Automated Lens Performance Manipulation
Mahvish Iqbal, Arvind Adapalli, Tyler Markle
Jingyie Lin, Jason Polasek, Kyle Webster
Essilor of America
Department of Mechanical & Biomedical Engineering
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Abstract
Essilor of America, Inc, the leading manufacturer of optical lenses in the United States, supplies ophthalmic lenses with slippery hydrophobic coatings to improve lens performance. They use a temporary Pad Control System on the lenses so that machines can grip the lenses effectively during manufacturing. Afterwards, employees remove the pad control system by hand; this wastes valuable employee time and can risk repetitive stress injuries. The team designed a mechanism to automate the removal of the pad control system.

Project Requirements
• Automate removal of Pad Control System
• Minimum Cleaning Rate of 1 lens per 1.5 minutes
• Clean lenses of different prescriptions
• No damage to lenses
• Safely operated by employee
• Load size 10 to 15 lenses
• Fits inside 30 in x 18 in
• Power supply can operate in US and France

Foam Cups
• Pronged PVC end caps with foam inserts covered with Selvyt cloth.
• Selvyt cloth attached to cups using Velcro strips to both top and bottom cups to clean lenses on both sides.
• Arranged in 4x3 configuration
• Bolted to lower aluminum tray and top delrin lids

Motor
• Friction tests show μs (cloth on cloth) = .89
• \( T = \mu_s F_N R \)
• \( F_N = 65 \text{ lbs} \) to compress each cups
• Moment arm of oscillation set to be 1/24 ft
• \( T = .89 * 65 * (1/24) = 2.41 \text{ lb*ft} \)
• Power = \( T \omega = 30.3 \text{ lb*ft/s} = 0.055 \text{ hp} \)
• Torque 695 oz-in and Max Speed 200 RPM

Motor Arm
The motor arm helps to create the oscillatory motion needed to move the aluminum tray to which the cups are bolted. The motor shaft connects to an offset arm, that connects to ring with bushing on the aluminum plate. This facilitates the rotational motion of the motor to the curvilinear motion of the plate.

Final Design
• Box opens at the top by releasing the four side latches.
• Lenses are placed into the cups (cups are color coded to denote groups of three).
• The lid is closed and latched; closing the lid creates compression that helps to clean the lenses.
• User selects desired system run time and returns when the time has expired.
• The lid is then opened for retrieval and inspection. If needed the system can be run again for a longer time period.
• Cloths on the cups can be removed for washing as needed and can be reused through multiple washes over time.

Conclusion
The prototype for this project is capable of cleaning 12 lenses at a time; and depending on the prescription of the lenses, the duration for which the lenses need to be cycled through can vary. The primary project goal of cleaning the lenses was accomplished successfully and it can be done within the given time constraint. The device speed can also be varied if desired since a brushless DC motor was used.

In the future this design can be improved to accommodate more lenses as well as an additional component that adds more sound proofing. Another potential improvement could be adding legs and a base to the device so that it can be a standalone ensemble; this could ease the ability to move the device as well as access all points. The final suggested improvement to this prototype would be to explore more ways to attach the cloth.

Contact: Mahvish Iqbal
mxi094020@utdallas.edu