Motion Stage for Optical Coherence Tomography

D. Frost, W. Stanford
Advisor: T. Yen
Client: C. Rasmussen
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ABSTRACT

We created a device using a fine adjust cross table capable of fine resolution movement in two directions (X and Y) along with a vertical table capable of motion in the Z-direction along with a spindle mechanism for rotational movement to aid in the fine adjustment of a optical coherence tomography camera.

PROBLEM STATEMENT

Develop a device capable of moving an 80 lbs OCT camera. The device must have adjustable motion in three directions (X,Y, and Z) and be able to rotate. The movement must have fine adjustment capabilities and a user friendly interface such as a joystick or spin wheel.

BACKGROUND

Optical coherence tomography (OCT) is the ideal imaging modality to diagnosing degenerative conditions of the eye, such as macular degeneration. It is non-invasive, requires no special preparation either on the patients' or clinicians' part, and does not harm the patient due to radiation. OCT uses laser light to scan the patient's eye, so precision is an important factor during image acquisition.

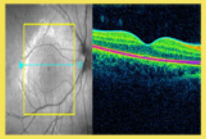

Figure 1: Image from OCT camera. The image on the left shows the scans position on the eye. The image on the right shows the tomography image. The indent in the middle indicates the fovea.

DESIGN CRITERIA

- The device must have fine adjustment in the x, y and z directions
- The device muse be able to rotate
- The device must be capable of being used with humans and sedated animals.
- The OCT camera must be within two inches of the eye
- Control of movement must be simple, such as by a crank or joystick

DESIGN SETUP

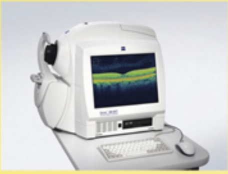

Figure 2: Carl Zeiss Meditec, Inc Cirrus OCT camera. The patient rests their chin on the chin rest and the camera operator electronically moves the chin rest to align the eye. Such electronic adjustment is not safe for use with sedated animals. [1]

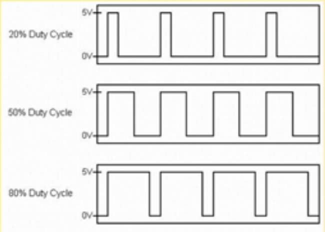

Figure 3: The motor controllers work by accepting a square wave signal. The period of the wave stays constant while the width of the square wave varies. A wider width results in more power. This variation changes the speed of the motor. [3]

- Two motors attached to table for xy motion
- One motor mounted to support table for rotation device
- Three motor controllers
- RC receiver and remote control transmitter for motor control

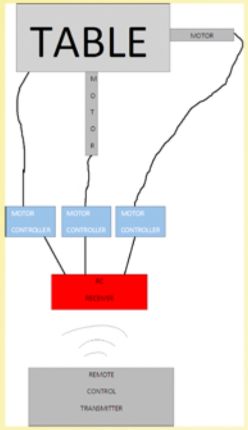

Figure 4: A schematic diagram of the prototype showing all components.

TESTING

- Timed movement of table over specified distance
- 10 reps with and without motor
- Avg by hand: 95.6 s
- Avg by motor: 32.6 s

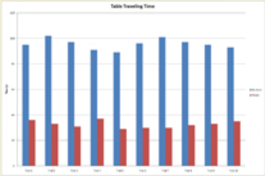

Figure 5: The graph shows the results of the 10 time trials for the traveling time for both movement of the table by hand and by use of the motor.

FUTURE WORK

- Configure second motor to work with table
- Mount rotation device to clinical table
- Test the prototype with camera
- Configure device to work with RC controller
- Add stop device to stop motion before reaching table limits

REFERENCES

[1] Optometric Management. (2008). For your Patients and Practice. Retrieved 12 Nov., 2008, from http://www.optometric.com/article.aspx?article=101348

[2] National Instruments. (2006). Pulse Width Modulation (PWM). Retrieved 29 Mar., 2009, from http://zone.ni.com/devzone/cda/tut/p/id/2991

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