Low-Cost Eye-Gesture Control System for Mobile Devices Using Reinforcement Learning for Paralyzed Patients

Mammadli, Tunar (School: School No. 42)
Ismayilov, Huseyn (School: Lyceum No. 27)

Millions of people with paralysis struggle to use everyday technology due to limited motor function. In the U.S. alone, over 5.3 million individuals—about 1.7% of the population—live with paralysis from strokes (33.7%), spinal cord injuries (27.3%), or multiple sclerosis (18.6%). Severity ranges from monoplegia (one limb) to quadriplegia or the rare locked-in syndrome, where only eye movements remain voluntary. Beyond mobility, paralysis often disrupts circulation, breathing, swallowing, and communication. Existing assistive systems—like dedicated eye-tracking rigs—can help, but they are expensive, bulky, and hard to configure. We propose a smartphone-based solution using the built-in camera and reinforcement learning to recognize subtle eye motions, blinks, and micro-gestures as control commands. By continuously adapting to each user's unique patterns, our system offers a cost-effective, personalized interface that boosts independence and quality of life. This innovation expands human-machine interaction in healthcare, making assistive technology more accessible to millions.

Awards Won: