OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG | INF | FAKULTÄT FÜR INFORMATIK

Distributed and Operating Systems Group

Implementation of Wireless Sensor Network Time Synchronization Algorithm on Embedded Devices

Type of work:	Teamproject
Estimated work time:	180 Hours
Advisor:	Christoph Steup

1 Introduction

Wireless sensor networks are closely related to the famous ”Internet of Things”, which promises a seamlessly digitalized world. Besides communication the nodes of these networks need temporal and spatial relations to fulfil their task, since a sensor's value is only useful in the context of time and space. Therefore these two values need to be provided within each node to enable processing and aquisition of data.
Even though the current and time and geospatial coordinates may be inferred through a GPS receiver, this approach is not generally valid. As an example a building may occlude the direct line of sight to the satellites disabling the GPS. Additionally, embedded devices need to be very limited in their power usage, which poses problems with current GPS receivers.
Another approach is the synchronization of the nodes using an internal synchronization algorithm without an external reference. This mechanisms needs to additional hardware and may even be piggybacked onto existing communication packets. This approach provides a lowe energy global time within the network enabling direct processing, comparision and ordering of aquired sensor data.
Therefore, this team project shall implement a distributed time synchronization algorithm on a wireless sensor network composed of embedded nodes.

2 Related work

Students should revise the published time synchronization algorithm[2], the hardware description of the wireless sensor nodes[4] , the description of the software stack[3] and the used communication system (compatible to IEEE 802.15.4)[1].

3 Detailed task description

The individual work consists of the following subtasks:

Review of the used time synchonization algorithm : The students should look into existing time synchronization algorithm and understand it.

Review of the existing software : Students shall revise the existing software available for the embedded platform.

Structuring of the implementation : Afterwards the implementation of the algorithm on the embedded platform shall be structure based on the existing software.

Implemtation of a prototype : A prototypical implementation needs to be provided.

Evaluation of the implementation : The evaluation of the implementation shall be based on experiments on the embedded hardware.

Referenzen

[1] IEEE standard for local and metropolitan area networks–Part 15.4: Low-rate wireless personal area networks (LR-WPANs). *IEEE Std 802.15.4-2011 (Revision of IEEE Std 802.15.4-2006)*, pages 1 –314, 2011.

[2] Christoph Steup; Sebastian Zug; Jörg Kaiser; Andy Breuhan. Uncertainty aware hybrid clock synchronisation in wireless sensor networks. *The Eighth International Conference on Mobile Ubiquitous Computing, Systems, Services and Technologies*, pages 1–8, 2014.

[3] Atmel Corporation. Atmel mac stack. Online: http://www.dresden-elektronik.de/fileadmin/Downloads/Produkte/6-Software/AVR2025_MAC_v_2_6_1.exe.

[4] dresden elektronik ingenieuretechnik GmbH. User manual - software programming. Technical report, April 2014. Online: http://www.dresden-elektronik.de/funktechnik/products/radio-modules/oem-derfsam3/description/?L=%2525270%25253DA&eID=dam_frontend_push&docID=1917.