

## Master's thesis IW: Electronics-ICT – Progress Report of the research

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**PROGRESS REPORT ON THE RESEARCH ACTIVITIES: ACADEMIC YEAR:** 2008/2009

**REPORT SUBMITTED ON:** 13/5/2009

Subject or title of the PhD research			Firstname, Familyname promotor		
WSN localization with Senseless framework			Jeroen Doggen, Maarten Weyn, Jerry Bracke		
Dates on which foregoing applications or reports were submitted	Progress reports	1. 12/11/2008	2. 11/3/2009	3. 13/5/2009	
		4.	5.	6.	
ABSTRACT OF THE RESEARCH					
Localization of nodes in wireless sensor networks (WSNs) is important to context-aware and position-dependent applications; data are generally meaningless without a known location. Many algorithms exist for localizing nodes using RSS, however a detailed quantitative comparison of these algorithms has not yet been published. With our master thesis, we present a quantitative comparison of algorithms which use RSS as a ranging method and present a localization software framework called Senseless. Using this framework, we implement several centralized algorithms: Min-Max, Multilateration, CL and WCL .					

## Short description of the progress of the research work during the past period, mentioning the already obtained results and planning for the next period

### General

We started expanding the framework(WSN/controller/GUI) with the new messages: location/sensor/status messages. After this, we added the possibility to change the frequency channel and power level of the nodes.

Next, we added some functionality and stability to the system of sending requests to the WSN for execution: the WSN needs to transmit a status message after a request is made. The packets do not always arrive, which make the system unreliable. We fixed this by making it send 5 status messages in a row and by implementing timeout functionality, to retransmit the request. After the framework came to a level of stability and correctness, we started to implement a couple of algorithms: Min-Max, Trilateration and Centroid localization.

We started researching about topics to improve the quality of the ranging, thus RSSI. We found some interesting topics: orientation, separate antenna, height, propagation models and frequency channel.

The WSN engine is the used name for our part in the Scala project. Currently, the engine supports all the C# interfaces required by Scala. The engine supports:

- Exchange of map data
- Exchange of location and sensor data
  - Via polling
  - Via events
- Listing of all the nodes

Not everything works flawlessly at the moment. We will begin to test the interface by connecting the engine directly to SUI. Integration with the middleware remains to be done.

### Problems and difficulties

Programming the WSN is difficult because of the small support. Implementing the three different messages cost us quite some time. As did, adding the functionality of frequency channel. Stabilizing the request system was also hard, because the status message is transmitted with the collection protocol, but that is a best effort protocol, so the WSN didn't always reply on a request, which made it unreliable.

The Scala interface is fairly simple to construct but nevertheless requires a great deal of time to implement. This is because Scala is still a project in progress. Interfaces are still changing. The communication with other team members is slow as there are a lot of bachelor students that need to be attended to. I needed to review my knowledge about C# events to implement the event interface. This was the most difficult interface to implement.

### Planning

The remaining weeks will be spent on improving the algorithms to extreme situations where the anchor nodes are too far from each other and to multihop. We will also keep working on the interface with SCALA, because this is a continuing job.

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Extra info
Attended seminars, presentations, workshops, company visits,... in this period (subject, date, short summary en evaluation)
1.
2.
3.
4.
New contacts in this period (name, First name, e-mail, Telephone number, company, position, relevance for the research)

1.
2.
3.
4.
<b>Articles, books, interviews, etc (title, authors, number of pages, short description, evaluation (what is the added value for the reserach))</b>
[1] An empirical characterization of radio signal strength variability in 3-d ieee 802.15. 4 networks using monopole antennas: research about the influence of antennas [2] RSS-based location estimation with unknown pathloss model, dynamically obtaining a parameter of the pathloss propagation model. [3] The indoor radio propagation channel, propagation models [4] Trilateration [5] Improved Weighted Centroid Localization in Smart Ubiquitous Environments, WCL algorithm
<b>Visum and comments, if any, of the promotor</b>
<div style="display: flex; justify-content: space-between; align-items: flex-end; height: 150px;"> <div>Date:</div> <div>Signature of the promotor:</div> </div>