

MASARYK UNIVERSITY
FACULTY OF INFORMATICS



Edu-hoc: Experimental and educational platform for wireless ad-hoc networking

MASTER'S THESIS

Lukáš Němec

Brno, Fall 2016

MASARYK UNIVERSITY
FACULTY OF INFORMATICS



Edu-hoc: Experimental and educational platform for wireless ad-hoc networking

MASTER'S THESIS

Lukáš Němec

Brno, Fall 2016

Replace this page with a copy of the official signed thesis assignment and the copy of the Statement of an Author.

Declaration

Hereby I declare that this paper is my original authorial work, which I have worked out on my own. All sources, references, and literature used or excerpted during elaboration of this work are properly cited and listed in complete reference to the due source.

Lukáš Němec

Advisor: RNDr. Petr Švenda, Ph.D.

Acknowledgement

TODO

Abstract

TODO

Keywords

keyword1, keyword2, ...

Contents

1	Introduction	1
2	Problem analysis (testbed, not general WSN)	3
2.1	<i>Creating WSN network</i>	3
2.2	<i>Possible challenges</i>	3
3	TESTBED deployment	5
3.1	<i>Network design</i>	5
3.2	<i>JeeTool (mass managment and communication)</i>	5
3.3	<i>HW (Arduino, JeeNodes, RF12B radio ...)</i>	5
4	Research use	7
4.1	<i>Keys from radio signal</i>	7
4.1.1	<i>4.1.1 Quantization principle (bits from signal strength)</i>	7
4.1.2	<i>RSSI version</i>	7
4.1.3	<i>CSI (channel state) version</i>	7
4.2	<i>Cooperative jamming (can it improve our situation?)</i>	7
4.3	<i>Performance Evaluation (results from experiments)</i>	7
4.3.1	<i>Enthropy of data</i>	7
4.3.2	<i>Speed (bits of key per time)</i>	7
4.3.3	<i>Possible errors</i>	7
4.4	<i>Discussion, is it achievable and under what conditions?</i>	7
5	Education use	9
5.1	<i>motivation for educational WSN network</i>	9
5.2	<i>Scenario approach (attack and repair) + iterative higher difficulty</i>	9
5.2.1	<i>scenarios</i>	9
5.3	<i>Evaluation principle</i>	9
5.4	<i>Web interface and auto run</i>	9
5.5	<i>PA197 use and results</i>	9
6	Summary	11
A	An appendix	13

1 Introduction

2 Problem analysis (testbed, not general WSN)

2.1 Creating WSN network

2.2 Possible challenges

3 TESTBED deployment

3.1 Network design

3.2 JeeTool (mass management and communication)

3.3 HW (Arduino, JeeNodes, RF12B radio ...)

4 Research use

4.1 Keys from radio signal

4.1.1 4.1.1 Quantization principle (bits from signal strength)

4.1.2 RSSI version

4.1.3 CSI (channel state) version

4.2 Cooperative jamming (can it improve our situation?)

4.3 Performance Evaluation (results from experiments)

4.3.1 Entropy of data

4.3.2 Speed (bits of key per time)

4.3.3 Possible errors

4.4 Discussion, is it achievable and under what conditions?

5 Education use

5.1 motivation for educational WSN network

The current state of the art WSN devices usually uses specialized hardware and software in order to achieve the best performance available. This, unfortunately, is not the ideal prerequisite for an easy to learn matter. In fact, most of WSN devices have rather complicated setup and are quite challenging for novices.

Because of such discouragement, it is difficult to teach how to work with WSN's; few hours (at least) are usually required to explain the basics, which is reasonable for research project or something similar, but for class exercise, this would turn out to be not the most effective use of time, if it would be achievable at all. And we have not yet mentioned more advanced topics in this area, such as common encryption or message authentication techniques.

Issue of this nature can be solved in various ways, in case of Eduhoc we decided to sacrifice performance 3.3; which is not that much important for network with educational purpose. On the other hand,

5.2 Scenario approach (attack and repair) + iterative higher difficulty

5.2.1 scenarios

- 5.2.5 individual scenarios

5.3 Evaluation principle

5.4 Web interface and auto run

5.5 PA197 use and results

6 Summary

A An appendix