# ABSTRACT

Stroke is a leading cause of upper extremity motor disability in hemiparetic patients, significantly impairing movement function and quality of life. Conventional rehabilitation approaches are often limited, driving the development of robotic technologies such as end-effectors. This study aims to develop and evaluate an upper extremity end-effector system based on Electromyography (EMG) as feedback and gyroscope as movement validation to improve post-stroke motor function. The system is designed to provide adaptive assistance (Assist-as-Needed), encouraging active patient participation in therapy.

The system design involves acquisition of EMG signals using BPF Butterworth IIR 74,5-149,5 Hz and MPU6050 gyroscope data, processed through dual-microcontroller architecture. The gyroscope functions as a gatekeeper to validate initial movement intention, then EMG signals proportionally control the end-effector *stepper* motor. The end-effector frame uses lightweight and robust aluminum extrusion.

Test results demonstrate average movement intention detection accuracy of 94% for elbow flexion and 95% for shoulder flexion. Gyroscope angle accuracy is below 2 degrees, and the motor can lift operational loads. Although jerky movements were found under 1 kg load in certain respondents, this prototype proves functional, reliable, and precise, showing great potential as an effective and safe motor rehabilitation tool.



**Kata Kunci:** *Rehabilitation, Stroke, Hemiparesis, End-effector, Electromyography (EMG), Gyroscope, Assist-as-Needed.*