

Muhammad Tahir

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Research Interests

Wireless multi-modal sensor networks, network modeling and resource optimization, distributed control of dynamical systems, networked control systems.

Teaching Experience

- Jan 2012 – **Associate Professor**, *University of Engineering and Technology (UET) Lahore.*
- Oct 2009 – **Assistant Professor**, *University of Engineering and Technology (UET) Lahore.*
- Dec 2011 Graduate courses taught: Random Processes in Physical Systems (Fall 2009), Linear System Theory (Spring 2010), Optimization Techniques (Spring 2011).
- Fall, 2004 – **Teaching Assistant**, *University of Illinois at Chicago.*
- Spring, 2007 Responsibilities included, delivering lectures on occasions, designing class projects, grading home works, conducting lab sessions for Communication Engineering (ECE 311) and Circuit Analysis (ECE 225) as well as preparing and grading lab projects.
- Dec, 2002 – **Assistant Professor/Lecturer**, *UET Lahore.*
- Dec, 2003/
Aug 2000 – Conducted lab sessions for Communication Systems, Microwave Theory and Techniques and
Nov 2002 Microprocessor Programming and Interfacing courses.

Research Projects & Experience

- July, 2014 – **Visiting Research Scholar**, *University of Illinois at Chicago.*
- Sep, 2014 The focus of this research activity was to explore the possibilities of improving data communication infrastructure performance for fast growing information transmission requirements in the domain of smart grids.
- Mar 2013 – **Multi-modal Sensing Enabled Real-time Intelligent Wireless Camera Networks for Secure Spaces**, *ICT R&D funded project*, Project funding (Pakistan side): PKR 22M.
- Sep 2015 Pakistan has suffered huge economic, social, infrastructural and human losses due to militancy and terrorist activities. Camera networks based on CCTV technology or even IP based camera networks are not intelligent enough to provide real time response generation in case of an event of interest. Automated response generation can be achieved by adding more intelligence to camera nodes in the form of multi-modal distributed sensing. Multiple sensing modalities such as camera, acoustic, pyro-electric infrared, light etc. will be used to increase robustness while collaborative sensing and sensor data/decision fusion will be used to extract information for consensus building and decision making for counter measures.
- Nov 2010 – **Ambient air quality monitoring using integrated secure wireless sensor and vehicular networks**, *HEC and USAID Jointly funded project*, Project funding (Pakistan side): PKR 3.6M, (total funding \$200,000).
- Nov 2013 This project is being conducted jointly by UET Lahore and Univ. of Michigan Dearborn. This project addresses limitations of existing solutions by developing an integrated wireless sensor and vehicular network. This research based on secure and reliable air quality data acquisition, processing, and visualization, will suggest short- and long-term countermeasures and should ultimately have a positive impact on the lives of ordinary Pakistanis. Further details can be obtained on my webpage.

- Oct, 2008 – **Postdoctoral Researcher**, *National University of Ireland Maynooth*.
 Sep, 2009 The research focus was on the design and development of wide area wireless multi-modal sensor networks for geo-sensing applications. We developed a multi-sensor multi-modal platform for human activity monitoring by employing acoustic, Pyro-electric InfraRed, magnetic, temperature and humidity sensors. Data from multiple of these sensors, when combined, can be used for classifying different activities.
- Aug, 2004 – **Research Assistant**, *University of Illinois at Chicago*.
 Sep, 2008
- Optimal resource utilization framework for wireless control networks.
 - Modeling and analysis of contention based MAC Protocol.
 - Design and development of Wireless control network testbed for distributed control of switching power electronic systems.

Professional Experience

- May, 2007 – **Intern**, *Motorola Labs Schaumburg, IL*.
 Aug, 2008 Worked as a part of a research team exploring *Visible Light Communications (VLC)* technology and building use case demos for Motorola product interests. I led the feasibility study of selecting either Power Line Communication (PLC) or IEEE 802.15.4 based wireless infrastructure, as the network backbone, to transport data to the LED light. We evaluated lighting LED's modulation bandwidth and demonstrated streaming two distinct audio streams using two seemingly identical LED light fixtures employing time division multiplexing schemes. The LED lights served as illumination light sources and as content delivery transmitters simultaneously. I also developed point to point communication protocols for a novel mobile handset to handset optical wireless communication technology intended to serve Bluetooth function for low cost mass market phones.
- Dec, 2000 – **Embedded Systems Engineer**, *Mentor Graphics Pvt. Pakistan*.
 Jan, 2004
- Designed and implemented CAN device drivers for Siemens C167 & Motorola MPC555 embedded target systems.
 - Implemented CANopen (CAN application layer protocol) for Nucleus PLUS real time operating system kernel for real time applications.
 - Ported Nucleus PLUS on Motorola 68328, TI 54xx and 62xx DSP Platforms. Complete software development for TI's C67xx, C62xx, C54xx DSPs.
 - Ported network stack protocols including PPP, PPPoE, HDLC, TCP/IP, UDP and Web-Serv. Device driver programming for wireless LAN and PC serial and parallel communication interfaces. Some experience of USB driver programming for SCSI command set.
- Dec, 1999 – **Automation Engineer**, *SIEMENS Pakistan*.
 Jul, 2000 Complete automation of Asia Poultry Feed Mills using SIEMENS Simatic S7 PLC controller and WinCC based graphical user interface. The project involved more than 500 digital I/Os, four analog inputs and one PID loop. An inventory system was also developed.

Education

- Fall, 2008 **Ph.D. Electrical and Computer Engineering**, *University of Illinois at Chicago*.
Dissertation Title: Wireless communication protocols and resource optimization for distributed control networks.
Advisor: Sudip K. Mazumder.
- Fall, 2003 **M.Sc. Computer Engineering**, *University of Engineering and Technology Lahore*.
- August, 1999 **B.Sc. Electrical Engineering**, *University of Engineering and Technology Lahore*.

Achievements and Awards

- 2013 National ICT R&D Research Award, *Multi-modal Sensing Enabled Real-time Intelligent Wireless Camera Networks for Secure Spaces*.
- 2010 Joint USAID-HEC Research Award, *Ambient Air Quality Monitoring Using Integrated Secure Wireless Sensor and Vehicular Networks*.
- 2007 Outstanding Student Paper Award, *IEEE International conference on Advanced Information Networking and Applications (AINA)*.
- 2007 Received UIC Graduate Student Council and Graduate College travel awards for the *IEEE AINA*.
- 2005 Led a team of six undergraduate and five graduate students who won 3rd prize in the worldwide *IEEE Future Energy Challenge*.
- 1998 Selected as student member of UET Proctorial board based on academic excellence.
- 1996,1997 Awarded Merit Certificates in 2nd and 3rd years of undergraduate studies for ranking among the top 2% in a batch of 250 students of Electrical Engineering, at the UET, Lahore, Pakistan.
- 1994 Received Silver Medal and won the Presidential Scholarship in the intermediate examination from the Board of Intermediate and Secondary Education Multan, Pakistan.

Professional Activities

- Member *IEEE* and IEEE Communication Society.
- Reviewer *IEEE Transactions on Communication*.
- Reviewer *IEEE Transactions on Wireless Communication*.
- Reviewer *IEEE Communication Letters*.
- Reviewer *IEEE Transactions on Industrial Electronics*.

Publications List

Journal Publications

- M. Tahir and S. K. Mazumder. Event- and priority-driven coordination in next-generation grid. *accepted IEEE Journal of Emerging and Selected Topics in Power Electronics*, 2016.
- M. A. Anwar, A. B. Siddique and M. Tahir. Relative self-calibration of wireless acoustic sensor networks using dual positioning mobile beacon. *accepted IEEE Systems Journal*, 2016.
- A. Dilawari and M. Tahir. Optimal video-distortion network utility and lifetime tradeoff for wireless multimedia networks. *accepted IEEE Systems Journal*, 2015.
- M. Tahir and A. Dilawari. Joint rate control for distortion optimization in video networks. *IEEE Communication Letters*, 19(12):2122 - 2125, 2015.
- M. Tahir and S. K. Mazumder. Self-triggered Communication Enabled Control of Distributed Generation in Microgrids. *IEEE Transactions on Industrial Informatics*, 11(2):441 - 449, 2015.
- M. Tahir and S. K. Mazumder. Improving the dynamic response of active harmonic compensator using digital comb filter. *IEEE Journal of Emerging and Selected Topics in Power Electronics*, 2(4):994–1002, 2014.
- A. B. Siddique and M. Tahir. Joint Rate-Brightness Control using Variable Rate MPPM for LED based Visible Light Communication Systems. *IEEE Transactions on Wireless Communications*, 12(9):4604–4611, 2013.

- M. Tahir and R. Farrell. A cross-layer framework for optimal delay-margin, network lifetime and utility tradeoff in wireless visual sensor networks. *Ad Hoc Networks (Elsevier Journal)*, 11(2):701–711, 2013.
- M. Tahir and A. B. Siddique. Optimal Brightness-Rate Control using VR-MPPM and its Spectral Analysis for VLC System. *IEEE Communication Letters*, 16(7):1125–1128, 2012.
- S.K. Mazumder, R.K. Burra, R. Huang, M. Tahir, K. Acharya. A universal grid-connected fuel-cell inverter for residential application. *IEEE Transactions on Industrial Electronics*, 57(10):3431–3447, 2010.
- M. Tahir and S.K. Mazumder. Experimental evaluation of optimal rate delay and power allocation algorithm in wireless control networks. *Journal of Electrical and Computer Engineering*, vol. 2010, Article ID 650756, 5 pages, 2010. doi:10.1155/2010/650756. [\[html\]](#)
- S.K. Mazumder, M. Tahir and K. Acharya An integrated modeling framework for exploring network reconfiguration of distributed controlled homogeneous power inverter network using composite Lyapunov function based reachability bound. *Simulation* 86(2):75-92, 2010.
- S.K. Mazumder, K. Acharya and M. Tahir. Joint Optimization of Control Performance and Network Resource Utilization in Homogeneous Power Networks. *IEEE Transactions on Industrial Electronics*, 56(5):1736–1745, 2009.
- M. Tahir and S.K. Mazumder. Delay constrained optimal resource utilization of wireless networks for distributed control systems. *IEEE Communications Letters*, 12(4):289–291, 2008.
- M. Tahir and S.K. Mazumder. Markov chain model for performance analysis of transmitter power control in contention based wireless MAC protocol. *Springer Journal of Telecommunication Systems*, 38(3):99–110, 2008.
- S.K. Mazumder, M. Tahir and K. Acharya. Master–Slave Current-Sharing Control of a Parallel DC–DC Converter System Over an RF Communication Interface. *IEEE Transactions on Industrial Electronics*, 55(1):59–66, 2008.
- S.K. Mazumder, M. Tahir and S.L. Kamisetty. Wireless PWM control of a parallel DC-DC buck converter. *IEEE Transactions on Power Electronics*, 20(6):1280–1286, 2005.

Conference Publications

- A. B. Siddique and M. Tahir. Bandwidth Efficient Multi-Level MPPM Encoding Decoding Algorithms for Joint Brightness-Rate Control in VLC Systems. *IEEE Global Communications Conference (GlobeCom)*, pages 2184–2188, 2014.
- S. A. Arshad, M. A. Murtaza and M. Tahir. Optimal Duty Cycling and Rate Control For Wireless Sensor and Vehicular Networks. accepted *IEEE Vehicular Technology Conference (VTC)*, 2014.
- A. B. Siddique and M. Tahir. Joint Error-Brightness Control Coding for LED based VLC Link. accepted *IEEE Wireless Communications and Networking Conference (WCNC)*, 2014.
- M. A. Anwar, H. Hassan, H. Maqbool, A. Rehman and M. Tahir. Acoustic Sensor Network Relative Self-Calibration using Joint TDOA and DOA with Unknown Beacon Positions. accepted *IEEE Wireless Communications and Networking Conference (WCNC)*, 2014.
- M. A. Murtaza and M. Tahir. Optimal Data Transmission and Battery Charging Policies for Solar Powered Sensor Networks using Markov Decision Process. *IEEE Wireless Communications and Networking Conference (WCNC)*, 2013.
- S. A. Arshad, M. A. Murtaza and M. Tahir. Fair Buffer Allocation Scheme for Integrated Wireless Sensor and Vehicular Networks using Markov Decision Processes. *IEEE Vehicular Technology Conference (VTC)*, 2012.
- M. A. Murtaza, M. M. Qudoos and M. Tahir. Stochastic Optimal SIM Selection for Multi-SIM Cell-phone Architecture using semi-Markov Decision Processes. *IEEE Vehicular Technology Conference (VTC)*, 2012.
- T. A. Khan, M. Tahir and A. Usman. Visible Light Communication using Wavelength Division Multiplexing for Smart Spaces. *IEEE Consumer Communications and Networking Conference (CCNC)*, pages 246-250, 2012.
- S. A. Arshad, M. A. Murtaza and M. Tahir. Optimal buffer management for relay nodes in integrated wireless sensor and vehicular networks. *IEEE Consumer Communications and Networking Conference (CCNC)*, pages 386-387, 2012.

- T. A. Khan and M. Tahir. A half-duplex rateless coded protocol for a fading multi-way relay channel. *IEEE Consumer Communications and Networking Conference (CCNC)*, pages 382-383, 2012.
- A. B. Siddique and M. Tahir. Joint brightness control and data transmission for visible light communication systems based on white LEDs. *IEEE Consumer Communications and Networking Conference (CCNC)*, pages 1026-1030, 2011.
- A. Arshad and M. Tahir. Stochastic modeling and performance evaluation of dual radio wireless sensor node architecture. *IEEE Consumer Communications and Networking Conference (CCNC)*, pages 983-984, 2011.
- M. Tahir and R. Farrell. Optimal resource control of multi-processor multi-radio nodes using semi-Markov decision processes. *IEEE International Conference on Communications (ICC)*, 2010.
- M. Tahir and R. Farrell. Optimal utility lifetime and delay-robustness tradeoff in wireless multimedia sensor networks.. *IEEE International Conference on Communications (ICC)*, 2010.
- M. Tahir and R. Farrell. Optimal communication-computation tradeoff for wireless multimedia sensor network lifetime maximization. In *Proc. of IEEE Wireless Communications and Networking Conference (WCNC)*, pages 1-6, 2009.
- S.K. Mazumder, M. Tahir, and K. Acharya. Joint optimization of control performance and network resource utilization in homogeneous power networks. In *Proc. of 35th Annual Conference of the IEEE Industrial Electronics Society (IECON)*, pages 815-820, 2008.
- S.K. Mazumder, M. Tahir, and K. Acharya. Pseudo-decentralized control-communication optimization framework for microgrid: A case illustration. In *Proc. of IEEE/PES Transmission and Distribution Conference and Exposition*, pages 1-8, 2008.
- S.K. Mazumder, K. Acharya, and M. Tahir. Towards realization of a control-communication framework for interactive power networks. In *IEEE Energy 2030 Conference*, pages 1-8, 2008.
- S.K. Mazumder, R.K. Burra, R. Huang, M. Tahir, K. Acharya, G. Garcia, S. Pro, O. Rodrigues, and M. Stasinopoulos. Single-stage low-cost and energy-efficient isolated phase-shifted high-frequency inverter followed by a forced cycloconverter for universal residential fuel cell power system. In *Proc. of IEEE International Conference on Electro/Information Technology*, pages 408-413, 2008.
- M. Tahir and S.K. Mazumder. Markov chain model for performance analysis of transmitter power control in wireless MAC protocol: towards delay minimization in power-network control. In *Proc. of IEEE International Conference on Advanced Networking and Applications*, pages 909-916, 2007.
- M. Tahir and S.K. Mazumder. Improving throughput-delay performance by merged packet routing in wirelessly controlled interactive power networks. In *Proc. of IEEE International Conference on Advanced Networking and Applications*, pages 274-280, 2007.
- S.K. Mazumder, K. Acharya, and M. Tahir. Network reconfiguration of distributed controlled homogenous power inverter network using composite Lyapunov function based reachability bound. In *Proc. of the 2007 Summer Computer Simulation Conference*, pages 76-87, 2007.
- K. Acharya, M. Tahir, and S.K. Mazumder. Communication fault-tolerant wireless network control of a load-sharing multiphase interactive power network. In *Proc. of IEEE Power Electronics Specialists Conference*, pages 1-8, 2006.
- S.K. Mazumder, K. Acharya, and M. Tahir. "Wireless" control of spatially distributed power electronics. In *IEEE Applied Power Electronics Conference and Exposition (APEC)*, pages 75-81, 2005.