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| **Arduino Controlled Micro-Pump**  **Design Controls Worksheet** | **ID: DCW-1** |

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**Authors: Odalis Castro, Meaza Feyso, Serena Kishek, Cassie Salem**

**Improvement on Existing Design**

The new and improved design encompasses features that make it easier to assemble and has a UI-friendly program. The new design includes a well-designed PCB for soldering or assembling all of the small electrical components, ultimately eliminating the use of the breadboard.

**User Needs**

*User Needs Matrix*

|  |  |
| --- | --- |
| ID | Description |
| UN-1 | Improved UX / UI to allow for operator control. |
| UN-2 | Improve Solidworks files to include assembly, hardware, configurations, and drawings. |
| UN-3 | Eliminate warping of the printhead resulting from motor temperature when located inside an incubator. |
| UN-4 | A method to stop or detach pump heads individually when part of a multi-pump design. |
| UN-5 | Eliminate breadboard or prototype parts in the circuit. |

**Design Inputs**

*Requirements Matrix*

|  |  |
| --- | --- |
| ID | Requirement |
| R-1 | The User Interface (UI) shall allow the user to set a pump flow rate. |
| R-2 | The design shall be scalable and have files structured for optimal modularity. |
| R-3 | There shall be a mechanism to prevent overheating. |
| R-4 | There shall be individual control of pumps in a multi-pump system. |
| R-5 | The circuit shall not include a breadboard. |

**Design Outputs**

*Design Outputs Matrix*

|  |  |
| --- | --- |
| ID | Requirement |
| DO-1 | The UI shall take input for the tubing's inner diameter to produce the proper flow rate. |
| DO-2 | There shall be an organized system of SolidWorks files that define all of the parts and have a complete assembly of the finished pump with proper references. |
| DO-3 | There shall be some sort of Peltier cooling system that fits onto a unit to keep them cool in the incubators. |
| DO-4 | The UI shall have additional functionality to control the pumps either individually or as a group. |
| DO-5 | The PCB shall allow the assembling of electrical components without a breadboard. |

**Design Verification**

*Verification Matrix –* Write at least 5 Verification tests that

|  |  |  |
| --- | --- | --- |
| Requirement ID | Description | Pass/Fail |
| R-1 | The UI is adjustable and takes proper inputs for the desired flow rate | Pass |
| R-2 | The PCB prototyping protocol is well-written and has thorough instructions for an individual wishing to build one. | Pass |
| R-3 | The device has a working PCB | Pass |
| R-4 | The circuit shall function the same when it moves to the actual user interface | Pass |
| R-5 | The device continues to run after detachment of individual pumps | Pass |

**Design Validation**

*Validation Matrix*

|  |  |  |
| --- | --- | --- |
| User Need ID | Description | Pass/Fail |
| UN-1 | SolidWorks file is improved. | Pass |
| UN-2 | Device assembly is facilitated | Pass |
| UN-3 | No warping of the printhead when it is located in the incubator | Pass |
| UN-4 | Multiple pump-design is applied to avoid individual pump heads | Pass |
| UN-5 | Breadboard is removed | Pass |