Shift register, IR sensor

Task 1 – Shift register (1+1p)

a) Use the 74HC595 shift register to display a message of your choice on the 4-digit 7-segment display.

b) Measure the temperature with a thermistor and display it on the display you've just built with $0.1\ ^\circ$C resolution.

It would be possible to drive the display without a shift register but that would use up many of the Arduino's pins. In more complex projects, the number of available GPIO pins is often a limiting factor, so moving components behind a shift register can free up pins for other uses. Shift registers can be cascaded, for example, so that two 74HC595s (16 outputs) can be controlled with only three GPIO pins.

Task 2 – Interrupts revisited (1.5p)

Take the following code block and add an interrupt service routine which counts the number of falling edges on a pin. You can connect either a button or the tilt switch to the pin to produce the edges.

Write a function (`displayNumber(byte number)`) which writes the input argument on the 7-segment display. Use the loop and variable given below.

```
volatile byte fallingEdges = 0; //why volatile?

void loop(){
  delay(5000);
  displayNumber(fallingEdges);
  fallingEdges = 0;
}
```

Task 3 – IR sensor (1p)

Light up an LED for 5 seconds when a passive IR sensor detects movement. Set its range to around 3 m and make the trigger repeatable.

NB: The IR sensor needs a supply voltage of 5 V. **If you are using the ESP32, make sure that 5 V goes only to the IR sensor.**

Task 4 – Capacitive button (1.5p) [Arduino][1]

Make a capacitive button without any external components. To test it make a reaction time tester. The tester should have two modes: Idle and running.

During idle mode, an LED (built-in or external) should be lit, and the Arduino should wait for input from the serial monitor.

Once an input has been given, the LED should go dark, and after a random 1-2 second delay, light up again. Measure and print the time it takes for you to touch the capacitive sensor.

Hint: Native Capacitive Sensors without additional Hardware (arduino.cc)

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[1]This task must be completed with the Arduino.