RADIOFARO

Arduino compatible Development Board
with ATmega128RFA1

by Daniel Thiele and Axel Wachtler

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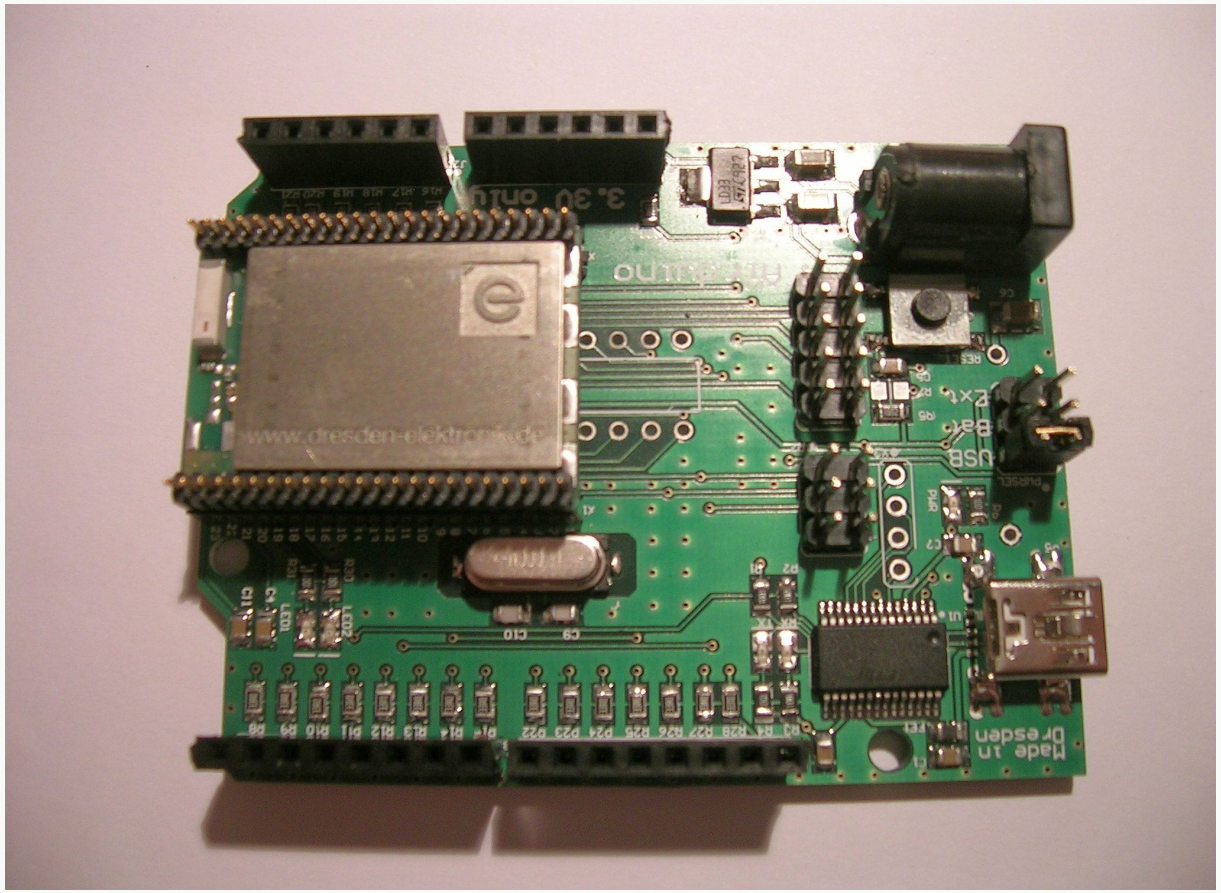
What is *RADIOFARO* ?

An Arduino 2009 compatible development board with a wireless AVR module.



Who is behind *RADIOFARO ?*

- The hardware design was done by Daniel Thiele, the idea came from Axel Wachtler. Both are engaged in the µracoli open developers project.
- The µracoli project provides basic driver functions for the current Atmel 802.15.4 transceivers.
- The idea of Arduino fits exactly to the idea of µracoli, to provide functionality which is easy to use.

Why Arduino with ATmega128RFA1?

- The integrated transceiver opens new application fields to Arduino. We are sure that the creative Arduino user community will find surprising applications.
- Existing shields are still usable.
- Much cheaper than Arduino + Xbee Shield.
- MCU resources (128KB Flash, 16KB RAM)

Initial Price Estimation

- Prices are estimated from RS-Components as single quantity, end user prices, tax excluded.
- Arduino Duemilanove with XBEE
  - Arduino 2009 + XBEE Shield + XBEE Module:
  - 28.80 € + 20.40 € + 25.49 € = **74.70 €**
- *RADIOFARO*
  - Arduino 2009 – Atmega328 + deRFmega128-22A00
  - 28.80 € - 6.00 € + 21.71 € = **44.51 €**.

Features

- Based on Arduino Duemilanove (2009)
- Configurable Power Supply:
  - USB, 7... 9V DC plug, 2 x AA Batteries
- 2 x custom LEDs
- JTAG and ISP connector

Status and Issues

- Status
  - Board design files currently in Altium format.
  - Functional prototypes available.
  - Basic software package available.
  - Testing in progress.
- Issues
  - Current tool chain in Arduino 0020 has limited device support (no Atmega128RFA1 support)
  - ATmega128RFA1 IOs not tolerant to 5V.

The Microcontroller

- Atmel ATmega128RFA1
  - 128K Flash, 16K RAM
  - up to 16MHz at 1.8V - 3.6V
- Integrated IEEE 802.15.4 Transceiver
  - 2.4 GHz (ISM band, usable w/o license)
  - link budget 103 dB (free field range > 300m)
  - datarate 250 kbit/s up to 2 Mbit/s
- Integrated Crypto Support
  - 128-Bit AES module

The Module

- Module deRFmega128-22XXX made by **dresden elektronik**
- *http://www.dresden-elektronik.de/shop/cat4.html*
- 46 Pin Module; 30 mm x 22.7 mm
- ETSI and FCC certified
  (easily shippable worldwide)
- ceramic chip antenna *or* UFL jack
- available with pin headers or as
  SMD variant.
- comes with unique 64-bit MAC address.

Existing Software

- Standard ATMEL protocol software and related applications/demos can be used:
  - IEEE 802.15.4-2006 MAC (Atmel)
  - ZigBee (Bitcloud)
  - IPv6 (Contiki, RUM).
  - ZigBee RF4CE (Atmel RF4Control)

- Programmable and debuggable with GNU and IAR tools.

More Software: µracoli Core for Arduino

- Integration of µracoli/*RADIOFARO* core into Arduino IDE via third party package.
- µracoli provides basic functions to control the 802.15.4 radio transceiver (configuration, frame receive and transmit).
- Wireless bootloader available.

Example Sketch

```
void setup() {
  Radio.begin();
  Radio.setChannel(11);
  Radio.setIdleState(STATE_TX);
  Radio.setState(STATE_TX);
}
void loop() {
  static uint8_t txbuf[] = {1, 0, 0, ... 'X','X' };
  Radio.sendFrame((uint8_t)sizeof(txbuf), txbuf);
  txbuf[2]++; /* increment sequence number */
  delay(2000);
}
```

Next Steps

- Finish and test ...
  - ... tool chain upgrade for Arduino package,
  - ... *RADIOFARO* third party package.
- Provide basic radio examles as sketches,
- Document the new *RADIOFARO* core functions,
- Deliver alpha packages (SW + HW),
- Retransfer design files to EAGLE format,
- Establish relations between **arduino** and **uracoli** and **dresden-elektronik**

Outlook

We would like to offer deliveries to the Arduino community and would be open to discuss arrangements.

So the Arduino community would adopt/welcome a new child in their family and eventually *RADIOFARO* may become …

… an official Arduino board like “RFArduino”