Post-Mortem

Team: Life-Support

Project: Catch The Light

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**Project Overview**

This project consisted of two phases being completed. Phase 1 was to recreate the original game create by Justin Meninno, which only used discrete logic. This design by Justin was created on a bread board, and our task was to recreate in on a PCB using only surface mount components and the same discrete logic that he used. Our phase 2 was to create the game using an Atmega328pb using a capacitive touch button to “catch the light.”

The main focuses of this project were on our phase 2 board. The intention of this project was to be gift that could be handed out at open house or accepted student day for the student to remember UMASS Dartmouth by. This led to some strict requirements as this needed to be a show piece and cheap to manufacture. As outlined in our requirement document, the board need to have UMASS related artwork as well as being priced at under $3 for all the components. Some of the other requirements included a capacitive touch button to be used, having a power saving mode to extent battery life, and running on a 3V coin cell battery. To see the full list of requirements, refer to our requirement document. Apart from the requirement pertaining to the board, we had the requirement of documentation of both phase 1 and phase 2. This included but was not limited to covering how the phase 1 was designed function and how the phase 2 was design function, as well as the whole process of how the project was completed.

Overall the project was able to meet all the requirements with the exception of having a power saving mode to extent battery life. A power reduction mode was implemented that turned off the LEDs after 30 seconds, but kept the processor running as normal. The intention was to have a full sleep mode that would shut down the processor and could then be woken up with the capacitive touch button. Other then this the project was a success. Only our phase 2 board was created, so our phase 1 board was never created and no able to be tested, but with the use of multisim we assured ourselves that we had a proper design. Our phase 2 design function as intended and meet all the requirements that were set fourth with the one exception stated above. Overall as a team, we worked well and were able to accomplish this task.

**Key Accomplishments**

As stated above, we were able accomplish most of our requirements that were set forth. Of the greatest accomplishments was creating a success PCB design that did not have any shorts or miss wiring. This allowed for the board to successfully be populated with all the needed components as well as being programmable. The next key point was successfully programming the capacitive touch button to function properly and “catch the light.” This was a feature that proved to be more difficult that anticipated. The last key accomplishment was the design of the PCB. Based on comments from our peers as well as our professors, the design was well liked.

**Key Problem Areas**

In terms of PCB design, there was not any major problems that arose. The only minor problem was the design of our capacitive touch button. The way these buttons work, there are two copper planes that act as a capacitor, and the capacitance changes when touched. For our design we made the whole back of the board a ground plane and had the smaller touch pad on the front of the board. This led to occasional problems when holding the board as the hand holding the board would affect the capacitance of the ground plane and processor would see it as the button being touched. Other then this the design worked well.

Apart from the design, we were riddle with more programming trouble. As mention, the capacitive touch button was more difficult then anticipated. As none of the member in the group had any experience using capacitive touch button, there was a learning curve. Through trial and error, our initial design of using only delays to cycle and delay the light had to be scraped and changed to timers. As the touch button needed to be polled or constantly check to see if there are any changes, delays had to be used at a minimal. It took trial and error to final find the right balance of delays and timers to make the program work as intended.

Another programming problem was setting then processor to sleep mode and waking up from it using the capacitive touch button. Again, as none of the member in the group had any experience with sleep mode, there was a lot of research that went into trying to program it. In the end were not successful in set the processor into a sleep state. Instead we implement our own “sleep” or power reduction mode. After 30 seconds of not being touched, all the LEDs would turn off and the capacitive touch button would only be check to see if it was touched. If it was touch, the game would restart.

**Post Project Tasks/Future Considerations**

One post project task is to future develop a function to set the Atmeag328pb to sleep state and wake back up from it. Unfortunately, as stated before this was a feature that was not fully implemented yet. The framework is there in the code, as the all the LEDs power off after 30 seconds of not being touch. Just the implementation of setting the processor into a deeper sleep or a better power save mode needs to be incorporated. Along with sleep mode, further implementation of the capacitive touch button code would need to be tweaked to optimize performance on this board design. Another future consideration would be to make a second revision of the board. As this was our first production of this board design, we include extra footprints for a tactile push button, an external crystal that was not used, as well as some unused capacitor and resistor footprints. These extra footprints were there for prototyping to allow for different configurations to be tested. Now since most of the prototyping has been done and the board function as design, these extra foots prints are not longer needed. Other part to this revision would be to redesign the capacitive touch button. As mention, the ground plan on the back of the board tends to interfere with processor ability to sense if the button is touched. In this revision, the two copper planes that make up the capacitive touch button would better isolated to reduced interference from the ground plan.