The software for the project will be written in C++ and will be mainly controlled by the ATMEL microcontroller chip on the Arduino Uno platform. The mechanical systems such as the stirring rods, pumps, air pumps, temperature sensor, and heating elements will be assembled and tested by me. Below I list the major requirements I will need for the construction of this system.

**Item Requirements:**

3x L298N Motor Driver Units

1x SMAKN 5v Active Low 2 Channel Relay

2x Cartridge Heaters

1x DS18B20 temperature Sensor

4x TITG02BDC12B Liquid Pumps

2x DC Motors

1x Arduino Uno

**Non-Electrical Item Requirements:**

Plastic Tubing (3”/16”)

3x Clear Plastic Reservoirs

* If cannot find clear plastic then:

Borosilicate Glass for Viewing Reservoirs

2 Part Epoxy for Glass Attachment to Reservoirs

Rubber Stirring Paddles

Switching valve

Chemicals Needed for Testing

**Price Estimate for Electronics:**

3x L298N Motor Driver Units --------------------$6.00

1x SMAKN 5v Active Low 2 Channel Relay ---$6.00

2x Cartridge Heaters -----------------------------$46.00

1x DS18B20 temperature Sensor -------------$10.00

4x TITG02BDC12B Liquid Pumps ------------$100.00

2x DC Motors ------------------------------------- $4.00

1x Arduino Uno ------------------------------------$25.00

Various Circuitry Elements ----------------------$20.00

*Total Price Estimated = $217.00*

Disclaimer: Price is likely to increase of estimated cost.

**Power Needed:**

3x L298N Motor Driver Units --- 15W

1x SMAKN 5v Active Low 2 Channel Relay ---160W

1x Arduino Uni --- < 1W

*Total Power Needed = 156 W*

Power calculations are not absolute and are estimated at the minimum. Over-estimating the power needed by 10% initially is suggested as power consumption cannot be calculated until the circuit has been assembled.

*Note: Although I am able to create a power distribution system for the electronics listed above, it is recommended I have the assistance of an Electrical Engineering Student. However, this is not required.*