Wireless Sensor Platform
C-WSEP-ARD
Arduino shield ready sensor prototyping platform

Description:
The notWired.co C-WSEP-ARD is an Arduino Shield ready sensor prototyping platform. By use of I2C and SPI break out boards (sold separately) the C-WSEP-ARD allows the testing of individual sensors, comparison of sensors side by side as well as the prototyping of various sensors working together as a mini-system, making the C-WSEP-ARD ideal for proof of concept design.

Communication to the C-WSEP-ARD takes place through the break out board, EMCOM-FT230X. This USB to UART converter can be used for programming, debugging output/application mode, and in the case of some Wireless modules direct communication. The C-WSP-ARD shield allows for up to 5 sensors to be connected (4 sections are dedicated to I2C inputs and one spot is designated for SPI) at any one time. In addition, a series of DIP switches allows for individual device interrupts. The C-WSP-ARD can be powered by different supplies – battery, USB or through the wireless plug in module.

Additional Information:
Arduino Shield: https://store-usa.arduino.cc/products/a000066
Nordic based Long Range BLE: https://www.notwired.co/ProductDetail/NWBLNRF52SKY66112-NotWired-CO/605602
NotWired.co Breakout Boards:
Motion: https://www.notwired.co/FeaturedProducts.aspx?type=10368&manf=1594&cate=1594:2&NavType=2&sd=true
Audio: https://www.notwired.co/FeaturedProducts.aspx?type=10368&manf=1594&cate=1594:4&NavType=2&sd=true
Environment: https://www.notwired.co/FeaturedProducts.aspx?type=10368&manf=1594&cate=1594:3&NavType=2&sd=true

Features:
- 5 Sensor plug in EM Blocks (Four I2C and one SPI inputs)
- Sensor Interrupt Control through built in DIP switches
- Multiple Supply option – USB, battery, or Wireless port
- Long Range Bluetooth Receiver capability
- Reference Software application
Hardware and Nomenclature Explanation:

Note: All referencing of the C-WSEP-ARD Development Kit are from top view.

Communicating with the C-WSEP-ARD:

Communication and software development were at the heart of the process when the C-WSEP-ARD board was developed. Great care was taken to allow for testing and system development tools within the Design Kit (DK) to be accessed using a variety of tools. Connection can be achieved to the Arduino family of products, to a computer via USB to UART converter break out board, and via firmware from any compatible BTLE platform.

Arduino Communication:
The C-WSEP-ARD is an Arduino shield, utilizing the standard Arduino connection point and communication through the headers provided on the back side of the board (P3, P6, P9, P12 and P15). These single in line headers will connect with any of the Arduino platforms. Note: For this option to be utilized, SW6-Tx/Rx EN and SW7CTS/RTS EN must be the OFF position.

Host Computer Communication/Programming:

From a host computer, communication to the C-WSEP-ARD takes place through the break out board, EMCOM-FT230X. (An EMCOM-FT230X is supplied with all C-WSEP-ARD shields.) The EMCOM-FT230X connects through P39 and P40, located on the lower left hand side of the board. See page 14 of the Schematics for correct operation. This USB to UART converter can be used for programming, debug output/application mode, or in the case of some Wireless modules, direct communication. Note: For this option to be utilized, SW6-Tx/Rx EN and SW7-CTS/RTS EN must be the ON position.

BTLE Communication:

In many applications, a wireless device will control the end product through firmware located on the stack of the wireless device. The C-WSEP-ARD device allows for the programming of the firmware when the compatible hardware is connected to the DK. Both the host computer connection through the EMCOM-FT230X and the BTL section are required.

Power Supply:
The power control portion of the C-WSEP-ARD board is located on the upper left hand corner of the board. C-WSEP-ARD power supply can be accomplished in various ways via slide switches: SW1 (labeled as CPWR EN) and SW5 (Labeled as CPWR/USB /VVIO_DK).

When the C-WSEP-ARD is used as a shield, power is supplied via the standard Arduino format. SW1 is not part of the circuit and SW5 should be located to the VVIO_DK location (pushed to the far right).

When utilizing a USB to UART break out board (EMCOM-FT230X, supplied with all C-WSEP-ARD boards), SW1 is not utilized and SW5 should be in the middle location, USB 3V. When battery operation is desired, there are two choices, a C-CP1654 break out board or an external power supply. In either case the EMPWR-MP2148 break out board is required. (Note, the P37 and 38 typically are supplied with, but not soldered on
the C-WSEP-ARD.) The MP2148 is a 1A Synchronous step-down converter. It allows for constant operation from an unregulated power source or regulation as the battery is drawn down in power. (See schematic section 12 and 13)

The C-C1654 connects through P31. SW1-CPWR EN should be in the VB+ mode of operation (pushed up) and SW5 should be pushed to the left CPWR position. The battery is reversed polarity protected.

If an unregulated power supply is utilized, it can be connected through BT1. For this option, the SW1 should be in the 5V position and SW5 should be pushed to the left CPWR position. Please note that BW1 is not reverse polarity protected and care must be taken to assure that the polarity is correct be for using BW1.

For more specific information regarding power supply options, see schematic pages 12 and 13.

**Sensor Test Location**
The C-WSEP-ARD shield allows for the testing of up to 5 sensors. One device can be SPI, and the four others I2C compatible. (See page 11 of the schematic drawing.)

**CBLOCK SPI.**
EMBLOCK SP1 will accept any 10 pin SPI break out board or other external SPI communication board. When using the SPI interface, a four DIP switches on SW1 (P22 and P23) must be on the ON position. In all other cases, they should be in the OFF position.

**CBLOCK I2C1, CBLOCK I2C2, CBLOCK I2C3, and CBLOCK 4**
EMBLOCK I2C1 will accept any 10 pin I2C break out board or other external I2C communication board through these sockets. The device interrupt is controlled through S2, INT1,1.

EMBLOCK I2C2, I2C3, I2C4 will accept any 8 pin I2C break out board or other external I2C communication board through these sockets. The device interrupt is controlled through S2, INT1,3, INT1,4 and INT1,5.

When utilizing the I2C EMBlocks, the four DIP switches on SW1 (P22 and P23) should be in the OFF position.

In addition, S2 allows for Sensor Interrupt detection through P29. The 6 DIP switches allow for various EMBLOCK Sensor Interrupt detection as well as an interrupt detection for the long-range Bluetooth platform.
Long Range-nRF52-LR Receiver
On the far-right hand side of the C-WSEP-ARD are located sockets P37, P38 and P39. This connection is for the notWired.co C-nRF52-SKY66112 Female Receiver, a long range BTLE device. (See the C-nRF52-SKY66112 Female Receiver datasheet for proper operation and page 12 of the schematic).

The pins located at N4 should be shorted together for proper operation when the nRF52 is in place. This connection will allow the power from the C-WSEP-ARD to be connected to the power side of the P34, pin 1., VDD for the nRF52.

In addition, the current can be measured on the nRF52 by inserting an ammeter between these points when desired, allowing the user to determine the power draw on the nRF52 module.

Arduino Shield
When with an Arduino, the C-WSEP-ARD is a shield. Connections are made on the back side of the board through sockets P2, P5, P11 and P8. The standard Arduino pin outs apply as shown on the schematic, page 11. In addition, the C-WSEP-ARD allows for many test points to be used so each line can be individually monitored if desired, through sockets P4, P7, P10, P13.

Auxiliary connections can be made through socket P14 (back side) and P15 and P16.
Slide Switches: SW1, SW5, SW6 and SW7

SW1:

SW1 is a three-position slide switch to allow the user to select from multiple power supply sources to power the C-WSEP-ARD main power net, V_WSEP. As viewed in the above image, the switch positions are Left, Center, and Right. (The switch is in the Center position in the image).

V_WSEP can be connected to three different supply rails:

[Left Switch Position] CPWR_Vo is a net fed by an optional external power supply board (DC/DC or otherwise), connected between P37 and P38. The headers P37 and P38 may not be populated on all boards, but can easily be hand-soldered on as needed.

[Center Switch Position] USB_3V is a net fed by the EMCOM board, optionally connected to P40.

[Right Switch Position] VIO_DK a net fed by the nRF52 development board, through connector P17 on the bottom side of the PCB.
SW5:

SW5 is a two-position slide switch that allows for various supply voltages to be fed to an optional off-board DC/DC converter (or other) power supply board connected between headers P37 and P38. The net used to feed an external power supply board is “CPWR_Vi”, and it can be fed from either net 5V or net VBAT. The net 5V is fed from the Arduino header pins on the bottom side of the PCB. The VBAT net is fed from either header P31, pin 1, or the VEXT connector P32, pin 2.
SW6 and SW7:

SW6 and SW7 can be used to route communication signals between the CCOM connectors (P39 and P40) and the nRF52 board connectors. If an external serial port is desired, it can be connected to header P33 (or the vias for this header if it is not populated). The switches can be used to “break” the connection to the CCOM header pins, allowing the user to switch back-and-forth between communication devices as needed.

To use the CCOM connectors and associated CCOM USB-to-serial conversion board, the switches should be in the “up” position as seen in the photo above. This connects the following nets from the CCOM connector P39 to the target nRF52 board:

TX, RX, CTS, and RTS

If the switches are in the “down” position, these nets will be sourced from P33 instead of P39.
DIP Switches: S1 and S2

S1:

DIP switch S1 is used to select the connected Serial Peripheral Interface (SPI) nets for the C-nRF52-SKY66112 and either the Arduino shield or the CBLK SPI connections. If the user is controlling a SPI device connected between P22 and P23, all four switches should be in the “On” position. Otherwise, they should be in the “Off” position. Refer to the table below for additional details.

<table>
<thead>
<tr>
<th>Connected C-WSEP-ARD Net Name</th>
<th>Connector, S8, and Pin Connections</th>
<th>S1 Switch Position</th>
<th>S1 Switch Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1 Position</td>
<td>nRF52 SoC Connected Pin</td>
<td>“On”</td>
<td>“Off”</td>
</tr>
<tr>
<td>1</td>
<td>P0.23/MOSI</td>
<td>SDI</td>
<td>nRF_MOSI</td>
</tr>
<tr>
<td>2</td>
<td>P0.24/MSI</td>
<td>SS0</td>
<td>nRF_MISO</td>
</tr>
<tr>
<td>3</td>
<td>P0.25/SCK</td>
<td>SCLK</td>
<td>nRF_SCK</td>
</tr>
<tr>
<td>4</td>
<td>P0.22/CS</td>
<td>CS</td>
<td>nRF_CS</td>
</tr>
</tbody>
</table>
DIP switch S2 is used to control the routing of various interrupt signals on the C-WSEP-ARD board to the nRF52 SoC on the C-nRF52-SKY66112 reference design. By changing the position of each switch from “off” to “on”, connections can be made from either populated female header connectors, or to open PCB vias to allow for manually soldered connections. Each open PCB via is located directly below the S2 switch, and is labeled (left to right) as 00, 01, 08, 04,05, and 15 respectively. Refer to the table below for routing information.

<table>
<thead>
<tr>
<th>S2 Position</th>
<th>nRF52 Soc Connected Pin</th>
<th>Connected C-WSEP-ARD Net Name</th>
<th>Connector and Pin Connection</th>
<th>S2 Switch Position</th>
<th>S2 Switch Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P0.00</td>
<td>INT1.1</td>
<td>P0.00</td>
<td>P18 Pin 5</td>
<td>P29 Pin 1 (Via)</td>
</tr>
<tr>
<td>2</td>
<td>P0.01</td>
<td>INT1.2</td>
<td>P0.01</td>
<td>P22 Pin 5</td>
<td>P29 Pin 2 (Via)</td>
</tr>
<tr>
<td>3</td>
<td>P0.08</td>
<td>INT1.3</td>
<td>P0.08</td>
<td>P20 Pin 4</td>
<td>P29 Pin 3 (Via)</td>
</tr>
<tr>
<td>4</td>
<td>P0.04/AIN2</td>
<td>INT1.4</td>
<td>P0.04/AIN2</td>
<td>P29 Pin 4 (Via)</td>
<td>Note that when switch is “On”, P29 Pin 4 (Via) remains connected to INT1.4</td>
</tr>
<tr>
<td>5</td>
<td>P0.05/AIN3</td>
<td>INT1.5</td>
<td>P0.05/AIN3</td>
<td>P26 Pin 4</td>
<td>P29 Pin 5 (Via)</td>
</tr>
<tr>
<td>6</td>
<td>P0.15</td>
<td>INT2</td>
<td>P0.15</td>
<td>P21, P25, P27 Pins 5-8</td>
<td>P29 Pin 6 (Via)</td>
</tr>
</tbody>
</table>

Note that when switch is “On”, P29 Pin 1 (Via) remains connected to INT1.1.
Note that when switch is “On”, P29 Pin 2 (Via) remains connected to INT1.2.
Note that when switch is “On”, P29 Pin 3 (Via) remains connected to INT1.3.
Note that when switch is “On”, P29 Pin 4 (Via) remains connected to INT1.4.
Note that when switch is “On”, P29 Pin 5 (Via) remains connected to INT1.5.
Note that when switch is “On”, P29 Pin 6 (Via) remains connected to INT1.6.
Pushbutton Switches: PO13, PO14 and RST

PB3 (RST): This is a momentary-contact single pole single throw switch. One side of the switch is connected to ground. The other side is connected to V_WSEP via 10 kohm pullup resistor. V_WSEP is the main power supply bus that is connected throughout the board. V_WSEP can be sourced from multiple power supply points or configurations, such as a battery, and is selectable using a series of switches that are covered elsewhere in this document.

As the name implies, this switch functions as a processor RESET line when the C-nRF52-SKY66112 reference design board is plugged in. Pressing and releasing the switch will pull this line to ground, providing a RESET signal to the processor inside the nRF52 SoC device. For the nRF52, the RESET line is P0.21/RST, and this signal is active low, meaning a reset condition occurs when the pin is pulled to ground.

PB1 and PB2: These two momentary-contact pushbutton switches are connected to ground on one side, and connected to P0.13 (PB1) and P0.14 (PB2) nets on the other. There are no pull-up resistors for these two switches. When using the C-nRF52-SKY66112 reference designs, P0.13 and P0.14 are connected to General Purpose Input/Output (GPIO) pins on the SoC. These can be user-configured to provide interrupt signals to the SoC processor for whatever purposes the user may desire.
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Arduino Connectors

10pin CSESNR's
I2C ONLY 500/400 MIL Spaced Header
Typically for CSESNR's in Default I2C Mode

CBLK I2C 1

6/8pin CSESNR's
I2C ONLY 400/300 MIL Spaced Headers

CBLK I2C 2

CBLK I2C 3

CBLK I2C 4

1) DIP = Connect nRF pins to CBLK SPI.
2) HDR = Manually wire pins to CBLK SPI by cutting Solder Bridge and jumpering your selected GPIO into the header.

1) DIP = Connect nRF Pins to CBLK INTs
2) HDR = Manually wire pins to CBLK INTs

Rev. 2/28/2017

Part Number: C-WSEP-ARD Web: www.notwired.co Toll-Free: 1-800-777-7334
**IDD Measure**

To use shield with DK without the CRF-xxxx. Cut the trace connecting V=WSEP to VNRF_WSEP to disconnect VNRF_WSEP from VTARG. A jumper can be inserted for manual control.

**C-nRF52-SKY66112 Female Receiver**

Receiver uses Sockets: P34, P35, P36

**CPWR BLOCK is ONLY needed if an external Battery >3.6V is plugged into the CBAT Connector OR an external voltage is supplied >3.6V**

EN line is Connected to VIN by default on the CPWR DC/DC boards.
Component Distributors will be offering several Battery options for the WSEP:
Current Offerings:
1. Varta CP1654 Rechargeable LiFePO4, CBAT-CP1654.

Coming Soon:
1. 300mAh Rechargeable LiPO
2. 300mAh Qi Wireless Charging LiPO.
3. Feel free to contact us with Suggestions.

**CBAT Connector**

**VEXT Connector**

**VBAT Measure**

NOTE: If Battery such as a Coin Cell or Vext voltage is used that is < 3.3V and does not require CPWR DC/DC regulation the user can manually run a jumper from VBAT to CPWR_Vo and select CPWR as the voltage source from the WSEP Power Selector Switch.
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