NORTHERN ARIZONA UNIVERSITY
College of Engineering, Forestry & Natural Sciences

COLLEGIATE WIND COMPETITION
U.S. DEPARTMENT OF ENERGY

2016 Collegiate Wind Competition: Tunnel Team B

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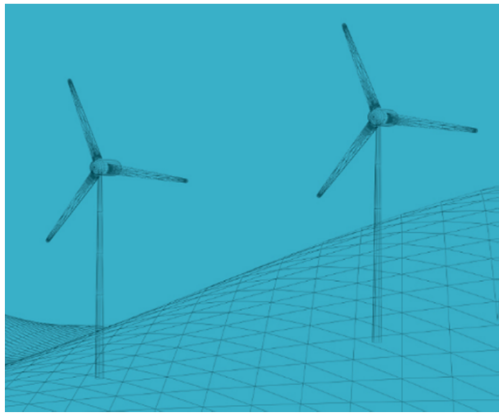
Project Description

Design, build, and test a wind-driven power system based on market research
- Electrical Design (Controls, Load, Power Electronics, Software)

Project Sponsors
- National Renewable Energy Laboratory (NREL)
- Department of Energy (DoE)

Faculty Advisors
- David Willy, ME Department
- Karin Wadsack, Project director and technical expert



Update 1: Layout

The layout of the turbine has changed, and is being updated as the hardware progresses along further

- Added in Competition specific pieces
- Competition Setup, more Controls sections.

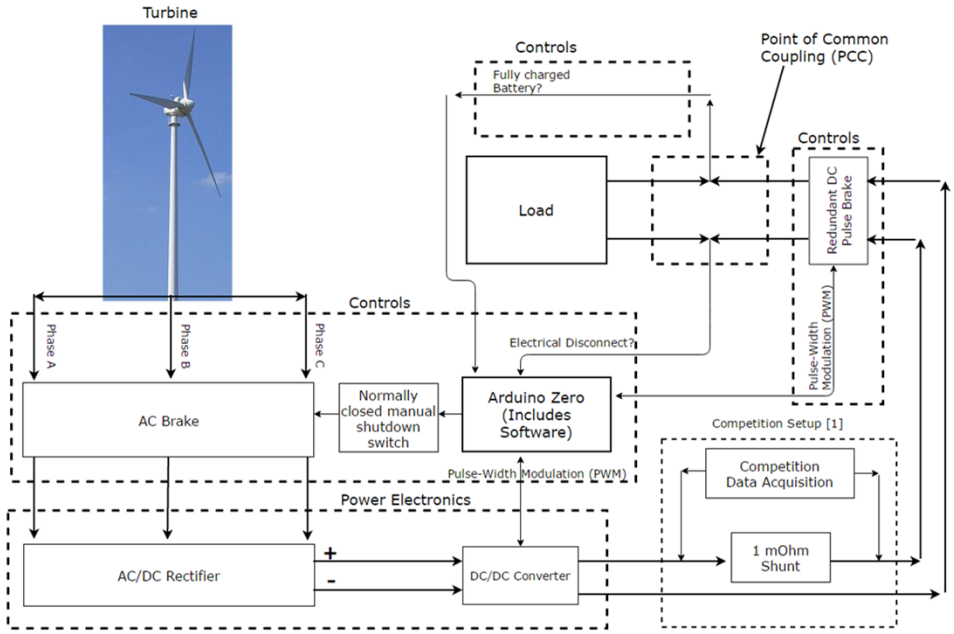


Figure 1: Current Turbine Layout with Subsystem Divisions

Update 2: Bonus Challenge

More work on Bonus Challenge for Load

- Resembles what we are trying to do on deployment side
- How the Challenge is scored
  - Effectively, display of the properties of the turbine, original, visually appealing
- Represent a telecom

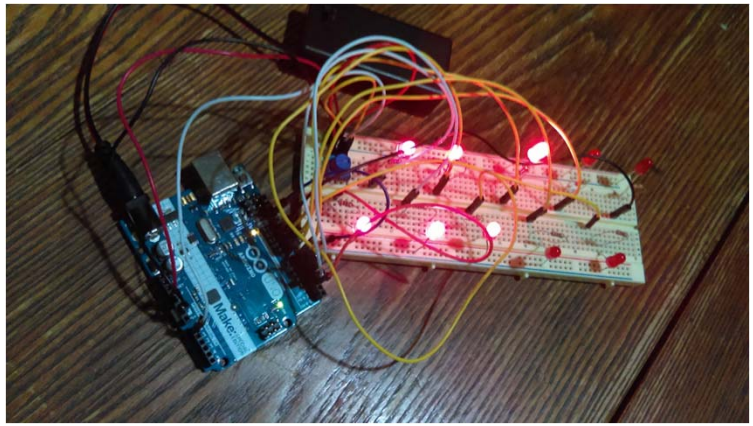
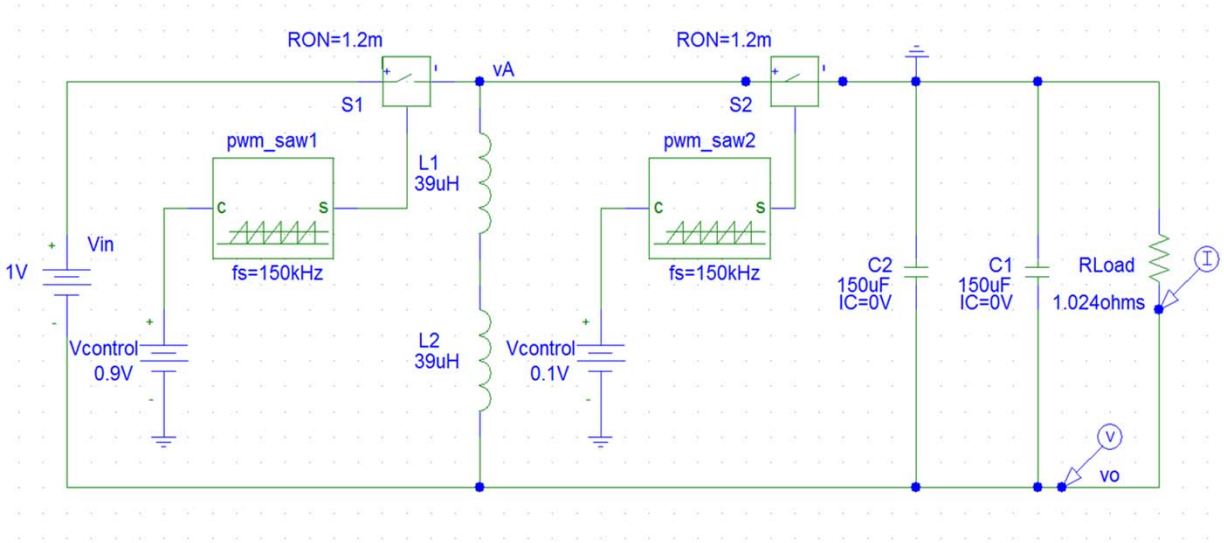


Figure 2: The Arduino-controlled Prototype for the Bonus Challenge

Update 2: Hardware (Power Electronics)

Rectifier
- Changed from active rectifier to passive rectifier
- Secured on heatsink, ready to mount onto prototyping board

DC/DC Converter
- Individual design components selected
- Prototyping materials and design components ordered
- Parts should arrive by Spring break



Update 2: Hardware

Software update
- Moving from pseudo-code (rough draft) to final draft
- State 4 (AC break) complete
- State 3 PWM next task

AC & DC Braking circuits
- Work on circuits nearly done
- DC vs AC brake

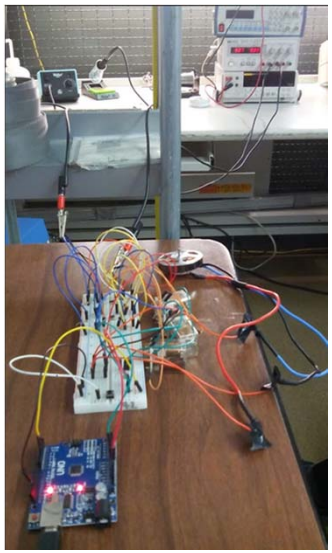


Figure 3: Brake Circuit Test

Moving Forward

Moving to wind tunnel testing phase

1. Mount any heat-sensitive components on the heat sink
2. Assemble DC-DC converter components onto prototyping board
3. Proceed with performance testing of rectifier and DC-DC converter
4. Testing for bugs within the controls code of the remaining states
5. Finalize program
6. Connect to Tunnel Team A's final design
7. Full system test

Moving Forward: Testing

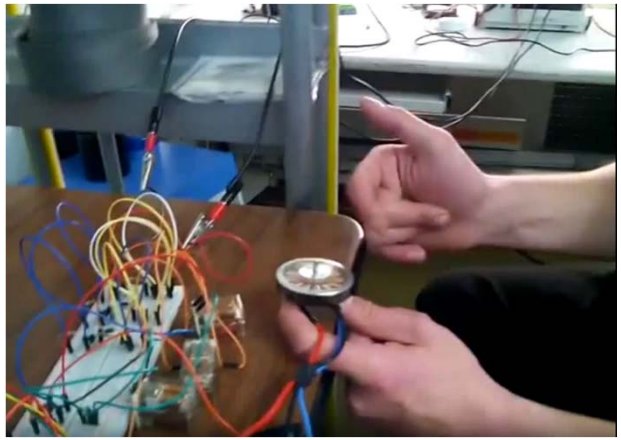
Safety Test

Input
- Wind speed

Output
- Percent reduction in RPM
- Time to reach reduced RPM

Test Factors
- Amount of relays used
- Characteristics of load
- Software algorithm

Test Constraints [1]
- Dropping below 10 percent of rated (max) turbine RPM
- Shutdown switch, load disconnect, charged battery



https://www.youtube.com/watch?v=GDhrspRBaWQ

Budget

Name of Part	Part Number	Name of Supplier	Unit Price	Quantity	Total
STMicroelectronics STP75NF75 Power MOSFET	B00W1587O8	Amazon	$4.55 (5 pcs)	2	$9.10
45 Amp Anderson Powerpole Connectors	B00HZ9A0FY	Amazon	$11.85 (10 sets)	1	$11.85
JACKY LED 32.8 ft. (10 m) 22 AWG Extension Cable Wire Cord for LED Strips	B00QTC0RAQ	Amazon	$6.99	1	$6.99
Grand General Back 10 AWG Primary Wire	B00INVF468	Amazon	$12.99	1	$12.99
Red Electrical Tape .75 in. x 66 ft. UL/CSA	B003ZWHSKK	Amazon	$4.75	1	$4.75
JST Male/Female Connectors 200 mm 22 AWG Wire	B00EZH8P9W	Amazon	$3.98 (20 pairs)	1	$3.98
STMicroelectronics STD52P3LLH6 Power MOSFET	497-15464-1-ND	DigiKey	$1.37	10	$13.68
ECOSPARK 2 IGNITION IGBT	FGP3040G2_F085-ND	DigiKey	$2.32	10	$23.24
TE Connectivity 1432873-1 Power Relay	PB2034-ND	DigiKey	$3.77	6	$22.62
TE Connectivity VCF4-1000 Relay Socket	PB232-ND	DigiKey	$1.96	6	$11.76
2 3/4" x 3 11/16 " Perfboard with Pads	N/A	Radioshack	$5.00	2	$10.00
Arduino Zero: 48pins LQFP, 3.3V	ATSAMD21G18	DigiKey	$49.90	2	$99.80
Power Sonic AGM Battery 6V 2.8AH	POWPS-628F	Batteries Plus	$21.99	1	$21.99
Boat RC Heli Watt Meter DC 60V 100A Digital LCD Display	B00RFDV87E	Amazon	$14.50	1	$14.15
				**GRAND	$266.90

We are still well below our agreed budget of $500 out of a total $1500 dollar budget between all three CWC teams.
Every part on this list has already been approved and ordered
Only a few more parts are needed and will be ordered over the course of the next week before the break

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Schedule

Date	Item/Event	Tasks Completed (Tunnel B)
3/7/2016	Midpoint Review Presentation	- Submit Midpoint Report (done) - Begin Spring Break work (assigned)
3/21/2016	Hardware Review 2	- Finalize assembly and enter final stage of testing - Project Integration with Tunnel Team A - Begin on final report (both DoE and Capstone)
4/4/2016	Staff Meeting	- Finalize testing - Finalize presentation outline for UGRADS
4/18/2016	Presentation Walk-through	- Poster and presentation finalized - Begin on final reports (both DoE and Capstone) - Begin drafting operational manual
4/25/2016	**UGRADS Presentations**	- Operational manual finalized - Begin revision of reports
5/1/2016	**Final Paper Due**	- Submit final paper to DoE (5/1) - Submit final paper to Capstone (5/6)
5/23 – 5/25	**AWEA Conference**	- Competition takes place in New Orleans

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References

[1] - (2015, September 4). U. S. Department of Energy Collegiate Wind Competition 2016 rules and requirements (2nd ed.) [Online]. Available: http://energy.gov/sites/prod/files/2015/09/f26/CWC%20Rules%20and%20Regulations%20Manual_Rev 2_150904.pdf

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Questions?