Nome Cognome studioso: Prof. Kauchick Chowdhury
indicare se professore/dottorando/post doc: Assistant Professor (approved for Associate)

Corso di riferimento: Wireless Networks (CLM Space Communications and Sensing)

Professore di riferimento a Pavia: Prof. Lorenzo Favalli

Titolo attività: Wireless Networks - Advanced Theory and Architectures

Overview: This instructional course is designed to highlight and introduce some of the cutting edge topics in wireless networking and communication. The emphasis is on technologies that shall result in not only massive spectrum enhancements and but also bring about energy efficiency in operation. The course will begin with advances in macro-networks that are critical in realizing the improvement of several orders of magnitude in the end-to-end data rate, and then progressively consider small form factor sensors that give high to the pervasive connectivity concept.

Syllabus:

Week 1.
Day 1. Cognitive radio and dynamic spectrum access- Spectrum management
Day 2. Cognitive radio and dynamic spectrum access- Protocols
Day 3. Full duplex communication
Day 4. New 802.11 flavors- 802.11n, 802.11ac, 802.11ad, 802.11p
Day 5. BigData in networks and mobile cloud computing

Week 2.
Day 1. Wireless sensor networks and participatory sensing
Day 2. Intra-body communication
Day 3. Energy harvesting sensors
Day 4. Software defined radios and wireless networks
Day 5. Optimizing wireless transmissions- Interference alignment and packet coding

Periodo di permanenza indicativo: The course will be conducted in two weeks i.e., weeks of Nov 9 and Nov 16. Each business day shall involve a 2-hour lecture, resulting in a 20-hour total contact duration.

Instructor Bio (allegato cv completo):

Kaushik Chowdhury is Assistant Professor in the Electrical and Computer Engineering Department at Northeastern University, Boston, MA, USA since 2009. He graduated with B.E. in Electronics Engineering with distinction from VJTI, Mumbai University, India, in 2003. He received his M.S. in Computer Science from the University of Cincinnati, OH, in 2006, and Ph.D. from the Georgia Institute of Technology, Atlanta, GA in 2009. His M.S. thesis was given the outstanding thesis award jointly by the ECE and CS departments at the University of Cincinnati. He received the Best Paper Award at the IEEE ICC Conference in 2009, 2012, 2013, as well as the Best Paper award in the ICNC Conference in 2013. His expertise and research interests lie in wireless cognitive radio ad hoc networks, energy harvesting, and intra-body communication. He is currently an area editor for the Elsevier Ad Hoc and Computer Communications journals, and the Chair for the IEEE Technical Committee on Simulation.
1. Education History

**Georgia Institute of Technology** Atlanta, GA, May 2006-Aug. 2009
Doctor of Philosophy in Electrical and Computer Engineering
Thesis: *Communication Protocols for Wireless Cognitive Radio Ad-hoc Networks*
Advisor: Prof. Ian F. Akyildiz

**University of Cincinnati** Cincinnati, OH, Sept. 2003-Apr. 2006
Master of Science in Computer Science
Thesis: *Multi-Channel Medium Access Protocols for Wireless Networks*
Advisor: Prof. Dharma Agrawal

**VJTI-Mumbai University** Mumbai, India, Aug. 1999-Aug. 2003
Bachelor of Engineering in Electronics Engineering

2. Employment History

*Assistant Professor* - Northeastern University, Boston, MA
Department of Electrical and Computer Engineering  
Sept. 2009- present

*Research Assistant* - Georgia Institute of Technology, Atlanta, GA  
Department of Electrical and Computer Engineering

3. Scholarship/Research/Creative Activity

3.1 Publications- Refereed Articles

**Summary:** h-index = 26, Total citations = 5276

*Above metrics are retrieved from Google Scholar on Feb 22, 2015.*

*Publications with NU students marked with * *

3.1.A. Refereed Journals and Magazines In Press/Published, in chronological order

*Qualifiers added where known: (Citations indicated for papers if >10, Impact Factor IF).*


3.1.B. Refereed Journals and Magazines Under Review


3.1.C. Refereed Conference and Workshop Proceedings In Press or Published


C32. R. Doost-Mohammady, K. R. Chowdhury, and M. DiFelice, “Routing and Link Layer Protocol Design for Sensor Networks with Wireless Energy Transfer,” IEEE GLOBECOM, Miami, Fl, USA, Dec., 2010. (34, 35.6%) *


3.1.D Publications- Book Chapters


3.1.E Publications- Others


3.2 Creative Activity

3.2.A. International Presentations
1. *Invited talk*—“The role of body coupled communication, energy harvesting sensors and dynamic spectrum access in future medical telemetry,” IIT Hyderabad, India, Nov. 27, 2013.
2. *Invited talk*—“The role of body coupled communication, energy harvesting sensors and dynamic spectrum access in future medical telemetry,” IIT Delhi, India, Nov. 25, 2013.

3.2.B. National Presentations
2. *Keynote Presentation*—“Closing the loop in cognitive radio networks: Towards higher layer protocol design and user applications,” IEEE Workshop on Cognitive Radio Architectures for Broadband (CRAB), Raleigh, in conjunction with the 22nd IEEE International Conference on Network Protocols (ICNP), NC, Oct. 21, 2014.

### 3.2.C. Regional Presentations


### 4. Grants

*Dollar amounts for multi-PI projects listed as: $Total ($NU Total, *$Chowdhury’s Share*)

#### 4.A. External Grants

1. **Title:** Holistic Design Methodology for Automated Implementation of Human-in-the-Loop Cyber-Physical Systems  
   **Agency:** National Science Foundation  
   **Status:** Co-PI, 25%  
   **Funding:** $1,650,000 ($1,250,000, **$312,500** )  
   **PI and Co-PIs:** Gunar Schirner (PI), Deniz Erdogmus, Taskin Padir (Worcester Polytechnic Institute)

2. **Title:** GENIUS: Green sEnsor Networks for aIr qUality Support  
   **Source:** National Science Foundation  
   **Status:** PI, 50%  
   **Funding:** $386,012 ($210,450, **$105,225**) incl. of 1 REU supplement of $6,000  
   **Co-PIs:** Stefano Basagni and Wendi Heinzelman (University of Rochester)

3. **Title:** Link Layer Design and Implementation for Software Defined Radios  
   **Agency:** MathWorks  
   **Status:** PI, 100%  
   **Funding:** **$239,999**

4. **Title:** CDRIVE: Cognitive Radio Enabled Spectrum Aware Intelligent Vehicular Networks  
   **Agency:** National Science Foundation  
   **Status:** PI, 100%  
   **Funding:** **$277,974**

5. **Title:** REU support for CDRIVE: Cognitive Radio Enabled Spectrum Aware Intelligent Vehicular Networks
Agency: National Science Foundation  
Funding: $16,000  
Status: PI, 100%

6. Title: A Flexible and Extensible Solution to incorporating new RF Devices and Capabilities into EWI ISR Networks
Agency: DARPA STTR Phase I  
Funding: $29,494  
Status: PI, 100%

7. Title: Transport Layer Design and Analysis for Cognitive Radio Ad Hoc Networks
Agency: Office of Naval Research (ONR)  
Funding: $299,661  
Status: PI, 100%

8. Title: A Flexible and Extensible Solution to incorporating new RF Devices and Capabilities into EWI ISR Networks
Agency: DARPA STTR Phase II (with VistoLogy Inc.)  
Funding: $294,339  
Status: PI, 100%

9. Title: Network Protocol Stack for Galvanic Coupled Intra-body Sensors
Agency: National Science Foundation  
Funding: $299,953  
Status: PI, 100%

4. B. Internal Grants
1. Title: Towards Secure Smartphones for Authorizing Financial Transactions
Agency: Provost Tier 1 Award  
Funding: $43,834 ($43,834, $33,626)  
Status: PI, 75%
Co-PI: Engin Kirda

5. Teaching and Advising

5.A.1 Courses Taught at Northeastern University (All Regular Load)

*Detailed TRACE results and student comments included in Appendix A.*

Summary: Average TRACE rating on instructor effectiveness from all courses: 4.65

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Title</th>
<th>Semester/Year</th>
<th>No. of students</th>
<th>Overall instructor effectiveness score (from TRACE)</th>
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<tr>
<td>EECE4628</td>
<td>Computer &amp; Telecommunication Networks</td>
<td>Fall 2009</td>
<td>7</td>
<td>5/5</td>
</tr>
<tr>
<td>EECE4628</td>
<td>Computer &amp; Telecommunication Networks</td>
<td>Spring 2010</td>
<td>40</td>
<td>4.5/5</td>
</tr>
<tr>
<td>EECE7398</td>
<td>ST: Wireless Cognitive Radio</td>
<td>Fall 2010</td>
<td>7</td>
<td>4.8/5</td>
</tr>
<tr>
<td>Networks</td>
<td>Semester</td>
<td>Grade</td>
<td>Rating</td>
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<td>-------------------------------------------------------------------------</td>
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<tr>
<td>EECE4628 Computer &amp; Telecommunication Networks</td>
<td>Spring 2011</td>
<td>42</td>
<td>4.7/5</td>
<td></td>
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<tr>
<td>EECE4628 Computer &amp; Telecommunication Networks</td>
<td>Spring 2012</td>
<td>40</td>
<td>4.8/5</td>
<td></td>
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<tr>
<td>EECE7364 Mobile and Wireless Networks</td>
<td>Spring 2012</td>
<td>17</td>
<td>4.7/5</td>
<td></td>
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<tr>
<td>EECE4628 Computer &amp; Telecommunication Networks</td>
<td>Spring 2013</td>
<td>42</td>
<td>4.6/5</td>
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<td>EECE7364 Mobile and Wireless Networks (classroom lectures)</td>
<td>Spring 2013</td>
<td>38</td>
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<tr>
<td>EECE7364 Mobile and Wireless Networks (video streaming)</td>
<td>Spring 2013</td>
<td>14</td>
<td>5/5</td>
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<tr>
<td>EECE4628 Computer &amp; Telecommunication Networks</td>
<td>Spring 2014</td>
<td>52</td>
<td>4.7/5</td>
<td></td>
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<tr>
<td>EECE7364 Mobile and Wireless Networks (classroom lectures)</td>
<td>Spring 2014</td>
<td>48</td>
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<tr>
<td>EECE7364 Mobile and Wireless Networks (video streaming)</td>
<td>Spring 2014</td>
<td>29</td>
<td>4.4/5</td>
<td></td>
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</tbody>
</table>

### 5.A.2 Courses Developed at Northeastern University

**EECE 7364: Mobile and Wireless Systems (new course, graduate)**

*Description:* I developed this new graduate course covering mobile and wireless networks, for both infrastructure-based and distributed systems. There is emphasis on the design and analysis of existing wireless technologies, as well as an exposure to new and emerging areas. The overall objective is to enable the student to critically evaluate current and future wireless and mobile systems, through an awareness of (i) theory, (ii) software protocols, and (iii) architectural knowhow. The course includes topics on cellular networks including design, evolution, handoff, analysis; traffic channel allocation; ALOHA and CSMA variants of multiple access schemes; link layer operation; network layer routing and wireless TCP at the transport layer. The course also includes discussions on ad hoc networks, sensor networks, and new advances such as cognitive radio, WiMAX, 4G, femtocells, and UWB.

**EECE 4628: Computer and Telecommunications Networks (revised, undergraduate)**

*Description:* I worked with my colleague Prof. Basagni (who teaches this course in alternate semesters) to make significant revisions over the past five years, both in content and presentation. This course focuses on fundamental concepts of computer networks with a particular focus on the Internet. The emphasis is on the study of computer networks from a variety of practical and research perspectives. The course covers basic definitions and concepts; organization of networks into layers; specific operating principles of the application layer, Internet TCP, Internet IP and forwarding, routing functions; link layer and local area networks, multimedia networking and network security.
EECE 7398: Wireless Cognitive Radio Networks (new course, graduate)

Description: I developed this new advanced level graduate course on cognitive radio (CR) networks that are capable of opportunistically choosing spectrum bands for communication, thereby resulting in high spectral efficiency. The course motivates the need for this next generation technology through real-world case studies, identifies the key issues in this area, and surveys the existing solutions at each layer of the protocol stack, with a special emphasis on building distributed network architectures. The course includes topics on different CR architectures and deployment scenarios; concept of cognitive cycles; spectrum sensing; spectrum decision; spectrum sharing; CR MAC protocols; CR ad hoc networks; routing protocols; transport layer protocols; design of CR prototypes and testbeds; introduction to GNU-radio programming, and CR standards.

5.B. Supervision of Graduate Students

Summary: 3 Ph.D. students graduated, 2 currently employed as assistant professors and third as post doctoral researcher
3 M.S. thesis students graduated
Current group: 8 Ph.D. students

5.B.1. Graduated Doctoral Students

1. Rahman Doost-Mohammady (Dec 2014)
   Current appointment: Post Doctoral Researcher, Electrical and Computer Engineering Department, Northeastern University, Boston, USA

2. Abdulla Al Ali (May 2014)
   Dissertation title: Database-assisted end-to-end theoretical and simulation framework for cognitive radio networks
   Current appointment: Assistant Professor, Qatar University, Qatar.

3. Prusayon Nintanavongsa (Dec 2012)
   Current appointment: Assistant Professor, Computer Engineering Department, Rajamangala University of Technology Thanyaburi, Thailand.

5.B.2. Graduated M.S. Thesis Students

1. Yifei Sun (April 2013, co-advised with Stephen Intille)

2. Ufuk Munchuk (June 2012)
   Thesis title: Design Optimization and Implementation for RF Energy Harvesting Circuits
3. David Lewis (July 2012)
   Thesis title: Towards Harvesting Energy from Digital Television and Energy Transfer Scheduling Algorithms

5.B.3. Graduated M.S. Project Students
   Xuege Cao, Zhe Li, Srilakshmi Jayaramappa, Idriys Harris

5.B.4. Current Doctoral Students Being Supervised
   Benjamin Drozdenko (co-advised with Miriam Leeser)
   Ufuk Muncuk
   Meenupriya Swaminathan
   Ramanathan Subramanian
   Fan Zhou
   Yanji Chen (co-advised with Mitch Kokar)
   Yousof Naderi (co-advised with Stefano Basagni)
   William Tomlinson (co-advised with Milica Stojanovic)

5.C. Advising Activities
5.C.1. Undergraduate
   Advised senior Capstone Team (2013)
   Independent study advisor for Alexandra Tinti (2010), Kshitij Lohani (2014)
   REU support for Megan Wood, Taylor Skilling and Kevin Dixon (2014)

5.C.2. Graduate
   Thesis Committee Member (not as primary advisor)
   2014: Jonathan Pendulum (M.S.), Jianzhe Tai (Ph.D.), Kasra Moazzemi (M.S.)
   2013: Curtis Watson (Ph.D.), Kivanç Kerse (M.S.), Xin Fang (M.S.)
   2012: Leszek Lechowicz (Ph.D.), Yueqian Li (Ph.D.), Cai Wei (M.S.), George Eichinger (M.S.), Rohan Kangralkar (M.S.),
   2011: Shujun Rachel Li (Ph.D.), Jiahui Chen (M.S.), Zhen Li (M.S.)
   2010: Maurizio Nanni (Ph.D.), Rameez Ahmed (M.S.)
   2009: Mohamed Ahmed T. Elgalhud (M.S.)

   Thesis Committee Member (for external students)
   Ignacio Llatser, UPC Barcelona, Spain, Ph.D., 2014
   Jeremy Lerch, Gordon Scholar, Raytheon, MS, 2013
   Adnan Abu-Mahfouz, University of Pretoria, South Africa, Ph.D. 2011
   Geoffrey Ashton, Gordon Scholar, Raytheon, MS, 2011

6. Service and Professional Development
6.A. Service to the Institution
6.A.1. Department Service
   Member of Undergraduate Study Committee, 2010-2011, 2014-date
- Member of ECE Department Hiring Committee, 2014-date
- Member of Graduate Affairs Committee, 2011-2014
- Member of Ph.D. Information Assurance Admission committee, 2011-date
- Member of the Computer Engineering faculty hiring committee, 2011
- Lead organizer for the CDSP Annual Workshop at Northeastern University, 2011

6.A.2. College Service
- Member of COE Community Committee, 2011-date

6.B. Service to the Discipline/Profession

6.B.1. Leadership Role in International Committees
- Chair of the IEEE Technical Society on Simulation, 2014-date
- Vice Chair of the IEEE Technical Society on Simulation, North America, under the IEEE Computer Society- 2011-2014

6.B.2. Editorial Work for Journals
- Area Editor for Computer Communications (Elsevier) journal, since January 2012.
- Area Editor for Ad Hoc Networks (Elsevier) journal, since January 2011.
- EAI Transactions on Wireless Spectrum (TWS), since 2013.

6.B.3. Chair Positions, Conference and Workshop Organization
- Local Arrangements Chair for ACM International Conference on Nanoscale Computing and Communication (NANOCOM), Boston, MA, September 2015.
- TPC Co-Chair for IEEE Vehicular Technology Conference (VTC), Boston, MA, September 2015.
- Poster/Demo Co-Chair, IEEE Intl. Conference on Computer Communications (INFOCOM), HongKong, April-May 2015.
- Workshop Chair, IEEE International Symposium on a World of Wireless Mobile and Multimedia Networks (WoWMoM), Boston, MA, June 2015.
- TPC Co-Chair, International Conference on Computing, Networking and Communications (ICNC), Anaheim CA, January 2015.
- Publications Co-Chair, International Conference on Cognitive Radio Oriented Wireless Networks (CROWNCOM), Washington DC, July 2013.
- Local Arrangements Chair for IEEE Conference on Distributed Computing for Sensor Systems (DCOSS), Boston, MA, May 2013.
- Workshop Co-Chair, Sustainable Monitoring through Cyber-Physical Systems (SuMo-CPS), in conjunction with ICDCN Conference, Mumbai, India, January 2013.
- Poster and Demonstrations Chair, IEEE International Conference on Mobile Ad hoc and Sensor Systems (MASS), Las Vegas, NV, October 2012.
- Publicity Co-Chair, ACM MobiHoc, SC, June 2012.
- Track Co-Chair for Wireless Communications and Networks track at the IEEE Intl. Conf. on Communication Technology (ICCT), China, Sept. 2011.
- Local Arrangements Chair for IEEE Conf. on Sensor, Mesh and Ad Hoc Communications and Networks (SECON), Boston, MA, June 2010.

6.B.4 Technical Program Committee Membership


6.B.5. Reviewer for Journals

IEEE/ACM Transactions on Networking; IEEE Transactions on Mobile Computing; IEEE Transactions on Vehicular Technology; IEEE Transactions on Parallel and Distributed
Systems; IEEE Transactions on Communications; IEEE Transactions on Wireless Communications; ACM Transactions on Sensor Networks; IEEE Communications Magazine; IEEE Network; IEEE Communications Letters; Computer Networks (Elsevier); Ad Hoc Networks (Elsevier); Wireless Comm. and Mobile Computing (Wiley); Wireless Networks Journal (Kluwer)

6.B.6. Reviewer for Grant Funding
- US Army Research Office (ARO) Young Investigator Award reviewer, 2011
- National Science Foundation Panel, 2011 (1 panel), 2013 (4 panels), 2014 (4 panels)

6.B.7. Participation in National Science Foundation Workshops
- Member of US contingent at the National Science Foundation (NSF) US-China Workshop on Environmental Monitoring for Public Health and Disaster Recovery, Yellow Mountains, China, 2012.
- Selected for the US contingent at the NSF Indo-US Workshop on developing a research agenda in Pervasive Communications and Computing Collaboration, Delhi, India, 2011.

6.C. Service to Community/Public
- Participation in the CoE organized “Building Bridges Program” targeted towards K-12 students for generating awareness about careers in engineering- 2011, 2012
- Hosting 100+ students annually from Brooke Charter Schools, Boston, with talks and demonstration sessions- 2012-2014
- Talks and demonstrations at the Boston Museum of Science, 2011

7. Selected Awards and Honors

7.A. Best Paper Awards
- Ad Hoc and Sensor Network Symposium, IEEE ICC. Conference, the flagship conference of the IEEE Communications Society, 2013. (#C14)
- International Conference on Computing, Networking and Communications (ICNC), 2013. (#C19)

7.B. Other Honors
- Key Member of the Multimedia Communications Technical Committee 2010-2012