Project proposed by: **Supervisor:**	Intelligent Sensory Microsystems Laboratory, ECE, U of T Prof. Roman Genov
Project title:	**Wireless RF Receiver Design for Medical Brain Implants**
Project description:	In recent years, there has been a rapid increase in the development of advanced brain-implantable devices, which have made high-quality medical diagnostics more accessible in increasingly compact and cost-effective forms. However, one of the most significant challenges in miniaturizing these devices is the issue of data communication between implants and external devices. Signal transmission through brain tissue and the skull poses a major challenge due to significant path loss, often exceeding 40 dB, rendering the signal nearly undetectable for the receiver. This problem necessitates careful attention, not only in the transmitter design on the implant side but also in the design of the external receiver. The primary aim of this project is to investigate and implement a high-frequency external receiver for decoding data transmitted by the implant. This receiver will be developed using both Matlab and FPGA, employing various modulation techniques, including Ultra-wideband and QAM. Additionally, candidates may have the opportunity to design high-frequency PCBs and antenna for transmitter testing. The project will take place in the Intelligent Sensory Microsystems Laboratory, with students working closely with a Ph.D. student. Candidates are expected to possess the following qualifications: • Self-motivation and a strong interest in signal processing and data communication. • A solid mathematical background, including knowledge of continuous-time Fourier transform and discrete Fourier transform. • Knowledge of communication systems, including the sampling theorem, synchronization methods, and filtering. • Proficiency in programming with MATLAB and FPGA. • Knowledge of microwave circuit / EM simulation is a plus This project offers an exciting opportunity to engage with state-of-the-art technology and make a significant impact in the field of medical diagnostics and neural interfacing.
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