Middle East Technical University

METU Communication Networks Research Group

METU
Communication Networks Group
(CNG)

www.cng.eee.metu.edu.tr

OUR TEAM

METU Communication Networks Group (CNG)
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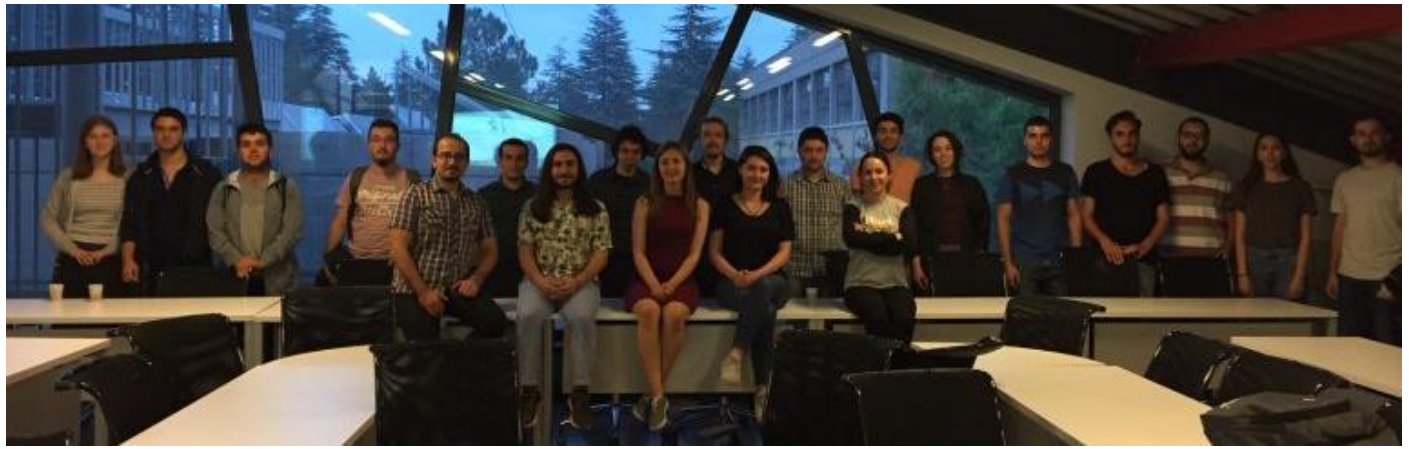
M.Sc. Student

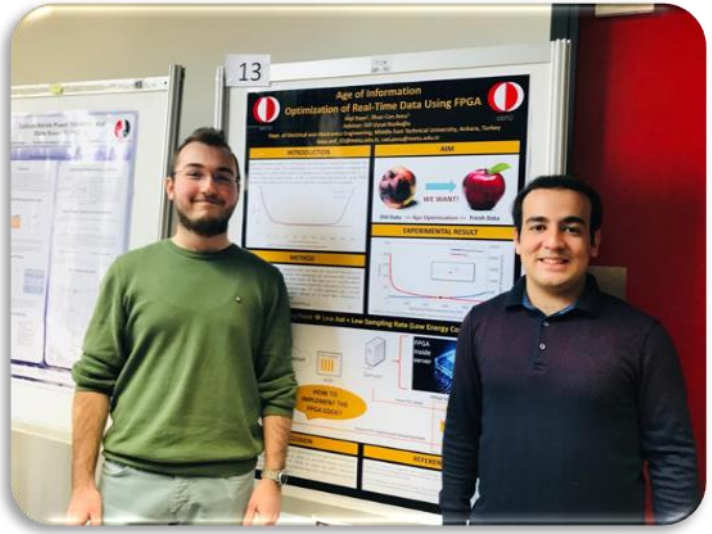
kerem.oguz
M.Sc. Student

Egemen Sert
Undergraduate

Canberk Sönmez
Undergraduate

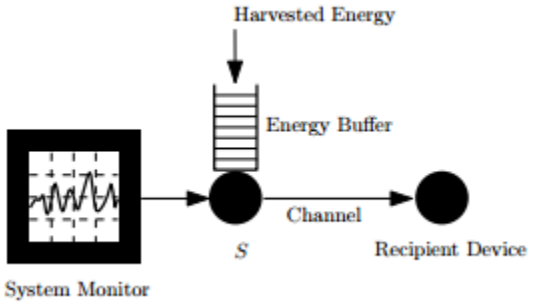
OUR STAR TEAM

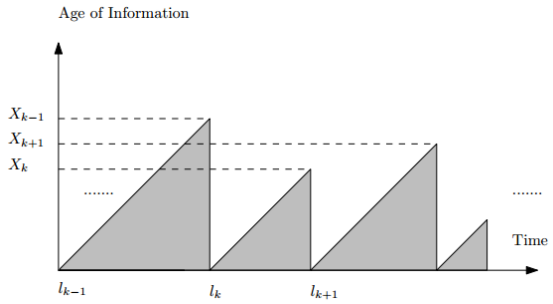


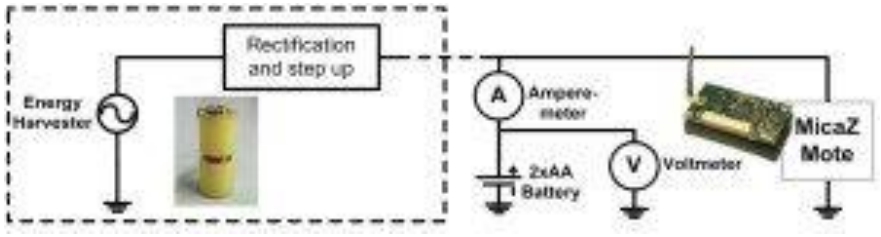


INTRODUCTION

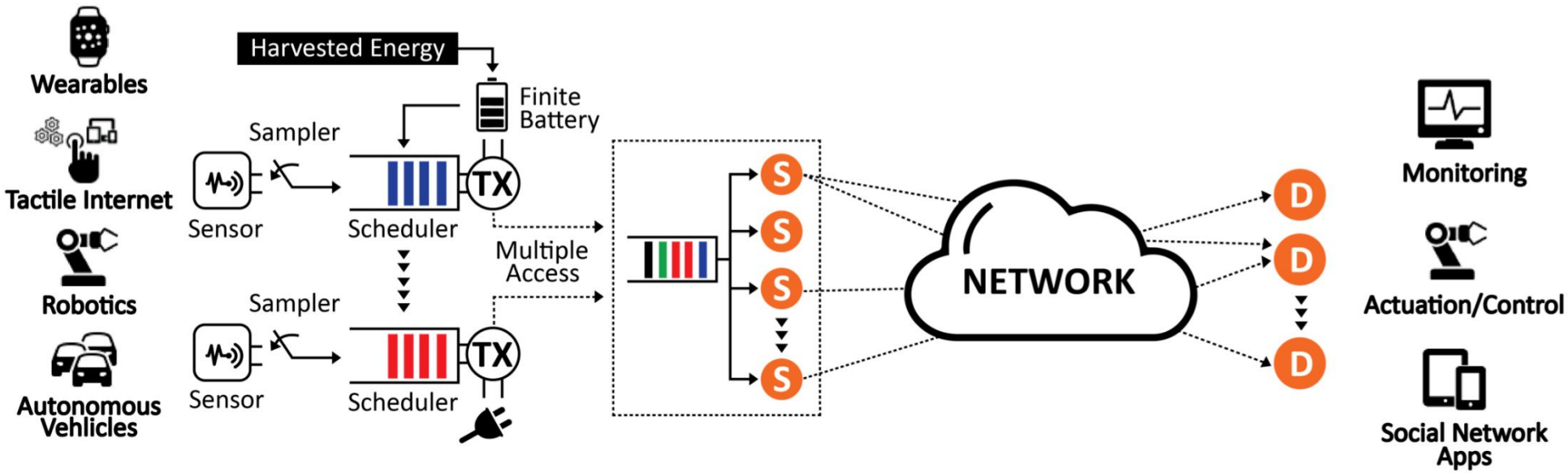
- Our works on Network topic :
  - Age of information
  - Energy optimization at the network layer
  - Models for energy consumption
  - Simulator
  - Energy harvesting (EM and vibration)

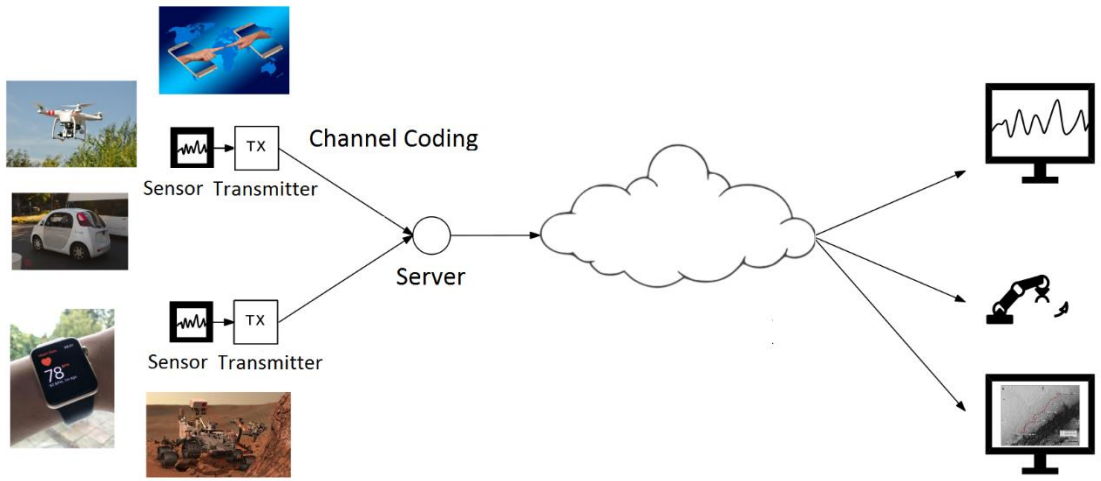


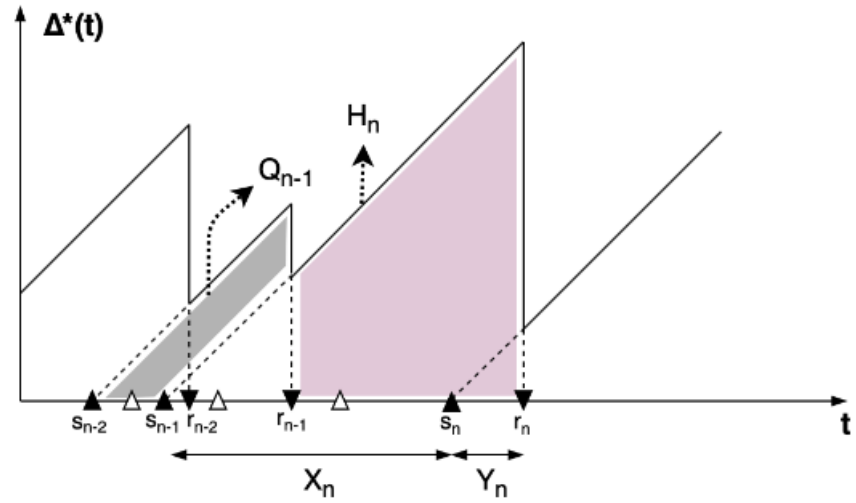




The Challenge of Providing Fresh Data

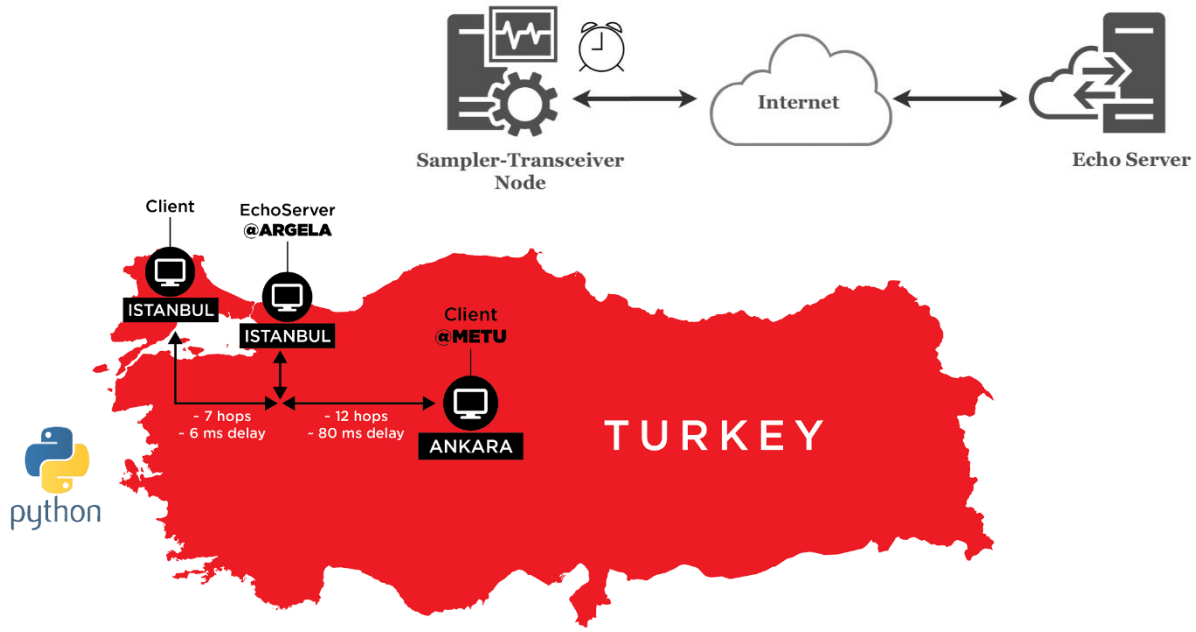


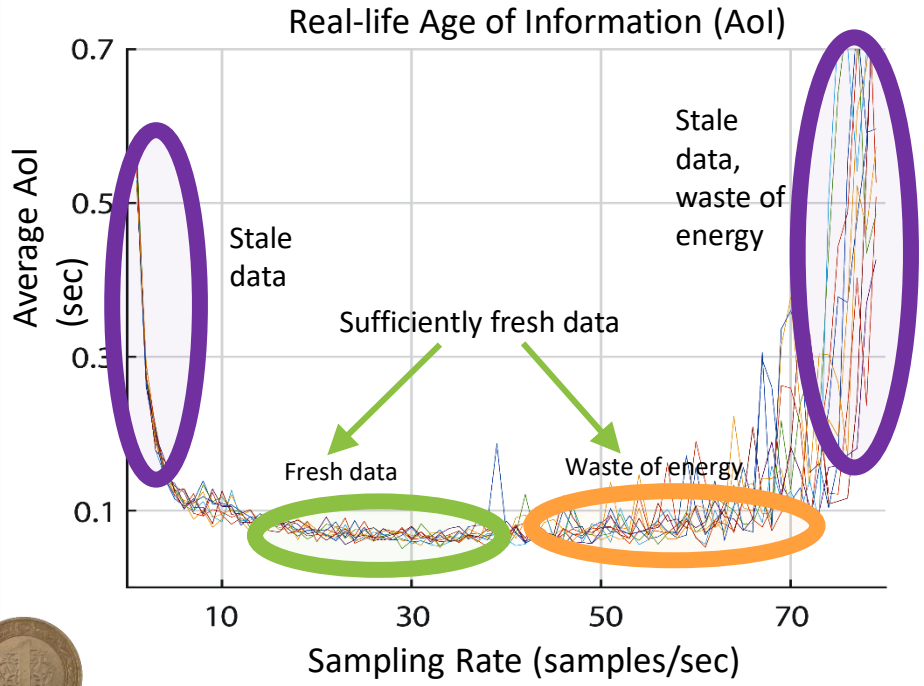




AoI in Today's Networks

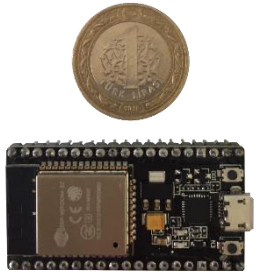
Internet based testbed





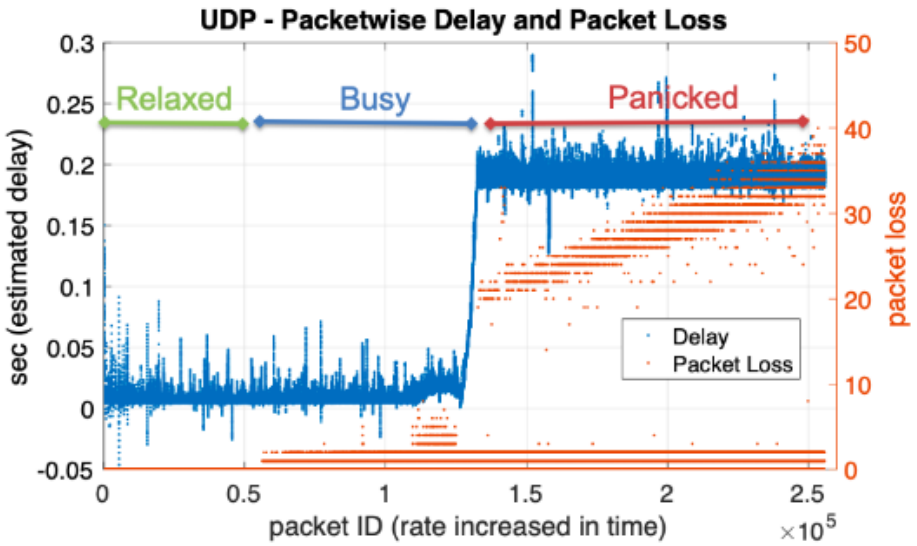
IoT based testbed

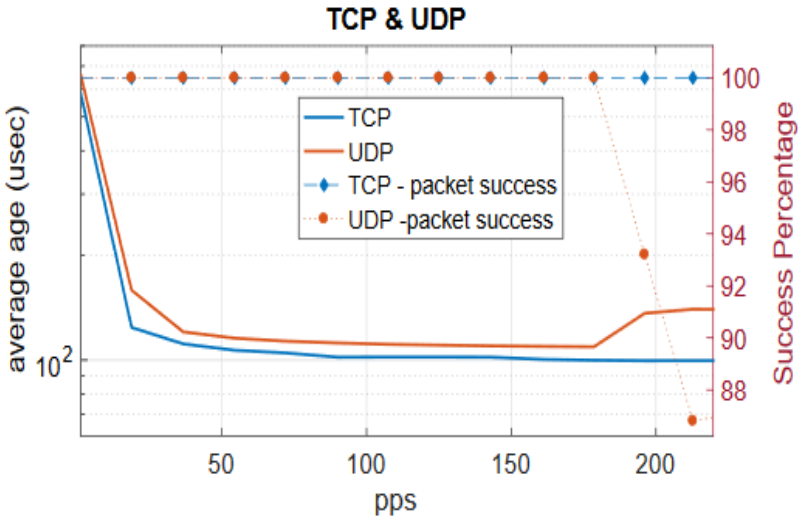
Lightweight IP (LWIP) Stack for TCP&UDP

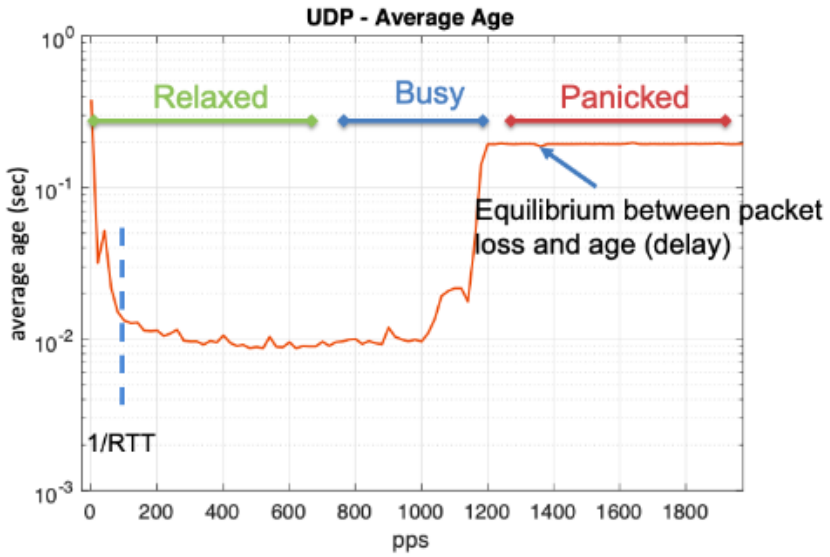


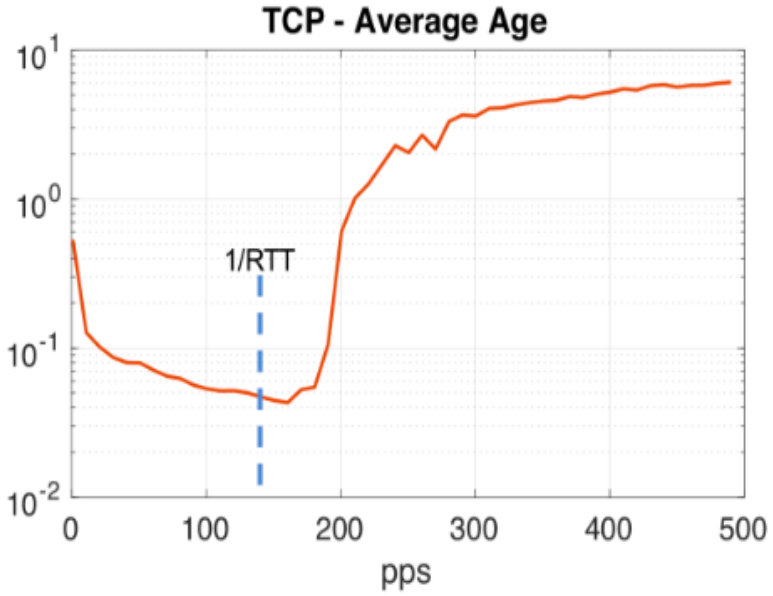
Node-MCU ESP32 Module

AoI in Today's Networks

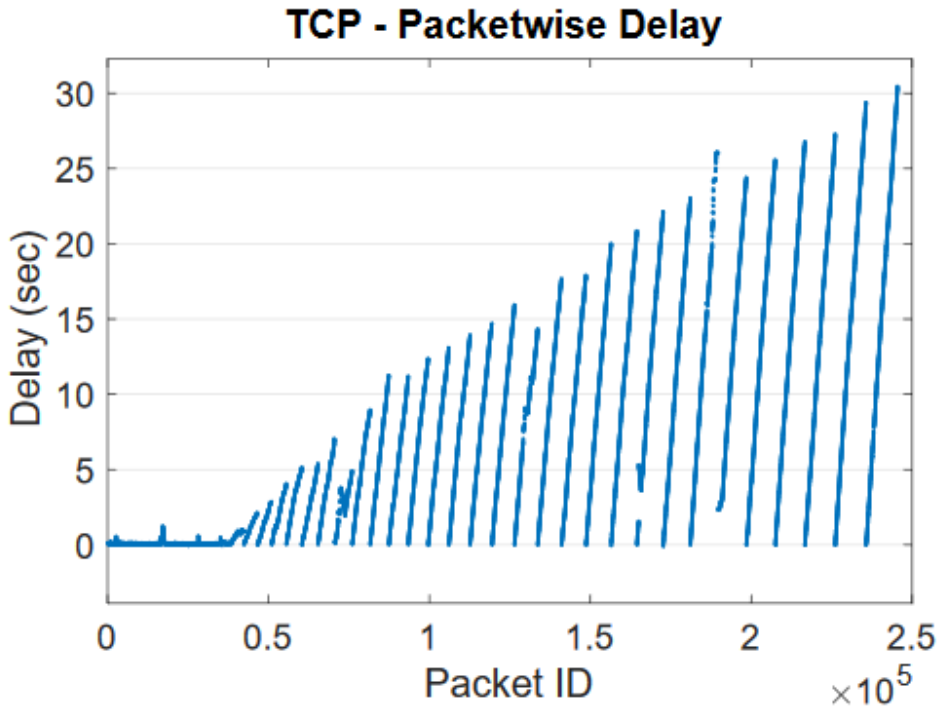


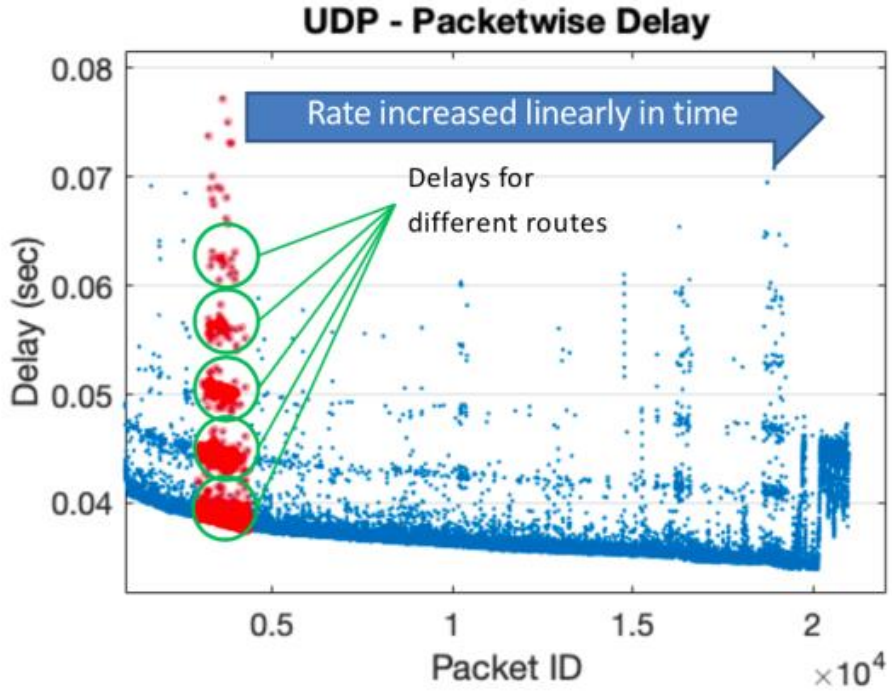




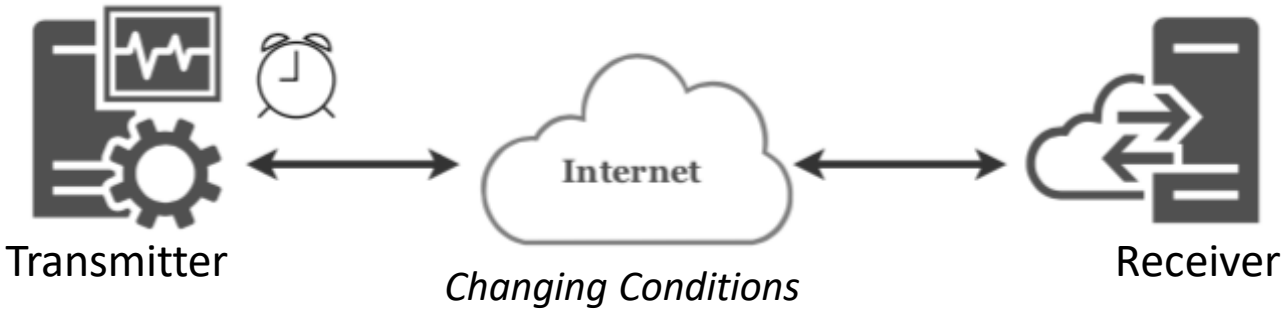


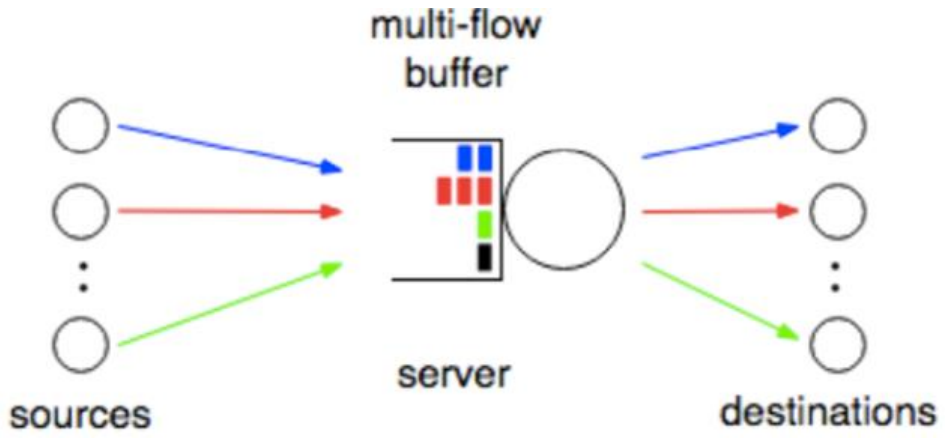
AoI in Today's Networks





Learning Based Optimization for AoI





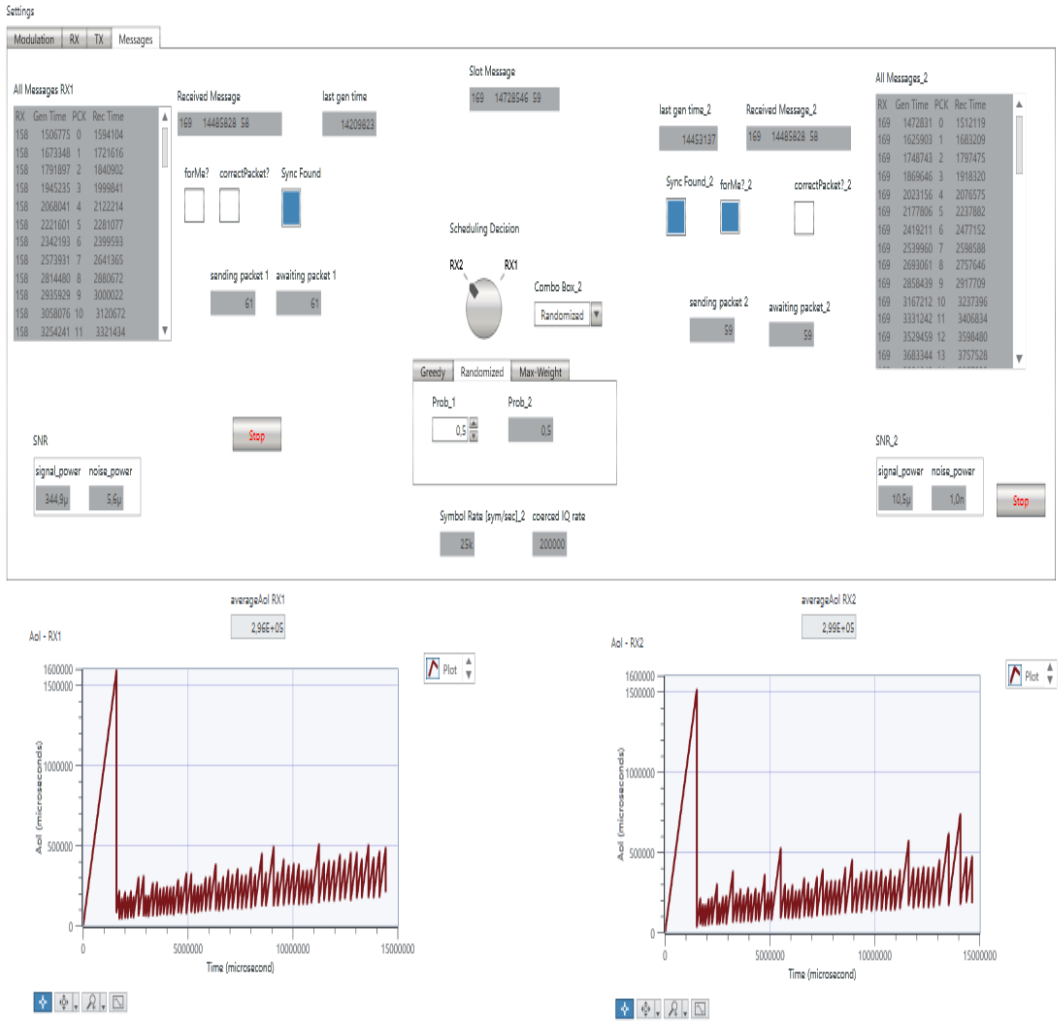
- Learning for Scheduling
  - Multiple source and recevier
- Learning for Adaptive Sampling
  - Single source and receiver
  - Changing network conditions
- Multiagent Learning for Sampling and Scheduling
  - Multiple source and receiver
  - Changing network conditions

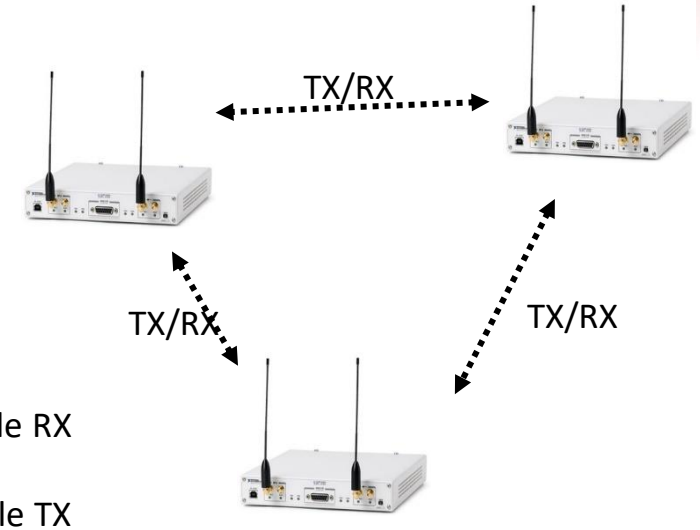
TensorFlow

python™

Age-aware MAC Protocol using USRP Radios

USRP Radios





- Multiple TX – Single RX
  or
- Multiple RX – Single TX

- Implementing low level RX/TX structure
- Measuring AoI in the connections
- Implementing and testing scheduling algorithms
- Proposing age-aware MAC Protocol

SELECTED PROJECTS

Ongoing Projects

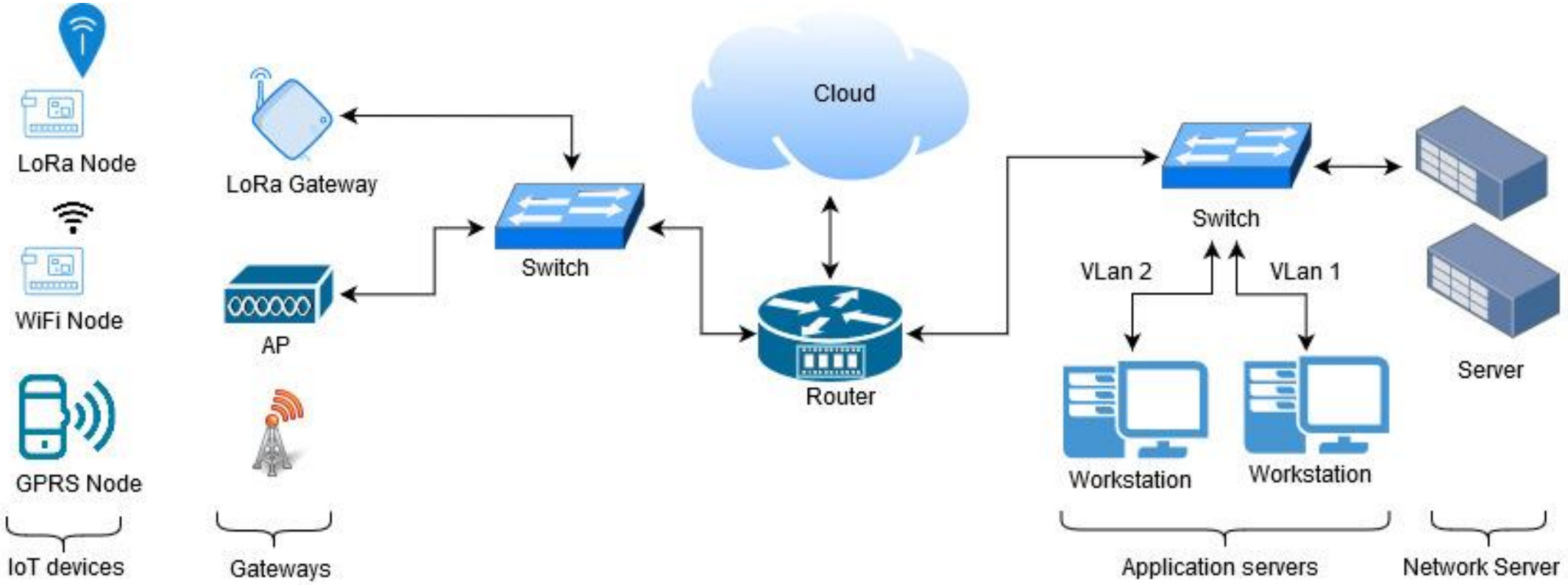
- Sampling and Scheduling for Optimal Age of Information (Funded by TUBITAK grant 117E215)

Completed Projects

- E-CROPS--- Energy Harvesting Communication Networks: Optimization and Demonstration, ERA-NET 2012-2015
- Principles and Experimental Implementation toward Energy-Efficient Design of Wireless Networks, TUBITAK grant, 2011-2014.
- Novel Transmission Techniques for Energy Harvesting Communication Systems, Funded by Turk Telekom, 2012-2013
- MIMO Networking: From Principles to Protocols.
  (Funded by NSF, under the Computing and Communications Foundations Program, 2006-2010.)
- Minimum Energy High Performance Wireless Communication Network Design: Inter-layer Optimization and Algorithms. (Funded by a TUBITAK "Kariyer" Award, 2007-2010.)
- Narrowband Wireless Ad-hoc Network Design. (Funded by ASELSAN 2009-2010) Design of a novel highly reliable and scalable wireless ad-hoc network protocol suite.
- Energy Efficient Wireless Mobile Networking Technologies to Enable Smart Infrastructures, IBM Faculty Award, 2010.

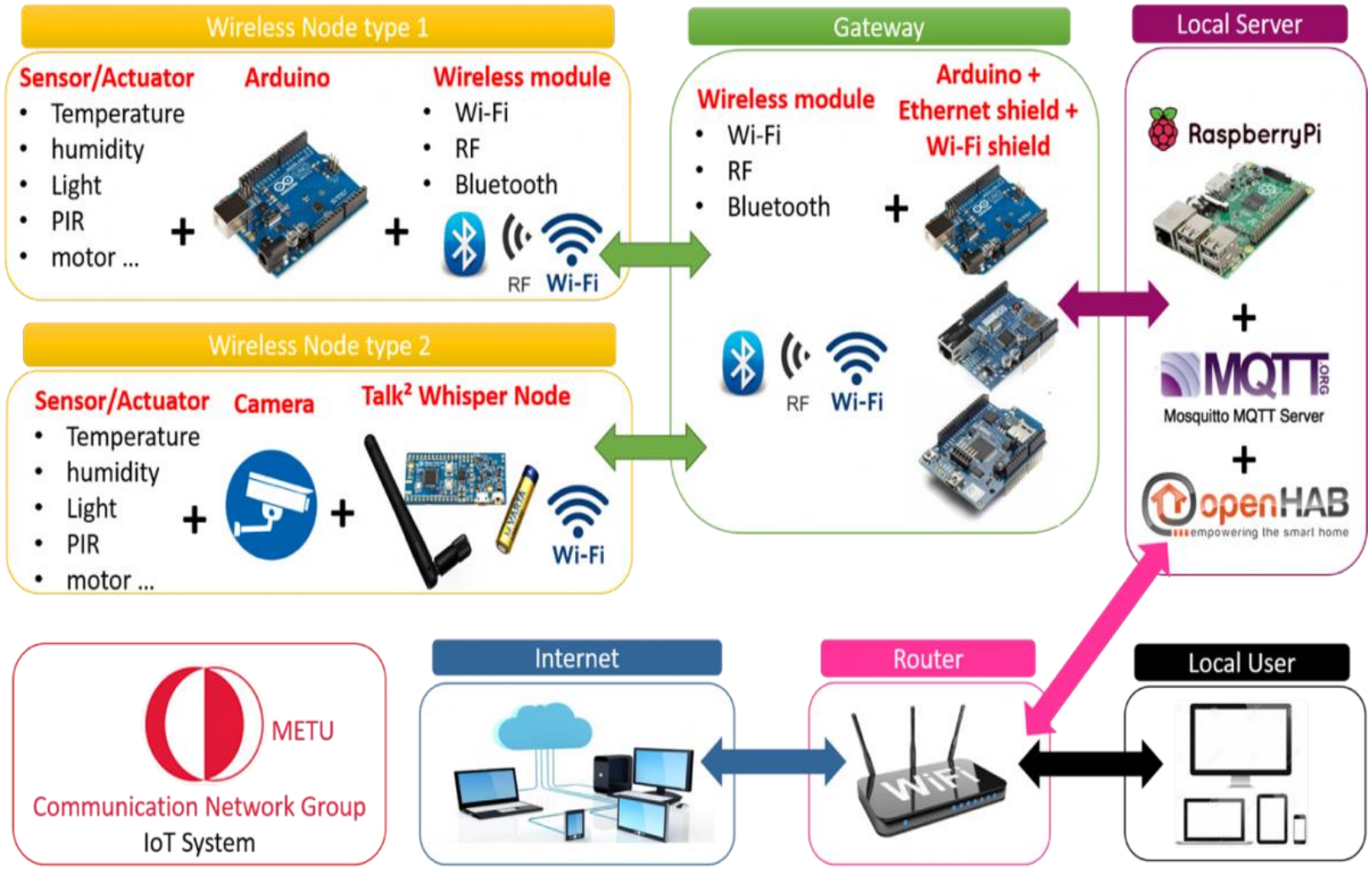
RELATED PROJECTS

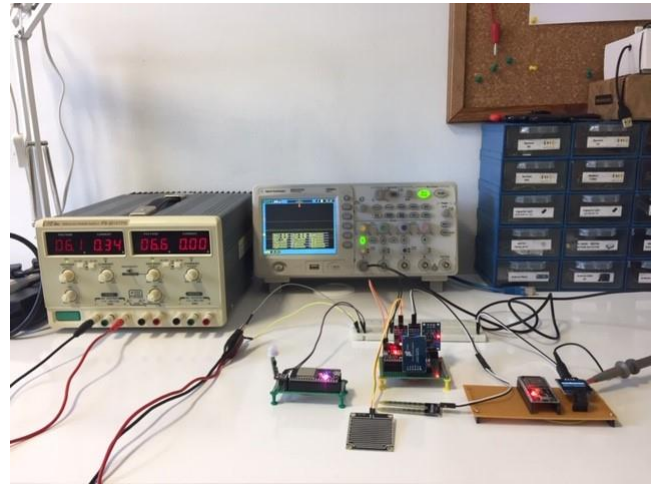
IoT Testbed

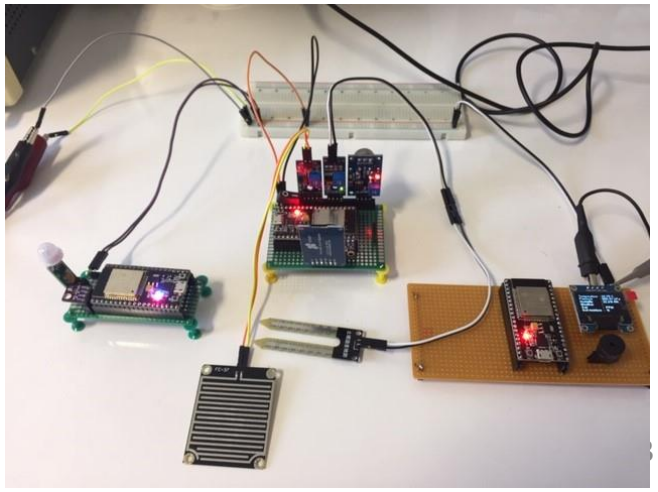


RELATED PROJECTS

IoT Testbed in Laboratory

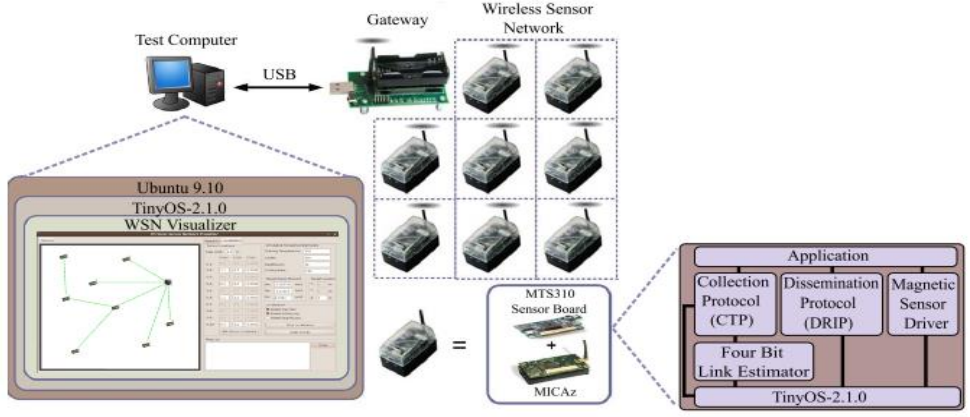


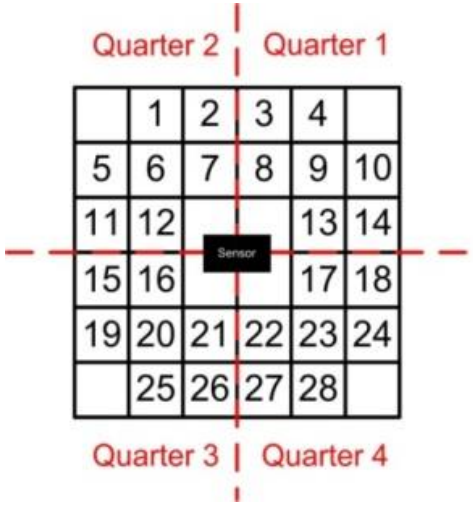




RELATED PROJECTS

Principles and Experimental Implementation toward Energy-Efficient Design of Wireless Networks , (Funded by TUBITAK), 2011-2013.





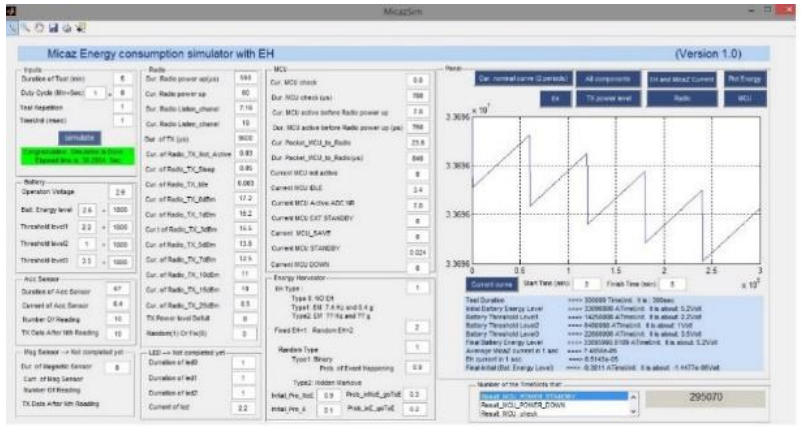
WSN network

Testbed in Laboratory

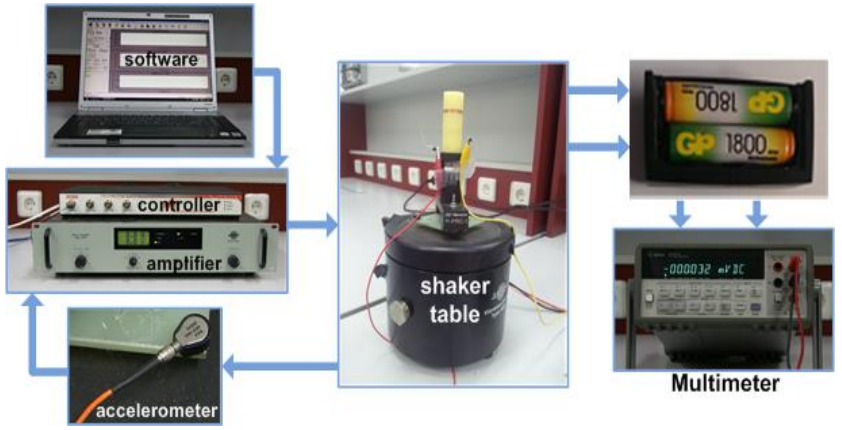
RELATED PROJECTS

E-CROPS--- Energy Harvesting Communication Networks: Optimization and Demonstration, ERA-NET 2012-2015

Vibration Characteristics in Real Application



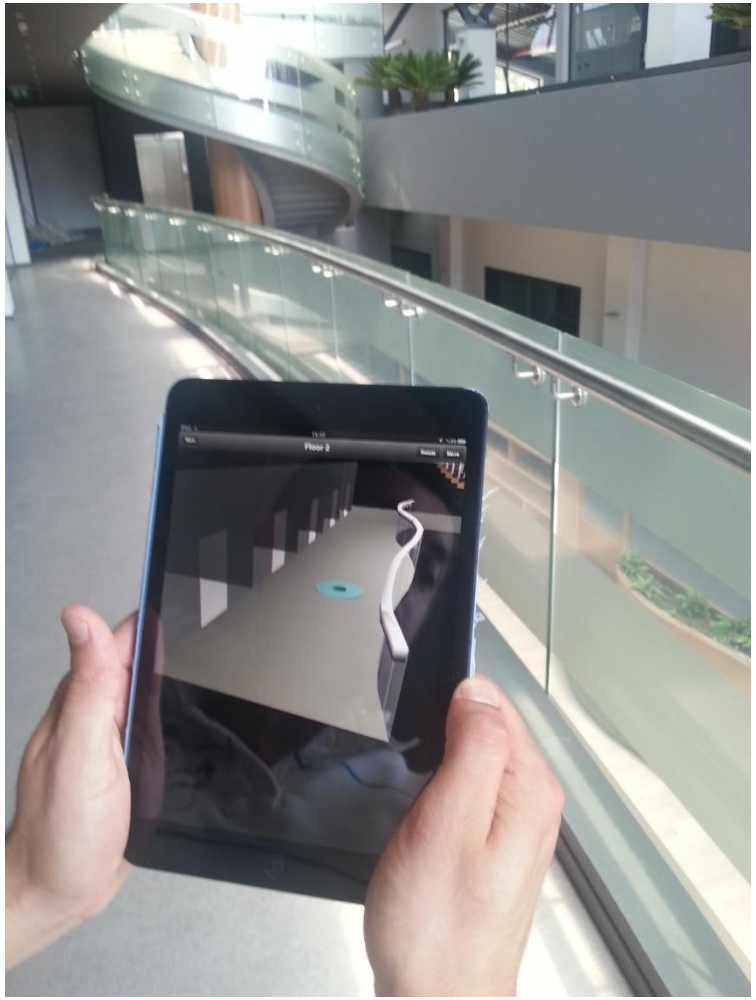
Wireless Sensor Network and Energy Harvestor Simulator

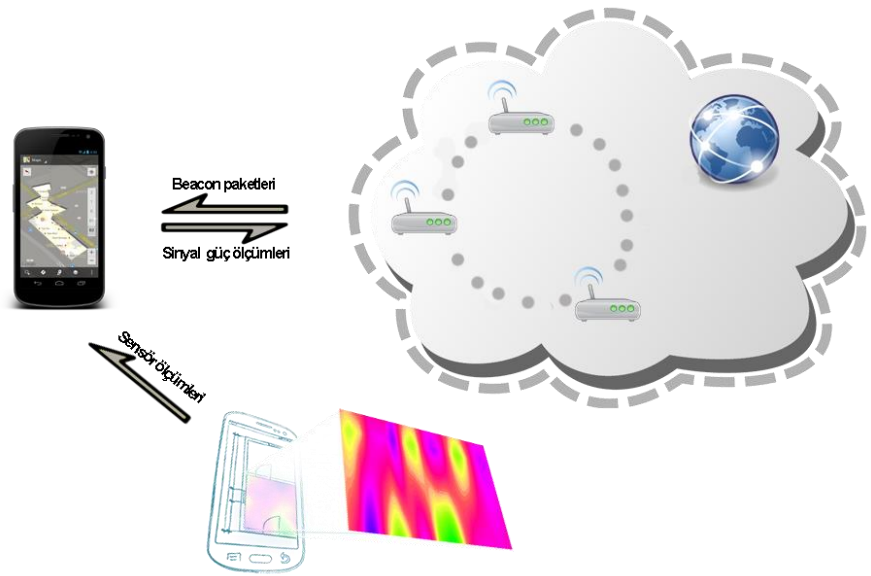


Energy Harvestor Testbed in Laboratory

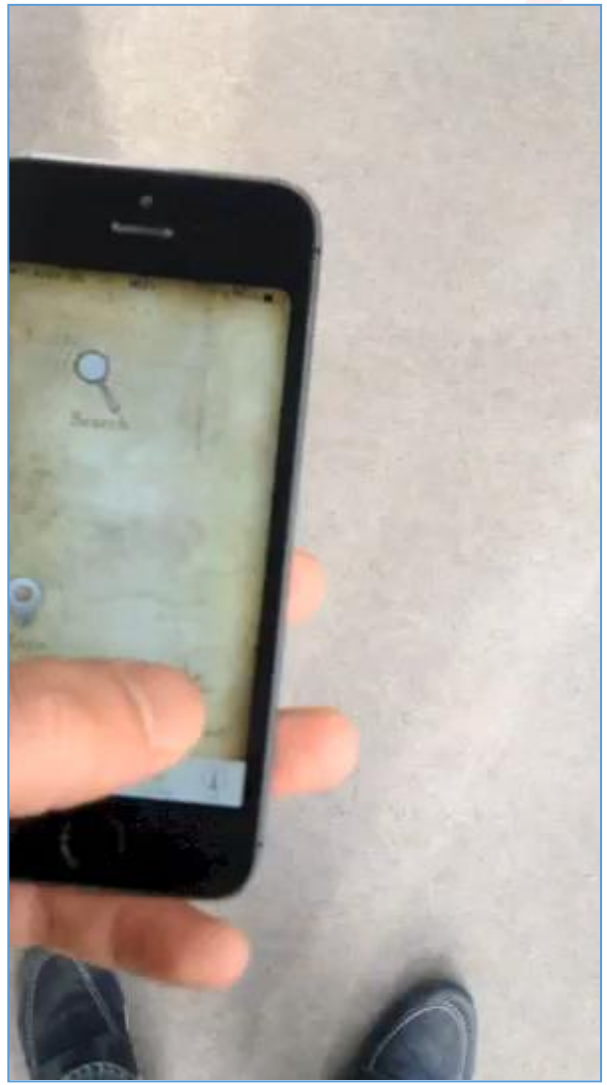
RELATED PROJECTS

Mobile Indoor Localization System





Navigation for Visually Impaired Students



Video

Recent Papers

- Hasan Burhan Beytur, Sajjad Baghaee, Elif Uysal, “Towards AoI-aware Smart IoT Systems,”arXivpreprint arXiv:1908.10739, 2019.
- BT Bacinoglu, Y Sun, E Uysal, V Mutlu, “Optimal Status Updating with a Finite-Battery Energy Harvesting Source,”arXivpreprint arXiv:1905.06679, 2019.
- H. B. Beytur, , S. Baghaee, and E. Uysal, “Measuring age of informationon real-life connections,” in2019 27th Signal Processing and Commu-nications Applications Conference (SIU), April 2019
- R. Devassy, G. Durisi, G. C. Ferrante, O. Simeone, and E. Uysal,“Reliable transmission of short packets through queues and noisychannels under latency and peak-age violation guarantees,”IEEEJournal on Selected Areas in Comm., 2019.
- H. B. Beytur and E. Uysal, “Age minimization of multiple flows using reinforcement learning,” inIntl. Conf. on Computing,Networking and Commun. (ICNC), 2019.
- R. Devassy, G. Durisi, G. C. Ferrante, O. Simeone, and E. Uysal, “Reli-able ransmission of short packets through queues and noisy channelsunder latency and peak-age violation guarantees,”IEEE Journal onSelected Areas in Communications, vol. 37, no. 4, pp. 721–734, Apr.2019.
- Chamanian, S.; Baghaee, S.; Uluşan, H.; Zorlu, Ö.; Uysal-Biyikoglu, E.; Külah, H. Implementation of Energy-Neutral Operation on Vibration Energy Harvesting WSN. IEEE Sens. J. 2019, 19, 3092–3099.

Recent invited talks

- Foundations of Wireless Networking, Schloss Dagstuhl, Germany, July 2017
- “Lazy Schedules for Freshest Data and Optimal Use of Renewable Energy in Networks”, Micro and Nano Technology Lab, University of Illinois Urbana Champaign, Sept 30, 2016.
- Energy Harvesting Networks”, Northeastern University, Boston, April 23, 2016.
- AGELESS: Scheduling Policies with Age as Objective”, ITA 2016, Information Theory and Applications Workshop, University of California San Diego, February 5, 2016.
- “Age_of information: controlling the freshness of status updates under energy constraints”, Keynote, The Gelenbe Symposium, Imperial College, London. September 21, 2015.
- “When to Update Data”, LIDS, MIT, October 2015.

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Thanks for your attention

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