**Project Idea**

The overarching goal of project heart bleed is to simulate a realistic heart beat for use in anatomical models that undercuts the competition on cost.

**Project Goals**

* Control the pressure of a fluid running through the anatomical model precisely.
* Simulate a realistic building a releasing of pressure
* Simulate different issues with the heart such as different types of irregular heartbeats
* Have the system be easily attached to any water tight anatomical model with only one inlet and one outlet.
* Have the electronics be put in a water-tight container to prevent electrical shorts and damage.

**Design Decisions**

* The pump currently chosen as of 3/9/20 is a 12V, 5A, 1.2GPM, 80PSI diaphragm pump from amazon. This pump does ~4.5 Liters per minute which is too low to realistically simulate a human heart. Instead a new pump is on order that is 12V, 8.5A, 2.1GPM, 60PSI diaphragm pump. This pump will be able to provide both the fluid flow and pressure requirements needed.
* Two 12V solenoid valves are used on the inlet and outlet of the anatomical model. They can be turned on and off to simulate the realistic build and release of pressure.
* A 60PSI pressure sensor is used on a T junction between the anatomical model and solenoid valve. It’s used to monitor the model’s pressure and adjust pum power accordingly to get realistic blood pressure. A 10 PSI sensor would be preferred but I haven’t been able to find one that actually works.
* A 0-30V 11A DC motor controller is used to drive the water pump. I had originally been using a solid state relay but it wasn’t able to turn on and off fast enough to create the precise control of the pump that’s necessary.
* An arduino is used as the controller board for this project because it runs on 5V logic. Both the solid state relays and motor controller require a 5V input to be actuated. A STM32 board with transistors that allow it to step up its output logic to 5V would be preferred over an arduino for its higher precision ADC and PWM signal production. It’s also a much faster processor.

**Need to Do**

- The PID loop needs to oscilate between two target pressures depending on which valves are open. The first is the closed valve pressure which will be the higher pressure. The second is the open valve pressure which will be lower. This will simulate a realistic blood pressure reading like 120 over 60.

- Need a second pressure transducer before the forward valve to measure the built up pressure in the input tube. This will probably be a more useful reading than the current pressure sensor placement after the forward valve.

- Add a GUI for easier interfacing between computer and arduino

- Switch from soft tubing to hard tubing for final version.

- Add a flow regulator

- Add a water heater

- Get a wind kestle with an airtight piston seperating the air fro the water

- Use a single non-transparent box for the final version