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Lab 5 Report

1. Calculate the angular resolution of the given motor, which makes 48 steps per revolution.

$$\text{Angular Resolution} = \frac{360^\circ}{\text{steps}} = \frac{360}{48} = 7.5^\circ$$

2.

Student number = 400313696

Thus, the period of one revolution is 63 seconds.

3. Determine the time period between two steps of the stepper motor used in the lab such that the motor completes one revolution in the time interval calculated in Step 2. Do this for:

1. Half-stepping sequence.

$$\text{Half} - \text{Step Period} = \frac{63}{48 \times 2} = 0.65625 \text{ seconds/ step}$$

2. Full-stepping sequence.

$$\text{Full} - \text{Step Period} = \frac{63}{48} = 1.3125 \text{ seconds/ step}$$

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4. In the lab you will use TIM3 of the STM32F429 to measure time periods. Assuming the system clock of the board is configured as 180MHz (SYSCLK) and the bus APB1 is configured as 45MHz, calculate the value of the prescaler for the timer counter and the value for the output compare register that will enable you to measure the time intervals calculated at steps 3.1 and 3.2.

1. Half-stepping sequence.

$$\text{System Clock Frequency} = 180\ \text{MHz}$$

$$\text{Bus APB1 Frequency} = 45\text{kHz}$$

$$\text{Prescaler Value} = \frac{180\ \text{MHz}}{45\ \text{MHz}} - 1 = 3$$

$$\text{OCR} = \frac{63}{48} * 45 \times 10^6 - 1 = 59062499$$

2. Full-stepping sequence.

$$\text{System Clock Frequency} = 180\ \text{MHz}$$

$$\text{Bus APB1 Frequency} = 45\text{kHz}$$

$$\text{Prescaler Value} = \frac{180\ \text{MHz}}{45\ \text{MHz}} - 1 = 3$$

$$\text{OCR} = \frac{63}{48 \times 2} * 45 \times 10^6 - 1 = 29531249$$

5. Write C code (only the relevant parts should be included in the report) that uses TIM3 and the stepper motor to implement the clock described in Step 2. Implement this for both full-stepping and half-stepping. Make sure that the direction of the motor movement (clockwise/counter clockwise) can be easily changed in your program. You may use the user button available on the Discovery boards.

```
uint16_t Presc = 3;
__IO uint16_t Tim3_CCR;
__IO uint16_t Tim3Period = 63;   //63 for full step 31.5 for half step
```

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See main.c code submitted

6. Perform any experiments required to answer the following questions:

1. *How does the behaviour of the stepper motor change when you exchange the two sides of one winding (e.g., exchange A1 and A2), without changing the program?*

   The motor spins in the opposite direction when A1 and A2 are exchanged.

2. *How does the behaviour of the stepper motor change when you exchange the two windings (i.e., exchange A1 and A2 with B1 and B2), without changing the program?*

   When the two windings are exchanged, without changing the program, the motor keeps on going clockwise and anticlockwise instead of spinning in one direction constantly.