



**CALIFORNIA STATE SCIENCE FAIR  
2006 PROJECT SUMMARY**

<b>Name(s)</b> <b>Bryan Lin</b>	<b>Project Number</b> <b>S1214</b>
<b>Project Title</b> <b>The Modeling of the Human Spherical Retina through Binocular Vision</b>	
<b>Abstract</b> <b>Objectives/Goals</b> The purpose of this project is to derive a more precise and realistic retinal representation in monocular as well as binocular vision based on its optical and geometrical properties. <b>Methods/Materials</b> Based on a #flat# shaped retinal model (used extensively in most of the visual servo controls), a new retinal model has been formulated based on the spherical shape of the human retina in monocular vision. Spherical model parameters, such as retinal arc length 'l' and angle 'alpha', have been carefully chosen so that they uniquely represent the projected location on the retinal surface. The uniqueness of this new model is that it establishes a differential relationship between an observed point in one#s visual space and the projected spot on the spherical retinal surface. Furthermore, the model of differential relationship in monocular vision is being extended to the binocular vision case. <b>Results</b> A novel and more precise differential model of the human spherical retina has been derived. The importance of this new model has two folds: (1) From mathematical and geometrical point of view, it solves a projection problem that a point in 3-dimensional space is projected onto a spherical surface via an optical pinhole; (2) From bio-engineering point of view, precise motion behavior of the projected spot on the retinal surface resulting from an observed point in one#s visual space can be predicted by the model. <b>Conclusions/Discussion</b> The model can readily be applied in scientific research, such as the human binocular visual servo computational study. Also, the idea of establishing a visual model based on a spherical retina can be extended to model other shaped retinas, such as parabolic or elliptical shaped retinas in other animals# ocular systems.	
<b>Summary Statement</b> A new retinal model for monocular and binocular vision for the human ocular system has been established.	
<b>Help Received</b> Ms. Amanda Day, my science teacher, was available for consultation. Mother helped to buy materials for project display.	