Remote Fall Detection for Seniors

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Introduction

• The Public Health Agency of Canada in Report on Seniors’ Falls in Canada [1] showed that

  – Falls are the second leading cause of injury-related hospitalizations accounting for 29% of injury admissions
  – Almost 62% of injury-related hospitalizations for seniors are the result of falls
  – The fall-related injury rate is nine times greater among seniors than among those less than 65 years of age
  – Half of seniors who fall experience a minor injury, and 5% to 25% sustain a serious injury such as a fracture or a sprain
  – Falls cause more than 90% of all hip fractures in seniors and 20% die within a year of the fracture.
Introduction (cont’d)

- Wireless sensors for telemedicine have been considered for various applications in several studies (e.g., [2], [3])
- Fall detection, in particular, has recently been proposed in [4], [5]
- Falls are detected using accelerometers by utilizing the body movement parameters, such as the movement speed, acceleration and direction
- In this project, we designed and implemented a remote real-time fall detection system for seniors
System Design

Diagram:
- Access Point/Mobile Phone
- Wrist-band with accelerometer sensors
- Internet Connection or Mobile Phone Network
- Monitoring Unit (Healthcare Giver Location)
Implementation
Implementation

• Two main components
  
  – Texas Instruments CC2540 Bluetooth mini development module (keyfob)
  – Mobile Android device with an app which receives a message from the keyfob once a fall has been detected, and sends a text message to a number of one's choosing
  – The keyfob includes a CMA3000 accelerometer which gives an interrupt when a free fall is detected
  – Free fall trigger conditions can be configured using two thresholds (the minimum duration of a fall & the maximum magnitude of the accelerometer reading)
Implementation
Implementation

• Communication range between the accelerometer sensor and the phone is up to 100 m
• Hardware cost is $100
• Cost can be reduced if the system is produced at a large scale
• If smart phone is not available, a laptop, tablet, or any Bluetooth device can be employed
• The alert message can be sent as SMS, e-mail or voice message
Conclusions

• Remote fall detection has been designed and implemented
• The system was tested and showed good performance
• The system is simple, easy to use, and inexpensive
• More features can be added to the system (e.g., location information)
• Wireless sensor networks have many applications for seniors and medical care systems
References


Questions