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Positioning/alignment device for ophthalmic scanning laser systems

Function

The device must be designed to position the 80lb. Cirrus-OCT ocular imaging device currently in use by the Ophthalmology clinic. While the clinic's current positioning system is capable of crudely positioning the OCT camera in the vicinity of the eye, it lacks fine positioning capability. This device we design must be able to refine the position of the OCT device by distances as small as a few millimeters. It must be able to position the camera in the horizontal plane, tilt the camera, and rotate the camera. The user interface for such fine movements must be simple, accurate, and repeatable, as is the joystick positioning device used for a different model of OCT camera currently in use at the clinic.

Client requirements:

- Height, angle, and tilt, and rotation adjustments
- Fine tuning of positioning
- OCT must be 2 inches away from the eye
- Preference for a joystick to adjust the instrument
- Must be used for both human and animal optical imaging
- Must be a device for supporting the OCT and not for positioning the head, for safety concerns

1. Physical and Operational Characteristics

a. *Performance requirements*: The device should be able to position the OCT at the correct height, angle, rotation, and tilt for proper optical imaging. The device will be used every time that the OCT is used, because the proper alignment will be different each time. It must support the weight of OCT and be able to lock into place once proper alignment is achieved.

b. *Safety*: The main safety concern is that the device must be able to support the weight of the OCT. The inability of the device to do this could cause injuries due to the falling or breaking of equipment.

c. *Accuracy and Reliability*: The device must be extremely accurate in order to be able to precisely align with the location of the eye that is to be imaged. This means that the device must be able to make very fine movements in height, angle, rotation, and tilt. Repeatability of positioning is desirable for when patients are imaged more than once.

d. *Life in Service*: The device will be used multiple times per day. It does not need to be designed to be mobile, because it will stay with the OCT at all times.

e. *Shelf Life*: The Ophthalmology Clinic uses the Cirrus-OCT on a daily basis. Because of this and its 80 lb. size, the Cirrus unit remains on the table in the clinic's imaging room at all times. Because transporting the Cirrus unit off the table is difficult due to its bulk, our positioning unit will presumably remain beneath the Cirrus unit at all times, both during periods of use and non-use. Therefore, its shelf environment is the same as its operating environment and it must be designed to withstand any harsh conditions of this persistent environment.

f. *Operating Environment*: The imaging room does not have any water sources. It is kept at a room temperature and humidity typical of most clinical environments. Patients and doctors do enter and exit the room frequently, and doctors will presumably be using the unit multiple times per day, so the unit will most likely be exposed to a significant number of low intensity stresses on a daily bases, and more intense stresses on a less frequent basis.

g. *Ergonomics*: The device's motion control interface must be user friendly and not cause stress to a frequent user. Both patients and doctors will be in close proximity to the device's moving parts. Therefore, any moving parts must be contained so as to avoid pinching or crushing of patients' and doctors' extremities should inadvertent contact occur.

h. *Size*: There is no strict restriction on weight as the unit will be stationary. In terms of spatial dimensions, it must either have a footprint small enough to fit on the imaging room's camera table or it must be a stand-alone unit small enough to fit into the 8' x 8' imaging room.

i. *Weight*: The weight of the device must be light enough to allow rotation and movement in the desired directions. If the device is too heavy, the operator will have to apply a great amount of force to move the position, eliminating any chance for fine adjustments.

j. *Materials*: The materials used to construct the positioned will have to be strong enough to hold 80 lbs. They should be capable withstanding year of use. They should be of a weight that fits with the requirements presented in the weight category.

k. *Aesthetics*: The design of the device should allow for easy use by any operator. All adjustment knobs or joysticks should be clearly labeled with their function. If electronics are used, all wires should be housed in a casing so they cannot be seen or accidently pulled. The color should be matched to the room so that it does not draw the attention of the patient.

2. Production Characteristics:

a. Quantity: there are two units. For the Cirrus unit, we need to be able to incorporate rotational movement. For the Stratus unit, we need to design a system capable of lateral, rotational and vertical movement.

b. Target Product Cost: we need to be as economical about materials as possible.

3. Miscellaneous

a. Standards and Specifications: none

b. Customer: would prefer to control any movements through a joystick.

c. Patient-related concerns: for animal studies, correct positioning of the chin platform is necessary to avoid injury to the animal

d. Competition: Although platform positioners and machine arms exist for moving heavy objects, they have not yet been applied for this purpose. The cost of such devices is extremely prohibitive, as well, based on a number of factors (precision, material used to build the structure, etc.)