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| [Link to QEs 1-28] [Link to QEs 44-69] |
| QE #29 (1.00 hrs) 7Feb19 **[D]**  Topic: Researching code for reading from SD (Secure Digital memory) card in order to be able to pull max force, etc. Need to add a method of getting unique file names.   1. <https://forum.arduino.cc/index.php?topic=148257.0>    1. Topic: storing values from an accelerometer into an SD as an array, then read the values out of the SD.    2. “johnwasser’ suggested using [parseInt()](https://www.arduino.cc/en/Reference/parseInt)       1. Returns the first valid, long integer 2. <https://forum.arduino.cc/index.php?topic=462059.0>    1. Topic: Logging data into an SD card efficiently.    2. “jremington” suggests using [sprint()](https://www.tutorialspoint.com/c_standard_library/stdio_h.htm) in order to format into a character array (says strings cause issues with memory).       1. Could store signed decimal integers, but would need to initialize an array length in advance. 3. [Arduino Time Library](http://playground.arduino.cc/Code/Time)    1. Can get time/date and time elapsed can be calculates    2. Have to sync with serial connection to a computer 4. [SD card variable file name](https://forum.arduino.cc/index.php?topic=71223.0)    1. Topic: Wants unique file names and to get a .txt file as an output in order to copy/paste into Excel.    2. “PualS” itoa() will convert integrers to strings and sprint() will make code large       1. Reminds that the file name can only be 8 characters long    3. “sjn3” made a function that would   **Outcome(s):** Have a method of creating variable file names. Could use with random number generator due to timestamps requiring a serial connection to a computer and/or not being turned off. |
| QE #30 (1.00 hrs) 7Feb19  Topic: Soldering SD breakout boards and the amplifier board and finding all the required materials to solder in the EE lab.    **Outcome(s):** Have boards that can be connected to bread boards for testing. The solder may or may not be removed later. |
| QE #31 (0.50 hrs) 7Feb19 **[D]**  Topic: Ordering another bread board and more jumper wires.  ([Link](../Admin/Emails/Order%20Confirmation%20No_%201974327-0981185531%20(for%20me).eml))  **Outcome(s):** Will have more pins to allow for the testing of all the components needed. The bread board now does not have enough space (and not enough wires). |
| QE #32 (1.00 hrs) 7Feb19 **[GP&A]**  Topic: Meeting with Dr. Gonthier and talking about ME setup.   1. DG: How much does it weight, EZ: we don’t know exactly yet 2. EZ: DrG really wants to recreate NASA’s current design    1. DG: why?, DB: Theirs is space efficient 3. DG: how long to run the test?, EZ: Issue with supply    1. DG: Real test? EZ: not long (signle digit seconds) 4. DG: looked into ergonomics? DB: last semester, and placement of peripherals and grips.    1. DG: Get better arguments to ergonomics. Must have a convincing “why.”    2. If you can explain and justify you’re going to be ok. 5. EZ: we are asked to test with no repeatability.    1. Wtf, why? Need repeatability. 6. IA: what things worked well for last semester project? DG: Honest effort. If it didn’t work: explain, and give recommendations. 7. DG: I don’t think your project is that complex, so it should work. (Seriously…) Raise flags if it doesn’t work. (Scalzo said otherwise.)    1. DG: need to be able to prove the design.   **Outcome(s):** Dr. Guo is still causing issues and Dr. Gonthier doesn’t remember the other meeting where Scalzo said we were messed up. MEs said that they are probably going to cut up the actuator to suit what Dr. Guo wants. Meeting next week to discuss the testing presentation. |
| QE #33 (1.50 hrs) 7Feb19 **[R]**  Topic: Researching Arduino interfacing with third party software. ([Arduino website](https://playground.arduino.cc/Main/InterfacingWithSoftware))   1. [Azande](https://zeijlonsystems.se/products/azande/index.html)    1. Live monitoring and commands (Windows PC)    2. Has a “Live-Chart” feature to view data.    3. USB, Virtual-COM, Ehternet/WiFi, and Bluetooth 2. [Junito](http://jubito.org/)    1. Designed for agnostic [interoperability](https://www.google.com/search?q=interoperability&rlz=1C1CHBF_enUS759US759&oq=interoperability&aqs=chrome..69i57&sourceid=chrome&ie=UTF-8)    2. Runs on any device that is capable of .NET or mono-runtime (e.g. Windows) 3. [Ardulink](http://ardulink.org/)    1. Java based and is mainly for “control and coordination”    2. Has several java libraries that look mostly for communications needs (e.g. MQTT, proxy sever…) 4. [MegunoLink](https://www.megunolink.com/)    1. “data-plotting, monitoring and user interface construction”       1. Dockable visualizers       2. Tables       3. Looks a lot like Microsoft Access for user interface design    2. Seems to be what Dr. Guo would want. Also, cool as hell.    3. **NOT OPEN SOURCE** ([Costs](https://www.megunolink.com/buy-now/)) 5. [Instrumentino](https://www.chemie.unibas.ch/~hauser/open-source-lab/instrumentino/index.html)    1. Similar to MegunoLink, but open source    2. Saves data to computer with logs    3. Can use Python to control devices (for more complex control)    4. They say Arduino environment is not for use with interactive control    5. GUI was written in Python    6. Allows for creating your own control sequences in the GUI. 6. [MakerPlot](http://www.makerplot.com/)    1. Using for plotting data gathered using a serial connection    2. **NOT OPEN SOURCE** ([Costs](http://www.makerplot.com/buy.html)) 7. [Blynk](https://www.blynk.io/#home)    1. An app (iOS and Android) that you build on top of.    2. Built of “widgets” that you assemble.    3. Free for developers 8. [Phiro](https://www.robotixedu.com/)    1. Smartphone app for Arduino and Phiro via Bluetooth 9. [iArduino App for iPhone and iPad](http://i-arduino.blogspot.com/)    1. BASIC, SCADA, Modbus Master, etc.    2. Has many pre-built modules for different controlling types (add widgets)    3. Wifi or Bluetooth 10. [Device Druid](https://devicedruid.com/)     1. Build GUI like Microsoft Access     2. Automated code created when design the GUI     3. The company will help [prototype](https://devicedruid.com/how-it-works/) 11. There are about 30 more links, but Arduino didn’t feel it necessary to describe each one.     1. [Arduino and C++ (for Windows)](https://playground.arduino.cc/Interfacing/CPPWindows)        1. How to use Arduino wiring language with Visual Studios 2008   **Outcome(s):** Some of these might be good as suggestions for Dr. Guo in the future. If he gets another team they might be able to use some of these to do what he wants on his device (depending on their experience, budget, etc.). |
| QE #34 (1.00 hrs) 8Feb19 **[R]**  Topic: Researching how to read values (the output) on the load cell.   1. [RobotShop Community](https://www.robotshop.com/community/blog/show/interfacing-a-load-cell-with-an-arduino-board)    1. Arduino has 10 bit A/D converter (i.e if analog pins take 5V, then ~4.9mV is the resolution. 2. [Sparkfun](https://learn.sparkfun.com/tutorials/getting-started-with-load-cells/all)    1. Gauge Factor (GF) – sensitivity to strain/weight = (fractional change in elec. Resistance) / (fractional change in length)       1. Strains are typically measured in millistrain (e 10-3), so for a 350 ohm LC and a 500ue => 0.35 ohm change    2. [Load Cell Amplifier HX711 Breakout Hookup Guide](https://learn.sparkfun.com/tutorials/load-cell-amplifier-hx711-breakout-hookup-guide)       1. Load cells are typically only +/- 5% due to all the variables the physical world      * + 1. If values read appear to be opposite of what you expected, switch O+/O- wires     2. VCC needs to be 5V and VDD needs to be 3.3V…**grounded on the microcontroller**     3. Code for load cell ([Sparkfun github repository](https://github.com/sparkfun/HX711-Load-Cell-Amplifier)) which has some good stuff. Lol Beerware license!        1. Need to run the calibration sketch! Then run the code on (b) to get tare, then read…   **Outcome(s):** Understand the output method of a load cell and found 2 sketches for Arduino to calibrate and read the load cell. Also, a great library for using the HX711 amplifier. |
| QE #35 (1.00 hrs) 10Feb19 **[M]**  Topic: Code for using load cell and amplifier.  This included reading the library definition and the calibration sketch in order to know functions available and function calls/usage.  **Outcome(s):** Have code to integrate the load cell and amplifier into whole. |
| QE #36 (0.75 hrs) 10Feb19 **[T]**  Topic: Writing testing procedure for load cell and amplifier.   1. Calibration    1. Objective: To obtain the calibration factor for the load cell/amplifier.    2. Setup       1. Wiring:          1. Data to pin          2. Clock to pin          3. VCC to 5V pin          4. VDD to 3.3V pin          5. Ground to GND pin          6. Excitation voltages should be from a “source”          7. ±output to ±A on breakout       2. No weight! Just let it hang, etc.       3. Open Arduino IDE:          1. Upload/run sketch (LoadCellAmp\_CALIBRATION)          2. Open serial window          3. Follow prompts in serial window             1. Allow the first reading to come in             2. Add a known weight             3. Adjust (code does by ±10) the calibration\_factor until the correct weight is shown in the serial window          4. RECORD THE FINAL “calibration\_factor” as it will be needed for the rest of the codes. 2. Reading Weight In Serial Window    1. Objective: To verify the load cell/amplifier, with calibration\_factor, are reading weights correctly over a range of weights.    2. Runt the LoadCellAmp\_TEST       1. Verify that the setup is reading the correct values, to a degree, from 0 to full load.       2. Record the read out for each weight in order to find the uncertainty (maybe can adjust the calibration\_factor)   **Outcome(s):** This is the procedure that will be followed in order to test the load cell and the amplifier (and be in the midterm presentation). |
| QE #37 (1.00 hrs) 11Feb19 **[T]**  Topic: Setting up the rest of the testing circuit (amplifier and SD breakout board)     1. Wiring the SD breakout    1. [Adafruit tutorial](https://learn.adafruit.com/adafruit-micro-sd-breakout-board-card-tutorial/arduino-wiring) says to wire in the following way:       1. 5V to 5V on Arduino       2. GND to GND on the Arduino       3. CLK to 52 on the Arduino       4. DO to 50 on the Arduino       5. DI to 51 on the Arduino       6. CS to 53 on the Arduino       7. CD to 38 on the Arduino 2. Amplifier    1. Pin out **towards** Arduino       1. Data to 46 on the Arduino       2. Clock to 44 on the Arduino       3. VCC to VCC on Arduino       4. GND to GND on the Arduino    2. Pin out **towards** amplifier ([documents](../Code/Testing/Load%20cell%20info.pdf))       1. E+ to red wire from load cell       2. E- to black wire from load cell       3. A- to green wire from load cell       4. A+ to white wire from load cell       5. B- to **Nothing**       6. B+ to **Nothing**   **Outcome(s):** Have a model circuit to test functionality and coupling of components and subsystems. |
| QE #38 (1.50 hrs) 11Feb19 **[M]**  Topic: Organizing EE4820\_Main\_v1 into collected sections and creating functions to carry out discrete operations.    [Function Declarations](https://www.arduino.cc/en/Reference/FunctionDeclaration) [Constants](https://www.arduino.cc/reference/en/language/variables/constants/constants/)  **Outcome(s):** The code is organized and functions are being created according to discrete functions. |
| QE #39 (0.50 hrs) 12Feb19 **[D]**  Topic: Creating the template for the team(s) to use when writing and carrying out tests. (I sent a copy to a friend on another team)  from book 🡪 mine  **Outcome(s):** Have the template for the team(s) to use when writing and carrying out tests. |
| QE #40 (1.00 hrs) 12Feb19 **[R]**  Topic: Researching when to use resistors in the circuit when dealing with sensors/buttons. Also, a video about using an SD card and loading data into Excel.   1. [Boolean Constants](https://www.arduino.cc/reference/en/language/variables/constants/constants/)    1. High       1. Over 3V for 5V boards       2. Over 2V for 3.3V boards    2. The Arduino has 20K Ohm pull up resistors built in.       1. Activate by defining pinMode() as having a type of INPUT\_PULLUP    3. The Arduino “looks like” a 100 Mohm resistor in series with the sensor/buttons, which means that barely any current flows.    4. External pull down resistors are normally 10K ohms, so that the do not draw much current.    5. If using pull down resistor the logic in 2.c will be reversed. 2. [Input Pullup Serial Example](https://www.arduino.cc/en/Tutorial/InputPullupSerial)    1. Can directly connect the button (etc.) to the Arduino without adding an external resistor.    2. Ex: “pinMode(2, INPUT\_PULLUP);”    3. When buttons is:       1. Not pressed = HIGH       2. Pressed = LOW    4. Can store the sensor value with a “digitalRead” 3. [Arduino SD Card and Data Logging to Excel Tutorial](https://www.youtube.com/watch?v=5Dp-XatLySM)    1. Set the chip select pin on the Arduino as OUTPUT    2. “SD.begin()” initializes the card for use    3. “return” in the setup() will terminate the program    4. After code in screenshot, he adds a delay in order to    5. In Excel: Data tab> From Text button>select file       1. Select “delimited” in the first screen then comma in the second screen 4. “How To Mechatronics” has a discussion on [Arduino DC Motor Control](https://howtomechatronics.com/tutorials/arduino/arduino-dc-motor-control-tutorial-l298n-pwm-h-bridge/)   **Outcome(s):** Don’t have to use as many external resistors, changed logic to suite not using external resistors, have example of using SD card with Excel, and have a resource for using the Arduino with DC motor control. |
| QE #41 (1.50 hrs) 14Feb19 **[GP&A]**  Topic: Meeting with team and Dr. Gonthier.   1. Dr. Gonthier    1. I walked in on them explaining the motor (voltage v. speed)    2. DG said that accuracy needs to be indicated.    3. DG need to review Engr specs and show how test related back    4. Need to show numbers to give reference and repeatability    5. DG: try to mimic the real life application in testing    6. IA thinks this this project is “fairly simple”    7. DG: “just make it work”    8. DG: “Jazz slide up. It looks pretty vanilla”       1. Reviewing slides:       2. General format ok,       3. Have system drawing with visuals? EZ: No because we had to redesign (thanks DrG)       4. Need to include the scope change to just NASA       5. He really wants a picture of device and maybe one showing the subsystems       6. DG still doesn’t understand that DrG messed us up by making us redesign (not that we had a meeting about it)       7. DG: maybe just list subsystems (need to orient the audience) [30 seconds] 2. Team    1. EZ: TC needs to pick a diameter for the encode,    2. TC: shafted or hallow encoder? EZ: how long of a shaft TC: Shafted more expensive    3. EZ: have precision weights in DrG’s lab…DrG    4. They finished the actuator test…redo calcs [4-6 V…not at 3, just in range] {probable up to 7}    5. The motor controller has a range of 5-28 V…may need a voltage divider.    6. TC found an encoder that is 100PPR, EZ: 1 rotation of lead screw = 1/16 linear    7. GB: how to address the engineering specs in each slide?       1. EZ: idk…   **Outcome(s):** T. Cao picked out the encoder and team discussed how to attach the encoder to the lead screw (have ratio of rotational to linear motion). |
| QE #42 (1.00 hrs) 14Feb19 **[M]**  Topic: Creating functions for specific “tasks” in process.    **Outcome(s):** Have new functions and logic flow design. This will allow T. Cao and I. Alexander to put code in seamlessly. |
| QE #43 (0.50 hrs) 14Feb19 **[T]**  Topic: Creating test plans and documentation for the battery system test.    **Outcome(s):** Have required documentation format for the battery system test. |
| QE #44 (0.50 hrs) 14Feb19 **[T]**  Topic: Creating test plans and documentation for the button test.    **Outcome(s):** Have required documentation format for the buttons test. |
| QE #45 (0.50 hrs) 14Feb19 **[T]**  Topic: Creating test plans and documentation for the display test    **Outcome(s):** Have required documentation format for the display test. |
| QE #46 (0.50 hrs) 14Feb19 **[T]**  Topic: Creating test plans and documentation for the load cell calibration test.    **Outcome(s):** Have required documentation format for the load cell calibration test. |
| QE #47 (0.50 hrs) 14Feb19 **[T]**  Topic: Creating test plans and documentation for the model circuit.    **Outcome(s):** Have required documentation format for the model circuit. |
| QE #48 (0.50 hrs) 15Feb19 **[T]**  Topic: Creating test plans and documentation for the encoder test.    **Outcome(s):** Have required documentation format for the encoder test. |
| QE #49 (0.50 hrs) 15Feb19 **[T]**  Topic: Creating test plans and documentation for the SD breakout test.    **Outcome(s):** Have required documentation format for the SD breakout test. |
| QE #50 (1.50 hrs) 15Feb19 **[A]**  Topic: Battery analysis based on MEs’ testing of new linear actuator.   1. ME testing of the actuators    1. Their tests found the following characteristics: 2. Interpretation    1. Minimums:       1. Voltage: 4 VDC       2. Current: 0.65 ADC    2. Maximums:       1. Voltage: 6.5 VDC       2. Current: 2.5 ADC    3. Array requirements       1. Voltage: over 8 VDC (see below about motor driver)       2. Current: maxed at about 4 ADC (recalculated with whole system) 3. Recommendation    1. Change array to 3S3P (11.1 V, 4.5 A) {$71.82}       1. Supply any less than 9 VDC will affect the maximum current output of the motor driver (constant current limit of 3A, which the motor *could* obviously get very close to).   **Outcome(s):** Have a modified design (scale) for the battery array based on MEs’ tests of the new linear actuator. |
| QE #51 (1.50 hrs) 19Feb19 **[GP&A]**  Topic: Team meeting with Dr. Gonthier.   1. Encoder changed so that the casing can be taken off    1. Hollow encoder so that shaft can be glued to the lead screw 2. Reviewing presentation and what is important to say out loud    1. Focus on: load cell, linear actuator, specs    2. Less on: buttons, SD, amplifier, battery system    3. Ian did a few practice runs to get within the time constraints    4. Team tried to identify :points of confusion” and how to address them    5. Meeting at 1200 for practice 3. Buttons    1. Just two 4. Encoder    1. 6 mm is only one available    2. Lead screw 0.76 mm    3. Could just machine our own shaft to fit the encoder 5. Changing design on attaching load cell 6. Management    1. Late to meetings—starting to get a rep    2. Deadlines – because we can’t wait to the last minute    3. Communication—read…and acknowledge    4. Meetings—in person by need, otherwise by wireless    5. If you see an error, say something    6. Maybe an outing   **Outcome(s):** Got midterm presentation, figured out parts to be ordered, and covered some management issues. |
| QE #52 (1.50 hrs) 20Feb19 **[D]**  Topic: BTB #2 creation and submission.    **Outcome(s):** Have BTB#2 and is submitted. |