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Professor Jennifer Graham
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RE: Proposal for a Dedicated Electronics Prototyping Laboratory Space

Dear Professor Graham,

My name is Joseph Lodato, a Junior Computer Engineering Student here at SU. I am writing to propose a new collaborative that is missing at Syracuse University, that being a new Electronics Prototyping Lab space on campus.

As I mentioned I am a Computer Engineering student who is also minoring in physics. On campus I am also the president and the lead of the electronic sub-team for Citrus Racing (Syracuse University's Formula SAE team). Because of these titles I hold, I have seen firsthand the importance of having hands-on opportunities for students, I feel there could be more for CE and EE students. Currently Syracuse University is lacking spaces for students to work on their own hands-on projects, as the only lab room is used for classes and labs.

I have prepared this report to highlight the current lack of resources and suitable lab spaces for personal projects, as well as my research backed proposal detailing how to design and equip a new lab space to help push students to get stronger foundations of Electrical and Computer Engineering, allowing them to be more successful in their professional careers.

Please review the proposal at your convenience. If you have any questions or feedback, feel free to email me at jalodato@syr.edu. Thank you very much for your time and consideration.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Joe', with a long, horizontal, slightly wavy line extending to the right.

Joseph Lodato

Establishing an Electronics Prototyping Lab for Students

Joseph Lodato

WRT 307

April 13, 2025

Abstract:

The purpose of this report is to propose that Syracuse University adds a dedicated Electronics Repair and Prototyping Laboratory for student use. It is no secret that Electrical and Computer Engineering is a field that is growing by the day, with the world going more electric by the day (whether its through EV Car sales, the revolution in the energy grid as it turns more green, or any of the other countless examples) it is important that Syracuse Invests in the quality of education and resources available to all students and Computer and Electrical Engineering Students (EE+CE) in particular. To gather information about the importance of this lab, how it should be designed and what it should include, I conducted a survey with engineering students at SU, read online journals and websites discussing labs like the one I'm proposing, as well as conducted an interview with Tim Breen as well as a past Syracuse Masters Student. This research provided me with crucial information about the importance of having a lab, and how having one makes the transition from accedemics to a professional career easier. I also learned from the research what sort of equipment this lab should have in it and how it should be run. All results point to this sort of Electronics Repair and Prototyping lab being an incredibly important space that SU does not have. Therefore, implementing a space for students to tinker with electronics and use the tools they will need in their professional careers is a vital piece that SU must add to campus.

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Introduction:

It is argued by many that computer and electrical are some of if now the most important engineering disciplines in the modern day. The need for high quality electrical engineers stems from the constant advancements in electrifying the modern world, whether that is due to the increase in electric vehicle production, or the never-ending battle to create an environmentally green and renewable source for our increasing power demands. Likewise, the need for high quality and knowledgeable Computer Engineers comes straight from the never-ending demand for better and faster computing chips, not to mention the specific requirements that new computer hardware is forced to have to enable AI breakthroughs. Needless to say, these two fields are in the spotlights of universities trying to hone their students' skills the best they can, hoping that their students can be apart from this.

Syracuse undoubtedly understands what is going on as there has been an unusually high amount of funding going forward in the ECE (Electrical & Computer Engineering) department of the engineering school. Recently they brought Micron on as a leading partner to help them develop the Center for Advanced Semiconductor Manufacturing, a more than 20-million-dollar investment happening right now on campus. All this to say it is safe to say SU is investing heavily in the future of the ECE students, as a current Computer Engineering Junior, I believe there is one glaring area SU has not accounted for. That being a dedicated lab space where students can work on their own personal electronic projects while learning the tools of their trade. This is where my proposal for a dedicated Electronics Repair and Prototyping lab comes in.

For this paper I have conducted research that I will go over in detail including gauging student interest, how it would be run, and what the space will contain.

Methods:

I collected and analyzed a range of sources for this research. The first information I collected was responses of a google survey that was aimed at gauging the interest in a lab space like the proposed repair and prototyping lab, as well as what equipment they would like to see in there. The survey was passed around to engineering students ranging from graduate level down to first-year students, the survey was passed out with no expectation to respond in a specific way. The survey was passed out primarily to ECE students but not exclusively to them. In total the form gathered a total of 52 responses. The full eSurvey question list can be found in Appendix A.

I also conducted two interviews for my research. One was with a former student that graduated from SU with a master's in electrical engineering in the past year, who wishes to remain unnamed. The former student shared valuable insight into how a shared lab space like this would work logically. While my second interview was an informal interview with my boss at the Link Hall student machine shop, Tim Breen. Tim discussed information about how the machine shop is funded by the school as well as general protocols involved with students working on projects in the machine shop.

I then finished off my research by analyzing articles. Some of these are from the printed IEEE catalog of professional journals (IEEE is the institute of Electrical and Electronics Engineers), while others are from independent electronics journals. These

helped me get research from professional sources and allowed me to understand elements of this project better.

Results:

One piece of research I wanted to make sure I had was feedback from students here at SU. I created a survey that was aimed at finding interest in a space like this but also to find out what students would use this space for. Starting with general interest. My first question asked about if students felt like they got enough hands-on opportunities to tinker and work with electronics, out of the 52 that answered, 64.7% of people answered no to this question as seen in this chart below.

Do you feel Syracuse University provides enough resources for hands-on electronics experimentation?

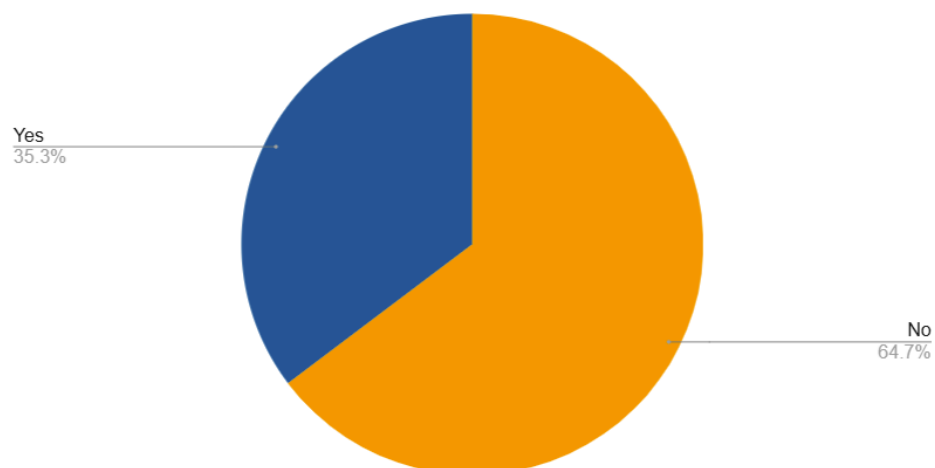


Figure 1: A breakdown of question 3 from my eSurvey

Of course, the next obvious question I could ask would be if students would even use a lab like I have been proposing. Regardless of what they answered on the last question they would be prompted with this one. Out of the total 52 that answered this question, 73.5% of them answered that they would use a space like this. I also included a 'maybe'

response to this question, while I can't know for certain how they were feeling when they responded with a maybe, a good 15.7% of them did, meaning only 11.8% of the 52 students said they would 100% not use a space like this. Again, there is a graph below showing this breakdown.

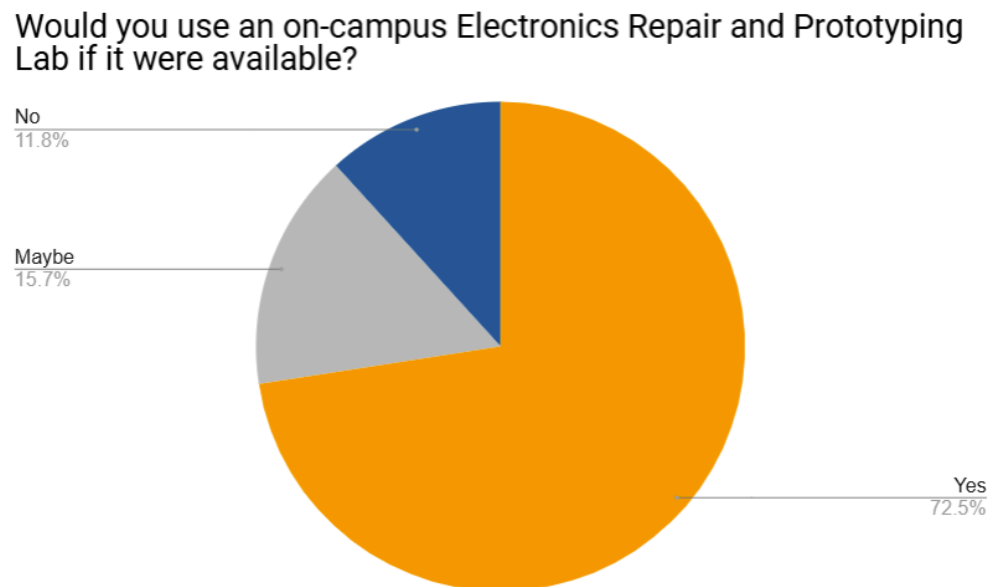


Figure 4: A breakdown of question 4 from my eSurvey

For these last two graphs I want to highlight, I asked about what type of projects students would work on in this lab, as well as what equipment they would want to have in the lab. These two questions go hand in hand and were only asked if students said 'Yes' or 'Maybe' to the last question above. I did this so people who answered that they were not interested in using this space would not skew their answers by just clicking the first thing they see to get out of the form faster. The total number of students that answered these questions was 46 students and the breakdown is as follows. For the question "What types of projects would you use this space for", the results were even, tied for the top spot was PCB design

projects and general soldering and wiring practice, although the others were not far behind.

Below is a graph that shows the breakdown of each.

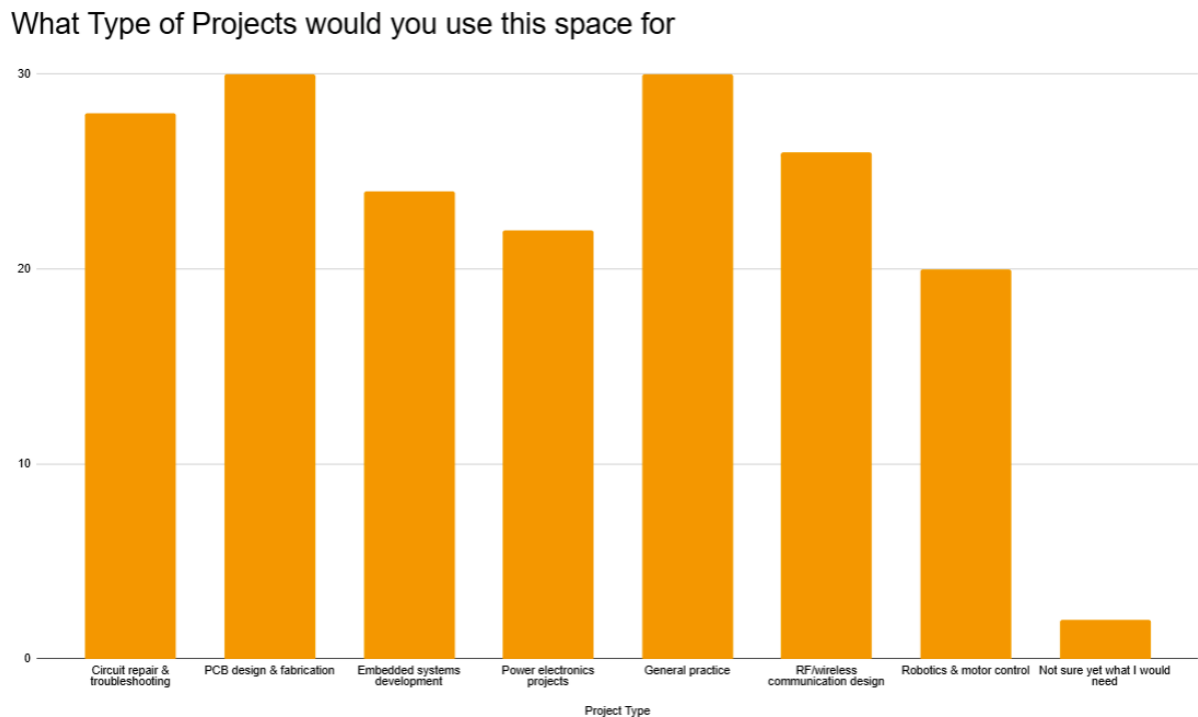


Figure 3: A breakdown of question 5 from my eSurvey

Directly after that last question the same group of participants were asked “What equipment would you like to have available in the electronics prototyping lab” while this question is very similar to the last it does also help me narrow down the equipment desired. The idea behind asking this question is because while students might not want to work on a specific project, they might say we need that equipment since they know it is unavailable. For example, a student might not be interested in doing a power engineering project but might still say the lab space should include high voltage phase analyzer since they know there is no access to them at SU now. The results of this question were very even with most people wanting to have access to general supplies like resistors, wire,

breadboards, LEDs, etc. A graph of the results is below once again, you can see that the first 4 categories are all extremely close with the embedded systems category being slightly less popular than the rest.

What equipment would you like to have available in the electronics prototyping lab

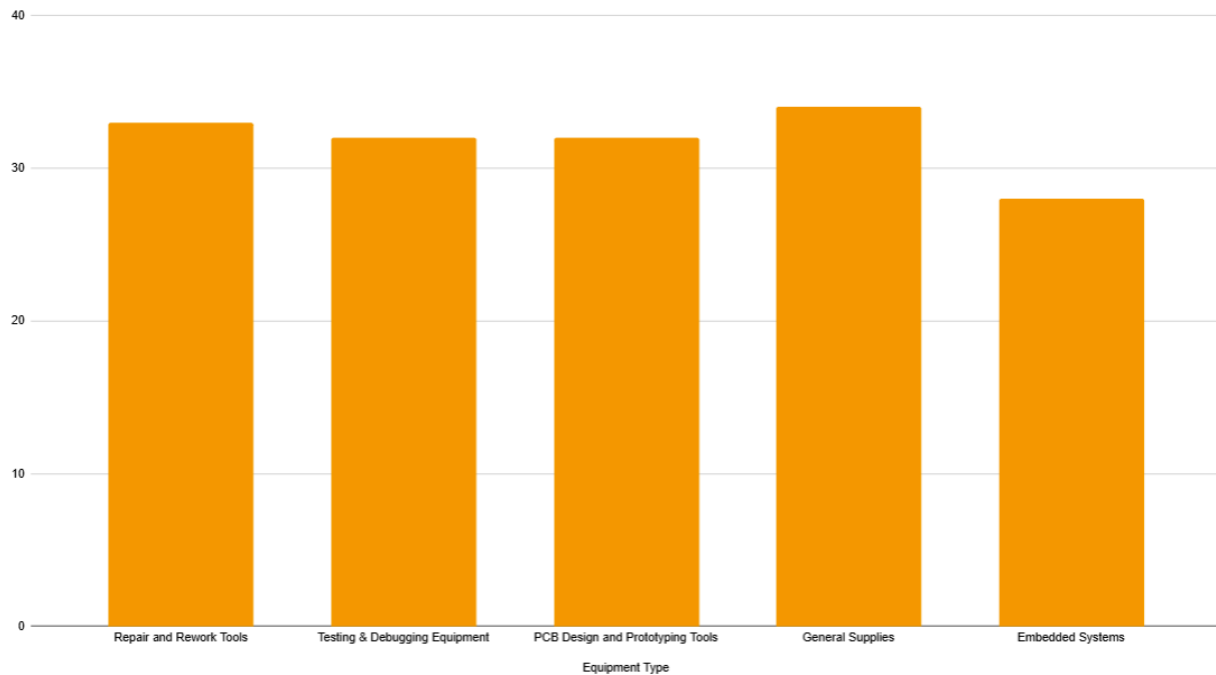


Figure 4: A breakdown of question 6 from my eSurvey

Discussion:

Starting with the results from the survey, some conclusions can be drawn immediately. Going in order, the first thing that we can observe is the massive student support for a collaborative lab space like this. 88.2% of students being in some favor of using this proposed lab (I am including the maybe responses to get this result) is a staggering result. Clearly there is massive support for this proposed lab, but this is also backed up by professional articles that discuss the gap between Industry and Academia [1] by allowing students to get experience with the tools and software that they will be

expected to use in their professional careers, they will make the “Industry–Academia gap” smaller allowing for a simpler transition. Knowing the importance of having a space like this, the next question should naturally be what it will look like, how it will be operated, and where it will be in Syracuse University.

Let’s start with what it will look like. This lab will consist of workstations around a single room. Each workstation will include the tools needed to a different type of project. For example, there might be 3 workstations that are just dedicated to soldering since it is a high demand topic, while there will be only one for example dedicated to working on embedded projects since it is a lower demand topic. Based on my research both by reading articles and journals, as well as the results from my conducted research, I am suggesting that the room includes the following 8 workstations: 3 Soldering stations, 2 for PCB design, and 2 for testing and debugging, and 1 for embedded system development. Each of the soldering stations will have both soldering irons and hot air reflow available, with a single reflow oven shared between the 3 since it is less used but still important to include. The two PCB stations will be different, one will include a computer that allows for the design of PCBs, while the other will include a small tabletop mill for PCB manufacturing. The testing and debugging stations will include oscilloscopes, variable power supplies, and other tools like a network analyzer. Finally the embedded workstation will be similar to the soldering ones but will smaller tools for more precision for the small, embedded PCBs and microcontrollers. I also propose this lab has a shelf with common materials and components for students to use, things like resistors, capacitors, LEDs, diodes, colored wire and breadboards will be provided here for project use. A set of small lockers would

also be ideal to include, meaning students can leave their projects in the lab without fear of it getting damaged or lost while the student is away. The next thing that needs to be discussed is the room this will take place in; I recommend that this happens in the Center for Science and Technology in room 3-221. This room is next to the junior electrical and computer engineering lab (3-216) and the room is currently just an overflow storage room for now that is not being used.

Now for the big one, cost. While I do not have an exact cost for this lab space, I have done enough research to get a pretty accurate estimate. The biggest things will be models of the tools and equipment. Here is a part list of all the equipment I would suggest the following [2][3][4].

Item	Quantity	Unit Price (\$)	Total Cost (\$)
Hakko FX-888D Soldering Station	3	120	360
Quick 861DW Hot Air Rework Station (Shared)	3	300	900
T-962A Infrared Reflow Oven (Shared)	1	400	400
Bantam Tools PCB Milling Machine	1	3100	3100
Rigol DS1202Z-E Oscilloscope	2	600	1200
Siglent SPD3303X-E Variable Power Supply	2	400	800
NanoVNA V2 Plus4 Network Analyzer	1	300	300
Embedded Workstation Tools	1	400	400
Common Components Shelf	1	800	800
iFixit Pro Tech Toolkit (Hand Tools)	8	75	600
Bertech ESD Mat Kit	8	100	800
Small Storage Lockers	1	700	700
		Total:	10360

Figure 4: A table of the cost breakdown for the proposed project

This list could also be reduced by a good but with educational discounts and equipment that I know is in storage not being used. After interviewing Tim Breen [6] in the Student Machine shop, this cost is something that would be able to be absorbed into his budget without much issue, and that is assuming the Engineering School does not contribute any

extra funding for this project or does not receive a sponsor (like they did for the Campos Student Center that recently opened in the Center for Science and Technology). This \$10,000 as well as any reoccurring expenses can easily be rolled into the machines shops yearly budget Tim receives from the school. In fact this is exactly how I think this space should be ran, as an extension of the Student Machine Shop in Link Hall, that lab space is filled with Mills, CNCs, Saws, Drills, etc. for mechanical and Aerospace students to work on projects, this proposed Electronics Repair and Prototyping lab is just the electrical extension of the machine stop, so it makes sense for it to be oversaw by the same manager and budget.

Conclusion:

Syracuse University is investing heavily in their future Computer and Electrical Engineers, Syracuse understands the growing importance of these two fields, but they have overlooked one critical lab space. That being a collaborative space where students can work on personal projects and learn the tools and software they will need to use in their professional careers. A room like this would allow Syracuse students to thrive and be one small but non-inconsequential part of SU's mission to develop the best EE and CE students possible. With articles showing the importance of hands-on work like this, and incredibly large student support for a lab space like this, it is clear that the School of Engineering and Computer Science needs to implement this Electronics Repair and Prototyping Laboratory as an addition to the already successful Student Machine Shop.

References:

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- [7] J. Lodato, "Survey on Building a Syracuse University Electronics Prototyping Lab," Syracuse University. Available: <https://forms.gle/bv8iTxEKcjhrMC38>. [Mar. 2, 2025].

Appendix 1:

Interview Questions for Tim Breen:

1. Do you think there should be an electrical equivalent of the machine shop at Link Hall?
2. How would you recommend an electrical equivalent be funded?
3. How does the student machine shop get funded, for both one-time purchases like new equipment, and reoccurring purchases like materials that get used?
4. What concerns would do you have about an electrical equivalent for this shop?

Appendix 2:

eSurvey Questions:

1. What is your major?
2. What year are you?
3. Do you feel that Syracuse University currently provides enough resources for hands-on electronics experimentation?
4. Would you use an on-campus Electronics Repair and Prototyping Lab if it were available?

If they answered “Yes” or “Maybe” to question 4:

5. What Type of Projects would you use this space for?
6. What equipment would you like to have available in the electronics prototyping lab?