Junior Design II
Cellcatraz Project Summary

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As an engineering student, I understand all too well how a distracting cell phone can hinder productivity, so I set out to create an accurate, safe, and intuitive device to assist the user in following the Pomodoro Technique to minimize distraction and increase productivity. My device, Cellcatraz, allows the user to select a 25-minute or 5-minute timer. If the 25-minute setting is selected, the user must place their phone in the box to start the timer. If the phone is removed early, an alarm will sound; the user has 5 seconds to return their phone before the system resets. If the 5-minute setting is selected, the user may remove their phone without penalty. If used correctly, Cellcatraz will promote an effective study routine.

This project was among the most complex I had yet faced, so I first tried to anticipate what parts of the project would come easily and which parts would require more investigation. I had done some Arduino programming in previous classes, so I felt confident in that respect. However, I had no prior PCB design experience, so I planned to devote more time to that part of this project. This self-reflection helped me create a project timeline that kept me on track.

Task Title	Start Date	End Date	Duration	% Complete
Overall Project Design				100%
Block Diagram	1/15/21	1/15/21	1	100%
Progress Reports	1/16/21	1/16/21	on-going	100%
Timeline	1/17/21	1/17/21	1	100%
Parts				100%
Switches	1/15/21	1/18/21	4	100%
ATmega328P	1/18/21	1/21/21	4	100%
Power Supply	1/19/21	1/22/21	4	100%
Photosensor	1/20/21	1/23/21	4	100%
Speaker	1/21/21	1/24/21	4	100%
7-Segment Display	1/22/21	1/25/21	4	100%
Circuit Design				100%
Photosensor	1/15/21	1/19/21	5	100%
Speaker	1/22/21	1/26/21	5	100%
7-Segment Display	1/29/21	2/2/21	4	100%
Switches	2/5/21	2/9/21	5	100%
Power Supply	2/10/21	2/12/21	3	100%
PCB	2/8/21	2/18/21	11	100%
Code				100%
Photosensor	1/20/21	1/22/21	3	100%
Speaker	1/27/21	1/29/21	3	100%
7-Segment Display	2/2/21	2/5/21	4	100%
Switches	2/7/21	2/11/21	5	100%
Enclosure				100%
Prototype Build	1/22/21	1/25/21	4	100%
Final Build	2/8/21	2/19/21	12	100%
Documentation				98%
Video Production	3/2/21	3/5/21	4	100%
System Verification	3/2/21	3/5/21	4	100%
Project Showcase	3/2/21	3/5/21	4	95%

The first important steps were to understand the project requirements and use this information to create a system block diagram with well-defined interfaces. This let me divide the project into manageable tasks. I front-loaded simpler parts of the project like the speaker and photosensor. I built and tested them on a breadboard to ensure that I had reliable elements that could be used in testing the more complex aspects of the project later on.

I then needed to decide what microcontroller to use. I initially determined to use an Arduino and design a simple PCB shield, but I decided to challenge myself and design a PCB around the ATmega328P itself. I knew this would be a more complex circuit, but I also saw that it would be a valuable learning experience. After several hours of tutorials and a day of verifying and tweaking my design, I ordered my first PCB!

Assembling the circuit and enclosure was straightforward, but I did note some revisions I would make for a subsequent iteration of this project. I made the enclosure out of wood and glass, which looks cool but is costly and time-intensive to replicate. Additionally, I realized that I could have designed a smaller, more compact PCB if I had used surface-mounted components rather than through-hole components. Finally, it would have been prudent to include a rechargeable battery pack, which would allow Cellcatraz to operate without relying on wall power. A smaller PCB, internal battery, and a more modular, perhaps 3D-printed enclosure would allow Cellcatraz to be a more compact, practical, and replicable device.

Bringing Cellcatraz from idea to product was both rewarding and exciting, and it was a great learning experience. I learned new tools, such as Fusion 360 and Eagle, and I learned some specific aspects of PCB design. I also built valuable habits for project management, including planning, self-reflection, and the value of ongoing design revision.