Security PUFfins
Month Recap Presentation

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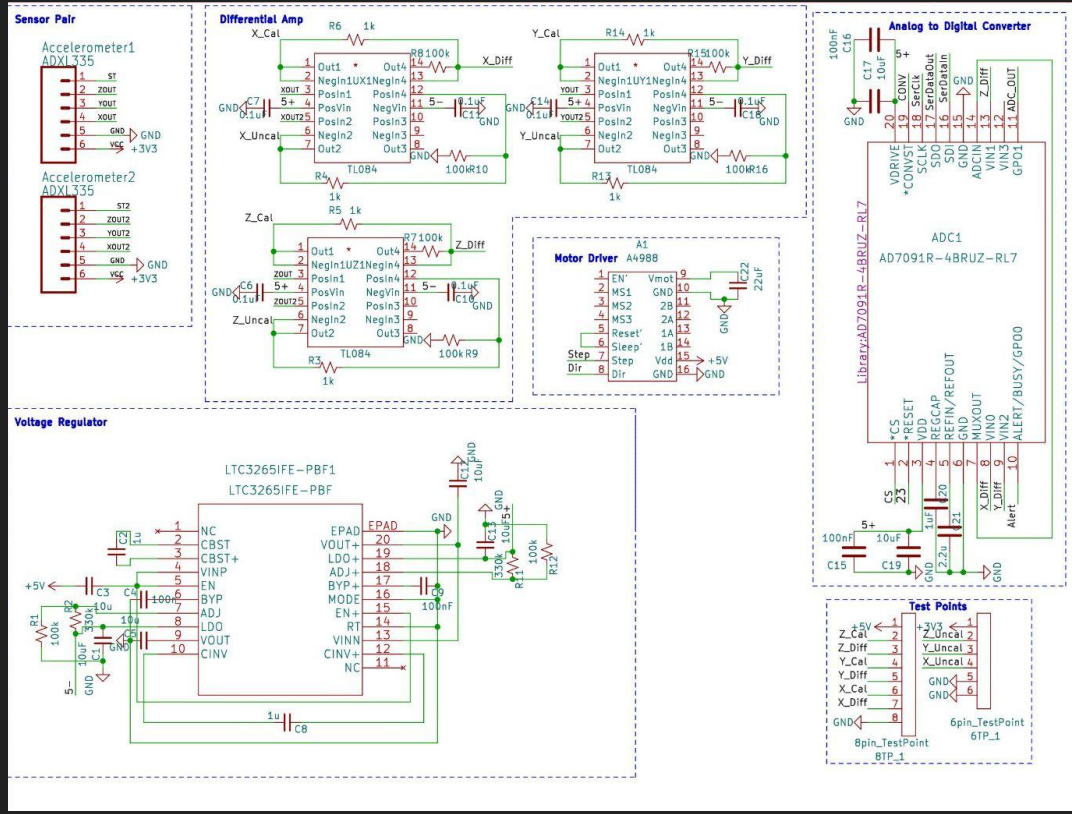
14 October, 2022

PCB

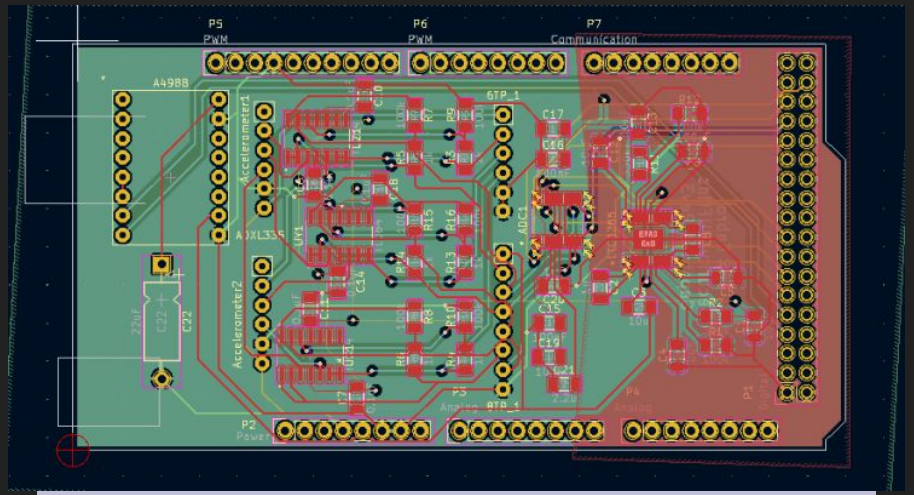
Modifications

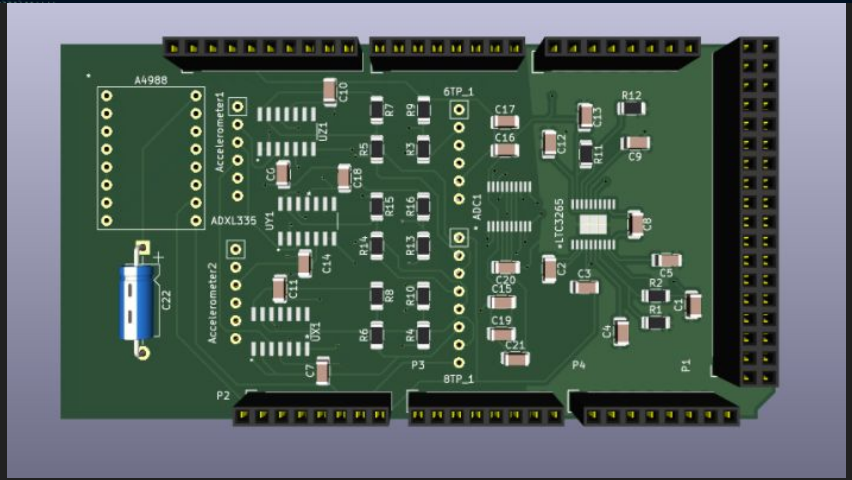
- Added more differential amplifiers
- Added motor driver for testing
- Added voltage regulator to supply a reliable ±5V
- Added test points to easily identify if there is data being read



PCB

- Grounding planes are utilized to isolate signals
- Testing points are available for raw data values to be read
- Capacitors are utilized to stabilize input voltages to devices
- Resistor values were chosen according to datasheet specifications
- PCB will arrive by the end of next week

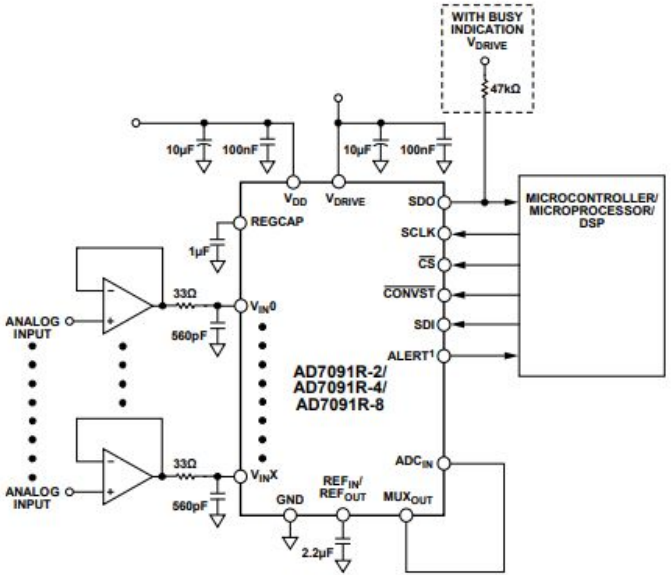


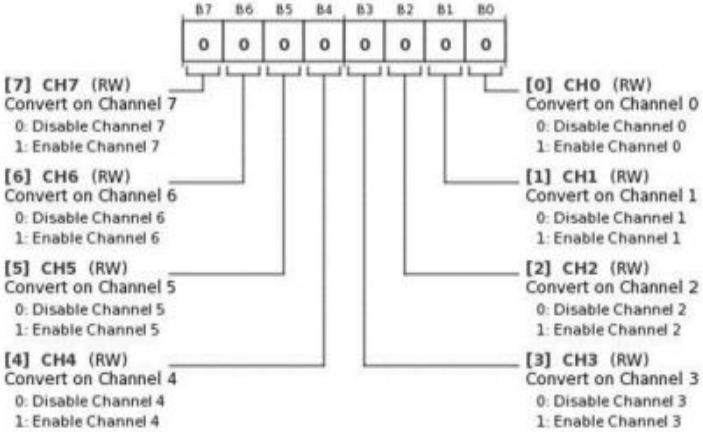


Arduino and ADC

- Pseudo code for reading and measuring values has been developed
  - Configure registers on the ADC
  - Start the conversion
  - Read the digital value
  - Change channel and repeat for other 2 channels

- Potential Issues with timing
  - Arduino clock speed is 62.5 ns
    ADC can lose data after a few 100 ns





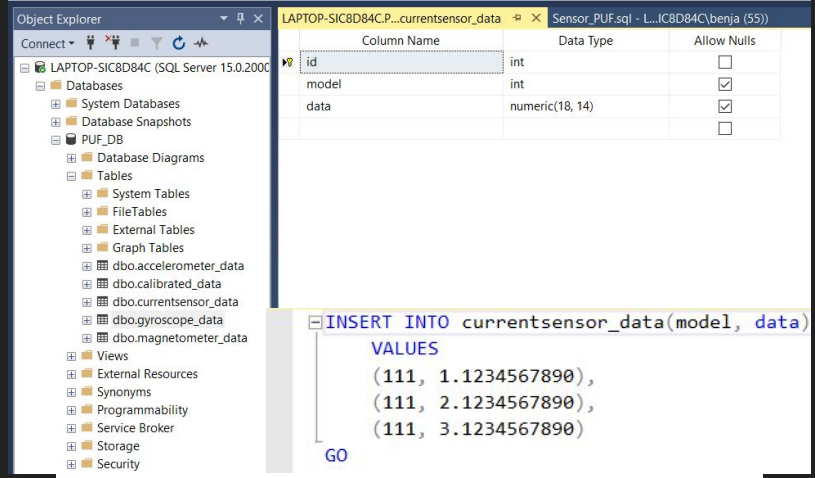
Arduino and ADC

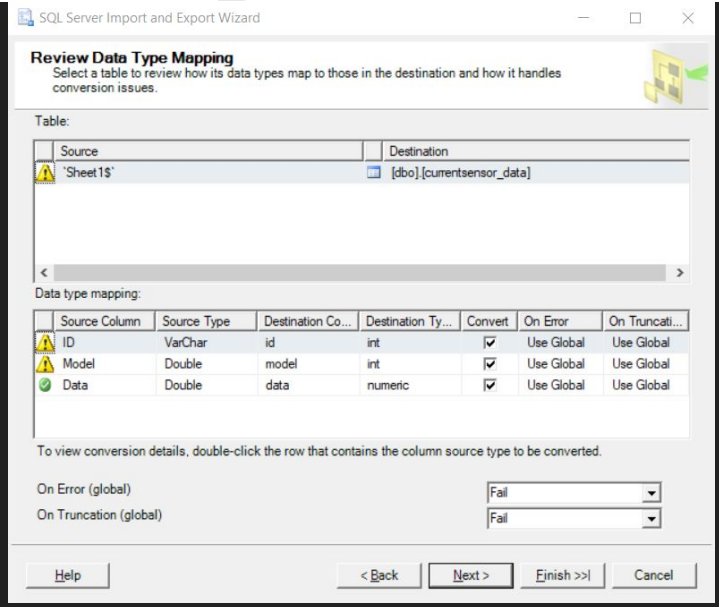
- Stepper Motor code has been completed
- Simple 40 step rotation, with stops to read values from accelerometers
- Currently reads values and develops PUFs, but not very precise

```
void loop()
{
  int steps;
  while (steps < 40) {
    if (steps == 0){
      delay(3000);} //wait 3 seconds. It gives enough time to read again once it comes back to the original position.

  // Set motor direction clockwise.
    digitalWrite(dirPin, HIGH);

  for(int x = 0; x < stepsPerRevolution; x++)
  {
    digitalWrite(stepPin, HIGH);
    delayMicroseconds(2000);
    digitalWrite(stepPin, LOW);
    delayMicroseconds(2000);
  }

  delay(1000); // Wait 1 second
  //reset the values before every read
  float ZDiff = 0.0;
  float YDiff = 0.0;
  float XDiff = 0.0;
  float ZCal = 0.0;
  float YCal = 0.0;
  float XCal = 0.0;

  for(i=0; i< 10; i++) {

  ZDiff = analogRead(A0);
  ZCal = analogRead(A1);
  YDiff = analogRead(A2);
  YCal = analogRead(A3);
  XDiff = analogRead(A4);
  XCal = analogRead(A5);

  //store 10 values for each axis
  ZDiff_values[i]= ZDiff;
  YDiff_values[i]= YDiff;
  XDiff_values[i]= XDiff;
  ZCal_values[i]= ZCal;
  YCal_values[i]= YCal;
  XCal_values[i]= XCal;
   }
```

Database

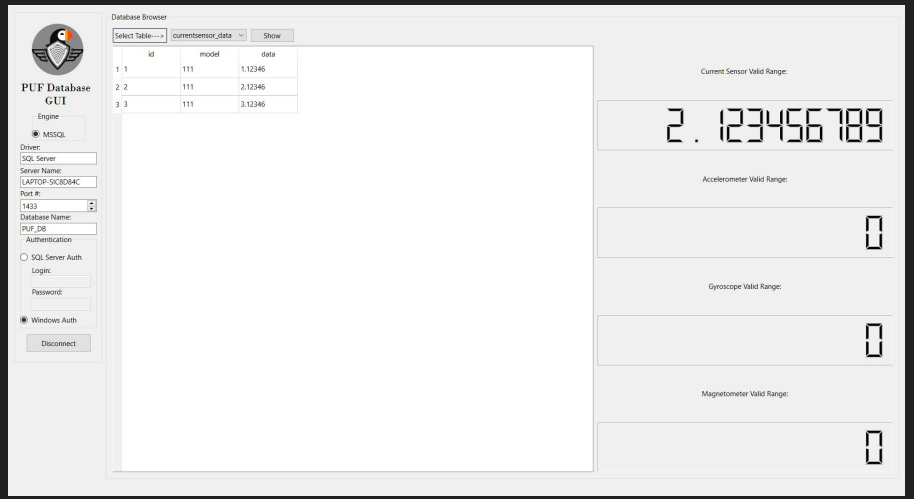
- Schema has been redone a few times to work with Microsoft SQL Server 2019
- Two ways of data insertion
  - One through built in Excel functionality and SQL Server Management Studio (SSMS)
  - Other through python script written that reads file and creates query file
- Working on writing documentation to ensure usability for everyone





Graphic User Interface(GUI)

- Ability to scale window and display as many data points as in table
- Cleaned up code and commented out sections for readability
- Ability to find statistic was added
- Ready for testing of bigger data sets and real data from our board



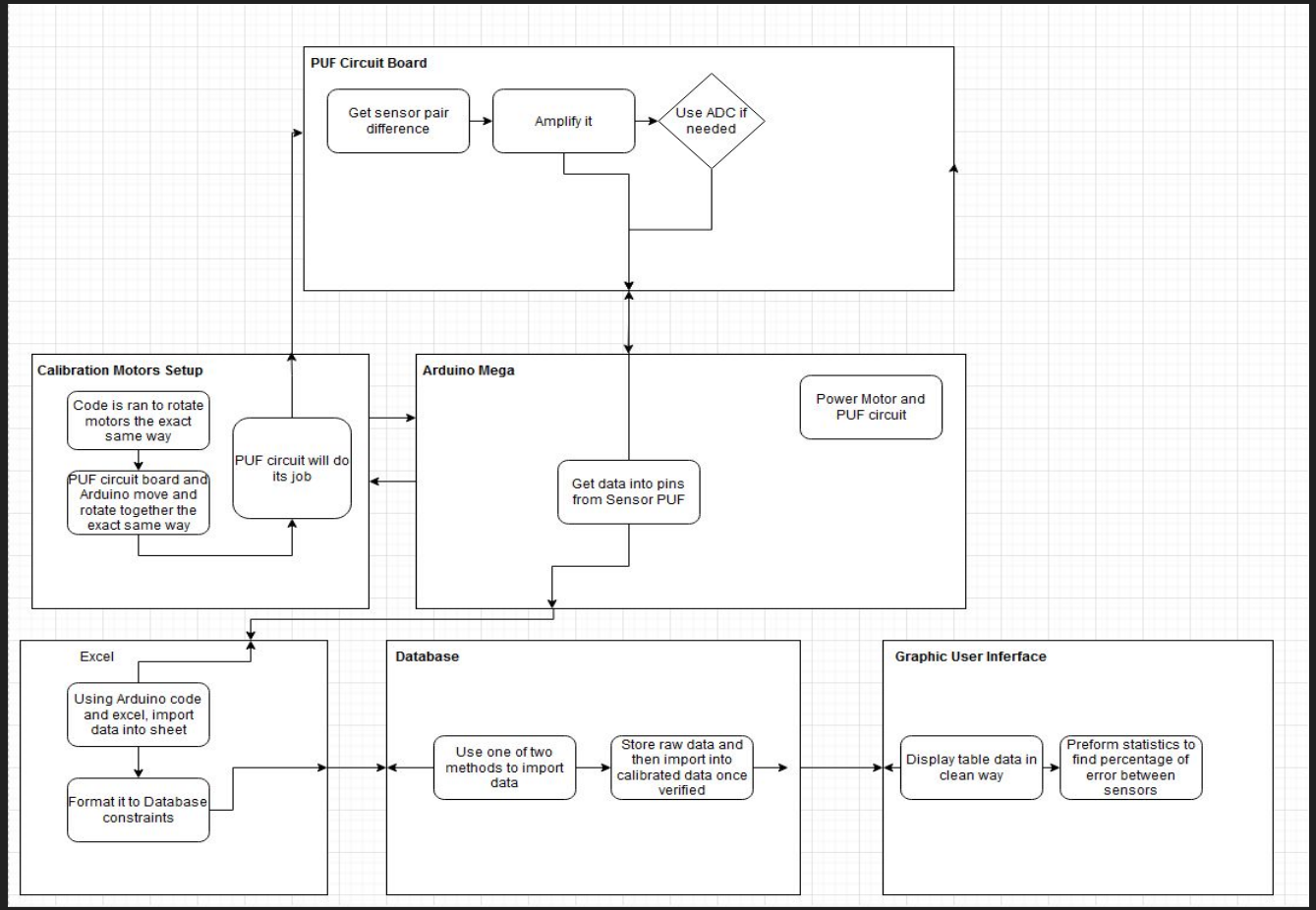
What needs to be Done

- PCB
  - Populate the board
  - Test the board
    - Voltage regulator supplying ±5V
    - Components are working as intended
    - Motor driver is working
  - Make revisions
  - Test Arduino Code with fully populated board

- Integrate all components and test the overall product together

- Database and GUI
  - Transfer compiled GUI and database code files from personal machine to a lab laptop
  - Ensure the system as a whole works with real data from our circuit
  - Fix math function. Make sure math function is accurate with small data set before large sets are used
  - Help others get familiar with how to use software and import data for calibration

Testing Process



Thank you for your time

Any Questions?