Abstract:

The main criteria of the project was to build a fluorescent bioreactor which consisted of three main components, the cell detector, protein injector, and a pump. The utilization of various prototyping tools was used such as CAD, Arduino microcontroller programming and 3d printing, was necessary for the complete build.

Introduction:

A complete bioreactor was required to detect cell growth and hence estimate a cell count. This could be done through the detection of a fluorescent protein produced by the GM bacteria culture used. This would start after a chemical inducer was somehow induced into the system.

Cell detection could be carried out through the means of measuring light intensity passed through the fluorescent sample. The light could be transmitted by an LED and detected by a photo diode or LDR. A cell counter had to be designed to allow light to pass from the led to the photodiode through the culture without inducing any external light effects.

To correlate the light intensity to an actual reading outputting the cell count, an Arduino code had to be written which could decipher the information from the voltage output of the photodiode.

An important aspect of the design was the consideration of maintaining a constant flow throughout the cycle to prevent stagnation, as that would result in the mechanism to seize.
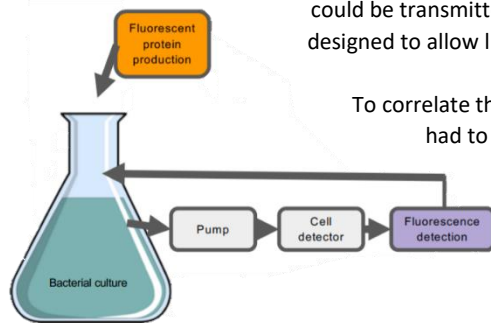
Cell Detector
-Shell made of black waterproof resin (3D printed)
-slots for inflow and outflow pipes
-clear acrylic covers
-photodiode and LED inserted into the covers also 3D printed.

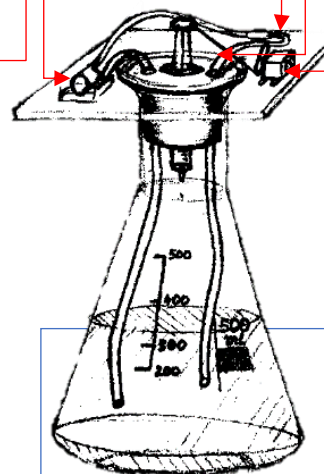Final CAD Design
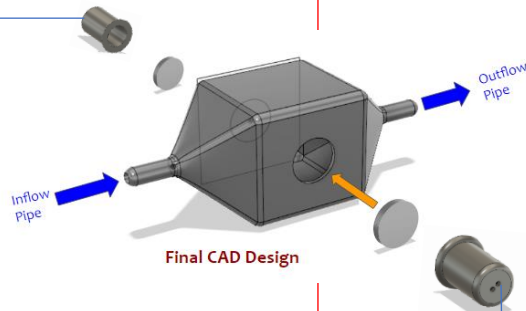
Peristaltic Pump
-maintains constant flow

Syringe
-contains chemical inducer

Servo Motor
-rotates from Arduino code
-connected to syringe by rigid metal wire
-syringe pushed by crank mechanism

Arduino Code

RESULTS
-Graph plotted shows a trend of decreasing light intensity measured by photo diode. Corresponds to increasing cloudiness of solution indicating production of photoluminescent proteins.