EGR326 Lab9 F22

Motion sensing using hall effect sensors.

As part of the prototyping of the electronic music machine, you need to detect the presence of a moving object. Two Hall effect sensors were included in your kit for your consideration in your design (other options are possible, but, these are simple, cheap, and reliable).

Start out by reviewing the documentation on how a Hall effect sensor works (see the data for the OH137 Unipolar Hall Effect Switch IC). Write a description of how these sensors work.

From the data sheet figure out how you will use these sensors to create a drum beat. NOTE: the supply voltage for this device requires a minimum of 4.5V. The output pin is on the collector of an NPN transistor inside the IC and is unconnected (called an **open collector** configuration). By using a pull-up resistor to the **3.3V** supply, you can get a signal that will be near 0V when a magnet is close to the sensor and 3.3V when it moves away. You may want to consider using the MSP432 I/O internal pull-up resistor instead of an external resistor to save a component. Be careful **not to connect 5V** to the MSP432 I/O pins! Draw a schematic diagram of how the sensors will be wired to the MSP432 (include I/O pin designations).

1. Write a test program that display the status (open or closed) of the sensor on your LCD. As you bring a magnet close to the hall effect sensor, the display should clearly show “CLOSED”. If the sensor is not triggered by the magnet, the display should read “OPEN”.
2. Create a program to control the speed of the unipolar motor. You will need to use the ULN2003 driver board powered from +5V to interface the MPS432 to the motor. The user will prompt the user to enter a number from 0-5. The motor will then start turning according the following chart:

|  |  |
| --- | --- |
| Digit entered | Speed |
| 0 | 500 msec/step |
| 1 | 400 msec/step |
| 2 | 300 msec/step |
| 3 | 200 msec/step |
| 4 | 100 msec/step |
| 5 | 50 msec/step |

Use “wave drive” stepping for this exercise**. The motor gears will need to be removed to increase the speed of the motor (at the expense of torque)**

1. Determine the rate of rotation of a stepper motor. Mount one or two magnets to the modified stepper motor shaft (without gears) . The student will align their hall effect sensor close to the rotating magnet(s) and determine the the rate of rotation (RPM) which will be displayed on the LCD. Note- RPM is a different unit than was used in step 2.

Submit all three main.c codes to blackboard along with a description of how you calculated speed.

An .stl file is included as an option to secure the magnets to the motor. You may use your own design if preferred