and has instructions to retrieve the positional information from the mySQL database every second. It then integrates this information into Google Maps through Google Maps API which displays the position on a map. Since the positional information is retrieved every second and the maps updated at the same frequency, a real time GPS tracking effect is achieved.

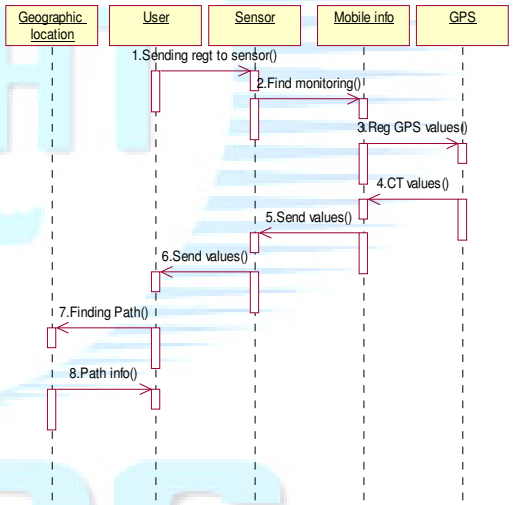
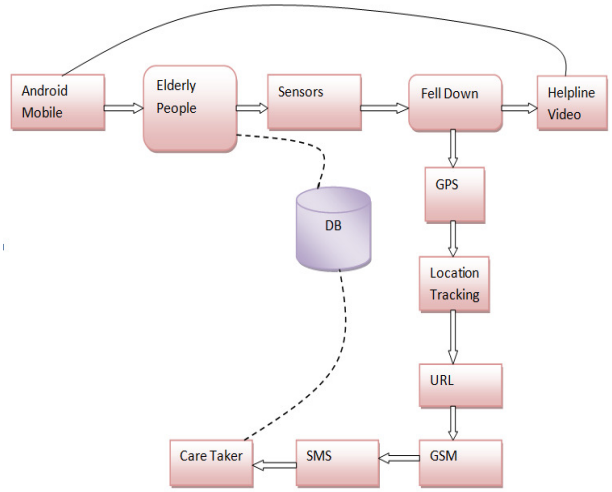


Fig 2.4 Route map Integration Example

3. SYSTEM DESIGN

3.1 Architecture Framework



4. SYSTEM FOR MONITORING AND FALL DETECTION

The whole system consists of a set of sensors (two or more sensors on the patient, usually MEMS sensors) which the patient wears on himself, local units to collect data that are placed in patient vicinity and systems for collecting. The tiny sensors in the strap are capable of measuring user orientation and motion in three-dimensions and it is constantly monitoring and analyzing the signals in real-time looking for movement indicating a fall.

The server information is processed local health care service. Personal computers are used to browse the database collected at the server. The database contains information about the mobility of people, treatment efficacy, joints. All these data can be analyzed offline and used to adjust patient therapy. This has served a double function of the system Real-time patient monitoring and early detection of the fall in order to deliver medical assistance as soon as possible.

5. FALL DETECTION USING TWO ACCELEROMETERS

The operation of the system through one of its functions and to the detection of fall will be described. The figures have been simplified for better understanding of the system. The algorithm used is improved algorithm given in, with better detection of backwards falls. Setup for accelerometer fall detection, consists of the measuring sensors with transmitter, receiver and server for data processing and fall detection.

The fall is detected by the algorithm described in. It can be seen that fall detection algorithm uses data from both sensors that are monitored at the same time. This algorithm is able to distinguish between falls (forward, back word fall into a sitting position) and the normal daily activity, such as walking, mastering stairs, sitting in a chair, lying walking is also detecting by the sensors. picture of the patients' status, to draw useful conclusions and proceed to possible change in medical treatment.

6. CONCLUSION

In this paper, we have proposed a secure and privacy preserving opportunistic computing framework for m-Healthcare emergency, which mainly exploits how to use opportunistic computing to achieve high reliability of PHI process and transmission in emergency while minimizing the privacy disclosure during the opportunistic computing. Detailed security analysis shows that the proposed SPOC framework can achieve the efficient user-centric privacy access control. In addition, through extensive performance evaluation, we have also demonstrated the proposed SPOC framework can balance the high-intensive PHI process and transmission and minimizing the PHI privacy disclosure in m-Healthcare emergency. In our future work, we intend to carry on smart phone-based experiments to further verify the effectiveness of the proposed SPOC framework. In addition, we will also exploit the security issues of PPSPC with internal attackers, where the internal attackers will not honestly follow the protocol.

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