Ultra Low Power Connected Demo Reference Design

Ultra Low Power Connected Demo Reference Design User's Guide

Preface

The Ultra Low Power Connected Demo (ordering code: ATULPC-DEMO) Reference Design evaluation kit is a hardware platform to address the wearable and Internet of Things (IoT) markets.

The Ultra Low Power Connected Demo Reference Design (referred to as "the wearable" in this document) incorporates the Microchip SAM L21 microcontroller and ATBTLC1000 fully certified module with sensors to demonstrate a complete solution needed for the wearable and IoT.

Supported by the Atmel Studio integrated development platform, the kit provides easy access to the features that can be custom integrated in a design, which will significantly reduce the time-to-market.

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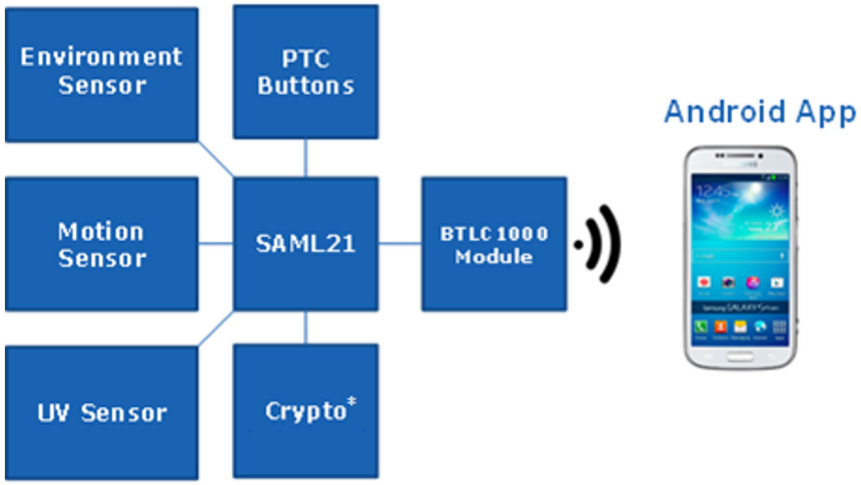
1. Introduction

This document helps the user to understand the underlying technical details and the steps to operate the SAM L21 Ultra Low Power Connected Demo.

1.1 Features and Overview

Figure 1-1. Functional Block Diagram



Note: * Crypto is an optional feature in the current design

Figure 1-2. Ultra Low Power Connected Demo Kit

1.2 Kit Overview

Figure 1-3. Top Side

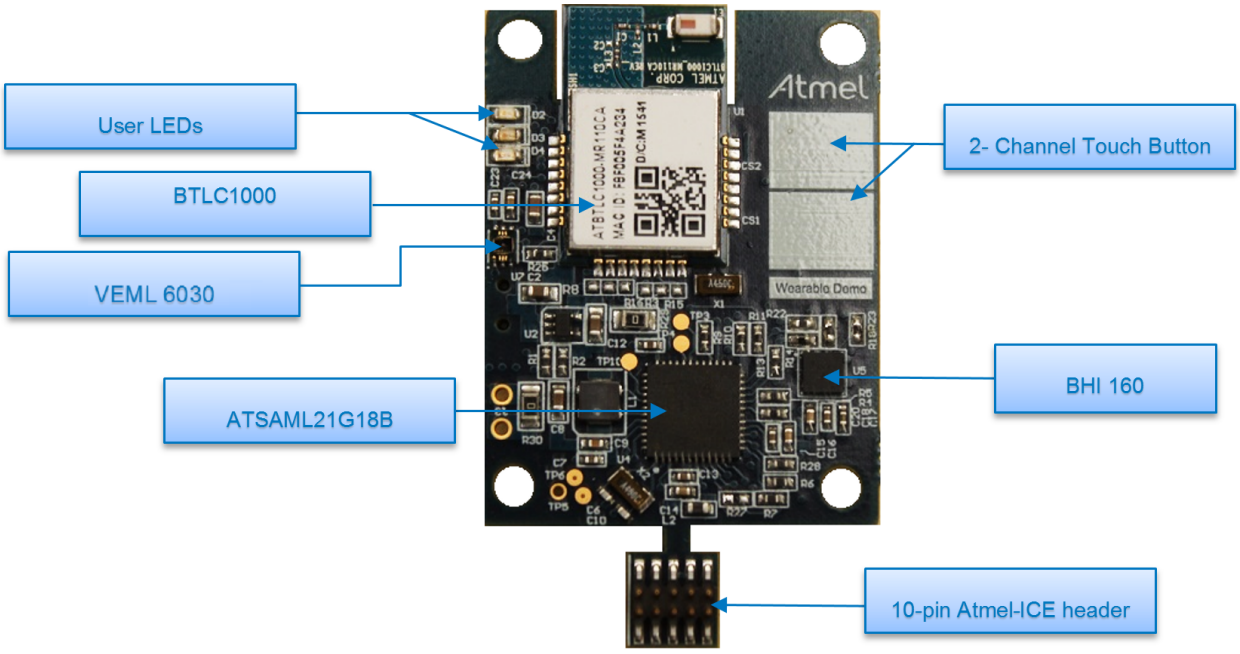
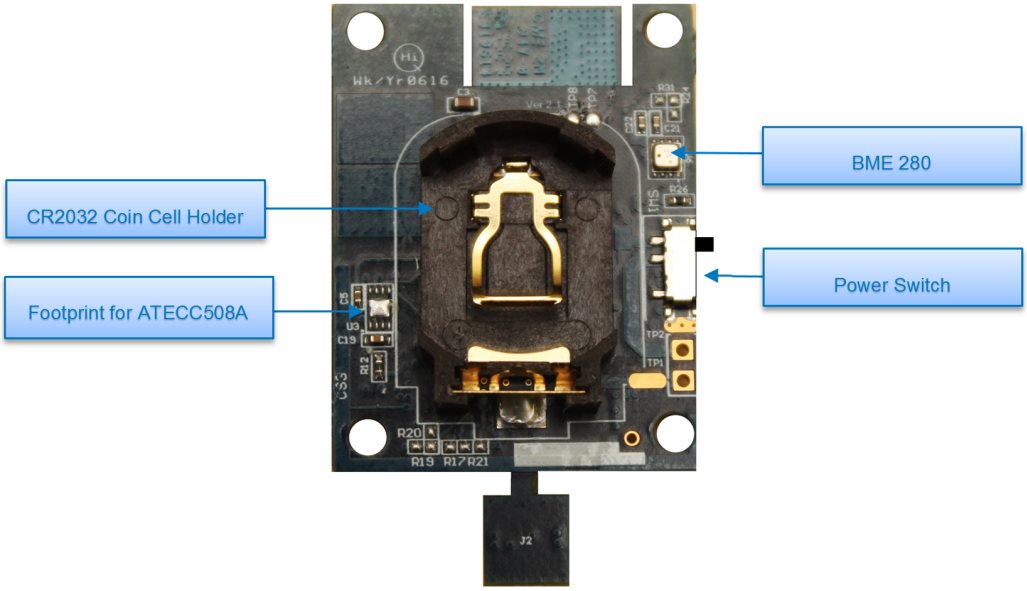


Figure 1-4. Bottom Side



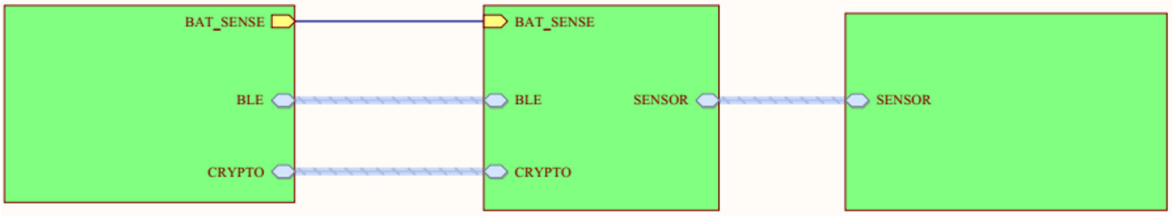
- Processor
  - SAML21G18B
- Sensors
  - Physical Sensors
    - Motion Sensors (6-axis motion BHI160)
      - Accelerometer
      - Gyro

        - Environmental Sensors (BME280)
            - Pressure
            - Humidity
            - Temperature
        - Light Sensor (VEML 6030)
            - Ambient Light
    - Virtual Sensors: The integrated Fuser Core of BHI160 receives raw sensor data from the connected sensors and provides virtual sensor data. The following virtual sensor data are supported in this reference design:
        - Game Rotation Vector
        - Step Detector
        - Gravity
        - Accelerometer
        - Gyroscope
- Crypto
    - ATECC508A
- Display
    - LED indicators for operational status
- Connectivity
    - ATBTLC1000 (an ultra low-power Bluetooth® Smart (BLE 4.1) System on a Chip (SoC))
- Power
    - CR2032 Coin Cell
- Programming Header
    - Atmel-ICE ARM 10-pin interface for programming
- CE/FCC certified
- Mechanical Dimension
    - 40mm x 30mm (excluding the programming header extension)

2. Getting Started

2.1 Quick Start

Figure 2-1. Functional Overview



The Microchip Smart SAM L21 MCU based on ARM® Cortex®– M0+, and the Microchip Smart Bluetooth solution are the key components of the Ultra Low Power Connected Demo platform. The ATBTLC1000 is an ultra low-power Bluetooth Smart SoC with Integrated Cortex – M0 MCU, transceiver, modem, MAC, PA, TR switch, and Power Management Unit (PMU). It can be used as a Bluetooth Low-Energy link controller or data pump with external host MCU or as a standalone applications processor with embedded BLE connectivity and external memory.

The qualified Bluetooth Smart protocol stack is stored in dedicated ROM. The firmware includes L2CAP service layer protocols, Security Manager, Attribute protocol (ATT), Generic Attribute Profile (GATT) and the Generic Access Profile (GAP). Additionally, application profiles, such as Proximity, Thermometer, Heart Rate, Blood Pressure etc., are supported and included in the protocol stack. The ATBTLC1000 exchanges data with SAM L21 MCU through UART interface.

A BHI160 6-axis Smart Hub motion sensor and a BME280 environmental sensor from Bosch™ Sensortec, Vishay® VEML 6030 light sensors form a network of sensors that provide periodic motion, environmental, and light sense data to SAM L21 MCU through two-wire interface. The entire wearable platform is powered by a simple coin cell battery. The Ultra Low Power Connected Demo reference design is powered by a CR2032.

2.2 Sensor Network

The organs of the Ultra Low Power Connected Demo are its sensors. The BHI160 integrates a 6-axis IMU with the Bosch Sensortec Fuser core. It provides a flexible, low-power solution for motion sensing and sensor data processing.

The BME280 is as combined digital humidity, pressure, and temperature sensor based on proven sensing principles.

The humidity sensor provides an extremely fast response time for fast context awareness applications and high overall accuracy over a wide temperature range. The pressure sensor is an absolute barometric pressure sensor with extremely high accuracy and resolution and drastically lower noise.

The integrated temperature sensor is optimized for the lowest noise and highest resolution. Its output is used for temperature compensation of the pressure and humidity sensors, and can also be used for estimation of the ambient temperature. VEML6030 is an ambient light sensor. The whole sensor network is connected to SAM L21 through a two-wire interface.

2.3 Design Documentation and Related Links

- SAM L21 Family Data Sheet: http://www.microchip.com/60001477/
- ATBTLC1000 fully certified module: http://www.microchip.com/wwwproducts/en/ATBTLC1000
- BHI160: https://www.bosch-sensortec.com/bst/products/all_products/bhi160
- BME280: https://www.bosch-sensortec.com/bst/products/all_products/bme280
- VEML6030: https://www.vishay.com/optical-sensors/list/product-84366/
- Ultra Low Power Connected Demo Android™ App: https://play.google.com/store/apps/details?id=com.atmel.wearables

Note: The mobile app shown in this user guide is for reference only. Microchip does not provide support for any mobile app related development or issues that may occur. Refer to the license agreement accompanying this Software for additional information regarding your rights and obligations.

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3. User Guide

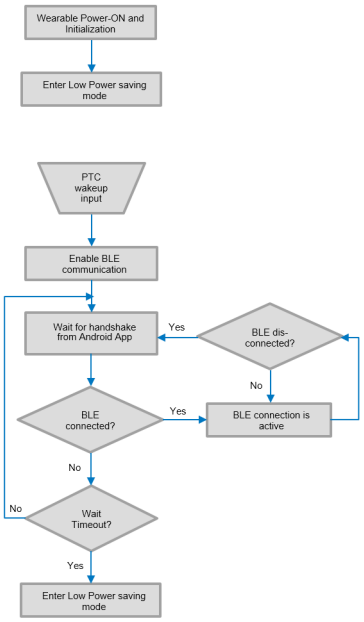
3.1 Kit Operation

The Ultra Low Power Connected Demo is powered using a CR2032 coin cell. A switch controls the power supply to the entire system. After power is ON, the wearable goes through the initialization phase where the MCU's internal system, BTLC1000 and all the connected sensors are initialized. The end of the initialization phase is indicated by the ON to OFF transition of power LED. After this phase, the user can enable BLE communication by "Touch and Hold" any one of the PTC button for about 1 second. When it is enabled, the BLE LED start to blink for 1 sec OFF + 1 sec ON. At this time, the user can connect the wearable from wearable Android App using the "Connect" button.

When the connection is established, the BLE LED will start blinking at faster rate, and the user can navigate to different Android App screens to check the sensor values, 2-D graphs, and 3-D plots. For the list of Android app screens supported, refer to the section Android Application Operation in this document. If user input is not received after the BLE is enabled or if the active session is disconnected from the Android app, the wearable enters to Low Power mode thus saving the system power consumption.

Refer to the following Functional Flow for additional details.

Figure 3-1. Functional Flow



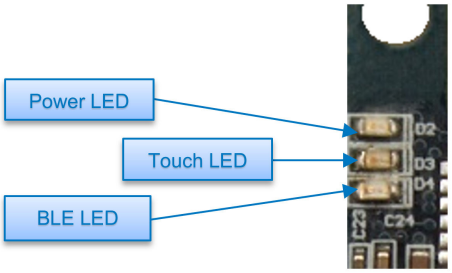
3.1.1 Status LED(s)

The Ultra Low Power Connected Demo supports three user interface LED(s).

- **Power LED:** The Power status LED blinks every 60 seconds. The reset status is ON to keep the user informed about the wearable initialization phase, which approximately takes 15 to 16 seconds.
- **Touch LED:** The Touch LED blinks when the user swipe across the 2-channel touch surface is detected in either right or left direction. The reset status is OFF.

- **BLE connection status LED:** The BLE status LED blinks at the rate of 50% duty cycle with period equal to 2 Sec when there is no active BLE connection. During an active BLE connection, the LED blinks at the rate of 980 msec (OFF) + 20 msec (ON). The reset status is OFF.

Figure 3-2. Status LEDs

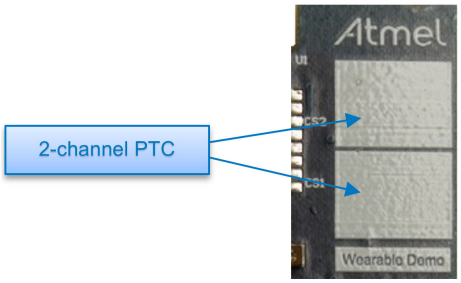


3.1.2 PTC Buttons

The touch plays a major role for the user interface. The 2-channel PTC on the top side of the wearable has three functionalities.

- **Enable BLE connection:** After the wearable power ON initialization, device is in Low-Power mode. The user must touch and hold anywhere in PTC button for about 1 Sec to enable BLE connection. Both touch buttons act as single button for waking up the device.
- **Wakeup from Low-Ppower mode:** Touch and hold any one of the PTC button for 1 Sec to wake-up the wearable from Low-Power mode. Exiting from Low-Power mode puts the BLE in Advertising mode. If connection is not established within 60 seconds, the wearable re-enters the Low-Power mode for power saving.
- **Swipe the Android App screen(s):** When the BLE connection is established with the Android phone and the app is active, swiping across the 2-channel PTC button from bottom to top or vice-versa equivalently swipe the app screen left to right or from right to left accordingly.

Figure 3-3. PTC Buttons



3.1.3 Bluetooth LE Operation

This design incorporates Microchip's Bluetooth Smart (BLE) technology using ATBTLC1000 BluSDK version 4.0.

In this design, Ultra Low Power Connected Demo acts as GAP peripheral which can advertise (to let other devices know its existence) and mobile application acts as GAP Central which scans for other devices and sends a connection request to establish a connection.

To exchange data between two connected devices, it uses Generic Attribute Profile (GATT) of BLE stack. It defines the way that two BLE devices transfer data back and forth using concepts called Services and Characteristics. GATT comes into play once a dedicated connection is established between the two devices.

Services are used to break up data into logic entities, and contain specific chunks of data called characteristics. A characteristic is a value used in a service along with properties and configuration information about how the value is accessed. A characteristic definition contains a characteristic declaration, characteristic properties, and a value.

A service can have many characteristics and each service distinguishes itself from other services by means of a unique numeric ID called a UUID, which can be either 16-bit (for standard BLE Services) or 128-bit (for custom services).

The Ultra Low Power Connected Demo kit uses custom profile with 128-bit unique UUIDs. It uses base 128-bit UUID: F05A0000-3936-11E5-87A6-0002A5D5C51B. All services use 128-bit UUIDs, but for easy documentation reason the 16-bit part is listed in this document. It is embedded in the 128-bit UUID as shown in the below example.

Example: 0xBAD0 maps as F05ABAD0-3936-11E5-87A6-0002A5D5C51B. All UUIDs that are mapped to 128-bit values are marked *.

In this design, Ultra Low Power Connected Demo acts as GATT Server which stores data locally and provides data access methods to a remote GATT client. Mobile Application acts as GATT client which accesses data on the remote GATT server through read, write, or notify operations.

The custom profile uses the following functions:

- Enable or disable sensor data from mobile application
- Configure sensor Output Data Rate (ODR) from mobile application
- Send data for enabled sensors at set output data rate to mobile application
- Send notifications for events, such as drop detection, low battery, step count, and touch gesture to mobile application

Table 3-1. Environment Service

Characterics	UUID	Properties	Data
Environment Data	BAD0 *	Read/Notify	(9 Bytes) Byte0 = Temp LSB Byte1 = Temp MSB Byte2 = Pressure LSB Byte3 = Pressure MSB Byte4 = Light LSB0 Byte5 = Light LSB1 Byte6 = Light MSB0 Byte7 = Light MSB1 Byte8 = Humidity
ODR	BAD1 *	Read/Write	1 Byte

When Environment Data Characteristics notification is enabled from the application. The sensors (BME280 and VEML6030) will perform measurements at set ODR. The data is updated in the Environment Characteristics and notification is sent to application. This data is used to display environment data in mobile application. When Environment Data Characteristics notification is disabled from application, the sensor is put in Stand-by mode.

Output Data Rate can be set by the application and it uses ODR Characteristics. The following ODR settings are allowed for Environment sensors

- 1Hz
- 2Hz
- 4Hz
- 8Hz
- 10Hz

ODR settings can be configured using mobile application settings screen.

Table 3-2. Environment Service Protocol

User Action	From Wearable	From Android Phone
User enters to Environment Screen		Enable Environment Characteristics Notification
Environment Screen	Update Environment Characteristics with sensor data and send notification to application at set ODR	
When user moves out of Environment Screen		Disable Environment Characteristics Notification
User Opens settings screen		Read ODR Characteristics to get the current Output Data Rate for environment sensors
User sets new ODR value for environment sensors in Settings Screen		Write ODR Characteristics to set the new Output Data Rate for environment sensors

Table 3-3. Device Orientation Service

Characteristics	UUID	Properties	Data
Device Rotation Vector	BAD8 *	Read/Notify	(8 Bytes) Byte0 = X LSB Byte1 = X MSB Byte2 = Y LSB Byte3 = Y MSB Byte4 = Z LSB Byte5 = Z MSB Byte6 = W LSB Byte7 = W MSB
Gyro-Positions	BAD4 *	Read/Notify	(6 Bytes) Byte0 = X LSB

Characteristics	UUID	Properties	Data
			Byte1 = X MSB Byte2 = Y LSB Byte3 = Y MSB Byte4 = Z LSB Byte5 = Z MSB
Accelero-Positions	BAD7 *	Read/Notify	(6 Bytes) Byte0 = X LSB Byte1 = X MSB Byte2 = Y LSB Byte3 = Y MSB Byte4 = Z LSB Byte5 = Z MSB
Drop Detection	BADA *	Notify	1 Byte
Step Increment	BADB *	Notify	1 Byte
ODR	BAD9 *	Read/Write	1 Byte

If even one of the Characteristics notification of this service is enabled from application, the sensor performs measurements at set ODR. The rotation vector data is updated in the Device Rotation Vector Characteristics and the accelerometer position data is updated in the Accelerometer-Positions Characteristics.

After updating the data, Ultra Low Power Connected Demo sends notification to the application. Ultra Low Power Connected Demo uses Game Rotation Vector (Quaternion+) data from BHI160 sensor for device orientation (3D image) plotting. Accelerometer data is used for 2D plotting graph in mobile application.

If Step Increment Characteristics notification is enabled by application, Ultra Low Power Connected Demo sends Step Increment notification to application for each step detection. This data is used for Step Count Screen in mobile application.

If Drop Detection Characteristics notification is enabled by the application, Ultra Low Power Connected Demo sends Drop notification to the application when it detects a device drop. This data is used for ‘Wearable Drop Detected’ popup in mobile application.

The BHI160 sensor is put in Stand-by mode, when all Device Orientation Characteristics notifications are disabled from the application. In other words, if the user navigates to environmental screen, BHI160 will be put in Stand-by mode.

Output Data Rate can be set by the application and it uses ODR Characteristics. The following ODR settings are allowed for Motion Sensors (Accelerometer and Gyroscope sensors).

- 12.5 Hz
- 25 Hz
- 50 Hz
- 100 Hz

- 200 Hz

Table 3-4. Device Orientation Service Protocol

User Action	From Wearable	From Android Phone
User enters to 3D Plot Screen		Enable Device Rotation Vector Characteristics Notification
3D Plot Screen	Update Device Rotation Vector Characteristics with Quaternion+ data and send notification to application at set ODR	
When user moves out of 3D Plot Screen		Disable Device Rotation Vector Characteristics Notification
User enters to Step Count Screen and starts step count.		Enable Device Step Increment Characteristics Notification
Step Count Screen or any other screen	Send Step Increment Characteristics notification for each step detection	
Stops step count in Step Count Screen		Disable Device Step Increment Characteristics Notification
User enters to 2D Plot Screen (Accelerometer graph) and start the plot.		Enable Accelero-Positions Characteristics Notification
2D Plot screen	Update Accelero-Positions Characteristics with accelerometer data and send notification to app	
When user moves out of 2D Plot Screen		Disable Accelero-Positions Characteristics Notification
User enters to 2D Plot Screen (Gyroscope graph) and start the plot.		Enable Gyro-Positions Characteristics Notification
2D Plot screen	Update Gyro-Positions Characteristics with Gyro data and send notification to app	
When user moves out of 2D Plot Screen		Disable Gyro-Positions Characteristics Notification
User Opens settings screen		Read ODR Characteristics to get the current Output Data Rate for motion sensors
User sets new ODR value for environment sensors in Settings Screen		Write ODR Characteristics to set the new Output Data Rate for motion sensors

User Action	From Wearable	From Android Phone
User enables Drop Detection in Settings Screen		Enable Drop Detection Characteristics Notification
User drops device	Send Drop Detection Characteristics notification	

Table 3-5. Battery Service

Characteristics	UUID	Properties	Data
Low Battery	BADC *	Notify	1 Byte

This service is used to send a low battery notification to mobile application. It has one characteristics Low Battery. Notification for this characteristics is enabled by the application once connection is established. When Ultra Low Power Connected Demo detects low-battery voltage, it sends notification to mobile application. Mobile application displays the 'Wearable Low Battery' pop up message, when it receives low battery notification from Ultra Low Power Connected Demo.

Table 3-6. Battery Service Protocol

User Action	From Wearable	From Android Phone
BLE connection is established between mobile application and Ultra Low Power Connected Demo		Enable Low Battery Characteristics Notification
Any Screen	Send Low Battery Characteristics notification when low battery voltage is detected.	

Table 3-7. Touch Service

Characteristics	UUID	Properties	Data
Touch Gesture	BADD *	Notify	1 Byte

This service is used to send left swipe or right swipe notification to mobile application. It has one characteristics Touch Gesture. Notification for this characteristics is enabled by the application once connection is established. When the Ultra Low Power Connected Demo detects left swipe or right swipe, it sends notification to the mobile application. The mobile application navigates the screen based on touch gesture received from the Ultra Low Power Connected Demo.

Table 3-8. Touch Service Protocol

User Action	From Wearable	From Android Phone
BLE connection established between mobile application and Ultra Low Power Connected Demo		Enable Touch Gesture Characteristics Notification
Any Screen	Update Touch Gesture Characteristics with gesture data and send notification to app.	

3.1.4 Debug/Programming Interface

The Ultra Low Power Connected Demo kit supports SWD debugging/programming interface through 10-pin Atmel-ICE ARM standard header. SAM-ICE can also be used with compatible 10-pin cable. Refer to Debugger pin assignments in the hardware schematic diagram.

Debug/Programmer: Atmel-ICE

IDE: Atmel Studio 7

ATBTLC1000: eFuse bits programmed to 4-wire mode

ATBTLC1000 has separate SWD interface, which can be connected to SAM-ICE for eFUSE programming.

CAUTION: The eFuse bits on the ATBTLC1000 module is mounted on the Ultra Low Power Connected Demo kit are pre-programmed before shipping. Re-programming the ATBTLC1000 module is not recommended as this will cause the Ultra Low Power Connected Demo to stop functioning.

Figure 3-4. Atmel-ICE 10-pin Header Orientation

3.2 Android Application Operation

The Wearable Android App is supported on Android phones/tabs running Android Kitkat, Lollipop and Marshmallow with Bluetooth BLE support.

3.2.1 App Screens

3.2.1.1 Main Screen

The Main Screen or Home Screen lists the available wearable devices in the vicinity.

When this page launches, the app should automatically start scanning for available wearables. The list should show all the available wearables within the range, by the device name, device address, and signal strength (in dB). Next to the name of each wearables, there is a button “CONNECT”.

The user must select a wearable in the list and connect by tapping on the “CONNECT” button. When connected, the app automatically navigates to the proximity screen. If the Wearable kit is already connected to the App, then the Main Screen will list the connected Wearable with “DISCONNECT” button. When disconnect button is pressed, the App should again scan the available wearable in the vicinity.

The scan should be stopped as soon as the user press the “STOP SCAN” button. There should be a Navigation drawer button in the Main Screen. Pressing the Back button should exit from the application. There should be no action corresponding to a swipe to the right or to the left on the App screen or on the touch buttons on the wearable.

Figure 3-5. Main Screen before Scanning

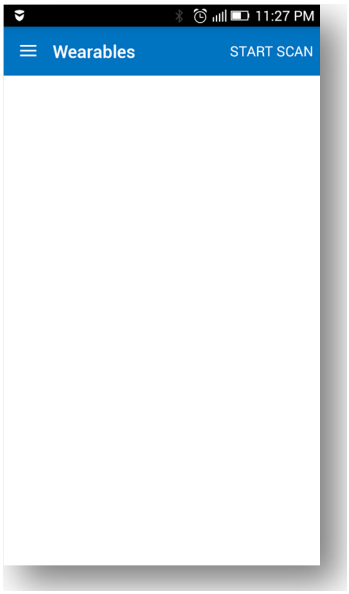


Figure 3-6. Main Screen while Scanning

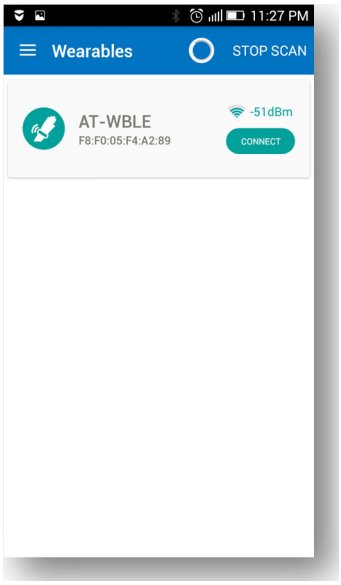
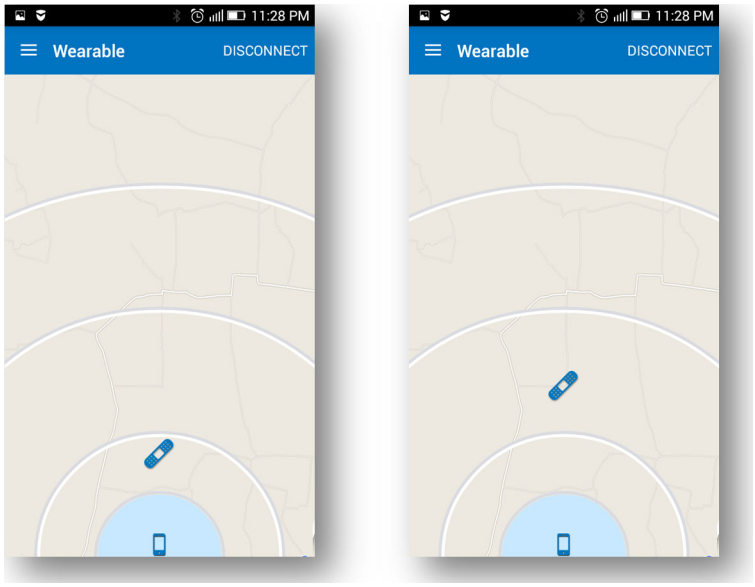


Figure 3-7. Connection In-progress

3.2.1.2 Proximity Screen

The figure below display the status of the Bluetooth link and using RSSI, the approximate range between the Android Host and the wearable can be located with a location icon. There is a Navigation Drawer button on the top left of the screen and a “DISCONNECT” button on the top right of the screen. When the user taps on this button, the wearable gets disconnected from the app and displays the Main Screen.

Figure 3-8. RSSI plot



3.2.1.3 Environmental Sensor Screen

The Environment App screen includes the following parameters with a graph button against each of them:

- Temperature (deg C or F)
- Humidity (%RH)
- Pressure (mbar)
- Light (lx)

The user is re-directed to the corresponding graph when the user presses the Graph button. There is a Navigation Drawer button on the top left of the screen and a “DISCONNECT” button on the top right of the screen. When the user taps on this button, the wearable gets disconnected from the app and displays the Main Screen. The graph plot against each parameters has the ability to hold the last 5 minutes to 1 hour data.

Figure 3-9. Environmental Sensor Screen

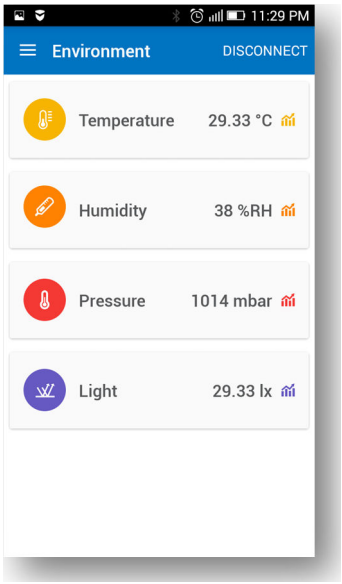


Figure 3-10. Temperature Plot

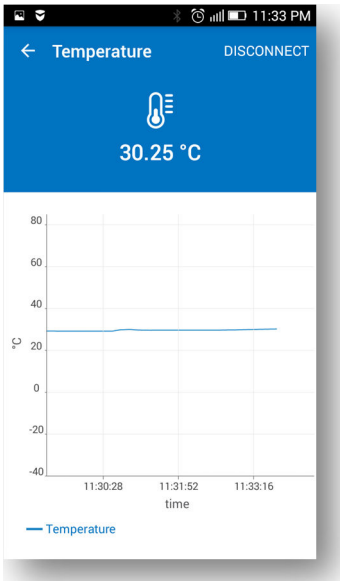


Figure 3-11. Humidity Plot

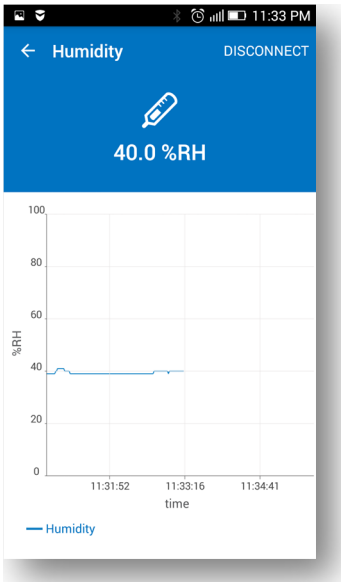


Figure 3-12. Pressure Plot

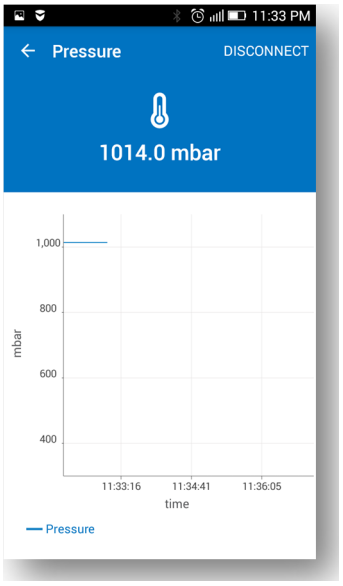
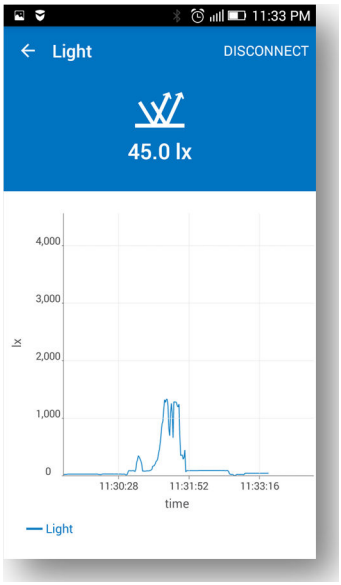


Figure 3-13. Light Plot

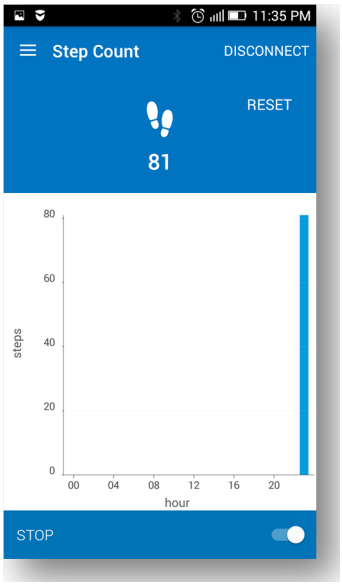


The user can slide the graph to the right or left as well as zoom in or zoom out. When the user zooms out the graph, the graph shows the last 1 hour data.

3.2.1.4 Step Count

The Step Count Plot is a 24-hour plot (12 a.m to 12 p.m) with one hour resolution points on the X-axis and Step Counts on the Y-axis. The Y-axis is auto scalable and the Y axis scale is auto-adjusted based on maximum Step Count for the available data. When the slider on the right bottom is flipped to ON state, irrespective of the screen, the counter increment for every Step Count is detected until the slider is flipped to OFF state. At the stop condition, the latest value of the Step Count is retained till the end of the plot time period. The latest value of the Step Count is shown on the top screen. When no step is detected, count will be taken as zero. When the “RESET” button is pressed, the value of the Step Count reset back to zero. The Step Count plot once started, irrespective of screen, the available Step Count data is plotted in the graph if the Step Count is detected. After every 24 hours, the plot resets itself.

Figure 3-14. Step Count Value and Plot



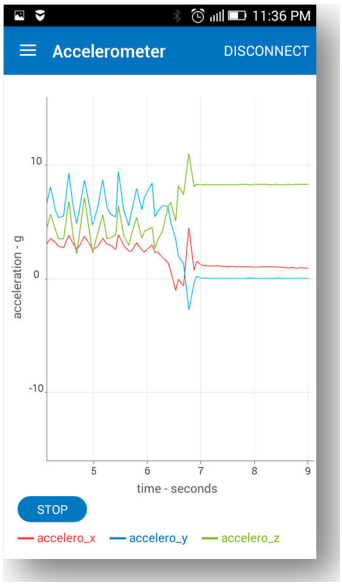
There is a Navigation Drawer button on the top left of the screen and a “DISCONNECT” button on the top right of the screen. When the user taps on this button, the Wearable gets disconnected from the app and displays the Main screen. The Step Count graph history can be cleared from the Setting Screen. Swiping the screen to the left displays the Environment Screen and swiping the screen to the right displays the Accelerometer Screen.

3.2.1.5 Motion Sense Screen

The screen below and the next app screen shows the Accelerometer plot and the Gyroscope plot. The Accelerometer plot is a 2D plot of Accelerometer against time from the data output from 6X sensor fusion algorithm. The 2D Plot of Accelerometer has time plot on x-axis and accelerating on the y-axis.

The 2D Plot of Gyroscope has time plot on x-axis and rotational speed (degree or second) on the y-axis. The user at any instance can “START” or “STOP” the plot using the button on the left bottom screen.

Figure 3-15. Accelerometer Plot

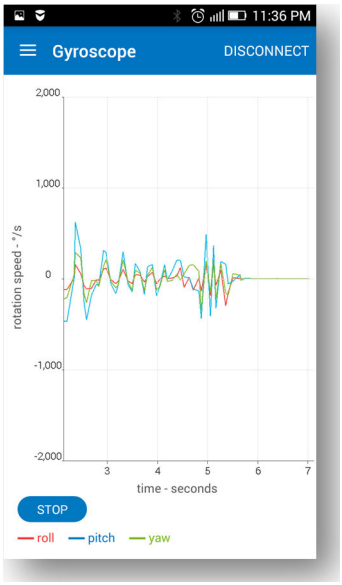


The Navigation Drawer button is on the top left of the screen and a “DISCONNECT” button is on the top right of the screen. When the user taps on this button, the wearable gets disconnected from the app and displays the Main Screen.

Swiping the screen to the left outside the plot take the user to the Step Count screen and swiping the screen to the left from within the plot allows the user to traverse along x-axis.

Swiping the screen to the right outside the plot take the user to the Gyroscope screen and swiping the screen to the right from within the plot allows the user to traverse along x-axis.

Figure 3-16. Gyroscope Plot



The Navigation Drawer button is on the top left of the screen and a “DISCONNECT” button is on the top right of the screen. When the user taps on this button, the wearable gets disconnected from the app and displays the Main Screen.

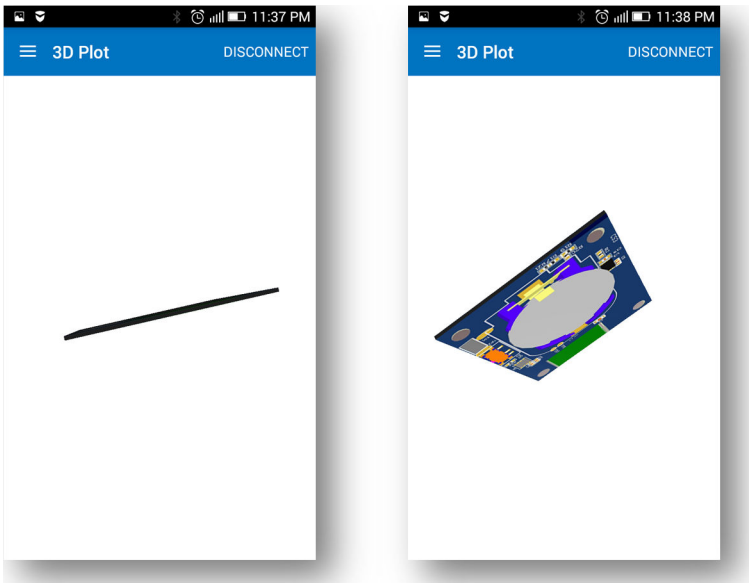
Swiping the screen to the left outside the plot take the user to the Accelerometer screen and swiping the screen to the left from within the plot allows the user to traverse along x-axis.

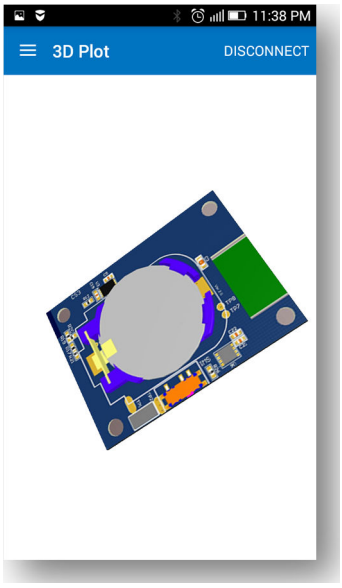
Swiping the screen to the right outside the plot take the user to the 3D Plot screen and swiping the screen to the right from within the plot allows the user to traverse along x-axis.

3.2.1.6 3D Plot

The image below shows the 3D plot of the wearable, thanks to the Quaternion Game Rotation Vector Data from BHI160 Sensor Fusion Core. The Navigation Drawer button is on the top left of the screen, and a “DISCONNECT” button is on the top right of the screen. When the user taps on this button, the wearable gets disconnected from the app and displays the Main Screen.

Figure 3-17. 3D Plot Screens





Pressing the Back button displays the Main screen. Swiping the screen to the left displays the Gyroscope Screen and swiping the screen to the right has no action.

3.2.2 Alert Messages

The Wearable App displays the following alert messages, irrespective of the screen in which the user is currently at.

- If the wearable is out of range, the “Wearable Out of Range” alert message will be displayed.
- If the wearable is being dropped on the floor, the “Wearable Drop Detected” alert message will be displayed.
- If the voltage of the wearable coin cell is below threshold (i.e., ~2.4V), the “Wearable Low Battery” alert message will be displayed.

Among the above three alert notifications, the last message has the highest priority in a scenario of simultaneous occurrence of all the three notifications. If the voltage of the wearable coin cell is below the threshold, the alert message will be displayed and alarmed continuously until the wearable is brought back to the range and the wearable re-connects. The user can only silence the alarm but cannot discard the notification, but the user can exit from the application by pressing ‘EXIT’.

If simultaneously the wearable is dropped on the floor and the voltage of the coin cell is below the threshold, then the alert messages alter among the two for a time period of 3 seconds each, until the user acknowledges the message by tapping 'OK' on the message. However, there is no corresponding acknowledgment action from the Android app side. Tapping OK will exit the alert message.

The images below display the three different alert messages.

Figure 3-18. Out of Range

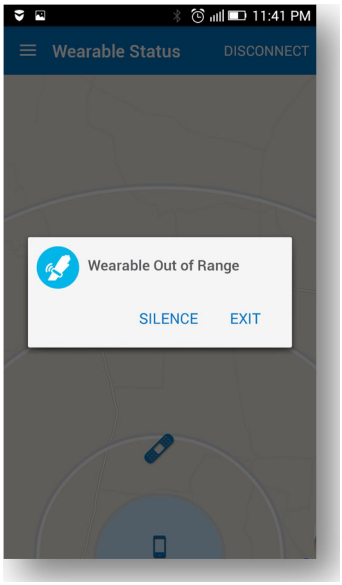


Figure 3-19. Drop Detection

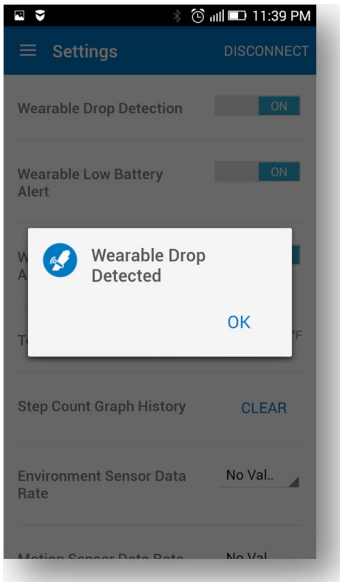
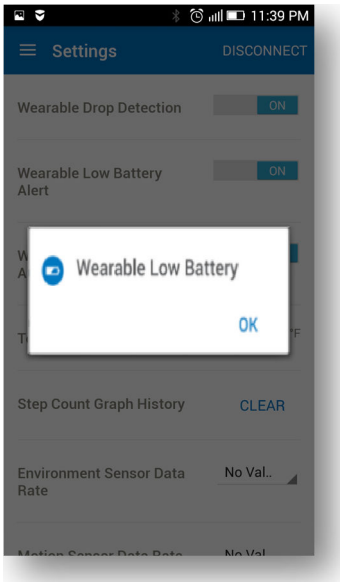


Figure 3-20. Low Battery



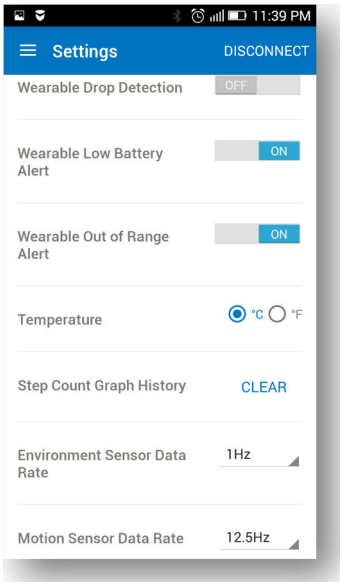
3.2.3 Settings Screen

In the Settings menu, the user can manually turn ON or OFF the alert notifications below and configure the ODR of sensors.

- Wearable Drop Detection
- Wearable Low Battery
- Wearable Out of Range
- Temperature unit selection (degree C or F)
- Option to clear Step Count Graph History
- Option to modify the Output Data Rate (ODR) for Environmental sensor
- Option to modify the Output Data Rate (ODR) for Motion sensor

There is a Navigation Drawer button on the top left of the screen.

Figure 3-21. Setting screen



3.3 Testing and Known Issues

The Ultra Low Power Connected Demo kit and Android App has been tested on different Android OS versions running on different Android Phones/Tabs.

KitKat - Samsung galaxy tab, Lenovo A6000, Lenovo K3 Note, Redmi Note 2 prime

Lollipop - Nexus9, Lenovo A6000

Marshmallow - Nexus6, Lenovo K3 Note

3.3.1 Erratas

The “ Wearable Out-Of-Range” alert message goes off automatically and the sensor values on-screen are frozen to the last known values. There is no auto re-connection during this time even if BLE advertising is active. This issue is observed with Android One running on the KitKat 4.4.4 version. After around 30 seconds, the OS informs the app incorrectly that the connection has been re-established again.

3.4 Ultra Low Power Connected Demo on the Public Domain

- https://www.microchip.com/pressreleasepage/microchip-releases-ULP-BLE-Demonstrator
- http://www.atmel.com/about/news/release.aspx?reference=tcm:26-79357
- https://www.youtube.com/watch?v=blb4XynMWkc

4. Revision History

Table 4-1. Revision A - 09/2017

Section Name or Type	Update Description
General Updates	• Updated from Atmel to Microchip style and template • Literature number was changed from Atmel 42750A to Microchip DS00000000A • Document revision letter remains at "A" • ISBN number added • The Light Sensor component was changed from VEML6080 to VEML6030

Table 4-2. Revision A - 08/2016

Comments
Initial Atmel document release.

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