ASL Tech (Knuckle Position Sensors)

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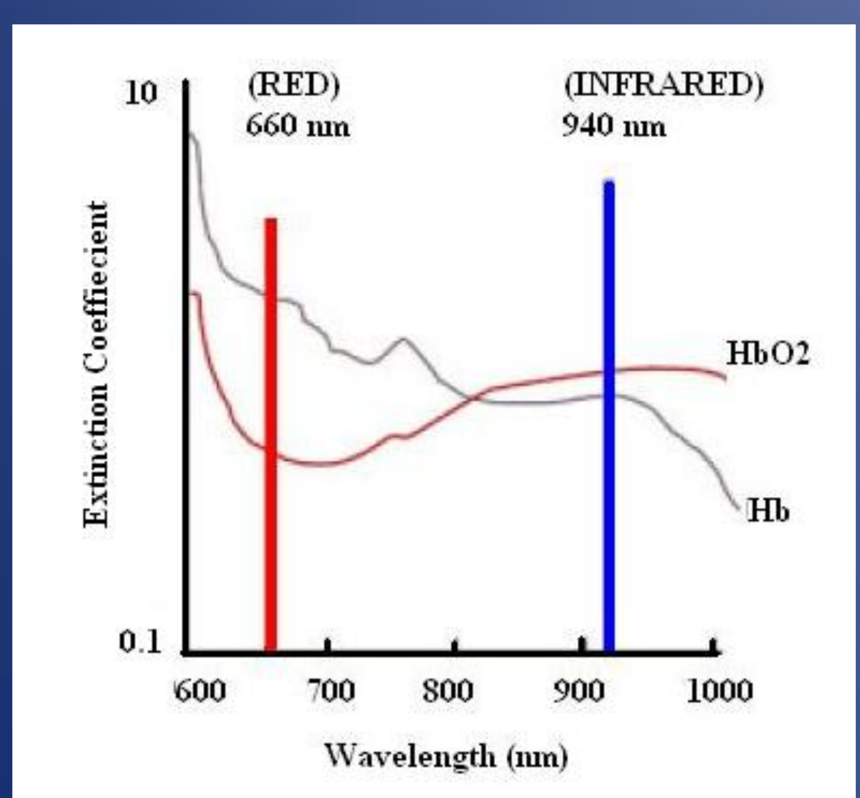
Introduction

The knuckle sensor, funded by the engineering research center at San Diego State University can be used for many applications, including wireless gaming, typing, position sensing, etc. Our team has redesigned the entire circuit to be used to interpret sign language into spoken English thus giving the audibly impaired a voice. Our device uses an infrared sensing system in order to determine the position of the users fingers.

Background

The original design used an unnecessarily large amplifier circuit which had been housed in an near-unusable package. The original photodiodes were held to the users hand through a Velcro system which limited the versatility of the system. Our teams initial steps were to redesign the amplifier circuit , making it smaller, more accurate, and able to transmit data wirelessly. Secondly, we aimed to create a housing package which could be comfortably worn on the users arm.



Research and Inspiration

Our project posed many challenges in many areas of engineering. Our team was required to address problems in programming, sensor selection, amplifier circuit design, infrared backscatter analysis, PCB design and manufacturing, sensor placement and tolerance, etc.

Conclusion

This project has greatly challenged every member of our group. Through this project, we were able to expand our knowledge beyond any individual aspect of engineering. Through our combined efforts, this team was able to produce a product which measures a small and noisy transmitted signal and map it into spoken word.

Acknowledgements

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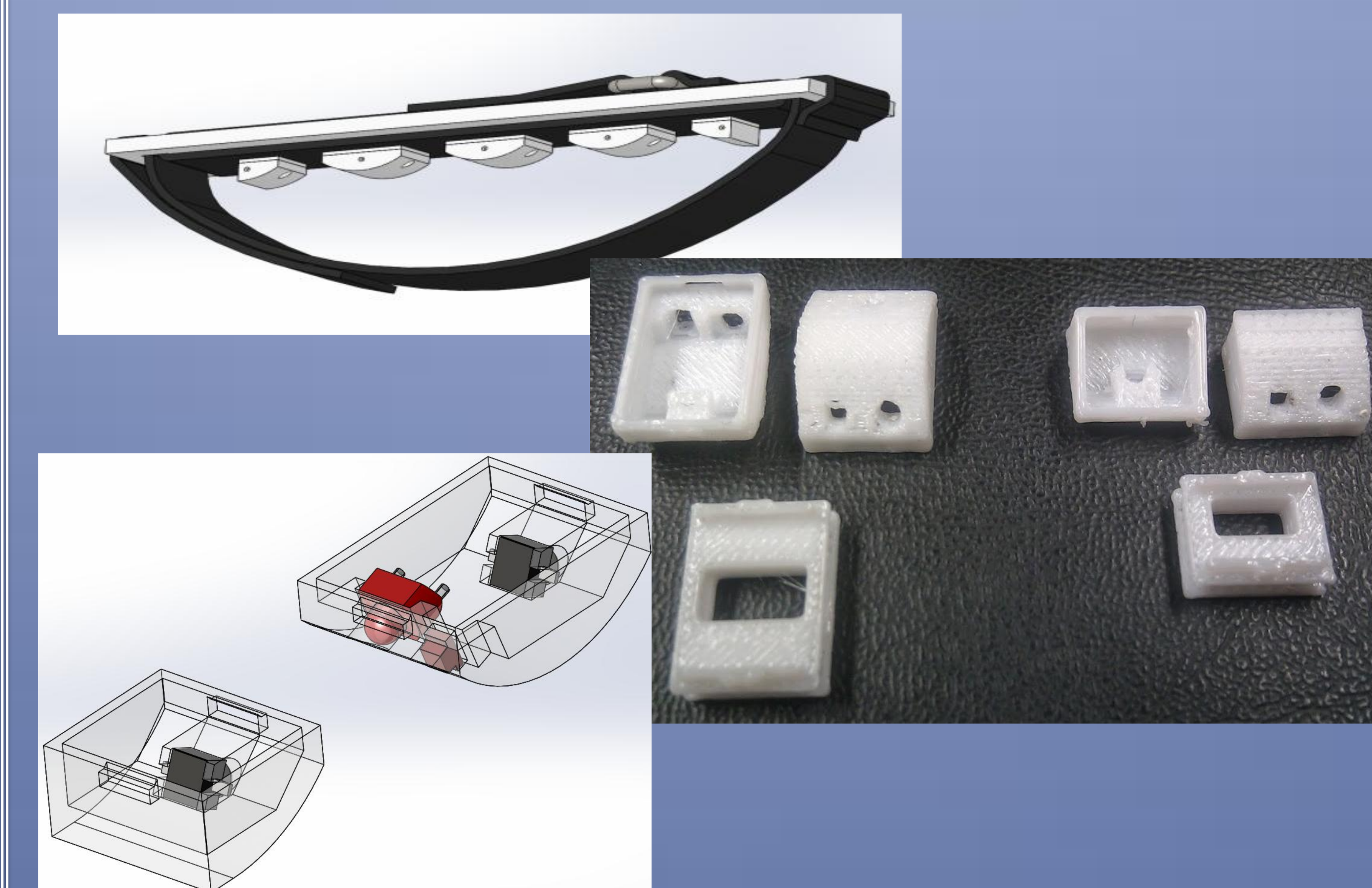
Housing Designs

The housing was primarily required to comfortably hold the sensors in place, close enough to the users knuckles to get an accurate reading while steady enough to limit the amount of noise into the system. Second, it was required to hold the PCB securely on the users arm.

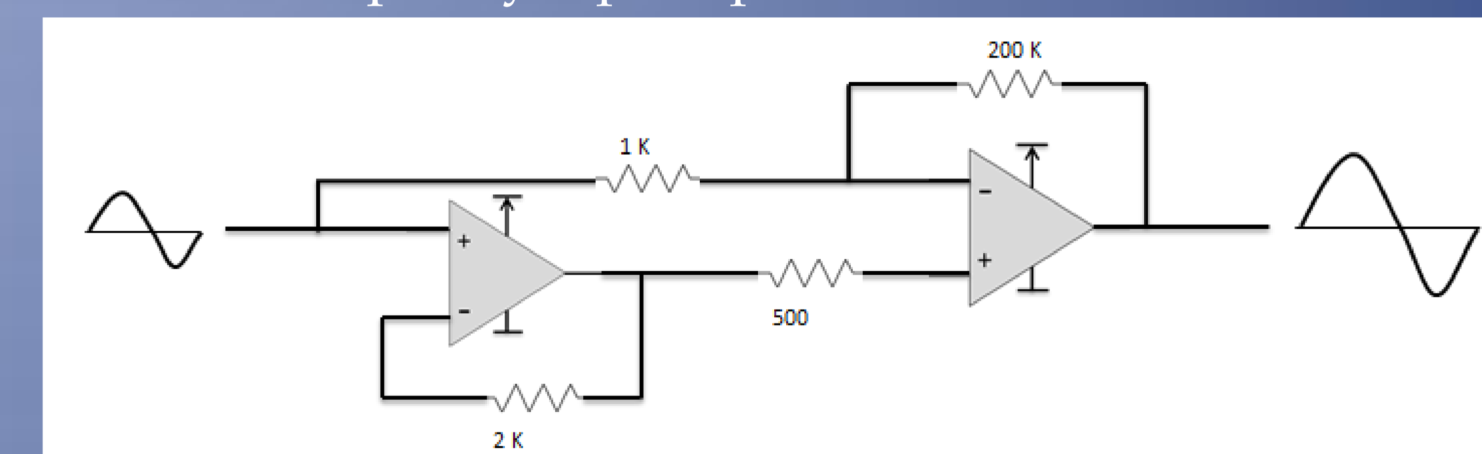


The sensors are placed into a semi-circular housing which fit comfortable between the users knuckles in order to ensure the closest possible sensor readings and minimizing noise as much as possible.

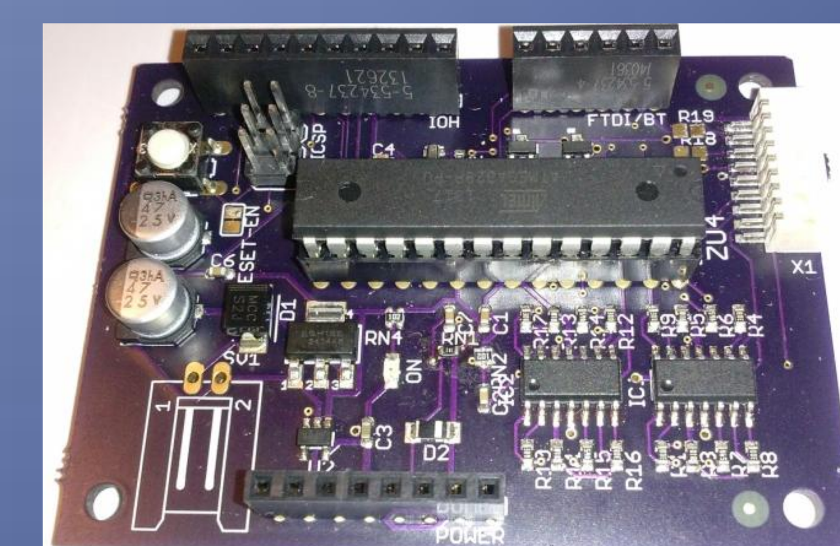
The PCB housing was designed around the PCB design. It was designed as lightweight and comfortable as possible. Because its size was primarily dominated by the size of the PCB, the circuit design became a critical factor of the project.

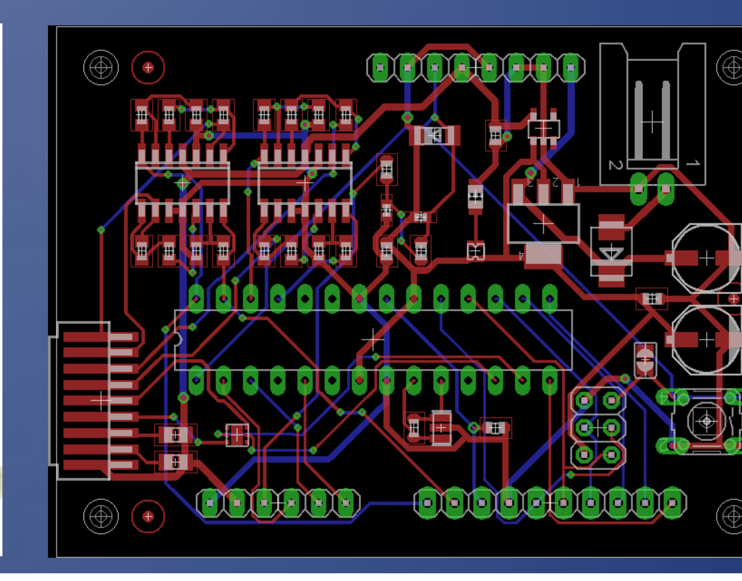
Circuit Designs

The original circuit was large, and made wearing the device highly uncomfortable. In addition, the original design made use of standard OpAmps, which introduced a significant amount of noise into the system. Our team aimed to minimize the size of the circuit and give it wireless capabilities while introducing high-quality OpAmps to minimize noise.



Our final amplifier circuit (above) made use of the MCP6004 microchips. A gain of ~100 was necessary to extract the desired signal.





After the PCB transmits the signal (via Bluetooth) it is read and interpreted by our teams java program. It reads the input data the creates and plays the corresponding audio file.