BPI-Scratch User Manual

V0.1.0

2015-03-24

Revision History

Revision	Data	Author	Description
0.1.0	2015-03-24	Alessia	Initial version

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1. Installation

1.1 Pre-requisites

The Scratch Handler Program: LeScratch is implemented in Python for hardware IO and extensions. It provides the functions to communicate with other boards.
Links@GitHub https://github.com/BPI-SINOVOIP/BPI-Scratch

Install
==========

Install python-dev or python3-dev with the following command::

```
$ sudo apt-get install python-dev

$ sudo apt-get install python3-dev
```

Install python-setuptools, python-smbus, i2c-tools then::

```
$ sudo apt-get install python-setuptools python-smbus i2c-tools
```

Since i2c drivers are installed and enabled by default, you only have to install the spi drivers. Download the package from github https://github.com/doceme/py-spidev:

```
$ cd py-spidev

$ sudo python setup.py install

$ sudo python3 setup.py install
```

Please remember to install the latest version of RPi.GPIO and install:
For Banana Pro:

```
$ git clone https://github.com/LeMaker/RPi.GPIO_BP -b bananapro
```

For Banana Pi:

```
$ git clone https://github.com/LeMaker/RPi.GPIO_BP -b bananapi

$ sudo apt-get update

$ cd /RPi.GPIO_BP

$ python setup.py install

$ sudo python setup.py install

$ python3 setup.py install

$ sudo python3 setup.py install
```

Enable the SPI module
==========
The extension boards communicate with the Banana Pi/Pro through the interfaces. The I2C module is included in the latest Banana Pi/Pro distributions and is enabled by default. But the SPI driver should be enabled manually::

```
$ sudo modprobe spi-sun7i
```

And you can permanently enable it by commenting out the ``blacklist spi-sun7i`` line in ``/etc/modprobe.d/bpi-blacklist.conf``.

```
$ sudo nano /etc/modprobe.d/bpi-blacklist.conf
```

Then enable spi modules by adding ``spi-sun7i`` and ``spidev`` to ``/etc/modules``

```
$ sudo nano /etc/modules
```

Enable the MESH mode for Scratch
==========
Please refer to http://wiki.scratch.mit.edu/wiki/Mesh => 1.3 Mesh by Modification of Scratch for details. Reboot after setting up the above steps.

1.2 Run

The file LeScratch.py can be run independently by either of the following: and it is suggested to start the Mesh mode Scratch first, and then run the python script, such that the connections will be built once the script runs.

```
$ sudo python LeScratch.py

or

$ sudo python3 LeScratch.py
```

2. Scratch Commands

2.1 GPIOs

2.1.1 Introduction

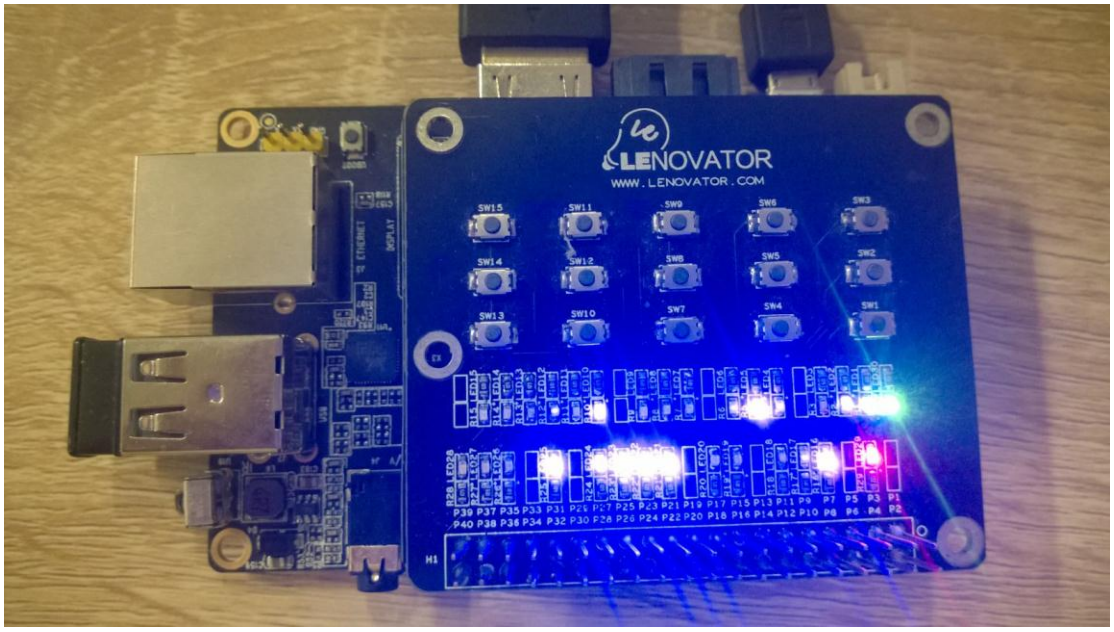
In the first place, remember to declare which GPIOs are going to be used by broadcast g[num]in and g[num]out, “in” means this GPIO will be the input and “out” means this GPIO will be an output. Then the declared GPIOs can be set to 1 or 0 easily:
Set the GPIO to High/1: g[num]on
Set the GPIO to Low /0: g[num]off

Usages of the General Purpose INPUT OUTPUT Controls:

Command Format:	*g[num]in*	*g[num]out*	*g[num]on*	*g[num]off*
	Input	*Output*	*on/high*	*off/low*

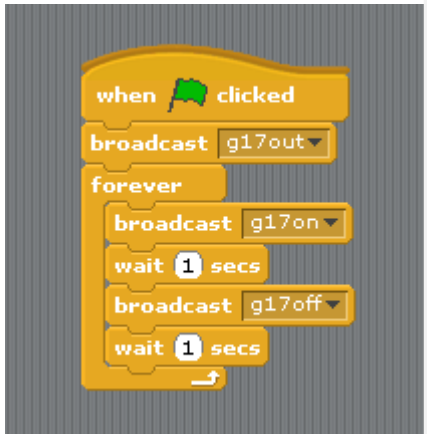
Number out of the List [4, 5, 6, 12, 13, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27]

2.1.2 Example 1 – GPIO Board



Purchase link: http://www.lenovator.com/

The GPIO board can be used to indicate the status of all the 40 pins on Banana Pi/Pro. The switches are related to some GPIO that can be used as input detection.



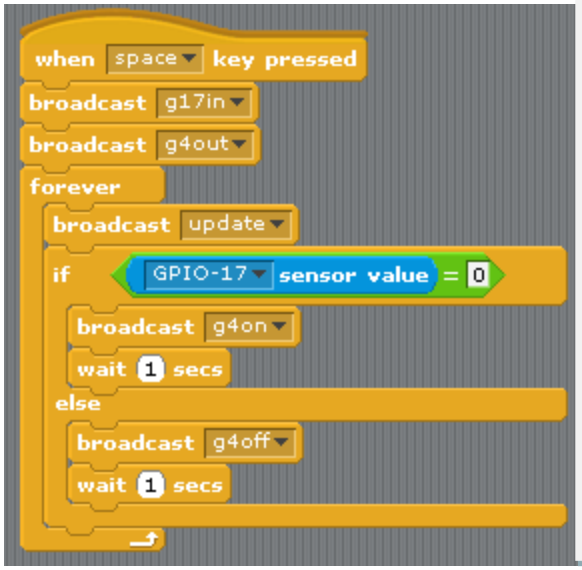
Click on the Green Flag to Run:
Declare GPIO 17 as output

While true
Set GPIO 17 to on/high
Wait for 1 second

Set GPIO 17 to off/low
Wait for 1 second

{Forever loop}

Click on the Green Flag to Run:
Declare GPIO 12, 13, 19, 16, 6 as output
While true
Set GPIO 12, 13, 19, 16, 6 to on/high, wait for 1 second
Set GPIO 12, 13, 19, 16, 6 to off/low, wait for 1 second
{Forever loop}



When keyboard Space is pressed
Declare GPIO 17 as input
Declare GPIO 4 as output

While true
Update step
Check
if GPIO 17 = 0
Set GPIO 4 to on/high
Wait for 1 second
Else
Set GPIO 4 off/low
Wait for 1 second
{Forever loop}

2.2 I2C

2.2.1 Introduction

I2C has various address, once you attach an extension board to banana pro/pi, open the terminal and use i2c-tools to detect its address:

```
$ sudo i2cdetect -y 2
```

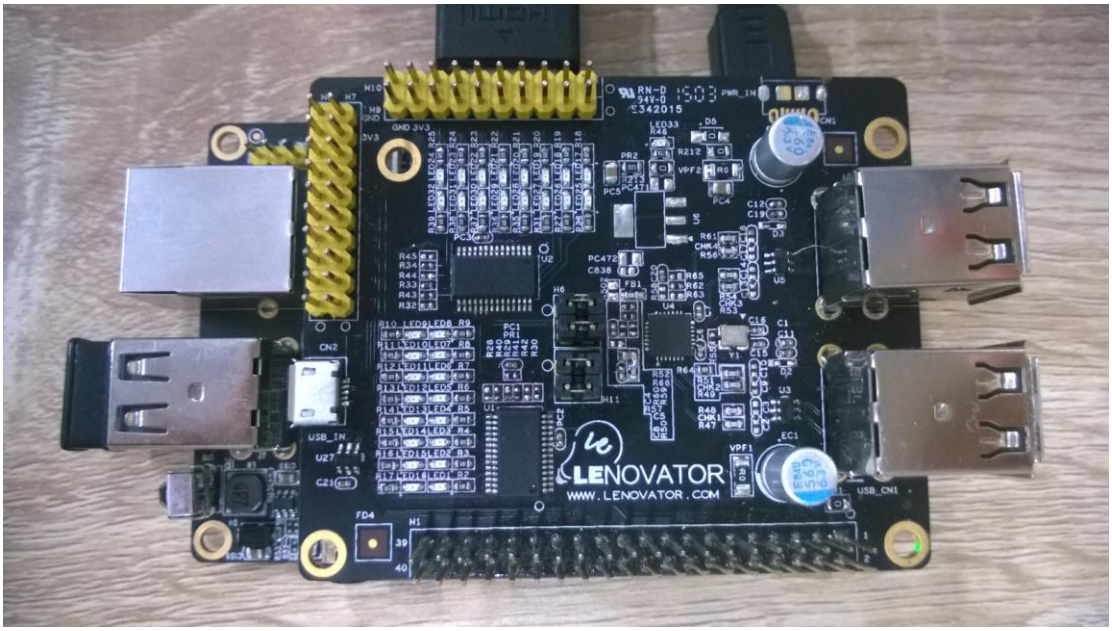
To specify the address, use the following formats:

Command "i2"+ "address 0x(20-27)" + "a" +"bit (0 to 7)" for Port A
Command "i2"+ "address 0x(20-27)" + "b" +"bit (0 to 7)" for Port B
Command "bit"+ "address 0x(20-27)" + "a" +"bit (7 to 0)" for Port A
Command "bit"+ "address 0x(20-27)" + "b" +"bit (7 to 0)" for Port B

Examples:
i221a1 => i2c address 0x21 Port A bit 1 ON
i222b4 => i2c address 0x22 Port B bit 4 ON
bit22b01010101 => address 0x22 port B from bit 7 to 0, output => 0b01010101
bit21a01010101 => address 0x21 port A from bit 7 to 0, output => 0b01010101
bit21aon => address 0x21 Port A all ON, 0b11111111
bit21boff => address 0x21 Port B all OFF/clear, 0b00000000
bit22aoff => address 0x22 Port A all OFF/clear

2.2.2 Example 1 – USB Hub

The USB Hub extension board has (4 Port USB Hub & 23017 x2 32GPIO) use I2C communication with banana pro/pi such that Scratch can control the extended functions.



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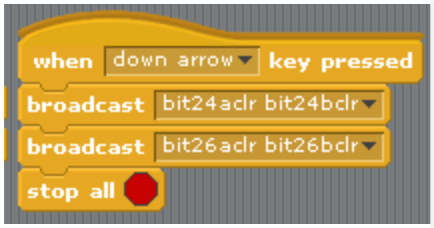
When keyboard a is pressed
(address 0x24, 0x26)
Clear port A, B

While true
Set address 0x24 port A to 0b10010111
Set address 0x24 port B to 0b01101000
{Forever loop}

When keyboard b is pressed
(address 0x24, 0x26)
Clear port A, B

While true
Set address 0x24 port A bit4 and bit7 to 1, wait for 1 second
Set address 0x24 port B to bit and bit6 to 1
{Forever loop}

When up arrow is pressed
(address 0x24, 0x26)
Clear port A, B



When up arrow is pressed
(address 0x24, 0x26)
Clear port A, B

2.3 SPI

2.3.1 Introduction

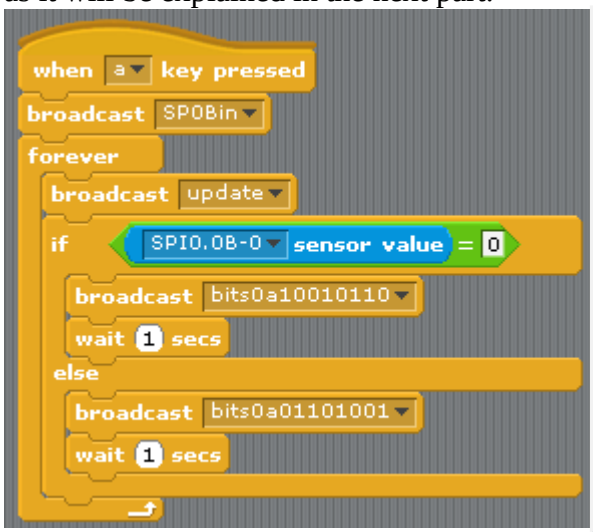
LN Digital has one 16 bits mcp23s17 that communicates with banana pro using SPI. Mcp23s17 has 8 various addresses that allow extending 8 boards at the same time.

Command "sp"+ "address (0-7)" + "a" +"bit (0 to 7)" for Port A
Command "sp"+ "address (0-7)" + "b" +"bit (0 to 7)" for Port B
Command "bits"+ "address (0-7)" + "a" +"bit (7 to 0)" for Port A
Command "bits"+ "address (0-7)" + "b" +"bit (7 to 0)" for Port B

Examples: (address 0-7 = 0x40-4E)
sp0a1 => spi address 0x40 Port A bit 1 ON
sp1b4 => spi address 0x42 Port B bit 4 ON
bits2b01010101 => address 0x44 port B from bit 7 to 0, output => 01010101
bits3a01010101 => address 0x46 port A from bit 7 to 0, output => 01010101
bits4aon => address 0x48 Port A all ON, 0b11111111
bits5boff => address 0x4A Port B all OFF/clear, 0b00000000
bits6aoff => address 0x4B Port A all OFF/clear

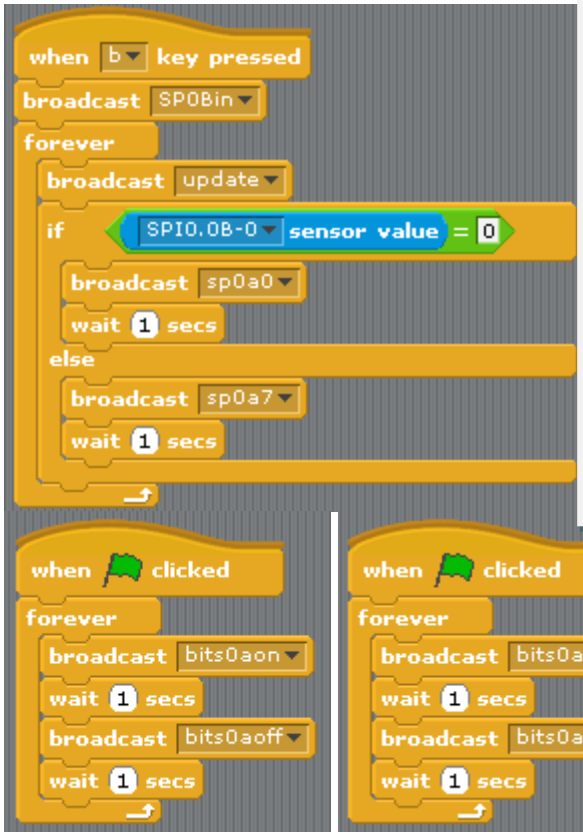
2.3.2 Example 1 – LNdigital

LNdigital can use general SPI format commands to control or use LNIO commands as it will be explained in the next part.



When keyboard a is pressed
Declare address 0x40 port B as input
While true
Update step
Check
If SPI address 0x40 port B bit0 = 0
Set SPI address 0x40 port A to 0b10010110, wait for 1 second
Else
Set SPI address 0x40 port A to 0b01101001, wait for 1 second

{Forever loop}



When keyboard b is pressed
Declare address 0x40 port B as input
While true
Update step
Check
If SPI address 0x40 port B bit0 = 0
Set address 0x40 port A bit0 to 1
Wait for 1 second
Else
Set address 0x40 port A bit7 to 1
Wait for 1 second

{Forever loop}

Click on the Green Flag to Run:
While true
Set SPI address 0x40 port A to all on, wait for 1 second
Set SPI address 0x40 port A to all off, wait for 1 second

2.4 LN Digital

2.4.1 Introduction

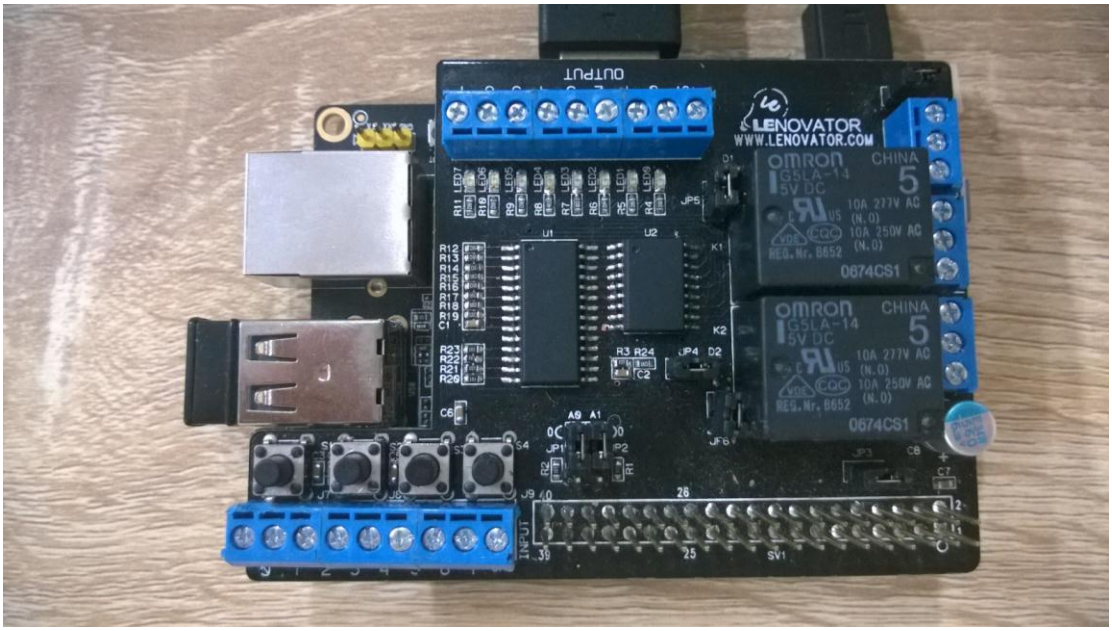
LN Digital has one 16 bits mcp23s17 that can be configured as 8 bits port A and port B or 16 bits. Each port (A/B) can be configured as either input or output. By default it is configured as port A – output (1 to 8), port B – input (1 to 8).

LNDI[num]in LNDI[num]out LNDI[num]on LNDI[num]off Number (1 to 8)

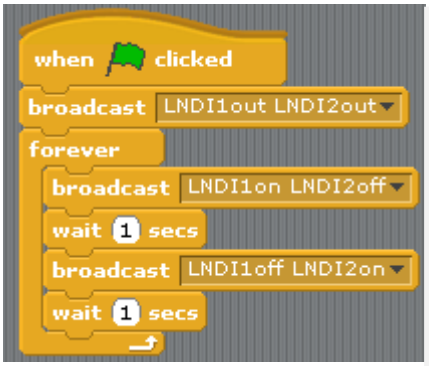
Set the output to High/1: LNDI [num]on
Set the output to Low /0: LNDI [num]off

2.4.2 Example 1 – LNIO

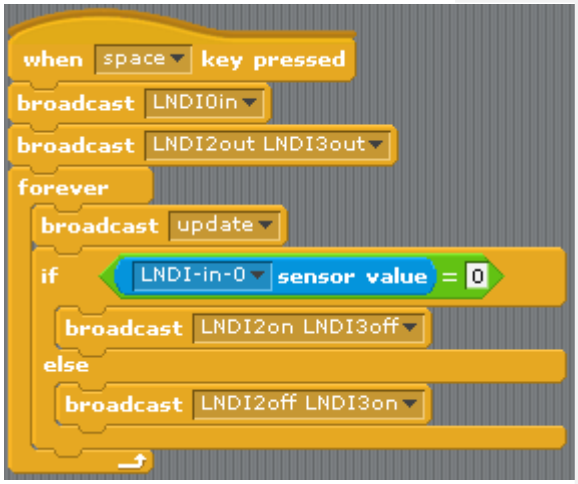
The extension board LN Digital use SPI communication with banana pro / pi such that Scratch can access the following:
8 Open-Collector Outputs
8 LED Indicators
8 Digital Inputs
4 Tactile Switches (The interrupt event is set to listen on the 4 inputs switch.)
2 Changeover Relays (Port A output bit1 – relay 1, Port A output bit2 – relay 2.)



Purchase link: http://www.lenovator.com/LN-Digital%28PCBA%29



Click the Green Flag to Run:
Declare LNDI1, LNDI2 output
While true
LNDI1out set to on/high
LNDI2 out set to off/low
Wait for 1 second
LNDI1 out set to off/low
LNDI2 out set to on/high
Wait for 1 second



When space is pressed
LNDI1out, LNDI2out, LNDI3out,
Declare LNDI1in,
While true
Update info
If LNDI1in is detected as input button pressed

Set LNDI1, 3 out to on/high
Set LNDI2 out to off/low
Else (no input is detected)

Set LNDI1, 3 out to off/low
Set LNDI2 out to on/high