NEXT STEPS: WHAT'S LEFT TO DO, AND WHERE TO GO FROM HERE...

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Want to see me wear this?

Turkey Suit Fundraiser Nov 15 - 19

Donate to see your favorite instructor wear the turkey suit. Donation Jars are located in the HKN Lounge EE 24

Participants:

Dr. Michael Capano

Dr. Mark Johnson

Dr. Steven Peka

Dr. Timothy Rogers

Dr. Phillip Walter

All proceeds go to the charity of the winners choice!

OUTLINE

- Summary of Remaining Work and Due Dates
- Project Improvements
- Project Ownership
- Design and Business Competitions
- Crowdfunding
- Entrepreneurship
- Research and Industry
- Closing Thought

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SUMMARY OF REMAINING WORK AND DUE DATES

Monday	Tuesday	Wednesday	Thursday	Friday	Monday	Tuesday	Wednesday	Thursday	Friday
8/23/2021 Begin Week 1	8/24/2021 Intro to 477	8/25/2021 Mandatory Lab	8/26/2021 Defining Requirements	8/27/2021 Final Project Proposal	10/18/2021 Begin Week 9	10/19/2021 PCB Ordering	10/20/2021 Mandatory Lab	10/21/2021 PCB Debugging	10/22/2021 PCB Verification & Submission
8/30/2021 Begin Week 2	8/31/2021 Hardware Interfacing	9/1/2021 Mandatory Lab	9/2/2021 Hardware Interfacing	9/3/2021 Functional Specification	10/25/2021 Begin Week 10	10/26/2021 Legal & Regulatory	10/27/2021 Mandatory Lab	10/28/2021 Legal & Regulatory	10/29/2021 Legal Analysis
9/6/2021 Labor Day (No Classes)	9/7/2021 Discrete Components	9/8/2021 Mandatory Lab	9/9/2021 Discrete Components	9/10/2021 Software Overview, Component Analysis	11/1/2021 Begin Week 11	11/2/2021 Reliability & Safety	11/3/2021 Mandatory Lab	11/4/2021 Reliability & Safety	11/5/2021 Reliability & Safety Analysis
9/13/2021 Begin Week 4	9/14/2021 Power Design	9/15/2021 Mandatory Lab	9/16/2021 Power Design	9/17/2021 Bill of Materials, Electrical Overview	11/8/2021 Begin Week 12	11/9/2021 Ethical Considerations	11/10/2021 Mandatory Lab	11/11/2021 Environmental Concerns	11/12/2021 Ethical & Environmental Analysis
9/20/2021 Begin Week 5	9/21/2021 Firmware Design	9/22/2021 Mandatory Lab	9/23/2021 Hardware Design 1	9/24/2021 Mechanical Overview	11/15/2021 Begin Week 13	11/16/2021 Final Steps	11/17/2021 Mandatory Lab	11/18/2021 No Lecture	11/19/2021 User Manual
9/27/2021 Begin Week 6	9/28/2021 Hardware Design 2	9/29/2021 Mandatory Lab	9/30/2021 PCB Assembly	10/1/2021 PCB Footprints & Schematic	11/22/2021 Begin Week 14	11/23/2021 No Lecture	11/24/2021 Thanksgiving Break	11/25/2021 Thanksgiving Break	11/26/2021 Thanksgiving Break
10/4/2021 Begin Week 7	10/5/2021 PCB Assembly	10/6/2021 Mandatory Lab	10/7/2021 Design Review Lecture	10/8/2021 PCB Layout Draft Software Formalization	11/29/2021 Begin Week 15	11/30/2021 No Lecture	12/1/2021 No Lab	12/2/2021 No Lecture	12/3/2021 Senior Design Report
10/11/2021 October Break	10/12/2021 October Break	10/13/2021 Midterm Design Review	10/14/2021 Midterm Design Review	10/15/2021 Midterm Design Review	12/6/2021 Begin Week 16	12/7/2021 No Lecture	12/8/2021 No Lab	12/9/2021 No Lecture	12/10/2021 No Homework Due

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Final Presentations session will be on Wednesday of Finals Week.
(Time and Location TBA)

SUMMARY OF REMAINING WORK AND DUE DATES

11/8/2021 Begin Week 12	11/9/2021 Ethical Considerations	11/10/2021 Mandatory Lab	11/11/2021 Environmental Concerns	11/12/2021 Ethical & Environmental Analysis
11/15/2021 Begin Week 13	11/16/2021 Final Steps	11/17/2021 Mandatory Lab	11/18/2021 No Lecture	11/19/2021 User Manual
11/29/2021 Begin Week 15	11/30/2021 No Lecture	12/1/2021 No Lab	12/2/2021 No Lecture	12/3/2021 Senior Design Report
12/6/2021 Begin Week 16	12/7/2021 No Lecture	12/8/2021 No Lab	12/9/2021 No Lecture	12/10/2021 No Homework Due

Final Presentations session will be on Wednesday of Finals Week.
(Time and Location TBA)

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SUMMARY OF REMAINING WORK AND DUE DATES

11/8/2021 Begin Week 12	11/9/2021 Ethical Considerations	11/10/2021 Mandatory Lab	11/11/2021 Environmental Concerns	11/12/2021 Ethical & Environmental Analysis
11/15/2021 Begin Week 13	11/16/2021 Final Steps	11/17/2021 Mandatory Lab	11/18/2021 No Lecture	11/19/2021 User Manual
11/22/2021 Begin Week 14	11/23/2021 No Lecture	11/24/2021 Thanksgiving Break	11/25/2021 Thanksgiving Break	11/26/2021 Thanksgiving Break
11/29/2021 Begin Week 15	11/30/2021 No Lecture	12/1/2021 No Lab	12/2/2021 No Lecture	12/3/2021 Senior Design Report
12/6/2021 Begin	12/7/2021 e	12/8/2021 No Lab	12/9/2021 No Lec	12/10/2021 Due

PSSCs

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SUMMARY OF REMAINING WORK AND DUE DATES

- Week 13 – This Week!
    - HW #12 (User Manual) Due 23:59 Friday, Nov 19 (Wed Labs) and 23:59 Sunday Nov 21 (Fri Labs)
- Week 14 – Thanksgiving
- Week 15
    - Initial draft of HW #13 (ABET Senior Design Report) – Due 23:59 Friday, Dec 3 (Since no lectures or labs, due for everyone on Friday!)
- Week 16 – Last week of classes
    - Final PSSC Demo Deadline – by Friday, Dec 10 - End of Day (17:00)
    - Make a PSSC Demo Video for your project – 4 minutes – Due in Final Presentation and Final Project Archive

SUMMARY OF REMAINING WORK AND DUE DATES

- Finals Week
  - Final Revised HW #13 (ABET Senior Design Report) – Due 23:59 Monday, Dec 13
  - Final Team Presentations and Reviews – Wednesday, Dec 15
  - HW #14 (Final Project Archive) – Due 23:59 Wednesday, Dec 15
  - Final Confidential Peer Review – Due 23:59 Wednesday, Dec 15

Team Components (40% of total)		Individual Components (60% of total)	
Project Success Criteria Satisfaction*	20.0%	Weekly Progress Update Reports*	20.0%
Design Review*	15.0%	Design Component Report*	15.0%
Final Presentation*	10.0%	Professional Component Report*	15.0%
Final Project Archive*	15.0%	Individual Contribution	20.0%
Concept Development Assignments	10.0%	Class Attendance and/or Participation	10.0%
System Integration and Packaging	20.0%	Mandatory Lab Session Attendance	10.0%
Educational (Senior Design) Report*	5.0%	Midterm and Final Confidential Peer Reviews	5.0%
PCB Completion and Submission*	5.0%	Design Review and Final Presentation Peer Evals	5.0%

Bonus Components (added to grade total)	
Early completion	1.0% per week early (team)
Design bonus contracts	(variable – negotiated with course staff)
Design Showcase participation	1.0% per individual
Design Showcase poster	1.0% per team
Motorola Award voting	0.5% per individual
Purdue mycourseval Evaluation	0.5% per individual
Instructor discretion (borderline resolution)	0.5% per individual

* *items directly related to ABET course outcome assessment*

USER MANUAL

User Manual

Year: _____ **Semester:** _____ **Team:** _____ **Project:** _____
Creation Date: _____ **Last Modified:** April 16, 2020
Author: _____ **Email:** _____

Assignment Evaluation:

Item	Score (0-5)	Weight	Points	Notes
Assignment-Specific Items				
Product Description		x1		
Product Illustration		x2		
Setup Instructions		x3		
Usage Instructions		x3		
Troubleshooting Instructions		x3		
Writing-Specific Items				
Spelling and Grammar		x2		
Formatting and Citations		x1		
Figures and Graphs		x2		
Technical Writing Style		x3		
Total Score				

5: Excellent 4: Good 3: Acceptable 2: Poor 1: Very Poor 0: Not attempted

Comments:
Comments from the grader will be inserted here.

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1.0 Product Description

In this section, provide a description of your product for your users/intended buyers. This should be a marketing description as opposed to a technical description, and should be tailored towards your intended customer base (those defined in the usage case portion of the Functional Specification homework assignment). This description should be effective and concise.

2.0 Product Illustrations

This section should contain photos, drawings, or renderings of your project, with key features for the end user highlighted. Depending on the nature of your product, it may be necessary to provide multiple images of the product as viewed from different perspectives. Your product may include a relevant mobile or desktop application; include application screenshots as appropriate for your project.

3.0 Setup Instructions

This section should contain any instructions the user needs to know when setting up your project; this should be written as a series of steps, rather than a narrative format. Refer to the product illustrations of section 2 as needed, and include images to assist the user with setup where appropriate.

4.0 Usage Instructions

This section should contain any instructions the user needs to know for regular use of your project; this should be written as a series of steps, rather than a narrative format. Refer to the product illustrations of section 2 as needed, and include images to assist the user with setup where appropriate. Any necessary user maintenance steps, such as how to load new firmware, change product settings, change batteries, etc. should be included here.

5.0 Troubleshooting Instructions

This section should assist the user with common issues they may encounter when using your product. There are a few ways to format this section: (1) a table showing common issues, their probable causes, and solution steps, (2) a question-and-answer style approach, (3) a troubleshooting flowchart. One format style that should not be used in this section is narrative style. Several common troubleshooting issues should be addressed here, and a link to a (fictitious) customer support help line/email/URL is also highly recommended

ABET SENIOR DESIGN REPORT – TEAM SECTION

Purdue ECE Senior Design Semester Report (Team Section)

Course Number and Title	ECE 47700 *Digital Systems Senior Design Project*
Semester / Year	Spring 2020
Advisors	Prof. Meyer and Todd Wild
Team Number	
Project Title	

Senior Design Students – Team Composition			
Name	**Major**	**Area(s) of Expertise Utilized in Project**	**Expected Graduation Date**

Project Description: Provide a brief (2-3 page) technical description of the design project, as outlined below:

(a) Provide a general description of the product to be delivered by this design project.

Place your description here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

(b) What is the purpose of this product? For whom is it intended?

Place your description here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

(c) Describe how the engineering design process used to create your product was utilized in this project. Include how you were able to develop and conduct appropriate experiments, analyze and interpret data, and use engineering judgment to draw conclusions related to the development of your product.

Place your description here……do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

(d) Describe the design constraints, and resulting specifications, incorporated into your product (list a minimum of 3).

Place your description here……do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

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(e) Describe how each of the following factors influenced your design specifications and constraints.

Public Health, Safety, and Welfare: Place your summary here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

Global Factors: Place your summary here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

Cultural Factors: Place your summary here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

Social Factors: Place your summary here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

Environmental Factors: Place your summary here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

Economic Factors: Place your summary here……do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

(f) Describe the appropriate engineering standards incorporated into the creation of your product.

Engineering standards can be defined as a set of technical definitions and guidelines that specify characteristics and technical details that must be met by products, systems and/or processes. Standards help to ensure that products meet minimum performance and safety requirements, that the product/system/process is consistent and repeatable, and are compatible with other standard-compliant products, systems, and processes. Some sources for engineering standards: IEEE (standards.ieee.org), ASTM International (www.astm.org), FCC, and ANSI (ansi.org).

(g) Describe the final status of your product.

Place your description here – should describe what was built and the extent to which functionality was achieved (do not list "reports" and "posters" as deliverables) …do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

(h) Describe the makeup of your project team and how you were organized to establish goals, plan tasks, and meet the objectives of this project.

Place your description here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

(i) Did your project require the production of any written documentation other than this document (i.e., manuals, educational materials, etc.)? If so, describe the types, composition, and nature of the audiences for whom these materials were intended.

Place your description here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

(j) Describe the types, composition, and nature of the audiences in attendance for the final oral design review. Discuss how you prepared for this audience.

Place your description here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

ABET SENIOR DESIGN REPORT – INDIVIDUAL SECTION

Purdue ECE Senior Design Semester Report
(Individual Reflections Section)

Course Number and Title	ECE 477 *Digital Systems Senior Design Project*
Semester / Year	Spring 2020
Advisors	Prof. Meyer and Todd Wild
Team Number	
Project Title	

Senior Design Student Completing This Section			
Name	**Major**	**Area(s) of Expertise Utilized in Project**	**Expected Graduation Date**

Individual Reflection: Provide a brief (1-2 page) individual reflection of the design project, as outlined below:

(a) Describe your personal contributions to the project.

Place your description here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

(b) Describe how your contributions to this project built on the knowledge and skills you acquired in earlier course work.

Place your description here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

(c) Describe how you acquired and applied new knowledge as needed to contribute to this project. What learning strategies did you employ to do so?

Place your description here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

(d) Discuss your ethical and professional responsibilities as they relate to this engineering design experience.

Place your description here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

(e) Consider what the impact of the product of this engineering design experience could have in economic, environmental, societal, and global contexts. Discuss how you would make (or did make) an informed judgement as to your product's impact in each of these four contexts?

Place your description here…do not change the indentation, format, font, or spacing (but do change font color to black)…this paragraph should be single-spaced and aligned exactly as shown.

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FINAL TEAM PRESENTATION

- Length: 15 minutes total (including Q & A)
- All team members should participate in the presentation as equally as possible
- Links to your presentation slides and demo video should be posted on your team webpage
- Use the presentation template provided and follow the outline:
  - Title slide/team introduction (a picture of team members should be on the title slide, annotated with names) – 1 minute
  - Project description and underlying motivation – 1 minute
  - Block diagram – 1 minute
  - Summary of design challenges faced, and how they were addressed – 2 minutes
  - Individual contributions (1 minute/team member = 4 minutes total)
  - Video documenting successful demonstration of PSSC – 4 minutes
  - Questions/discussion – 2 minutes

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FINAL TEAM PRESENTATION

Public Service Announcement Concerning Your Demo Video (PSA)

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FINAL PROJECT ARCHIVE

- File Folder Organization (ZIP)
  - Documents
    - Homework Assignments 1, 2, 9, 10, 11, 12, 13
    - Midterm Design Review Slides
    - Final Presentation Slides
    - PSSC Demo Video
  - Electrical
    - Homework Assignments 4, 5, 6
    - Schematic and PCB Files
  - Mechanical
    - Homework Assignment 7
    - Packaging CAD Files
  - Software
    - Homework Assignments 3, 8
    - Code Source Files

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FINAL CONFIDENTIAL PEER REVIEW

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Name:

Team number:

Your expected grade for ECE 477:

- A
- B
- C
- D
- F

Evaluation of teammate:

On a scale of 1 to 10 (where 1=bad, 5=average, 10=excellent), rate this teammate:

Comments on rating:

On a scale of 1 to 10 (where 1=bad, 5=average, 10=excellent), rate this teammate:

Comments on rating:

Evaluation of teammate:

On a scale of 1 to 10 (where 1=bad, 5=average, 10=excellent), rate this teammate:

Comments on rating:

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PROJECT IMPROVEMENTS

- Congratulations! You've finished version 1 of your project!
- What about version 2?
  - Streamlined design? (remove unnecessary features to make it more cost efficient)
  - Additional features and capabilities?
  - Design for production?
  - Boot loader and other production hardware?
  - Built-in self test (BIST)?

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PROJECT OWNERSHIP

You've finished your project, now… who owns your project?

- Any development tools/systems provided by course staff (development boards, tools, most reusable components) are property of Purdue University and must be returned
- Sponsored projects may be property of the sponsors, depending on specific conditions related to the agreement between the sponsor and the project team
- Ownership of all other project materials is decided upon by the student team members

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PROJECT OWNERSHIP

Who owns the intellectual property for your student project?

- Intellectual property is handled at the University level. Policy on student-generated intellectual property is described here.
- Student project work is classified at this time as Scholarly Copyrightable Works. The University retains a perpetual nonexclusive royalty-free license for pedagogical, research, and educational purposes.
- Aside from this University license, students retain ownership of their intellectual property and are free to continue pursuing and/or commercializing their projects

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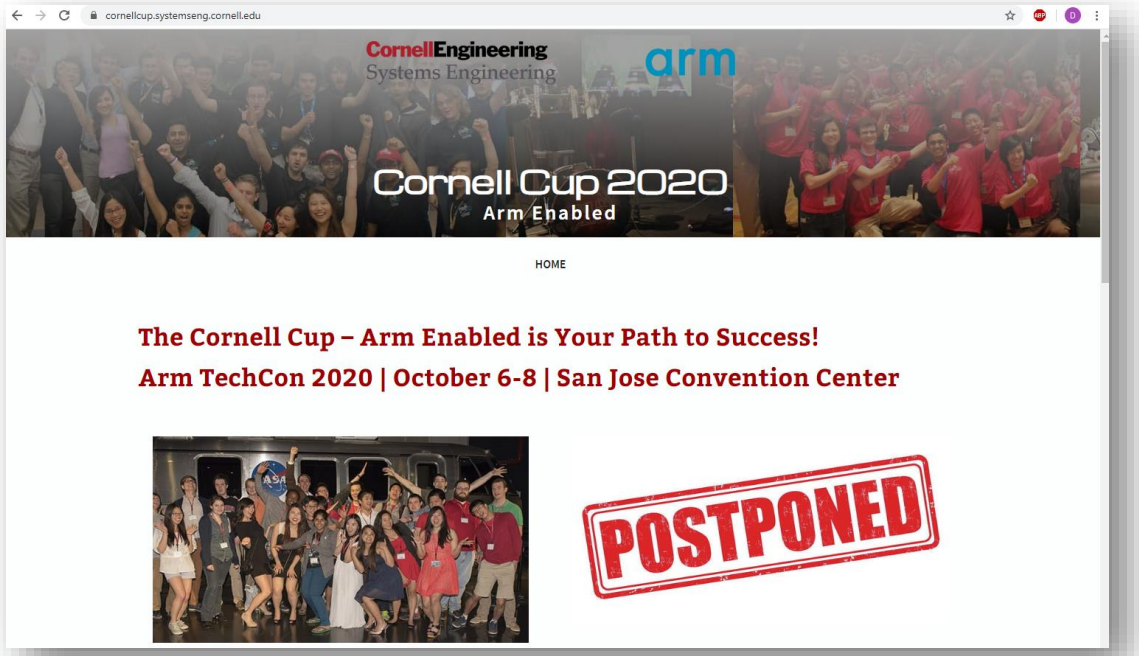
DESIGN COMPETITIONS

Cornell Cup

- Yearly design competition in which student teams demonstrate embedded projects developed using ARM hardware
- Purdue has regularly participated since the original Cornell Cup in 2012
- $10,000 prize for first place, chance for fame and recognition



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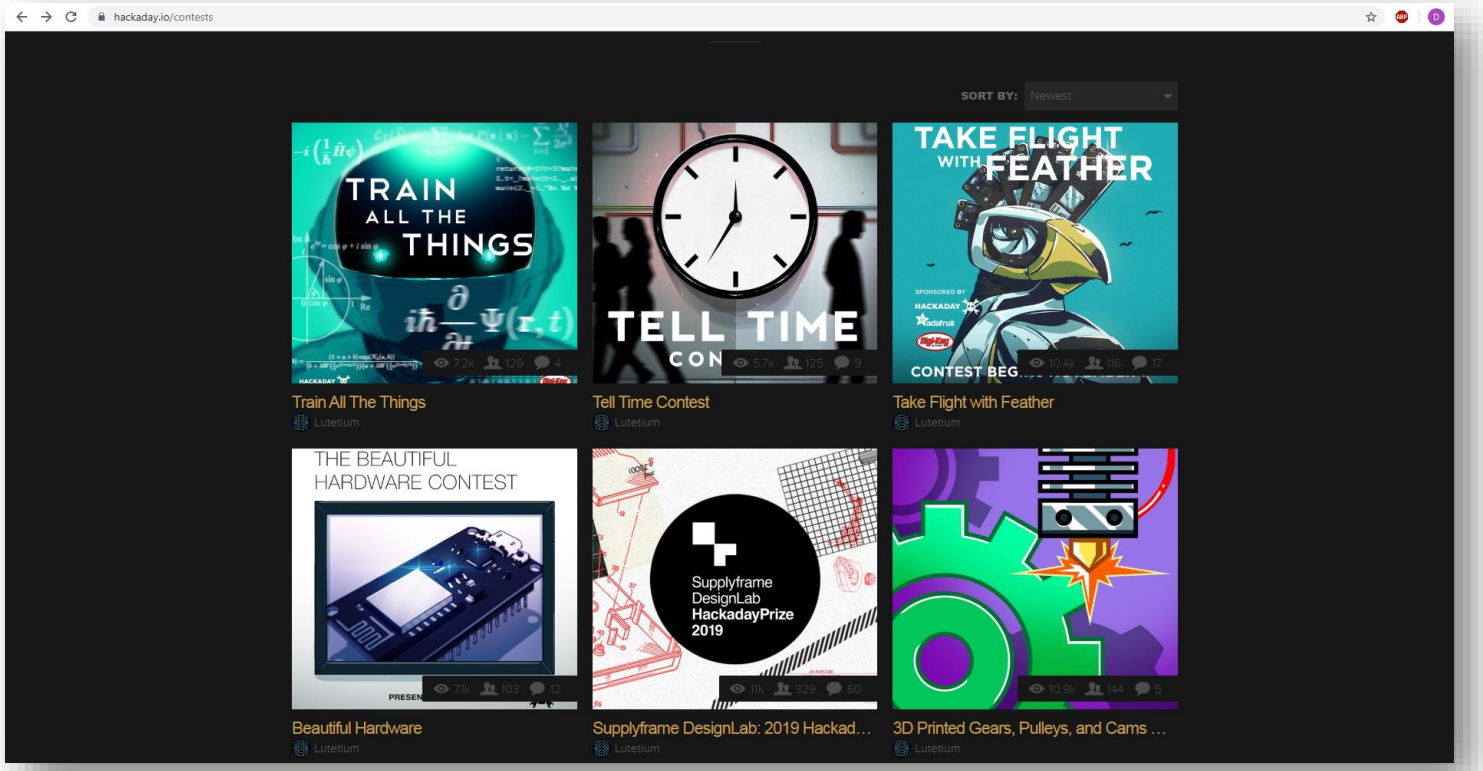
https://cornellcup.systemseng.cornell.edu/

DESIGN COMPETITIONS

Hackaday

- Started in 2014, a global design competition open to all entrants
- Develop embedded, open-source hardware/software for unique challenges



https://hackaday.io/contests

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BUSINESS COMPETITIONS

Burton Morgan Business Plan Competition

- The Burton D. Morgan Center for Entrepreneurship at Purdue University organizes an annual **Business Model Competition** that encourages students to develop their unique ideas for new products or services into a profitable business
- The competition format provides participants with an opportunity to develop and improve transferable skills that will be valuable throughout their career
- Over $100,000 in cash and in-kind prizes awarded (2019 winners in chart)

Place	Social Entrepreneurship	B2B
1st	$15,000 - GlobalSign	$20,000 - SnapWire
2nd	$10,000 - StemNode	$15,000 - OPSUS
3rd	$5,000 - Greeks For Good	$7,500 - FlykeArt
finalists	$2,500 - Engineering for Social Good	$2,500 - RightFit

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https://www.purdue.edu/discoverypark/bdmce/competitions/business-model-competition/index.php

CROWDFUNDING

- In 2012, the **Jumpstart Our Business Startups (JOBS) Act** was signed into law, easing securities regulations and granting legal allowance to crowdfunding practices
- Numerous crowdfunding sites exist where inventors can pitch ideas to the general public, who can then pledge support to sponsor crowdfunding projects
- Many inventions have been financially supported through sites such as Kickstarter and Indiegogo, with tens of millions of dollars pledged on a yearly basis

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CROWDFUNDING

Despite the success and allure of crowdfunding, there are a few pitfalls that anyone considering this approach should be aware of:

1. You aren't ready to start crowdfunding until you have viable hardware ready for a production run – *never start a campaign on the promise of future hardware development*
2. Occasionally, a campaign's popularity can wildly exceed expectations and go from something manageable to an out of control time sink that devours the creator's life – therefore, set limits on any campaigns and start small until you know what you're getting into

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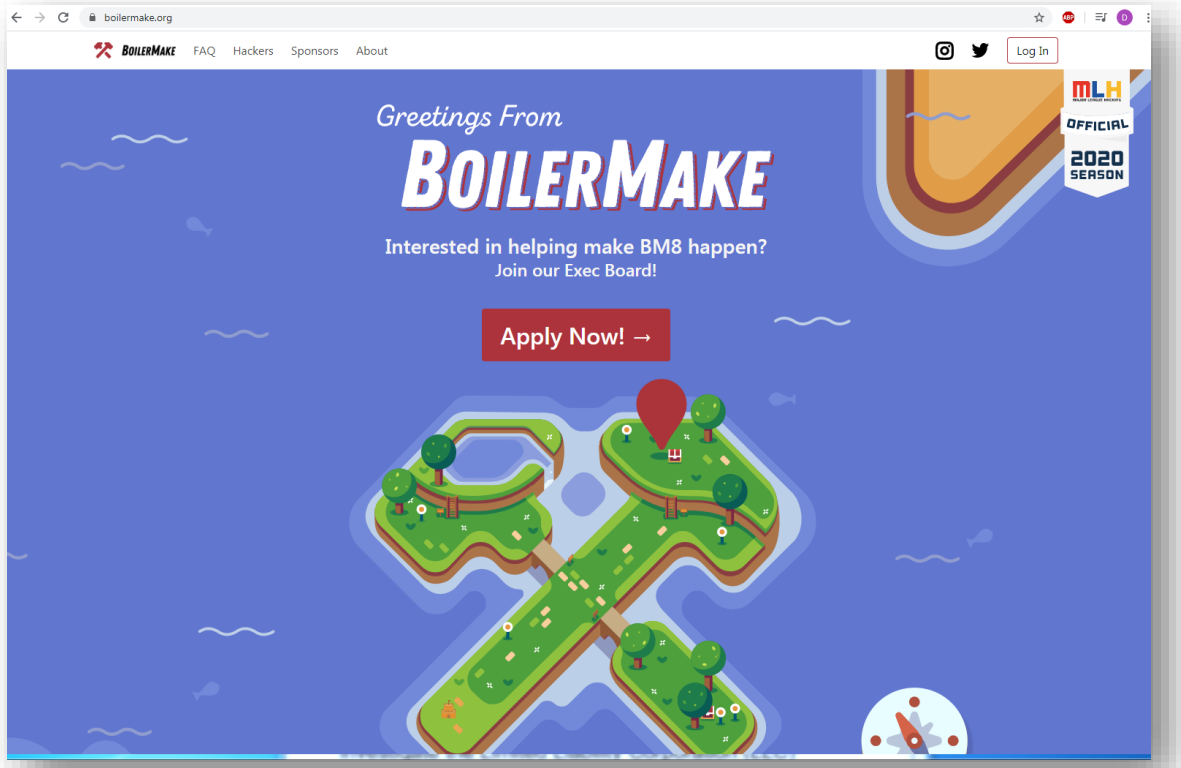
HACKERSPACES AND ACCELERATORS

- Hackathons: Weekend events sponsored by organizations to produce innovative hardware in a short period of time (e.g. BoilerMake at Purdue)
- Accelerators: Investor groups, trade equity for resources and connections to help commercialize hardware
  - HAX Accelerator (Shenzhen, China)
- Hackerspaces: Community groups and workshops for collaborative hacking opportunities
  - The Anvil (West Lafayette)
  - Club Cyberia (Indianapolis)



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ENTREPRENEURSHIP

- Instead of or in addition to methods already discussed above, students might be interested in starting their own businesses
- Students interested in starting a business are directed to investigate the Limited Liability Corporation (LLC) structure, as it reduces legal and financial liability for business owners compared to simpler structures (such as a sole proprietorship)
- NOLO legal reference books can be purchased or acquired from the local library and provide a great starting point for small business ownership
- Other legal services, such as web hosting and development, are readily available and inexpensive

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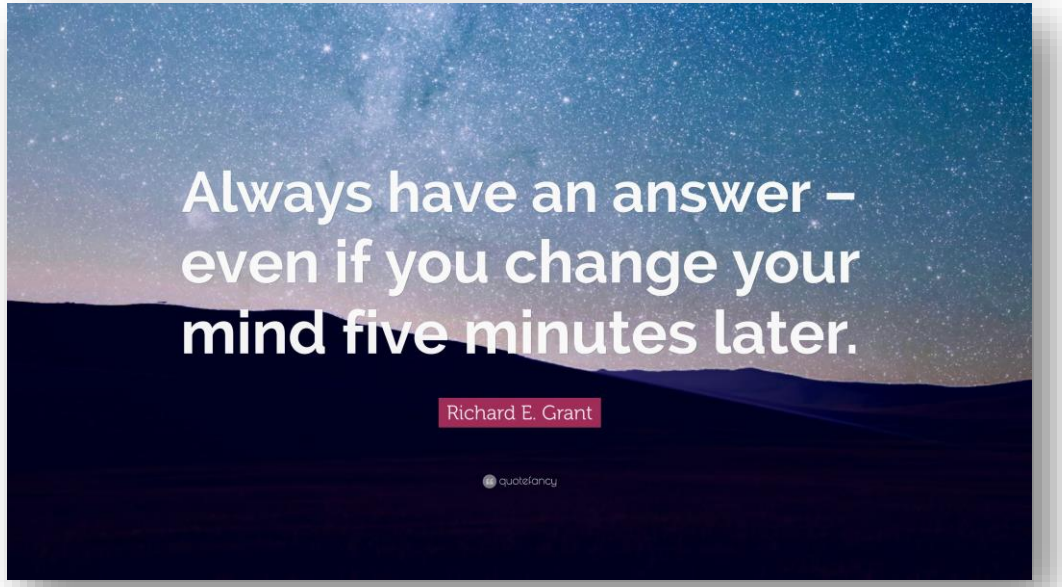
RESEARCH AND INDUSTRY

- *"We have too many people with hardware experience; we should reduce the number of people who understand how things work and how they are built"* – *No research or industry leader ever*
- Life advice #1: Every once in awhile, your supervisor is going to peak in and ask you what you're working on that they don't already know about – *Always have an answer to that question*
- Life advice #2: The jobs you take will determine where you get to live, what you get to do, and how much time outside of work you'll have to do the non work-related things you enjoy – *so choose wisely*



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CLOSING THOUGHT

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