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ECE 375

Lab#6 PreLab

*1. In computing, there are traditionally two ways for a microprocessor to listen to other devices and communicate: polling and interrupts. Give a concise overview/description of each method, and give a few examples of situations where you would want to choose one method over the other.*

Polling is when a program has a loop to constantly check to see if input or new information has arrived. The status of a device is checked and if the condition is met than some action occurs. Polling can be used when external devices are not independent systems, but rather part of the same system of the program. This system of constant monitoring is a huge waste of resources for the controller which is the primary drawback of using it.

Interrupts are special functions that are automatically called when input or an event creates a trigger in the hardware. An interrupt is a request for the processor to stop what it’s doing and to execute a special code. When a device needs a specific service it can send an interrupt signal via the interrupt service routine. These external devices which send an interrupt signal can be independent of the primary system of the program and do not require any monitoring by the program.

*2. Describe the function of each bit in the following ATmega128 I/O registers: EICRA, EICRB, and EIMSK. Do not just give a brief summary of these registers; give specific details for each bit of each register, such as its possible values and what function or setting results from each of those values. Also, do not just directly paste your answer from the datasheet, but instead try to describe these details in your own words.*

The EIMSK register is used to determine which interrupts are enabled. It masks the interrupt signals to allow each interrupt to be detected or not detected.

Both the EICRA and the EICRB are external interrupt control registers, and they determine how interrupts should be detected. There are 8 possible external interrupts; EICRA configures registers 0-3 and the EICRB configures registers 4-7. The registers are divided into nibbles. Each nibble is used to configure its corresponding interrupt. So the first nibble would configure the first interrupt, the second would configure the second interrupt etc. Each nibble can have one of four different states, and each state has a different meaning for the EICRA and the EICRB interrupts. These registers are used to set when the interrupt occurs, whether it is on a falling or rising clock edge, or the low edge of the clock cycle.

*3. The ATmega128 microcontroller uses interrupt vectors to execute particular instructions when an interrupt occurs. What is an interrupt vector? List the interrupt vector (address) for each of the following ATmega128 interrupts: Timer/Counter0 Overflow, External Interrupt 5, and Analog Comparator.*

Interrupt vectors are special functions that are automatically called when trigger in the hardware of the ATmega128.

Timer/Counter0 Overflow interrupt is at $0020

External Interrupt 5 is at $000C

Analog Comparator is at $002E

*4. Microcontrollers often provide several different ways of configuring interrupt triggering, such as level detection and edge detection. Suppose the signal shown in Figure 1 was connected to a microcontroller pin that was configured as an input and had the ability to trigger an interrupt based on certain signal conditions. List the cycles (or range of cycles) for which an external interrupt would be triggered if that pin’s sense control was configured for: (a) rising edge detection, (b) falling edge detection, (c) low level detection, and (d) high level detection. Note: There should be no overlap in your answers, i.e., only one type of interrupt condition can be detected during a given cycle.*

Clock cycles for a rising edge detection are: 8, 23

Clock cycles for a falling edge detection are: 3, 20

Clock cycles for a low level detection are: 1-2, 9-19, 24 …

Clock cycles for a high level detection are: 4-7, 21-22