Coding a Goniometer Robot To Replicate Human Eye Movements as Tool for Improved Disease Research

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The eye makes movements when attempting to see a target: the most common movements are saccades and fixational movements are microsaccades and tremor. These three types of movements have correlations with many diseases, including Parkinsons' and Alzheimer's Disease. A previous attempt at creating a robotic eye was only able to replicate saccades. The robot in this study looks to further this by replicating microsaccades and tremor with the use of goniometers, devices that allow for precise angular movements. This research reports the development of movement and analysis code that brings the goniometric robot into service. To analyze the accuracy of the robot and movement code, a mirror was used in the place of an eye and a laser was directed at it to mimic the line of vision. A camera recorded the moving laser and the analysis code used the footage to determine the movement of the robot. The tests showed that the robot was able to replicate saccades and microsaccades in both the horizontal and vertical directions as well as tremor. The saccades were the most accurate since they had minimal overshooting. The simulated tremor reached a frequency of 28 Hz which reflects Parkinson's tremor and the lower threshold for human tremors. This robot is the first device to replicate tremor, along with saccades and microsaccades. By replicating these eye movements, this robot is an avenue to improve accuracy and consistency of disease detection and research without the need for human participants.

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