

IEEE CTW 2019 – Molecular MIMO Competition

Background

As a carrier of information today, most communication systems exploit electromagnetic waves. There are, however, exceptional scenarios that call for alternative schemes. For example, molecular communication may be used, and this is not limited to in-body or underwater environments [1]. The most severe drawback of molecular communications is the data rate, for molecules cannot match the speed of light. To overcome this drawback, the authors in [2] introduced the use of multiple-input-multiple-output (MIMO) techniques, and also designed a novel, actual testbed for verification.

The Competition and Evaluation Criteria

The task is to design a molecular MIMO communication detection method using datasets that contain real measurements. Possible solutions may include classic approaches (e.g., thresholding-based detection) as well as deep learning-based approaches. Test-sets will be utilized to evaluate the best performing detection method. The goal is to minimize the bit error rate (BER) of all test sets.

To compete, teams should download the dataset and develop algorithms. At the IEEE CTW, in the morning of Monday May 27, 2019, a set of test data will be distributed. During the day, the participating teams should run their algorithms on this test data (received signal), and submit their estimated bit sequences to cm.lee@yonsei.ac.kr no later than 20.00 (Iceland local time). The winners will be determined by the organizers by evaluating and comparing the BER.

Competing teams should also present a poster at the conference, describing their algorithms and experiments.

Awards

A 500 USD prize will be awarded to the winning team.

About the Dataset

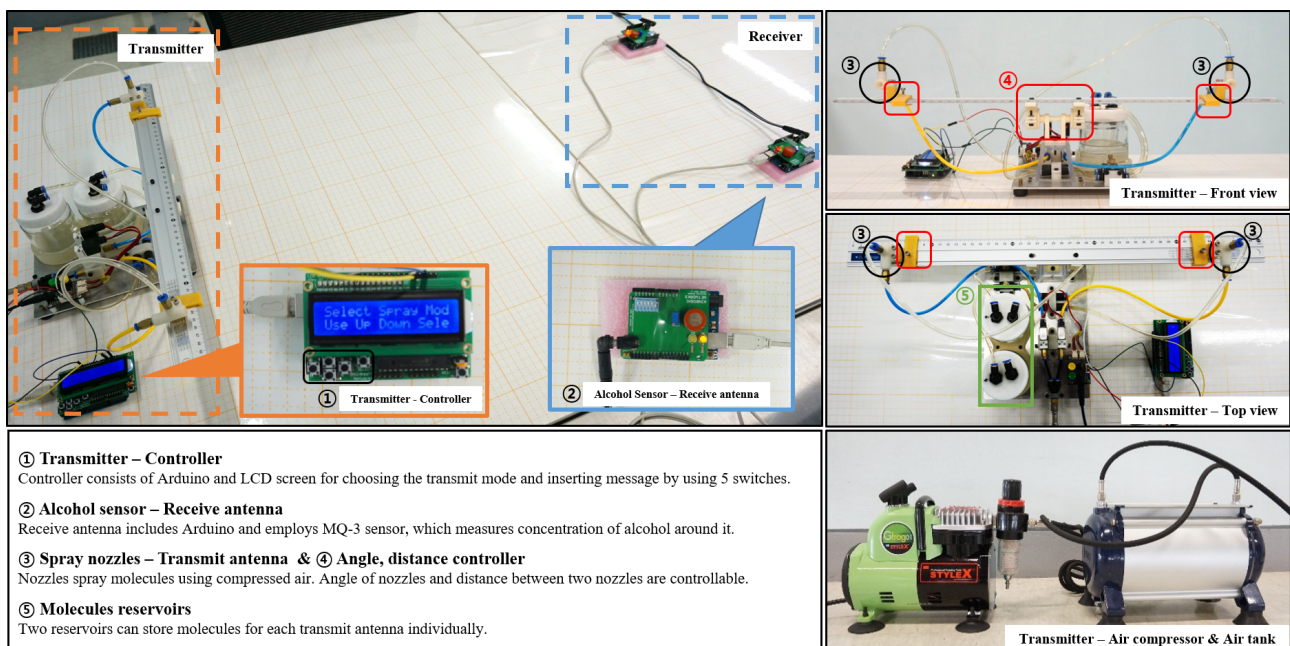


Figure 1. The macro-scale molecular MIMO communication testbed

Molecular MIMO channel impulse responses were measured using the testbed illustrated in Figure 1. The testbed employed 83 % ethanol as a message carrier and emitted molecules by controlling compressed air through nozzles. The release duration of molecules is controllable but it was set as 100 ms when the channel information was collected. The receiver includes an MQ-3 sensor that detects alcohol concentration around the sensor and converts the information into an electrical signal. An Arduino micro-controller was used to collect the data.

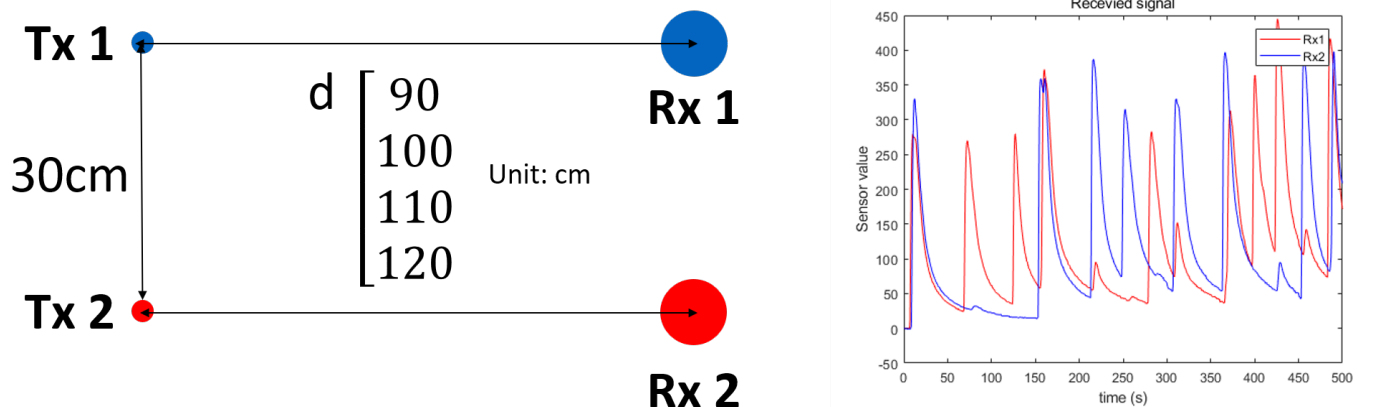


Figure 2. The molecular MIMO system and the received signal

In the competition, we will use data from the molecular MIMO system illustrated in Figure 2. The nozzle and receiver are aligned at the corners of a rectangle. The distance between the nozzles is fixed at 30 cm and the distance between the nozzle and the receiver (d) is chosen from the set [90, 100, 110, 120] cm. The system sends information using molecule concentration shift keying (MC-OOK) and the symbol duration is chosen from a set [15, 30] sec. The received signal is generated based on random bit sequences and channel information. The channel information is estimated by the experiment using the testbed and available at the link below.

The received signal dataset is provided in one format (.mat) and each data is named as “Example_ d cm_ **symbol duration** s_ **number**”. The sensor data-sheet is also provided. Further details are available in the FAQ file. These are available at the following links:

https://drive.google.com/open?id=1b0FLSMefcN-zHkPs_LpiFAb0zbxYKmG1

Reference

- [1] N. Farsad, H. B. Yilmaz, A. Eckford, C.-B. Chae, and W. Guo, ‘A Comprehensive Survey of Recent Advancements in Molecular Communication,’ *IEEE Comm. Surveys & Tutorials*, vol. 18, no. 3, pp. 1887-1919, 3Q, 2016
- [2] B. Koo, C. Lee, H. B. Yilmaz, N. Farsad, A. Eckford, and C.-B. Chae, ‘Molecular MIMO: From Theory to Prototype,’ *IEEE Jour. Sel. Areas in Comm.*, vol. 34, no. 3, pp. 600-614, March 2016

Contact

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