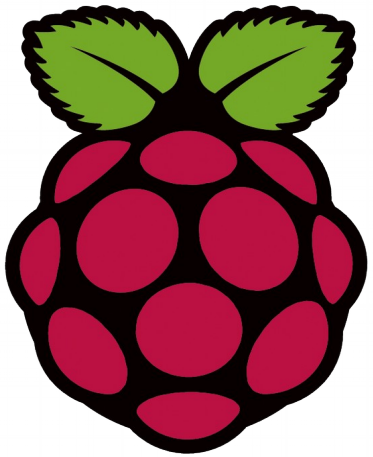
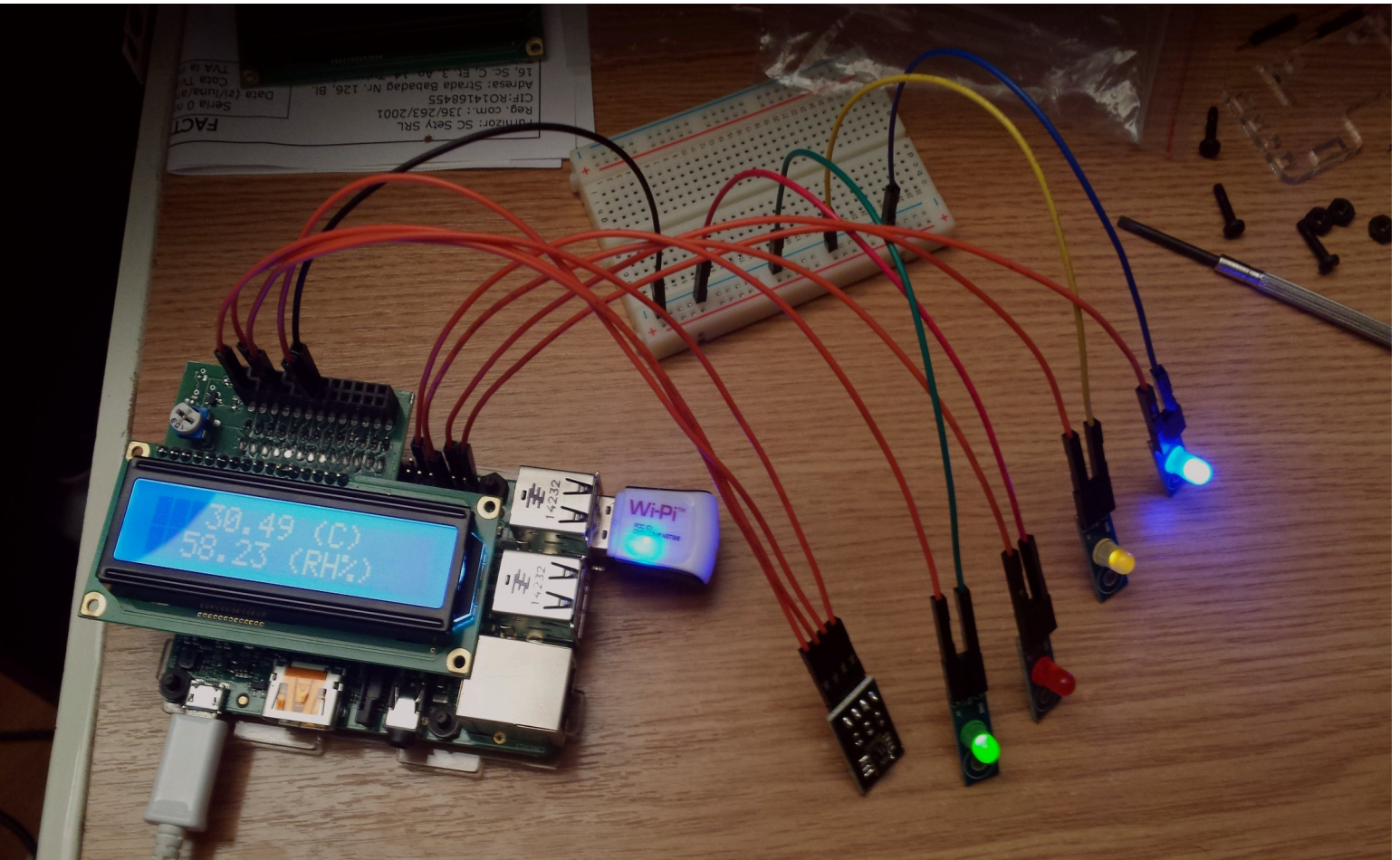


pi + sensor = weather station



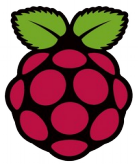
Nashwan Azhari

Robert Krody

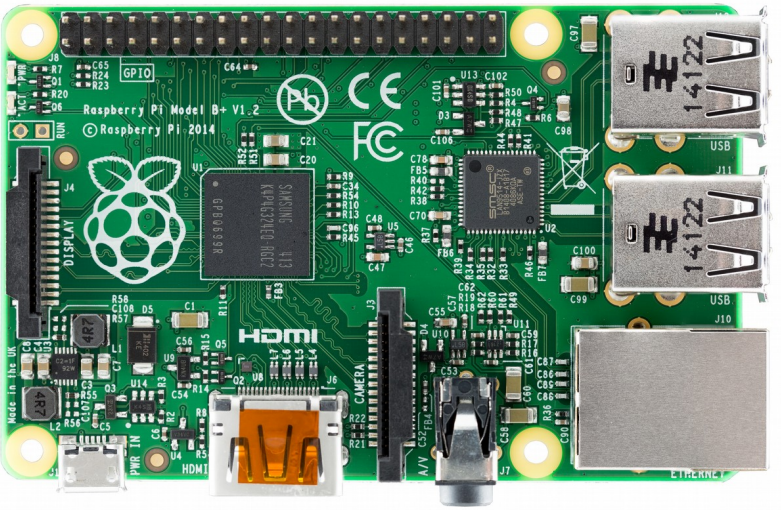
Tudor Vioreanu

Contents:

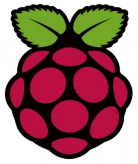
- about the Raspberry PI
- technologies used for the project
- driving the components
- the weather station as a whole
- short demo
- Q&A
- closing thoughts



Raspberry PI B+



- full OS-capable PC for $35
- Broadcom SoC running at 700MHz with 512 MB RAM
- runs 32-bit ARM builds of Linux or the BSDs
- various peripherals including:
  4xUSB, Ethernet, Composite A/V, HDMI
- General Purpose Input/Output header



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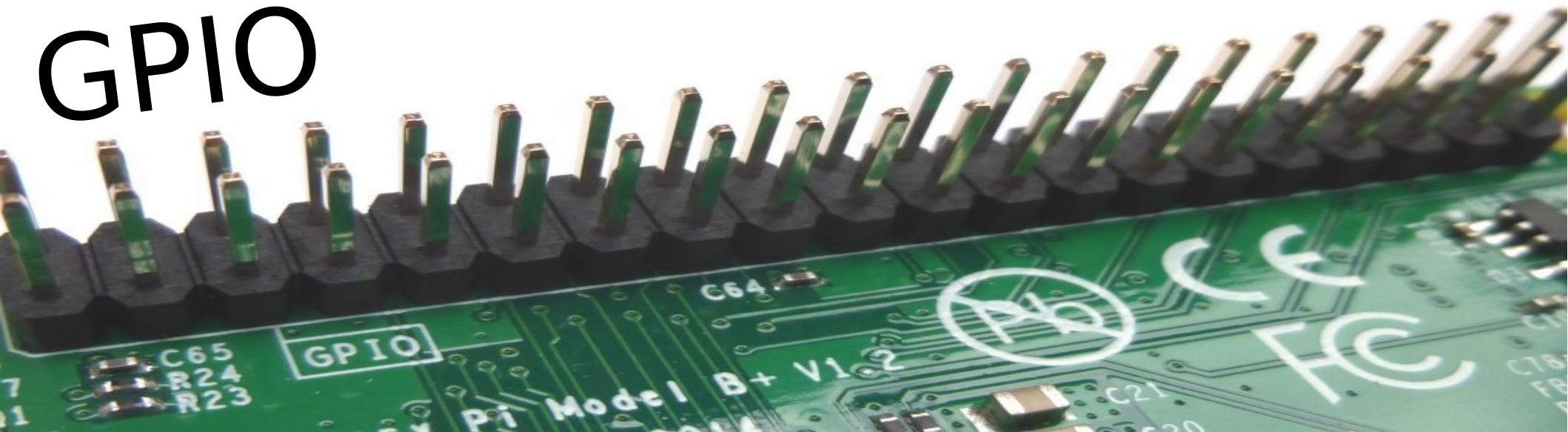
upJ

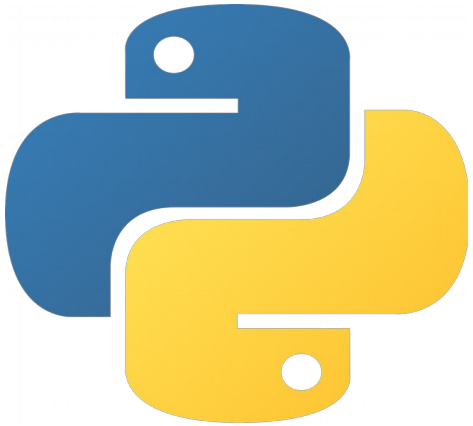
- 40 in number
- have PWM support, but mostly used digitally
- have kernel drivers on all major OS-es

  (file descriptors can be found in /sys/class/gpio)
- have pre-made libraries for BASIC, C, C++, Java, Perl and Python

GPIO



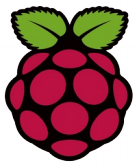
RPi.GPIO



- CPython library
- Has functions for:
  - setting up
  - reading from
  - outputting to
  - cleaning up
- the GPIO pins

Raspberry Pi B+ J8 Header

Pin#	NAME		NAME	Pin#
01	3.3v DC Power		DC Power 5v	02
03	GPIO02 (SDA1 , I2C)		DC Power 5v	04
05	GPIO03 (SCL1 , I2C)		Ground	06
07	GPIO04 (GPIO_GCLK)		(TXD0) GPIO14	08
09	Ground		(RXD0) GPIO15	10
11	GPIO17 (GPIO_GEN0)		(GPIO_GEN1) GPIO18	12
13	GPIO27 (GPIO_GEN2)		Ground	14
15	GPIO22 (GPIO_GEN3)		(GPIO_GEN4) GPIO23	16
17	3.3v DC Power		(GPIO_GEN5) GPIO24	18
19	GPIO10 (SPI_MOSI)		Ground	20
21	GPIO09 (SPI_MISO)		(GPIO_GEN6) GPIO25	22
23	GPIO11 (SPI_CLK)		(SPI_CE0_N) GPIO08	24
25	Ground		(SPI_CE1_N) GPIO07	26
27	ID_SD (I2C ID EEPROM)		(I2C ID EEPROM) ID_SC	28
29	GPIO05		Ground	30
31	GPIO06		GPIO12	32
33	GPIO13		Ground	34
35	GPIO19		GPIO16	36
37	GPIO26		GPIO20	38
39	Ground		GPIO21	40



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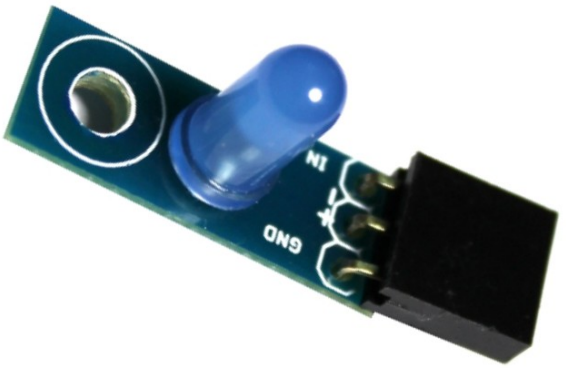
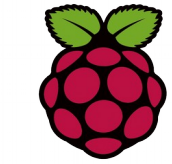
5v brick LEDs

```
ledexample.py
1
 1 import RPi.GPIO as gpio
 2
 3 ledpin = 20
 4
 5 gpio.setmode(gpio.BCM)
 6
 7 gpio.setup(ledpin, gpio.OUT)
 8
 9 gpio.output(ledpin, True)
10
```





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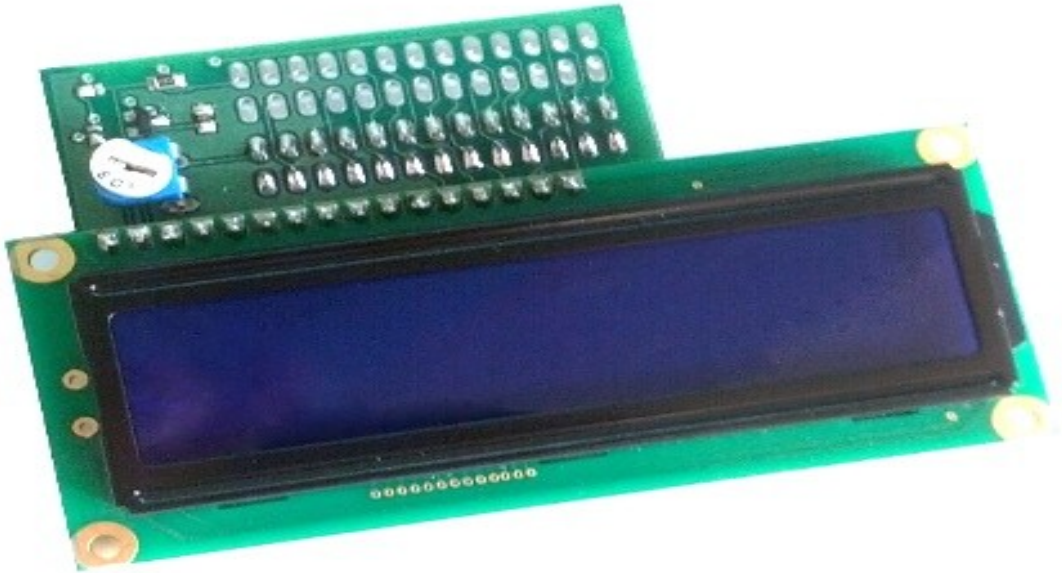
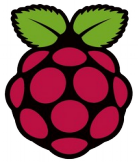
LCD

- Adafruit 16x2 LCD SHIELD
- 8 bit operation mode, fully ASCII capable

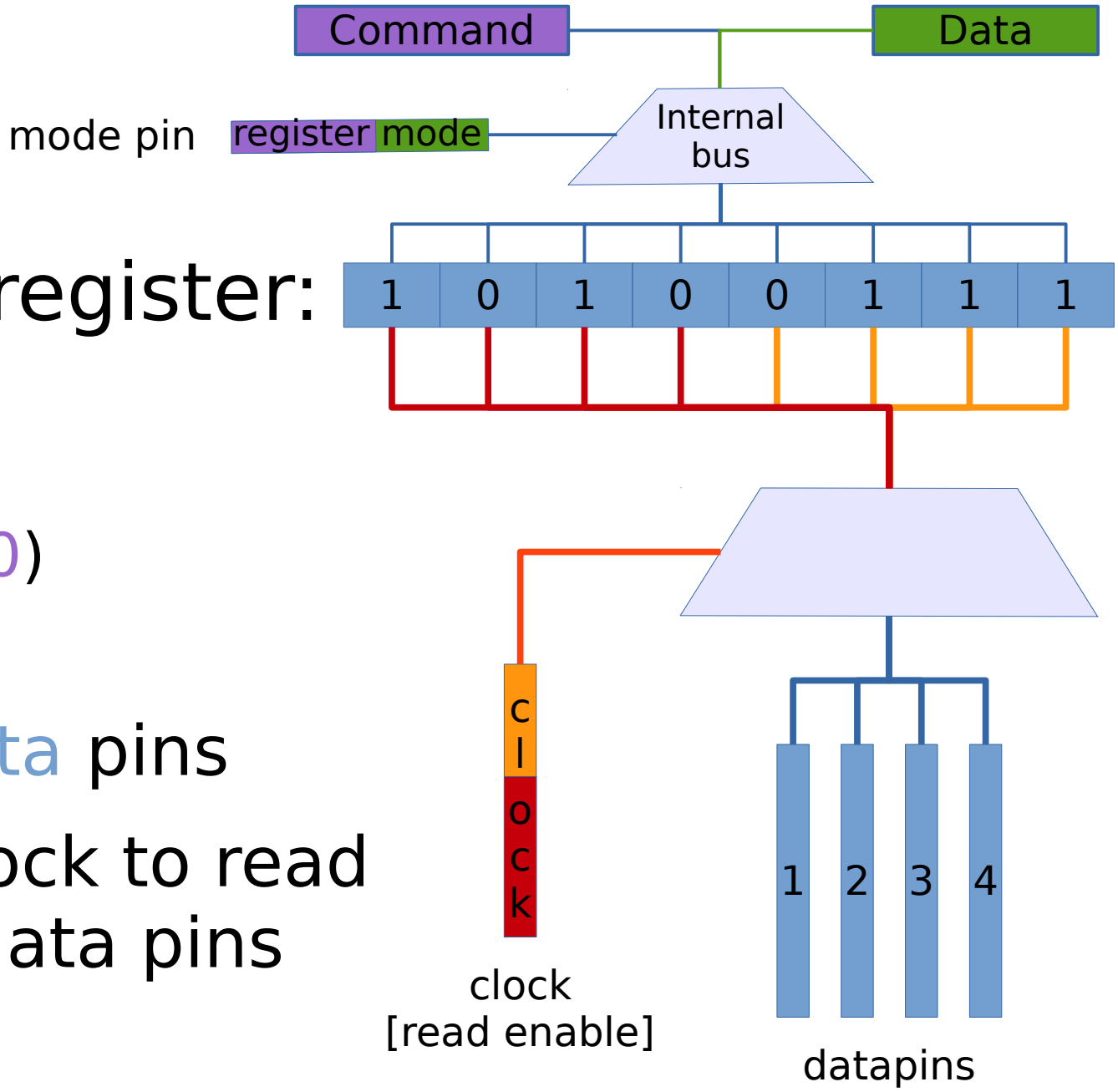


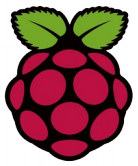
- uses 6 GPIO pins:
  - 1 mode selector
  - 1 serial clock
  - 4 data pins



Writing to the register:

- mode pin:
  - command (0)
  - data (1)
- output to data pins
- tick serial clock to read 4 bits from data pins





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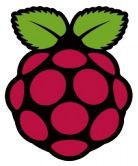
SHT11

- temperature and humidity sensing digital IC
- VCC usually around 4v
- bi-directional DATA line
- All I/O coordinated by the Serial ClocK



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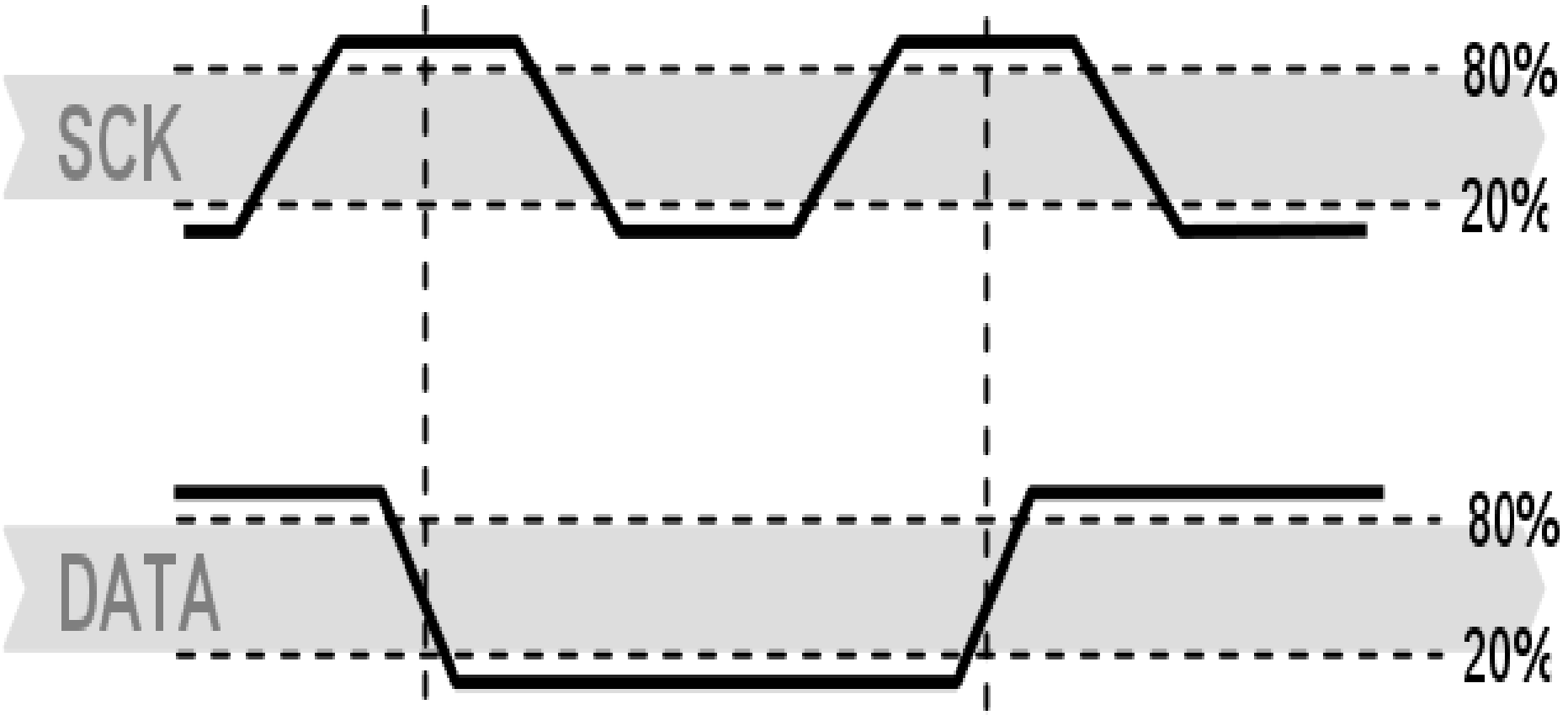
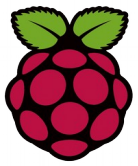
Initiating SHT11 Transmission





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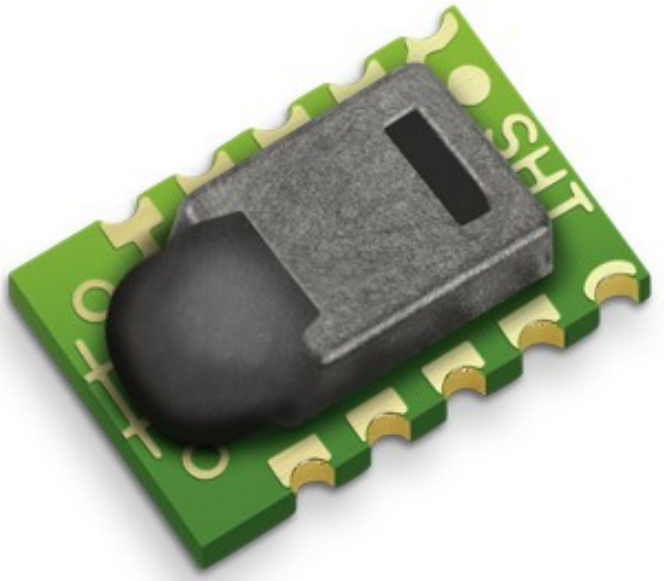
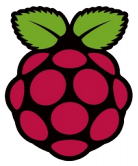
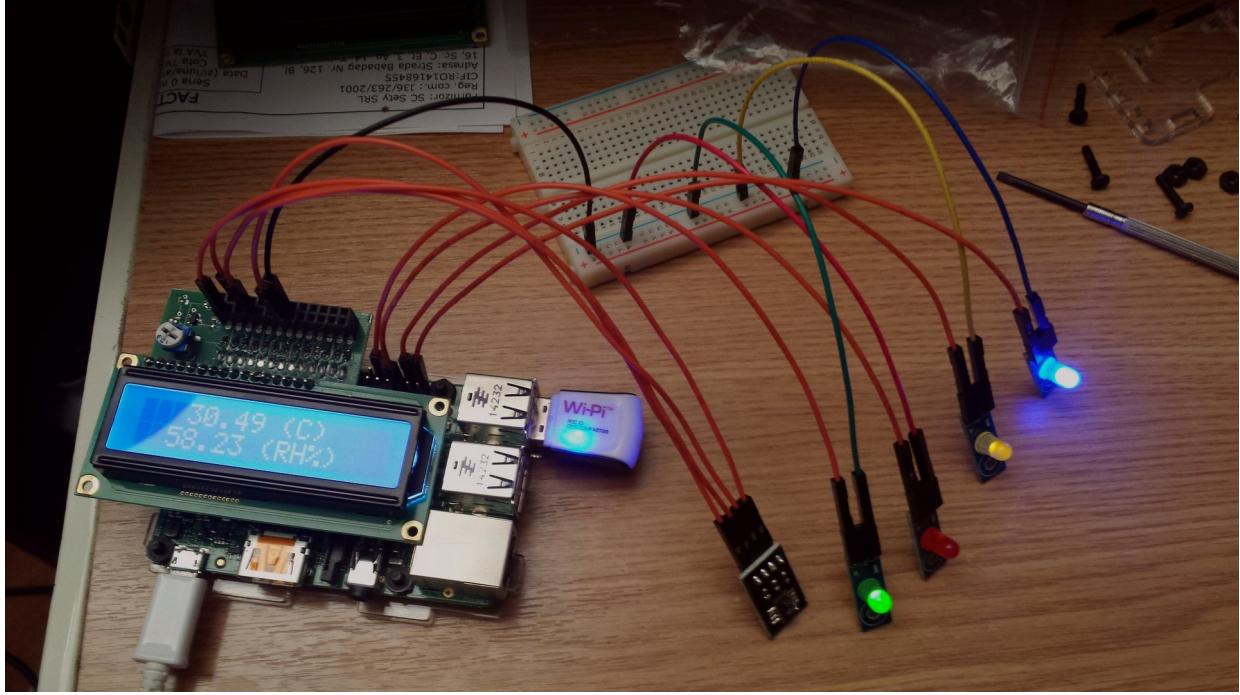
Communicating with the sensor:



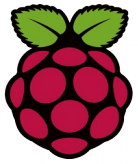
- write 1 bit/clock cycle
- commands are 1 byte:
  - 0x03 for temperature
  - 0x05 for humidity
- results are on 2 bytes + 1 CRC byte
  - raw results require minor processing



PI-sense



- each component has a Python class
- central WeatherStation class which:
  - reads all necessary parameters from config
  - queries the SHT11 for temperature and humidity
  - writes to the LCD
  - triggers the appropriate LEDs



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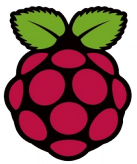
upt

DEMO



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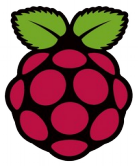
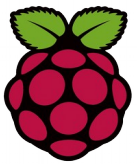
What we have gained:

- appreciation for hardware
- sense of respect for hardware people
- good understanding of serial communications between components
- writing a basic serial driver
- Linux hardware handling
- Python module writing



Q&A



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github.com/aznashwan/pi-sense

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