

Tao Liu

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Qualifications

- **Experienced programmer** with more than 7 years of software development experience. Thorough understanding of the entire cycle of software development process. Hands-on experience with Linux network programming, as well as the design and implementation of low-power wireless networking stack for embedded sensors. Familiar with low-level hardware interfaces and bus protocols such as GPIO, UART and I²C.
- **Network Engineer with extensive knowledge** of TCP/IP protocol suite and wireless standards such as IEEE 802.11 and 802.15.4. Familiar with various low power wireless protocols such as 6LowPAN, RPL, CoAP, etc. Extensive experience on low power wireless network design and contributed to the design and deployment of several large scale low power wireless sensor networks.
- **Researcher with proven track record** in the fields of wireless sensor networks. Strong background on distributed systems and wireless networks, with a research focus on applied machine learning techniques as well as algorithms optimization for low-power, resource-constrained wireless sensor networks.

Technical Skills

- **Computer Languages:** Proficient in C/C++, Java and Python. Familiar with SQL, PHP and HTML/CSS.
- **Operating Systems:** Linux (Ubuntu/Debian), TinyOS, Contiki (Embedded OSs)
- **Applications:** MATLAB, ArcGIS, NI ELVIS II, IAR Embedded Workbench, tcpdump, Wireshark
- **System Admin:** mySQL, PostgreSQL, Apache2, Postfix, Mailman, NFS, NIS, iptables

Education

- **Ph.D. in Computer Science**, University of California - Merced, CA 2013
- **M.Sc. in Internet and Multimedia Engineering**, London South Bank University, London, UK 2006
- **B.Eng. in Power System and Its Automation**, Wuhan University, Wuhan, China 2000

Professional Experience

- **Research Specialist**, University of California - Merced, CA 2014 – Present
 1. Campus Level Building Information Monitoring and Visualization
 - Configured Python modules that continuously pull data from hundreds of devices across multiple buildings using an multi-thread approach. Data is aggregated and stored in PostgreSQL databases as time series.
 - Custom built BACnet C library for building data collection from BACnet supported devices.
 - Provided visualization of historical data (e.g. CO₂, air flow, etc.) in a RESTful web interface.
 2. Solar Dome Instrument for Solar Irrandiance Monitoring
 - Designed a solar radiation sensing instrument prototype comprised of 200+ light sensors.
 - Implemented C driver in Arduino platform for sensor data gathering via GPIO, as well as Python programs for data preprocessing and storage using mySQL backend servers.
- **Graduate Student Researcher**, University of California - Merced, CA 2007 – 2013
 1. Wireless Sensor Network Testbed Deployment
 - Designed and installed a wireless sensor network testbed of 54 TI MSP430 based embedded sensors (TMote).
 - Implemented a virtual USB driver in Linux (C and socket) to enable direct USB communication between the central server and the sensor nodes over IP networks.
 - Developed a multiple-thread Python library for simultaneous data collection from multiple sensors.
 - Setup a time-sharing web interface for multiple user testbed access (PHP + mySQL). The online testbed interface is available at <http://www.andes.ucmerced.edu/sling>.
 2. Solar Irrandiance Prediction System
 - Deployed a network with 50+ wireless light sensors covering a 10-acre solar power plant.
 - Maintained the low-power ad-hoc wireless network for wireless data collection.

- Designed a tiered architecture to retrieve data from multiple distributed sources (solar radiation readings, GPS data, power plant energy output, etc.) for centralized storage (MySQL database).
- 3. Online Machine Learning Models for Wireless Link Quality Prediction
 - Performed experimental study to model the temporal variations of radio channel quality using machine learning methods (regression analysis, Artificial Neural Networks, etc.)
 - Constructed prediction models using Logistic Regression with online learning (Stochastic Gradient Descent) to prediction short term quality variations of low-power wireless links.
 - Optimized and implemented the prediction model as a part of low-power networking stack for wireless sensor nodes (TMote). Empirical study showed the model can reduce the radio communication cost by up to 90%.
- 4. Low-Power Wireless Network Protocol Design
 - Designed and implemented a low power bulk data transmission protocol that improves energy efficiency of data transmission by leveraging the spatial diversity of wireless links.
 - Performed experimentally verification of the energy reduction of the protocol in multiple networks.
- 5. Network and Server Administration
 - Maintenance of local network infrastructure, including system-level firewall (iptables), network user management and file sharing (NIS, NFS), Email service (Postfix, Mailman) and Web server (Apache2).
 - Deployed a autonomous backup/restore system for high-performance computation servers.
 - Administration of MySQL and PostgreSQL database servers to ensure uninterrupted service to all projects.
- **Software Engineer**, Yangtze River Scientific Research Institute, Wuhan, China 2000 – 2005
 1. Implemented 3D mesh visualization software for finite element analysis using OpenGL (C++)
 2. Designed an online water population report system based on ArcGIS models (VBA for ArcGIS)
 3. Network administration of departmental Windows servers workgroup and the IIS based website

Publications

- **Tao Liu**, Alberto Cerpa, “Data-driven Link Quality Prediction Using Link Features”. To be appear in *ACM Transactions on Sensor Networks (TOSN)*, Volume 10, Issue 3, August 2014.
- **Tao Liu**, Alberto Cerpa, “Temporal Adaptive Link Estimator with Online Training”. *ACM Transactions on Sensor Networks (TOSN)*, Volume 10, Issue 2, May 2014.
- **Tao Liu**, Ankur Kamthe, Varick Erickson, Carlos F. M. Coimbra, Alberto Cerpa, “SDI: Solar Dome Instrument for Solar Irrandiance Monitoring”. *UC Merced Technical Report 2014-001*, pp. 1–12, University of California, Merced, CA, March, 2014.
- **Tao Liu**, Alberto Cerpa, “TALENT: Temporal Adaptive Link Estimator with No Training”. *Proceedings of the 10th ACM Conference on Embedded Network Sensor Systems (SenSys '12)*, Toronto, Canada, November 2012.
- **Tao Liu**, Alberto Cerpa, “Foresee (4C): Wireless link prediction using link features”. *Proceedings of the 10th International Conference on Information Processing in Sensor Networks (IPSN '11)*, Chicago, IL, April 2011.
- **Tao Liu**, Ankur Kamthe, Lun Jiang, Alberto Cerpa, “Performance Evaluation of Link Quality Estimation Metrics for Static Multihop Wireless Sensor Networks”. *Proceedings of the 6th Annual IEEE Communications Society Conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON '09)*, Rome, Italy, June 2009.

Awards, Grants & Honours

UCM Graduate Division Summer Fellowship	2013
UCM Graduate Division Spring Fellowship	2012
Travel Award for IPSN 2011	2011
NSF Travel Grant for SenSys 2007	2007
M.Sc. Graduation with Distinction	2006