By now many students have thought of a microcontroller project they would like to make outside of class. If you have such a project in mind, then use it for this final Life Long Learning exercise. If you do not have something in mind, then you will need to think of a small microcontroller project you might like to work on for a hobby, a research project, or maybe even a new product. Just to be clear: this does not involve actually building a project. It involves just describing one, and sketching out a circuit for it that uses a microcontroller.

1. Describe your project in one or two sentences.

My proposed microcontroller project is a very small (essentially something that could fit comfortably behind the ears) system that provides an interface between my biological auditory system and the external world. There are additional mechanical and chemical considerations involved in this project, but the bulk of the functionality is electrical (both hardware and software). The mechanical components to this system involve designing a layered approximately cylindrical system that can dampen or filter most if not all of the sound waves that travel via the ear canal. In addition, at both ends of this cylinder there needs to be one or more speakers and microphones built into the dampening substrate. Chemically, the surface of this system must be inert and highly resistant (as it pertains to the environment of the human ear canal). Finally, the microcontroller would be measuring the electrical signal from the transduced sound on the outside of the ear canal and the inside of the ear canal, and it would be actuating the speakers to produce the desired output. The bulk of the functionality would then be in software (or dedicated hardware peripherals) running on a microcontroller that continuously performed signal processing functions on the audio stream to produce any type of auditory environment that the user desired. In effect, this system would isolate my biological auditory system from the whims of my environment both protecting and enhancing my ability to sense auditory signals.

2. Search the Internet to find examples of similar projects that might help you get started. List the links, each with a brief description, to similar projects that you found on the Internet.

A DIY hearing aid. This project was only implemented on a bread board and the microcontroller was an Arduino model, but some of the logic and art that went into the circuit design could be used as a jumping off point for miniaturization.

Source: https://hackaday.com/2013/12/15/diy-hearing-aid/

A hearing aid kit that can be ordered from the company iHear Medical. The $200 dollar kit is self-assembled, and ordering one of these kits could provide me with significant resources for copying what they did well and avoiding what they did poorly.

Source: https://innovatemedtec.com/content/an-affordable-diy-solution-for-hearing-impairment

3. Describe why the use of a microcontroller would make this project much easier than not using a microcontroller... is it even possible to do the proposed project without using a microcontroller?

It would be possible to do this project without a microcontroller, but a microcontroller makes it significantly easier, more flexible, and better. There is precedence for an entirely analog audio amplifier and signal processor, but once the circuits are designed and fabricated, it's much more difficult to adjust the signal modification parameters. Additionally, a microcontroller is capable of providing much greater computing power and flexibility while taking up less physical space than the equivalent analog computing power. Finally, a microcontroller provides near infinite flexibility because any time new computing operations are desired only the software needs to be changed.

4. Sketch out a prototype circuit using EagleCAD, and paste your schematic into the document you submit for this exercise.