

Template for thesis project proposals

Project Title	This thesis work aims to implement a demonstrator, where we can demonstrate the improvement of robustness by channel hopping sequence adaptations, in IEEE 802.15.4 TSCH networks.
Author(s)	Tomas Nordstrom
Keywords	Dependable wireless communication, Time-Slotted Channel Hopping (TSCH), IEEE 802.15.4 TSCH, OpenMote, Contiki, 6TiSCH
Project description	<p>Description:</p> <p>In many domains, such as in-vehicle networks, there is a wish to replace wired communication with wireless communication, in order to reduce weight (and therefore fuel), plus it simplifies production and maintenance. However, in order for the industry to be conformable with such switch there is a need for dependable wireless solutions (infrastructure and communication).</p> <p>Recent wireless standards targeting the needs of industrial networks, like IEEE 802.15.4 TSCH, seems to be good candidates also for in-vehicle networks. It provides a Medium Access Control (MAC) protocol called TSCH (Time-Slotted Channel Hopping), that both introduces more determinism through a TDMA protocol with a central scheduler, and more interference robustness through channel hopping.</p> <p>Researchers at Halmstad University has introduced a method to further improve the interference robustness by adapting the channel hopping sequence in IEEE 802.15.4e based on measured channel interference.</p> <p>This thesis work aims to implement a demonstrator, where we can demonstrate the improvement of robustness by channel hopping sequence adaptations. The demonstrator will be using OpenMote hardware and Contiki software.</p> <p>Project goals:</p> <ul style="list-style-type: none"> * Explore the suggested method of channel sensing (mostly using RSSI or packet error rates), if possible suggest improvements, and implement live visualization of per-channel quality. Also conduct a measurement campaign determining normal and worst case disturbances per channel. From those measurements determine the robustness improvement possible (theoretically, by simulation, and by running the demonstrator). * Implement the suggested synchronized update of the channel hopping sequence, and demonstrate the ability to adapt the hopping sequence as new disturbers appears. Evaluate the synchronization method and suggest improvements. <p>Notes on prerequisites: The thesis work will need to modify the Contiki (http://www.contiki-os.org/) communication stack in order to correctly interpret channel hopping sequence updates and implement the synchronization of updates. That is, some experience in navigating larger software projects, basic understanding of OS and communications stacks, as well as programming in C, will be necessary in order to complete this project. However, note that it is not sufficient to complete the implementation; the focus of this project is to use the implementation to verify and assess the suggested adaptation method from a communication aspect.</p>
References	<i>Give 2-3 references for students to start with</i>
Prerequisites	The student(s) should have solid skills in C/C++ programming and familiarity with MATLAB. The students should also be familiar with wireless standards like 802.11, and knowledge about 802.15.4 (like zigbee) would be beneficial.
Time frame	6 month, spring 2019
Supervisor(s)	Tomas Nordstrom, Kristina Kunert
Programme	<i>Name and the number of credits</i>
Examiner	<i>Name of project Examiner</i>

Signatures	<i>Student(s):</i> <i>Supervisor(s):</i> <i>Examiner:</i>
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