A Wireless Sub-Microwatt Intraocular Pressure Sensor

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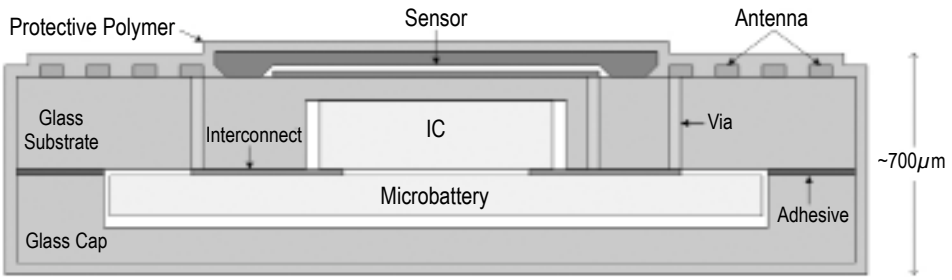
This project seeks to help glaucoma patients by facilitating better control of intraocular eye pressure. By implanting a pressure-monitoring microsystem directly in the eye, pressure can be measured over extended periods of time. The microsystem can collect data during daily activities, away from the doctor's office, without any effort by the patient. The implantable device is designed to resolve ±1mmHg over a range from 550mmHg to 850mmHg with device dimensions of no more than 1mm x 2mm, allowing it to be implanted using minimally invasive surgical techniques. The microsystem includes a pressure sensor, ultra-low-power microcontroller, antenna, and battery, all integrated into a package that is biocompatible and hermetically sealed. The sensor capacitance changes with intraocular pressure, and an integrated



Cross-section of Intraocular Glaucometer, illustrating the various components.

capacitance-to-frequency converter periodically (e.g., every 15 minutes) generates a data point that is stored in on-chip memory. When requested (e.g., once per day), the embedded microcontroller, operating in the subthreshold regime and realized using deep submicron technology, transmits the stored data wirelessly to the outside world. While existing microbattery technology is probably sufficient to operate the device for many weeks *in-vivo*, energy scavenging techniques are being explored for recharging the microbattery and extending the life of the system. This project will provide a device for chronically measuring intraocular pressure and will demonstrate the practicality of extremely-small-size, ultra-low-power, wireless implantable sensors. It also addresses the problems of accurate data capture at extremely-low-power levels. The project is supported by the Engineering Research Centers Program of the National Science Foundation under award number EEC-9986866 and by a gift from Ms. Polly Anderson.