



EyeSim

An Artificial Simulator for Patient Training

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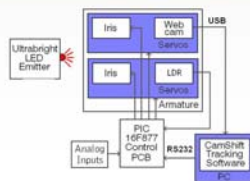
Project Objectives

To develop an eye simulator that can be used to teach medical students how to examine the eyes for cranial nerve lesions. EyeSim should be capable of both normal and pathological binocular motion and pupillary dilation.

Project Background

The ophthalmic examination is a simple, yet informative procedure that medical practitioners should be proficient at performing. Ophthalmic examination can provide diagnostic clues to a patient's state of consciousness, cranial nerve condition and possible cause(s) of abnormalities in ocular function. The ophthalmic examination is a challenging skill to learn and present methods are unsatisfactory. The use of simulators in medical training allows students to learn critical thinking skills and to integrate theoretical and clinical assessments in a risk-free environment. EyeSim will facilitate repetitive and realistic training of these skills.

Design



Methods

Ocular motion: The image of a torch is detected by a Webcam within one eyeball. The position of a red LED mounted in the torch is tracked with CamShift software and the coordinates sent to a PIC PCB. Control software drives two servos on the eyeball armature to keep the torch image centred.

Pupillary response: a light dependent resistor in the eyeball controls illumination of the circular rings of LEDs representing the iris.

Results

The PIC PCB was tested and shown to be fully capable of handling all analog, RS232 and in-circuit programming inputs and producing PWM outputs for iris LEDs and servomotors.

Future Directions

- Independent left/right eye movements
- Pupil response derived from video image
- Expansion of pathology base
- Addition of lifelike cosmetic cover

Conclusion

The first ever prototype simulator for ophthalmic response examination has been designed, manufactured, tested and developed. Possibilities exist for EyeSim to be commercialised and included as part of the teaching curriculum in teaching hospitals.

Within Flinders University, the Clinical Skills and Simulation Unit of the School of Medicine utilises numerous commercial simulators alongside many custom simulators that have resulted from previous collaborations with the School of Informatics and Engineering. The EyeSim project represents the most recent of these ventures.

The team identified the need for a simulator capable of replicating the ophthalmic response of patients with typical and a range of atypical neurologies.

At present EyeSim comprises the electrical, electronic and mechanical components that replicate the pupillary response of the iris and the motility of the ocular muscles, a computer for the reception and analysis of a video signal and the micro-controller components, which determine the action of the physical components based on an array of inputs.

This prototype is the first of its kind and presents Flinders University School of Informatics and Engineering with an valuable opportunity in terms of commercialisation with the medical simulator industry.

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