

# Chayan Sarkar

## Researcher

(h-index: 5, [google scholar](#))

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### Chayan Sarkar

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### Short Biography

I am working as a researcher at SICS Swedish ICT in Sweden. My role is to develop various communication protocols for resource constrained IoT devices. I spend my childhood in Coochbehar, West Bengal, India, where I did my schooling. In the two major school-level exams in India conducted by the West Bengal secondary and higher secondary boards, I secured 18th and 22nd positions in the merit lists out of almost 1M examinees. I completed my bachelor's and master's study in computer science and engineering at the Jadavpur University in Kolkata in 2009 and at the Indian Institute of Technology in Mumbai (IIT Bombay) in 2011, respectively. During my master's, I visited the Telecommunication Networks group at TU Berlin for 9 months under the DAAD scholarship. I completed my PhD studies at the faculty of Electrical Engineering, Computer Science and Mathematics at the Delft University of Technology in Netherlands. I worked at the embedded software group at TU Delft for my PhD. In this period, I was involved in an EU project called iCore, where I collaborated with various industrial and academic partners.

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### Skills

Wireless sensor networks, Ad-hoc and computer network protocols (MAC layer and above), Internet of Things, Algorithms and Data Structures, Statistics, Machine Learning.

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### Experience

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#### SICS Swedish ICT AB / Guest Researcher

June 2016 - Present, Sweden

##### Scalable security protocol for resource-constrained IoT devices.

Existing standards of security mechanisms have significant overhead considering resource constraints in embedded IoT devices. The goal is to develop a scalable security mechanism that can reduce this overhead, especially reduce the control message exchange per session. The protocols should uphold highest level of security (standard) while ensuring easy communication among heterogeneous devices.

## TU Delft / PhD Researcher

January 2012 - May 2016, Netherlands

### Research on WSN and IoT

- a. *Distributed architecture for IoT*: A scalable and distributed architecture is developed that can support heterogeneous types of IoT applications, considering the key challenges of IoT, i.e., heterogeneity, scalability, interoperability, and security & privacy.
- b. *Virtual sensing framework for energy-efficient IoT application*: This framework provides mechanism to create virtual sensor, which can accurately estimate sensed data, which leads to lesser traffic in a network and higher energy-efficiency.
- c. *Efficient communication protocols for IoT*: Routing protocols for WSN are not well suited for IoT application. A bunch of protocols are developed to cater the needs of various IoT applications.
- d. *Smart lighting and heating control*: Individual user preference about thermal and visual comfort is learned. Lighting systems and HVAC are controlled automatically which energy-efficient as well as maintain user comfort.
- e. *BLE-based automated public transport payment system*: For automated payment in public transport, an energy efficient, secure and privacy preserving protocol is developed that leverage upon the smartphone of the traveller.
- f. *Real-time IoT System*: Traditional communication protocols for WSN are optimized more towards energy-efficiency than delay constraint. A communication protocol is developed to support real-time data transmission, i.e., time bounded data delivery for IoT applications.

### Teaching and Supervision

- A. One student completed his MSc thesis.
  - a. Secure and energy-efficient automated public transport payment system using smartphone (in collaboration with Technolution).
- B. Three ongoing MSc thesis.
  - a. Optimized HVAC control in a multi-room, multi-occupant apartment (in collaboration with Shell).
  - b. Smartband-based contextual indoor localization in home and office environment.
  - c. Location-aware passenger monitoring in an airport (in collaboration with KLM).
- C. Guest lectures in Ad-hoc networks, '15, '14.
  - a. WSNs and their customized MAC protocol.
- D. Teaching assistant in Ad-hoc networks '15, '14, '13; IoT seminar '15, WSN seminar '12.
  - a. guided student projects on routing and MAC protocols using Contiki.
  - b. guided student project about indoor localization based automated lighting control (Demo paper in EWSN '16).

## **IIT Kharagpur / Guest Researcher**

January 2014 - March 2014, India

### **Routing protocol for WSN under few active node constraint.**

As virtual sensors can predict data for the nodes without sensing under certain conditions, a number of nodes can be kept in a low-power sleep mode. In such a situation, when many nodes are sleeping, how to maintain a connected network? In other words, ensure connectivity of the active nodes under the constraint of maximum sleeping nodes to save maximal energy.

## **TU Berlin / Master Thesis**

September 2010 - May 2011, Germany

### **Thesis title: Efficient Support of Video Streaming to Mobile Devices with Utilization of Multiple Radio Interfaces and Scalable Video Coding.**

The goal of the system design is to provide stable quality during a video streaming session, irrespective of weak connectivity or bandwidth variation in the network. Following requirements are fulfilled to meet the goal -

- (i) Receive video data of a single video streaming session using multiple interfaces of the mobile device.
- (ii) Adapt scalable video, i.e. receive only part of the video data (some of the scalable video layers).
- (iii) Dynamically adapt scalable video layers depending on bandwidth variability in an interface. This requires continuous monitoring of available bandwidth for that interface.
- (iv) Shift video layers between wifi and umts during the streaming session.
- (v) Minimize the delay and packet loss due to shifting of video layers between wifi and umts. After shifting one or multiple layers to another interface, the layers need to be synchronized.

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## **Recent publications**

1. C. Sarkar, R. Venkatesha Prasad, Raj Thilak Rajan , Koen Langendoen, "Sleeping Beauty: Efficient Communication for Node Scheduling", IEEE MASS, 2016.
2. C. Sarkar, V. Rao, R. Venkatesha Prasad, S. Das, S. Misra, A. Vasilakos, "VSF: An Energy-Efficient Sensing Framework using Virtual Sensors", IEEE Sensors Journal, 2016
3. C. Sarkar, A. U. Nambi, R.V.Prasad, "iLTC: Achieving Individual Comfort in Shared Spaces", ACM EWSN, 2016.
4. V.S.Rao, M. Koppal, R.V.Prasad, T.V.Prabhakar, C. Sarkar, I.G.Niemegeers, "Murphy loves CI: Unfolding and Improving Constructive Interference in WSNs", IEEE Infocom, 2016.
5. Chayan Sarkar, Akshay Uttama Nambi S.N., and R. Venkatesha Prasad, Learning Individual Preferences for Energy-Efficiency and Comfortable Living, ACM BuildSys, 2015.
6. C. Sarkar et al. "DIAT: A Scalable Distributed Architecture for IoT", IEEE IoT Journal, 2015.
7. J. J. Treurniet, C. Sarkar, R. V. Prasad, W. D. Boer, "Energy Consumption and Latency in BLE Devices under Mutual Interference: An Experimental Study", IEEE FiCloud, 2015.

8. C. Sarkar, V. S. Rao, R. V. Prasad, K. Langendoen, "Sleep-Route: Assured Sensing with Aggressively Sleeping Nodes", IEEE MASS, 2014.
9. C. Sarkar, V. S. Rao, R. V. Prasad, "No-Sense: Sense with Dormant Sensors", IEEE NCC, 2014.
10. A. U. Nambi, C. Sarkar, R. V. Prasad, "A Unified Semantic Knowledge Base for IoT", IEEE WF-IoT, 2014.
11. C. Sarkar, A. U. Nambi, R. V. Prasad, "A Scalable Distributed Architecture Towards Unifying IoT Applications", IEEE WF-IoT, 2014.

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## Awards

1. DAAD IIT Master Sandwich Scholarship, 2010, German Academic Exchange Service.
2. Best runner-up presentation awards in GNARP 2014.

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## Projects

### **iCore** — EU FP7 Project

The project addressed key issues in the context of the Internet of Things.

### **COAST** — EU FP7 Project

The project's aim was to build a future content-centric network.

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## Education

### **TU Delft / PhD**

January 2012 - may 2016, Netherlands

**Doctoral courses and events** - SenZations Summer school on IoT, Estimation and Detection, Advanced pattern recognition, Autumn school on cyber physical systems, ICT with Industry.

### **IIT Bombay / Master of Technology**

July 2009- June 2011, India

CPI - 8.09 / 10, Computer Science and Engineering.

**Major courses** - Computer Networks, Mobile Computing, Program Analysis, Advance Computer Architecture, Advanced Compiler Design, Ad-hoc and wireless sensor networks.

### **Jadavpur University / Bachelor of Engineering**

August 2005 - May 2009, India

CGPA - 8.11 / 10, Computer Science and Engineering.

**Major courses** - Digital logic, Data Structures, Operating Systems, Algorithms, Database management systems, Compiler design, Computer organization, Computer Networks.

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## Mini Projects

**R&D Project – I : KVM Based Virtual Machine Placement and Monitoring Tool.** A bunch of disk images (created using KVM) are available in a common directory (NFS). The tool (via GUI) can choose a disk image to start (and stop) with initial parameters and the destination physical machines (instructs the machine to start the virtual machine). The tool can monitor the amount of resources used by virtual machines and log the data in a file. Also the tool is able to migrate a virtual machine from the current physical machine to another physical machine. The tool maintains the list of physical machines and the virtual machines running in it as a tree structure.

**R&D Project – II: Implementation of SSA and E - path PRE as a new optimization pass in LLVM.** Epath-PRE is an efficient PRE (partial redundancy elimination) technique in which an eliminable path for an expression is identified and after proper insert and save, the elimination of the redundant occurrences is done. It was the implementation of the algorithm described in “Eliminability path – a versatile basis for partial redundancy elimination”.

**Bachelor's' Project: Extracting Brain Image from Vertical sectional Image of human head with the guidance of sub - cortical gray matter.** Magnetic Resonance Imaging (MRI) of human brain consists skull around the brain. There is sub-cortical gray matter between the skull and actual brain. Considering the gray matter as guideline, identify the grey matter first. Then everything outside the gray matter line can be removed as skull. In some frontal images, eyeballs are also need to be removed from the brain image.

### Seminars :

- Data center network design.
- Sudoku solving algorithms.
- Image enhancement in the spatial domain.

### Other Projects

- Implementation of a “Bittorrent “ using C.
- Implementation of “SNOOP - TCP “ using C.
- “Mobile review and rating” website using html , CSS , MySql.
- “Data structures through GUI” using win32 programming.
- “Automated Traffic Signaling” using 8085 microprocessor.
- “Sudoku Solver” using C.

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## Computer Skills

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### Programming language:

C, JAVA, MATLAB, UNIX shell scripting, Python, Android Programming.

### Operating systems:

Ubuntu, Contiki, Mac OS X.

### Working knowledge:

C++, HTML, R, TinyOS, Windows, SQLite, MySql, Subversion.

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## Languages

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**English** - Excellent,  
**Bengali** - Native,  
**Hindi** - Excellent.

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## Interests

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Teaching content development for school children.  
Writing small android apps for own use.  
Singing and acting.

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## Others

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Conducted various academic and social events as a PhD Council member.  
Volunteered in IEEE Section Congress 2014.

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## References

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**Dr. R. Venkatesha Prasad** – Assistant Professor, TU Delft  
PhD Supervisor, r.r.venkateshaprasad@tudelft.nl, +31 (0)15 278 6272.

**Prof. Dr. Koen Langendoen** – Professor, TU Delft  
PhD Promotor, k.g.langendoen@tudelft.nl, +31 (0)15 278 7666.

**Dr. Marco Zuniga** – Assistant Professor, TU Delft  
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