CARLETON UNIVERSITY

Department of Systems and Computer Engineering
SYSC4700 Telecommunications Engineering 2012

Course Instructor: Akram Bin Sediq

TERM PROJECT

Radio Frequency Identification and its Applications in Wireless Cellular Networks

SUBMIT TWO HARD COPIES OF THE REPORT IN THE ASSIGNMENT BOX BY 4:00 PM, THURSDAY, APRIL 5.

Context

Radio Frequency Identification (RFID) is a system where a small device (called an RFID tag) is attached to any object for the purpose of identification and/or tracking. When this tag comes within close range of a reader, it communicates its stored data, allowing the reader to wirelessly identify the object [1]. There exists a wide variety of radio frequency identification technologies. However, any RFID system must consist of at least two components:

- An RFID tag
- An RFID reader

Although the first modern RFID tag appeared in 1973, the RFID market started to gain momentum only in the past decade when mass production managed to reduce the tag production costs. This momentum is expected to grow even further throughout the next decade. For example, the retail supply chain consumed 1.2 billion tags in 2011, and this number is expected to reach 18.3 billion by the year 2015 as RFID tags continue to replace UPCs (Universal Product Codes) [2].

RFID tags open the door to a wide variety of applications when combined with cellular networks such as LTE (Long Term Evolution). Allowing the data collected by RFID readers to be communicated over the cellular network could allow servers to be located at centralized locations away from the RFID readers. For this to be achieved, an RFID reader must be equipped with a cellular modem. A case study of such a system can be found in [3]. In addition, this combination advances the vision of the "Internet of Things"[4]. Specifically, it allows computers to identify real life objects and interact with

them accordingly over the Internet. For example, an alarm clock equipped with Internet access can sound the alarm earlier based on traffic and weather conditions. In this case, not only do objects aggregate information, but also they utilize this information as knowledge and take actions accordingly.

Description

This project involves

a. Radio Frequency Identification (RFID)
b. Wireless cellular network standards, namely LTE (Long Term Evolution) and LTE-Advanced
c. The Internet of Things

In addition to the references listed at the end, you can find abundant material on each of the above three subjects on the Internet.

Note that real-life applications of RFID over cellular networks have not been realized at the moment. Therefore, your creativity will play an important role.

Requirements

The report will address the following points, in separate sections:

1. Describe the following concepts:
    a. RFID
    b. LTE-Advanced
    c. The Internet of Things
2. Improvise an innovative application that comes from merging cellular networks and RFID systems under the umbrella concept of the Internet of Things (Allowing objects to access the Internet and interact with their environment).
3. Describe the proposed system in detail. Both the system's hardware and software should be described.
4. Build a realistic case study where the system can be implemented. In order to do so you should first describe the environment where such a system can be implemented and evaluate its expected performance in terms of:
    a. Cost
    b. Efficiency
    c. Reliability

Report

A group is normally formed by three or four students. Two-member groups are not allowed.

There are two deadlines ahead of you:

- Deadline 1: Midnight, Tuesday, March 7. E-mail your group information to the course TA Furkan Alaca at **falaca@sce.carleton.ca** after getting the consent of the other group members. The only information required is the names of the students in your group. **This e-mail must be copied to all group members.**
- Deadline 2: 4:00 pm, Thursday, April 5. **Two** copies of the final report due in the course assignment box.

Missing the first deadline may result in some penalty in your overall mark for this project.

Each group will write one report, and will submit it in two hard copies. All group members will get the same mark. It is up to your group to organize the work and allocate tasks to group members. Your group output will be a report which addresses the above issues. Include references (papers, books, internet, etc.), with enough information that they can be verified by readers.

Do not copy from other sources (especially from internet) or use others' ideas, unless they are acknowledged and properly referenced. Violating this rule amounts to plagiarism, which is a serious instructional offence (see "instructional offences" in the undergraduate calendar, and www.plagiarism.org for definitions and examples of plagiarism). Reference to "other sources" also includes any overlap of your own work in other courses, such as fourth year projects, for example.

The report itself (without figures) should be no more than 10-15 pages of double-spaced text; you may put as many figures as you deem appropriate. Your marks will be based on the correct knowledge and persuasiveness revealed in your report, its organization, coherence and clarity, and use of references.

References

[1] Radio-frequency identification [Online]. Available: http://en.wikipedia.org/wiki/Radio-frequency_identification

[2] Joe Pleshek (2011, July 20). RFID will see double-digit growth in the healthcare market [Online]. Available: http://wtnnews.com/articles/8824

[3] M. Holmqvist and G. Stefansson, "Mobile RFID—A Case from Volvo on Innovation in SCM", In *Proceedings of the 39th Annual Hawaii International Conference on System Sciences*, vol. 6, 2006, pp. 251-272.

[4] The internet of things [Online]. Available: http://en.wikipedia.org/wiki/Internet_of_Things