

Exjobb opposition report

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Date of review: May 14, 2015

Title: Radio Based User Presence (Draft)

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Section I. Evaluation

Radio Based User Presence is a very interesting thesis project report that I'm grateful I had the opportunity to read. The thesis very clearly describes what the researched problem is from the abstract and onwards. The major contribution is to improve the reading range of RFID technology with a fractal based antenna. The process of this is pedagogically explained. The antenna design is described by several citations, making the design choice appear motivated.

The language used is consistently simple and straight to the point. It almost never uses overly complicated words or sentence structures. It feels natural, yet formal enough for a master thesis. The structure and disposition is mostly good, chapters and sections are placed in a way that makes sense when reading the thesis. Sometimes sections could be moved around to better follow a red thread, I give suggestions to this in Section II.. Most notably, Parts of Chapter 3 could have been moved to the background chapter. Almost all subjects and concepts mentioned in the thesis directly relate to the research conducted, nothing irrelevant is kept.

It was easy to look up cited bibliography, since almost all of the entries have associated URLs. This makes it easy for a reader to look cited statements up if questioning them. Unfortunately, citations are few and (sometimes) far between. Many statements throughout the thesis, could be cited, in order to make the reader trust that such statements are backed up by reliable literature. Table 1 shows the rating given to each listed category.

Category	Rating
Relevance of content	5
Disposition	3
Evaluation of published results	4
Abstract	5
Conclusion	5
Presentation of related work	3
Language	4

Table 1: Category ratings

Section II. Recommendations

This section contains some of the improvements that can be made to *Radio Based User Presence*. These suggestions are less specific than the improvements proposed in Section III.

- As in all texts, there are some minor typos, spelling errors, and grammar mistakes appearing. These are collected and listed in per-chapter tables in the appendix of this opposition report. Addressing these flaws would improve the overall experience of reading the thesis.
- The thesis would be more complete, if it contained a specific section describing which scientific methods and research methods were used during the measuring and analysis. This could be located either within

the introductory chapter or in a new chapter. I recommend looking at *Portal of Research Methods and Methodologies for Research Projects and Degree Projects* [3] for some inspiration and a collection of many methods. Describing one or several of these methods in the thesis would make it easier for the reader to quickly understand what types of research has been performed, and help the reader to understand how your results can be validated and repeated.

- All chapters could benefit from introducing more citations. For example, the first entry in the bibliography is *The RF in RFID* [1], perhaps this can be cited more often in Chapter 2 to give more credibility to the statements made. Maybe *RFID Essentials* [2] can be used too? Is it simply so that all of what is stated in Chapter 2 is described in [1]? If so, maybe that should be explained to the reader. In Chapter 3, it would likely be easy to cite some papers to justify the statements made about the dipole, Yagi-Uda, and fractal based antenna designs.

Section 2.2.1 could cite RFC 3261 or one of the other SIP related RFCs. Alternatively, maybe cite a text book such as *Understanding the Session Initiation Protocol* [4]. Furthermore, this section could cite the RFC document of some of the referenced protocols (such as TCP, UDP, STCP, etc.), so that the user can quickly find a URL to access for more information.

- Chapter 4 was significantly more difficult to read for me, than the rest of the thesis. Perhaps this can be made easier by adding a background section introducing physics units (Henry, decibel, Farad, and Maxwell's equations) and signal theory/electronics (Matching an antenna, Balun, Transformer Matching, transducer, backscatter, and CMOS). Maybe background information like this can be added to *2.1.4 RFID Antennas*?
- At times, the thesis could be made a little less repetitive. Concepts introduced in the Background chapter (for instance the responsibilities of SIP components) are explained both in 2.2.2 and 2.2.3, and then again in 4.3. Removing such re-occurrences would make the flow of reading better, with fewer distractions.
- Even though energy savings are mentioned in the introduction chapter, the thesis could be improved by introducing a new section discussing environmental concerns and sustainability. For instance, perhaps the thesis could suggest that increasing the range of passive RFID tags would improve energy savings because the antenna proposed and evaluated can reach longer distances with lower energy consumption, than alternatives with a less refined antenna can.

The thesis already states that it is more sustainable to produce long lifespan tags, rather than battery powered tags. Statements such as this one could perhaps be moved to an environmental concerns section to make it very clear to the reader what these positive sustainability implications are.

- Sometimes, the abbreviation and spelled out meaning of the abbreviation are used interchangeably. See for instance *IC* in the RF Antenna section, and *Session Initiation Protocol/SIP* of the User Presence Detection section. The thesis would benefit from always using only the abbreviations after the point that they have been introduced/spelled out. This reminds the reader that the concept has already been explained and that the reader can go back to look it up if needed.
- The descriptions of different antenna designs in Chapter 3 seem to be background information, provided so that the reader can later understand the analysis of your results. Maybe this text can be moved to the background chapter, in order to keep all background information in one place.
- In the related work section, I got the impression that particularly the PYGMALYON Dag-System is very suitable to your thesis. Perhaps you can motivate why it is not used in the thesis.
- Take a look at your Figure 2.5, it is adapted from *Xueliang Ren's* master thesis Figure 2.7. You have changed the direction of some of the the arrows (9,8 and 5,6) in your version. Is this a choice you did, or just a mistake? I do not understand the order of events in your version.

- Formula 4.2: Previously r was associated with distance (metres), now it (or R) is used to measure resistance. It would cause less confusion if this variable was given another name (RPar?).
- Would it be possible to show some of the FEKO environment variables in an appendix? So that a fellow student could have the same environment as you, and thereby repeat your experiments?
- Figure 3.23 depicts a reflector behind an antenna. The antenna is not entirely covered by the reflector (filled with green) as shown by the figure. Can this have any implications? Can it be the case, that the reflector would have worked better if it fully covered the back of the antenna?
- Chapter 4 states *The copper clad board is composed of a copper sheet attached to a fiberglass board by using Epoxy*. You mention that a thicker copper layer gives better results in simulations, but is it possible to reason about what effect the fiberglass (FR-4) board had on the measurement of the gain? Could it be possible to experience better results using another material than FR-4?
- Section 5.3, Reflections, (as well as 2.3.1 Skimmer) considers ethical concerns. This section could be made even better by adding some more in depth thinking about ethical concerns. Can we design any technical solutions to stop or make it more difficult to track certain objects or people for instance? Perhaps this is covered by security in the SIP protocol though?

Section III. Detailed comments for the author

In the Contents listing, perhaps *Abstract*, *Sammanfattning*, *Acknowledgements* can be removed because they appear before the Contents section. In *Abbreviations*, sometimes not all words of the definitions are capitalized, for instance *Integrated circuit* instead of *Integrated Circuit*. Table 2 of this document shows suggestions on modifications to the abstract (I liked the abstract very much).

The Swedish abstract has some language flaws that are pointed out in Table 3. These flaws are easily fixed so that the abstract will be more inviting to Swedish speaking readers. I can help you to improve the final version of the Swedish abstract, if you decide to do changes to it. Just write me an e-mail (my address is listed at the top of this document) at that point in time. In thesis outline, it would be advantageous if the the chapters mentioned were also links to the place in the thesis where they appear. Table 4 shows suggested modifications to Chapter 1.

The figures 2.2 to 2.4 are blurred when printed, however the text they contain is still legible. In the last paragraph before Section 2.2, consider to specify what is referred to by *the first leads to* (is it copper, or copper and aluminium, and the later is conductive ink?), as well as why the later leads to insecurity. I could not figure out what kind of security properties would be violated by this. In section 2.2.1, it would be nice with a brief example of what a SIP message can look like, to quickly make the reader acquainted with SIP. You should make sure to write *an RFID* instead of *a RFID*, or at least make the use consistent throughout the thesis.

Section 2.2 mentions that the tags used in the thesis project operate at 13.56 MHz, perhaps the RFID background section could introduce this and motivate why this is so. Consider moving section 2.2.3 *SIP Messages* to be right after 2.2.1 SIP, because *Operation of the protocol* uses concepts that are introduced in 2.2.3. In Section 3, it would be good for the reader if you explain the different colors of the sphere figures used later, since the font size of the texts in the figures are rather small. It would be great if the reader could immediately understand that in the red part of the sphere, the gain is too low, and that around the yellow or green parts, the gain meets the requirement. Table 5 shows the suggested modifications in the background chapter.

In Section 3.1.2, perhaps a short explanation could be provided to Maxwell's equations. When you say *We knew that a dipole antenna was not the most suitable antenna for our aim*, you can also say that this will be explained in 3.1.2.2. Can the colors of Figure 3.10, and 3.11 be inverted so that it will be easier to see the shapes? Now there is a thin white line on a black canvas. Consider to move gcc compilation instructions to the appendices where the programs are presented, because the compilation instructions do not improve the sections

they are placed in now considerably. Figures 3.20, 3.21, and 3.22 are not referenced to in the text. Table 6 shows the suggested improvements in Chapter 3 of your thesis.

In 4.1.2, the antenna's *tracks* are described as radius and then in 4.2 as diameter. This can be simplified by using only radius, or, only diameter. Is a track the copper thread? The meaning of a track is not described before this section.

Section 4.3.2 has a language style that is not present anywhere else in the thesis. Namely, "*Server agent handles ...*", "*Presence server handles*", instead of "*The server agent handles*" and "*The presence server...*". Changing this style to match the style of the rest of the thesis report would make the flow of reading this part of the thesis even better. Table 7 shows suggested improvements in Chapter 4.

Citation [7] and [16] in the bibliography of the thesis seem to be broken links. Perhaps change these to something Google/Wayback Machine has cached, or find it again on their current website. Citation [4] is a web page, maybe the quality of this citation can be improved by referencing an IEEE report such as [5], that also mentions Walmart and RFID. Citation [6] refers to a really short document that does not explain much about this ISO standard as far as I can tell. Could it be improved by referencing a more detailed document? Citation [12] can be improved by inserting a link to the BibTex. *The RF in RFID* is the most frequently cited publication in your bibliography, cited by 731 other papers, according to Google Scholar. This is followed by *How to build a Low-Cost, Extended-Range RFID Skimmer* with 107 other papers citing it. Many of the other documents in your bibliography are cited by low numbers of other papers, this could potentially lead some readers to believe your sources have not been well scrutinized. Maybe it is possible to find more frequently cited sources, covering the same area as some of the publications in your bibliography? Table 8 shows suggested improvements to the last chapter of the thesis.

References

- [1] D.M. Dobkin. *The RF in RFID: Passive UHF RFID in Practice*. Communications engineering series. Elsevier Science, 2007.
- [2] B. Glover and H. Bhatt. *RFID Essentials*. Theory in practice. O'Reilly Media, 2006.
- [3] Anne Håkansson. Portal of research methods and methodologies for research projects and degree projects. In *Proceedings of the International Conference on Frontiers in Education : Computer Science and Computer Engineering FECS'13*, pages 67–73. CSREA Press U.S.A, 2013. QC 20131210.
- [4] A.B. Johnston. *SIP: Understanding the Session Initiation Protocol*. Artech House telecommunications library. Artech House, 2004.
- [5] R. Weinstein. Rfid: a technical overview and its application to the enterprise. *IT Professional*, 7(3):27–33, May 2005.

A Appendix: Typos, Spelling, Grammar

Where in current text	Suggested modification
Session Initiation Protocol	add (SIP)
FEKO	perhaps shortly explain what it is
Providing an RFID based presence	An RFID based presence .. can be used

Table 2: Abstract

Where in current text	Suggested modification
radiofrekvents taggar	radiofrekvenstaggar
användnings	användningsområdet
är närvarande i en given plats	på en given plats
från en rad 50 till 100 cm	radie? (radius)
förlänga en SIP system	förlänga ett SIP-system
I denna anökan	I denna appliceringen
öka läsavståndet	öka läsavståndet och samtidigt hållas under de maximala RF effektgränserna
RFID baserad	RFID-baserad
luftkonditionering system	remove the word system
analyserades och simulerade	analyserades och simulerades
hjälp FEKO att erhålla	hjälp av FEKO för att erhålla
och skälen till varför de är enorm används i de nuvarande RFID-system	This is not written in the english abstract. och skälen till varför de ofta används i nuvarande RFID-system

Table 3: Sammanfattning

Where in current text	Suggested modification
some of limitations	some of the limitations
can connected to	can be connected to
there exist battery	there exists battery

Table 4: 1.1 Problem Statement

Where in current text	Suggested modification
wystems	systems
(Header) 2.1.3 RFID reader	2.1.3 RFID Reader
the receiver will receive the radio signal emitted by the tags	Will it not reply here?
Typically the information will be collected and stored in a database.	Already mentioned before.
the tag to return data to the receiver	Isn't the tag itself the receiver?
at greater ranges that the range	than
the field component E	E is never used later on
is that intensity	is that the intensity
100-150 turns each	turns of copper thread around a pole?
as they may printed	as they may be printed
UHF frequencies (UHF)	remove (UHF)
typical integrated circuit	typical IC
single laye structures	single layer structures
MMUSIC	Spell out MMUSIC
be in faciliates the receiver can make use of it	faciliates → makes sure/guarantees?
client send an INVITE	client sends an INVITE
different transport protocol	different transport protocols
TLS	Spell out TLS
these task later	these tasks later
RFC 254	RFC 2543
the aforementioned one	Do you refer to the request?
Microsoft Lync	Cite or explain?
there have been some attempt	there have been some attempts
when distribution was disrupted	Does this mean someone stole phones?
to determine of the contents	to determine the contents

Table 5: 2 Background

Where in current text	Suggested modification
in all of my studies is	my → our?
Directors elements	Director elements
a suitable Yagui antenna	a suitable Yagi antenna?
unfeasible	infeasible instead?
while random fractal contains elements	while random fractals contain elements?
it draws a Equilateral	it draws an Equilateral
FEKO then perform a simulation	FEKO and then perform a simulation
Fig 3.15: Kch Snowflake	Koch
third iterations I fabricated	third iterations we fabricated

Table 6: 3 Goals & Implementation

Where in current text	Suggested modification
In this section we describes the implementation	In this section we describe the implementations
which was build	which was built
PCB	Spell out or explain, then only mention PCB afterwards
make it on a printed circuit board (PCB)	PCB was mentioned, but not spelled out earlier
to the reader so measure	to the reader to measure
design and 0.4 mm radius	radius → thickness or diameter instead?
are showed in Tables 4.1 and 4.2.	Make link/ref to the tables
Figure 4.6: ... for 2 and 3 iterations	change order to 3 and 2
a SIP for RFID management	a SIP extension?
An user agent	a user agent (user sounds like soft j therefore a)
on or more of the followers	one or more of the following
A redirect server responds to a SIP INVITE request by indicating the user agent server that is prepared to forward INVITE requests to a SIP proxy that knows the current location of the user's SIP usage agent server.	This sentence is long and hard to follow, can you break it down?
by an Uniform	by a Uniform
to determine current location	to determine the current location
each RFID tage	each RFID tag
where the tag was read to the URL	Suddenly URL? Or URI?
with in	within
an URI	a URI
SIMPLE includes XML tag	SIMPLE includes XML tags?
agent handles request such as	agent handles requests such as
SUSBSCRIBE	SUBSCRIBE
ir order to	in order to

Table 7: 4 Testing & Analysis

Where in current text	Suggested modification
master's thesis	master thesis
possible to simulations the	possible to simulate the
the previous antenna prototype	prototypes, you just said you had many protypes
the matching these antennas	the matching of these antennas
potentially enable us	potentially enables us
space and increased	space and increases (active form)
fractal antena for	fractal antenna for
metamaterial	What is this? Could be explained a litte.
one coulf use	one could use
which athough	which although
the system proposed system	the proposed system?
meets the requirement	meets the requirements?
can be carrying anywhere on their person	Simplify: can carry?
where the user is carrying them	them → the tags?
foils would given	foils would give
multiples antennas	multiple antennas
can help to several systems	can help several systems
like in a library	for instance, in a library
abuse such stealing	abuse such as stealing
Texas Instuments	Texas Instruments

Table 8: 5 Conclusions and Future Work