ERCIM "ALAIN BENSOUSSAN"
FELLOWSHIP PROGRAMME

ERCIM
European Research Consortium
for Informatics and Mathematics

# Scientific Report

| | |
|---|---|
| First name / Family name | Evren Catak |
| Nationality | Turkey |
| Name of the *Host Organisation* | Norwegian University of Science and Technology (NTNU) |
| First Name / family name of the *Scientific Coordinator* | Arild Moldsvor and Mohammad Derawi |
| Period of the fellowship | 01/04/2020 to 31/03/2021 |

## I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

The research topics performed during the fellowship are categorized into three main topics:

A. A survey/review on IoT Communication Technologies and Challenges

With the advancement of technology, the various devices connect to the Internet and each other. IoT communication technologies promise to connect every physical object on a communication network. Although there are lots of studies in the literature about IoT communication, there are still unresolved problems. Thus, in the first part of the fellowship, we aim to introduce i) the challenges of the IoT communication systems, ii) a review of the literature for the solution. Then, based on review information, we discussed the challenges of IoT technologies and our contributions. We used our knowledge in writing a journal paper.

B. Transceiver Design with Low Cost and Latency

We studied the transceiver structures of the IoT devices with low cost and latency. We proposed a multi-carrier lattice structure using Fourier transform and polyphase decomposition of a filter. The proposed method results show that our proposed method decreases the latency of the propagation by about 20 percentage. We published our study as a journal paper [1].

C. Backscatter Communication for an IoT Communication

Finally, we studied backscatter communication for the massive amount of IoT users. The receiver structure is enhanced by using the different types of interference cancellation algorithms. After the fellowship, we will collaborate to complete the study [2].

## II – PUBLICATION(S) DURING YOUR FELLOWSHIP

[1] Evren Catak, Arild Moldsvor, and Mohammad Derawi, “Transceiver Design for GFDM withHexagonal Time-Frequency Allocation Using the Polyphase Decomposition," Electronics 2020, 9, 1862. https://doi.org/10.3390/electronics9111862

[2] Evren Catak, Serhat Erkucuk, Arild Moldsvor, and Mohammad Derawi, “Modifed Successive Interference Cancellation for Massive IoT in Ambient Backscatter Communication Systems," in preparation.

## III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES

1- IEEE Washington Tech Talk Series: Machine Learning for Wireless Communications and Security in 5G and beyond, virtual, 25 Feb 2021 (as a listener)

2- 6G Symposium: Spectrum Sharing in 6G Systems, virtual, October 21 (as a listener)

3- Smart mobility at the European land borders final project presentations webinars, Jun 18, 2020 (as a listener)

## IV – RESEARCH EXCHANGE PROGRAMME (REP)

Host Institute: Distributed & Interactive Systems Group on Centrum Wiskunde & Informatica (CWI) in the Netherlands.

I gave a presentation about my research work with the title “Research topics of the wireless communication for 5G-and-beyond and open questions not answered yet.” It

was a great opportunity to exchange ideas with the Distributed & Interactive Systems Group researchers with Dr Pablo Cesar, about potential research collaborations.