

**Project Title:** Measuring Lighting Using Micro:bits

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**Brief Description:**

During the spring semester of 2023, I measured the lighting in the Dreyfuss building of Fairleigh Dickinson University's Florham campus. I used a tiny piece of hardware called a micro: bit to collect and store the data. Similar to a minicomputer, a micro: bit uses a unique combination of hardware and software. I can code the micro: bit with my laptop and watch how it responds to gain information about the environment . In this case, I coded the micro: bit to record the light intensity of the Dreyfuss bulbs on the first floor that receive little natural light. Additionally, I programmed the micro: bit to monitor how long the lights stay on for each week. This allowed me to be able to use this data to inform Fairleigh Dickinson about an estimate of our energy costs for the spring semester. This project would investigate how technology might be utilized to address the challenges associated with reaching the Sustainable Development Goals through problem-solving and prototype exercises. This project concentrated on SDG #7 (climate action), #11 (sustainable cities and communities), and #13 (affordable and clean energy).

**Accomplishments:**

In this research project, I have accomplished all what I had set to do. I have completed the necessary code to be programmed in the micro: bit, and have successfully uploaded it to the hardware. I also then recorded data for 8 weeks and calculated the estimated energy costs. Given

that I have gathered enough data to come up with an energy cost number, I can say that I have completed my research.

### **Revisions to Original Proposal:**

As mentioned in my interim report, I have changed the original location of where I wanted to record my data. In my original proposal, I stated that I was going to measure the lights in the Monninger Center on Fairleigh Dickinson's Florham campus, but that was then switched to the first floor of the Dreyfuss building. This was because the Monninger Center had too many windows and natural light coming in that the micro: bit had trouble getting a good reading from those bulbs. The first floor on the Dreyfuss building however, does not have any windows and the source of light comes purely from the bulbs, making it easy for the micro: bit to get a more accurate reading.

### **What I have learned:**

I have learned plenty during the duration of this research project. For starters, I learned how to use and program a micro: bit. I also successfully learned how to code for the micro: bit to take light intensity readings, measure how long lights have been on for, and created an energy cost calculator. A mistake that I had made was setting up the micro: bit too far from the light source during my pilot week. After adjusting the placement of the micro: bit, I was able to get 8 weeks of usable data. With the data gathered during those 8 weeks, I found that the lights on the first floor of Dreyfuss stay on for about 120 hours per week at an average light intensity of 208 on a 0-255 scale.

### **Conclusions derived from research about climate change and sustainability:**

In my research, I found that the total cost of energy spent by one bulb in the Dreyfuss building throughout 8 weeks is \$1.73. Given that we use LED bulbs, our kWh is low compared to other lighting options. With about 25-30 bulbs in Dreyfuss, I estimate that we spend about \$25 a month to provide light to this building. I have compared these numbers with the ones found on the Energy Information Administration page to see if we are contributing to SDGs. I found that as long as we spend less than 1000 kWh per month, we are on the right track. Thanks to the LED lights, Dreyfuss accumulates about 30 kWh per month. With this, I conclude that Fairleigh Dickinson is doing their part in contributing to sustainability as much as we can while still being able to efficiently run a University.

### **What are your recommendations for future research into this area?**

From what I have learned during this project, I would recommend expanding this project by measuring the lights and energy costs in the other academic buildings at Fairleigh Dickinson University. The only obstacle that would stand in the way of doing this is the entrance of natural light in most of the buildings. This makes it hard for the micro: bits to get an accurate reading of the lights. A solution to this however could be to create a holder for the micro: bit so that it is right under the bulb. It would be interesting to see the energy costs in buildings that are usually open 24/7 on campus as a continuation to this project.

**Data Table:**

Week	Hours	Cost (USD)
1 (3/24/2023)	121	0.22
2 (3/31/2023)	120	0.22
3 (4/7/2023)	120	0.22
4 (4/14/2023)	119	0.21
5 (4/21/2023)	121	0.22
6 (4/28/2023)	119	0.21
7 (5/5/2023)	119	0.21
8 (5/12/2023)	120	0.22
	Total (in USD)	\$1. 73

**References:**

- <https://www.eia.gov/tools/faqs/faq.php?id=97&t=3#:~:text=In%202021%2C%20the%20average%20annual,about%20886%20kWh%20per%20month.>
- <https://microbit.org/>