Client/Instructor Meeting #1

Agenda

- Introduction to the project: goals, parameters, specifications
- Team plan
- The budget and ordering parts
- Snapshot #1
- Brainstorming

Introduction to the Project

- The battery charger prototype currently is set to basically receive 120V AC from an outlet. This will flow into a rectifier and be converted into DC voltage. From there it will be stored in a capacitor bank of approximately 70 Farads.
- The rectifier has a controller in order to maintain a modulated output (via Pulse-Width Modulation [PWM]). It runs a current a maintainable limit in order to charge the capacitor bank in 2 minutes.
- The device detects when the bank has fully charged.
- One important thing to note: noise is inconsequential for this project, just so long as it can still charge in 2 minutes.
- Maintain a consistent charge and avoid tripping any breakers when using it.
- Once the switch for phone charging has been activated, a USB DC/DC converter allows the 28V DC to decrease enough to fit the 5V USB voltage limit.

Team Plan

- Complete the team contract.
- Get caught up on the project's current state and determine where to go.
- Get the contact information of the previous group.

Budget

- All financial transactions must go through Molly Jones.
    - Some parts which needt to be ordered may already be available. Speak to Greg in Gauss Johnson 001 for more information.

Snapshot #1

- This will be just before Spring Break.
- Have the project clearly defined and have the original prototype up and running.
- We can try to trade a slower charge time (around 2 minutes, possibly just a bit longer) to take advantage of other options if necessary.

Brainstorming Session

- Since a PCB will eventually be required for the final circuit, PCB demonstrations need to be in order at some point.
    - Dr Wall could be advised on this front.
- Capacitors will remain the power storage medium for this project since it will be about 8 Watt-hours stored for what would be a presumably short time.
    - The current ultracapacitors are too large, smaller ones do exist.

- Using a flywheel for power is a distinct possibility, though not the best option for various reasons (time and resources chief among them).
- It would be nice to have a second PCB built and ready to be packaged by the end of the semester. One major issue to be solved once this stage is reached will be dealing with heat.

Client/Instructor Meeting #2

Agenda

- Client Interview, Part 1 (Brief Overview)
- Cover a few research questions

Client Interview, Part 1 (Brief Overview)

1) What should the focus be?
    a. This is based on human need. If a phone is low in power during traveling, having a device which could charge up in 2 minutes and then charge the phone as needed would be invaluable. Based on last year's developments on the project, the goal should now to be complete the design and bring it to a near-production state.
2) Where did the previous group leave off?
    a. The rectifier used for converting voltage never quite worked, thought they could have it work so directly from the wall and through the device they could charge the phone.
    b. Switching between charging modes (charge capacitors vs charge phone) was not automatic and did not work as well as it could have.
3) Is the original direction for the project non-negotiable?
    a. While it can be taken in several directions, it does depend on the group's intentions, but it also must remain true to Dr. Hess' vision.
4) What should the group's first steps be?
    a. Figure out what to build
    b. Figure out a plan to get it done
    c. Figure out how to finish in the time given
    d. Figure out how to finish in reasonable finances
5) Is battery life a concern?
    a. Dependent on the battery. It is highly advisable to find products which could streamline the work. Texas Instruments and Maxim apparently make great chargers, worth enough to look into.
    b. Life cycle issues are not incredibly worrisome, though keep in mind a battery's optimal charge range are to discharge down to 15% and then charge it up to 95%.
6) Will damaging the phones be a worry?
    a. Just as long as the voltage/current running through the device are kept under control, things will be fine. The TI and Maxim chips could help with this.
7) Is it possible to charge the phone and the capacitor bank simultaneously?
    a. Yes. This is a highly recommended course of action.
8) How open are the dimensions for this project? Must it remain similar to an iPad or can it be altered to decrease length/width for more thickness?
    a. Since this is supposed to be a carry-on, it is preferred to keep it close to the iPad rather than changing the basic shape.
9) Assuming this project gets to a production point, are patents an option?
    a. Two options come up with patents:
        i. Hire a patent attorney for large sums, but risks run if the device doesn't sell.

ii. University: The bills for the patent are covered, however the school earns all profits.

Research Questions

- The capacitors need to be smaller. How can this be done?
    - First, fix the current design's flaws while making use of the smaller ultracapacitors.
    - Once a working design has been made, the ultracapacitor manufacturers can be contacted and shown the working product, and they can produce the capacitors in the size we need.
- What about the phone batter, especially the type?
    - This is inconsequential. The USB charging cable makes this a non-issue, especially if USB 3.0 is utilized.
- What do we need to worry about in terms of tripping a breaker?
    - Keep in mind national code is a 20A limit in major buildings like airports.
    - Since a breaker will trip some time after the limit has been breached (depending on how far beyond 20A it has gone), it is best to avoid tripping it entirely and shoot for a lower current.

Client/Instructor Meeting #3

Agenda

- Covering research from the past week (Charger, chips, and circuit breakers)
- Checking in and receiving critiques on our research

Research Updates

- Maxim Chips ideas
    - Look for a development board for ease of testing
    - USB compatibility?
- Circuit Diagrams
    - There are two unidentified circuits on some of the charger schematics. These turned out to be for an electromagnetic interference filter and an iron core transformer.
- Looking to power up the capacitor bank once we're able
    - There are several DC power supplies in the power lab to make use of.
        - Check with Ian King or Jackson Bates if there are any questions on using these power supplies.
        - Use the voltage and current knobs to control flow. The limits of the supply are set by both of the knobs.
        - Example: 4A with 10Ω will of course produce a 40V DC output.
        - Set the current limit before beginning.

Last Minute Mention

- There is an opportunity for another presentation at the beginning of March, in Boise. It would be on March 1st, with a return on the following day.
- Our group will discuss this and see if our schedules will allow for it.

Client/Instructor Meeting #4

Agenda

- Clearing up where we are on the project
- Questions on where the project is headed
- Snapshot Day

Where the Group is

- Research on dedicated ICs vs using a microcontroller has been pursued. The dedicated IC is seen as a component which, while involving some extra work, would make the job easier.
    - If the conditions of the IC were matched with the job, it could help converting power.
    - Additionally, one of these may be useful for helping in the charge rate.
- The current prototype is incredibly similar to the Apple charger.
    - There are no legal issues to this design similarity
    - In fact, on second glance there are more alterations than were initially realized
    - Main advice for going forward: maintain a constant current at the max signal possible
- The budget for this project is to cover the entire year, not just a semester

Where the Group is going/needs to go for Snapshot Day

- Gantt Chart: this needs to be built in a way that will work for us.
    - Take a reasonable estimate of our work, create a chart with these major elements, then as time goes on create smaller tasks to be added into it.
    - Have this ready for the Snapshot Day
- Wiki Page
    - There were issues with them in the past, this will be sorted out later
- Budget
    - This needs to be created once a better idea of what the group will need is sorted out.

Client/Instructor Meeting #5

Agenda

- Team Issues & Organization
- DC Power Supply/Generator Room
- Deadlines
- Additional Questions

Team Organization

- Mariana had to leave the team for medical reasons, leaving only two remaining members.
- Roles need to be maintained and reorganized. They are:
    - Finances
    - Minutes
    - Agenda/Moderation
    - Wiki Page Moderator
    - Formal Project Leader

Upcoming Deadlines

- Snapshot day is coming up at the beginning of March. Know what must be done.
- Have the Gantt chart finished and ready to present at the next meeting.

DC Power Supply

- Make it a current source when we charge it
- For the project itself, base the rectifier around the same idea
- The actual level of voltage is inconsequential
- Another note brought up for the project: the previous team used a buck converter to help maintain a certain range of currents for charging. This is inefficient and more work than necessary since the current will be constantly bumping up and down within this boundaries.
    - Adjust it for more control
    - Consult the Mintyboost design for USB voltage control (USB 3.0)

Additional Notes

- Cadance License
    - Talk to Dr. Ay or Dr. Hemati, they are the two professors with access to a license
    - Otherwise, the ECE 311 lab is the best bet for working with Cadence to reproduce the schematics from the previous team
- "H" bridge of resistors on the first prototype
    - This is a set-up for a voltage and current sensor, since it feeds from both sides into the microcontroller and to the capacitor bank
    - This design was removed from the 2nd schematic due to a better microcontroller being installed, therefore no longer have as low of a voltage tolerance
- Drivers
    - Take caution with these

    - There is a MOSFET in the circuit used as a switch between charging modes. This may be wholly unnecessary and complicated. If we choose to keep separate charging modes, use a mechanical switch.
- Synchronous generators through the rectifier will produce a variable DC voltage. This could be useful as well in updating the design
- Wiki page
    - The issue should be resolved; consult Dr. Li.

Client/Instructor Meeting #6

Agenda

- How should the capacitor bank be aligned?
- Gantt Chart
- Turn in materials for Boise presentation
- Cadence Simulation
- Snapshot Day
- Portfolio/Logbook Review
- PCBs

Snapshot Day

- Make a large poster (Dr. Hess has some examples; there is also one from the previous team in our lab room)
- Block diagram with major pieces/milestones from our work
    - Lift these from the Gantt Chart
- Questions to expect:
    - What is it (the project)?
    - How are you doing/accomplishing the goals of it?
- Make sure to have an "elevator pitch" to sell everyone on the idea
- What time on the 8th? Talk to Dr. Li about this.

Gantt Chart

- Add mention of when the "final design" will be created
- Packaging should be built concurrent with the PCB creation
- Order parts for the final design at the end of the spring semester
    - Ensures parts will be in once the fall semester begins
- Add in design reviews (one towards the end of the first semester, another within the first two months of the second semester)

PSB

- Check with Amrit Dahal about PCBs
    - Many in the senior design lab could help with this
    - Faster turnaround will result in a more expensive board, and vice-versa
        - Construct time will vary from a few hours to several weeks, all depends on how much one is willing to pay

Cadence

- Several parts were difficult to implement; this was fixed by looking up by part number
- Instead of a separate voltage source for the 20V into the microcontroller, there is the option to divert power from the 120V AC source
    - Another option would be a housekeeping supply
    - Check into Maxim chips or other manufacturers to control this
- Zener diodes could supply the conditions for an LED to signify a full charge
- Microcontrollers with a "sleep mode" to save power when the device is unplugged could be useful to look up

Capacitor Bank

- PCB to add capacitors? Or put them together akin to the original capacitor bank?
- Mounts for a PCB to hold the bank in place would be a good idea
- Mount the capacitors in a sideways position since the through-hole leads are not the only way to make connections
    - Hockey puck device?
    - This will need to be much more rugged
    - A bus bar would be needed here. Speak to Greg before he retires
- Look at how electronic packaging is done
    - This will go directly off of the capacitor bank design
    - Check packaging catalogues for ideas

Generator Room Testing

- DC supply (18A) will work well enough for our purposes
- Find a way to control the rate of charging from the power supply (current-limited)
    - Don't charge otherwise. This could trip the breaker since a large current is being sent through
    - A buck converter (like the one in the prototype) will control this
        - The capacitor bank would be the load in this situation

Idaho Government Proposals

- The state government is looking for ideas to "advance the state's economic progress"
    - This is an ideal project for it, and if it impresses then it could earn itself some extra cash to cover expenses

Client/Instructor Meeting #7

Agenda

- Snapshot Review
- Expo
- Boise Conference

Snapshot Review

-PowerPoint Slides:

- Strike "Battery Pack"; replace it with "energy bucket" or another similar phrase. Remember we are moving energy, so give it a bit more expression.
- Don't restrict the usage description to phones. This this can be used on any device.
- Use the term Solid State Relay rather than "mechanical switch."
- Use some kind of advertising or an eye-catch to grab attention. Photos, especially funny ones or ones which will harken a need. Use ideas from magazine ads if inspiration is needed.

Expo

-Show a need: on-the-go, airport, camping, etc.

-Really sell the device so people will want to see it and use it.

Boise Conference

-Camping company was interested in the device.

-A representative will be coming next Thursday to discuss things in further detail.

-We'll be looking to get funding from this as an option. Additionally, state or federal grant funding could be a reality.

Client/Instructor Meeting #8

Agenda

- Inergy Meeting Preparations

Inergy Meeting Preparations

- Show basic concepts of how the charger works, using what works.
    - Show the charging of the bank.
    - Charge the phone from the bank.
    - DC/DC conversion from 28V to 5V.
- See if we can get the time for the meeting changed from 10:30 AM to 11 AM.
- Put everything onto a cart with a power strip to set things up more easily.
- Prepare for potential negotiations with the representative.
- And as a reminder, this device is not patented. Therefore there may be open negotiations for selling a concept once it's completed and getting the patents.

Client/Instructor Meeting #9

Agenda

- Inergy Representative Recap
- Snapshot Day Recap
- Future Changes

Inergy Representative Recap

- Nothing was really able to get working (issues with power supply are primarily to blame). Regardless, get everything working in the future.
- Ignore the representative's suggestions about alterations to the design or desires. Stay the course on this and make it work.

Snapshot Day Recap

- Fairly uneventful. Not many stopped by to ask about the project, though the few that did had many great questions to ask.

Future Changes

- Get the project up and running.
- Get rid of the transistor, create a switch (28V to 5V area)
- Between the rectifier and the capacitor bank is first major area to get working. After that, it's the capacitor bank and the buck converter area. These are the most crucial interfaces, and once they're going everything should be set.

Client/Instructor Meeting #10

Agenda

- Testing and Results
- Wiki
- Design Review
- Expo

Testing and Results

- Everything on the project was put back together and repaired to better than it was before.
- Unfortunately, no voltage results came into the capacitor bank when plugged in – this is an issue the previous group had encountered.
- There is a rogue wire from the isolated gate driver leading into the series of inductors, completely bypassing the Power MOSFET.
- There are many underlying issues with the design that need to be fixed. It's time to take a completely fresh look at the project, determine what works and what doesn't, and fix it now.
    - First, the overall circuit can work. The meat of this is a buck converter, with the Power MOSFET acting as the switch. Input voltage is the 138V DC from the bridge rectifier.
    - A better fundamental understanding of the circuit is necessary to get this working. Remember the transient functions for voltage and current using inductors and capacitors.
    - There was an inherent problem with the circuit created by the previous team that has only now been realized: they had designed things with a steady state in mind, when this needs to follow transient circuit conventions.
        - This means we will need the switch toggling. The capacitor current needs to jump between 3A and 2.5A. As this happens, the capacitor voltage will be increasing at each toggle, rising at 3A and plateauing at 2.5A, working until it gets up to about 28V, give or take.
        - As it stands, the current N channel MOSFET won't work for this. We'll need a new one which can handle at least 3A and 138V, preferably one with a much higher voltage. We will also need some kind of driver to help get this moving and induce the switching.
        - For this, the input (drain) of the MOSFET will be 138V. Gate will be greater than 20V, and there will be about 28V exiting the inductors. We need to find the parts to achieve parameters like these.
        - Some things to keep in mind: When the switch is on, there will be 138V crossing the MOSFET. In order to turn off the N channel V_GS, we will need to drop it below the threshold voltage.
        - To turn it back on, the gate voltage needs to be equal to the source voltage plus the drain voltage.
    - Other options:
        - Use a P channel MOSFET rather than an N channel one.
        - In here, it will still get 138V input, but it will have a gate voltage of 118V to compensate.

        - We will need some kind of current source to get the buck converter working, something enough to provide the 3A.
        - We could also use something other than a buck converter, but they come with their own hosts of issues.
            - Boost converters have no actual way of restraining the rise of the capacitor current like the buck does, making that a vexing problem to fix.
            - Buck-boost converters have the same issue.
    - As of now, we need a solid current, so some kind of replacement for the MOSFET will be necessary. It needs to be some kind of current source which can switch modes and provide the 3A required.

Wiki

- Wiki development is well underway. First review went well, with only a few small adjustments needed to be made.

Design Review

- This needs to be done by about the 13th. Shooting for during the regular meeting time on the 14th. This will give us plenty of time to get a new plan formulated and be ready to show it off.

Expo

- Preparations are beginning.
    - Find out if we need to have a laminated poster at all.

Client/Instructor Meeting #11

Agenda

- Review from last week
- Solution Possibilities
- Design Review

Review from last week

- Briefly went over the jist of the previous meeting.
- It was deemed that an NMOS was still incredibly problematic to pursue.

Solution Possibilities

- Some other ideas were brought to the table:
    - Voltage Doubler/Dickson Charge Pump could do the job while also keeping current under control.
        - For help, checking the old Razavi "Microelectronics" book or the "Art of Electronics" by Horowitz and Hill could give some insight on these designs.
- Boost converters and voltage doublers don't have the same issue with the gate like the power mosfet in the buck converter has. This is because no matter what, the voltage for the gate will remain constant since it has a direct line to ground.
- Boost converters are not a desired pursuit since the current will increase and gain too much unless the capacitor bank voltage becomes greater than the input voltage, a feat not at all possible for this project.
- Bootstrapping is another concept worth pursuing.
    - The IRF21_ _ series of MOSFETS could very well get us what we need.
- Switch Capacitor circuits:
    - Contains both a boost converter and a Dickson charge pump
    - Uses a switch capacitor filter (ISL7662)
- Buck Boost could always be an idea, too
    - Inverting the leads on the load could potentially work
- Cuk converters have a regulatory induction current like the buck converter, but involve a different design philosophy lifted from boost converters. Could certainly work in this.
- Recommended ideas:
    1) Find a working NMOS that won't have the same gate issue
    2) Create a suitable Dickson circuit
    3) Use a Cuk converter circuit

Design Review

- Postponed until April 21st so sufficient research and planning can be conducted
- Be sure to invite others, especially those whose interests may align
- During presentation, make use of a variety of media such as pictures, plots, schematics, and more
- Provide an updated Gantt
- Don't just use PowerPoint to convey data (see some of the above suggestions)
- Prove what works and what doesn't work

- Give basic project info, how it works, and a concept on finishing it while also filling in the blanks on getting to that point.

Client/Instructor Meeting #12

Agenda

- Power Supply Issues
- Status of Systems
- Design Review

Power Supply

- New power supply (18A) is down, needs maintenance
- Other supplies worked just fine, thankfully
- Capacitor bank is able to demonstrably charge

Status of Systems

- 2/5 parts confirmed to work
    - Input across bridge rectifier
    - Capacitor bank charge
- Rest of the parts will be checked and/or repaired as able

Design Review

- Calculations are being added through MATHCAD file
- Dickson + Cuk converter research has begun
    - Various designs have been found. The Cuk/Buck-Boost (Current Mode) appear to be the most reasonable solutions.
- Reminder that current drives the gate rather than the voltage. The regulated current from a converter should do the job nicely.
    - If Buck research continues, use a PMOS and find a proper driver
    - If Cuk, use an N channel and find some other placements

Client/Instructor Meeting #13

Agenda

- Expo
- Converter Discussion
- Parts

Expo

- Expo has come and gone; everything went well during the day. Plenty of interested people stopped by, some offering ideas for potential applications, other just enjoying what we had to show.

Converter Discussion

- We have 330 W we need to input into this circuit in order to pull off. We've looked into flyback converters, but they're simply not powerful enough to handle the loads we need.
- Push-Pull converters are an option, albeit a complex one. This will need to be researched in order to determine if it's good or not.
- Research through Siemenns, PCIM, and powerelectronics.com
- Some converters will have their own control algorithm (if used in an IC), so regulation is what we will need to supply to keep them running smoothly

Parts

- Capacitors need to be changed at some point
    - The new small ones don't fit the needs we have for the current.
    - We have two possible replacements, but their size/cost are definitely a huge issue.

Next design review: The week of August 29th.

Client/Instructor Meeting #14

Agenda

- Part Discoveries
- Layout Development

Part Discoveries

- Two possibilities: halogen transformer and a DC/DC converter by Vicor. Both show potential, but both are very different devices.
- Dr Hess was not certain if the devices could handle slow rises in the voltage, since it may take several minutes to reach the full voltage capabilities.
- The switch in our design is currently a through-switch, not a ground-connected one. This makes our gate voltages that much higher to achieve, and it should be heavily considered before we continue.
- All things outside of the MOSFET were in operating status as of last semester. We need to know the details of input/output at every step of the way.
- Returning the problem:
    - Pulling about 10A or more and 170V DC from the wall socket as input.
    - This goes into an interface and into the capacitor bank.
    - Capacitor bank then leads into the USB charger
- All that is missing now is a gate driver. A PMOS is most desirable in buck converter layouts.

Layout Development

- What we at this point is something to raise up the gate voltage from the isolated gate driver, or have a different driver entirely.
- If we use a level shifter to raise the voltage, we need to have the Vgs = 0V when off, and 10V when on. It must also be floating and allow for current amplification.
    - The level shifter would increase the gate voltage output from the driver and increase it from about 5V to 170V.
    - Additionally, current amplifier must have two inputs (meaning two MOSFETs).
- If the level shifter doesn't work, looking into the dual driver/PWM Amplifier. Make sure to only use the floating side.
- Look into a bootstrap circuit if all else fails.

Client/Instructor Meeting #15

Agenda
- Schedule + Questions
- Current Sense Amplifier
- Design Review

Schedule + Questions
- The Arduino has output voltage of either 3.3V or 5V depending on need.
    - The current OpAmp jumps up this to 20V
- Check back with each other & Dr. Hess as we continue research
- Shoot for the design review to occur next Friday (September 23)

Current Sense Amplifier
- Sense current from a large overall power, using controller logic to maintain what we need.
- Current should push floating device, preferably for a single floating driver.
- Check the IRF series and others.

Design Review
- Shoot for Friday, from 9 AM to 10 AM.
- Need to discuss with Dr. Li to ensure the date and time will work.
- Have a backup set for Friday at 4 PM.

Client/Instructor Meeting #16

Agenda
- Go over recent findings
- Outline and prep for Friday

Go over recent findings
- There's a voltage shift between the floating gate and the source-side voltage that is also connected to ground.
- Looking at the MOSFET:
  C = 12000pF
  Gate Threshold = 3 to 5V (6V used)
  Q = CV = (1200nF)(6V) = 72 nCoul, which is close to the 74nC/10V from the MOSFET as well

- The IRF640 MOSFET is promising, able to handle 18A and 200V
- IRFP9240 is another option
- Contact IRF and ask what they recommend as a gate driver in a buck configuration with a slow switching frequency.

Client/Instructor Meeting #17

Agenda

- Design Review Followup
- Part Discussion
- Gate Driver Layouts

Gate Driver Layouts

- We have two options:
    - First, going the same general design as the present, only with two drivers and two MOSFETs.
    - Second, a dual-MOSFET layout where the second is grounded.

Part Discussion

- Found an Ultracapacitor charger, $4.50 per part
- It has a constant current mode
- Can run up to 10A through
- Vin is from 5V to 28V, the Vout is 2.1V to 26V. This means at max output we're getting about 260W, much less to the ideal 330W.
- Talk to Stephanie Burney about shipping the part and how to pay
- Look into an evaluation board for the part as well.
- For the voltage conversion, perhaps a DC motor driver?
    - Look for DC output with a brushed permanent magnet, regulated current is ideal, and look for one able to go from AC to DC.

Design Review Followup

- Not much to be said overall, just be sure to have things to show off at the next one.
- Also, don't do it all on PowerPoint. Datasheets are always very nice to have.

Client/Instructor Meeting #18

Agenda

- Research Results
- Parts

Research Results

- As it turns out, UC Santa Cruz had a very similar project a few years back.
    - It makes use of a "Mean Well, Inc." power supply. Don't know what that is, but it can be researched.
    - This however proves one thing: that the project can be done.

Parts

- Check the efficiency of the components to ensure how well they will each work.
- Ensure the size of each part is small enough to fit.
    - There may be a snag with this in that DC/DC converters are often fairly large.
    - Charger port found however is 3.75mm x 3.75mm x 1.15mm
- We need to come up with a driver, or a dual driver of some sort.
    - If for nmos + pmos, we need it to invert controls so one is off when the other is on.
    - Or, look for a motor driver

Client/Instructor Meeting #19

Agenda

- Parts Review

Parts Review

- Found a possible driver: NCP5109A/B (Two separate types)
- It can bridge at high voltages
- Can also take the 3.3V/5V output of an Arduino and react accordingly.
- Recommended having an inverter in series with each Arduino output to insure no backflow damage if the driver fails.
    - Be wary of the cost of such a thing.
- The Vcc source of this part and Arduino power supply need to be finalized.
    - Be sure to step down from the input of the circuit so that these parts are not receiving the full brunt of the rectified DC voltage. A voltage divider and/or linear regulator would be useful. Capacitors in parallel could remove the ripple from these.

Client/Instructor Meeting #20

Agenda
- Finalize the parts
- PCB construction

Finalize the parts
- For a DC/DC conversion on the other parts' power, things such as a capacitor, diode, and linear regulator could ensure no issues when powering up parts such as the Arduino.
- Watch out for the input power range on the Arduino. Part regulator may just raise the voltage up to something like 5.22V rather than a flat 5V.
- May want to consider looking into newer ultracapacitors, at least to determine if the technology has changed over the last few years, enough to make smaller, cheaper ones.
- Part orders will be sent out ASAP.

PCB construction
- A PCB mill has become available to our uses. We should find a way to create one and specify the board file on the mill itself.
    - Check BEL 330 for this.
- A PCB for this project may have wide traces of copper in order to carry the current.
    - Rule of thumb is 4A/square mm

-No meeting to be held next week

Client/Instructor Meeting #22

Agenda
- Wiki Review
- DipTrace/PCB
- MOSFET Current (Gate)

MOSFET Current (Gate)
- Through some calculations using basic equations (Q=CV, I=C*(dV/dt), V=IR) and the test data from the MOSFET datasheet, we were able to determine just how much current is required to flip the gate switch, about 400mA at minimum.
    - This is perfect, as our driver outputs approx. 600mA.

Wiki Review
- We had very few, but useful critiques
    - Changed size of images
    - Rearranged and added a few details on our project

DipTrace/PCB
- PCB crashed when testing; the issue causing this was thanks to the nodes, already fixed.
- Should be more than ready to move on to the next part.

-Need to run testing on parts this week, ensure they work, and then move on to final testing of the project.

Client/Instructor Meeting #22

Agenda

- Wiki Review
- DipTrace/PCB
- MOSFET Current (Gate)

MOSFET Current (Gate)

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    - This is perfect, as our driver outputs approx. 600mA.

Wiki Review

- We had very few, but useful critiques
    - Changed size of images
    - Rearranged and added a few details on our project

DipTrace/PCB

- PCB crashed when testing; the issue causing this was thanks to the nodes, already fixed.
- Should be more than ready to move on to the next part.

-Need to run testing on parts this week, ensure they work, and then move on to final testing of the project.

Client/Instructor Meeting #23

Agenda

- Parts Testing Update

Parts Testing Update

- Speak with Ryan Ready (BEL 330) about the current probe testing for the PCB
- Testing has been coming along, should hopefully be completed within the next couple of days
- Take a look at the driver to see if it will hold the current or if it begins to decay.
    - Solution to this issue: PWM by timing out until set point (check the driver data sheet for the frequency), though this may actually be unnecessary.
- Capacitor between the driver's boot and bridge needs to be watched, just in case
- Isolation of the microcontroller inputs needs to be looked into since there's a good chance of 170V after the inductor.
    - And Optoisolocator device can provide the isolation through its LED + phototransistor combination.
- An op amp can possibly be placed into line between the lower output and the microcontroller. This could help to avoid frying the microcontroller during normal operation.

Client/Instructor Meeting #24

Agenda

- Snapshot Day
- Updates

Snapshot Day

- Our poster will be done up twice
    - Paper version for Snapshot day
    - Glossy board as the final version next week

Updates

- DC/DC Converter has been having major issues ever since we began testing.
    - 5V, 1A input into the Arduino is known
    - This is a tricky problem overall, as the converter does not seem to want to act as expected.
    - Something to try: 1 ohm power resistors in series in order to get close to the rated current.
    - Additionally, when using the DC Voltage Supply, go on ahead and preset the voltage before powering the test. This won't actually hurt anything.

Client/Instructor Meeting #25

Agenda

- Finalization

Finalization

- The Dual Driver will be hooked up to the final device, and at this point we can only pray that it will work. Testing was promising and showed accurate output, we just need it to cooperate when applied into the project.
- On the DC/DC converter:
    - Issues continue plaguing tests on the part. The datasheet is very little help, and attempts and making progress are met with failure.
    - First possible check: ensure ground is connected and that it is in the proper position
    - Next, change the resistance, making it around 10 ohms rather than 5. This would allow for a much closer current to the desired output.
- Deliverables for the end of the week:
    - Poster should be finished after the devices are checked and added onto the project
    - The final report is being written at present, will be turned in at week's end.
    - Send Dr. Hess an electronic copy of the schematics, files, our report, and more.
    - A hard copy of the final report and the schematics should be turned in as well.