Measuring Thermal Comfort with a Watch

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Introduction

In the i-Lab in the Department of Civil Engineering lab, I was led by Professor Burcin Becerik-Gerber and Ph.D. student Ashrant Aryal. With their help, I researched about temperature and thermal comfort in buildings. After reading several research papers, I then started to use the information collected from the research paper to build and create a wearable device to monitor physiological changes of a person. In this case, we made a wrist worn device that monitors the person's skin temperature and the temperature in the room.

What I did in the lab/ research process

In the lab I programmed with the platform Arduino and created a data collection system with multiple sensors. My research consisted of many challenging problems that I had to solve. I first learned the coding language Arduino. It started off easy with a simple blink a LED program. Then I learned how to program all of temperature sensors that I used later on separately. Then lastly I programmed all of the sensors so that they would work together. After the coding was done, I used my soldering skills that I learned in the first week to solder all of the wires together. Then I attached the sensors to the board. Finally we started the experiment. In order to see if the person was comfortable, I had to make a survey that the person would have to take every 30 minutes.

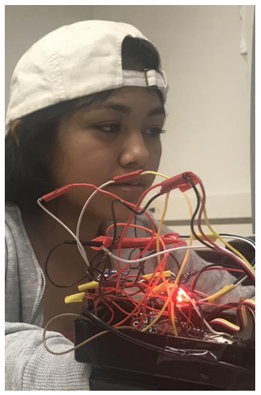
Skills Learned

With the research the I have done, I also learned many skills along the way. I learned how to solder wires together. It wasn't easy at first but in the end I became a master at solder. I also learned after many failures how to wire successfully and which wires work better. The last skill but the most important skill I learned was coding. This was the skill that I grew to like at my time at SHINE after years of resisting it.

I also learned:

- How to read a research paper
- Create an experiment by asking what the problem is
- Develop a method to solve the problem
- Do a human subject test
- Visualize the data

The survey I used to know if the person is comfortable

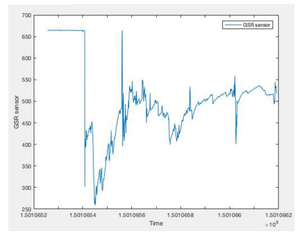


Victoria was used to test the sensors

Results

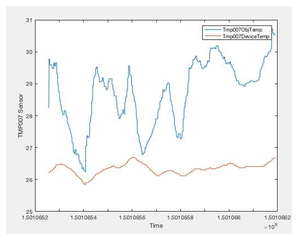
With our experiment, we used multiple heaters and fans to put our human subject under hot and cold conditions. In the graph and pie chart below, we noticed that our subject didn't get uncomfortable as easily as we predicted. We used the survey to see how she was feeling and we used the data we collected from the sensors to see how hot she was and the room. We made her take the survey about every 10 minutes and we changed the temperature every 20 minutes.

This is the survey of how they feel

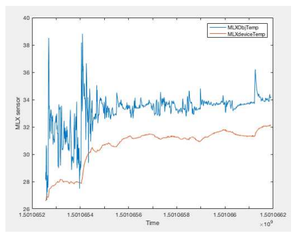


This shows the GSR sensor.

This is the finished prototype



This shows the TMP007 sensor



This shows the MLX sensor

Next Advice for Future SHINE Students

When I came into SHINE, I just finished my freshman year of high school; being one of the few rising sophomores, I was very intimidated about how I would do at SHINE and if I would be able to be friends with upperclassmen. My advice for future sophomore SHINE students:

- relax
- take advantage of this program
- make friends with upperclassmen
- I would recommend to ask upperclassmen about their high school experience.

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