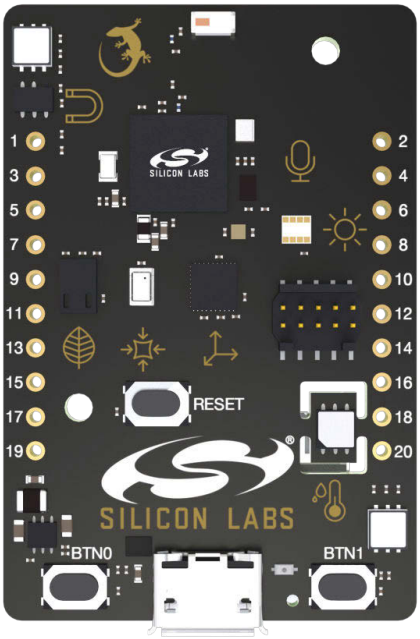
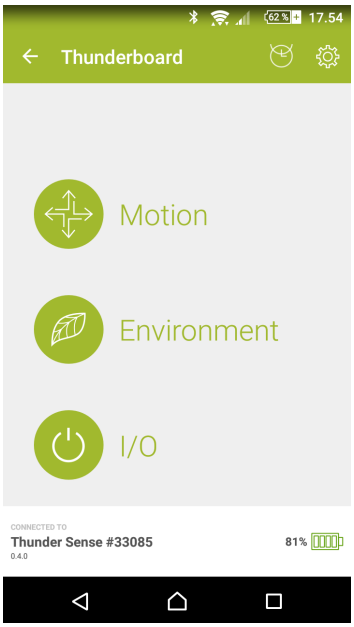
UG313: Thunderboard Sense 2 Bluetooth Low Energy Demo User's Guide

The Thunderboard™ Sense 2 Bluetooth® Low Energy Demo is a complete sensor-to-cloud solution for the Thunderboard Sense 2 kit and accompanying iOS/Android application.

The demo collects and processes sensor data from the Thunderboard Sense 2, and gives immediate graphical feedback to the user through the Thunderboard iOS/Android application. Cloud connection enables real-time graphs and past sessions of the sensor data to be viewed on other devices through the web client. The demo is open source and provides a great demonstration and evaluation tool for adding Bluetooth Low Energy connectivity to a sensor or actuator project.





THUNDERBOARD SENSE 2 HARDWARE

- Orderable pn: SLTB004A
- EFR32 Wireless System-on-Chip
- Hall effect sensor
- Relative humidity and temperature sensor
- UV index and ambient light sensor
- Indoor air quality gas sensor
- 6-axis inertial sensor
- Barometric pressure sensor
- MEMS microphone
- Four high brightness RGB LEDs

BLUETOOTH LOW ENERGY DEMO FIRMWARE

- Silicon Labs Bluetooth Low Energy protocol stack
- Board Support Package including board peripheral drivers
- Bluetooth LE services supporting hardware peripherals
- Source code available

THUNDERBOARD MOBILE APP

- Bluetooth Low Energy enabled mobile application
- iOS/Android platform support
- Cloud connected
- Source code available

THUNDERCLOUD

- Web client based on Google Firebase
- Visualizes real-time sensor data and past sessions
- Source code available

1. Introduction

The Thunderboard Sense 2 Bluetooth Low Energy Demo is an excellent starting point to get familiar with the Thunderboard Sense 2 and its many sensors and wireless connectivity. The demo consists of the Thunderboard Sense 2 and accompanying Bluetooth Low Energy (BLE) firmware, the Thunderboard app with cloud integration and a web client. Once the app and hardware is connected using BLE, the Thunderboard app receives sensor data from the Thunderboard Sense 2 at a regular interval for graphical visualization on the screen. The app lets the user turn on and off the LEDs on the board as well as control the intensity and color of the RGB LEDs using buttons and slide controls. If chosen, the app delivers sensor data to the cloud, which can be viewed live on other devices or saved for later use. Raw data from the sensors is also available for download.

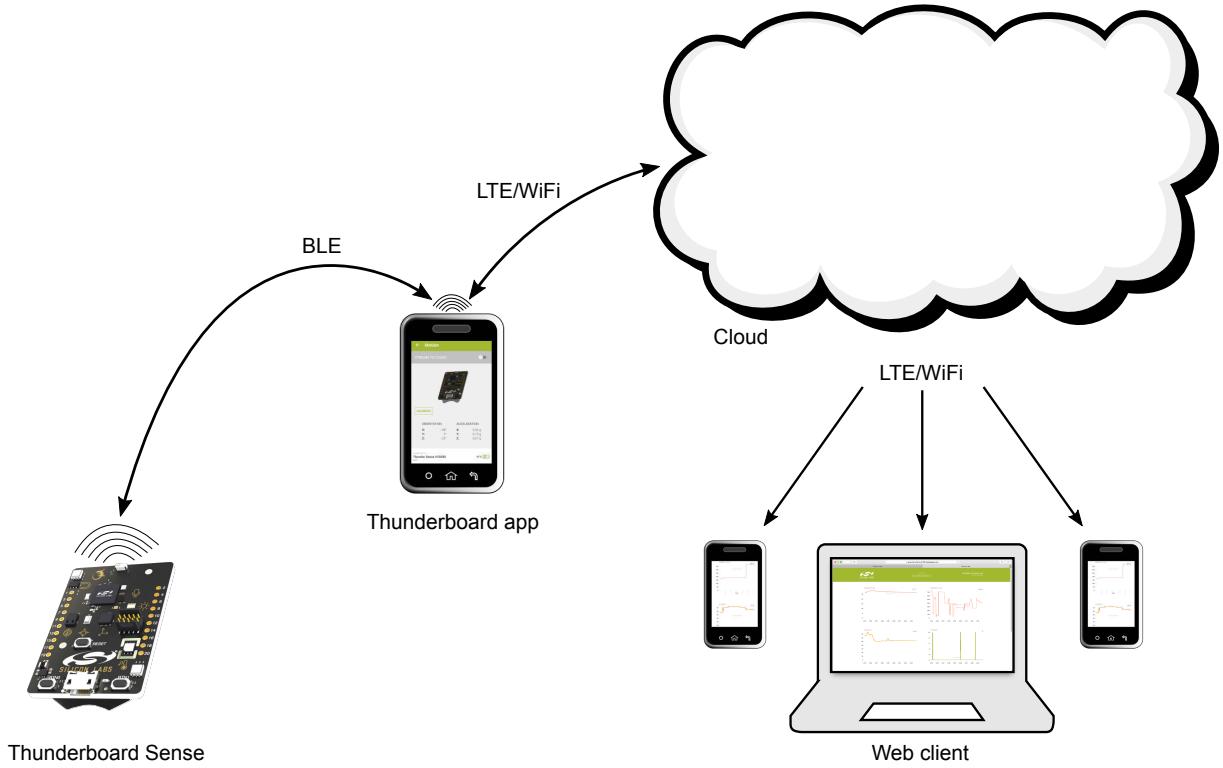


Figure 1.1. System Application Diagram

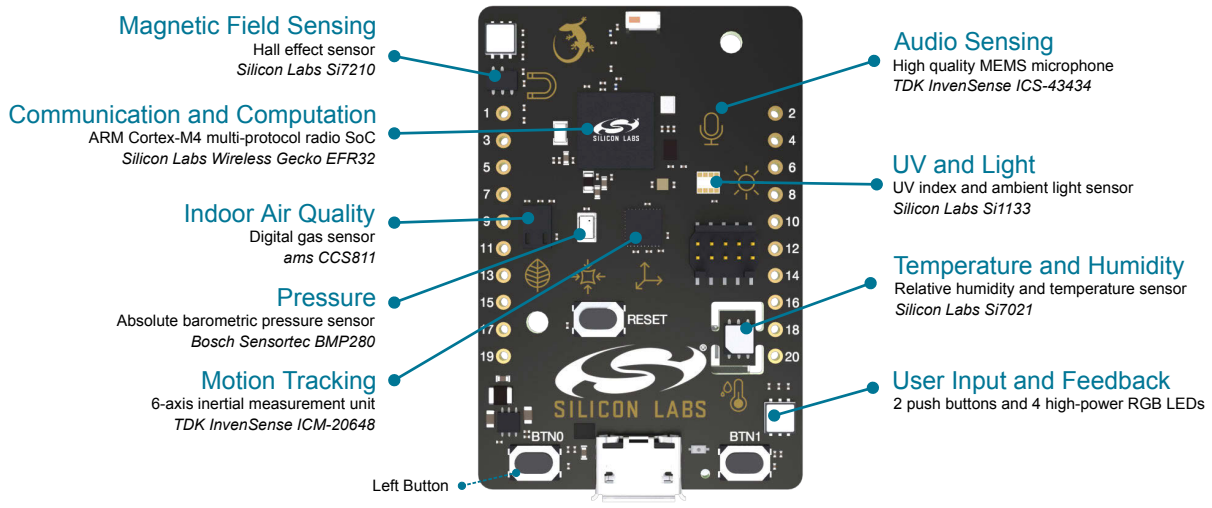


Figure 1.2. Thunderboard Sense 2 Hardware Features

More in-depth information on the Thunderboard Sense 2 can be found in *UG309: Thunderboard Sense 2 User´s Guide*. All instructions, collateral and source files for the solution can be found here: http://www.silabs.com/thunderboard.

2. Getting Started

This section describes how to quickly get started with the Thunderboard Sense 2 Bluetooth Low Energy Demo. Before proceeding, it is recommended to download Simplicity Studio and check for kit firmware updates.

1. Install the *Thunderboard* app from iOS App Store or Google Play Store

Links to the mobile app can be found here: http://www.silabs.com/start-sense.

2. Launch the app

If prompted, allow the app to turn on Bluetooth.

3. Supply power to the Thunderboard Sense 2

Connect a USB cable to the kit or insert a CR2032 coin cell battery. The Thunderboard Sense 2 now starts to advertise over Bluetooth for a duration of 30 seconds.

4. Connect the Thunderboard Sense 2 to the Thunderboard app

Click the device that shows up on the start-up screen on the Thunderboard app to connect the devices. If more than 30 seconds has elapsed since power was applied, the left button can be pushed to put the Thunderboard Sense 2 back in advertisement mode for another 30 seconds. A green LED blinks on the Thunderboard Sense 2 when the board is in advertisement mode and ready to be paired with the app. The figure below shows the firmware state diagram running on the kit and how the start-up screen on the app looks like when a Thunderboard Sense 2 is ready to be paired.

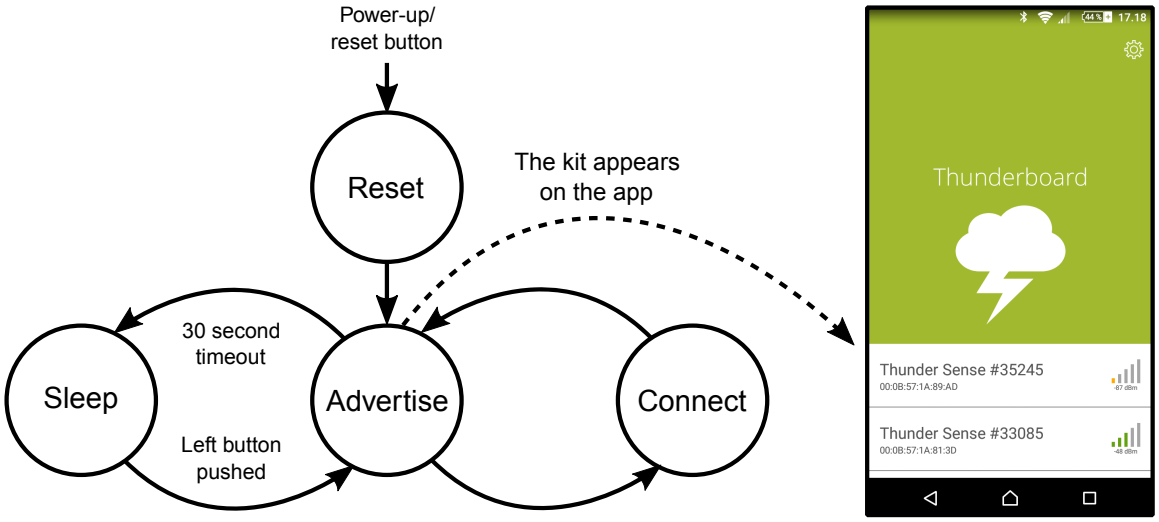


Figure 2.1. Kit Firmware State Diagram and App Start-up Screen

5. Explore the app

Click on the screen to navigate through the app, watch live sensor data and control the LEDs on the Thunderboard Sense 2. Streaming data to the cloud is also possible. The two figures below show screenshots from the app running on an Android phone.

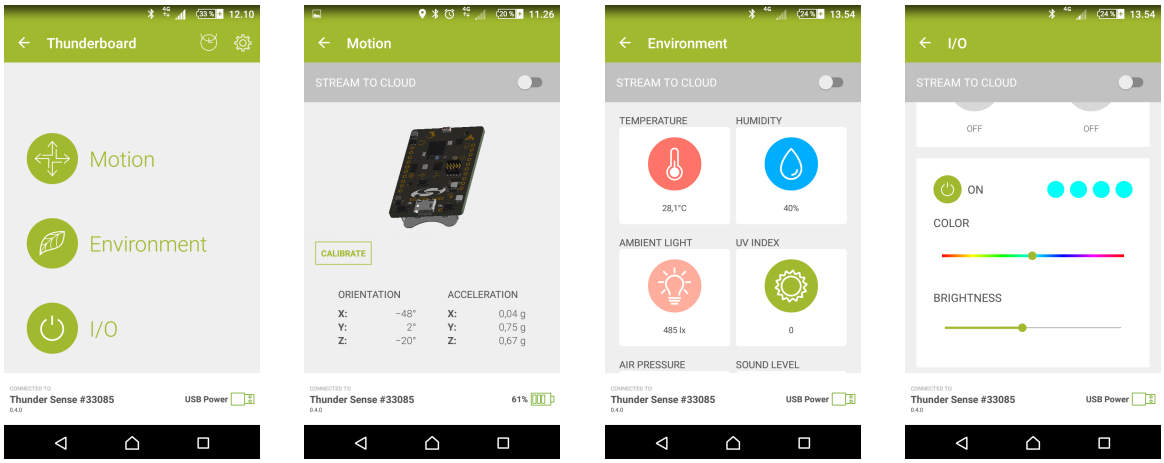


Figure 2.2. App Graphical User Interface

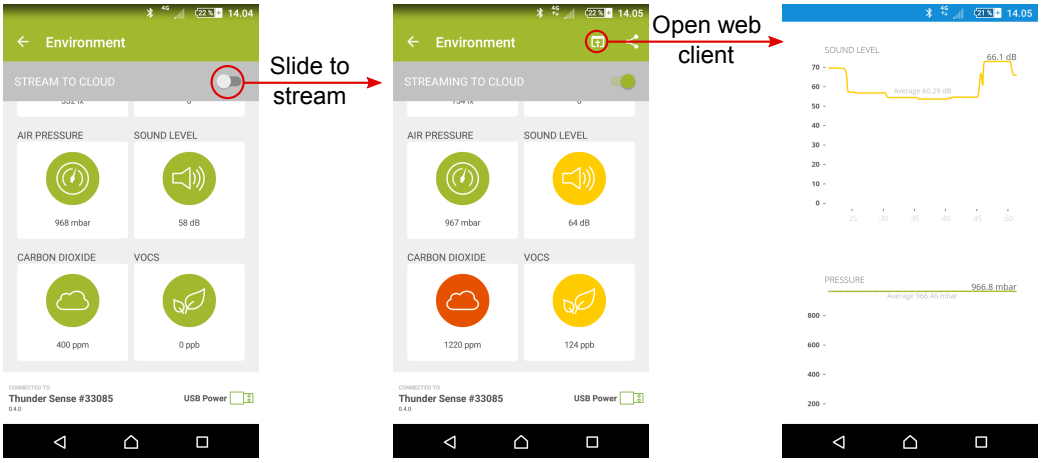


Figure 2.3. Stream To Cloud

6. Disconnect the Thunderboard Sense 2 from the Thunderboard app

Push the back-key until the start-up screen is reached, or close the app. Turn off Bluetooth if desirable.

3. Additional Information

3.1 Power Supply

The Thunderboard Sense 2 estimates the source impedance of its power source and transmits this information to the app. If the power source is classified as a CR2032 coin cell, the following features will be disabled in order to conserve power and avoid brown-out situations:

- RGB LEDs
- CCS811 indoor air quality sensor

The remaining battery percentage of the Thunderboard Sense 2 is also estimated and shown on the app if a battery source is powering the board. Note that some external batteries, especially if they are nearly discharges, may be classified as CR2032 coin cells even though they are not.

3.2 Motion Calibration

Calibration of the gyroscope is performed when launching the motion view, and the orientation of the board will be reset to a predetermined position. In motion view, recalibrating the gyroscope can be performed anytime by clicking the calibrate button. Remember to place the board on a level surface and orient the board in the same direction as the image of the board shown in the app. The board needs to be held steady while calibration is in progress.

3.3 Sensor Data Refresh Rate

The sensor read-out rate on the board and app directly influences the refresh rate of the sensor data shown on the screen. The environmental sensor data are, for instance, read at a fairly slow rate in order to conserve power. The refresh rate of the sensor data may differ depending on the firmware and app revision.

3.4 Gas Sensor Initialization

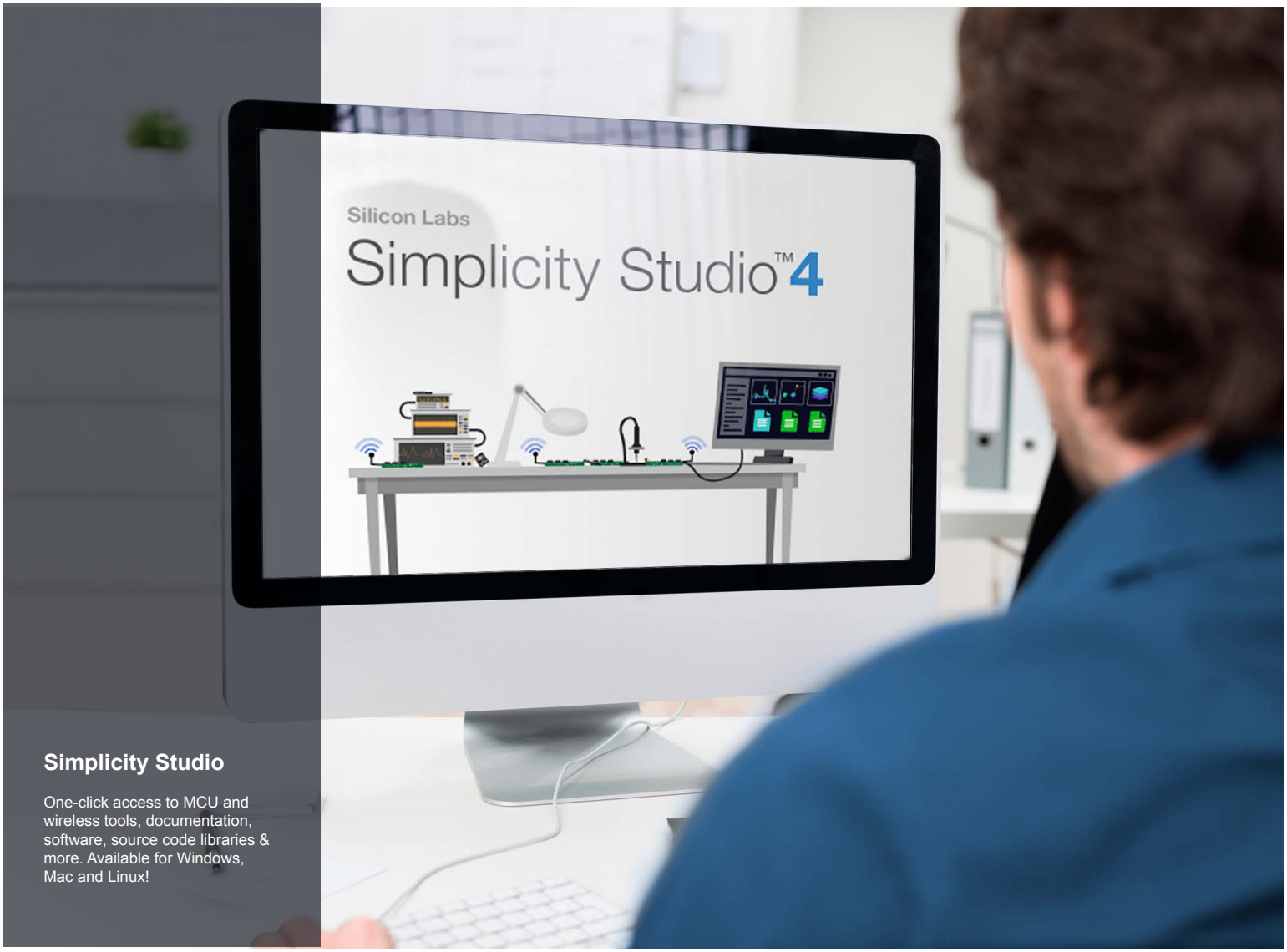
The indoor air quality sensor reporting carbon dioxide and volatile organic compounds to the Thunderboard app requires a start-up period before it transmits data to the app. The app will therefore show a value of 0 ppm and 0 ppb, respectively, during the start-up period.

4. Document Revision History

Revision 1.00

2017-09-27

Initial document version.



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