

Project Budget & Support Theoreticals

Budget A (no money restrictions + prebuilt components)

Direct Costs (A): \$1188.34

- BLDC Assembly (\$148, Samsung, free shipping) – prewrapped coil motor that can be used to spin the ferrofluid
- Ferrofluid (1000ml, \$220 each bottle, Educational Innovations Inc, free shipping) – multiple bottles may be needed in case of spillage or multiple trials (also the BLDC assembly is large and would require more fluid), 3 bottles for maximum waste projection
- Filament (PLA or ABS, 1kg, \$14.50, DIYInks, free shipping) – Need filament to construct the structure that will contain the ferrofluid, 2 rolls for design changes or printing difficulties or failures, No structure was found made out of nonmetallic material, 3D printing the structures should take less time than the shipping time and overall better approach than searching for a structure
- AutoCad software (free, AutoDesk, online) – Needed for creating the design of the structures
- CircuitMaker (free, CircuitMaker, online) – Needed for creating the circuit design
- Arduino Uno (\$26.50, Amazon, free shipping) – Needed for circuit, 3 Arduinos may be needed in case they might get damaged, the Arduino will implement the needed output signal to my voltage converters that will power the coils
- Lithium Ion battery (12V 420 CCA, \$187.90, Amazon (MMG), free shipping) – needed to power the inductors with maximum amps
- Voltage Converters (12V to 35V output, \$13.99, DROK, free shipping) – needed to amplify voltage signals to run the inductors, 6 converters may be needed for each coil winding

Budget B (maximum money savings + raw material utilizing labor)

Direct Costs (B): \$499.74

- Enameled copper wire (20-30 AWG, (2) *314 ft., \$12.72, TEMCo, free shipping)
- AutoCad software (free, AutoDesk, online)
- Ferrofluid (1000ml, \$220 each bottle, Educational Innovations Inc, free shipping) – multiple bottles may be needed in case of spillage or multiple trials, 2 bottles with cautionary use for least waste
- Filament (PLA or ABS, 1kg, \$14.50, DIYInks, free shipping) – Need filament to construct the structure that will contain the ferrofluid 1 roll should be enough if designs are revised and checked thoroughly before attempting prints
- Darlington Transistor (\$0.75, Texas Instruments, free shipping) – needed to power the inductors or coil windings, 1 is sufficient for small application (minimum order of 10 for free shipping) might be worth in case some of the IC's get damaged)
- CMOS Counters/Divider (\$0.45, Texas Instruments, free shipping) – needed to convert clock signal (frequency) into different phase shift outputs, 1 is sufficient (minimum order of 10 for free shipping) might be worth in case some of the IC's get damaged)

Mick Zaatra

Item 9

- IC Timers (\$0.78, Texas Instruments, free shipping) – needed to produce the clock or frequency input to the CMOS (minimum order of 10 for free shipping) might be worth in case some of the IC's get damaged)

Support Costs:

- 3D printer (Available at home or school)
- Soldering Equipment (Available at home or school)
- Circuit components (Available at home or school)
- Circuit analysis instruments (Available at home or school)
- 2V-9V batteries (Available at home or school)

Opportunity Costs:

- Building the circuit using smaller voltage regulators with small batteries instead of Arduinos is cheaper (\$252.04 cheaper), (most likely my planned budget will only include one bottle of fluid), also constructing the driver by hand-spinning copper wires into inductors and printing the frame for the motor is also cheaper than buying the motor prebuilt. All in all, savings of \$688.60 by dissecting all components into barebone materials and constructing them by hand, but now labor is more intensive and will surely take longer to implement, revisions and troubleshooting is surely to occur and will likely take the most time.

Projected/Planned Budget Route

*(Some parts might be swapped/changed as project progresses)

Direct Costs (Planned Budget): \$279.74

- Enameled copper wire (20-30 AWG, (2) *314 ft., \$12.72, TEMCo, free shipping)
- AutoCad software (free, AutoDesk, online)
- Ferrofluid (1000ml, \$220 each bottle, Educational Innovations Inc, free shipping) – Realistically, 1 Bottle will have to do due to price and fluid amount should be enough
- Filament (PLA or ABS, 1kg, \$14.50, DIYInks, free shipping) – Need filament to construct the structure that will contain the ferrofluid 1 roll should be enough if designs are revised and checked thoroughly before attempting prints
- Darlington Transistor (\$0.75, Texas Instruments, free shipping) – needed to power the inductors or coil windings, 1 is sufficient for small application (minimum order of 10 for free shipping) might be worth in case some of the IC's get damaged)
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