Design of an experimental setup to validate ROP Laser Surgery Device

Retinopathy of Prematurity (ROP) is a disease associated with the vision loss of premature babies and is a major cause of childhood blindness globally. Unfortunately, the severity of ROP not only depends on the neonatal care but also on the socioeconomic status of the country.

As a result, 60% of the premature babies born each year belong to the developing countries; naturally, these babies have a higher risk of developing severe ROP. In India there are approximately 100 surgeons for 3.5 million premature babies born per year, hence a vast majority of infants remain untreated.

The existing solution to treat ROP is depicted in Figure 1. To perform ROP treatment the surgeon delivers laser through a pupil of diameter less than 4 mm while rejecting the disturbances due to his (a) head rotation, (b) hand held lens motion, and (c) eyeball motion of the baby. Hence the existing process affects the treatment accuracy, causes high fatigue on the surgeon and the patient, and eventually less number of patients can be treated.

To perform pre-clinical trials for ROP treatment a novel experimental setup was designed and developed to replicate the disturbances created due to the eye movements, Figure 2 shows the realized eyeball motions. Additionally, significant improvement has been achieved in the performance of the visual servo feedback system for laser delivery.

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Retinal detachment

Figure 1: Existing ROP treatment - Laser Indirect Ophthalmoscopy.

Figure 2: Realized eyeball motion from the ROP validation setup.