pinMode(), digitalRead(), digitalWrite(), analogWrite() work as usual.

Pin numbers correspond directly to the esp8266 GPIO pin numbers. To read GPIO2, call digitalRead(2);

All digital IO pins are protected from over-voltage with a snap-back circuit connected between the pad and ground. The snap back voltage is typically about 6V, and the holding voltage is 5.8V. This provides protection from over-voltages and ESD. The output devices are also protected from reversed voltages with diodes.

At startup, pins are configured as INPUT.
GPIO0-GPIO15 can be INPUT, OUTPUT, or INPUT_PULLUP.
GPIO16 can be INPUT, OUTPUT, or INPUT_PULLDOWN_16. It is also XPD for deepSleep() (Perhaps via a small capacitor.)
Note that GPIO6-GPIO11 are typically used to interface with the flash memory ICs on most esp8266 modules, so these pins should not generally be used.

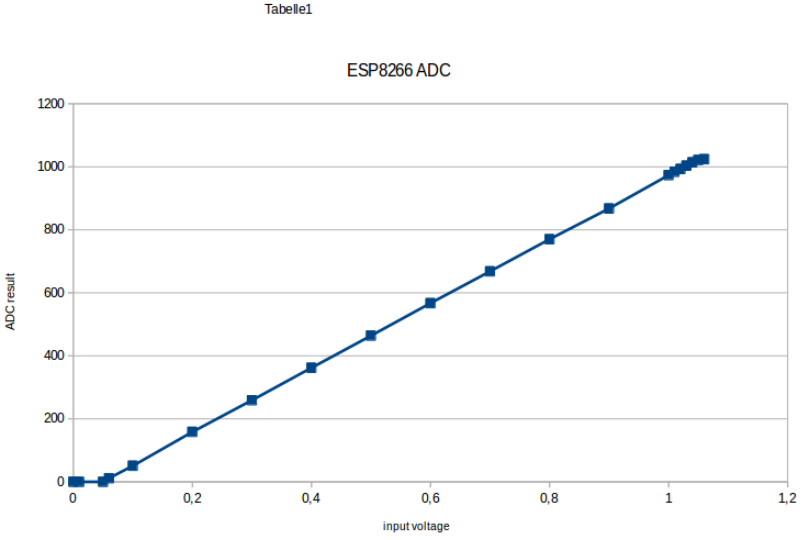
analogRead(A0) reads the value of the ADC channel connected to the TOUT pin .

Analog ADC ESP8266EX also integrates a generic purpose 10-bit analog ADC. The ADC range is from 0V to 1.0V. It is typically used to measure the voltages from the sensor or battery status. The ADC cannot be used when the chip is transmitting. Otherwise the voltage may be inaccurate.(From Expressif datasheet CH 8.5)

Tabelle1

Voltage	ADC min	ADC max	ADC mean
0	0	0	0
0,01	0	0	0
0,05	0	0	0
0,06	9	14	11,5
0,1	49	53	51
0,2	157	160	158,5
0,3	257	261	259
0,4	360	364	362
0,5	463	465	464
0,6	565	569	567
0,7	666	670	668
0,8	768	772	770
0,9	865	870	867,5
1	971	976	973,5
1,01	982	986	984
1,02	990	996	993
1,03	1001	1006	1003,5
1,04	1011	1017	1014
1,05	1020	1023	1021,5
1,06	1024	1024	1024

Measurement equipment:
Labjack U12 (DAC output)



Interupts

Pin interrupts are supported through attachInterrupt(), detachInterrupt() functions. Interrupts may be attached to any GPIO pin except GPIO16, but since GPIO6-GPIO11 are typically used to interface with the flash memory ICs on most esp8266 modules, applying interrupts to these pins are likely to cause

problems. Standard Arduino interrupt types are supported: CHANGE, RISING, FALLING.

PWM

analogWrite(pin, value) enables software PWM on the given pin. PWM may be used on pins 0 to 15. Call analogWrite(pin, 0) to disable PWM on the pin. value may be in range from 0 to 1023. 0 to 255 is normal on an arduino board as its an 8bit ADC but ESP8266 is 10 bit so 1023 is full duty cycle.

Pin Functions

The most usable pin functions are mapped to the macro SPECIAL, so calling pinMode(pin, SPECIAL) will switch that pin to UART RX/TX on pins 1 - 3, HSPI for pins 12-15 and CLK functions for pins 0, 4 and 5.

SPECIAL maps to:

- 0. CLK_OUT
- 1. TX0
- 2. TX1
- 3. RX0
- 4. CLK_XTAL
- 5. CLK_RTC
- 12. SPI_MISO
- 13. SPI_MOSI
- 14. SPI_CLK
- 15. SPI_SS

You can activate any “FUNCTION_” with pinMode(pin, FUNCTION_1)for example
Note : func number 1-5 in Expressife table correspond to FUNCTION 0-4 in SDK
http://bbs.espressif.com/download/file.php?id=442

GPIO	Inst Name	Function 0	Function 1	Function 2	Function 3	Function 4	At Reset	After Reset	Sleep
0	GPIO0_U	GPIO0	SPICS2			CLK_OUT	oe=0, wpu	wpu	oe=0
1	U0TXD_U	U0TXD	SPICS1		GPIO1	CLK_RTC	oe=0, wpu	wpu	oe=0
2	GPIO2_U	GPIO2	I2SO_WS	U1TXD		U0TXD	oe=0, wpu	wpu	oe=0
3	U0RXD_U	U0RXD	I2SO_DATA		GPIO3	CLK_XTAL	oe=0, wpu	wpu	oe=0
4	GPIO4_U	GPIO4	CLK_XTAL				oe=0		oe=0
5	GPIO5_U	GPIO5	CLK_RTC				oe=0		oe=0
6	SD_CLK_U	SD_CLK	SPICLK		GPIO6	U1CTS	oe=0		oe=0
7	SD_DATA0_U	SD_DATA0	SPIQ		GPIO7	U1TXD	oe=0		oe=0
8	SD_DATA1_U	SD_DATA1	SPID		GPIO8	U1RXD	oe=0		oe=0
9	SD_DATA2_U	SD_DATA2	SPIHD		GPIO9	HSPIHD	oe=0		oe=0
10	SD_DATA3_U	SD_DATA3	SPIWP		GPIO10	HSPIWP	oe=0		oe=0
11	SD_CMD_U	SD_CMD	SPICS0		GPIO11	U1RTS	oe=0		oe=0
12	MTDI_U	MTDI	I2SI_DATA	HSPIQ MISO	GPIO12	U0DTR	oe=0, wpu	wpu	oe=0
13	MTCK_U	MTCK	I2SI_BCK	HSPID MOSI	GPIO13	U0CTS	oe=0, wpu	wpu	oe=0
14	MTMS_U	MTMS	I2SI_WS	HSPICLK	GPIO14	U0DSR	oe=0, wpu	wpu	oe=0
15	MTDO_U	MTDO	I2SO_BCK	HSPICS	GPIO15	U0RTS	oe=0, wpu	wpu	oe=0
16	XPD_DCDC	XPD_DCDC	RTC_GPIO0	EXT_WAKEUP	DEEPSLEEP	BT_XTAL_EN	oe=1,wpd	oe=1,wpd	oe=1

ESP8266 has three modes of operation: SDIO mode, UART mode and FLASH mode. These are obtained by pulling three pins either high or low at bootup. GPIO15 GPIO0 GPIO2 according to this table 0 Low. 1 High x floating

MODE	GPIO15	GPIO0	GPIO2

SDIO (BootSDCard)	1	x	x
UART (UploadCode)	0	0	x or 1
FLASH (NormalRunning)	0	1	x or 1

Note :- GPIO2 It is considered safer to pull it high with a resistor on boot rather than leave it floating to avoid possible chip damage if pin is pulled high by your program but also see http://www.esp8266.com/viewtopic.php?f=6&t=3862&p=22524#p22524.

FLASH mode is when running the program. Take GPIO0 high or float or it will stall on first reset,intentional or not

UART mode is how the code is uploaded to the chip and GPIO0 and GPIO15 must be low on boot to enter this mode. .

SDIO mode is where the chip boots from an SD card. I don't think this is available to us yet

UART pins

Note that there's a special switch to swap UART0 RX/TX with UART0 CTS/RTS which is what system_uart_swap does and is explained in http://bbs.espressif.com/viewtopic.php?f=7&t=22&p=54&hilit=system_uart_swap#p54:

```
#define FUNC_U0CTS    4
#define FUNC_U0RTS    4

void user_init(void) {
PIN_FUNC_SELECT(PERIPHS_IO_MUX_MTCK_U, FUNC_U0CTS);//CONFIG MTCK PIN FUNC TO U0C
PIN_FUNC_SELECT(PERIPHS_IO_MUX_MTDO_U, FUNC_U0RTS);//CONFIG MTDO PIN FUNC TO U0R
SET_PERI_REG_MASK(0x3ff00028 , BIT2);//SWAP PIN : U0TXD<==>U0RTS(MTDO) , U0RXD<=
......
}
```

original func: U0TXD⇒pin:U0TXD U0RXD⇒pin:U0RXD U0CTS⇒pin:MTCK U0RTS⇒pin:MTDO

after pin swap: U0TXD⇒pin:MTDO U0RXD⇒pin:MTCK U0CTS⇒pin:U0RXD U0RTS⇒pin:U0TXD

This allows the MTDO and MTCK to be connected to a microcontroller as UART tx/rx. The bootup info will be output via U0TXD pin, but after start-up, the UART0 will output data via MTDO and receive via MTCK.

kolban asserts:“ The device writes to UART1 by itself in certain circumstances. First, when you flash the device, the data received is apparently also written to the TX pin of UART1 (GPIO2). Second, the “debug” code in the device writes its output to UART1.”
If anyone has a reference for this please post it on the thread http://www.esp8266.com/viewtopic.php?f=6&t=3862&p=22524#p22524

LED Pin

GPIO1 which is also TX is wired to the blue LED on many devices. Note that the LED is active low (conected to Vcc and sinks through the chip to ground) so setting a logical value of 0 will light it up. Since GPIO1 is also the TX pin, you won't be able to blink the LED and perform Serial communications at thew same time unless you switch TX/RX pins.

Maximum Current

When using a GPIO as output (i.e. to drive something such as an LED) it is important to note that the maximum output current is 12mA. (I_{MAX}=12mA per Espressif datasheet) If you try and output more current than that, you run the risk of damaging the device. Since many LEDs are able to draw 20mA you should adjust your current limiting resistor to be 12mA or less.
Using https://en.wikipedia.org/wiki/LED_circuit - R=(Vout-Vled)/I so (3.3V-1.8Vred) at 12mA = 125Ω min for a red LED.