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**Mon-T2 Bluetooth Low Energy Connection**

16th October 2017 – Firmware version 1.00 and Hardware version 2.00

1. **General Information**

This Document is intended to describe the additions made to the Existing Mon-T2 PCB design to add Bluetooth low energy functionality.

After testing evaluating considering cost, ease of use, support and signal strength, the NINA B112 BLE module was chosen over the other modules.

1. **PCB Design Additions**

The Module communicates over UART which is connected to the UART2 of the PIC 18.

|  |  |
| --- | --- |
| **BLE Module** | **PIC 18** |
| TX | RX |
| RX | TX |
| GND |  |
| Vcc |  |
| CTS | GND |

It is recommended on the module data sheet that the CTS pin should be connected to GND if flow control is not used. The module can be in different modes such as command mode, data mode and sleep mode. Three LEDs are used in the debugging stage to indicate these modes.

Connections to SPI communication was made available but not connected on the PCB for later use as this communication protocol can be more energy efficient than the UART.

1. **Firmware Implementation Additions**

The module is programmed using AT-Commands over the UART when the module is in command mode.

At start up the module configurations are done in following order.

1. Reset Module – This is done by toggling the reset pin on the module to and then high
2. Then a delay of 3 seconds is introduced as recommended by the datasheet
3. Disable Flow Control – Since flow control CTS and RTS pins are not used, a command is used to disable this functionality.

*AT+UMRS=115200,2,8,1,1,1*

1. Reboot Module – This command reboots the module and saves all the previous setting on the module by replacing the default settings.

*AT+CPWROFF*

1. Set Name – Any name can be set to the module which will be used in the discovery and connecting process. The name is set as BLETEM. A functionality will be added in the android application which will allow the user to set the name.

*AT+UBTLN=BLETEM*

1. Store Config – This allows the setting set previously to be saved on the module over writing the existing default settings and Reboot Module command must be called next

*AT&W*

The existing push button on the PCB is used to turn on Bluetooth and a timer is used to inactivate the radio and put it to sleep.

Once the logger is started by pressing the push button for three seconds the BLE module goes into command mode. On the next press of the button the module configuration procedure mentioned above is done only ones and then the module goes into data mode. At this stage, the module can communicate with the android application and send and receive data. The module then time out after 5 minutes, exit out of data mode and goes in to sleep mode.

Time out after 5 minutes

Exit Data Mode

Device goes into sleep

Device wake up

Data Mode

Push button press

Initial Configuration

Push button press

The existing uart communication functions will be used for decoding the data send over Bluetooth. First stage of the implementation process, the following commands will be implemented

* Query Logger
* Program Parameters
* Start Logger
* Tag Logger
* Stop Logger
* Read Logger
* Re-Use Logger

1. **Future work**

* Finish all the commands
* Implement the LCD to display some functionality as required
* When the PCB version 2 is available test the sleep mode of the module and the RX interrupts

1. **Test Cases**

* Test connection range after placing in a case – specifications suggest this needs to be between 3 to 5 meters
* Temperature vs the connection range and communication quality
* Multiple module detection on the android application