Hardware Software Platforms
Project Presentation

Distance Detection

Abrassart Theo & Hubert Louis

Theo.Abrassart@student.umons.ac.be

Louis.Hubert@student.umons.ac.be

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Project presentation

Four main parts :

- ❑ Sensor presentation with tools
- ❑ I2C
- ❑ Unit tests
- ❑ Application

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Sensor presentation with tools

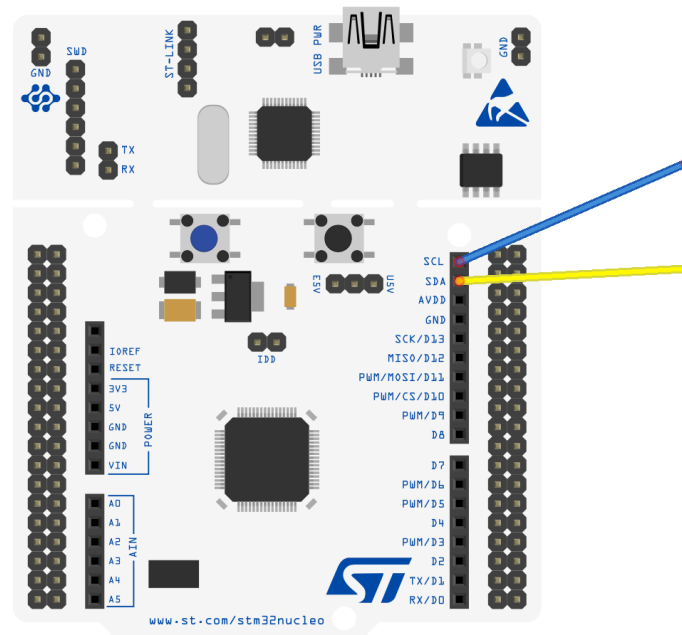## Hardware : Sonar sensor (SRF02)

❑ I2C communication
❑ Driven by STM32

Road trip time

Distance

Sonar ▮ Returning sound waves

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Chip presentation

Hardware : STM32F303RE nucleo 64 chip

Software presentation
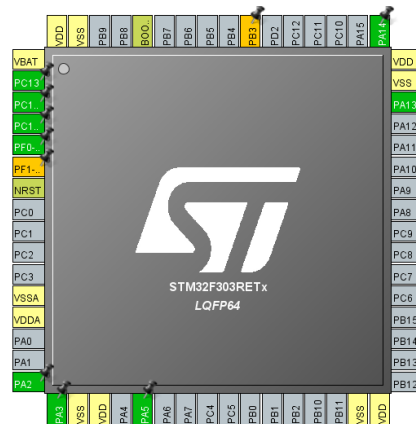
- ## AC6 :

Complete and useful environment
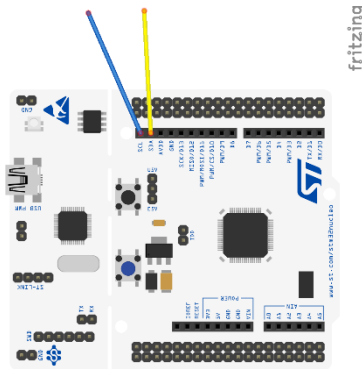
Allows to compile and put code on chip

- ## CubeMX :

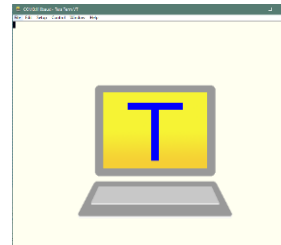Chip selection and pins configuration
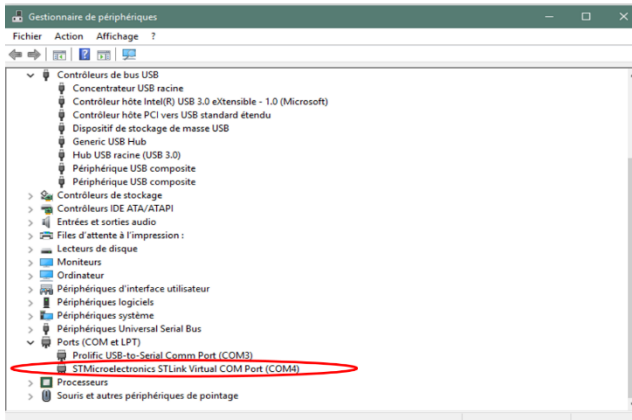
Code creation to set the drivers

Hardware Software link

UART com.

Visualization of the com.

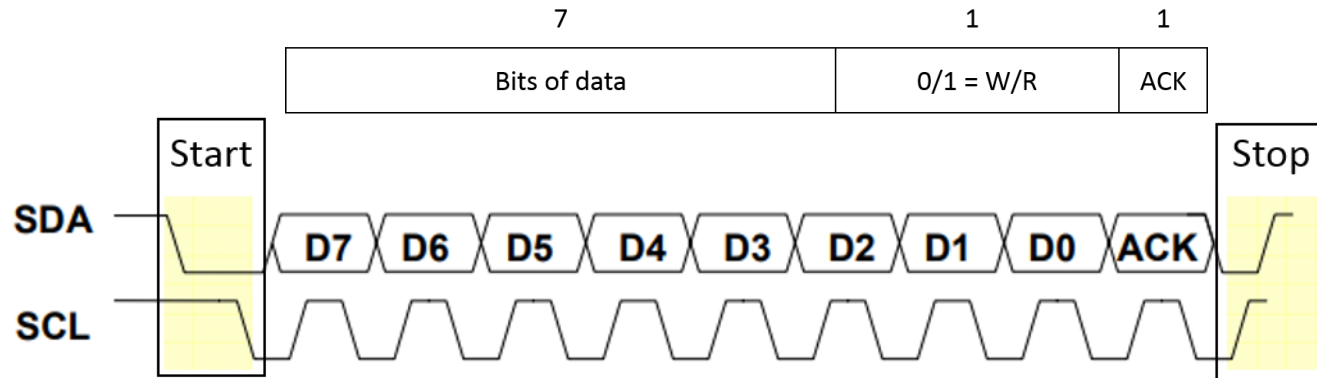Don't forget to select good port

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Communication protocol I2C

3 signals → SDA/SCL/Bulk

Data frame :

Start condition : SDA passes to 0 while SCL is equal to 1

Stop condition : SDA passes to 1 while SCL stays at 1

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Unit tests : LED and button

Driving LED with switch case

Using the button

```
while (1)
{
  /* USER CODE END WHILE */
if(!HAL_GPIO_ReadPin(GPIOC,GPIO_PIN_13)) {
 choix = ((choix+1)%3);
 HAL_Delay(10);
}
```
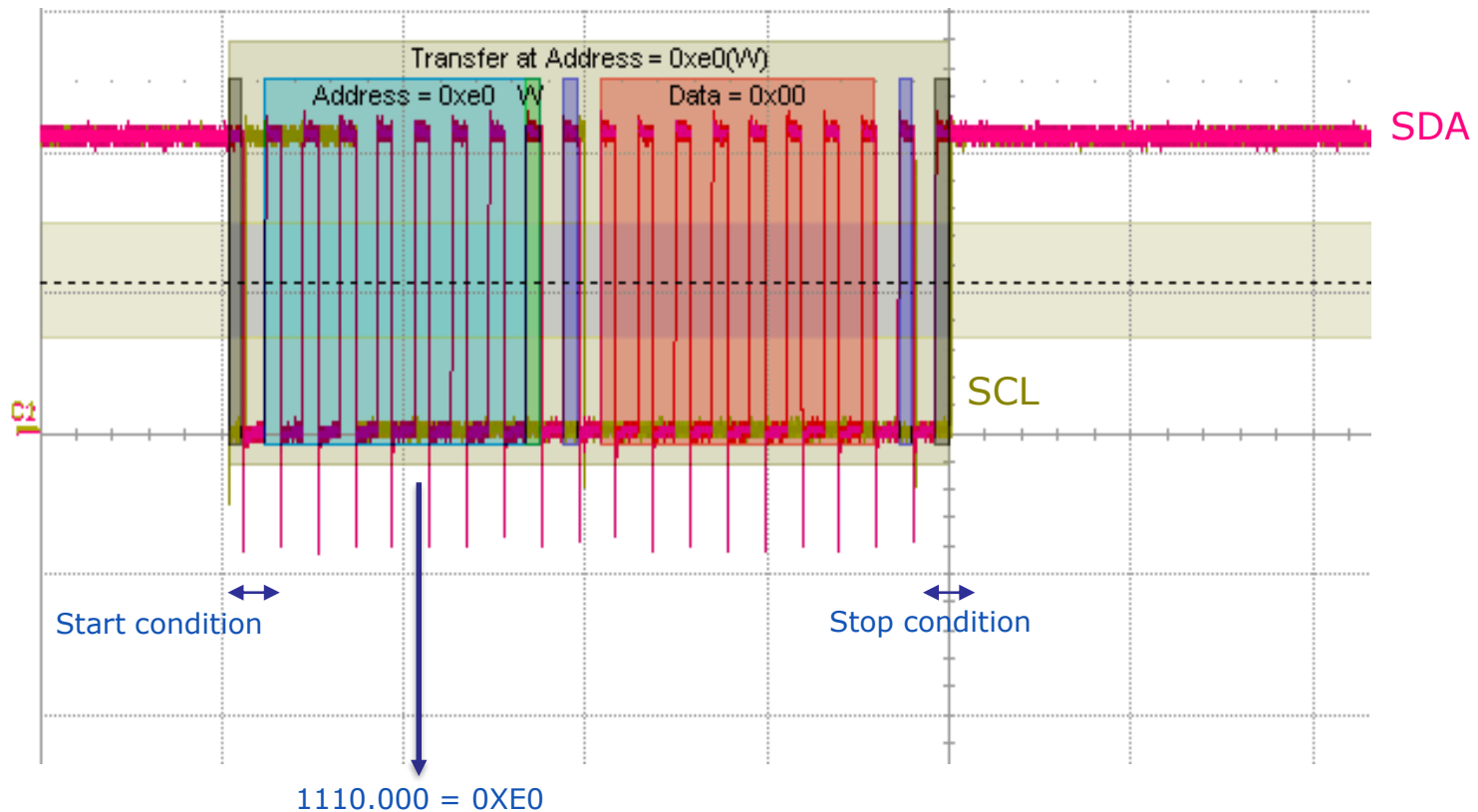
```
switch (choix){

case 0 :
 HAL_GPIO_WritePin(LD2_GPIO_Port, LD2_Pin, 0);
 HAL_Delay(250);
 HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, 1);
 HAL_Delay(250);
 break;

case 1 :
 HAL_GPIO_WritePin(LD2_GPIO_Port, LD2_Pin, !HAL_GPIO_ReadPin(LD2_GPIO_Port, LD2_Pin));
 HAL_Delay(500);
 break;

case 2 :
 HAL_GPIO_TogglePin(LD2_GPIO_Port, LD2_Pin);
 HAL_Delay(50);
 break;
}
```

Unit tests: I2C

Test transmission and reception of sequences

SDA

SCL

Transfer at Address = 0xe0(W)

Address = 0xe0   W

Data = 0x00

Start condition

Stop condition

1110.000 = 0XE0

⚠ Rest state at 1

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Unit tests : interrupt
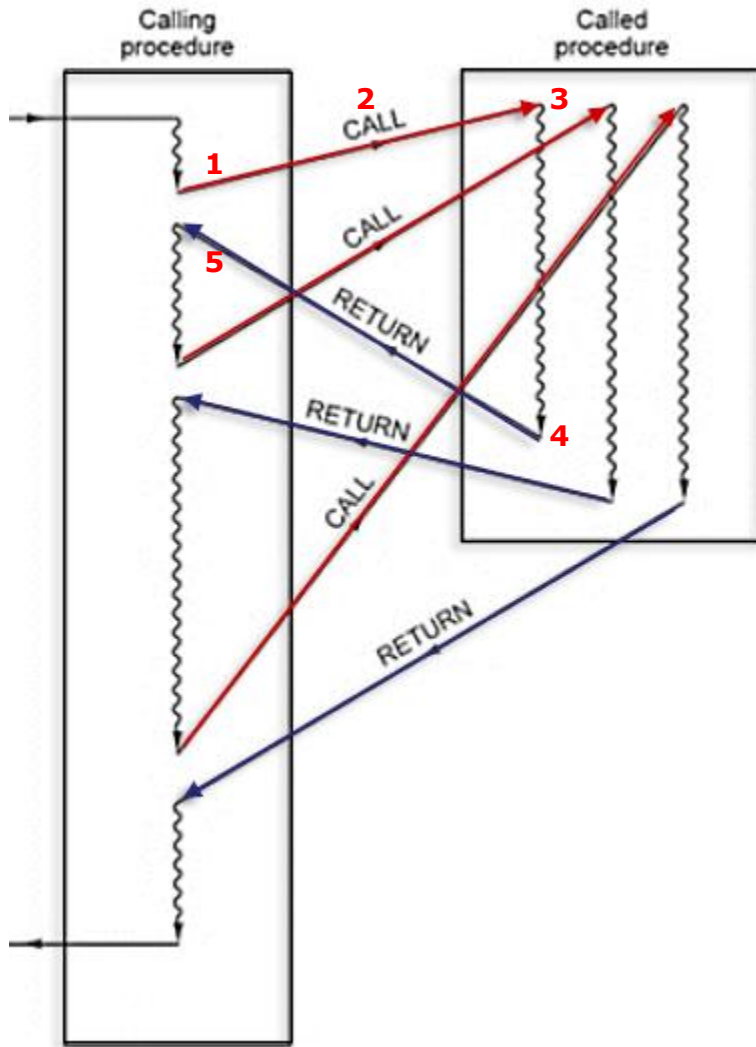
1. - detection of the triggering event
    - end of the current instruction
    - ident. of the event occurred
    - saving the address of current instruction in a stack

2. traversal to the interrupt processing routine

3. treatment of the corresponding interrupt

4. retrieving the return address

5. Return to the initial program

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Sensor's datasheet

Location	Read	Write
0	Software Revision	Command Register
1	Unused (reads 0x80)	N/A
2	Range High Byte	N/A
3	Range Low Byte	N/A
4	Autotune Minimum - High Byte	N/A
5	Autotune Minimum - Low Byte	N/A

LSB register (8bits)

MSB register (8bits)

Information : 16 bits
→ Concatenation of MSB and LSB registers

Information	→	MSB register	LSB register

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Different commands of the sensor

Command		Action
Decimal	Hex	
80	0x50	Real Ranging Mode - Result in inches
81	0x51	Real Ranging Mode - Result in centimeters
82	0x52	Real Ranging Mode - Result in micro-seconds
86	0x56	Fake Ranging Mode - Result in inches
87	0x57	Fake Ranging Mode - Result in centimeters
88	0x58	Fake Ranging Mode - Result in micro-seconds
92	0x5C	Transmit an 8 cycle 40khz burst - no ranging takes place
96	0x60	Force Autotune Restart - same as power-up. You can ignore this command.
160	0xA0	1st in sequence to change I2C address
165	0xA5	3rd in sequence to change I2C address
170	0xAA	2nd in sequence to change I2C address

Here are the different commands to put in the CR

UART communication :
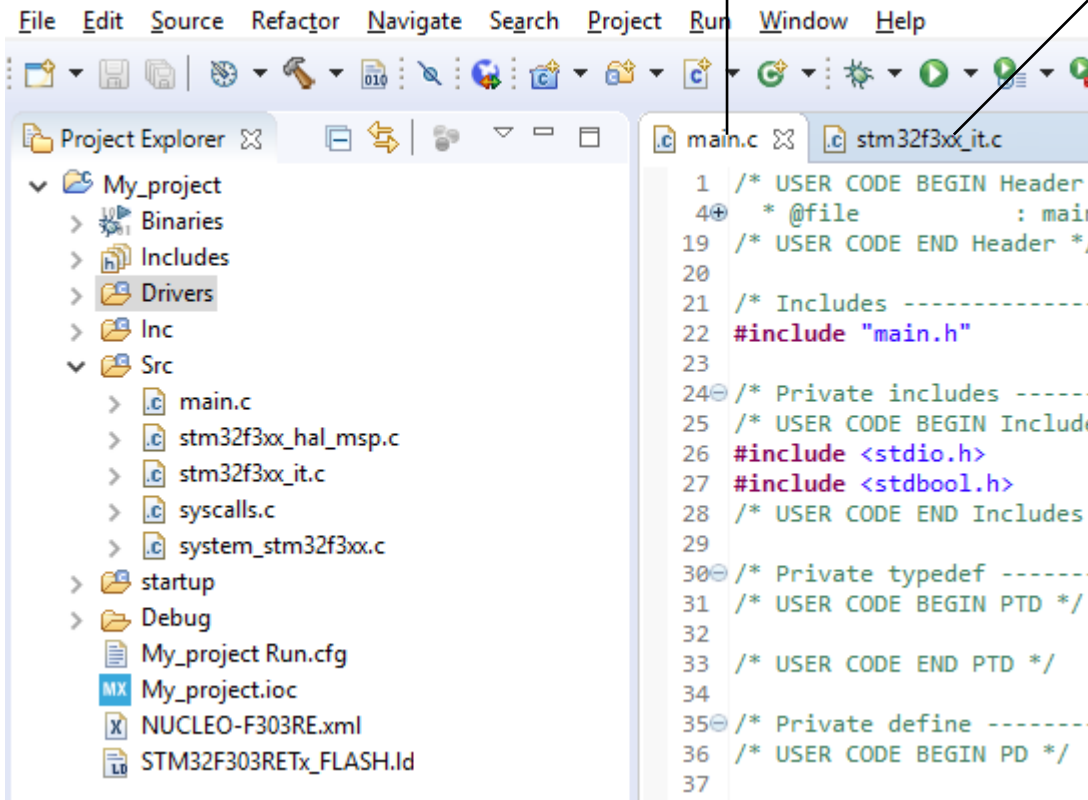

Enable the UART com. with STM32

```
#ifdef __GNUC__
 #define PUTCHAR_PROTOTYPE int __io_putchar(int ch)
#else
 #define PUTCHAR_PROTOTYPE int fputc(int ch, FILE *f)
#endif

 PUTCHAR_PROTOTYPE{
  HAL_UART_Transmit(&huart2, (uint8_t *)&ch, 1, 100);
  return ch;

 }
```

Software implementation
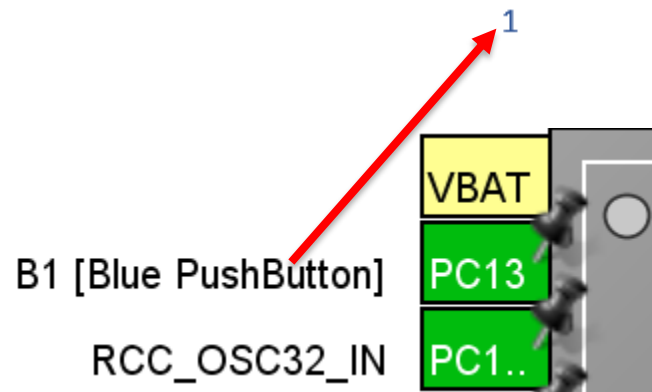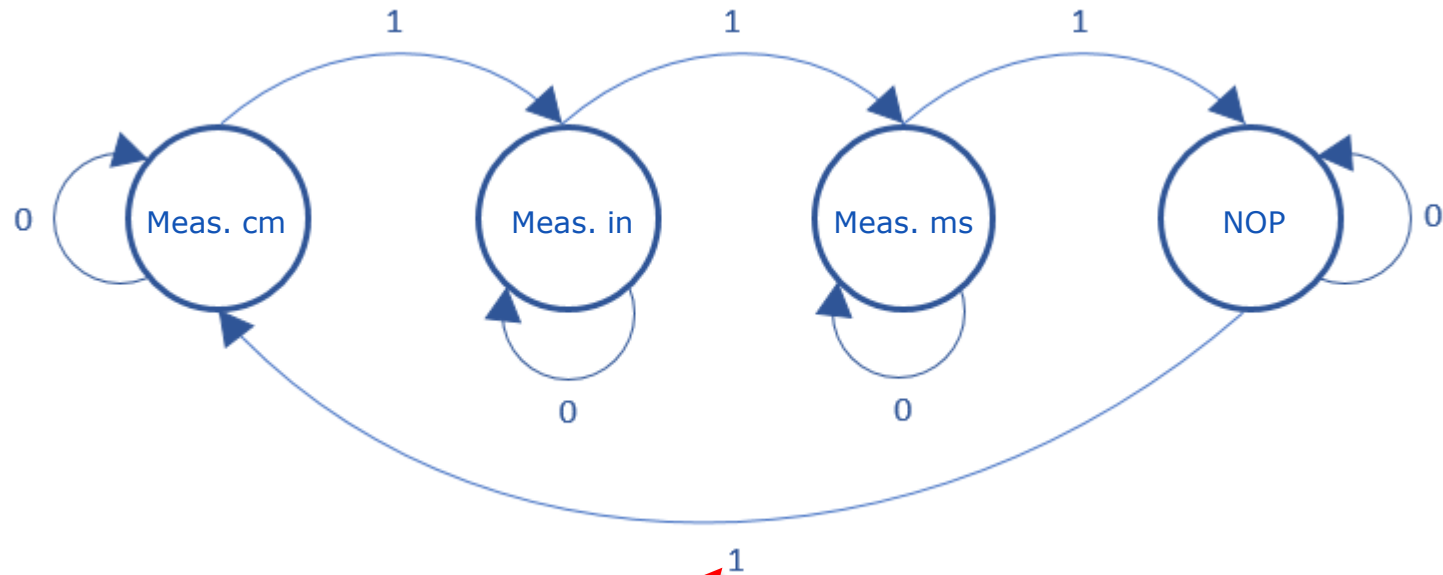
FSM management

Interrupt management

Modification of C code on AC6

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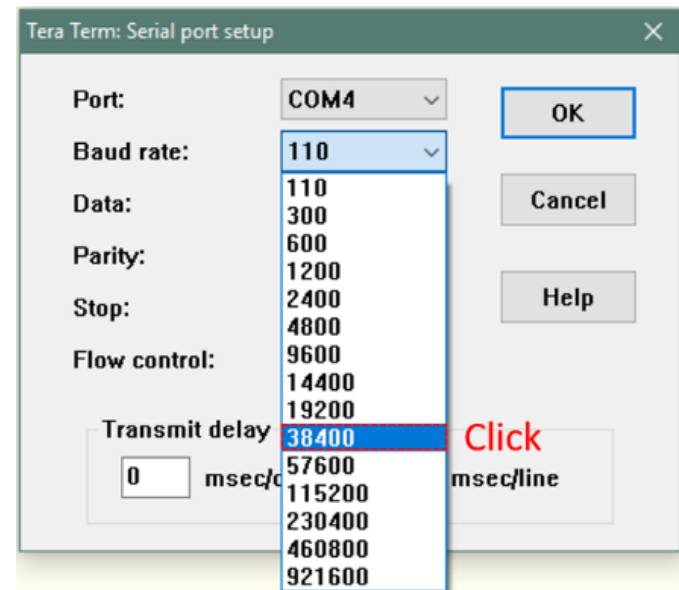
Application : Finite State Machine

Final results :

Don't forget :

Video : hardware and software

https://www.youtube.com/watch?v=smweBf85Wjg&feature=youtu.be&fbclid=IwAR36StgG_NxwbV-TLYLgbpehZIk4X9RS3St-fv-t5zZuzoIZ4vy58R3xnsk

Acknowledgement

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Bibliography

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❑ https://chauve-souris.ca/tout-savoir-sur-les-cha1uves-souris; (bat)

❑ https://www.jaycar.com.au/white-5mm-led-4000mcd-round-clear/p/ZD0190; (LED)

❑ https://www.robot-italy.com/download/srf02_i2c.pdf; (Datasheet)

❑ https://moodle.umons.ac.be/mod/resource/view.php?id=7403 (Interrupt)

❑ https://french.alibaba.com/product-detail/volume-control-adjustable-potentiometer-knob-switch-rotary-angle-sensor-for-arduino-avr-stm32-60294805563.html. (button)