List of Materials

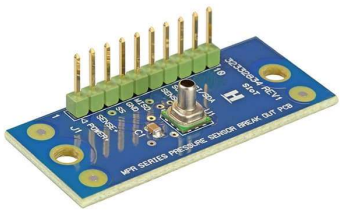
(Note: Links listed for items were what was used for this specific project and can be purchased from many other sources)

- An STM32F4DISCOVERY microcontroller board
  https://www.mouser.com/ProductDetail/STMicroelectronics/STM32F4DISCOVERY?qs=J2qbEwLrpCGdWLY96ibNeQ%3D%3D

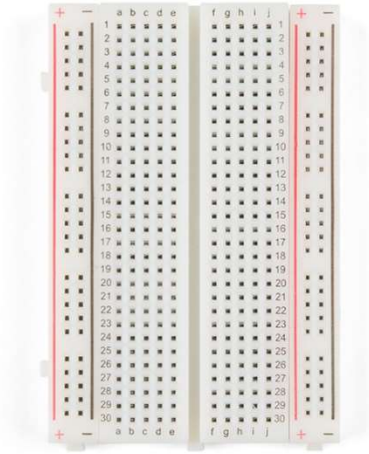
  https://www.digikey.com/en/products/detail/stmicroelectronics/STM32F4DISCOVERY/2711743

- An I2C pressure sensor, in this case a Honeywell MPRLS0300YG00001BB
  https://www.mouser.com/ProductDetail/Honeywell/MPRLS0300YG00001BB?qs=w%2Fv1CP2dgqqBhqVdSnhm%2Fg%3D%3D

  https://www.digikey.com/en/products/detail/honeywell-sensing-and-productivity-solutions/MPRLS0300YG00001BB/9758948?utm_adgroup=Sensors%20%26%20Transducers&utm_source=google&utm_medium=cpc&utm_campaign=Dynamic%20Search_EN_RLSA_Buyers&utm_term=&utm_content=Sensors%20%26%20Transducers&gclid=Cj0KCQjwnueFBhChARIsAPu3YkTS1vh-RXYBTJI_n4JU17DUEDhIAscDWrjZux9a-kTT1cky1_FLwToaAgg4EALw_wcB



- A typical breadboard
  https://www.digikey.com/en/products/detail/pololu-corporation/4000/11586861?utm_adgroup=Solderless%20Breadboards&utm_source=google&utm_medium=cpc&utm_campaign=Shopping_Product_Prototyping%2C%20Fabrication%20Products&utm_term=&utm_content=Solderless%20Breadboards&gclid=Cj0KCQjwnueFBhChARIsAPu3YkRNcGthTtoMdIDHfpqik2a1wn8sn9QRWkIXoVV-tUnmGvZbERbD2pIaAuvrEALw_wcB



- Two 10kΩ resistors
  https://www.mouser.com/ProductDetail/Yageo/CFR-12JB-52-10K?qs=oypCK0zG3276BM%252BiOkzQgg%3D%3D&mgh=1&gclid=Cj0KCQjwnueFBhChARIsAPu3YkRjssKuwJ9tJjDCP1UBUTary8Y1651S3pfQsNycGbpqTxNnt9zG2aAaApQ6EALw_wcB

- Various wire jumpers (F-F, M-F, M-M)
  https://www.digikey.com/en/products/filter/jumper-wire/640?s=N4IgTCBcDaIFYFcC2AHApgJwAQHcCWGaAziALoC%2BQA

- USB Cable A Male to Mini B Male
  https://www.digikey.com/en/products/detail/molex/0887328702/2711792

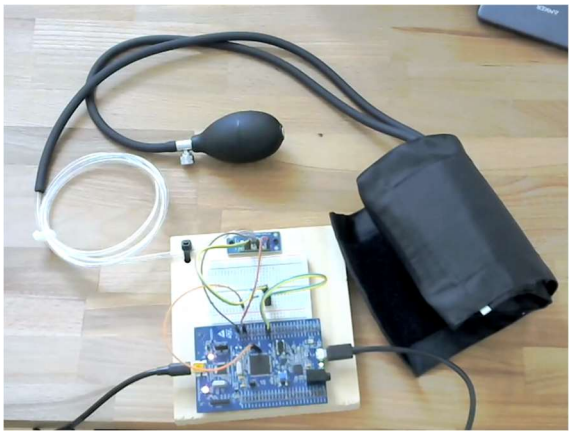
- USB Cable A Male to Micro B Male
  https://www.digikey.com/en/products/detail/cnc-tech/102-1092-BL-00100/3064859

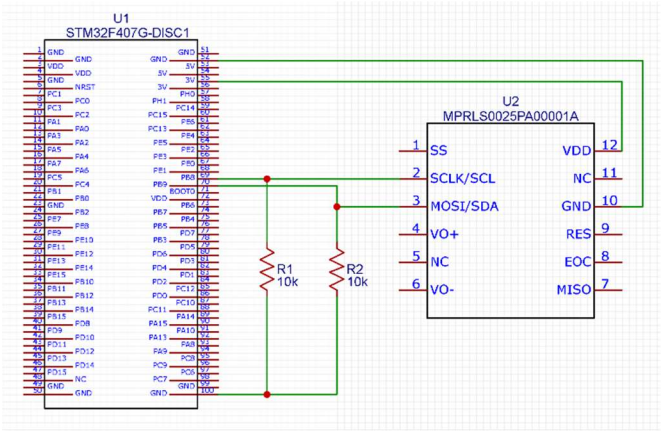
- Manually inflatable blood pressure cuff
  https://www.amazon.com/Dixie-Ems-Aneroid-Sphygmomanometer-Pressure/dp/B00RY3ASUS/ref=sr_1_10?dchild=1&keywords=blood+pressure+cuff&qid=1611595891&sr=8-10

- Transition air tubing
  https://www.amazon.com/gp/product/B06X1C6RGD/ref=ppx_yo_dt_b_asin_title_o00_s00?ie=UTF8&psc=1

Materials Setup

Remove existing pressure gauge from the manual cuff and fit in the transition tube snuggly with no gaps. Connect the STM board, pressure sensor and resistors to the breadboard as shown in the schematic. Connect the Mini USB for power, Micro USB for serial printing and transition tube for pressure reading from the inflation of the cuff as shown in the picture below.





Procedure

First, setup the materials as shown above and have both the C++ code and Jupyter Notebook Python code up and running. Attach the cuff to your nondominant arm and run the C++ code. For this project once the code begins to run, there is roughly 30 seconds of sample gathering before all the data is placed into an array and loops infinitely in this sequence. Within that timeframe, start pumping air and inflate the cuff until the pressure reads about 200mmHg. Once reached, begin deflating the air from the cuff at a rate of 5mmHg. Pumping the cuff up to 200mmHg stops blood circulation to the arm, and once pressure is released blood starts rushing back in and begins a pulse again. This pulse bounces the pressure and is used to calculate the BPM and heart rate of the person. Once the data reading has finished and the array of all 3000 samples has been written out on the terminal, stop the serial printing. Copy the array and paste it into the data frame array in the Jupyter Notebook Python code. Finally, run the Python code and it will display filtered and processed plots of the pressure readings, as well as the BPM and heart rate. All required code can be found in the same GitHub repository.