Deep Integration of Thin Flexible Autonomous Microsystems for Vision Correction

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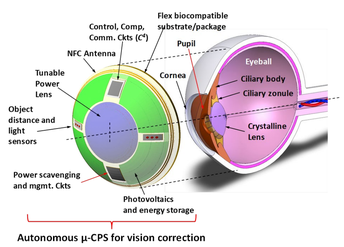
https://mastrangelo.ece.utah.edu/research/current-projects/smart-contact-lenses/

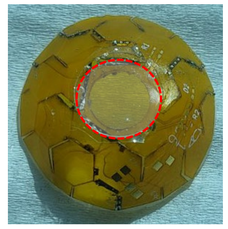
Autonomous Medical µ-Systems for Active Vision Restoration can benefit 1.7B people affected by **presbyopia.**

Challenges/Project Goals

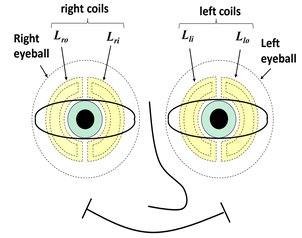
- Unavailability of an integrated platform featuring an autofocusing tunable lens for presbyopia correction.
- Development of thin electrically tunable contact lenses and vision correction algorithms.
- Implementation of thin, autonomous energy scavenging, communications, computing and sensing microsystems.
- Inhomogeneous technology integration on flexible bio-compatible substrates.



µ-CPS Platform

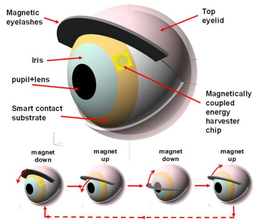


LC Lens

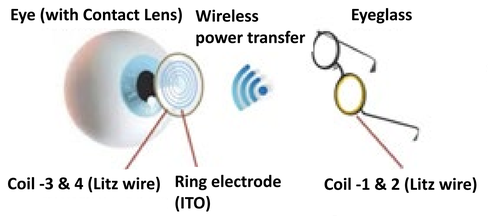


Passive Eye-tracker

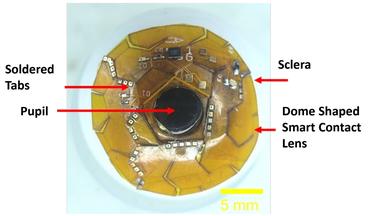
Flexible Photovoltaics



Eyelid motion energy scavenger



RF Power transfer



Flexible PCB susbtrate

Solution/Scientific Impact

- Developed µW digital liquid crystal tunable contact lens
- Developed tiled multilevel-wire flexible substrate approach for non-planar MCM
- Developed low-energy RF-coupled object bearing and range detector
- Developed thin-film solar cells for power scavenging
- Developed eyelid motion scavenger + RF power transfer schemes
- Developed low-power algorithms for controlling tunable lens
- Developed highly-flexible conductive wiring for multi-level PCB interconnects.

Broader Impact

- Paradigm shift in the approaches for the treatment of deteriorating vision.
- Potentially lead to increased utilization of advanced technologies to help solve universal health problems.

Education and Outreach

- Setup interactive website to provide in-depth information regarding progress of µ-CPS project.
- Setup online/in-person info-sessions between undergrads and project team members.

Broad Impact Quantification

- 1.7 Billion individuals suffer from presbyopia in 2021.
- 2.1 Billion individuals projected to suffer from presbyopia by 2030.

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