## Objective

This example demonstrates the use of the BLE Component to design a simple Heart Rate Sensor application.

## Overview

This example project demonstrates the BLE Heart Rate Sensor workflow. The project simulates Heart Rate data and performs communication with BLE enabled central/client device.

## Requirements

**Design Tool:** PSoC Creator 3.1 CP1, CySmart 1.0

**Programming Language:** C (GCC 4.8.4 – included with PSoC Creator)
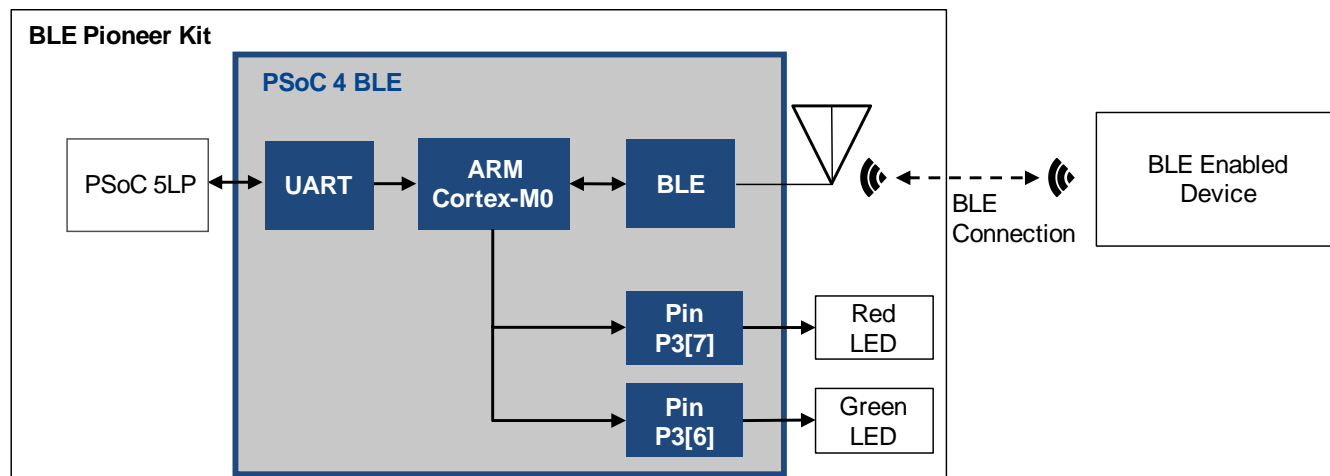
**Associated Devices:** All PSoC 4 BLE devices

**Required Hardware:** CY8CKIT-042-BLE Bluetooth® Low Energy (BLE) Pioneer Kit

## Hardware Setup

The BLE Pioneer Kit has all of the necessary hardware required for this lab. In this setup, following connections are done in the BLE Pioneer Kit.
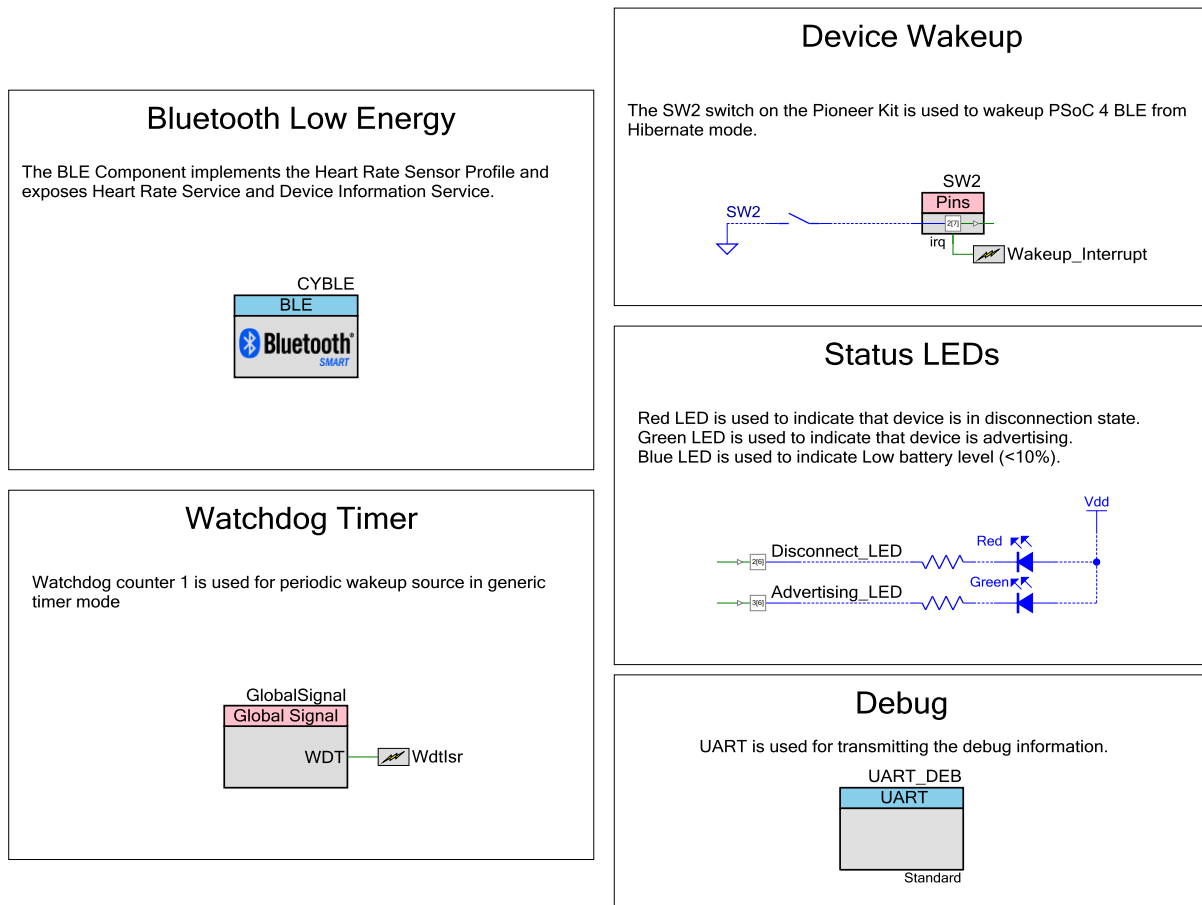
- The UART RX pin is connected to port 1 pin 4.

- The UART TX pin is connected to port 1 pin 5.

- The red LED (port 2 pin 6) is used to indicate the BLE disconnection state.

- The green LED (port 3 pin 6) is used to indicate the advertising state.

- A mechanical button (port 2 pin 7) is used to wake up the device and start re-advertising.

Figure 1: Block Diagram

# PSoC Creator Schematic

Figure 2. PSoC Creator Schematic



## Bluetooth Low Energy

The BLE Component implements the Heart Rate Sensor Profile and exposes Heart Rate Service and Device Information Service.

CYBLE
BLE

## Watchdog Timer

Watchdog counter 1 is used for periodic wakeup source in generic timer mode

GlobalSignal
Global Signal
WDT — WdtIsr

## Device Wakeup

The SW2 switch on the Pioneer Kit is used to wakeup PSoC 4 BLE from Hibernate mode.

SW2
Pins
SW2
irq
Wakeup_Interrupt

## Status LEDs

Red LED is used to indicate that device is in disconnection state.
Green LED is used to indicate that device is advertising.
Blue LED is used to indicate Low battery level (<10%).

Vdd
Disconnect_LED    Red
Advertising_LED    Green

## Debug

UART is used for transmitting the debug information.

UART_DEB
UART
Standard

# Project Description

The project demonstrates the BLE workflow procedures like advertising, connecting, notifying Heart Rate data, Device Information, etc.

The project is designed so there is no need to initiate any of mentioned actions manually – it automatically starts the BLE Stack, then, when the Stack is on (STACK_ON event is received), the advertising GAP procedure is initiated. The green LED is blinking while the device is advertising. Once connection request is received, it performs the connection procedure and provides its GATT database (configured in the GATT tab) for discovery process performed by client. The supported services are: Generic Access (GAP) and Attribute (GATT) Services, Heart Rate Service (HRS), and Device Information Service (DIS). When the Heart Rate notification is enabled by Client, the project starts to simulate all the Heart Rate Service related data (Heart Rate itself, Energy expended, R-R intervals).

The WDT is used to time the simulations, measurements and LED blinking. The red LED is turned on after disconnection to indicate that no Client is connected to the device. On disconnection event the device immediately starts to advertising. When the device connects successfully, both red and green LEDs are turned off.

## Expected Results

The project sends the Heart Rate and Battery Level notifications to the Central Client device which can show them for user. LEDs are blinking as described in Project Description section.

The project can work with any BLE-compatible device (e.g. phone, tablet) with appropriate software (with e.g. Android, iOS with installed application which supports Heart Rate Profile). For instance, you can use CySmart mobile app (Android / iOS) as Heart Rate Service client:
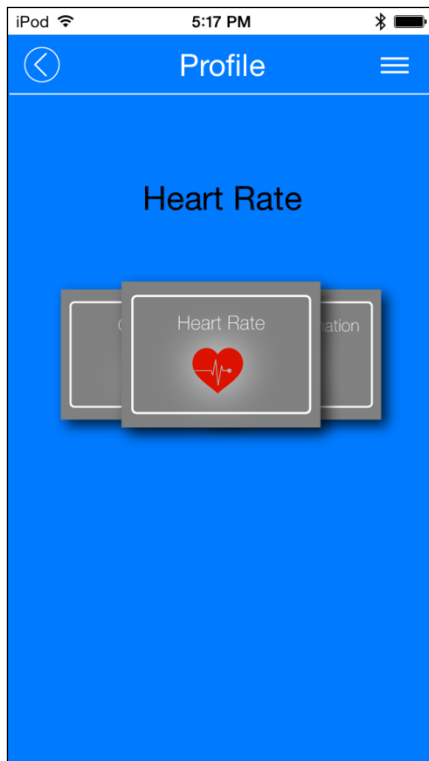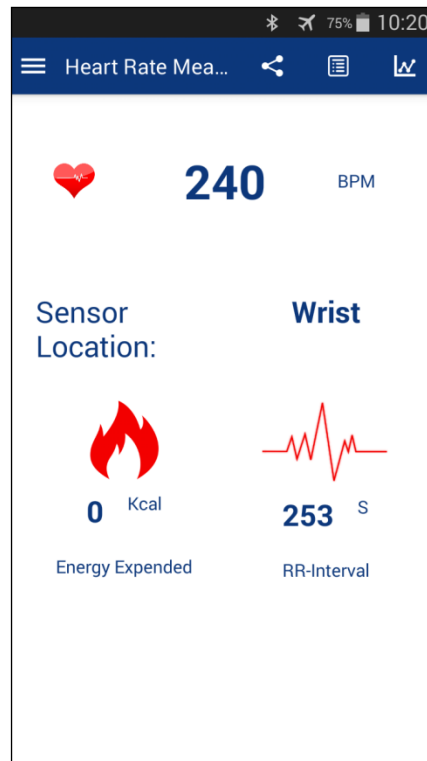


Figure 3. CySmart iOS app



Figure 4. CySmart Android app

Also, the Heart Rate Sensor can be used together with CySmart Central Emulation Tool for Windows. It is required to match the security settings between Heart Rate Sensor and CySmart Client and perform pairing (bonding) before any writing (enabling notifications etc.) into Server's GATT database. For further instructions on how to use CySmart application, see CySmart User Guide.

# Related Documents

Table 1 lists all relevant application notes, code examples, knowledge base articles, device datasheets, and Component / user module datasheets.

Table 1. Related Documents

| Document | Title | Comment |
|---|---|---|
| AN91267 | Getting Started with PSoC 4 BLE | Provides an introduction to PSoC 4 BLE device that integrates a Bluetooth Low Energy radio system along with programmable analog and digital resources. |
| AN91445 | Antenna Design Guide | Provides guidelines on how to design an antenna for BLE applications. |