2013年度

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춘계학술대회

- 일시 : 2013년 5월 10일(금요일)
- 장소 : 동신대학교 첨단강의동
- 주관 : KICS 한국통신학회
  한러MT-IT융합기술연구센터
- 주최 : 한국통신학회 광주전남지부
- 후원 : ETRI 호남권연구센터, 한국방송통신전파진흥원 전남본부,
  한국정보통신공사협회 광주전남도회, LG유플러스,
  KT전남고객본부, 대한정보통신(주), (주)유비이테크,
  (주)엠시스템즈, (주)티디엘, (주)국민통신

발 표 장 소 : 202호

2. 임베디드응용기술

15:00-18:00

좌장 : 지유강(동신대), 조병록(순천대)

[2-1] ZigBee IP 응용에 관한 연구
……………………………………… 이계주, 임솔, 최진수*, 박주봉*, 김대진(전남대학교, *LG이노텍)

[2-2] ZigBee IP 프로토콜 스택구현 방법 연구
……………………………… 임 솔, 이계주, 최진수*, 박주봉*, 김대진(전남대학교, *LG이노텍(주))

[2-3] 임베디드시스템 설계를 위한 프로세서의 특성 분석
……………………………………………………………………………… 최홍준, 정우준, 김철홍*(전남대학교)

[2-4] ARM11•AVR을 적용한 소형 식물공장 구현
……………………………………… 최종두, 조병록, 김동현, 박종찬, 장백산, 신성욱(순천대학교)

[2-5] UWB radar sensor를 적용한 의료용 모니터링 시스템
…………………………………………………………………………………………… 조병록, 최종두(순천대학교)

[2-6] 의료용 인체통신네트워크에 EVOMA UWB 방식 적용
…………………………………………………………………………………………… 조병록, 최종두(순천대학교)

[2-7] IR-UWB를 활용한 물체 탐지 및 거리 측정 연구
………………………………………………………………………………………… 김동민, 변재영*(조선대학교)

[2-8] Mobile Location Estimation Based on the TOA Geometry
………………………… Sajina Pradhan, Grishma Khadka, Hwang Suk Seung*(Chosun University)

발 표 장 소 : 203호

3. 정보기술 및 USN

15:00-18:00

좌장 : 변재영(조선대), 김대진(전남대)

[3-1] 해양 센서 네트워크 시스템 및 저전력 시스템 관리에 관한 연구
…………………………………………………………………………………………… 이정무, 송종인(광주과학기술원)

[3-2] Experimental Systems Observing Hydro-physical Behaviors of Korean Strait near No-Ryuk-Do Island … J. Pyo*, Hoki Jung*, V. Kartavenko, Yu. N. Morgunov, A. A. Golov, and Kiseon Kim*

[3-3] Data Acquisition for Quantitative Fall Risk Assessment using Instrumented Directed Routine
………… Ahsan Shahzad, Kiseon Kim*(Gwangju Institute of Science and Technology (GIST))

[3-4] A New Approach for Nonlinear State Estimation using Unscented Kalman Filter
………………………… Byun Jae uk, Kim Ki Seon(Gwangju Institute of Science and Technology)

[3-5] Polynomial Approximation Algorithm for Resource Utilization in Distributed Computing Systems
……………………………………………………………………………………… Abbas Mehrabi, Kiseon Kim(GIST)

[3-6] 협동교전능력을 위한 비선형 정보융합 기법의 성능 비교
……………………………………………… 정효영, 김기성*, 김기선(광주과학기술원, *국방과학연구소)

[3-7] Improvements in PAPR Problem Using Compressed Sensing Approach
……………………………………………………………………………………………… Zehra Ali, Kiseon Kim*(GIST)

Data Acquisition for Quantitative Fall Risk Assessment using Instrumented Directed Routine

Ahsan Shahzad, Kiseon Kim*

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Abstract

Older people makeup a large and increasing percentage of the population and Falls are a major problem in older adults worldwide and major cause of morbidity and long hospitalization. A system that could provide an accurate automated assessment of falls risk prior to falling would allow timely intervention and ease the burden on overstretched healthcare systems worldwide. A data acquisition environment for assessing falls risk using body worn kinematic sensors is reported specially on data acquisition using Shimmer modules.

I. Introduction

FALLS in older people are very common and their incidence increases with age. Approximately 30% of people over 65 years of age fall each year, and for those over 75 years of age the rates are even higher [6]. Nowadays different clinical tests that are used to investigate person' s mobility and even fall risk involved some physical movements or the Directed Routine like Timed up and go test and Five times sit to stand test. The timed up and go (TUG) test is a well known clinical test of mobility and fall risk in elder people. Alternatively, five times sit to stand (FTSS) test is a standardized measure of lower extremity strength, postural balance disorders and can be used as fall risk predictor. Recently, several research studies have suggested that the use of body fixed inertial sensors during the Directed Routine tests (TUG, FTSS etc.), can provide more quantitative evaluation of movement, gait and sensitive determination of falls risk.[1][2][4]. Narayanan et al. [3] used waist mounted triaxial accelerometer to assess fall risk using Directed routine tests such as TUG, FTSS and AST. A number of timing and energy related features are extracted from accelerometer signals. Greene et al. [4] used kinematics sensors on the shank to assess fall risk using the TUG.

The aim of this study is to collect optimized features set derived from instrumented (Triaxial accelerometer) TUG and FTSS tests and to compare its performance with the Berg balance scale (BBS) test score and the manual timed TUG and FTSS tests. This paper describes a data acquisition process for the Directed Routine tests.

II. Methods:

A data acquisition environment for assessing falls risk using body worn kinematic sensors using Shimmer modules is shown in Figure 1.

Fig.1 Data Acquisition Environment

A. Data Acquisition: A SHIMMER Accelerometer sensor (http://shimmer-research.com) attached on the lower back between L3-L5 vertebrae by means of elasticized bandages was used to measure the trunk acceleration during the DR tests (TUG & FTSS). The Shimmer platform programmed to sample each axis at a rate of 102.4 Hz and streams acceleration data with a sensitivity of +/- 1.5G [where G= 9.81m/s2] via Bluetooth radio to a nearby laptop where custom built application in Matlab (www.mathworks.com) logs the data. While the subjects performed the Directed Routine tests, an observer will insert the markers in the data stream by pressing any keyboard button to note important transition phases of the tests.

The time taken to complete the FTSS and TUG test was recorded by the clinician using a stopwatch. Manual TUG time means the time when the clinician says " go" to the moment when participant finally sits back on chair. (Same definition for Manual FTSS)

Each patient was evaluated using the manual TUG, FTSS and also the Berg balance scale (BBS) in order to provide three standard measures of falls risk for each patient that can be compared to our method.

B. Preprocessing: After the data acquisition, all the post processing and analysis were also carried out using the MATLAB programming environment. The accelerometer data were calibrated using a method proposed by Ferraris [5] and then bandpass filtered 0.1-5Hz using an 8th order Butterworth filter with a 50.2 Hz corner frequency (corner frequency, fc = (f_s/2) − 1, where f_s is the sampling rate).

C. Acceleration Derived Parameters: A number of parameters were derived from the waist mounted accelerometer signals in each of the anterior-posterior (AP), Medio-lateral (ML) and vertical (V) axes (Using the data markers) in order to capture the timing and movement properties of each subject while performing the DR tests.

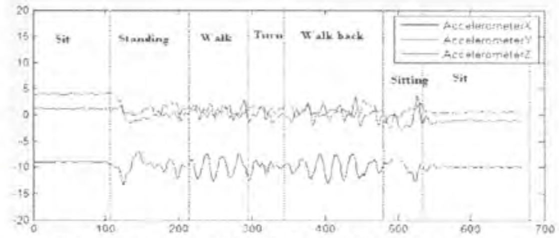

Fig. 2 Example of TUG Test data (waist mounted Accelerometer, non-faller)

The features derived from the TUG test included: acceleration-derived total TUG duration (s), different transition times like Sit-to-Stand and Stand-to-Sit durations (s), turning time, 3m walk time and their differences. Also the Signal magnitude related like Sit-to-Stand and Stand-to-Sit Range (g), median (g), standard deviation (g) and Sit-to-Stand and Stand-to-Sit Jerk (g s^{-1}).

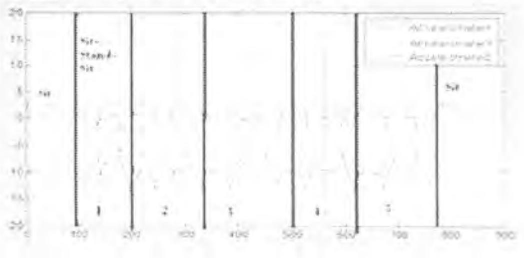

Fig. 3 Example of FTSS Test data (waist mounted Accelerometer, non-faller)

Some other good features are number of steps, Average step length (m), gait speed (m s^{-1}) and average step duration. Where Gait speed was calculated by dividing the total path length by the acceleration-derived TUG duration and average step duration was defined as the reciprocal of the dominant frequency in the AP Signal [1].

In FTSS test the first five data markers denotes the start of each STS cycle and can be represent as ti^{STS5} , where i ∈ {1, . . . , 5}. The total time to complete the test was calculated as the difference between the time at the end of the fifth sitting phase and the time at the start of the first standing phase. Like TUG test many timing and signal magnitude related features and their differences or coefficient of variances were calculated like mean sit-stand, stand-sit times (s), mean sit-stand and stand-sit acceleration (g). Other features are root mean Squared (RMS) amplitude and the spectral edge frequency (SEF), which is defined as the frequency below which 95% of the power of the signal is contained [2].

Acknowledgement

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References

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[2] Doheny, Emer P., et al. "An instrumented sit-to-stand test used to examine differences between older fallers and non-fallers." Engineering in Medicine and Biology Society, EMBC, 2011 Annual International Conference of the IEEE. IEEE, 2011.

[3] Narayanan, Michael R., et al. "Longitudinal falls-risk estimation using triaxial accelerometry." Biomedical Engineering, IEEE Transactions on 57.3, pp. 534-541, 2010.

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