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| **Mark** | **A** |

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| Team name: | *B01* | | |
| Homework number: | *HOMEWORK 8* | | |
| Due date: | 28/11/2023 | | |
|  |  |  |  |
| Contribution | NO | Partial | Full |
| Francesco Scroccarello |  |  | *x* |
| Paolo Salvatore Galfano |  |  | *x* |
| William Stucchi |  |  | *x* |
| Giada Silvestrini |  |  | *x* |
| Francesco Maria Tranquillo |  |  | *x* |
| Notes: | | | |

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| Project name | Encoder | | |
| Not done | Partially done  (major problems) | Partially done  (minor problems) | Completed |
|  |  |  | *x* |
| Explanation:  We successfully completed the homework.  8a) In the GUI we activated PC6 and PC7 as TIM3\_Ch1 TIM3\_Ch2 respectively, then we activated TIM1 with: internal clock, 10000-1 as prescaler, 8400-1 as counter and activated the interrupt. We also activated TIM3 in encoder mode (under the combined channels tab) and in his settings: - internal clock division: division by 4 - for both channels: input filter to 15, opposite polarity (one rising edge the other falling edge) In the connectivity section we activated the DMA of the UART leaving the default settings; we activated also the UART2 global interrupt (in order to allow multiple DMA requests). In the code we declared the timer’s interrupt function HAL\_TIM\_PeriodElapsedCallback were we set a flag. In the main we started the encoder (HAL\_TIM\_Encoder\_Start) with mode TIM\_CHANNEL\_ALL and the timer (HAL\_TIM\_Base\_Start\_IT) in interrupt mode. In the while loop when the flag was set we retrieved in an uint16\_t variable the counter value of the encoder with the macro \_\_HAL\_TIM\_GET\_COUNTER, then we calculated the delta as the difference between the new and the old value of the counter. With an if we check if the value of the delta is greater then 32767 (in which case the counter of the encoder underflowed) and the real delta is set to new – 65536 + old; in the else branch, if the delta was smaller then -32767 (the overflow case) the real delta is set to new + 65536 - old. We assume that the encoder can’t rotate at a speed capable of changing the counter more than 32767 times in the period of the timer (which in our case is 1 second). After the if we sent the value of the delta, multiplied by 60 and divided by 24, to the UART in DMA mode (with function HAL\_UART\_Transmit\_DMA).  8b) After checking we noticed that if we saved the value of the counter in an int16\_t variable and the delta (new value – old) as an int16\_t variable, the if was not necessary because in the underflow case the new value is interpreted as a positive number (for example -32769 is 32767, -32770 is 32766 and so on) so the result was the same as the if branch used with the uint16\_t variables (in which we added 65536 to the new value). In the overflow case the new value is interpreted as a negative number (for example 32769 is -32767, 32770 is -32766 and so on) so the result was the same as the if branch used with the uint16\_t variables (in which we subtracted 65536 to the new value).  8c) The polarity of the 2 channels is needed to decide if the single tick (with tick we mean the smallest rotation noticed by the encoder) must be added or subtracted to the counter of the encoder. For example, in the case of rising edge of A and falling edge of B, when the rising edge of A comes first, the tick is added to the counter, otherwise if the falling edge of B comes first, the tick is subtracted to the counter. So if we change just one of the polarities (having both to rising edge or both falling edge) the position of the edges noticed by the counter is inverted. For example, starting in the case of rising edge for A and falling edge for B and let’s suppose that the rising edge of A comes first then the falling edge of B the counter increments; if we invert just one of the polarities, the edge of B comes before then the edge of A and the ticks are subtracted. So inverting the polarities change the increment direction of the counter with respect to the encoder rotation. | | | |
| Professor comments:  Ok, good! | | | |