Pomodoro Timer

PROJECT SUMMARY

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Summary

This project requires a sensor to be used to detect an object such as a phone, and output an alarm if the phone is removed before the timer is complete. A timer must be displayed on a 7-segment display and be able to switch between a 25 and 5 minute timer setting. The user interface requires physical switches and an intuitive design.

In addition to these design specifications, the customer is also asking for the following:

1. The timer must be less than 1 second off every minute.

2. The system must use connectors for every module used in the timer system, have a power disconnect switch, and not have any exposed conductors. Wires must be organized in split loom or other protective materials. All devices must be rated at least IP43

3. Every switch and potentiometer on the user interface should have a label that can be read from three feet away by at least 2 people other than the project designer.

4. The alarm should be 440 Hz +/- 1 Hz.

5. The LEDs on the timer display should have 3 brightness levels (not 4, not 2, but 3). The brightness level will be selected by a switch, potentiometer, or photosensor.

Execution

The initial planning phase was spent developing an execution plan, creating block diagrams with sub-systems and researching hardware and software possibilities. An execution plan was drafted with an additional design requirement proposal for the customer's approval. My initial proposal was later modified to better fit the difficulty of the project.

My approach to customer requirements began with breaking the system down into isolated sub-systems. I could then build and test each of these to ensure it could be incorporated into the completed system. After revision, I found three distinct sub-systems which included a 4 digit 7-segment display, interface buttons, and a light-sensitive sensor with speaker.

The largest revision occurred when implementing the brightness controls. The initial design was to use the a 7-segment Arduino library that offered brightness controls. For better functionality, the Arduino library was scrapped and replaced with the MAX7219 LED driver which allows for more control over the 7-segment display.

Key Lessons

I began the project with he idea of separating the system into sub-blocks in order to test the functionality of my sensors and interface. I began constructing these sub-blocks with the idea that they would each directly translate into the complete design.

This assumption really set me back and gave me a lot of difficulty because my brightness control needed for the 7-segment display, did not match what I tested. Only when I began putting the whole system together did I realize the sub-block would not translate into what it needed to do. This required me to revise my design at the end of phase 2. Thankfully I was able to accomplish the brightness controls and all working sub-blocks are now working together. Additionally, the individual aspect of this project was the most difficult to deal with.

There were so many times I had questions or ideas that I would have loved to talk to a team about, but I often found myself searching the internet for advice. Overall, it was an incredible time-consuming task as an individual.