Cognitive radio test bench applied to communicating objects (IoT)

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Cognitive radio internship
Duration: 6 months remunerated
Basic knowledge: Student interested in the physical layer and wireless communications link
Note: Teleworking during the internship

The cognitive radio makes possible to adapt certain parameters (frequency, modulation, access technique ...) of radio systems according to the RF spectrum occupation (radio frequencies), and thus to improve the communication. The Internet of Things (IoT) objects will be interconnected using wireless networks allowing full accessibility to different devices to communicate with a home, a city, a medical control system, etc. The implementation of IoT and 5G also presents challenges related to, among other things, dynamic environmental conditions, saturation on certain frequency bands and current problems in the cost of using the RF spectrum. Cognitive radio can make decisions about using the RF spectrum to achieve interference-free connectivity according to Quality of Service (QoS) requirements.

Thus, cognitive radio first consists in listening to the RF spectrum to detect the used frequency bands, then to configure its equipment to transmit on the unused frequencies. Cognitive radio is therefore based on reconfigurable SDR (Software Defined Radio) hardware where digital and RF components are controlled by software.

This internship first requires a detailed bibliographic study (state of the art) of the implementation techniques of cognitive radio. Then, the choice of software allowing the reconfiguration of the radio module such as GNU Radio (free and open source software), Python or Matlab. Among the reconfigurable radio modules available in our laboratory, mention may be made of the USRP equipment of Ettus Research (National Instruments) (figure 1), whose internal block diagram is shown in figure 2.

Thus, this project aims to set up a test bench to study the detection of the RF spectrum of a cognitive radio network for communicating objects. The test bench will include a USRP module associated with one of the software mentioned above and will allow the processing of RF signals in real time. This software will be the back-end of the URSP module. A simulation phase would be expected at the beginning where pre-recorded radio signals could be used to understand the principle.

Figure 1 : USRP B200 Software Defined Radios [1]

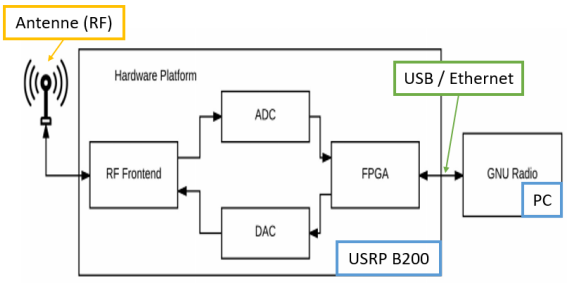

Figure 2 : Test bench diagram [2]

The expected deliverables are:

- A report containing a brief state of the art on the topic, a positioning of the evaluated techniques and their implementation.

References

[1] A. Devices, «USRP™ B200mini Series,» 2013. [Online]. Available: https://www.ettus.com/wp-content/uploads/2019/01/USRP_B200mini_Data_Sheet.pdf. [Accessed 03 10 2019].

[2] Q. Dong, Y. Chen, L. Xiaohua and K. Zeng, «A Survey on Simulation Tools and Testbeds for Cognitive Radio Networks Study,» *CoRR,* vol. abs/1808.09858, 2018.