**UART – Universal Asynchronous Receiver Transmitter**

* 5 to 9 data bits
* 1 start bit
* 0 to 1 parity bit
* 1 or 2 stop bits
* Asynchronous because communicating devices don’t share common clock
* Start bit used to let the device know that communication is about to start so that receiving device can synchronise its clock with the incoming data to receive it properly.
* Standard baud rates include: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200.
* 1 to 1 communication
* Least significant bit gets transferred first
* Requires 1 line for transmitting and one for receiving.
* Consequences of baud rate mismatch

<https://learn.sparkfun.com/tutorials/serial-communication/all>

<http://www.circuitbasics.com/basics-uart-communication/>

**SPI – Serial Peripheral Interface**

* Supports transmission of 8 or 16-bit data
* For operating modes: CPHA = CPOL = 0, CPHA = CPOL = 1, CPHA = 0 & CPOL = 1, CPHA = 1 & CPOL = 0.
* 4 Lines: CLK, MISO, MOSI and CS
* Data sent MSB first
* Clock signal is sent along with data
* CS lowered first before data is sent
* At high frequencies should not be used over long distances otherwise will give errors

<https://learn.sparkfun.com/tutorials/serial-peripheral-interface-spi/all>

**IMU**

* Accelerometer, gyroscope and magnetometer theory
* Getting angles from the three theory
* Gyroscope noise, gimbal lock
* sensor accel, gyro and magnetometer offsets and noise and cross-axis sensitivity

**Complementary Filter**

* Complementary filter equation
* Theory

<https://www.pieter-jan.com/node/11>

<https://www.researchgate.net/publication/308850497_MEMS_based_IMU_for_tilting_measurement_Comparison_of_complementary_and_kalman_filter_based_data_fusion/download>

**Direct Memory Access**

* Theory and benefits

**Bluetooth Wireless**

**FPGA**

* Synchronisation is required so that metastability does not occur
* Controller Datapath architecture

**Euler Angles**

* Gimbal lock
* Theory

<https://en.wikipedia.org/wiki/Euler_angles>

<https://en.wikipedia.org/wiki/Gimbal_lock>