

Automated Dye Dispensing System for Coloring Fishing Line



Kaitlyn Knight¹ Derek Oakley² Ryan Somerville²



Colorado Mesa University¹ University of Colorado Boulder²

Background



Design Requirements

- Prototype system
 1. Implement 5 liquid components into system
 2. All aspects must be scalable from 1 gallon to 55-gallon barrels
 3. Repeatable color dispensing in 0.1 pounds of input
 4. Must meet Class I Division II safety requirements
 5. Must be chemically resistant to dyes and acetone

Evaluation

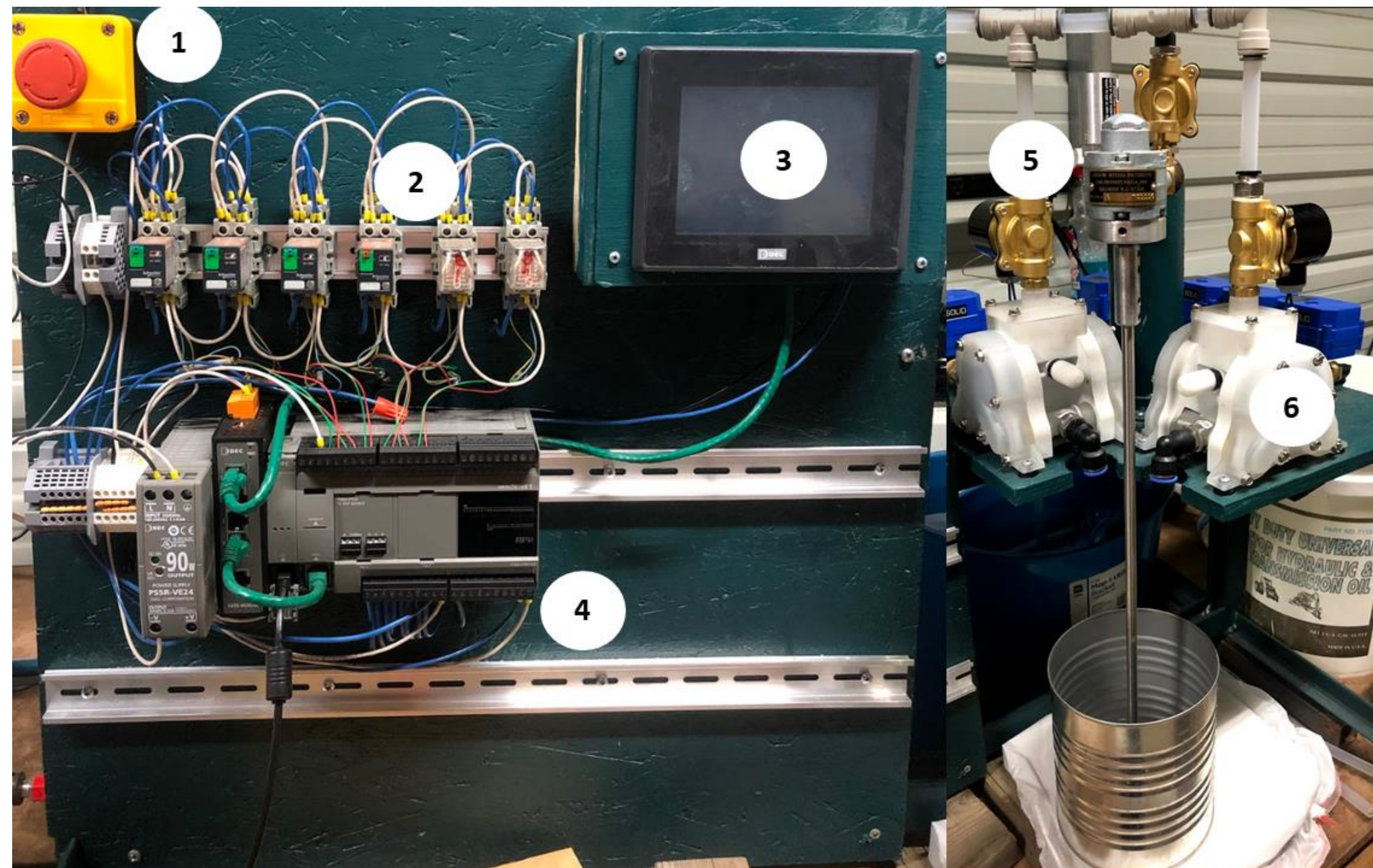
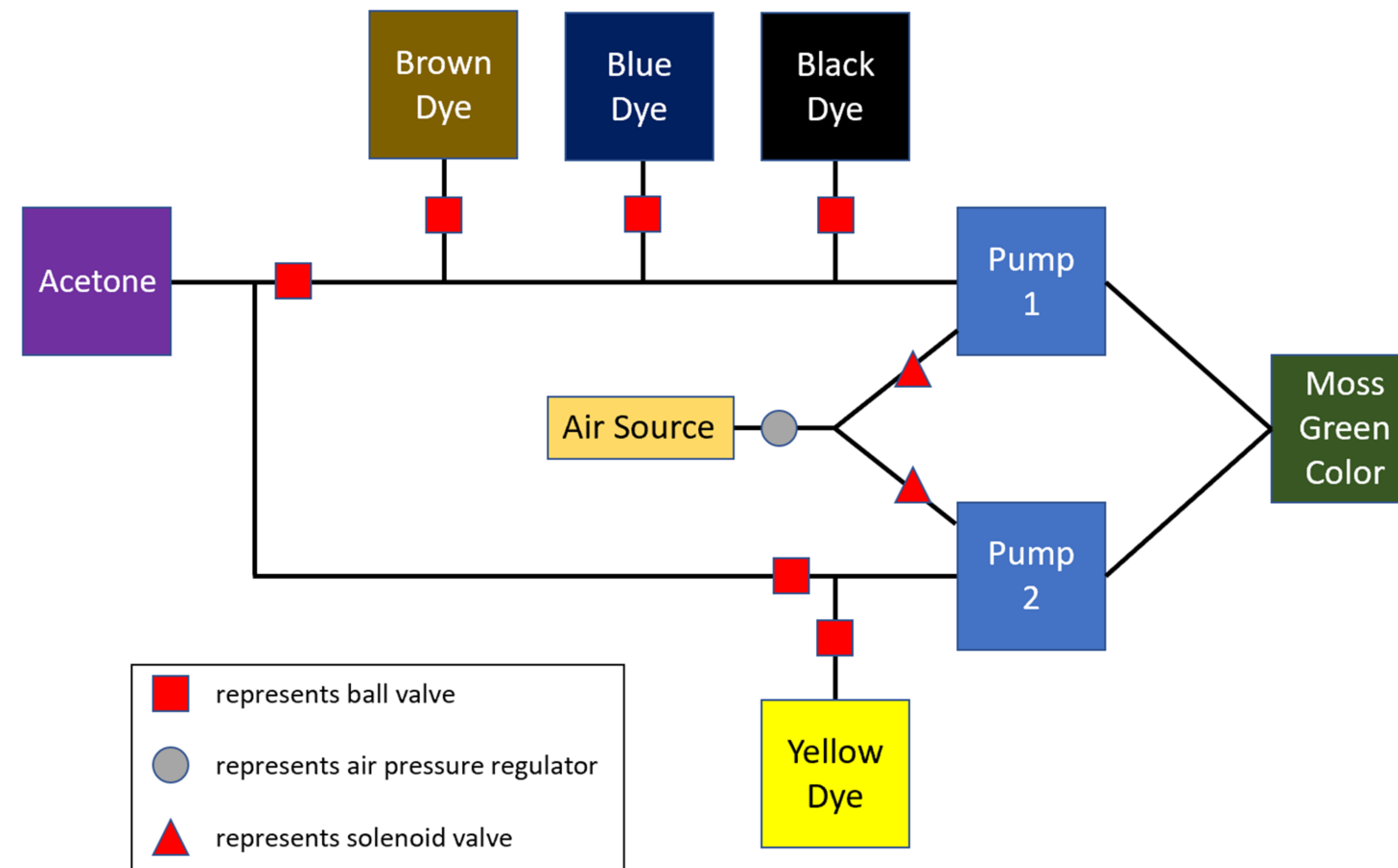
- Test Plans
 1. Record weight of each color dispensed and final mixture for 10 cycles
 2. Calculate flow variability and size ratios between prototype and large-scale components
 3. Measure the output of the power supply to ensure it is at or below 24VDC
 4. Ensure components chemical resistance by submerging in acetone and dye

Results

	Criteria	Met
1	Scalability	Yes
2	Repeatability	Unknown
3	Class I Division II	Yes
4	Chemical Compatibility	Unknown

Conclusions / Next Steps

- Complete testing
- Perform statistical analysis on repeatability results
- Improve component selection
- Improve project layout
- Gain communication between components



- 1. E-stop button
- 2. Relays
- 3. HMI
- 4. PLC
- 5. Mixer
- 6. Diaphragm Pump
- 7. Ball Valve
- 8. Solenoid Valve

Sponsored by:

Dana Hansen
Brett Hensley



SCAN ME

For more information, please scan the barcode to the left

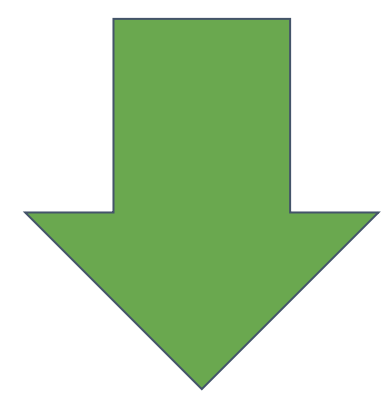
Acknowledgements: Phil Huemmler, Tom Kramp, Joe Neiman, Chris Penick, Greg Short, Shawn Whitney

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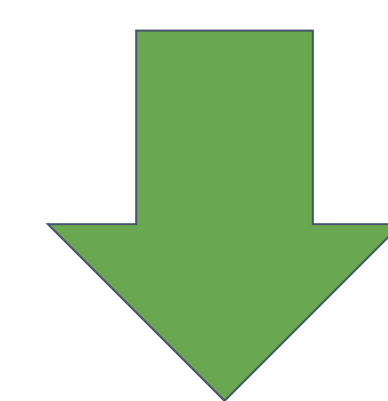
Design Evaluation

Main Objective: Repeatability

Record component and total weights for each test.



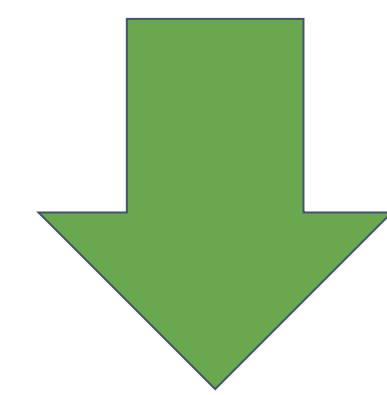
Ensure each component weight is within 0.1 lb of specified.



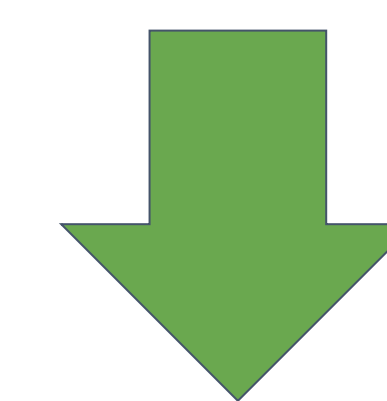
Ensure the total weight is within 0.5 pounds of recipe.

Main Objective: Scalability

Ensure current setup has ability to move dye



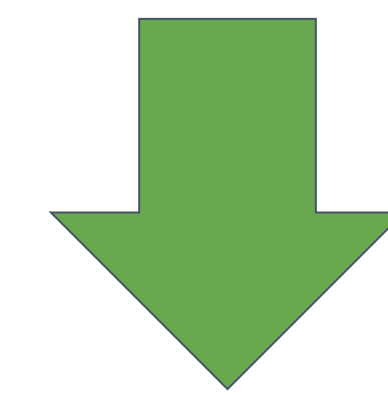
Modify pump flow rate so that dye is dispensed at a constant rate



Ensure each component weight is within requirements for large scale

Main Objective: Class I Division II

Measure power source to ensure 24VDC or less



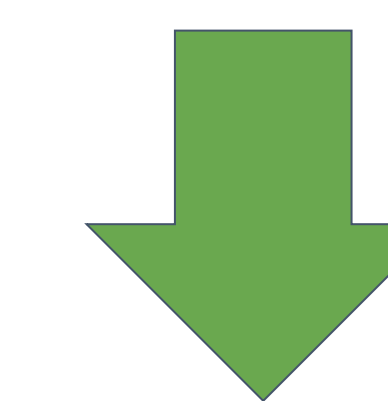
Move higher voltage parts into an enclosure for operation in C1D2 space

Main Objective: Chemical Compatibility

Run system using acetone and dye multiple times



Use rinse cycle to clean out dye



Allow to sit so that all components are exposed to chemicals

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Results

	Criteria	Met
1	Utilize 5 Components	Yes
2	Scalability	Unknown
3	Repeatability	Unknown
4	Class I Division II	Yes
5	Chemical Compatibility	Unknown

Recipe Weights (lb)							
Test	Black Dye	Brown Dye	Blue Dye	Yellow Dye	Acetone	Total	
1	1	1.22	1.16	1.1	1.38	5.86	
2	1.24	1.08	1.24	1.1	1.64	6.3	
3	1.16	1.22	1.32	1.1	1.42	6.22	
4	0.96	1.04	1.28	1.02	1.42	5.72	
5	0.98	1.1	1.28	1.02	1.48	5.86	
6	1.24	1.3	1.14	1.1	1.66	6.44	
7	1.18	1.34	1.12	1.12	1.68	6.44	
8	1.14	1.38	1.14	1.14	1.94	6.74	
9	1.36	1.4	1.14	1.18	1.68	6.76	
10	1.26	1.36	1.08	1.14	1.54	6.38	
Range	0.4	0.24	0.18	0.16	0.56	1.54	

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Conclusions

- The system meets the pass/fail requirements of the project.
- Repeatability is not achieved for the prototype.
- Full scale implementation may be within tolerance.

Next Steps

- Complete testing (including statistical analysis of results).
- Reconfigure the system to obtain more precise and accurate results.
 - Select other pumping technology if possible.
- Perform necessary modifications to gain communication with the scale to improve operation.
- Solve splashing issue.

