BTnode Peripherals

Philipp Stadelmann

Advisor: Matthias Dyer
Co-Advisor: Dr. Jan Beutel

Prof. Dr. Lothar Thiele

February 8, 2007
Task

Write demo applications to show the BTnode’s ability to connect to external devices.

Two parts:
1. Cell Phone
2. CMOS VGA Camera
Bluetooth Peripherals – Cell Phone

Goal: Establish a connection from a BTnode to a cell phone and make the phone send an SMS message.
Bluetooth Stack – RFCOMM

- Simple transport protocol
- Emulates a serial interface over an L2CAP link

Already implemented in the BTnut system software
Bluetooth Stack – AT Commands

Originally

- Programming language for dialup modems
- Allows configuration over data line

Cell Phones

ETSI Technical Specification 100 916: AT Command Set for GSM Mobile Equipment
Bluetooth Stack – Application Layer

- SMS text mode
  - Number and message in plain text
  - Coding done by phone
- SMS protocol data unit (PDU) mode
  - Number and message encoded
  - Coding done by user
- Not every phone supports text mode
Approach

1. Testing on a Linux computer
   - Bluetooth dongle
   - „BlueZ“ official Linux Bluetooth protocol stack
     • hcitool HCI interface
     • hcidump debug output
     • rfcomm rfcomm layer
   - Terminal application: minicom

2. Implementation on the BTnode
Implementation

1. AT Commands Layer
   - Protocol
     - at_phone.h, at_phone.c

2. Application Layer
   - SMS sending interface
     - at_sms.h, at_sms.c
   - Demo Application
     - sms.c
Chapter 7

Interfacing to Handheld Devices

7.1 Introduction

In addition to the regular BtNode hardware, a cellular phone with a Bluetooth interface is required for successful completion of this tutorial.

Figure 7.1 shows an overview of the Bluetooth protocol stack. On top of the Host Controller Interface (HCI) layer, the Bluetooth Low Energy (BLE) protocol is used to connect to the BtNode device. The BtNode uses the GATT (Generic Attribute Profile) protocol to exchange data with client applications.
Serial Peripherals – CMOS Camera

Goal: Control the chip of a CMOS camera from the BTnode and receive an image.

Camera Operation
- JPEG compression chip
- RS232 interface
Implementation

1. Camera device driver
   - btnode_cam.h, btnode_cam.c
2. API for receiving an image
   - btnode_cam_cmds.h, btnode_cam_cmds.c
3. Demo application
   - cam.c
Application

BTnode Network

12/14
Demonstration

1. Get picture from camera
2. Output image data in intel HEX format to the terminal
3. Convert data from HEX format to binary
Questions?