Introduction

Radio Frequency Identification (RFID) is a hot technology in wireless applications. However, the performance of current RFID systems need to be further improved, and it is time-consuming and of high cost to test and implement a new system in hardware directly. Software-Defined Radio (SDR) is a radio communication system where components that have been typically implemented in hardware (e.g. mixers, filters, amplifiers, modulators/demodulators, detectors, etc.) are instead implemented by means of software. It is a rapidly evolving technology that is receiving enormous recognition and generating widespread interest in wireless communication systems. This project aims to build a flexible and enhanced passive UHF RFID system which follows the EPC Class-1 Generation-2 protocol with the help of Ettus’s SDR development platform.

Short Description

Fig. 1 shows the system architecture. It can be divided into two parts: software and hardware.

The hardware and parts of the software are available. The hardware includes Ettus’s SDR development platform and tags from Alien Technology. Ettus’s SDR development platform has three parts: USRP (Universal Software Radio Peripheral) N210, RFX900 Transceiver and VERT900 Antenna.

Figure 1: System Architecture for SDR-based Passive UHF RFID
The software includes GNU Radio toolkit, SIMULINK-USRP and a control panel. GNU Radio is a free software development toolkit that provides the signal processing runtime and processing blocks to implement software radios using readily-available, low-cost external RF hardware and commodity processors. GNU Radio toolkit will be used to program USRP N210. SIMULINK-USRP provides the possibility to build a wide variety of signal processing applications and wireless communication devices directly in SIMULINK while being able to test them on real hardware at the same time. It will be used as an accessory development toolkit for USRP N210. A simple control panel will be designed by the master student to set configuration to and get data packet from the software defined RFID reader and tag.

**This master thesis project** will focus on programming USRP N210 and testing the software defined RFID reader and tag. It has four steps:

- **Step 1**: Use GNU Radio toolkit and SIMULINK-USRP to program one USRP N210 and build a software defined RFID reader.
- **Step 2**: Build a simple control platform with C++/MFC or Python GNU Radio for the software defined RFID reader, and test the reader with tags from Alien Technology.
- **Step 3**: Use GNU Radio toolkit and SIMULINK-USRP to program one USRP N210 and build a software defined RFID tag.
- **Step 4**: Test the communication between the software defined RFID reader and tag.

**Schedule**

6 months in total:

- 1 month for learning the basic knowledge about Software Defined Radio, RFID and EPC Class-1 Generation-2 protocol;
- 1 month for learning how to use GNU Radio toolkit to program Ettus’s SDR platform;
- 1 month for implementing the basic functions of EPC Gen-2 protocol in the SDR platform and building the software defined RFID reader;
- 1 month for debugging and testing the software defined RFID reader with tags from Alien Technology;
- 1 month for building the software defined RFID tag and testing the whole RFID system;
- 1 month for thesis writing.

**Requirements**

Good at C/C++, Familiar with MATLAB/SIMULINK and Digital Communication, RFID

**Job & Ph.D. Opportunities**

When you finish this master thesis project well, you are expected to be expert in C/C++ and MATLAB/SIMULINK. You will learn a lot of knowledge about Software Defined Radio and passive UHF RFID, and know how to use the Ettus’s SDR development platform and GNU Radio toolkit. Therefore, you will have the following opportunities:

1. Easier to find a job in Sweden as a software engineer;
2. Easier to find a job in a wireless communication company, e.g., Ericsson;
3. Find a job in a RFID company;
4. Continue the research about Software Defined Radio and/or RFID as a Ph.D. candidate.