

Eye-controlled Wheelchair: A Low-cost Open Source Hard- and Software System Allowing Independent Mobility for People with Severe Disabilities

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Spinal cord injuries (SCI) or illnesses like ALS or MS cause disabilities that make people dependent on a wheelchair and in their etiopathology are robbed of any movement at all. Our project gives these disabled people back some freedom to move independently again – using their eyes only. Our goal was to construct a wheelchair that can be steered only by the movement of one eye developing an open source, low-cost approach, since 50% of the people suffering from SCI are not adequately insured. Therefore we chose to start with a hand driven wheelchair we motorized ourselves instead of a powered one. Two windscreen wiper motors from the trash provide the thrust needed and an Eyetracker we built ourselves using a normal webcam, a safety glasses frame and 3d-printed parts is responsible for providing close-up images of one eye to the embedded hardware platform. It is a Raspberry Pi2b that provides processing power to filter the video frame-by-frame using a cascade of 4 filters to extract the position of the pupil. Depending on the direction of the gaze – up, down, left, right – a speech synthesis reads the direction out. It has to be confirmed by twitching a cheek muscle for safety reasons – the wheelchair does not follow unintended eye-movements. We attached the motors to the wheelchair and constructed attachment wheels to drive the main wheels using 3d-printing. In conclusion everything works well and the total budget needed is below \$200.

Awards Won:

Second Award of \$2,000

Sigma Xi, The Scientific Research Honor Society: Intel ISEF Best of Category Award of \$5,000