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Design and Construction of the Game Show Box

During review sessions for her finals, Dr. Hwang divides the students in some of her classes into teams that compete to answer questions about material that will be on the finals. In order to facilitate this "quiz show" type game, she requested that someone create a "game show box."

During a meeting with Dr. Hwang, she laid out the specifications for the game show box. The device is to have six buzzers, one for each team. When a team presses their buzzer, it should provide and audio and visual indication that a buzzer has been presses. No other team should be allowed to buzz in until after their buzzer has become cleared. Dr. Hwang made it clear that there was no particular way she wanted the device implemented; she simply wanted a working product to meet her specifications.

The design chosen for the device features an Atmel 89C51 microcontroller. This processor was chosen because it has programmable ROM and up to four ports which can be used for input and output. The device also has two built-in timers and two external interrupts. Also this microcontroller is relatively inexpensive.

For the connections to the buzzers, two RJ-45 cables were used. They were selected because each RJ-45 cable contains 4-pairs of twisted pair wires. Simple push buttons found in the stock room were used for the actual buzzer mechanism, and the buzzers were housed in six of wooden bell shapes objects purchased from Ben Franklin Crafts. The six buzzers were attached to port 1 of the 89C51. They were also attached to the inputs of an 8-input NAND gate. The output of this gate was inverted and used for the falling edge triggered external interrupt 0 on the 89C51. The device also had two additional buttons. The clear button is used to clear the current "buzzed-in" buzzer and block it from future buzzing. This button was also connected to the NAND gate and port 1 on the 89C51. The reset button is used to clear the status of the buzzer system. Instead of writing additional software to handle the reset button, it was connected to the reset line of the 89C51 microcontroller.

Also connected to Port 1, was a Sonalert sound device. This Sonalert was used to generate the sound of the buzzer. Seven status LEDs were connected to the remaining pins of Port 3 (one pin had already been taken for external interrupt 0). The Sonalert and the LEDs were all driven using a 7406 Open Collector Hex Inverter. The 7406 inverter was used instead of individual transistors because it provides a small package that can be used to drive six devices each. In addition, an inverter was already needed to invert the output of the NAND gate for use as external interrupt 0. Of the LEDs, six are used to indicate which buzzer buzzed in, and one is used to indicate that one or more buzzers has been blocked. There is an eighth LED used to indicate that the device has power.

The brains of the game show box lie in the software written for the 89C51 microcontroller. The software was written using the Kiel µVision for the 8051. The software handles the

external interrupt 0 to detect button presses. No debouncing is needed because the buzzer buttons are disabled once they are pressed.

The design and programming phases of the project was very easy. Within a couple of hours, the logic needed for the project had been determined and the software written; however, the task of putting together the hardware components was quite long and involved. It took several days to connect all of the parts and ensure that it would fit into the project enclosure. Also, I tried several different connections for the buzzers before I found one that worked. After the hardware was completed it was determined that two LEDs and one 7406 was defective. The defective components were replaced and the device worked as designed.