Microscope Manipulator for Zebra Fish Analyses
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Function : Design a digitally controlled microscope manipulator (table) for accurate scanning/re-positioning of Petri dish samples containing zebra fish under a dissecting microscope. The project will also include, if time permits, image analyses to create a composite picture of the entire Petri dish. The manipulator would first require systematic scanning of the entire Petri dish (scanning resolution depends on the required microscope magnification), analyses of the acquired images using image fusion, and re-positioning of the Petri dish, by digital means, to locations determined after the image analyses.

Client requirements : Our client requirements are as follows:

- Stepper and imaging software must be interactive
- The software must be operable for a trained professional
- The stage must be less than 6cm tall
- The stage must hold a Petri dish that is 6cm in diameter
- The steppers must be have an accuracy of at least 100 microns
- The entire unit must be less than commercial value
- The unit must have a PC interface with USB or Serial connection
- The program should be created on either Matlab or another reputable programming package
- The microscope camera must be ~1.3 Mega pixels

Design requirements :

1. **Physical and Operational Characteristics**

   a. *Performance requirements:* The device should be able to withstand normal use indefinitely, while at the same time still remaining precise and accurate. The software must be user friendly. There is not a specific time limit for how long the process will take, but shorter will be better. The stage must be mobile in the x and y axes, with the z axis as an added goal.

b. *Safety:* The power cord must be grounded. Operators also need to be aware of the potential harm of the radiation from the micro-collimator.

c. *Accuracy and Reliability:* The steppers must have an accuracy of at least 100 microns. The image fusion must be automatic and accurate. The entire system should sync together and run automatically. Zebrafish location and orientation must be determined by a digital filter and grid system.

d. *Life in Service:* The entire unit must function indefinitely.

e. *Operating Environment:* Our device will be exposed to normal lab conditions. We will assume the lab to be quiet and peaceful, with no noise affecting the image analysis.

f. *Ergonomics:* We will include any manuals and instructions with the software, but it needs to be relatively easy to use. The operator will simply need to input a command or coordinates and press go.

g. *Size:* The table must not be taller than 5 cm. It must have a large enough light source and surface to accommodate a Petri dish that is as large as 6cm in diameter. There are no size restrictions on the overall size of the microscope system.

h. *Weight:* The weight will not be factored into our design, as it will be limited by the size of the unit, but must still be within reasonable standards.

i. *Materials:* The table will be made of some composite material that is strong and durable.

2. Product Characteristics

a. *Quantity:* Only one unit will be necessary to meet the requirements of a successful design.

b. *Target Product Cost:* The total cost must be less than a market price of $6,000 – 12,000. Our current quoted cost is as follows :

i. *Steppers* - **$25 – 200**
ii. *Camera (w/software)* - **$400 – 1500**
iii. *Stage* – **$3000 – 6000**
iv. *Driver* – **($50 – 300) x 2**
v. *Labor* ~ **$300 – 500**

3. Miscellaneous

a. *Competition:* There are several competitive brands on the market. Our goal is to make a product more cost effective and as efficient as a commercial product.