OCULAR BOBBING COMPENSATION

Yucong Gu, Yuchen Yan, Tai Kim, You Chen
University of Kansas, Lawrence, KS

Project Advisor: Dr. Ken Fischer
Project Liaison: Mr. Paul Haley

Introduction

The term "ocular bobbing" defines a distinctive class of abnormal, spontaneous, vertical eye movements which occur in a variety of clinical pathological settings . For those ocular bobbing patients, their primary connection to the outside world depends on their vision. With ocular bobbing, the patients not only have limited muscular control, but may also have intermittent blurred and/or double vision. Ocular bobbing creates many difficulties in their lives, such as being unable to read books or use a computer normally. At this moment, there is no device on the commercial market designed to improve the vision of patients with ocular bobbing.

Design Goal

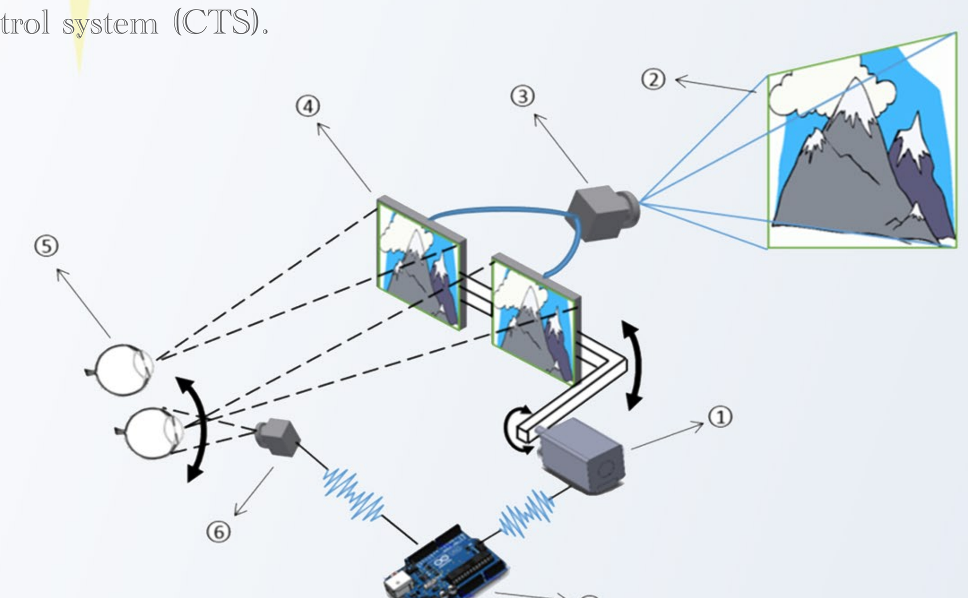
Our goal is to help these ocular bobbing patients to achieve a more normal vision, so that they can read books, watch TV, use a computer, and enjoy outdoor activities.

Requirments:

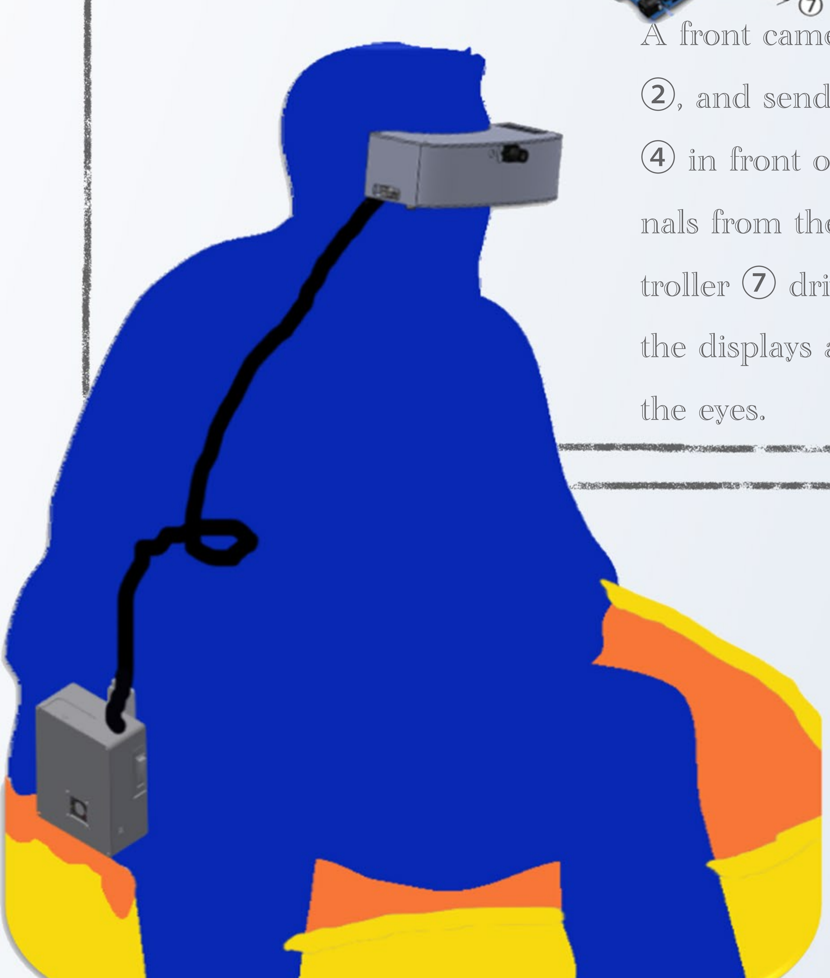
- Weight less than 5 lb
- Able to read book with font size greater than 11 pt
- Watching TV clearly at 6 feet or less
- Battery life or working time greater than 8 hours

Design: Computer Vision Compensator

The computer vision compensation system utilizes a wearable display that stabilizes the front view. It has two parts, a pair of display goggles and a contorl box. The display goggles has overall dimensions of 10 inches by 3 inches by 2.5 inches, and the contorl box has overall dimensions of 3 inches by 2.4 inches by 1.5 inches. This compensator contains an eye tracking subsystem (ETS), a dynamic display subsystem (DDS), a display position check subsystem (DPCS), and a control system (CTS).

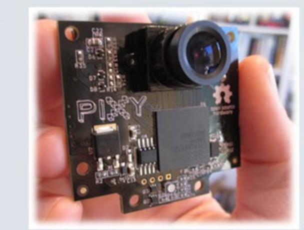


A front camera ③ captures the forward view ②, and sends the view to two small displays ④ in front of user's eyes ⑤. Based on the signals from the eye tracking system ⑥, the controller ⑦ drives a stepper motor ① to move the displays and keep them directly in front of the eyes.



Eye Tracking Subsystem (ETS)

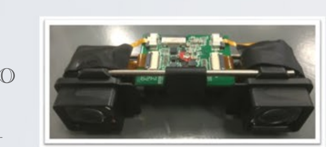
User's eye movement is tracked by a Pixy camera and the eye movement data are transferred to the CTS. Two infrared LEDs are used to provide adequate illumination for the Pixy camera.



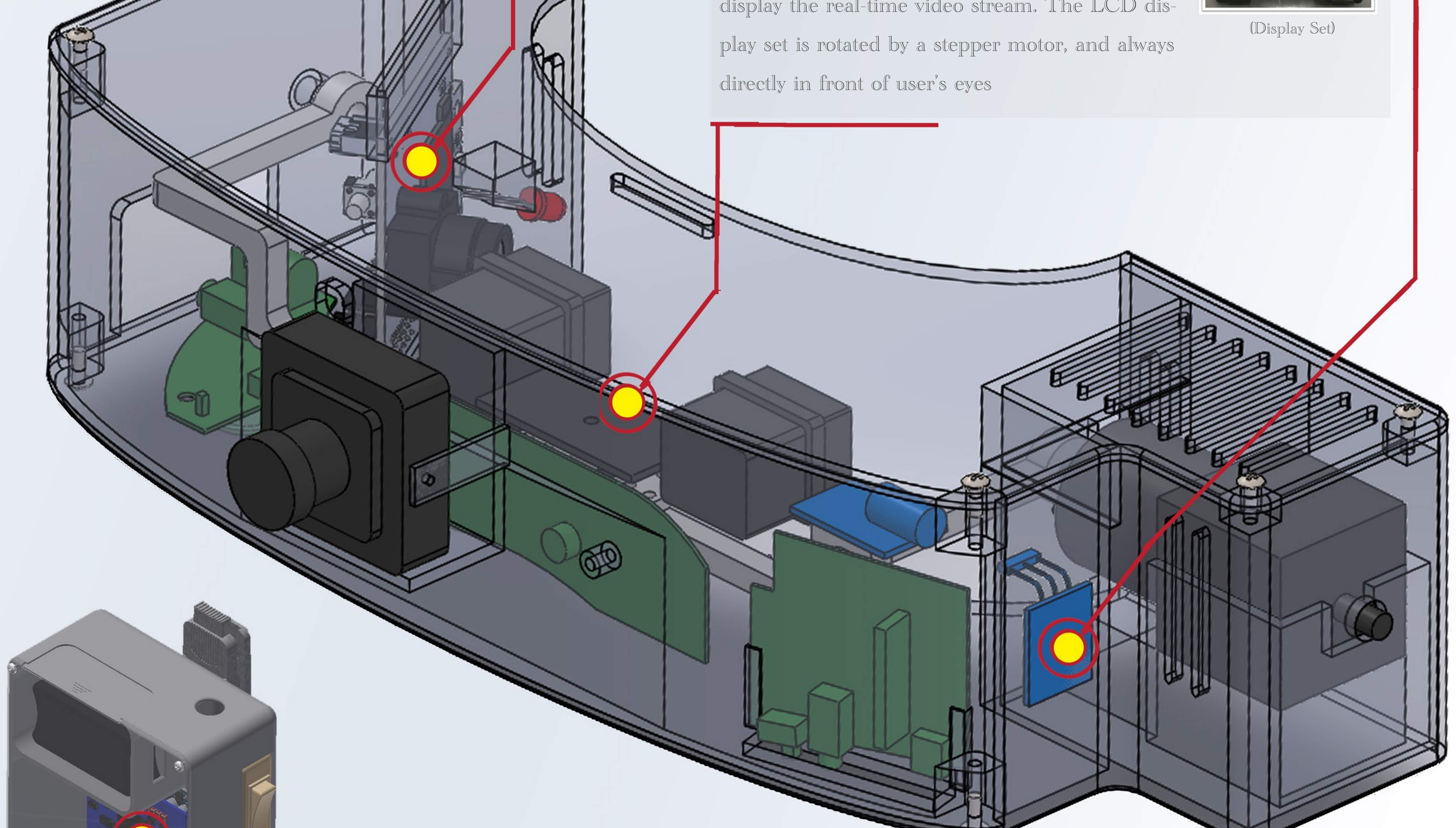
(Pixy Camera)

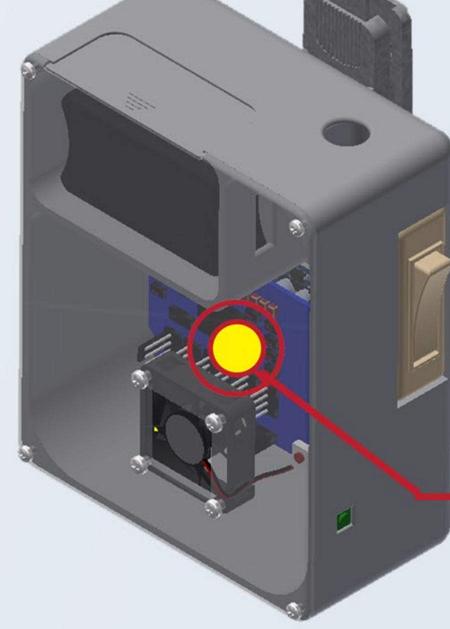
Dynamic Display Subsystem (DDS)

A front camera is used to capture the front view, and a set of special LCD display system is used to display the real-time video stream. The LCD display set is rotated by a stepper motor, and always directly in front of user's eyes



(Display Set)



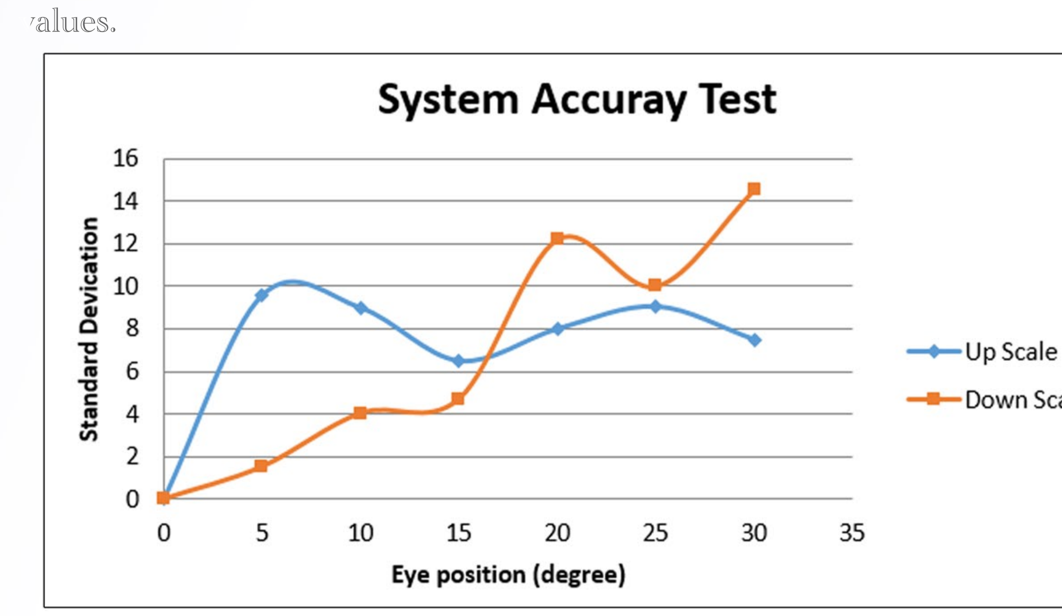


Display Position Check Subsystem (DPCS)

A laser transmitter is attached to one of the DDS supporting arms, and a Laser sensor is fixed on the case at DDS's zero-degree point. Once the LCD display set passes the zero-degree point, the Laser transmitter will active the laser sensor, and CTS will overwrite the display position information to zero to eliminate error.

System Accuracy Test

The Pixy camera was fixed at a proper place. An infrared LED (to simulate eye) was attached on a rotator witch can rotate on a protractor (initially set up to 0 degree). The stepper motor with an arm was fixed at a proper place where the arm rotating angle can be measured by a protractor. Rotate the infrared LED to -30,-25,-20,-15,-10,-5, 0, 5, 10, 15 20, 25, 30 degree and record the angles of the stepper motor arm rotates to. Repeat the test three times and create graphs by using the average values.



Control Subsystem (CTS)

Eye positon data from the ETS and signals from the DPCS are analyzed by an Arduino controller. Based on the analyze result, the controller drives a stepper motor to move the LCD displays and keep them directly in front of the user's eyes.

Test Summary & Future Work

- The front camera is able to capture the forward view, and the two displays are able to show the captured view in real-time.
- The stepper motor is able to drive two displays to different locations follow signals from the controller.
- System accuracy need to be impoved.

Challenges:

- Design the Eyetracking System
- Program the Control System

Future work

- Final Assembly
- System accuracy impovement
- System Test and Validation

Poster designed by:
Yucong Gu
2015/04/30

Another Possible Solution: Static Optical Compensator

This compensator is designed with a specific curvature aspheric lens to refract the view in front of the subject into subject' pupil regardless of their eye movement. The basic design includes a pair of special lenses in front of each of the patients' eyes. These lenses will refract the light from the frontal view to his pupils, no matter what angle to which his eyes have rotated. In the final arrangement, this system will be essentially like a pair of specialized glasses, with two lenses per eye. However, it is not yet certain that both redirection and focus can be simultaneously achieved.

Acknowledgements

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