Utilizing Bluetooth for Supporting Real-Time Wireless Communication

Bachelor Thesis in Computer Science

Topic

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Android is currently one of the most used operating systems for mobile applications. Using Android as foundation, the Chair of Computer Science 11 at RWTH Aachen University developed RTAndroid to support applications with basic real-time requirements.

In order to make RTAndroid more attractive for industrial applications Twistturn was developed. It is a software PLC enabling the execution of Structured Text programs on RTAndroid devices. Communication with sensors and actuators is accomplished by a field device adapter.

The Arduino Yún board is used as such a field device adapter. It contains both an Linux SoC (system on a chip) running OpenWRT and an Atmel microcontroller. Therefore it combines computational power with several I/O possibilities.

Objective

Primary goal of this thesis is the design, implementation and analysis of Bluetooth communication for Twistturn. As WiFi functionality already exists, it is desired to develop and analyze Bluetooth capabilities for use with Twistturn. Hence Bluetooth hardware is already available in the used RTAndroid tablet, the tablet's hardware remains unmodified. The Arduino Yún does not have hardware to use Bluetooth, so a suitable adapter has to be integrated.

In order to use these Bluetooth adapters, the drivers have to be interfaced on both RTAndroid and OpenWrt. To be able to fulfill basic real-time requirements on the RTAndroid device, the driver interface has to be implemented natively in Twistturn.

Approach

The first step consists of designing and implementing a Bluetooth interface for the Arduino Yún based upon existing driver structure. Therefore the official Linux Bluetooth stack, called "BlueZ", will be utilized. Basic Bluetooth support will be added in Twistturn by adding a native interface to the Android Bluetooth stack.

In order to gain meaningful information regarding real-time capabilities, the performance of Bluetooth has to be compared to the existing WiFi performance. Therefore, several performance characteristics like transmission time and jitter will be evaluated.

If Bluetooth turns out to be suitable for basic real-time applications, redundant data transmission with WiFi and Bluetooth will be designed, implemented and evaluated.

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