The 2013 International Congress on 3D IT, Communications, and Convergence (3DITCom 2013)

FutureTech 2013, MUSIC_2013, NBiS_2013, 3DOC 2013, FC 2013, WTA 2013

The FTRA 9th International Symposium on Wireless sensor network Technologies and Applications for Smart Space

(WTA 2013)

September 4-6, 2013, Gwangju, Korea

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2014 FTRA International Conferences

- The 9th FTRA International Conference on Future Information Technology **(FutureTech 2014),** May 29-31, 2014, Zhangjiajie, China, http://www.ftrai.org/futuretech2014/
- The 5th FTRA International Conference on Mobile, Ubiquitous, and Intelligent Computing **(MUSIC-14),** May 29-31, 2014, Zhangjiajie, China, http://www.ftrai.org/music2014/
- The 8th FTRA International Conference on Multimedia and Ubiquitous Engineering **(MUE 2014),** May 29-31, 2014, Zhangjiajie, China, http://www.ftrai.org/mue2014/

- The 2014 International Conference on Computer, Information, and Telecommunication Systems **(CITS 2014)**, July 7-9, 2014, Jeju, Korea
- The 2014 International Symposium on Information Technology in Medicine and Education **(ITME 2014)**, July 7-9, 2014, Jeju, Korea
- The 3rd FTRA International Conference on Ubiquitous Context-Awareness and Wireless Sensor Network **(UCAWSN-14)**, July 7-9, 2014, Jeju, Korea

- The 11st FTRA International Conference on Secure and Trust Computing, data management, and Applications **(STA 2014)**, August, 2014, Cebu, Philippines
- The 6th FTRA International Conference on Information Technology Convergence and Services **(ITCS 2014)**, August, 2014, Cebu, Philippines
- The 4th International Conference on Intelligent Robotics, Automations, Telecommunication facilities, and applications **(IRoA 2014)**, August, 2014, Cebu, Philippines

- The 9th FTRA International Conference on Embedded and Multimedia Computing **(EMC 2014)**, October, 2014, Beijing, China
- The 7th FTRA International Conference on Human-centirc Computing **(HumanCom 2014)**, October, 2014, Beijing, China

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Welcome Message from the FTRA WTA 2013 Program Chairs

On behalf of the organizing committee, it is our pleasure to welcome you to the FTRA 9th International Symposium on Wireless sensor network Technologies and Applications for Smart Space (WTA 2013), will be held in Gwangju, South Korea on September 4-6, 2013.

The papers included in the proceedings cover the following topics: Architectures, protocols and algorithms of WSN, Energy, management and control of WSN, Resource allocation, services, QoS and fault tolerance in WSN, Performance and simulation and modeling of WSN, Network Middleware and protocols for WSN, Security and monitoring of WSN, Deployments and implementations of WSN, Energy optimization for WSN, UCA-WSN applications and services, Ubiquitous Context Awareness, Context-aware models and control, Ubiquitous and context-aware computing, Context-aware networks and communications, Context-awareness reasoning and representation, Context-awareness-based systems, Locations awareness services, Adaptive and context-based multimodal interaction, Context-awareness in energy-efficient computing, Context-awareness in smart spaces, Use of context-aware technologies for HCI, Context-aware advertising
Portable and smart devices, Context-aware services, Awareness mechanism and modeling, Power-aware software/hardware/algorithms/protocols, Pervasive/ubiquitous media and services, Smart vehicle/road/traffic/transportation, Internet of Things, Advanced security, privacy, authentication and trust for WSN/IoT.

We sincerely thank all of our chairs and committee members, as listed in the following pages. Without their hard work, the success of WTA-13 would not have been possible. We hope you find WTA-13 enjoyable and please let us now if you have any suggestions for improvement.

Young-SikJeong, Dongguk University, Korea
SajidHussain, Fisk University, USA

WTA-13 General Chairs

Welcome Message from the FTRA WTA 2013 Program Chairs

On behalf of the program committees for the FTRA 9th International Symposium on Wireless sensor network Technologies and Applications for Smart Space (WTA 2013), we would like to extend my warmest welcome to all of you who participated in this substantial conference.

The theme of WTA is focused on the various aspects of wireless sensor network, QoS and fault tolerance in WSN, Performance and simulation and modeling of WSN, Network Middleware and protocols for WSN, Security and monitoring of WSN, Deployments and implementations of WSN, Energy optimization for WSN, UCA-WSN applications and services, Ubiquitous Context Awareness, Context-aware models and control, Ubiquitous and context-aware computing, Context-aware networks and communications and so forth.

WTA 2013 is the next event in a series of highly successful symposium on wireless sensor network technologies and applications for SS (WTA), previously held as WTA-12 (Jeju, Korea, Nov 2012), WTA-11 (Jeju, Korea, Dec 2010), WTA-10 (Gwangju, Korea, Dec 2010), SH-10 (Busan, Korea, May 2010), SH-09 (Toronto, Canada, July 2009), SH-08 (Hainan, China, Dec. 2008), SH-07 (Jeju, Korea, Dec. 2007), IWSH-06 (Jeju, Korea, Nov. 2006).

We would like to thank all of you for your participation in our conference, and also thank all the authors, reviewers, and organizing committee members.

Michael Hwa Young Jeong, Kyung Hee University, Korea
Jen Juan Li, North Dakota State University, USA
Hongxue (Harris) Wang, Athabasca University, Canada

WTA-13 Program Chairs

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Keynote Speech

IoT/CPS: M2M communication, actuation and coordination challenges

Dr. Ivan Stojmenovic
Professor
University of Ottawa, Canada

Abstract
Existing machine-to-machine (M2M) communications incorporate a central point for gathering information, making decision, and acting. Large scale cyber-physical systems (CPS) beyond M2M concept are envisioned with the distributed actuation and in-network processing. Machine-to-machine communication aspects include data dissemination, data aggregation, reporting mechanisms for monitoring, cooperative access. Other related issues that would be explored are modeling, inter-dependency and topology control, and security and privacy. This lecture emphasizes actuation as one of important tools in the future applications of Internet of Things and Cyber Physical Systems architectures. Various existing models for wireless sensor and actuator networks are elaborated. It then concentrates on the network layer issues in wireless sensor and sensor-actuator networks. Coordination between sensors and robots, and robot to robot coordination are then covered with some concrete problem formulations. These include robot dispersion, communication aspects of robot coordination, robot task allocation, and sensor placement and relocation to improve sensing area coverage.

Biography
Ivan Stojmenovic received his Ph.D. degree in mathematics in 1985. He earned a third degree prize at the International Mathematics Olympiad for high school students in 1976. He is Full Professor at the University of Ottawa, Canada. He also held regular or visiting positions in Serbia, Japan, USA, France, Spain, Brazil, Hong Kong, Taiwan, China (Distinguished Professor, Tsinghua University in Beijing and Dalian University of Technology, 2010-2), UK (Chair in Applied Computing, EECE, University of Birmingham, 2007/8).
Stojmenovic is Fellow of the IEEE (Communications Society, class 2008), and Canadian Academy of Engineering (since 2012), and Member of the Academia Europaea (The Academy of Europe), from 2012 (section: Informatics). He was IEEE CS Distinguished Visitor 2010-11. He received 2012 Distinguished Service Award from IEEE ComSoc Communications Software TC. He was cited >13000 times. His h-index is 56 (he is among 250 computer scientists with h≥50; top h-index in Canada for mathematics and statistics). ESI Special Topics listed him #3 in papers, #9 in cites/paper, and #20 in total cites among all authors Wireless/Mobile Networks 1995-2005. One of his articles, on broadcasting in ad hoc wireless networks, was recognized as the Fast Breaking Paper, for October 2003 (as the only one for all of computer science), by Thomson ISI Essential Science Indicators http://esi-topics.com/fbp/fbp-october2003.html.
Google Scholar lists him as the top researcher in parallel and distributed systems by citations, and among the top ten in two more fields: wireless networks and algorithms. He received four best paper awards at conferences (IFIP PWC 2004, SENSORCOMM 2008, CSA 2009, ICA3PP 2011) and Excellence in Research Award of the University of Ottawa for 2009. He presented a number of tutorials and invited talks. He is Tsinghua 1000 Plan Distinguished Professor (2012-5). He is recipient of the Royal Society Research Merit Award, UK, 2007-8. http://www.site.uottawa.ca/~ivan (contains full and medium size CVs and many articles)

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Keynote Speech

Big Data is all about data that we don't have

Dr. David Taniar
Associate Professor
Monash University, Australia

Abstract
Big Data is now becoming a buzz word in information technology industry and research. Is Big Data only about large volume of data?, and if it is yes, why is it suddenly becoming a trend. Hasn't the gr owth of data volume been gigantic in the last decade? From a research point of view, it is not surpri sing to see researchers from all walks of computer science are trying to align their research to Big D ata for the sake of being trendy. The question remains whether it tackles the real Big Data problems. In this talk, I will describe the misconceptions of Big Data, present motivating cases, and discuss the unavoidable challenges faced by industry and research.

Biography
David Taniar is recognized for significant contributions in database query processing in (i) Parallel Database, and (ii) Mobile/Spatial Databases. His primary contribution is to make access pattern to these databases more efficient. He has authored two books on databases ("High Performance Parallel Database Processing and Grid Databases", Wiley 2008, and "Object-Oriented Oracle", 2006), and has received four best paper awards (from three IEEE conferences and one international journal). His list of publications can be found at the DBLP server (http://www.informatik.uni-trier.de/~ley/db/indices/a-tree/t/Taniar:David.html). He is the founding editor-in-chief of three Science Citation Index Expanded (SCI-E) journals (Mobile Information Systems, Intl. J. of Data Warehousing and Mining, and Intl. J. of Web and Grid Services), a PC chair and a General chair of a number of international conferences, and has been invited to deliver keynote speeches and tutorials at various international events. He is an Associate Professor at Monash University, Australia. Further details on his track records can be found at http://users.monash.edu/~dtaniar/.

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Keynote Speech

Broadband Wireless Access in 3D Environment Using Fibre-connected Massively Distributed Antennas

Dr. Victor Leung
Professor
University of British Columbia, Canada

Abstract
Wireless access architectures employing femto- and pico-cell base-stations/access points can reduce po wer consumption and enhance wireless spectrum utilization by shortening the links and exploiting coo perative and cognitive mechanisms, but co-ordinations between base-stations or access points may inc ur large overheads. We present a novel architecture that exploits wireless-optical convergence for next generation broadband wireless access employing fibre-connected massively distributed antennas (BWA -FMDA). In this architecture, a large number of distributed antennas are connected via radio over fibr es (RoF) to a centralized processing entity to minimize the communication overhead of system co-ord ination. The coverage area of the proposed BWA-FMDA system can range from a few tens of square meters in homes and office environments, delivered via IEEE 802.11a/g/n or femto-cell hotspot soluti ons, to several square kilometers supporting last-mile technologies such as WiMAX, LTE, and LTE-A using pico- and micro-base-stations. This new architecture leads to many new research problems, i ncluding the fundamental performance limits of massively distributed antenna systems, improved mea surement-based channel models involving massively distributed antennas, advanced radio resource ma nagement and access control schemes that approach the performance limits in realistic propagation en vironments, and improved opto-electronic transceivers designs for low cost active optical cables suitab le for RoF applications. In this talk we demonstrate the potentials of BWA-FMDA architecture by co nsidering its application in license-free and licensed wireless systems. We present the cognitive WLA N over fibre (CWLANoF) system, which applies the BWA-FDMA architecture in the license-free IS M band for cooperative spectrum sensing, interference avoidance/mitigation and dynamic channel assi gnment. In licensed bands, we demonstrate the application of BWA-FMDA to create coordinated mult iple point (CoMP) operations of femto-cells in a 3D environment, which provides higher spectral effi ciency (bps/Hz) and higher energy efficiency (bits/Joule). Simulation results and address potential rese arch issues are presented for each scenario. We conclude with a short discussion on our current effort to develop and deploy a BWA-FMDA testbed based on commercially available equipment.

Biography
Victor C. M. Leung received the B.A.Sc. (Hons.) degree in electrical engineering from the University of British Columbia (U.B.C.) in 1977, and was awarded the APEBC Gold Medal as the head of the graduating class in the Faculty of Applied Science. He attended graduate school at U.B.C. on a Natural Sciences and Engineering Research Council Postgraduate Scholarship and completed the Ph.D. degree in electrical engineering in 1981. From 1981 to 1987, Dr. Leung was a Senior Member of Technical Staff at MPR Teltech Ltd. in Canada, specializing in the planning, design and analysis of satellite communication systems. In 1988, he was a Lecturer in the Department of Electronics at the Chinese University of Hong Kong. He returned to U.B.C. as a faculty member in 1989, and currently holds the positions of Professor and TELUS Mobility Research Chair in Advanced Telecommunications Engineering in the Department of Electrical and Computer Engineering. He is a member of the Institute for Computing, Information and Cognitive Systems at U.B.C. He also holds adjunct/guest faculty appointments at several universities including the Hong Kong Polytechnic University and Beijing University of Posts and Telecommunications.

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Dr. Leung has co-authored more than 600 technical papers in international journals and conference proceedings, and several of these papers had been selected for best paper awards. His research interests are in the broad areas of wireless networks and mobile systems. Dr. Leung is a registered professional engineer in the Province of British Columbia, Canada. He is a Fellow of IEEE, a Fellow of the Engineering Institute of Canada, and a Fellow of the Canadian Academy of Engineering. He was a Distinguished Lecturer of the IEEE Communications Society. He is serving on the editorial boards of the IEEE Transactions on Computers, IEEE Wireless Communications Letters, Computer Communications, as well as several other journals. Previously, he has served on the editorial boards of the IEEE Journal on Selected Areas in Communications – Wireless Communications Series, the IEEE Transactions on Wireless Communications, the IEEE Transactions on Vehicular Technology, and the Journal of Communications and Networks. He has guest-edited many journal special issues, and served on the organizing committees and technical program committees of numerous international conferences. He is a recipient of an IEEE Vancouver Section Centennial Award and a 20112 UBC Killam Research Prize.

PROGRAM SCHEDULE

Wednesday, September 4th, 2013		
Time	**Min**	
08:30-09:00	30	**Registration**
12:10-13:00	50	**Lunch**
13:00-13:55	55	**Opening Remark and Keynote 1** **Title : IoT/CPS: M2M communication, actuation and coordination challenges** **By Ivan Stojmenovic, Professor, University of Ottawa, Canada** **Room: 214 / Chair : Min Choi**
13:55-14:05	10	**Coffee Break**
14:05-15:00	55	**Keynote 2** **Title : Big Data is all about data that we don't have** **By David Taniar, Associate Professor, Monash University, Australia** **Room 214 / Chair : Young Ae Jung**
15:00-15:10	10	**Coffee Break**
19:10-21:00	110	**Reception**

Thursday, September 5th, 2013		
Time	**Min**	**Room: 210**
08:40-09:00	20	**Registration**
12:10-13:30	80	**Lunch**
13:30-14:30	60	**Keynote 3** **Title : Broadband Wireless Access in 3D Environment Using Fibre-connected Massively Distributed Antennas** **By Victor Leung, Professor, University of British Columbia, Canada** **Room 214 / Chair : Young Ae Jung**
14:30-14:40	10	**Coffee Break**
14:40-16:10	90	**Session 5-F** (6) WTA Chair : Ho Bin Song
16:10-16:20	10	**Coffee Break**
16:20-18:20	120	**Session 6-F** (9) WTA Chair : Neil Yen
19:10-21:00	110	**Banquet**

Friday, September 6th, 2013					
Time	**Min**	**Room: 208**	**Room: 209**	**Room: 210**	**Room: 213**
09:00-10:30	90		**Session 7-B** (5) WTA Chair : Ho Bin Song		**Session 7-F** (4) WTA Chair : Bong Hwa Hong
10:30-10:40	10	**Coffee Break**			
10:40-12:10	90	**Session 8-A** (5) WTA Chair : Young Ae Jung	**Session 8-B** (5) WTA Chair : Yoon Ho Kim	**Session 8-C** (5) WTA Chair : Gangman Yi	
12:10-13:00	50	**Organizing Committee Meeting**			

DETAILED SCHEDULE
FOR THE 16TH INTERNATIONAL CONFERENCE ON NETWORK-BASED INFORMATION SYSTEMS (NBIS 2013)

September 4, 2013 (Wednesday)

08:30-09:00 **Registration**

12:10-13:00 **Registration / Lunch break**

12:50-13:00 **Coffee break**

13:00-13:55 **Keynote I**
(Room:214)
(Chair: Min Choi)

Title: **IoT/CPS: M2M communication, actuation and coordination challenges**
By Ivan Stojmenovic
Professor at University of Ottawa, Canada

13:55-14:05 **Coffee break**

14:05-15:00 **Keynote II**
(Room:214)
(Chair: Young Ae Jung)

Title: **Big Data is all about data that we don't have**
By David Taniar
Associate Professor at Monash University, Australia

15:00-15:10 **Coffee break**

19:10-21:00 **Reception party**

September 5, 2013 (Thursday)

08:40-09:00 **Registration**

12:10-13:30 **Lunch break**

13:30-14:30 **Keynote 3**
(Room:214)
(Chair: Young Ae Jung)

Title: Broadband Wireless Access in 3D Environment Using Fibre-connected Massively Distributed Antennas
By Victor Leung
Professor at University of British Columbia, Canada

14:30-14:40 **Coffee break**

14:40-16:10 **Session 5-F: WTA**
(Room: 210)
(Chair: Ho Bin Song)

1. **Constructing A Portable Platform for Medical Training**
   Lun-Ping Hung, Neil Y. Yen, Nan-Chen Hsieh
2. **Efficient depth map estimation method based on gradient weight cost aggregation strategy for distributed vifeo sensor networks (WTA-1)**
   Gwang-soo Hong, Byung-gyu Kim, Kee-koo Kwon
3. **Using NVRAM-based Main Memory in Wireless Sensor Nodes (WTA-2)**
   Soohyun Yang, YeonseungRyu
4. **Anonymous Authentication Scheme for Large-Scale Mobile Networks (WTA-3)**
   Kuo-HuiYeh, Kuo-Yu Tsai, Hung-Lun Chang
5. **RFID System in Elderly Care (WTA-5)**
   SrijanaAcharya, Gyanendra Prasad Joshi, MD Khalil Afzal and Sung Won Kim
6. **Spatial data synchronization method to support location based service in cloud computing (WTA-7)**
   Doohee Song, Kwangjin Park

16:10-16:20 **Coffee break**

16:20-18:20 **Session 6-F: WTA**
(Room: 210)
(Chair: Neil Yen)

1. **A Leakage-aware Scheduling for Real-time Task Synchronization**
   Da-Ren Chen

2. **Building a ubiquitous learning system based on augmented reality for natural science learning**
   Mu-Yan Chen
3. **Creating an augmented reality learning space with indoor positioning technology for smart learning**
   Vincent Huang
4. **An Efficient Data Sharing Scheme using Mobile Grid Sequence in Vehicular Sensor Networks**
   Chyi-Ren Dow, Yu-Hong Lee, Wei-Ting Hsiao, Shiow-Fen Hwang
5. **The Green Campus - Constructing the Internet of Things on Campus**
   Hsing-I Wang
6. **Distributed Channel Assignment in Self-Organized Cognitive Sensor Networks**
   Li-Chuan Tseng, Feng-TsunChien, ChingYao Huang, Ronald Y. Chang, Wei-Ho Chung, and Daqiang Zhang
7. **An Efficient Bus Arrival Prediction System Using P2P Overlay Network**
   Ssu-Hsuan Lu, Yu-Wei Chan and Yeh-Ching Chung
8. **A Simple and Effective Routing Protocol for Wireless Ad Hoc Networks with Guaranteed Route Preference**
   Min-Kuan Chang, Yu-Wei Chan,Feng-TsunChien, Yi-Sheng Su,
9. **Instant Decision-making Support via Social Context Extraction**
   Neil Y. Yen, Jason C. Hung, Qun Jin

19:10-21:00 Banquet

September 6, 2013 (Friday)

09:00-10:30 **Session 7-B: WTA**
(Room: 209)
(Chair: Ho Bin Song)

1. **Formal Specification of Hybrid Systems: Case Studies Based on Hybrid Relation Calculus (WTA-15)**
   Wenli Zhang ,lichen Zhang
2. **A Three Dimensional Location based Two-Factor TL-OTP Protocol (WTA-22)**
   Hwajeong Seo, Taehae Kim, Howon Kim
3. **Smart surveillance camera based on Pattern (WTA-26)**
   Xu Yongzhe, Byungsoo Lee
4. **Community Vitality in Dynamic Temporal Networks (WTA-28)**
   Fu Cai, Li Min, Zou Deqing, Han Lansheng, James J. Park
5. **An Efficient Outlier Detection Technique in Wireless Sensor Networks (WTA-30)**
   Hongyeon Kim, Jun-Ki Min

09:00-10:30 **Session 7-F: WTA**
(Room: 213)
(Chair: Bong Hwa Hong)

1. **PIDA: Privacy and Integrity-Protected Data Aggregation Scheme for Sensitive Data in Wireless Sensor Networks (WTA-34)**
   Hyunjo Lee, Jae-Woo Chang
2. **A DTMNs Routing Protocol for Sparse Machine-to-Machine environment and Wireless Sensor Networks (WTA-35)**
   Doo-Ok Seo, Dong-Ho Lee
3. **A Fast TRW Algorithm using Binary Pattern (WTA-14)**
   Jun-Young Park, Chang-Suk Cho
4. **Integrated vehicle OBD-II connector for reading vehicle information (WTA-52)**
   Sung-hyun Baek, Jong-Wook Jang

10:30-10:40 **Coffee break**

10:40-12:10 **Session 8-A: WTA**
(Room: 208)
(Chair: Young Ae Jung)

1. **Securing USB Data for Xen Virtual Machine Environment (WTA-39)**
   Weizhong Qiang, Pei Duan, Deqing Zou, Hai Jin, Zhiyuan Shao, James J. Park
2. **Simultaneous Tracking Method of Multiple Moving Objects Using Clausius Entropy Mask Image and Fast Level Set Method (WTA-40)**
   Wan Hyun Cho, In Seop Na, Seong Chae Seo

3. **Password Authentication Scheme Resistant to Spyware Based Recording Attacks (WTA-41)**
   Taejin Kim, Jeong Hyun Yi, and Changho Seo
4. **RIX-MAC: An Energy-Efficient Receiver-Initiated Wakeup MAC Protocol for WSN (WTA-42)**
   Inhye Park, Hyungkeun Lee
5. **A Propose of M-payment system based on Near-Field Communication and Location-Based Services for M-Commerce in WSN (WTA-45)**
   Sun-Kuk Noh, ByungRae Cha, DongYou Choi

10:40-12:10 Session 8-B: WTA
(Room: 209)
(Chair: Yoon Ho Kim)

1. **Semi-supervised Localization in Wireless Sensor Networks using Laplacian Support Vector Regression (WTA-47)**
   Jae Hyun Yoo, H. Jin Kim
2. **Real-Time Multiple Object Tracking in Particle Filtering Framework using Codebook Model and Adaptive Labeling (WTA-48)**
   Zhenhai wang, Kicheon Hong
3. **PAPR Reduction with Companding Transform for OFDM Transmission over Dispersive Visible Light Communication Channels (WTA-49)**
   K. Bandara, P. Niroopan, Y. H. Chung
4. **A Study on Ranked Query using Skyline Index (WTA-50)**
   Sun-young Ihm, Aziz Nasridinov, Young-Sik Jeong, Young-Ho Park
5. **A Study on the Correlation between the Customers' Perceived risks and Online Shopping Tendencies (WTA-11)**
   Chiung-En Huang

10:40-12:10 Session 8-C: WTA
(Room: 210)
(Chair: Gangman Yi)

1. **A study on the Intelligent Fire Video Control System using USN (WTA-53)**
   Young-Choon Kim, Moon-Taek Cho, Ho-Bin Song, Ok-Hwan Kim
2. **Performance Test of Tag Read Range for International Standards using RFID (WTA-54)**
   Bong-Wha Hong, Hae-Jong Joo, Sang-Soo Kim
3. **New promising service infrastructure for smart IoT applications (WTA-55)**
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RFID System in Elderly Care

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Abstract

One of the potential application fields of RFID system is elderly care. It plays vital role for the care givers and elderly to maintain their daily life. In this paper we briefly survey the application areas and the proposed algorithms existing in the literature so far to ease the elderly life. Similarly, falls are the leading cause of death and disabilities in the elderly. Immediate action should be taken to mitigate such tragedy. Several proposals are in the literature to detect elderly fall. One of the approaches to detect such fall is by deploying RFID system at nursing home or elderly house or the house of the elderly. Therefore we suggest a smart solution for fall accident and point out the technical challenges, issues of deploying RFID system in the elderly cares for the fall detection.

Keywords: RFID system, fall detection, elderly care, RSSI, posture.

1 Introduction

Taking care of the elderly people is chaotic at times as they move unknowingly and they suffer from various mental diseases due to which they cannot know their where about. A home accident such as falls is one of the major causes of injury in the elderly. In developed countries, most falls occur around the home or community [1]. The recent advancement in tracking and communication technologies has provided innovation to apply their applications in our daily lives. One of such technology is RFID system that could be deployed at home or nursing homes to ease their life. It can be deployed in the nursing homes at the large scale for the elderly care. It may prevent from many serious injuries to the elderly, it may store some health related data, it may act as a reminder system and also as a tracking system for the elderly as well as tracking of their goods. So RFID has a significant importance in the life of and elderly as well as this simplifies the care providing processes to the professional or the family members at times.

In this paper we discuss the existing RFID systems in the literature that proposed for elderly care. We also propose a system that identifies elderly fall and informs family member or/and healthcare professional.

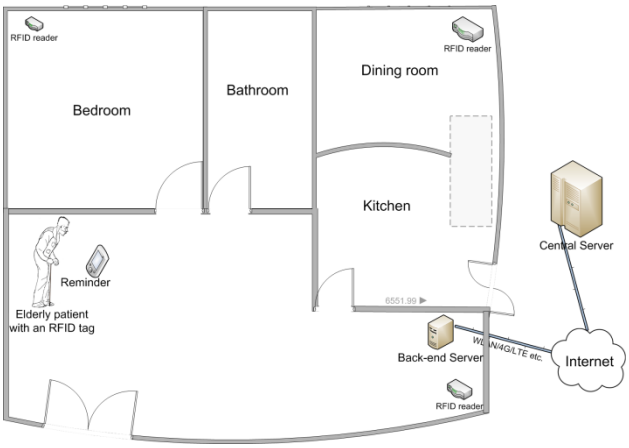

Figure 1. General Framework of RFID Deployment in Elderly Home.

Figure 1 shows the framework of RFID deployment in elderly home. A number of RFID readers are installed in different rooms as required. The tag information pass to the back-end server through wire or wirelessly. The back-end server sends information to the center server and also to the care givers or family members. Passive or active RFID tags can be used and they can be integrated in a single application. RFID reader periodically broadcasts queries. The user tag returns an acknowledgement when the tag is in the reading radius of the reader. Figure 1 discusses just a single person in home scenario. It can be extended to the nursing home scenario where the numbers of elderly are many, physical, mental condition varies from person to person and some

immediate facility and the care giver facility needed instantly. In such a scenario various kinds of tags and readers can be deployed and the service and the care can also be provided according to the need.

2 Existing RFID applications for elderly care

There have been a number of researches on RFID system for assisting the elderly life at home or hospital environment [2-6]. RFID applications have been deployed in various hospitals to overcome the medical errors, to improve the patients care, to identify patients, to track the medical equipment among others. Some pilot tracking projects have been implemented in some hospitals for efficient administrative work and to improve productivities. There are several literatures exist so far that addresses the application and algorithms to enhance the elderly life by the use of RFID. We categorize those solutions as follows:

2.1 Reminder system

As the age progresses the memory of the elderly also slow down so an intelligent remainder system plays an important role to support elderly life. They may also suffer from various kinds of dementia, such as Alzheimer's disease, multi-infarct dementia, and dementia with Lewy bodies among others. Huang et al. [7] proposed an intelligent RFID system to assist elder living independent and improve aged quality of life. The proposed system assists elderly to remind their schedules via EPC GEN 2. Intel labs has taken initiative to design sensors tags for the care of the elderly that will collect information in which objects are touched and when. The data are used by the artificial intelligence [8].

2.2. Telemedicine system

A mobile telemedicine solution based on low cost wearable RFID bracelet tags for perceiving emergency situations in elderly with chronic diseases and initiate emergency action is presented in [9]. This system may assist elderly by collecting vital signs for prompt care remotely.

Maderia et al. [10] present a preliminary work on the design issues of a pervasive healthcare assistive environment for the elderly. This study discusses deployment of the smart objects with embedded sensors and RFID to measure physiological parameters and user ID.

Chen et al. [12] proposed an e-healthcare management system based on 2G-RFID system that integrates the wireless body area networks and WLANs. The purpose of this system is to collect patient information via the body sensor network and enhanced diagnosis assistance and action handling.

2.3. Behavioral modeling

Hsu and Chen [12] proposed a RFID-based human behavior modeling and anomaly detection for elderly. This research is focused on building an intelligent system to detect abnormal behavior of the elderly at home. An elderly is mounted with RFID readers and active RFID tags are mounted at home. The reader collects daily movement data of the elderly. With the movement data, the clustering technique is then used to build a personalized model of normal behavior. The movement patterns of the elderly are compared with the normal behavior.

2.4. Tracking system

A novel intelligent RFID-based indoor tracking system for elderly is proposed in [13]. This system uses signal strength of an RFID reader and estimate the elderly location. This system coordinates with the wireless sensor node of a three-axis accelerometer and uses a genetic algorithm to compute the elderly location. The development of a prototype RFID home support tool is described in [14].

Some issues and challenges are also discussed. The system is designed to support assisted living for elderly and inform people in a simple, usable and extensible way in particular for supporting the finding and identification of commonly used and lost objects such as spectacles.

2.5. Fall detection

It is estimated that major cause of death in the elderly is due to the accidental stumble and fall. Therefore, taking this consideration various algorithms have been proposed in the literature to identify the falls and report to the caregivers. Lin et al. [15] presented a ubiquitous monitor system integrated with biosensors and RFID by implementing as a prototyping system. The system is expected to detect the emergencies or accidents such as stroke, falling down, fainting, and heart attack, etc.

Chen and Wang [16] proposed a design of RFID-based intelligent emergency notification system with GSM, 3G video services and two way radio functionalities for elderly. In this system, user pushes button on active tag on his/her wrist to send

message for help after fall. This system works fine if a fallen person is in condition to push the button, however this system does not work in case of the injury is serious and the person is unconscious.

Chen and Lin [17] proposed a RFID based gait monitoring system that consists of a pair of slippers with dual-band RFID module built inside, several readers, and a computing system. This system provides graphical feedback to caregiver for gait monitoring. This system monitors gait in normal cases, however it does not specify how it detects fall is not mentioned clearly. It has some other challenges such as mounting RFID reader in shoes is not always feasible as people wear different slippers/shoes in different places such as bathroom or outdoor etc. Depending upon the elderly's physical state they may not be able to change according to the places. Fall may take place anywhere and bathroom is the most venerable place.

3 Proposed solution for the fall accident

Because the solution proposed in [16] is manual rather than automated and the solution proposed in [17] has also some drawbacks, in this section we propose a method. The proposed method is an enhancement on the method given in [17].

In this work we assume that fall means a person fall down and lie on the floor anywhere in home. We assume a water proof multipurpose portable mobile RFID reader in a locket. This multipurpose device also works as a reminder device. Passive tags are deployed underneath all over the nursing home or the elderly house. The minimum distance between two tags is calculated depending upon the average height of the elderly. Because, the average height of a person is depends on genetic background and environmental factors, the RFID tags deployment is also dependent on geographical region. We do not consider the height of the people that differ from normal height due to gigantism or dwarfism. The tags are deployed in a triangular array. The portable RFID reader (in locket) is always connected to the central sever wirelessly. The RFID reader reads tags in every 30 seconds. The elderly is sleeping on the bed or sitting on the chair or moving posture is assumed.

In every reading the minimum distance between RFID reader and any RFID tag (l_{min}) is calculated by observing received signal strength indicator (RSSI) value. When an elderly individual falls down on the floor, the distance between reader and nearest tag becomes less than a default value (α). If $l_{min} < \alpha$ for two reading cycle (i.e. 30 sec. × 2), the system sends notification to the elderly on the reminder device. If there is no response for t time then the system sends message to the concerned personal, such as healthcare professional or family member. If elderly lies down on the floor on propose, he or she has to push the button to stop sending warning to the healthcare professional or family member. The value of α depends on the average height of the elderlies, and the value of t depends on how fast medical attention needed (as suggested by the medical professionals). The proposed method is for taking action after the fall occurs. It's not the avoidance of the problem.

There are various research challenges to overcome for the fall detection. There can be an interference problem as there are a number of mobile readers and tags deployed. The various other technologies such as the WLAN, Bluetooth etc. are uses along with the RFID system; therefore there can be co-channel interference while using the ISM band. As a number of passive tags are deployed in the triangular array there can be a cross talk among the tags if they are energized. Therefore the separation distance between the tags needs to be ensured experimentally for the practical use in the nursing home.

The localization problem occurs in the indoor system as the fall detection work on the RSSI value. The signal can be distorted by reflection, refraction or multipath fading. The size of the reader must be very small, portable, water proof and easily wearable. There can be a reliability issues as the tags and the readers need to be functional every time. Making the elderly life easier through RFID, covering just one issue is not sufficient. Different kinds of low complexity algorithm need to be developed to ease the elderly life with the current readers and tags. The cost is another issue, as there is a need of a number of RFID readers, tags and other additional hardware as well as manpower required for monitoring. The need of the organizational support, trust issue, unclear return on investment, security concern, current RFID systems on the elderly homes is hard to be achieved.

4 Conclusion and further works

The population of elderly is in increasing trend. Therefore to live an independent life or a care assisted life at home or in the nursing home RFID plays a vital role. Proving the care to the elderly the RFID system can be the simple system with RIFD readers and passive tags to make their life easier. This

paper discusses about the existing solutions and proposes a new solution. It also discusses about the challenges that can occur in deploying the RFID system for the elderly care. This is the position paper and we are working more on realizing it in the real life. We are working on the detail implementation of RFID in elderly home. The more anthropometry study to enhance the system is remaining for the future work.

References

[1] Downton, J.H. (1993). Falls in the elderly. Kent, UK: Edward Arnold, a division of Hodder & Stoughton Limited.

[2] Smith, A. D., & Rupp, W. T. RFID-Related Applications in the Healthcare and Voice-Recognition Industries: A Case Study. Journalof Interdisciplinary Business Studies, Vol. 1 – 2012, PP. 1-28.

[3] Mateska, A., Pavloski, M., & Gavrilovska, L. (2011, May). RFID and sensors enabled in-home elderly care. In Proceedings of the IEEE 34th International Convention MIPRO, vol., no., pp.285,290, 23-27 May 2011

[4] Zeng, Y., Lau, T.L. (2006). The application of RFID in healthcare environment: a case study in an elderly center. Proceedings of the International Conference on Logistics and Supply Chain Management, LSCM2006.

[5] Lai, Y. L., & Chen, C. C. (2011). An Intelligent RFID Fall Notification System. International Journal of Innovative Computing, Information and Control, 7(6), 3133-3145.

[6] Alemdar, H., Durmus, Y., & Ersoy, C. (2010). Wireless healthcare monitoring with RFID-enhanced video sensor networks. International Journal of Distributed Sensor Networks, 2010(ID 473037), pp 1-10, 2010.

[7] Huang, K. T., Lin, P. Y., Chiang, C. Y., Chang, J. S., Huang, C. N., & Chan, C. T. (2008). An intelligent RFID system for improving elderly daily life independent in indoor environment. In 6th International Conference on Smart Homes and Health Telematics, ICOST 2008, pp. 1-8.

[8] Dishman, E. (2004). Inventing wellness systems for aging in place. Computer, 37(5), 34-41.

[9] Raad, M. W. (2010). A ubiquitous mobile telemedicine system for the elderly using RFID. International Journal of Security and Networks, 5(2), 156-164.

[10] Maderia, R.N., et al. Designing a Pervasive Healthcare Assistive Environment for the Elderly, UbiComp '10, Sep 26–Sep 29, 2010

[11] Chen, M., Gonzalez, S., Leung, V., Zhang, Q., & Li, M. (2010). A 2G-RFID-based e-healthcare system. IEEE Wireless Communications, 17(1), 37-43.

[12] Hsu, H. H., & Chen, C. C. (2010). RFID-based human behavior modeling and anomaly detection for elderly care. Mobile Information Systems, 6(4), 341-354.

[13] Hsu, C. C., & Chen, J. H. (2011). A novel sensor-assisted RFID-based indoor tracking system for the elderly living alone. Sensors, 11(11), 10094-10113.

[14] Parry, D., & Symonds, J. (2009). RFID and Assisted Living for the Elderly. RFID and Smart Technologies for Information Convergence, 119-135.

[15] Lin, Y. J., Su, M. J., Chen, S. J., Wang, S. C., Lin, C. I., & Chen, H. S. (2007). A study of ubiquitous monitor with RFID in an elderly nursing home. International Conference on Multimedia and Ubiquitous Engineering, 2007, pp.336-340, 26-28 April 2007.

[16] Chen, Y. C., & Wang, C. C. (2007, June). RFID emergency notification system for fall accidents at home. 9th International Conference on e-Health Networking, Application and Services, pp.323-326, 19-22 June 2007.

[17] Chen, Y. C., & Lin, Y. W. (2010). Indoor RFID gait monitoring system for fall detection. In 2nd IEEE International Symposium on Aware Computing (ISAC), pp. 207-212, 1-4 November 2010.