

# Smart Vibes Project Log

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Starting on January 23, 2017

## Monday, January 23, 2017

- Worked on first presentation and report on Google Drive.
- Converted the Google Doc into a Latex doc

## Tuesday, January 24, 2017

- I was chosen as team leader by Joshua due to his busy schedule impeding him from leading.
- Performed presentation 1.
- Jordan bought a Feather for about \$40 in order to start programming it. The reason he bought it on his own is because we don't know when the parts will get ordered.
- Submitted first presentation and report to Git repo. Also submitted two peer assessments of Positive Resonance and Intellisense teams.

### To do list:

- ~~Fix system level design overview.~~ (Completed on 1/27/2017)
- ~~Create a Github private repo to host Design 2 group work.~~ (Completed on 1/27/2017)

## Thursday, January 26, 2017

- Submitted peer assessments for Poly Builders, Team Concrete, and Phoenix Designs.

## Friday, January 27, 2017

- Created a private Github repo named Design 2 for our group to host code and other work.
- Begin working with Adafruit Feather that Jordan ordered and received
- Learning objectives for Adafruit Feather:
  - Write up a simple LED program
  - Use SPI
  - Connect using the built-in Wifi module
- Setup procedure for Adafruit Feather:
  1. Insert the header pins on a breadboard and place the Feather on top of the pins. No soldering required.

2. Went to the following website: <https://learn.adafruit.com/adafruit-feather-m0-wifi-atwinc1500/>.
3. Download and install Arduino IDE v1.6.4+.
4. Go to File → Preferences. Type in [https://adafruit.github.io/arduino-board-index/package\\_adafruit\\_index.json](https://adafruit.github.io/arduino-board-index/package_adafruit_index.json) into the **Additional Boards Manager URLs** box.
5. Navigate to Tools → Boards → Boards Manager. Install **Arduino SAMD Boards** version 1.6.8
6. Install the **Adafruit SAMD** package version 1.0.13.
7. Quit and reopen Arduino IDE. After restart, new boards will be listed on Tools → Boards. Select the appropriate board.
8. Install drivers (Windows only). Link: [https://github.com/adafruit/Adafruit\\_Windows\\_Drivers/releases/download/1.0.0.0/adafruit\\_drivers.exe](https://github.com/adafruit/Adafruit_Windows_Drivers/releases/download/1.0.0.0/adafruit_drivers.exe).

## Friday, February 3, 2017

Revised the functional diagram and bill of materials.

## Monday, February 6, 2017

- Worked on presentation 2.
- Worked on report 2.

## Thursday, February 9, 2017

- Met together with team during class time, even though it was cancelled, to work on programming.
- Josh began designing the casing in SolidWorks.
- Marc was given the task of learning the cloud access aspect of this project.
- Jordan and I will program the sensor.
- Can SPI communicate with parallel devices at the same time like I2C? SPI devices communicate in full duplex mode using a master-slave architecture with a single master. The master device originates the frame for reading and writing. Multiple slave devices are supported through selection with individual slave select (SS) lines.
- Does the wifi chip not allow other communication to happen simultaneously? .

## Friday, February 17, 2017

- Go together with Marc and Jordan. Jordan and I looked how to get the wifi working. Marc took charge of learning how to push stuff to Azure cloud.
- I managed to scan for networks and connect to an access point set up by Marc with the Feather microcontroller.
- We are left with the question of how to connect the Feather to MS Azure and push data to it.

## Friday, February 24, 2017

- Met together with my team at 11am to work on the presentation due on Monday.

## Friday, March 3, 2017

- Began programming the other Feather that we received.
- Follow the wifi tutorial on this [Adafruit](#) page.
- Go to **Sketch** → **Include Library** → **Manage Libraries** and search for **wifi101**. Install the latest version.
- Go to the Adafruit page for the [LSM303DLHC](#) to learn how to wire it up and write code for it.
- Installed the LSM303DLHC through the Library Manager and the Adafruit Sensor library from the git [repo](#).

## Thursday, March 9, 2017

- Googled **arduino mongodb example** for help!

## Tuesday, March 14, 2017

- Visited this [Adafruit](#) page on everything about the Adafruit Feather M0 WiFi - AT-SAMD21 + ATWINC1500 microcontroller.
- Googled *Atsamd21* to learn more about the chip architecture. Clicked on an [Atmel](#) page to learn more. More specifically, the Feather features an ATSAM21G18A ARM Cortex-M0+ processor. The Feather also includes an Atmel ATWINC1500 Wi-Fi network controller.

- The datasheet for the ATSAM21 can be found [here](#) and a programming guide for the ATWINC1500 can be found [here](#).
- Googled what ASF is; the short answer is the following: the Atmel Software Framework (ASF) is a MCU software library providing a large collection of embedded software for Atmel flash MCUs. More info on the ASF can be found [here](#).
- Googled what an mcu is; it stand for microncontroller unit.
- Visited this [Adafruit](#) page to learn more on the pinouts of the Feather.
- Googled what UART is; go to this [Sparkfun](#) page to learn more. Basically, the universal asynchronous receiver/transmitter (UART) is a block of circuitry responsible for implementing serial communication.

**To do:** Look into EagleCAD and Fritzing software.

## Wednesday, March 15, 2017

- Go to this [Adafruit](#) page to learn more about the LSM303DLHC compass and accelerometer.
- Go to this [Adafruit](#) page for the assembly and wiring of the LSM303.
- Downloaded the Adafruit Fritzing Library from this [GitHub](#) repo in order to get access to the LSM303DLHC, Feather, and Adalogger diagrams.
- Connected the accelerometer to the microcontroller. The Fritzing object is under the `fritzing_objects` folder in the Design 2 Github repo.
  - Currently having trouble with detecting the sensor!
  - Fixed the above problem. Use a lower value for the pullup resistors, like 2.2 k $\Omega$ !
- [Datasheet](#) of the LSM303DLHC accelerometer and compass.
- Visit this [Adafruit](#) page to learn more about the calibration of the accelerometer and compass. There is a calibration tool that can be found [here](#).
- Calibration steps in Windows PC:
  - Go to the this [GitHub](#) page for more detailed instructions.
  - Download the this [tarball](#) of the source files.
  - Download [Python 2.7.13](#).
  - **keep it going...**

**To do:**

- Look up the power-saving features of the LSM303DLHC (accelerometer).
- Perform interrupts using accelerometer.
- Write data to the SD card with the Adalogger breakout board.

## Thurssday, March 16, 2017

Had a group talk with Harish, here are the notes.

- Study the example code for the accelerometer.

## Friday, March 17, 2017

- Cloned the Azure Docs [GitHub](#) repo.
- Cloned the Azure IoT Starter Kit [GitHub](#) repo. The Microsoft page on the same subject can be found [here](#).
- More Microsoft IoT repos can be found [here](#).
- The Windows Remote Arduino Experience app can be found [here](#). With it, you can control an Arduino compatible device with a Windows 10 computer. The GitHub repo can be found [here](#).
- The Windows Remote Arduino Samples repo can be found [here](#).

**To do:** Take a look at the last three bullet points.

## Sunday, March 19, 2017

- Looked up what analog-to-digital converter channels meant. It means the number of inputs the ADC can select from.
- Looked up what direct memory access (DMA) channels were. Short for direct memory access, a technique for transferring data from main memory to a device without passing it through the CPU. Computers that have DMA channels can transfer data to and from devices much more quickly than computers without a DMA channel can. To learn more go to the [Wikipedia](#) page.

## Monday, March 20, 2017

- Read more on timer interrupts. I don't understand much of what the says on timer counters.

- Googled timer interrupts on ATSAM21G and stumbled across this [site](#). This guy made his own library to abstract interrupts. I will to download and install them.
  - Downloaded [SAMDTimer](#) library.
  - Also clone the Arduino ZeroTimer library.
  - Could not get the example to work!
- Visited this [Adafruit](#) website with very useful SERCOM info.
- Cloned this [repo](#) that helps you print out the low-level configuration registers for the Arduino Zero and similar boards.

## Tuesday, March 21, 2017

- SERCOM 3 is used for I2C.
- Tried to understand the SAM D21 datasheet.
- Tried to get the yesterday's library to work.
  - Cloned [avdweb SAMDTimer](#) library.
  - Cloned [Arduino ZeroTimer](#) library.
  - Cloned [Adafruit ASFCORE](#) library.
  - The program compiled but I don't know what pin the PWM signal is being sent to. =(
- This [Arduino Forum](#) post tells you what the equivalent cli and sei commands are for SAM D21 boards.
- Cloned [Arduino tools](#) repo.
- Followed this [guide](#) related to timer interrupts and tested all the digital output pins.
- [https://github.com/maxbader/arduino\\_tools/blob/master/libraries/timer\\_zero\\_tc\\_counter/timer\\_zero\\_tc\\_counter.ino](https://github.com/maxbader/arduino_tools/blob/master/libraries/timer_zero_tc_counter/timer_zero_tc_counter.ino)
- <http://www.gammon.com.au/interrupts>

## Tuesday, March 21, 2017

- Run `pip install xbee pyserial`.
- Go this [Google Groups](#) post to learn how to fix the following error: "Unrecognized response packet with id byte 0".format(data[0])) KeyError: 'Unrecognized response packet with id byte \x90'

## To Do List

- Look into EagleCAD and ~~Fritzing~~ software.
- Look up the power-saving features of the LSM303DLHC (accelerometer).
- Perform interrupts using accelerometer.
- Write data to the SD card with the Adalogger breakout board.
- Take a look at the last three bullet points for March 17, 2017.
- Read up on DMA.
- Left off on page 28 of *atmel-42181-sam-d21\_datasheet.pdf*.
- <https://learn.adafruit.com/adafruit-feather-m0-wifi-atwinc1500/adapting-sketches-to-m0>
- <https://forum.arduino.cc/index.php?topic=332275.15>
- <https://gist.github.com/jdneo/43be30d85080b175cb5aed3500d3f989>
- <https://github.com/arduino/ArduinoCore-samd/issues/136>
- <https://docs.microsoft.com/en-us/azure/iot-hub/iot-hub-adafruit-feather-m0-wifi-kit-arduino-get-started>

## Sunday, March 26, 2017

- Read an article by [NI](#) on measuring vibrations with accelerometers.
- The datasheet of the accelerometer can be found [here](#).
- They are basically three components to ground motion: longitudinal or radial (X direction), transversal (Y direction), and vertical (Z direction). **We should write the XYZ directions clearly outside the sensor housing.**
- Read the following pages:
  - <http://en.allexperts.com/q/Construction-Contractors-1093/2008/5/PPV-s-G.htm>
  - [http://vibrationdamage.com/Vibration\\_standards.htm](http://vibrationdamage.com/Vibration_standards.htm)
- Currently working on vibration sensor sketch. **I will postpone the FFT for later.**
- I'm moving on to writing data to the SD card. The real-time clock (RTC) chip running on the Adalogger FeatherWing is the PCF8523.
- **Configure the Adalogger:**



- Install the RTClib by Adafruit library through the library manager in the IDE.
  - Set the right time using the example. FYI, it takes about 7 seconds for compilation and uploading of example.
- Adalogger resources:
    - [RTC datasheet](#)
    - [Adafruit](#) page on using the RTC.

## Sunday, March 26, 2017

- Scrapped the SD library in favor of the SdFat library over at <https://github.com/greiman/SdFat>.

## Tuesday – April 4, 2017

- Watched this [YouTube](#) on how to wire up a speaker with an Arduino.
- Followed this [MS Azure](#) IoT tutorial of the Adafruit Feather M0.

## Friday – April 7, 2017

- The speaker we have is a  $4\Omega$  2W speaker that can handle up to around 700 mA.

## Tuesday – April 11, 2017

- Worked vigorously to get the remote monitoring sketch to work.
- Updated the WiFi101 firmware of the Feather to version WINC1501 Model B (19.5.2)