

Vaskar Raychoudhury

CONTACT INFORMATION	Department of Electronics & Computer Engineering Indian Institute of Technology (IIT) Roorkee Roorkee 247667, Uttarakhand, INDIA http://people.iitr.ernet.in/facultywebsite/vaskafec/Website/	Office: (+91) 1332-28-5848 Mobile: (+91) 75790-72357 e-mail: vaskar@ieee.org
RESEARCH INTERESTS	Mobile and pervasive computing, parallel and distributed computing, (mobile) social networks, fault tolerance and middleware, cyber-physical systems	
CURRENT STATUS	Currently working as an Assistant Professor in the Department of Electronics & Computer Engineering, Indian Institute of Technology Roorkee, India October 27, 2011 - Till date	
PAST WORK EXPERIENCE	<ul style="list-style-type: none">• Postdoctoral Researcher Engineer in the Handicom Lab, Telecommunication Network and Services Department, Institut TELECOM & Management SudParis, Evry, France (March 1, 2011 - October 31, 2011)• Postdoctoral Research Associate, Internet and Mobile Computing Lab, Department of Computing, The Hong Kong Polytechnic University (May 19, 2010 – February 28, 2011)	
EDUCATION	<p>Ph.D. in Computer Science, The Hong Kong Polytechnic University, Hong Kong April 2006 – May 2010</p> <ul style="list-style-type: none">• <i>Advisor:</i> Dr. Jiannong Cao• <i>Thesis title:</i> Reliable Service Discovery and Access in Pervasive Computing Environments <p>M.S. (by research) in Information Technology, Indian Institute of Technology (IIT) Kharagpur, India August 2003 – January 2006</p> <ul style="list-style-type: none">• <i>Thesis title:</i> A Middleware for Building Mobile Agent Based Distributed Applications <p>B.Tech. in Information Technology, B.P. Poddar Institute of Management & Technology (Affiliated to Kalyani University), Kolkata, West Bengal, India September 1999 – July 2003</p>	
HONOURS AND AWARDS	<ul style="list-style-type: none">• The Hong Kong Polytechnic University International Postgraduate Scholarship for PhD Studies.• A national prize and a certificate of merit as a selected candidate in the 12th all India essay contest on nuclear science and technology, conducted by Bhabha Atomic Research Centre (BARC) & the Dept. of Atomic Energy, Govt. of India.• A national prize, a certificate of merit and a national scholarship for being 33rd in the state (West Bengal) in Higher Secondary Examination (M.O: 89.9%).• A national prize, a certificate of merit and a national scholarship for being 24th in the state (West Bengal) in Secondary Examination (M.O: 91.625%).	
PUBLICATIONS	<p>Book Chapters</p> <ul style="list-style-type: none">• Jiannong Cao, Joanna Siebert, and Vaskar Raychoudhury, "Service Management in Pervasive Computing Environments", <i>Pervasive Computing and Networking</i>, Mohammad S. Obaidat, Mieso Denko, and Isaac Woungang (Eds.), John Wiley & Sons, Ltd. <p>Journal Publications</p> <ul style="list-style-type: none">• Vaskar Raychoudhury, Jiannong Cao, Weigang Wu, and Steven Lai, "K-Directory Community: Reliable Service Discovery in MANET," <i>Journal of Pervasive and Mobile Computing</i>, Elsevier	

Volume 7, Issue 1, February 2011, Pages 140-158.

- *Vaskar Raychoudhury*, Jiannong Cao, Mohan Kumar, and Daqiang Zhang, “Middleware for Pervasive Computing: A Survey,” Accepted for publication in the Journal of Pervasive and Mobile Computing, Elsevier.
- *Vaskar Raychoudhury*, Jiannong Cao, and Weigang Wu, “Top K-leader Election in Mobile Ad Hoc Networks,” submitted to the Journal of Pervasive and Mobile Computing, Elsevier.

Conference Publications

- *Vaskar Raychoudhury*, Jiannong Cao, Weiping Zhu, and Ajay D. Kshemkalyani, “Context Map for Navigating the Physical World,” Accepted for Publication in Proceedings of 20th Euromicro International Conference on Parallel, Distributed and Network-Based Computing (PDP), February 15-17, 2012, Munich, Germany.
- *Vaskar Raychoudhury*, Ajay D. Kshemkalyani, and Jiannong Cao, “Querying Context Maps using Relative Timing Predicates in Pervasive Environments,” Accepted for Publication in Proceedings of 6th International Workshop on Middleware Tools, Services and Run-time Support for Networked Embedded Systems (MidSens’11) to be held with Middleware 2011 Conference, December 12-16, 2011, Lisbon, Portugal.
- Weiping Zhu, Jiannong Cao, Yi Xu, and *Vaskar Raychoudhury*, “Event Aggregation with Different Latency Constraints and Aggregation Functions in Wireless Sensor Networks,” In Proceedings of IEEE International Conference on Communications (ICC), June 5-9, 2011, Kyoto, Japan.
- *Vaskar Raychoudhury*, Jiannong Cao, Weigang Wu, and Cheng Hui, “Service Handoff for Reliable and Continuous Service Access in Pervasive Computing,” In Proceedings 19th Euromicro International Conference on Parallel, Distributed and Network-Based Computing (PDP2011.), pp-172-179, February 09-11, Ayia Napa, Cyprus.
- *Vaskar Raychoudhury*, Jiannong Cao, Weigang Wu, and Steven Lai, “K-Directory Community: Reliable Service Discovery in MANET,” In Proceedings of 11th International Conference on Distributed Computing and Networking (ICDCN2010), January 3-6, 2010, Kolkata, India.
- *Vaskar Raychoudhury*, “Efficient and Fault Tolerant Service Discovery in MANET using Quorum-based Selective Replication,” In Proceedings of 7th Annual IEEE International Conference on Pervasive Computing and Communications (Percom 2009: Google PhD Forum), Galveston, Texas, USA, March 9-13, 2009.
- Daqiang Zhang, Jiannong Cao, Jingyu Zhou, Minyi Guo, and *Vaskar Raychoudhury*, “An Efficient Collaborative Filtering Approach Using Smoothing and Fusing,” In Proceedings of the 38th International Conference on Parallel Processing (ICPP’09), September 22-25, 2009, Vienna, Austria.
- [Invited Paper] *Vaskar Raychoudhury*, Jiannong Cao, and Weigang Wu, “Top K-leader Election in Wireless Ad Hoc Networks,” In Proceedings of 17th International Conference on Computer Communications and Networks (ICCCN’08), August 3-7, 2008, St. Thomas, U.S. Virgin Islands.
- Joanna Izabela Siebert, Jiannong Cao, Yu Zhou, Miaomiao Wang, and *Vaskar Raychoudhury*, “Universal Adaptor: A Novel Approach to Supporting Multi-protocol Service Discovery in Pervasive Computing,” In Proceedings of International Conference on Embedded and Ubiquitous Computing (EUC’07), pp. 683-693, December, 2007, Taipei, Taiwan.

- Miaomiao Wang, Jiannong Cao, Joanna Izabela Siebert, *Vaskar Raychoudhury*, and Jing Li, “Ubiquitous Intelligent Object: Modeling and Applications,” In Proceedings of 3rd International Conference on Semantics, Knowledge and Grid (SKG’07), Oct. 29-31, 2007. Xian, China.
- Yu Zhou, Jiannong Cao, *Vaskar Raychoudhury*, Joanna Izabela Siebert, and Jian Lu, “A Middleware Support for Agent-Based Application Mobility in Pervasive Environments,” In Proceedings of the 27th International Conference on Distributed Computing Systems Workshops (ICDCSW’07), June 25-29, 2007, Toronto, Ontario, Canada.
- *Vaskar Raychoudhury* and Arobinda Gupta, “A Middleware for Building Mobile Agent-Based Distributed Applications,” In Proceedings of the 13th International Conference on Advanced Computing & Communications (ADCOM’05), December 14-17, 2005, Coimbatore, India.

RESEARCH
EXPERIENCE

Postdoctoral Researcher
March 2011 – October 2011

HANDICOM Lab
Institut TELECOM & Management SudParis, France

I have worked in an EU FP7 funded project named *Self Orchestrating Community ambiEnT Intelligent Spaces*, or SOCIETIES (<http://www.ict-societies.eu/>), in short. The vision of SOCIETIES was to develop a complete, integrated Community Smart Space (CSS), which extends pervasive systems beyond the individual to dynamic communities of users. CSSs would embrace on-line community services, such as Social Networking in order to offer new and powerful ways of working, communicating and socialising. The project had 16 partners spread over 10 different EU countries.

Our primary task in this project was to develop a user agent functionality that will coordinate and manage the implementation of behaviors on behalf of a user. Therefore it would provide various decision making functionalities with the aim of mitigating the need for user intervention while automatically resolving conflicts in the CSS. Decisions had to be based on the needs of the user as an individual and as a member of multiple communities. My responsibility was to analyse the user agent function over various application use cases and then proposing a suitable and effective architecture for the user agent system. Later I was responsible for implementing the user agent functionalities.

Postdoctoral Research Associate
May 2010 – February 2011

Internet and Mobile Computing Laboratory
The Hong Kong Polytechnic University

During my PhD study, I have written the proposal with another team mate for the project titled “*A Ubiquitous Searching and Browsing Framework (USBF)*” for NOKIA Research Centre, Beijing and we received the funding of **224,980 Hong Kong dollars (~23,652 Euros)**. I have worked on this project during my postdoctoral research. The objective of this project was to develop a Google-like search engine to enable users to identify, search, and browse information about objects and people in the physical world as they do in the cyber space of the Internet. We considered that all the physical world objects as well as humans are smart entities with embedded sensing, computing and communication capabilities, and they are interconnected through different contextual relationships. We developed a smart logistics system which entitles users to search objects and people and browse through their contextual links. Please check here (<http://imc.comp.polyu.edu.hk/pvc/doku.php?id=demonstration>) for a demo video and related documentation.

I have also worked in another project titled “*Programming Pervasive Computing Middleware based on Ubiquitous Interacting Objects*”. A middleware for pervasive computing is required to assist application developers by bridging the huge gap between the high-level application requirements and the heterogeneity of the underlying devices, networks and platforms. However, Most existing middleware systems for pervasive computing are based on a top-down, centralized model which lacks flexibility. In this project, we worked to develop a bottom-up, decentralized approach for designing and programming pervasive computing middleware functions based on ubiquitous interacting objects (UIOs), which are smart objects augmented with various processing capabilities. Many middleware functions, such as service discovery and composition, context derivation, and context inconsistency checking, could be performed through the decentralized interaction and autonomous collaboration of the UIOs. I, along with a team member, wrote a proposal requesting funding for this topic, under the

guidance of my supervisor, and we received a grant of **1,218,000 Hong Kong dollars (~127,844 Euros)** from GRF Hong Kong for the period 2010-2013.

A third project I have worked during my postdoctoral stint at The Hong Kong Polytechnic University dealt with designing a novel simulation platform for aiding developers in developing applications, protocols, and algorithms in pervasive networking and computing (PNC) environment. Development and deployment of systems and applications for PNC is challenging due to the need of creating various application specific smart environments. In many cases, it is very difficult and even impractical to experiment with and test the proposed mechanisms due to the overhead of managing a large number of smart devices. Existing test-beds and simulators for experimenting with PNC systems are limited in scale and are mostly designed for simulating applications and not protocols and algorithms. In this project we aimed to develop a generic framework and software environment for simulating different types of PNC applications, protocols and algorithms. Along with the traditional computing devices, sensors and actuators, we planned to model everyday physical objects as smart entities called ubiquitous interacting objects (UIOs), and to develop the simulation system based on the abstraction of UIO and their interactions. I, along with a team member, wrote a proposal requesting funding for this topic, under the guidance of my supervisor, and we received a grant of **945,000 Hong Kong dollars (~99,189 Euros)** from GRF Hong Kong for the period 2011-2014.

Graduate Research Assistant

April 2006 – May 2010

Internet and Mobile Computing Laboratory

The Hong Kong Polytechnic University

Service discovery is one of the fundamental services in pervasive computing where different services are provided by various portable devices interconnected in an ad hoc manner. Given its dynamic nature, service unavailability can frequently occur in pervasive environments due to service provider failure, network partitioning, or service scope outage by service provider or user mobility. As part of my Ph.D. thesis, I attempted to address some of the fault-tolerance issues associated with service discovery applications in pervasive and mobile computing environments and proposed some algorithms and protocols. Following is a brief description of these approaches.

- **Formation of a Directory Community:** Directory community framework consists of a set of relatively resource-rich mobile devices acting as directory nodes and the framework along with a suite of protocols works as the basis of our research in reliable service discovery and access in ad hoc networks. The directory community formation problem has been modeled as top-K highest resource leader election in mobile ad hoc networks and a distributed algorithm has been proposed to achieve the objective in a scalable, reliable, and message-efficient manner.
- **Quorum-based Reliable Service Discovery:** Using the directory community framework, a quorum-based fault-tolerant service discovery protocol has been developed. The elected directory nodes are divided into multiple quorums. Services registered with a directory are replicated among its quorum members, in order to increase availability. This approach guarantees network-wide service availability using the quorum intersection property and reduces replication and update costs by minimizing the quorum size.
- **Service Handoff based Reliable Service Access:** Based on the directory community, a reliable and continuous service access mechanism has been developed for mobile users and it works using service handoff. Service handoff provides mobile users seamless service access by proactively finding new matching services once the original service becomes unavailable. Three different service handoff protocols have been designed for different situations. The handoff protocols can reduce handoff message cost and time delay while achieving a load balance on service providers.

Junior Project Assistant

August 2003 – January 2006

Microsoft Laboratory

Department of Computer Science and Engineering
Indian Institute of Technology, Kharagpur

During my M.S. study, I was associated with the project “*A Middleware for Building Mobile Agent-*

Based Distributed Applications”, sponsored by the Ministry of Human Resource Development (MHRD), Govt. of India. This project was targeted to the users unacquainted with mobile agent programming. The project aimed to develop a middleware to facilitate the automatic generation of mobile agent codes based on certain input parameters specified by the user. The middleware also provided certain fault-tolerant functionalities.

FUNDED
RESEARCH
PROJECTS

Development of an Internet-of-Things (IoT) framework for navigating the physical world, Faculty Initiation Research Grant, Ministry of Human Resources Development (MHRD), Govt. of India || Rs. 10 Lakh (~20,000 USD) (ongoing)

RESEARCH
STUDENTS

Currently supervising 3 graduate (MTech) students:

- *Dinesh Rathore*
- *Gyanesh Meena*
- *Sunkula Lakshmana Rao*

TEACHING
EXPERIENCE

Assistant Professor - IIT Roorkee, Uttarakhand, India

- *EC-252: Computer Architecture & Microprocessors - Spring 2012 (3L-4T-0P) [Enrolment 159]*
- *EC-253: System Software - Autumn 2012-13 (2L-2T-0P) [Enrolment 82]*
- *EC-351: Design & Analysis of Algorithms - Autumn 2012-13 (3L-2T-0P) [Enrolment 124]*

Teaching Assistant - The Hong Kong Polytechnic University

- *Information Technology Systems (COMP 111) - Spring 2008*
Assisted undergraduate students in computer laboratory to learn C programming. I was in charge of projects and assignments for this course.
- *Computer Applications (COMP 250) - Fall 2006 and 2007*
Taught undergraduate students the basic computer applications using Microsoft Word, Excel, PowerPoint and Access. Also assisted them to develop simple Web applications using HTML.

Teaching Assistant - Indian Institute of Technology, Kharagpur

- *Computing Systems Laboratory*
Assisted graduate students in laboratory assignments.

TEACHING
TRAINING

Underwent teaching training course titled “*Basic Teaching Techniques for Research Staff & Research Students*” offered by the Educational Development Centre, The Hong Kong Polytechnic University.

PROFESSIONAL
ACTIVITIES

Track Chair:

- Organizing a special session titled “*Applications of Bio-inspired Techniques to Social Computing*” to be held along with the 7th International Conference on Bio-Inspired Computing: Theories and Application, 2012 (BIC-TA 2012) in ABV-IIITM Gwalior during December 14 - 16, 2012.

Short-term Course:

- Organized a week-long (June 25-29, 2012) AICTE sponsored short-term course in IIT Roorkee, titled “*Applying Pervasive Computing and Social Networks to Accelerate the Growth of Rural and Urban India*”. The course received extremely-positive feedback from the participants.
- Two distinguished researchers from the famed IBM India Research Lab (IRL) came to IIT Roorkee as guest speakers during the course.

Member – ACM,

Member – IEEE,

Member – IEEE Communications Society

Reviewer:

- International Journals including Communications of the ACM, Pervasive and Mobile Computing Journal - Elsevier, International Journal of Information Technology and Decision Making, Multiagent and Grid Systems Journal, Journal of Parallel and Distributed Computing - Elsevier, Journal of Ubiquitous Computing and Intelligence, IEEE Communications Magazine, Ad Hoc Networks - Elsevier, International Journal of Computers and Applications, KSII Transactions on Internet and Information Systems, Journal of Computer Sc. and Technology, International Journal of Signal and Imaging Systems Engineering (IJSISE), Journal of Internet Technology, EURASIP Journal on Wireless Communications and Networking, IEEE Transactions on Systems, Man and Cybernetics, Part A.
- International Conferences and Workshops including ICDCS, ICPP, PERCOM, ICNP, ICC, SRDS, AD HOC NOW, APSCC, CHINACOM, EUC, HiPC, MDM, MP2P, NPC, OPODIS, PRDC, ICDCN, SKG, CCGrid, SCC, FGCN, HPCC, ICPADS, GPC, GLOBECOM, SSS, TrustCom, Mobilware, CCNC.

Program Committee Member:

- ASE/IEEE International Conference on Social Informatics, Washington D.C., USA, December 14-16, 2012
- 4th ASE/IEEE International Conference on Social Computing (SocialCom 2012), Amsterdam, The Netherlands, September 3-6, 2012
- International Workshop on Knowledge Acquisition and Management in the Internet of Things (KAMIoT 2012), in conjunction with 11th IEEE International Conference on Ubiquitous Computing and Communications (IUCC-2012), Liverpool, UK, June 25-27, 2012
- Track on Cyber Physical Society with SOA, BPM and Sensor Networks, in 21st International Conference on Collaboration Technologies and Infrastructures (WETICE-2012), Toulouse, France, June 25-27, 2012

REFEREES

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